US EPA ARCHIVE DOCUMENT

ARCADIS BBL
Infrastructure, environment, facilities

Imagine the result

US EPA ARCHIVE DOCUMENT

AGENCY REVISION
performed for EPA Region 1 by the
Environmental Services Assistance Team (ESAT)
Contractor

Baseline Ecological Risk Assessment

Peterson Puritan Site – Operable Unit 2
Cumberland and Lincoln, Rhode Island

June 2007
Revised November 2007
Revised September 2008
Updated August 2009

SDMS Doc ID 488187

STATEMENT OF LIMITATIONS

This Baseline Ecological Risk Assessment (BERA) for the Peterson Puritan Superfund Site - Operable Unit 2 in Cumberland and Lincoln, Rhode Island (dated August 2009) is a revision of the version prepared by Arcadis in September 2008, for the PRP Group under the requirements of the Administrative Order by Consent (AOC), U.S. EPA Docket No.1-87-1064, May 29, 1987; as amended. The revisions, which were made by the United States Environmental Protection Agency (EPA) with assistance from its Environmental Services Assistance Team (ESAT) contractor, TechLaw Inc. consisted of revising certain sections of the document to address agency comments on the draft BERA.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Acronyms **xii**

EXECUTIVE SUMMARY **xiv**

ES.1 INTRODUCTION xiv

ES.2 SITE DESCRIPTION xiv

ES.3 BERA METHODS xv

ES.4 GENERAL CONCLUSIONS OF THE BERA xvii

ES.4.1 Benthic invertebrates xvii

ES.4.2 Fish xix

ES.4.3 Amphibians xix

ES.4.4 Large omnivorous birds xx

ES.4.5 Small omnivorous birds xx

ES.4.6 Large piscivorous birds xxi

ES.4.7 Small piscivorous birds xxi

ES.4.8 Large omnivorous mammals xxi

ES.4.9 Small omnivorous mammals xxi

ES.4.10 Large piscivorous mammals xxii

ES.4.11 Small piscivorous mammals xxii

ES.5 UNCERTAINTY ANALYSIS xxii

ES.5.1 Benthic invertebrates xxii

ES.5.2 Fish xxiii

ES.5.3 Amphibians xxiv

ES.5.4 Birds and mammals xxiv

ES.6 CONCLUSIONS xxv

7.0 BASELINE ECOLOGICAL RISK ASSESSMENT **1**

7.1 INTRODUCTION 1

7.2 SITE DESCRIPTION 1

7.2.1 Overview of the USEPA Ecological Risk Assessment Process 2

7.2.2 SLERA Summary 3

7.3 PROBLEM FORMULATION 4

7.3.1 Conceptual Site Model 4

7.3.1.1 Site Characteristics 4

7.3.1.2 Habitat Description 5

7.3.1.3 Source Identification 6

7.3.1.4 Fate and Transport Mechanisms 7

7.3.1.5 Identifying Potential Ecological Receptors 8

7.3.1.6 Exposure Pathways 9

7.3.2 Assessment endpoints, risk questions, measurement endpoints, and weight of evidence 9

7.3.2.1 Introduction 9

7.3.2.2 Selecting representative assessment endpoint species or communities 10

7.3.2.3 Endpoint selection 11

7.3.2.4 Weight of Evidence 17

7.3.3 Exposure Assessment 17

7.3.4 Effects Assessments 20

7.3.5 Risk Characterization 21

7.4 ASSESSMENT OF RISK TO BENTHIC MACROINVERTEBRATES 23

7.4.1 Introduction 24

7.4.2 Measurement Endpoint 1.A 25

7.4.3 Measurement Endpoint 1.B 30

7.4.4 Measurement Endpoint 1.C 33

7.4.5 Sediment Quality Triad Analysis 37

7.4.6 WOE integration for assessment endpoint 1 38

7.5 ASSESSMENT OF RISK TO FISH 38

US EPA ARCHIVE DOCUMENT

7.5.1 Measurement Endpoint 2.A 39

7.5.2 Measurement Endpoint 2.B 41

7.5.2.1 Exposure Assessment 41

7.5.2.2 Effects Assessment 41

7.5.2.3 Risk Characterization 42

7.5.3 Measurement Endpoint 2.C – Critical Body Residues 47

7.5.3.1 Exposure Assessment 47

7.5.3.2 Effects Assessment 47

7.5.3.3 Risk Characterization 47

7.5.3.4 WOE integration for assessment endpoint 2 49

7.6 ASSESSMENT OF RISK TO AMPHIBIANS 49

7.6.1 Measurement endpoint 3.A 49

7.6.2 WOE integration for assessment endpoint 3 50

7.7 ASSESSMENT OF RISK TO BIRDS 50

7.7.1 Omnivorous Birds 50

7.7.1.1 Exposure Assessment 51

7.7.1.2 Effects Assessment 51

7.7.1.3 Risk Characterization 51

7.7.1.4 Large omnivorous birds 51

7.7.1.5 Small omnivorous birds 52

7.7.2 Piscivorous Birds 55

7.7.2.1 Exposure Assessment 55

7.7.2.2 Effects Assessment 56

7.7.2.3 Rick Characterization 56

7.7.2.4 Large piscivorous birds 56

7.7.2.5 Small piscivorous birds 57

7.8 ASSESSMENT OF RISK TO MAMMALS 58

US EPA ARCHIVE DOCUMENT

7.8.1 Omnivorous Mammals 59

7.8.1.1 Exposure Assessment 59

7.8.1.2 Effects Assessment 59

7.8.1.3 Risk Characterization 59

7.8.1.4 Large omnivorous mammals 60

7.8.1.5 Small omnivorous mammals 60

7.8.2 Piscivorous Mammals 63

7.8.2.1 Exposure Assessment 64

7.8.2.2 Effects Assessment 64

7.8.2.3 Risk Characterization 64

7.8.2.4 Large Piscivorous mammals 64

7.8.2.5 Small piscivorous mammals 65

7.9 UNCERTAINTY ANALYSIS 66

7.9.1 Selecting representative receptors 67

7.9.2 Comparing site data to screening-level benchmarks 67

7.9.3 Exposure Point Concentrations 68

7.9.4 Exposure Assumptions 69

7.9.5 Toxicity Benchmarks 69

7.9.6 Critical Body Residue Analysis 69

7.9.7 Fish and Invertebrate Surveys 70

7.9.8 Vernal Pools 70

7.9.9 Uncertainty Conclusions 71

7.10 SUMMARY AND CONCLUSIONS 71

7.10.1 Benthic invertebrates 71

7.10.2 Fish 72

7.10.3 Amphibians 73

7.10.4 Large omnivorous birds 74

US EPA ARCHIVE DOCUMENT

7.10.5 Small omnivorous birds 74

7.10.6 Large piscivorous birds 74

7.10.7 Small piscivorous birds 74

7.10.8 Large omnivorous mammals 75

7.10.9 Small omnivorous mammals 75

7.10.10 Large piscivorous mammals 75

7.10.11 Small piscivorous mammals 76

7.10.12 CONCLUSIONS 76

8.0 REFERENCES 78

Tables

Executive Summary Tables

ES-1a Summary of Ecological Risk in Aquatic Habitats - Blackstone River (Near-Site)

ES-1b Summary of Ecological Risk in Aquatic Habitats - Pond A

ES-1c Summary of Ecological Risk in Aquatic Habitats - Pond B

ES-1d Summary of Ecological Risk in Aquatic Habitats - Pond C

ES-1e Summary of Ecological Risk in Aquatic Habitats - Pond D

ES-1f Summary of Ecological Risk in Aquatic Habitats - Pond E

ES-1g Summary of Ecological Risk in Aquatic H

ES-1h Summary of Ecological Risk in Aquatic Habitats - Pond I

ES-1i Summary of Ecological Risk in Aquatic Habitats - Pond N

ES-1j Summary of Ecological Risk in Aquatic Habitats - Pond P

ES-1k Summary of Ecological Risk in Aquatic Habitats - Wetlands A Through D

ES-2a Summary of Ecological Risk in Terrestrial Habitats - J.M. Mills Landfill

ES-2b Summary of Ecological Risk in Terrestrial Habitats - Unnamed Island

ES-2c Summary of Ecological Risk in Terrestrial Habitats - Nunes Parcel

ES-2d Summary of Ecological Risk in Terrestrial Habitats - Quinnville Well Field

ES-2e Summary of Ecological Risk in Terrestrial Habitats - Wetlands A Through D

US EPA ARCHIVE DOCUMENT

ES-2f Summary of Ecological Risk in Terrestrial Habitats - Pratt Dam

Section 7.0 Tables

7-1a Summary of COPECs Forwarded to the BERA – Aquatic Areas

7-1b Summary of COPECs Forwarded to the BERA – Terrestrial Areas

7-1c Weight-of-Evidence Documentation

7-2a Exposure Parameters for Omnivorous Birds

7-2b Exposure Parameters for Piscivorous Birds

7-2c Exposure Parameters for Omnivorous Mammals

7-2d Exposure Parameters for Piscivorous Mammals

7-3 Biota-Soil Accumulation Factors

7-4a Avian Toxicity Benchmarks

7-4b Mammalian Toxicity Benchmarks

7-5a Selection of Screening Criteria for Volatile Organic Compounds in Sediment

7-5b Selection of Screening Criteria for Semivolatile Organic Compounds in Sediment

7-5c Selection of Screening Criteria for Pesticides and PCBs in Sediment

7-5d Selection of Screening Criteria for Metals in Sediment

7-5e Selection of Screening Criteria for Volatile Organic Compounds in Surface Water

7-5f Selection of Screening Criteria for Semivolatile Organic Compounds in Surface Water

7-5g Selection of Screening Criteria for Pesticides and PCBs in Surface Water

7-5h Selection of Screening Criteria for Metals in Surface Water

7-6a Calculated Hazard Quotients for Benthic Invertebrates – Blackstone River (Upstream)

7-6b Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Blackstone River (Near-Site)

7-6c Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Pond A

7-6d Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Pond B

7-6e Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Pond C

7-6f Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Pond D

7-6g Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Pond E

7-6h Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Pond F

7-6i Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Pond I

US EPA ARCHIVE DOCUMENT

7-6j	Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Pond N
7-6k	Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Pond P
7-6l	Calculated Hazard Quotients and Residual Risks for Benthic Invertebrates – Wetlands
7-6m	Weight-of-Evidence Integration for Benthic Invertebrates
7-7	LMW PAHs, HMW PAHs, and Total PAHs in Sediment Collected From Aquatic Habitats
7-7a	This table was removed from the May 2009 revised BERA
7-7b	This table was removed from the May 2009 revised BERA
7-7c	This table was removed from the May 2009 revised BERA
7-7d	This table was removed from the May 2009 revised BERA
7-8a	Summary of Sediment AVS/SEM Results – Blackstone River
7-8b	Summary of Sediment AVS/SEM Results – Pond Areas
7-9a	Sediment Toxicity Test Results
7-9b	Triad Sediment Chemistry and Toxicity Results - River
7-9c	Triad Sediment Chemistry and Toxicity Results - Pond
7-10a	Sediment Triad Study – Water Quality Measurements
7-10b	Sediment Triad Study – Grain Size and TOC Results
7-10c	Sediment Triad Study – Benthic Organism Counts
7-10d	Sediment Triad Study – Benthic Percent Higher Order Abundance
7-10e	Sediment Triad Study – Benthic Community Metric Results
7-10f	Sediment Triad Study – Weight-of-Evidence Table
7-11	Fish Community Organism Counts
7-12	Fish Community Metric Results
7-13a	Calculated Hazard Quotients and Residual Risks for Fish and Amphibians – Blackstone River (Near-Site)
7-13b	Calculated Hazard Quotients for Fish and Amphibians – Blackstone River (Upstream)
7-13c	Calculated Hazard Quotients and Residual Risks for Fish and Amphibians – Wetlands A through D
7-13d	Calculated Hazard Quotients and Residual Risks for Fish and Amphibians – Pond A
7-13e	Calculated Hazard Quotients and Residual Risks for Fish and Amphibians – Pond C
7-13f	Calculated Hazard Quotients and Residual Risks for Fish and Amphibians – Pond D
7-13g	Calculated Hazard Quotients and Residual Risks for Fish and Amphibians – Pond E

US EPA ARCHIVE DOCUMENT

7-13h	Calculated Hazard Quotients and Residual Risks for Fish and Amphibians – Pond F
7-13i	Calculated Hazard Quotients and Residual Risks for Fish and Amphibians – Pond I
7-13j	Calculated Hazard Quotients and Residual Risks for Fish and Amphibians – Pond N
7-13k	Calculated Hazard Quotients and Residual Risks for Fish and Amphibians – Pond P
7-14	Critical Body Residues for Fish
7-15a	Comparison of Fish Tissue Data to CBRs – Effect and No-Effect HQs – Blackstone River (Upstream)
7-15b	Comparison of Fish Tissue Data to CBRs – Effect and No-Effect HQs –Blackstone River (Near-Site)
7-15c	Comparison of Fish Tissue Data to CBRs – Effect and No-Effect HQs –Pond A
7-15d	Comparison of Fish Tissue Data to CBRs – Effect and No-Effect HQs –Pond F
7-15e	Comparison of Fish Tissue Data to CBRs – Effect and No-Effect HQs –Reference Pond
7-16a	Summary of Residual Risks for Fish Collected From the Blackstone River (Near-Site)
7-16b	Summary of Residual Risks for Fish Collected From Pond A
7-16c	Summary of Residual Risks for Fish Collected From Pond F
7-16d	Weight-of-Evidence Integration for Fish
7-16e	Weight-of-Evidence Integration for Amphibians
7-17a	Calculated Hazard Quotients for Large Omnivorous Birds – Blackstone River (Upstream)
7-17b	Calculated Hazard Quotients and Residual Risks for Large Omnivorous Birds – All on-site terrestrial habitats combined
7-17c	Weight-of-Evidence Integration for Large Omnivorous Birds
7-18a	Calculated Hazard Quotients for Small Omnivorous Birds – Blackstone River (Upstream)
7-18b	Calculated Hazard Quotients and Residual Risks for Small Omnivorous Birds – J.M. Mills Landfill
7-18c	Calculated Hazard Quotients and Residual Risks for Small Omnivorous Birds – Unnamed Island
7-18d	Calculated Hazard Quotients and Residual Risks for Small Omnivorous Birds – Nunes Parcel
7-18e	Calculated Hazard Quotients and Residual Risks for Small Omnivorous Birds – Quinnville Well Field
7-18f	Calculated Hazard Quotients and Residual Risks for Small Omnivorous Birds – Wetlands A through D
7-18g	Calculated Hazard Quotients and Residual Risks for Small Omnivorous Birds – Pratt Dam

US EPA ARCHIVE DOCUMENT

7-18h Weight-of-Evidence Integration for Small Omnivorous Birds

7-19a Calculated Hazard Quotients for Large Piscivorous Birds – Blackstone River (Upstream) and Pond P-6 combined

7-19b Calculated Hazard Quotients and Residual Risks for Large Piscivorous Birds – Blackstone River (near-site), Pond A and Pond F combined

7-19c Weight-of-Evidence Integration for Large Piscivorous Birds

7-20a Calculated Hazard Quotients for Small Piscivorous Birds – Blackstone River (Upstream)

7-20b Calculated Hazard Quotients and Residual Risks for Small Piscivorous Birds – Blackstone River (Near-Site)

7-20c Calculated Hazard Quotients and Residual Risks for Small Piscivorous Birds – Pond A

7-20d Calculated Hazard Quotients and Residual Risks for Small Piscivorous Birds – Pond F

7-20e Weight-of-Evidence Integration for Small Piscivorous Birds

7-21 This table was removed from the May 2009 revised BERA

7-22a Calculated Hazard Quotients for Large Omnivorous Mammals – Blackstone River (Upstream)

7-22b Calculated Hazard Quotients and Residual Risks for Large Omnivorous Mammals – All on-site terrestrial habitats combined

7-22c Weight-of-Evidence Integration for Large Omnivorous Mammals

7-23a Calculated Hazard Quotients for Small Omnivorous Mammals – Blackstone River (Upstream)

7-23b Calculated Hazard Quotients and Residual Risks for Small Omnivorous Mammals – J.M. Mills Landfill

7-23c Calculated Hazard Quotients and Residual Risks for Small Omnivorous Mammals – Unnamed Island

7-23d Calculated Hazard Quotients and Residual Risks for Small Omnivorous Mammals – Nunes Parcel

7-23e Calculated Hazard Quotients and Residual Risks for Small Omnivorous Mammals – Quinnville Well Field

7-23f Calculated Hazard Quotients and Residual Risks for Small Omnivorous Mammals – Wetlands A through D

7-23g Calculated Hazard Quotients and Residual Risks for Small Omnivorous Mammals – Pratt Dam

7-23h Weight-of-Evidence Integration for Small Omnivorous Mammals

7-24a Calculated Hazard Quotients for Large Piscivorous Mammals – Blackstone River (Upstream) and Pond P-6 combined

US EPA ARCHIVE DOCUMENT

7-24b Calculated Hazard Quotients and Residual Risks for Large Piscivorous Mammals – Blackstone River (near-site), Pond A, and Pond F combined

7-24c Weight-of-Evidence Integration for Large Piscivorous Mammals

7-25a Calculated Hazard Quotients for Small Piscivorous Mammals – Blackstone River (Upstream)

7-25b Calculated Hazard Quotients and Residual Risks for Small Piscivorous Mammals – Blackstone River (Near-Site)

7-25c Calculated Hazard Quotients for Small Piscivorous Mammals – Pond A

7-25d Calculated Hazard Quotients for Small Piscivorous Mammals – Pond F

7-25e Weight-of-Evidence for Small Piscivorous Mammals

7-26a Summary of Ecological Risk in Aquatic Habitats - Blackstone River (Near-Site)

7-26b Summary of Ecological Risk in Aquatic Habitats - Pond A

7-26c Summary of Ecological Risk in Aquatic Habitats - Pond B

7-26d Summary of Ecological Risk in Aquatic Habitats - Pond C

7-26e Summary of Ecological Risk in Aquatic Habitats - Pond D

7-26f Summary of Ecological Risk in Aquatic Habitats - Pond E

7-26g Summary of Ecological Risk in Aquatic Habitats – Pond F

7-26h Summary of Ecological Risk in Aquatic Habitats - Pond I

7-26i Summary of Ecological Risk in Aquatic Habitats - Pond N

7-26j Summary of Ecological Risk in Aquatic Habitats - Pond P

7-26k Summary of Ecological Risk in Aquatic Habitats - Wetlands A Through D

7-27a Summary of Ecological Risk in Terrestrial Habitats - J.M. Mills Landfill

7-27b Summary of Ecological Risk in Terrestrial Habitats - Unnamed Island

7-27c Summary of Ecological Risk in Terrestrial Habitats - Nunes Parcel

7-27d Summary of Ecological Risk in Terrestrial Habitats - Quinnville Well Field

7-27e Summary of Ecological Risk in Terrestrial Habitats - Wetlands A Through D

7-27f Summary of Ecological Risk in Terrestrial Habitats - Pratt Dam

Figures

1-1 Site Location Map

1-2 Site Layout

1-3 Sub-Area Definition

US EPA ARCHIVE DOCUMENT

2-4 Sediment Sampling Locations

2-7 Fish Community Survey and Fish Tissue Sample Locations

2-8 Habitat Characterization Areas

7-9 Ecological Exposure Pathways and Exposure Routes

Appendices

K Benthic Community Species Abundance Report (Normandeau)

L Toxicity Testing Report (EnviroSystems, Inc.)

Q Habitat Characterization Summary

R Vernal Pool Evaluation Memorandum

Z Screening Level Ecological Risk Assessment

AA Data Groupings for Exposure Point Concentration Calculations

BB Exposure Point Calculations

EE Correspondence from USFWS Service Regarding Threatened and Endangered Species

FF Benthic Multivariate Statistical Analysis

GG Distributional Analysis

HH Summary of Species-Specific Fish Tissue Data

II Fish Tissue Sampling Data

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ACRONYMS

ARCADIS BBL	ARCADIS U.S., Inc.
ASTM	American Society for Testing and Materials
AVS	Acid Volatile Sulfide
AWQC	Ambient Water Quality Criteria
BBL	Blasland, Bouck & Lee, Inc.
BERA	Baseline Ecological Risk Assessment
BSoilAF	Soil-to-Biota Accumulation Factor
bw	Body Weight
CBR	Critical Body Residue
CCC	Criterion Continuous Concentration
cfs	cubic feet per second
cm	centimeters
CMC	Criterion Maximum Concentration
COPEC	Constituent of Potential Environmental Concern
CSM	Conceptual Site Model
CTE	Central Tendency Exposure
^{o}C	degrees Celsius
4-4'-DDD	4-4'dichlorodiphenyldichloroethane
4-4'-DDE	4-4'-dichlorodiphenylchloroethene
4-4'-DDT	4-4'-dichlorodiphenyltrichloroethane
EPC	Exposure Point Concentration
HQ	Hazard Quotient
kg	kilograms
LOAEL	Lowest Observed Adverse Effect Level
mg	milligrams

mg/kg	milligrams per kilogram
mg/larvae	milligrams per larvae
NOAEL	No Observed Adverse Effect Level
ORNL	Oak Ridge National Laboratory
OU2	Operable Unit 2
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PEC	Probable Effect Concentration
PRPs	Potentially Responsible Parties
RIDEM	Rhode Island Department of Environmental Management
RME	Reasonable Maximum Exposure
RR	Residual Risk
SCV	Secondary Chronic Value
SEM	simultaneously extracted metal
Shield	Shield Environmental Associates, Inc.
SLERA	Screening-Level Ecological Risk Assessment
SQG	Sediment Quality Guideline
SQT	Sediment Quality Triad
SVOC	Semivolatile Organic Compound
TEC	Threshold Effect Concentration
TOC	Total Organic Carbon
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This Baseline Ecological Risk Assessment (BERA) presents the results of the ecological investigations for the Peterson Puritan Superfund Site, Operable Unit 2 (OU2). The BERA quantifies the potential for ecological risks associated with site-related Constituents of Potential Environmental Concern (COPECs). This potential was first evaluated in the Screening-Level Ecological Risk Assessment (SLERA). The SLERA used conservative screening criteria to identify COPECs that require further evaluation. The BERA uses more detailed and site-specific evaluations to determine if COPECs in specific aquatic and terrestrial habitats could present ecological risks. This information may be used to support risk management or remedial action decisions.

The BERA uses data collected between 2003 and 2006. However, much of the data were obtained from ecological investigations conducted in 2005, including a fish community survey, fish tissue sampling, benthic invertebrate survey, sediment toxicity testing, and habitat assessments.

ES.2 SITE DESCRIPTION

The study area considered in the BERA is OU2 of the Peterson Puritan Superfund Site. OU2, which consists of the Blackstone River and its various aquatic and terrestrial habitats, starts due north at about 1 mile below Ashton Dam and ends just south of Pratt Dam.

The Blackstone River has been historically impacted by many industrial and non-point sources upstream of the site. Possible site-related COPEC sources include the sub-surface waste deposits at the J.M. Mills Landfill, associated debris fields, transfer station properties (referred to as the Nunes Parcel), and the Unnamed Island in the river. Sources of contaminants in Wetlands A through D may include stormwater runoff from nearby urban areas unaffected by past site activities. OU2 is about 5,600 feet long and 1,600 to 1,800 feet wide, covering an area of around 220 acres. Distinct sub-areas of interest are identified in the study area, as follows:

Aquatic habitats:

- Blackstone River (near-site)
- Ponds A, B, C, D, E, F, I, N, and P
- Wetlands A through D

Terrestrial habitats:

- J.M. Mills Landfill
- Unnamed Island
- Nunes Parcel (the riparian corridor portion)
- Quinnville Well Field
- Wetlands A through D
- Pratt Dam

Reference areas are used, when available, to provide comparative data and associated background risk estimates. The reference areas are the Blackstone River upstream of the site and (off-site) Pond P-6.

US EPA ARCHIVE DOCUMENT

ES.3 BERA METHODS

The BERA generally follows the USEPA guidance for ecological risk assessments (USEPA, 1997c) and also reflects discussions with the USEPA. Potential ecological receptors evaluated in the BERA are selected using a feeding guild approach. Specifically, the receptor groups used in the evaluation are common to the local ecosystem and could be exposed to COPECs. The selected feeding guilds and representative species are listed below:

- benthic macroinvertebrates (e.g., midges, mayflies)
- amphibians (e.g., frogs, newts)
- fish (e.g., largemouth bass, golden shiner)
- small and large omnivorous birds (American robin and American woodcock, respectively)
- small and large piscivorous birds (belted kingfisher and great blue heron, respectively)
- small and large omnivorous mammals (short-tailed shrew and red fox, respectively)
- small and large piscivorous mammals (mink and river otter, respectively)

The assessment endpoints (and their associated risk question) evaluated in the BERA are as follows:

- **Maintain a stable and healthy benthic invertebrate community:** *Are the COPEC levels in sediment sufficiently high to cause biologically-significant changes or impair the function of the benthic invertebrate community in the Blackstone River, the wetlands, and the ponds at the site?*

- **Maintain a stable and healthy fish community**: *Are the COPEC levels in surface water sufficiently high to cause biologically-significant changes or impair the function of the fish community in the Blackstone River, the wetlands, and selected ponds at the Site?*

- **Maintain stable and healthy amphibian populations**: *Are the COPEC levels in surface water sufficiently high to cause biologically-significant changes or impair the function of the amphibian populations in the wetlands and the ponds at the Site?*

- **Maintain stable and healthy omnivorous bird and mammal populations**: *Are the COPEC levels in surface water, soil, and terrestrial biota sufficiently high to cause biologically-significant changes or impair the function of populations of large and small omnivorous birds and large and small omnivorous mammals foraging in the terrestrial habitats and the wetlands at the site?*

- **Maintain stable and healthy piscivorous bird and mammal populations**: *Are the COPEC levels in surface water, sediment and fish sufficiently high to cause biologically significant changes or impair the function of populations of large and small piscivorous birds and large and small piscivorous mammals foraging in the Blackstone River and selected ponds at the site?*

It is not possible to directly quantify the risk to these assessment endpoints. Instead, several measurement endpoints are identified for this purpose. These endpoints represent measurable ecological characteristics, quantified through laboratory or field experimentation, which could be related back to the valued ecological resources chosen as the assessment endpoints. The measurement endpoints represent the same general exposure pathways and mechanisms of toxicity as the assessment endpoints to which they are related.

The following measurement endpoints are used in the BERA:

US EPA ARCHIVE DOCUMENT

- Compare COPEC levels in sediment and surface water collected from each aquatic habitat to published sediment and surface water benchmarks.
- Assess the bioavailability of divalent metals by measuring the Acid Volatile Sulfides (AVS) and Simultaneously Extracted Metals (SEM) in a subset of sediment samples obtained from a few aquatic habitats.
- Perform laboratory toxicity tests by exposing sensitive life stages of two aquatic invertebrate species to the same subset of sediment samples obtained from a few aquatic habitats.
- Quantify the structure and function of the benthic invertebrate community in the same subset of sediment samples obtained from a few aquatic habitats.
- Compare the COPEC levels in whole fish collected from the three largest aquatic habitats to literature-derived Critical Body Residues (CBRs) for fish.
- Quantify the structure and function of the fish community in the three largest aquatic habitats.
- Use food chain modeling to calculate a Total Daily Intake (TDI) to omnivorous and piscivorous wildlife receptors from exposure to surface water, sediment, soil and earthworms or fish; compare these TDIs to Toxicity Reference Values (TRVs) obtained from the literature.

The measurement endpoints used in this BERA vary in their ability to quantify the risks to their related assessment endpoints. Some of the measurement endpoints are quite generic (e.g., sediment benchmarks), whereas others were more site specific (e.g., sediment toxicity testing). To support risk characterization, each measurement endpoint is provided with a descriptive Weight-of-Evidence (WOE) score which runs from “low” to “high”. The final risk integration step includes this descriptive score to determine the potential for and significance of the risk to the various assessment endpoints.

Specific Exposure Units (EUs) are defined for each assessment endpoint. These EUs are needed to determine how to summarize the analytical data into specific data sets for use in the risk calculations.

The aquatic EUs are as follows:

- Blackstone River (near-site)
- Pond A (located on Unnamed Island)
- Pond B (located along the banks of the Blackstone River [near-site])
- Pond C (located along the banks of the Blackstone River [near-site])
- Pond D (located on Unnamed Island)
- Pond E (located on Unnamed Island)
- Pond F (located next to Pratt Dam)
- Pond I (located along the banks of the Blackstone River [near-site])
- Pond N (located along the banks of the Blackstone River [near-site])
- Pond P (located on Unnamed Island)
- Wetlands A through D

The terrestrial EUs were as follows

- J.M. Mills Landfill
- Unnamed Island
- Nunes Parcel
- Quinville Well Field
- Wetlands A through D
- Pratt dam

US EPA ARCHIVE DOCUMENT

Each EU has an associated "reference" EU which is unaffected by past site activities. The reference EUs serve to quantify the risks associated with regional background levels of COPECs.

The EU-specific Central Tendency Exposures (CTEs) are calculated as the geometric means for each COPEC at an EU (note: except for the sediment CTEs which represent arithmetic means), whereas the Reasonable Maximum Exposures (RMEs) represent either the 95% Upper Confidence Limit (UCL) or the maximum concentration for those same COPECs, depending on the size and structure of an analytical data set. The wildlife food chain models include an additional assumption when calculating the TDIs, as follows: the RME TDI represents an exposure which assumes that the target wildlife receptor forages exclusively (100%) in the site EUs of interest, whereas the CTE TDI represents an exposure which assumes that the target wildlife receptor forages only half of the time (50%) at the site EUs of interest, with the other half spent foraging at locations unaffected by past site activities.

The potential for ecological risk is determined using Hazard Quotients (HQs), whenever possible. COPEC-specific HQs are calculated by dividing a RME or CTE exposure or dose by a corresponding toxicity value (i.e., published benchmarks for surface water and sediment; CBRs for fish tissues; or TRVs for birds and mammals). Alternatively, statistical tests are used to determine the presence of risk identified by the sediment toxicity tests and the benthic community surveys. The fish survey data are only evaluated semi-quantitatively.

COPEC-specific Residual Risks (RRs) are calculated during risk characterization by subtracting the COPEC-specific background HQs from the COPEC-specific site HQs. A RR above 1 represents the number of times that a site exposure, adjusted for background, exceeds its toxicity benchmark. A risk is deemed unrelated to past site activities if the RR falls below 1 (i.e., if the background HQ exceeds the site HQ for a given COPEC). Conversely, a risk is site-related if the RR exceeds 1 (i.e., if the background HQ falls below the site HQ for a given COPEC). The RR approach allows for a more focused assessment of site-related impacts by accounting for background risk. The conclusions discussed in the next subsection are based exclusively on RRs.

A ranking of possible risk outcomes and associated uncertainty was developed in consultation with the USEPA to help interpret the HQs and RRs. These two ranking schemes provide a coherent framework to distinguish among the multiple COPECs, benchmarks, EUs, receptors, and exposure scenarios at the site. They also help to identify and focus the discussion on those issues that have the highest potential for population-level adverse effects and the highest confidence in results (i.e., risk scenario 6).

ES.4 GENERAL CONCLUSIONS OF THE BERA

Tables ES-1.a to ES-1.k and **Tables ES-2.a to ES-2.f** provide a general summary and conclusions of the potential for ecological risk at all of the aquatic and terrestrial EUs, respectively. These conclusions are discussed below by target receptor group.

ES.4.1 Benthic invertebrates

The potential for ecological risk to the benthic community is assessed in all of the aquatic EUs using up to three measurement endpoints (depending on the EU), as follows:

- Compare the RME and CTE COPEC levels in bulk sediment samples to no effect and effect sediment benchmarks (Blackstone River, Wetlands A through D, and Ponds A, B, C, D, E, F, I, N,

US EPA ARCHIVE DOCUMENT

and P). In addition, the bioavailability of divalent metals in sediment is assessed based on measures of AVS and SEM (Blackstone River [near-site], Pond A, Pond D, Pond F, and Pond I).

- Measure survival and growth in two benthic invertebrate test species exposed to bulk sediment samples in the laboratory (Blackstone River [near-site], Pond A, Pond D, Pond F, and Pond I).
- Evaluate the structure and function of the invertebrate benthic community (Blackstone River, Pond A, Pond D, Pond F, and Pond I)

The first measurement endpoint is evaluated at each aquatic EUs, independently from the results of the toxicity tests and benthic community surveys. The RR analysis for this first measurement endpoint shows that severe ecological risk is possible to benthic invertebrates exposed to sediment in Pond E. The major risk driver at this EU is Pb, with an effect CTE RR equal to 11. This value indicates that the central tendency exposure to Pb at this EU, adjusted by subtracting background risk, exceeds the effect sediment benchmark for this COPEC (which equals 128 mg/kg) by 11 times. The RR analysis shows that some ecological risk is possible in the Blackstone River, Pond A, Pond B, Pond C, Pond D, Pond F, Pond I, and Pond N. Finally, the RR analysis shows that ecological risk is possible but not expected in Pond P and Wetlands A through D.

A subset of the sediment samples (specifically, four samples from the Blackstone River [near site], two samples from Pond A, and one sample each from Ponds D, F, and I) are also used in chemical analyses, toxicity testing, and a benthic community survey. These three lines of evidence are assessed collectively using the Sediment Quality Triad (SQT) approach.

The SQT results are summarized below to identify locations that may show site-related impacts:

- *Pond D (sample PD-002)*: Sediment chemistry and toxicity test results appear to show impacts, but benthic community metrics are not different from background.
- *Pond A (sample PA-003)*: Sediment chemistry and toxicity test results appear to show impacts, and benthic community data are inconclusive but suggestive of impacts.
- *Pond F (sample PF-004)*: Sediment chemistry data indicate potential impacts, but toxicity test results are inconclusive compared to background, and observed benthic community differences may be habitat-related (e.g., low dissolved oxygen).
- *Pond I (sample BR-005)*: Sediment chemistry data and toxicity test results appear to show impacts; but benthic community differences may be habitat-related (e.g., water temperature, grain size).

The following site locations have inconclusive evidence of potential site-related impacts:

- *Blackstone River (sample BR-006*): Toxicity test and benthic community data appear to show impairment, but sediment chemistry does not show high levels of site-related COPECs.
- *Pond A (sample PA-001)*: Toxicity test and benthic community results appear to show impairment, but sediment chemistry does not show high levels of site-related COPECs.

The following site locations do not show evidence of site-related impacts:

- *Blackstone River (sample BR-001)*: Sediment chemistry and toxicity test results do not show impacts; differences in the benthic community metrics seem unrelated to COPECs.
- *Blackstone River (sample BR-003)*: Sediment chemistry, toxicity test, and benthic community results do not show impacts.
- *Blackstone River (sample BR-007)*: Sediment chemistry, toxicity test, and benthic community results do not show impacts.

US EPA ARCHIVE DOCUMENT

The triad study indicates that potential site-related impacts are evident primarily in the ponds (Ponds A, D, and F) and possibly Pond I. These SQT results are not clear-cut, however, because a consistent link is not found between chemistry, toxicity, and community structure.

ES.4.2 Fish

The potential for ecological risk to fish exposed to site-related contamination is assessed in all of the aquatic EUs (except for Pond B) using up to three measurement endpoint (depending on the EU), as follows:

- Evaluate the structure and function of the fish community in the field (Blackstone River, Pond A, and Pond F).
- Compare RME and CTE COPEC levels in unfiltered surface water samples to acute and chronic surface water benchmarks (Blackstone River, Wetlands A through D, and Ponds A, C, D, E, F, I, N, and P). Note: the risk conclusions discussed below focus exclusively on the chronic benchmarks since they are the most conservative.
- Compare RME and CTE COPEC levels measured in whole fish to no effect and effect fish CBRs (Blackstone River, Pond A, and Pond F).

The first measurement endpoint is omitted from the risk characterization because the habitat structure of the upstream reference sections and the near-site locations is different enough to affect the species composition. Also, no suitable fish community data are available from an off-site reference pond to compare against the data collected from Pond A and Pond F. The reason is that the selected reference pond (Pond P-6) is actively managed as a fishery and does not provide “natural” fish community data.

The RR analysis shows that adverse effects to the fish community are possible but not expected at the Blackstone River (near-site), Pond A, Pond F, and Wetlands A through D. This conclusion is based on a lack of or only small exceedances of COPECs above background conditions in surface water or in whole fish collected from these EUs.

The RR analysis shows that severe ecological risk is possible to fish exposed to surface water in Pond C, Pond D, Pond E, Pond I, Pond N, and Pond P. The major risk drivers at each of these aquatic EUs are as follows: Pond C shows a chronic CTE RR for Pb equal to 62, Pond D shows a chronic CTE RR for Pb equal to 77, Pond E shows a chronic CTE RR for Ba equal to 55 (and 8 for Pb), Pond I shows a chronic CTE RR for Pb equal to 10, Pond N shows a chronic CTE RR for Al equal to 22 (and 12 for Pb), and Pond P shows a chronic CTE RR for Mn equal to 13. These findings are generally consistent with the location and disposal history of some of these aquatic EUs. For example, Pond C is next to the J.M. Mills Landfill, and Unnamed Island, where Ponds D and E are located, has a history of waste disposal.

ES.4.3 Amphibians

The potential for ecological risk to amphibians exposed to site-related contamination is assessed in all of the aquatic EUs (except Pond B) using a single measurement endpoint:

- Compare RME and CTE COPEC levels in unfiltered surface water samples to acute and chronic surface water benchmarks (Blackstone River [near-site], Wetlands A through D, and Ponds A, C, D, E, F, I, N, and P).

US EPA ARCHIVE DOCUMENT

The risk conclusions focus specifically on the chronic surface water benchmarks since they are the most conservative. The RR analysis shows that severe ecological risk is possible to amphibians exposed to surface water in Pond C, Pond D, Pond E, Pond I, Pond N, and Pond P. The major risk drivers at each of these aquatic EUs are as follows: Pond C shows a chronic CTE RR for Pb equal to 62, Pond D shows a chronic CTE RR for Pb equal to 77, Pond E shows a chronic CTE RR for Ba equal to 55 (and 8 for Pb), Pond I shows a chronic CTE RR for Pb equal to 10, Pond N shows a chronic CTE RR for Al equal to 22 (and 12 for Pb), and Pond P shows a chronic CTE RR for Mn equal to 13. These findings are generally consistent with the location and disposal history of some of these aquatic EUs. For example, Pond C is next to the J.M. Mills Landfill, and Unnamed Island, where Ponds D and E are located, has a history of waste disposal.

The RR analysis also shows that ecological risk is possible but not expected, or is unlikely, to amphibians exposed to surface water in the Blackstone River (near-site), Pond A, Pond F, and Wetlands A through D.

ES.4.4 Large omnivorous birds

The American woodcock is retained as a representative species of large omnivorous birds that may feed at the site. The evaluation assumes that this target species feeds across the six terrestrial EUs combined. These EUs are J.M. Mills Landfill, Unnamed Island, Nunes Parcel, Quinnville Well Field, Wetlands A through D, and Pratt dam. The woodcock is also assumed to have a diet consisting of 100% earthworms. The COPEC levels in earthworms are estimated based on site-specific soil analytical data and generic soil-to-biota Bioaccumulation Factors (BsoilAFs) for earthworms obtained from the literature. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect avian TRVs to estimate the potential for risk to this receptor group.

The RR analysis shows that severe ecological risk is possible to large omnivorous birds feeding across the six terrestrial EUs combined. Pb is the major risk driver, with an effect CTE RR of 17.

ES.4.5 Small omnivorous birds

The American robin is retained as a representative species of small omnivorous birds that may feed at the site. The evaluation assumes that this target species feeds in each individual terrestrial EUs at the site. These EUs are the Blackstone River (near-site), J.M. Mills Landfill, Unnamed Island, Nunes Parcel, Quinville Well Field, Wetlands A through D, and Pratt dam. The robin is assumed to have a diet consisting of 100% earthworms. The COPEC levels in earthworms are estimated based on site-specific soil analytical data and generic BsoilAFs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect avian TRVs to estimate the potential for risk to this receptor group.

The RR analysis indicates that severe ecological risk is possible to small omnivorous birds feeding at four of the six terrestrial EUs at the site. Pb is the major risk driver in each EU, as follows: J.M. Mills Landfill shows an effect CTE RR for Pb of 41, Unnamed Island shows an effect CTE RR for Pb of 15, Nunes Parcel shows an effect CTE RR for Pb of 81, and Pratt Dam shows an effect CTE RR for Pb of 34.

The RR analysis also shows that ecological risk is possible but not expected at the Quinnville Well Field, or is unlikely at Wetlands A through D to small omnivorous birds feeding at these EUs.

US EPA ARCHIVE DOCUMENT

ES.4.6 Large piscivorous birds

The great blue heron is retained as a representative species of large piscivorous birds that may feed at the site. The evaluation assumes that this target species feeds across the three largest aquatic EUs combined. These EUs are the Blackstone River (near-site), Pond A, and Pond F. The heron is also assumed to have a diet consisting of 100% fish captured at these three EUs. The COPEC levels for the fish are measured values from fish collected at the EUs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect avian TRVs to estimate the potential for risk to this receptor group.

The RR analysis shows that ecological risk is unlikely to large piscivorous birds feeding across the three aquatic EUs combined.

ES.4.7 Small piscivorous birds

The belted kingfisher is retained as a representative species of small piscivorous birds that may feed at the site. The evaluation assumes that this target species feeds in each of three aquatic EUs. These EUs are the Blackstone River (near-site), Pond A, and Pond F. The kingfisher is also assumed to have a diet consisting of 100% fish captured at each of these three EUs. The COPEC levels for the fish are measured values from fish collected at the EUs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect avian TRVs to estimate the potential for risk to this receptor group.

The RR analysis shows that ecological risk is possible but not expected at Ponds A and F, and unlikely at the Blackstone River (near-site) to small piscivorous birds feeding at these EUs.

ES.4.8 Large omnivorous mammals

The red fox is retained as a representative species of large omnivorous mammals that may feed at the site. The assessment assumes that this target species feeds across the seven terrestrial EUs combined. These EUs are J.M. Mills Landfill, Unnamed Island, Nunes Parcel, Quinnville Well Field, Wetlands A through D, and Pratt dam. The red fox is also assumed to feed exclusively on earthworms. The COPEC levels in earthworms are estimated based on site-specific soil analytical data and generic BsoilAFs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect mammalian TRVs to estimate the potential for risk to this receptor group.

The RR analysis shows that ecological risk is unlikely to large omnivorous mammals feeding across the six terrestrial EUs combined.

ES.4.9 Small omnivorous mammals

The short-tailed shrew is retained as a representative species of small omnivorous mammals that may feed at the site. The assessment assumes that this target species feeds in each individual terrestrial EUs at the site. These EUs are J.M. Mills Landfill, Unnamed Island, Nunes Parcel, Quinville Well Field, Wetlands A through D, and Pratt dam. The shrew is assumed to have a diet consisting of 100% earthworms. The COPEC levels in earthworms are estimated based on site-specific soil analytical data and generic BsoilAFs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect mammalian TRVs to estimate the potential for risk to this receptor group.

US EPA ARCHIVE DOCUMENT

The RR analysis indicates that ecological risk is possible to small omnivorous mammals feeding at three of the six terrestrial EUs at the site. Al is the major risk driver at these three EUs, as follows: J.M. Mills Landfill shows an effect CTE RR for Al equal to 6, Nunes Parcel shows an effect CTE RR for Al equal to 7, and Quinnville Well Field shows an effect CTE RR for Al equal to 4.

The RR analysis indicates that ecological risk is possible, but not expected, or is unlikely, at Unnamed Island, Wetlands A through D, and Pratt Dam to small omnivorous mammals feeding at these EUs.

ES.4.10 Large piscivorous mammals

The river otter is retained as a representative species of large piscivorous mammals that may feed at the site. The evaluation assumes that this target species feeds across the three largest aquatic EUs combined. These EUs are the Blackstone River (near-site), Pond A, and Pond F. The otter is also assumed to have a diet consisting of 100% fish captured at these three EUs. The COPEC levels for the fish are measured values from fish collected at the EUs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect mammalian TRVs to estimate the potential for risk to this receptor group.

The RR analysis shows that ecological risk is unlikely to large piscivorous birds feeding across the three aquatic EUs combined.

ES.4.11 Small piscivorous mammals

The mink is retained as a representative species of small piscivorous mammals that may feed at the site. The evaluation assumes that this target species feeds in each of the three largest aquatic EUs. These EUs are the Blackstone River (near-site), Pond A, and Pond F. The kingfisher is also assumed to have a diet consisting of 100% fish captured at these three EUs. The COPEC levels for the fish are measured values from fish collected at the EUs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect avian TRV to estimate the potential for risk to this receptor group.

The RR analysis shows that ecological risk is possible, but not expected at Ponds A and F, and unlikely at the Blackstone River (near-site) to small piscivorous mammals feeding at these EUs.

ES.5 UNCERTAINTY ANALYSIS

Uncertainty is associated with each of the measurement endpoints because multiple assumptions are built into the evaluation. The degree of uncertainty needs to be considered when interpreting the risk conclusions. The major uncertainties associated with each of the assessment endpoints are summarized below.

ES.5.1 Benthic invertebrates

- The no effect and effect sediment benchmarks used in the evaluation are generic and non site-specific, but considered to be conservative and therefore protective. It is deemed unlikely that substantial risk would be present for COPECs with concentrations below their effect sediment benchmarks.

- Sediment benchmarks are unavailable for a number of COPECs. The lack of benchmarks essentially obscures these COPECs from the evaluation and results in uncertainty about their potential impacts. The (unproven) assumption is that toxicological data would mainly be missing for

chemicals considered to be of lesser toxicological concern. If so, then the actual risk would not be much different from what is reported in this BERA. Otherwise, risk could be higher than reported.

- Only one or two sediment samples were collected for chemical analyses, toxicity testing, or community evaluation from the smaller aquatic EUs. Such small data sets create uncertainty when one or more lines of evidence suggest the potential for risk, but which cannot be compared against additional samples from the same EU.

- Toxicity is observed in one of the test species exposed to two of the seven background samples collected for evaluation. The presence of toxicity in around 30% of the background sediment samples complicates the interpretation of toxicity in some of the site samples.

- Multivariate statistical analyses show that some of the apparent changes in benthic community structure and function between background locations and the site EUs may reflect, at least to some degree, differences in habitat quality. These differences add unknown uncertainty when trying to identify a clear signal linking benthic community health to EU-specific COPEC levels.

- US EPA (2005c) recommends measuring AVS and SEM on surficial (0-2 cm) sediment collected between November and early May. This sampling approach ensures a conservative assessment by focusing on the top layer of the "biologically active zone" during cool weather seasons when AVS is most likely to be at a minimum. The sediment samples used in the triad approach were collected 0-6" deep in late June. It is prudent to assume that the AVS and SEM in those samples may not necessarily represent more conservative (= more toxic) conditions during colder months.

- A handful of sediment samples were collected from the Blackstone River (n = 4), Pond A (n = 2), Pond D (n = 1), Pond F (n = 1), and Pond I (n = 1) for AVS, SEM, and organic carbon analysis. All of these samples show $(\Sigma SEM\text{-}AVS)/f_{oc}$ below 130 µmol/g oc, indicating a low risk of adverse biological effects from divalent metals (i.e., cadmium, copper, lead, nickel, silver, and zinc) in those samples. This limited AVS and SEM database suggests, but cannot prove conclusively, that the observed benchmark exceedances of divalent metals in sediment from these aquatic EUs may not be ecologically relevant. The reason for this uncertainty is that many more sediment samples were collected from these EUs but were not analyzed for AVS, SEM, and OC. It is not know how representative this smaller dataset is of divalent metal bioavailability in the larger dataset.

ES.5.2 Fish

- Only one or two surface water samples are available from the smaller aquatic EUs. Such small data sets may not represent the full range of chemical conditions in surface water over time at these EUs. The risk may be over- or underestimated if the samples represent "worst case" or "best case" conditions, respectively.

- Metals, and Pb in particular, are identified as risk drivers in the smaller aquatic EUs. The surface water samples are not filtered, so that the data represent total metals. The BERA assumes that the inorganics are 100% bioavailable, even though metal toxicity is associated only with the dissolved (i.e., filtered) fraction, which can have much lower metal concentrations than the total fraction. The evaluation of risk using unfiltered surface water data is conservative and likely overestimates the risk to fish.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

- Fish were collected only from the three largest aquatic EUs (i.e., the Blackstone River [near site], Pond A, and Pond F). It is not known if or how many fish are present in the other EUs. The risk in the smaller aquatic EUs may be overstated if fish are absent from them.

- Fish CBRs are unavailable for many COPECs. These COPECs are obscured from the evaluation, which results in uncertainty about their potential impacts. The (unproven) assumption is that published tissue residue data are missing mostly for chemicals of lesser toxicological concern. If so, then the actual risk would not be much different from what is described in this BERA. Otherwise, risk could be higher than reported.

- HQs and RRs are calculated on a COPEC-specific basis assuming that a COPEC exerts toxicological pressure on fish independently from all other COPECs. This assumption may be violated in situations were fish are exposed to multiple COPECs. Several COPECs may target the same organ and cause a combined effect at lower individual doses. The COPEC-specific HQ and RR approach used in this BERA may underestimate the potential for ecological risk to fish.

- The fish survey data from the river are inconclusive because they cannot identify community responses caused by habitat differences versus COPEC exposures. The data from Ponds A and F cannot be properly evaluated due to a lack of a suitable off-site reference pond. The effect on risk is minimal since no impact to the fish community is expected based on the other two measurement endpoints evaluated for the river and the two ponds.

ES.5.3 Amphibians

- Only one or two data points are available for several of the smaller aquatic EUs. The potential for risk may be over- or underestimated depending on whether the samples represent “worst case” or “best case” conditions, respectively.

- The surface water samples used in the evaluation are unfiltered. Hence, the risk associated with metals in surface water is conservative and likely overestimated.

- HQs and RRs are calculated on a COPEC-specific basis assuming that a COPEC exerts toxicological pressure on amphibians independently from all other COPECs. This assumption may be violated in situations were amphibians are exposed to multiple COPECs. Several COPECs may target the same organ and cause a combined effect at lower individual doses. The COPEC-specific HQ and RR approach used in this BERA may underestimate the potential for ecological risk to amphibians.

- It is not known which of the aquatic EUs at the site actually support amphibian populations, particularly the embryo-larval aquatic stages. The risk may be overstated if one or more of the aquatic EUs is not used as amphibian habitat. On the other hand, it is also not known if surface water data have been collected from all the potential vernal pools at the site (particularly on Unnamed Island). Additional risk to local amphibian populations may be present at unsampled vernal pools.

ES.5.4 Birds and mammals

- The food chain modeling assumes a diet of 100% earthworms for omnivores and 100% fish for piscivores. These diets may be “worst-case”, at least for some wildlife receptors. For example,

US EPA ARCHIVE DOCUMENT

shrews eat other terrestrial invertebrates, such as crickets or beetles. Robins eat fruits during certain times of the year. Mink may also feed on amphibians, small mammals and birds. These other food items may accumulate COPECs differently from earthworms.

- COPECs in earthworms are not measured, but estimated using generic BsoilAFs from the literature. Site-specific, measured values would provide more reliable concentrations with less uncertainty.

- The BERA assumes conservatively that all COPECs are 100% bioavailable. In other words, the entire estimated COPEC load from ingesting soil/sediment and earthworms/fish is assumed to be released during digestion and transferred in its entirety into the wildlife receptor with no loss from excretion. This assumption is, by definition, "worst case", and results in overestimates of the daily doses, and hence risk.

- The TRVs are derived from published toxicity studies, but are typically not specific to the target wildlife receptors. Hence, the TRVs used in this BERA are the same for the kingfisher, heron, robin, and woodcock, even though these avian wildlife receptors are unrelated to each other. The same is true for the mammal TRVs. It is not known how much more, or less, sensitive a particular target receptor may be to a given COPEC compared to the test species used for deriving the TRVs for that COPEC. This uncertainty can be controlled to some degree by deriving TRVs using the most sensitive test species, but only if toxicity data are available on a wide range of species for a given chemical. A TRV may therefore overestimate or underestimate risk to the wildlife receptors.

- TRVs are also missing for a number of COPECs. The lack of toxicity data obscures these COPECs from the risk characterization and results in uncertainty about their potential impacts. The (unproven) assumption is that toxicological data would mainly be missing for chemicals considered to be of lesser toxicological concern. If so, then the actual risk would not be much different from what is reported in this BERA. Otherwise, risk could be higher than reported.

- HQs and RRs are calculated on a COPEC-specific basis assuming that a COPEC exerts toxicological pressure on a wildlife receptor independently from all other COPECs. This assumption may be violated in situations were a receptor is exposed to multiple COPECs. Several COPECs may target the same organ and cause a combined effect at lower individual doses. The COPEC-specific HQ and RR approach used in this BERA may underestimate the potential for ecological risk to birds and mammals.

ES.6 CONCLUSIONS

The BERA has identified the potential for severe ecological risk to omnivorous birds feeding at the individual terrestrial EUs or at all the terrestrial EUs combined. Pb is the biggest risk driver. The WOE for this measurement endpoint is "low-medium". The food chain modeling assumes a diet of 100% earthworms. Field-collected tissue residue data are not available for earthworms from any of the terrestrial EUs at OU2. Hence the COPEC levels in earthworm tissues are estimated using generic and conservative BsoilAF values.

The BERA has also identified the potential for severe ecological risk to fish and embryo-larval stages of amphibians exposed to surface water in Ponds C, D, E, I, N, and P. Pb is the biggest risk driver in three of these EUs, and a secondary risk driver in two others. The WOE for this measurement endpoint is "low-medium". Only one measurement endpoint is available for evaluation at these six EUs, namely comparing surface water chemistry to generic benchmarks. No surface water toxicity testing was performed. Also,

none of the surface water samples used in the EPC calculations were filtered before chemical analyses. Hence, the metals data used in the evaluation represent (unfiltered) total metals, instead of (filtered) dissolved metals which are more representative of the toxic fraction. Also, only one surface water sample was collected from Ponds N, and P, and two surface water samples from Ponds C, D, E, and I. Such small datasets may not represent the full range of exposure conditions in surface water at these habitats.

Finally, some potential for ecological risk to the benthic invertebrate community is possible at one or more locations in Ponds A, D, E, F, and I from sediment exposure. However, the cause for this risk is unclear and may result from a combination of habitat disturbances/differences and COPEC exposures.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

7.0 BASELINE ECOLOGICAL RISK ASSESSMENT

7.1 INTRODUCTION

This Baseline Ecological Risk Assessment (BERA) presents the results of the ecological investigations for the Peterson Puritan Superfund Site, Operable Unit 2 (OU2), located in the towns of Cumberland and Lincoln, Rhode Island (United States Environmental Protection Agency [USEPA] ID# RID055176283). This BERA was prepared by ARCADIS U.S., Inc. (ARCADIS BBL, formerly known as Blasland, Bouck & Lee, Inc. [BBL]) on behalf of the consenting Potentially Responsible Parties (PRPs). The PRPs consist of Custom Manufacturing, Inc., Bestfoods (formerly CPC International, Inc.), and Waste Management, and are collectively referred to as the "Group."

The goal of this BERA is to evaluate potential ecological risks posed by site-related constituents. Potential ecological risks were first evaluated in the Screening-Level Ecological Risk Assessment (SLERA) (ARCADIS BBL, 2007c), using conservative screening criteria to identify Constituents of Potential Environmental Concern (COPECs) that require further evaluation (**Appendix Z**).

The BERA was conducted in general accordance with the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA, 1997c). Consistent with this guidance, the BERA uses additional evaluations (i.e., site-specific exposure estimates, population surveys, and toxicity testing) to determine if COPEC concentrations present potential ecological risks. The BERA identifies specific site-related constituents, ecological receptors, and areas that may pose elevated risks. This information may be used to support risk management or remedial action decisions.

The BERA relies on data from previous site investigations conducted during a multi-phase remedial investigation. The initial two phases were completed in 2003 and 2004, and the second phase was conducted in 2005 and 2006. Much of the information in this BERA was obtained from ecological investigations conducted by BBL in 2005 which included a fish community survey, fish tissue sampling, benthic invertebrate survey, sediment toxicity testing, and habitat assessment activities.

Previous documents that summarize earlier investigations include the *RI/FS Phase 1A Initial Site Characterization Report* (Shield Environmental Associates, Inc. [Shield], 2004a), the *Revised Phase 1A Database Summary Report* (BBL, 2006a), and the *Phase 1B Database Summary Report* (BBL, 2006b).

7.2 SITE DESCRIPTION

The study area considered in the BERA is OU2 of the Peterson Puritan Superfund Site (**Figure 1-1**). OU2 is located along the banks of the Blackstone River, starting due north at about 1 mile below Ashton Dam and ending just south of Pratt Dam (**Figure 1-2**). Bordering the study area to the north is the Hope Webbing Company Property. The northwest border is occupied by the Mackland Sand and Gravel operations and the Berkshire Commons (residential development). The southwest border of the study area is defined by the Blackstone River Canal, and to the southeast is the Stop-N-Shop market (and strip mall) on Mendon Road (Route 122).

The site encompasses the land formerly owned or operated as a landfill by Mr. Joseph Marzalkowski and his agent(s)/associates for waste transfer and disposal. OU2 is located mostly in the Town of Cumberland in north-central Rhode Island and includes a small segment in the Town of Lincoln. OU2 is just over 1 mile long (5,600 feet) and ⅓ mile wide (1,600 to 1,800 feet), corresponding to a total area of about 220 acres.

US EPA ARCHIVE DOCUMENT

The following distinct Exposure Units (EUs) are present in the study area (ARCADIS BBL, 2007a) (**Figure 1-3**):

Aquatic habitats:

- Blackstone River (near-site)
- Pond A (located on Unnamed Island)
- Pond B (located along the banks of the Blackstone River [near-site])
- Pond C (located along the banks of the Blackstone River [near-site])
- Pond D (located on Unnamed Island)
- Pond E (located on Unnamed Island)
- Pond F (located next to Pratt Dam)
- Pond I (located along the banks of the Blackstone River [near-site])
- Pond N (located along the banks of the Blackstone River [near-site])
- Pond P (located on Unnamed Island)
- Wetlands A through D

Terrestrial habitats

- J.M. Mills Landfill
- Unnamed Island
- Nunes Parcel (the riparian corridor portion)
- Wetlands A through D
- Quinnville Well Field
- Pratt Dam

In addition to the sub-areas in the OU2 study area, reference areas were also identified to provide comparative data and associated risk estimates. The reference areas are the Blackstone River upstream of the site and Pond P-6 (located about 2.5 miles due north from the site).

7.2.1 Overview of the USEPA Ecological Risk Assessment Process

The USEPA (1997c) guidance outlines an eight-step process for conducting ecological risk assessments. The USEPA (1997c) developed this process to provide a "rational, science-based approach" for evaluating ecological risks for remedial decision making. The eight steps are:

- Step 1 – Screening-Level Preliminary Problem Formulation and Ecological Effects Evaluation
- Step 2 – Screening-Level Preliminary Exposure Estimate
- Step 3 – Baseline Risk Assessment Problem Formulation
- Step 4 – Study Design and Data Quality Objectives
- Step 5 – Field Verification of Sampling Design
- Step 6 – Site Investigation and Analysis of Exposure and Effects
- Step 7 – Risk Characterization
- Step 8 – Risk Management

Steps 1 and 2 were addressed by the SLERA (**Appendix Z**), whereas this BERA focuses on Steps 3 through 7. Step 8 will be addressed by the USEPA (with recommendations and input from the Group) during the feasibility study and remedial design.

US EPA ARCHIVE DOCUMENT

7.2.2 SLERA Summary

The SLERA presented an initial conservative evaluation of potential ecological risks associated with the site (ARCADIS BBL, 2007c) (**Appendix Z**). The SLERA objective was to identify COPECs and sub-areas of interest that required a more detailed evaluation in the BERA. The SLERA identified COPECs by comparing maximum concentrations to conservative ecological screening benchmarks. The SLERA used soil, sediment, and surface-water data from Shield (2004a) and data obtained in the Phase 1B investigation (BBL, 2006b). A constituent (and the associated sub-area) was carried through to the BERA if the maximum concentration equaled or exceeded the screening value. A constituent was also retained as a COPEC if it did not have a screening benchmark, or if the maximum detection/reporting limit (when the substance was not detected) exceeded its screening benchmark (ARCADIS BBL, 2007c).

The SLERA evaluated all constituents detected in soil, sediment, and surface water, including Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), Polycyclic Aromatic Hydrocarbons (PAHs), pesticides, Polychlorinated Biphenyls (PCBs), and metals. Dioxins and furans were not included in the analysis because the detected concentrations were all below the project action limits (ARCADIS BBL, 2007c). Based on the conservative evaluations presented in the SLERA (**Appendix Z**), each sub-area and medium contained at least one COPEC, which are further evaluated in this BERA. **Tables 7-1a and 7-1b** present a complete list of COPECs.

The following is a summary of the COPECs identified in the SLERA (ARCADIS BBL, 2007c).

Blackstone River

- *Sediment* – COPECs are various VOCs, SVOCs, PAHs, PCBs, pesticides, and metals.
- *Surface Water* – COPECs are various VOCs, SVOCs, PAHs, PCBs, pesticides, and metals.

Ponds A through P

- *Sediment* – COPECs are various VOCs, SVOCs, PAHs, PCBs, pesticides, and metals.
- *Surface Water* – COPECs are various VOCs, SVOCs, PAHs, PCBs, pesticides, and metals.

J.M. Mills Landfill

- *Soil* – COPECs are various VOCs, SVOCs, PAHs, pesticides, and metals. PCB concentrations were all below the screening criteria.

Unnamed Island

- *Soil* – COPECs are various VOCs, SVOCs, PAHs, pesticides, and metals. PCB concentrations were all below the screening criteria.

Nunes Parcel

- *Soil* – COPECs are various VOCs, SVOCs, PAHs, pesticides, and metals. PCB concentrations were all below the screening criteria.

Wetlands A through D

- *Sediment* – COPECs are various VOCs, SVOCs, PAHs, PCBs, pesticides, and metals.

- *Surface Water* – COPECs are various VOCs, SVOCs, PAHs, PCBs, pesticides, and metals.

Quinnville Well Field

- *Soil* – COPECs are various VOCs, SVOCs, PAHs, pesticides, and metals. PCB concentrations were all below the screening criteria.

PCBs were not detected above the SLERA screening criteria in any of the soil samples. Therefore, the SLERA concluded that PCBs in soil were not likely to pose an ecological risk, and that soil PCBs did not require further evaluation in the BERA (ARCADIS BBL, 2007c).

7.3 PROBLEM FORMULATION

The key components to the BERA were submitted to the USEPA in the *Ecological Risk Assessment Work Plan* (BBL, 2006d), and further developed in subsequent meetings and discussions with the USEPA. The BERA approach follows agency guidance (USEPA, 1997c) and also reflects previous discussions with USEPA personnel. The BERA begins with problem formulation, which includes a Conceptual Site Model (CSM) and identifying assessment and measurement endpoints. This BERA also presents a method for quantifying exposure (exposure assessment) and toxicity (effects assessment). The results of the exposure assessment and effects assessment are then evaluated in the risk characterization.

7.3.1 Conceptual Site Model

The CSM summarizes site characteristics, including physical setting, ecological characteristics, and possible source areas. The CSM also describes potential fate and transport of site-related chemicals, potential ecological receptors and exposure pathways, and specific ecological endpoints and mechanisms of toxicity (USEPA, 1997c).

7.3.1.1 Site Characteristics

The OU2 boundaries encompass a ½ mile length of the Blackstone River, an Unnamed Island encircled by the main stem and backwater channels of the Blackstone River, several ponds, forested upland, wetland areas north of the site, and disturbed/developed areas surrounding the site (**Figure 7-9**).

The Blackstone River and associated floodplain are the predominant physical features of the study area. The river, with a drainage area of 416 square miles, flows southeast, originating in Worcester, Massachusetts, and continuing to Woonsocket, Rhode Island (at the state border) to the confluence of the Seekonk River in Central Falls and Pawtucket, Rhode Island. The river is classified by the Rhode Island Department of Environmental Management (RIDEM) as Class B/B1 (i.e., suitable for primary and secondary contact recreations and fish and wildlife habitat, recognizing the potential for impacts due to approved wastewater discharges and combined sewer overflows). The river is listed on the RIDEM's List of Impaired Waters under Section 303(d) of the Clean Water Act based on biodiversity impacts and the presence of pathogens and metals (mainly copper and lead). The Blackstone River has been historically impacted by industrial and non-point sources (U.S. Army Corps of Engineers, 1994). A large number of mills and factories were located on the Blackstone River to access hydro power and waste assimilation.

The on-site portion of the river flows rapidly. With an average annual flow of 729 cubic feet per second (cfs) and a 7Q10 low flow of 101 cfs (Woonsocket, Rhode Island, United States Geological Survey [USGS]

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

gauging station), local stagnation and associated dissolved oxygen deficits are not expected to occur frequently. A significant flood measuring about 7,000 cfs occurred in April 2005. Another flood in October 2005 had flows of about 14,000 cfs as measured at the USGS station at Woonsocket, Rhode Island (USGS 01112500, approximately 7 miles upstream from the site) (Shield, 2004a).

The Unnamed Island, located toward the downstream portion of the site, is largely forested and contains several ponds (Ponds A, D, E, and P) that vary in the amount of surface water present throughout the year (Shield, 2004a), depending on river stage and weather patterns (i.e., storm events). Pond A is the largest pond at the site. It has a coarse sand and gravel bottom, with sparse vegetation in and around the basin. The substrate is consistent with the sand and gravel mining operations which took place at that location in the 1960s (Shield, 2004a). In wet weather and medium river stages, water flows from the Blackstone River to Pond A, but during high river water stages, the entire island may be underwater for long periods of time.

Besides the ponds on the Unnamed Island, several water bodies also referenced as "ponds" (Ponds B, C, F, and I) are located along the banks of the river. Pond F is the largest and is located next to Pratt Dam in the southeastern portion of OU2. These ponds are generally shallow, contain sand/silt bottoms, and are prone to flooding by the Blackstone River due to their proximity to the riverbank. The water quality characteristics of the ponds are similar because they are all directly or indirectly connected to the Blackstone River.

The northern section of OU2 contains four large interconnected water bodies that comprise a wetland system (Wetlands A through D). Wetland A, B, and C are interconnected. Wetland A contains a concrete drain that discharges surplus water from the wetlands into the Blackstone River below Pratt Dam. This system may have been created as a result of historical sand and gravel extraction, and/or the construction of a railroad levee across a meandering section of the river in the late 1800s (Shield, 2004a). These wetlands receive water from overland runoff and groundwater discharge. At extreme river stages, overflow from the Blackstone River occurs at the upstream location and floods all four wetlands. For overflow to occur, the river water must rise high enough (70 feet above National Geodetic Vertical Datum 29) to overflow the railroad tracks. Such a high water stage is relatively rare. All other flows discharging to the wetlands are from upland residential and commercial areas. These areas are sources of nutrients, PAHs, and bacteria, which recently has come to the attention of the RIDEM. Therefore, overland runoff and groundwater recharge are likely to be the main sources of water to the wetlands (ARCADIS BBL, 2007a).

The wetlands overlay highly permeable sand and gravel soils, and they are prone to drying out in late summer and early fall (Shield, 2004a). A large stormwater drain, located at the northeastern area of the wetlands, likely dominates wetland hydrology due to the volume of water discharged into the wetland system.

7.3.1.2 Habitat Description

Habitat descriptions for OU2 were presented in the *RI/FS Phase 1A Initial Site Characterization Report* (Shield, 2004a). Habitat assessment activities, including cover-type mapping and wildlife surveys, were conducted by BBL in 2005 as part of the ecological investigation. The results of the 2005 habitat assessment are presented in the *Habitat Characterization Summary Report* (**Appendix Q**). A habitat evaluation of on-site vernal pools was also conducted by BBL in 2005. The results of the vernal pool survey are presented in **Appendix R**.

The river and backwater areas generally contain riverine habitats. Some small, open-water habitats are present on the Unnamed Island in the river (attributable to island ponds). The remaining habitat consists of wetlands, maple-sycamore floodplain forests, late successional fields, and urban/disturbed areas (**Figure 2-8**) (**Appendix Q**).

US EPA ARCHIVE DOCUMENT

The vegetation in these habitats consists of trees, scrub-shrub, and aquatic plants. Silver maple (*Acer saccharinum*), black willow (*Salix nigra*), and sycamore (*Platanus occidentalis*) are the dominant tree species. Other common plant species include cottonwood (*Populus deltoides*), speckled alder (*Alnus rugosa*), cattail (*Typha latifolia*), purple loosestrife (*Lythrum salicaria*), soft rush (*Juncus effusus*), and duck weed (*Lemna minor*). Disturbed areas are characterized by golden rod (*Solidago canadensis; S. graminifolia*), blue vervain (*Verbena hastata*), curly dock (*Rumex crispus*), evening primrose (*Oenothera biennis*), *Polygonum* sp., rabbit-foot clover (*Trifolium arvense*), Queen Anne's lace (*Daucus carota*), and chicory (*Chicorrum* sp.).

Single-cell plants observed in the river included flagellated algae, diatoms, green algae, and blue-green algae (Shield, 2004a). Aquatic invertebrates include amphipods, clams, crayfish, and numerous insects (i.e., midges, beetles, caddisflies, mayflies, stoneflies, dragonflies, and damselflies). Fish surveys conducted by BBL in 2005 identified numerous species, including white sucker (*Catostomus commersoni*), common shiner *(Notropis cornutus)*, bluegill (*Lepomis macrochirus*), and largemouth bass (*Micropterus salmoides*).

A list of species observed at the site is included in the *RI/FS Phase 1A Initial Site Characterization Report* (Shield, 2004a) and in the *Habitat Characterization Summary Report* (Appendix Q). Wildlife species frequenting the site include redwing blackbird (*Agelaius phoeniceus*), yellow warbler (*Dendroica petechia*), mallard duck (*Anas platyrhynchos*), mourning dove (*Zenaida macroura*), crow (*Corvus brachyrhynchos*), red-tail hawk (*Buteo jamicensis*), song sparrow (*Melospiza melodia*), painted turtle (*Chrysemys picta*), raccoon (*Procyon lotor*), woodchuck (*Marmota monax*), gray squirrel (*Sciurus carolinensis*), white-footed mouse (*Peromyscus leucopus*), and opossum (*Didelphis virginiana*).

No rare plants or animals or ecologically significant natural communities are found within OU2 according to the Rhode Island Natural Heritage Program (Enser, 2004),. The American brook lamprey (*Lampetra appendix)* is listed as a State Interest Species. Although this species was not observed during the recent (2005) fish survey, it was observed during earlier surveys (Shield, 2004a). The Arrow Clubtain dragonfly (*Stylurus spiniceps*) has been proposed for listing as a Species of Special Concern (Brown, 2004). Correspondence from the U.S. Fish and Wildlife Service confirmed that threatened and endangered species are not found at the site (ARCADIS BBL, 2007c) (**Appendix EE**).

7.3.1.3 Source Identification

Site investigations identified several potential source areas, as summarized in the *RI/FS Phase 1A Initial Site Characterization Report* (Shield, 2004a). Possible COPEC sources include the sub-surface waste deposits at the J.M. Mills Landfill, associated debris fields, transfer station properties (referred to as the Nunes Parcel), and the Unnamed Island in the river. Other potential sources of COPECs at the site include historic industrial activities in the region that have contributed to the presence of contaminants in the general area and in the Blackstone River. Sources of contaminants in Wetlands A through D may also include stormwater runoff from urban upland areas unrelated to the site.

Potential chemical stressors were identified in the SLERA (**Appendix Z**). The primary categories of COPECs were VOCs (e.g., acetone, carbon disulfide), SVOCs (e.g., phenolics, aldehydes, PAHs), metals (e.g., arsenic, copper, lead), pesticides (e.g., dichlorodiphenyltrichloroethane [DDT], dieldrin), and PCBs. **Tables 7-1a and 7-1b** provide a list of COPECs in each sub-area of interest. Some of these stressors may also have originated off site.

Additional non-site-related stressors may also be present. Typical stressors to large urban rivers are low dissolved oxygen content, increased surface-water temperature, dynamic flow regimes, organic enrichment,

US EPA ARCHIVE DOCUMENT

and chemical loadings from non-site sources. Many of these stressors may influence the distribution of biological communities. The effects of these types of stressors should be considered when evaluating potential site-related COPECs.

7.3.1.4 Fate and Transport Mechanisms

Information on COPEC fate and transport in the environment helps identify complete exposure pathways. The following is a brief discussion of the fate and transport properties of each general category of COPECs.

Inorganics

Metals are chemical elements that cannot be destroyed by normal biophysical processes. The fate includes cycling and chemical transformation rather than degradation to simpler substances. For metals released into aquatic ecosystems, sediments may act as a sink (Campbell et al., 1988). Biotic and abiotic processes can cause sediment-bound metals to re-enter the water column and the food chain. The partitioning of metals between sediments and ecological compartments (i.e., water column and biota) is influenced by numerous physicochemical factors and the concentration and nature of ligands in the ambient water. In turn, the partitioning of metals determines the bioavailability of the chemical to aquatic organisms (Campbell et al., 1988).

Some metals (e.g., arsenic, mercury) exhibit trophic transfer via uptake from food, but quantities are insufficient to result in biomagnification (Suedel et al., 1994). Mercury and arsenic transform to organic forms in aquatic food chains, and this transformation affects the accumulation of these metals in aquatic organisms (Bryan and Langston, 1992; Suedel et al., 1994). Other factors that may affect the biological availability of metals to organisms include temperature, salinity, hydrogen ion concentration, oxygen-reduction potential, complexation, methylation, and demethylation. In addition, bioaccumulation may also depend on sediment properties, such as the presence and concentration of iron oxides, sulfides, and organic matter (Campbell et al., 1988).

Semivolatile Organic Compounds

SVOCs, especially those containing chlorine atoms and/or two or more fused benzene rings (see below), are relatively persistent in the environment. In air, soil, and water, the half-lives of chlorinated SVOCs are typically measured in hours. In groundwater and sediment, they are measured in days. The higher the number of chlorine atoms, the more likely the SVOC will be persistent and more difficult to degrade (Eisler, 1997). Moreover, the chlorine-substituted molecules are more likely to be present in the ionic form in the environment. This is important because the degree of ionization controls the fate and transport of SVOCs, according to the pH of the receiving medium (Eisler, 1997). In the normal range of pH, chlorinated SVOCs exist as ionic species. This leads to increased water solubility and mobility (and subsequent transport) in the aqueous phase as a result of reduced sorption potential. With decreased sorption, there is also increased potential for volatilization and transport via air. In the neutral form, chlorinated SVOCs tend to have low water solubility and increased capacity for sorption. Some SVOCs (including methylphenols) may enter the food chain and accumulate in biota. However, the magnitude of this bioaccumulation is low due to metabolic degradation in biota (Eisler, 1997). The main degradation processes for SVOCs are photolysis and biodegradation.

PAHs are a special subgroup of SVOCs that contain two or more fused benzene rings. Examples of PAHs include naphthalene, acenaphthylene, fluorene, and pyrene. In aquatic systems PAHs do not usually exist in the dissolved form because they are hydrophobic. PAHs are either removed from the water column via photodegradation, are taken up by aquatic organisms (and subsequently metabolized), or rapidly become

US EPA ARCHIVE DOCUMENT

associated with particles and are deposited in bottom sediments (McElroy, 1985; McElroy et al., 1989). Due to their hydrophobicity and strong affinity for organic matter, accumulation in sediments is the primary fate of PAHs in the environment (Herbes and Schwall, 1978). Studies have shown that any PAH bioaccumulation by aquatic organisms is correlated with physical/chemical properties of the given PAH, such as molecular weight and octanol/water partition coefficients (McElroy et al., 1989). However, given their affinity for sediments, PAHs are characterized as only moderately bioavailable, particularly in environments with high organic carbon content.

Volatile Organic Compounds

This group of chemicals is characterized by extreme volatility. For example, acetone will evaporate from water in less than 24 hours. As a result, air plays the main role in the environmental transport and degradation of VOCs released into the environment. Once in the atmosphere, VOCs tend to degrade rapidly. The typical half-life of acetone in air is 30 days. Although VOCs have moderate solubility in water, they are rarely found in surface water due to their high volatility. VOCs are sometimes detected in groundwater where the potential for volatilization is limited. In addition to volatilization, VOCs are generally rapidly degraded or attenuated in the environment. Chlorinated VOCs tend to degrade less rapidly than other VOCs. In general, concentrations of VOCs in soil, sediment, or water are usually very low unless there is an active groundwater recharge zone and continued source load. VOCs do not bioaccumulate due to their short-lived nature in the environment (http://www.atsdr.cdc.gov/toxprofiles/phs21.html).

Pesticides

Pesticides encompass a wide variety of chemical compounds whose specific function is to control insects and other pests. Many of the older formulations (such as DDT) were specifically designed to be resistant to degradation. The most likely fate of pesticides is metabolic degradation/transformation and accumulation in sediments and biological tissues (Howard, 1991).

Polychlorinated Biphenyls

PCBs are typically resistant to biological or physical degradation (Howard, 1991). They have a high affinity for biological tissues (especially fats) and sediment particles. The fate of PCBs in the environment includes bioaccumulation in biota and cycling between various ecological compartments (i.e., biological tissues, prey, sediment, and soil) (Howard, 1991).

7.3.1.5 Identifying Potential Ecological Receptors

Potential ecological receptors to be evaluated in the BERA were selected using a feeding guild approach as described in the *Ecological Risk Assessment Work Plan* (BBL, 2006d) and subsequent meetings and discussions with the USEPA. Specifically, groups of species representing various phylogeny and feeding habits were selected to represent ecological receptors that are common to the ecosystem and have a potential to become exposed to COPECs. The selected feeding guilds and representative species are listed below:

- benthic macroinvertebrates (e.g., midges, mayflies)
- amphibians (e.g., frogs, newts)
- fish (e.g., largemouth bass, golden shiner)
- omnivorous birds (e.g., American robin, American woodcock)
- piscivorous birds (e.g., great blue heron, belted kingfisher)

- omnivorous mammals (e.g., short-tailed shrew, red fox)
- piscivorous mammals (e.g., mink, river otter)

The USEPA, the trustee agencies, and the Group determined that terrestrial plants and soil invertebrates would not be quantitatively addressed in this BERA due to a paucity of soil benchmarks.

7.3.1.6 Exposure Pathways

Exposure pathways are defined by the USEPA (1998) as "the paths of stressors from the source(s) to the receptors". A complete exposure pathway includes four components: 1) source and mechanism of chemical release, 2) retention or transport medium, 3) a receptor at a point of potential exposure to the affected medium, and 4) an exposure route at the exposure point (USEPA, 1992c). If any one of the four components is not present, then a potential exposure pathway is considered incomplete and is not evaluated further in the risk assessment.

Complete exposure pathways may be further categorized as primary pathways (pathways expected to be significant due to high exposure potential) and secondary pathways (pathways expected to be insignificant due to low exposure potential).

Exposure routes are the entry methods of a compound from the environment into an organism (USEPA, 1997a). Typical exposure routes for aquatic and terrestrial receptors are inhalation, ingestion, and dermal absorption. Ingestion routes can include ingestion of soil while foraging, consumption of contaminated water, or ingestion of contaminated food. These ingestion routes are considered the primary exposure routes in this assessment. Inhalation and dermal absorption tend to be less important for terrestrial receptors because COPEC concentrations in air are usually low and skin/fur/feathers often form an effective barrier. Furthermore, ambient air sampling at the site did not indicate elevated levels of any constituents. Therefore, these routes are considered secondary and are not examined for terrestrial receptors. **Figure 7-9** provides a general model of the main exposure pathways and routes at the site.

7.3.2 Assessment endpoints, risk questions, measurement endpoints, and weight of evidence

7.3.2.1 Introduction

Endpoints help quantify the risks to representative receptors that may be exposed to site-derived contaminants. Assessment endpoints are explicit expressions of the key ecological resources to be protected from harm. They generally reflect sensitive populations, communities, or trophic guilds. Four criteria for selecting the assessment endpoints are listed below. The ecological resource should:

- have relevance,
- be susceptible to the stressors of concern,
- have biological, social, and/or economic value, and
- be relevant to the risk management goals for the site.

By carefully considering these selection criteria, risks identified to one or more of the assessment endpoints will influence the risk management decision process at the site.

Measurement endpoints, on the other hand, represent measurable ecological characteristics, quantified through laboratory or field experimentation, which can be related back to the valued ecological resources chosen as the assessment endpoints. Measurement endpoints are needed because it is often not possible

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

to directly quantify risk to an assessment endpoint. The measurement endpoints should represent the same exposure pathway(s) and mechanisms of toxicity as the assessment endpoints in order to be relevant and useful.

Risk questions establish a link between assessment endpoints and their predicted responses when exposed to COPECs. The risk questions should provide a basis to develop the study design and evaluate the results of the site investigation in the analysis phase and during risk characterization (USEPA, 1997).

7.3.2.2 Selecting representative assessment endpoint species or communities

It is neither practical nor possible to evaluate the potential for ecological risk to all of the individual parts of the local aquatic ecosystem affected by site-related chemical stressors. Instead, key components are identified to select those species or groups most likely to experience exposure to the stressors.

Non-wildlife receptors

Benthic invertebrates

Benthic invertebrates form an integral link in all aquatic ecosystems. They play a key role in nutrient and energy transfers within those systems. They also process and assimilate organic material, feed on other invertebrates, and are themselves consumed by fish, birds, and mammals.

COPECs with the potential to bioaccumulate can be transferred from the sediment into the benthic invertebrate community and up the food chain, thereby harming higher-level receptors. Significant alterations in invertebrate communities could also impact the energy cycling at the base of the aquatic food chain.

The substrate in the various aquatic habitats at the site should be able to support a diverse benthic invertebrate community. Key invertebrates include snails, freshwater mussels, crayfish, and the aquatic life stages of numerous insect species (e.g., mayflies, stoneflies, caddisflies, dragonflies, etc.).

Fish

The Blackstone River and the ponds at the site should be able to support a healthy fish community, consisting of warm water species, such as shiners, sunfish, and bass. The aquatic environment should provide such a community with a diverse food base, suitable feeding and spawning areas, refuges for juvenile fish, and other essential environmental services.

The presence of site-derived COPECs in the surface water and sediment can impair the local fish community in two general ways: (1) mortality of sensitive early life stages exposed to COPECs in the water column, or (2) uptake of certain COPECs in aquatic biota via food chain uptake which could affect reproduction and the long-term survival of the exposed fish.

Amphibians

Amphibians are a key receptor group of concern. Amphibian populations are generally considered to be in broad decline in the U.S. due to habitat loss and environmental degradation. The local amphibian populations at the site are known to use some of the ponds for breeding in the spring. The conditions in

US EPA ARCHIVE DOCUMENT

those ponds should be such that amphibian embryo-larval life stages can survive and develop normally in order to maintain the local amphibian populations.

Wildlife receptors

Numerous birds and mammals forage at the site and feed on terrestrial and aquatic food items. The wildlife receptors selected for evaluation is this BERA consist of the following target species:

- The American robin and the short-tailed shrew, representing small omnivorous birds and mammals, respectively
- The American woodcock and the red fox, representing large omnivorous birds and mammals, respectively
- The belted kingfisher and the mink, representing small piscivorous birds and mammals, respectively
- The great blue heron and the river otter, representing large piscivorous birds and mammals, respectively

7.3.2.3 Endpoint selection

The following assessment endpoints are used to evaluate the potential for ecological risks to the aquatic receptors, and wildlife receptors feeding on aquatic and terrestrial prey. A risk question is appended to each assessment endpoint. One or more measurement endpoints are then provided to help quantify risk to the assessment endpoints. It is assumed that by evaluating and protecting the assessment endpoints, all of the habitats, and the wildlife receptors associated with them, are protected as well.

Assessment endpoint 1:

Maintain a stable and healthy benthic invertebrate community: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of the benthic invertebrate community in the Blackstone River, the wetlands, and the ponds at the site?*

Up to three measurement endpoints are used to assess the potential impacts of COPECs to this receptor group, depending on the EU:

1.A Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.

1.B Measure survival and growth in the benthic invertebrate species *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.

1.C Evaluate the structure and function of the benthic invertebrate community.

Exhibit 1 summarizes the aquatic EUs at the site and the measurement endpoints evaluated by assessment endpoint 1.

Exhibit 1: Summary of aquatic exposure units and measurement endpoints evaluated for assessment endpoint 1 (benthic community)			
	Measurement Endpoints		
Exposure Unit	**1.A: Compare COPEC levels to Benchmarks**	**1.B: Sediment toxicity testing**	**1.C: Benthic community evaluation**
Blackstone River (near-site)	√	√	√
Pond A	√	√	√
Pond B	√		
Pond C	√		
Pond D	√	√	√
Pond E	√		
Pond F	√	√	√
Pond I	√	√	√
Pond N	√		
Pond P	√		
Wetlands A through D	√		

Assessment endpoint 2:

Maintain a stable and healthy fish community: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of the fish community in the Blackstone River, the wetlands, and the ponds at the Site?*

Up to three measurement endpoints are used to assess the potential impacts of COPECs to this receptor group, depending on the aquatic EU:

2.A Evaluate the structure and function of the fish community.

2.B Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.

2.C Compare COPEC levels measured in whole fish to no effect and effect Critical Body Residues (CBRs).

Exhibit 2 summarizes the aquatic EUs at the site and the measurement endpoints evaluated by assessment endpoint 2.

Exhibit 2: Summary of aquatic exposure units and measurement endpoints evaluated for assessment endpoint 2 (fish community)			
	Measurement Endpoints		
Exposure Unit	**2.A: Fish Community Evaluation**	**2.B: Compare COPEC levels in surface water to benchmarks**	**2.C: Compare COPECs in fish to CBRs**
Blackstone River (near-site)	√	√	√
Pond A	√	√	√
Pond C		√	

US EPA ARCHIVE DOCUMENT

Exhibit 2: Summary of aquatic exposure units and measurement endpoints evaluated for assessment endpoint 2 (fish community)			
	Measurement Endpoints		
Exposure Unit	2.A: Fish Community Evaluation	2.B: Compare COPEC levels in surface water to benchmarks	2.C: Compare COPECs in fish to CBRs
Pond D		√	
Pond E		√	
Pond F	√	√	√
Pond I		√	
Pond N		√	
Pond P		√	
Wetlands A through D		√	

Assessment endpoint 3:

Maintain stable and healthy amphibian populations: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of the amphibian populations in the Blackstone River, the wetlands, and the ponds at the Site?*

One measurement endpoint is used to assess the potential impacts of COPECs to this receptor group in all EUs:

3.A Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.

Exhibit 3 summarizes the aquatic EUs at the site and the measurement endpoints evaluated by assessment endpoint 3.

Exhibit 3: Summary of aquatic exposure units and measurement endpoints evaluated for assessment endpoint 3 (amphibian populations)	
	Measurement Endpoint
Exposure Unit	3.A: Compare Concentrations to Benchmarks
Blackstone River	√
Pond A	√
Pond C	√
Pond D	√
Pond E	√
Pond F	√
Pond I	√
Pond N	√
Pond P	√
Wetlands A through D	√

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Assessment endpoint 4:

Maintain stable and healthy populations of large omnivorous birds: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large omnivorous birds foraging in the wetlands and terrestrial habitats at the site?*

One measurement endpoint is used to assess the potential impacts of COPECs ingested by this receptor group:

4.A Use soil analytical data to estimate the body residues of COPECs in earthworms; use food chain modeling to calculate daily doses in large omnivorous birds from ingesting surface water, soil, and earthworms, and compare these values to no effect and effect avian TRVs.

Exhibit 4 summarizes the terrestrial EUs at the site and the measurement endpoint evaluated by assessment endpoint 4.

Exhibit 4: Summary of terrestrial exposure units and measurement endpoints evaluated for assessment endpoints 4 and 5 (populations of large and small omnivorous birds, respectively)

Terrestrial Exposure Units	Large omnivorous birds	Small omnivorous birds
	4.A: Compare Doses to TRVs	5.A: Compare Doses to TRVs
J.M. Mills Landfill	All terrestrial EUs combined	√
Unnamed Island		√
Nunes Parcel		√
Quinville Well Field		√
Wetlands A through D		√
Pratt Dam		√

Assessment endpoint 5:

Maintain stable and healthy populations of small omnivorous birds: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small omnivorous birds foraging in the wetlands and terrestrial habitats at the site?*

One measurement endpoint is used to assess the potential impacts of COPECs ingested by this receptor group:

5.A Use soil analytical data to estimate the body residues of COPECs in earthworms; use food chain modeling to calculate daily doses in small omnivorous birds from ingesting surface water, soil, and earthworms, and compare these values to no effect and effect avian TRVs.

Exhibit 4 summarizes the terrestrial EUs at the site and the measurement endpoint evaluated by assessment endpoint 5.

US EPA ARCHIVE DOCUMENT

Assessment endpoint 6:

Maintain stable and healthy populations of large piscivorous birds: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large piscivorous birds foraging in targeted aquatic habitats at the site?*

One measurement endpoint is used to assess the potential impacts of COPECs ingested by this receptor group:

6.A Use food chain modeling to calculate daily doses for large piscivorous birds from ingesting surface water, sediment, and fish, and compare these values to no effect and effect avian TRVs.

Exhibit 5 summarizes the targeted aquatic EUs at the site and the measurement endpoint evaluated by assessment endpoint 6.

Exhibit 5: Summary of targeted aquatic exposure units and measurement endpoints evaluated for assessment endpoints 6 and 7 (populations of large and small piscivorous birds, respectively)

Aquatic Exposure Units	Large piscivorous birds 6.A: Compare Doses to TRVs	Small piscivorous birds 7.A: Compare Doses to TRVs
Blackstone River (near-site)	The three targeted aquatic EUs combined	√
Pond A		√
Pond F		√

Assessment endpoint 7:

Maintain stable and healthy populations of small piscivorous birds: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small piscivorous birds foraging in targeted aquatic habitats at the site?*

One measurement endpoint is used to assess the potential impacts of COPECs ingested by this receptor group:

7.A Use food chain modeling to calculate daily doses for small piscivorous birds from ingesting surface water, sediment, and fish, and compare these values to no effect and effect avian TRVs.

Exhibit 5 summarizes the targeted aquatic EUs at the site and the measurement endpoint evaluated by assessment endpoint 7.

Assessment endpoint 8:

Maintain stable and healthy populations of large omnivorous mammals: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large omnivorous mammals foraging in the wetlands and terrestrial habitats at the site?*

One measurement endpoint is used to assess the potential impacts of COPECs ingested by this receptor group:

US EPA ARCHIVE DOCUMENT

8.A Use soil analytical data to estimate the body residues of COPECs in earthworms; use food chain modeling to calculate daily doses for large omnivorous birds from ingesting surface water, soil, and earthworms, and compare these values to no effect and effect avian TRVs.

Exhibit 6 summarizes the terrestrial EUs at the site and the measurement endpoint evaluated by assessment endpoint 8.

Exhibit 6: Summary of terrestrial exposure units and measurement endpoints evaluated for assessment endpoints 8 and 9 (populations of large and small omnivorous mammals, respectively)

Terrestrial Exposure Units	Large omnivorous mammals 8.A: Compare Doses to TRVs	Small omnivorous mammals 9.A: Compare Doses to TRVs
J.M. Mills Landfill	All terrestrial EUs combined	√
Unnamed Island		√
Nunes Parcel		√
Quinville Well Field		√
Wetlands A through D		√
Pratt Dam		√

Assessment endpoint 9:

Maintain stable and healthy populations of small omnivorous mammals: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small omnivorous mammals foraging in the wetlands and terrestrial habitats at the site?*

One measurement endpoint is used to assess the potential impacts of COPECs ingested by this receptor group:

9.A Use soil analytical data to estimate the body residues of COPECs in earthworms; use food chain modeling to calculate daily doses for small omnivorous mammals from ingesting surface water, soil, and earthworms, and compare these values to no effect and effect avian TRVs.

Exhibit 6 summarizes the terrestrial EUs at the site and the measurement endpoint evaluated by assessment endpoint 9.

Assessment endpoint 10:

Maintain stable and healthy populations of large piscivorous mammals: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large piscivorous mammals foraging in targeted aquatic habitats at the site?*

One measurement endpoint is used to assess the potential impacts of COPECs ingested by this receptor group:

10.A Use food chain modeling to calculate daily doses for large piscivorous mammals from ingesting surface water, sediment, and fish, and compare these values to no effect and effect avian TRVs.

Exhibit 7 summarizes the targeted aquatic EUs at the site and the measurement endpoint evaluated by assessment endpoint 10.

Exhibit 7: Summary of targeted aquatic exposure unit and measurement endpoints evaluated for assessment endpoints 10 and 11 (large and small piscivorous mammals, respectively)		
Aquatic Exposure Units	**Large piscivorous mammals**	**Small piscivorous mammals**
	10.A: Compare Doses to TRVs	**11.A: Compare Doses to TRVs**
Blackstone River (near-site)	All three targeted aquatic exposure units combined	√
Pond A		√
Pond F		√

Assessment endpoint 11:

Maintain stable and healthy populations of small piscivorous mammals: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small piscivorous mammals foraging in targeted aquatic habitats at the site?*

One measurement endpoint is used to assess the potential impacts of COPECs ingested by this receptor group:

11.A use food chain modeling to calculate daily doses for small piscivorous mammals from ingesting surface water, sediment, and fish, and compare these values to no effect and effect avian TRVs.

Exhibit 7 summarizes the targeted aquatic EUs at the site and the measurement endpoint evaluated by assessment endpoint 11.

7.3.2.4 Weight of Evidence

A Weight-of-Evidence (WOE) approach (Menzie et al., 1996) is used to help evaluate the potential for ecological risk to the target receptor groups identified above. This method recognizes that all measurement endpoints do not carry the same weight when it comes to determining ecological risk. Some are quite qualitative (e.g., comparing sediment analytical data to sediment benchmarks), whereas others are more quantitative (e.g., sediment toxicity testing). Risk identified based on a more qualitative endpoint has more uncertainty associated with it than risk identified based on more quantitative endpoint.

A relative weight is assigned to all the measurement endpoints before they are used in risk characterization. Menzie et al. (1996) describe ten attributes which, when summed, can help determine these relative weights. **Table 7-1c** summarizes the BERA endpoints and provides the WOE scoring for each measure of effect used in this BERA.

7.3.3 Exposure Assessment

The exposure assessment estimates the degree of contact between the ecological receptors and COPECs in exposure media. These estimates are then compared to toxicity benchmarks to estimate potential risks. The next sections describe the exposure assessment approaches and assumptions used in this BERA. The potential uncertainties associated with these approaches and potential effects of alternative approaches that might have been used are discussed in the uncertainty section at the end of the BERA.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

The available analytical data for soil, sediment, surface water, and fish tissue are presented in the *Revised Phase 1A Database Summary Report* (BBL, 2006a), as well as Phase 1A (Shield, 2003b), Phase 1A Expanded (Shield, 2004b), and Phase 1B (BBL, 2006b) investigation reports. The analytical data for each medium are summarized by EU to evaluate potential ecological exposure. Exposure Point Concentrations (EPCs) are calculated for each EU for receptors with smaller home ranges (e.g., benthic invertebrates, amphibians, small birds, and small mammals). The data are combined for receptors with larger home ranges. The data are grouped according to EU, and a summary of the data groupings with a list of samples is presented in **Appendix AA**. Sediment and surface-water samples are not available for Pond P-6. Fish tissue samples collected in Pond P-6 are included with other reference samples (i.e., river upstream) for the piscivorous bird and mammal models. The Pond P-6 tissue data are combined into a single dataset for modeling exposure to large piscivorous birds and mammals. These same data are used separately for modeling exposure to small piscivorous birds and mammal.

Several measurement endpoints in the BERA use exposure media concentrations and/or dietary intake models to evaluate exposure. The first method is similar to that used in the SLERA, where a COPEC concentration serves as the exposure level. Unlike the SLERA, however, the BERA does not use maximum concentrations to estimate exposure. The geometric mean concentration and the 95% Upper Confidence Limit (UCL) on the mean are used to reflect Central Tendency Exposures (CTEs) and Reasonable Maximum Exposures (RMEs), respectively (Note: This statement is true for all the ecological receptor groups, except one. The CTEs for the sediment analytical data used to asses the potential risk to the benthic invertebrate community represent arithmetic means). The maximum observed concentration is used as the RME EPC only when data sets do not have enough data to calculate 95% UCLs.

CTE and RME EPCs are based on data collected in the Phase 1A, 1B, and 2006 sampling events. Both the CTEs and RMEs are calculated for each receptor, EU, matrix, and COPEC. CTE EPCs are estimated as the geometric mean, using half the reporting limits for non-detects. RME EPCs are based on 95% UCLs on the mean using USEPA's (2006b) ProUCL 4.0 software. ProUCL is useful for computing EPCs for datasets with non-detects, and applies as many as 15 different methods to the same data set to arrive at a UCL. For smaller data sets (n< 8) with low detection (number of detects less than 5), the 95% UCL statistics can be unreliable, and professional judgment is needed to see if the maximum detected concentration gives a reasonable estimate of the EPC (USEPA, 2006b). When a dataset does not meet the thresholds listed above, statistical methods, such as those implemented in ProUCL 4.0, are impractical for computing a reliable EPC. In such cases, the BERA uses the maximum detected concentration as the RME. Half the maximum reporting limit is used as the RME if all samples are non-detect. In some cases, half the maximum reporting limit also exceeds the maximum detected concentration; for those cases, half the maximum reporting limit is used over the maximum concentration as a conservative RME. Note, however, that the USEPA (2006b) suggests that in cases of low detection frequency, the maximum often comprises a small percentage of the total exposure area and can be a poor indicator of the overall mean concentration.

Data from field duplicate and parent samples are combined into a single result using the following rules:

- The arithmetic mean of the parent and duplicate sample is used as the final result if both samples have detected concentrations.

- The maximum reporting limit is used as the final result if both samples have non-detect concentrations.

- The detected concentration is used as the final result if only one of the two samples has a detected concentration.

Appendix BB provides EPCs and supporting summary statistics, including the 95% UCL method recommended by ProUCL. Note that **Appendix BB** presents EPCs for all COPECs identified at the site; however, only those identified as COPECs for a given EU are carried forward to the HQ calculations.

Several measurement endpoints (i.e., dietary intake for birds and mammals) use a general ingestion model from the USEPA (1993):

$$TDI = P\left(FIR \cdot C_f + DR \cdot C_w + SIR \cdot C_s\right)$$

where:

TDI	= Total Daily Intake (milligrams [mg] constituent per kilogram [kg] body weight [bw] per day)
P	= proportion of contaminated food, water, and sediment or soil (unitless)
FIR	= Food Ingestion Rate normalized to bw (kg food/kg bw-day)
C_f	= concentration of constituent in food (milligrams per kilogram [mg/kg])
DR	= Water Ingestion Rate normalized to bw (liter water/kg bw-day)
C_w	= concentration of constituent in ambient water (milligrams per liter)
SIR	= Soil/Sediment Intake Rate normalized to body weight (kg sediment/kg bw-day)
C_s	= concentration of constituent in sediment or soil (mg/kg)

A TDI is calculated using central tendency values to estimate CTE and conservative values to estimate RME. The input variables are as follows:

- *Proportion of Contaminated Food, Water, and Sediment or Soil (P)*: A P of 1 is used for the RME estimate. This value assumes that the receptor forages exclusively in the EU interest. A P of 0.5 is used for the CTE estimate, which assumes that the receptor forages in the EU only half the time.

- *Food, Water, and Sediment/Soil Ingestion Rates (FIR, DR, and SIR)*: Ingestion rates for representative avian and mammalian species are obtained from literature sources, including the *Wildlife Exposure Factors Handbook* (USEPA, 1993). Actual measured ingestion rates were preferred to those based on allometric model predictions (as per the USEPA [1993] guidance).

- *Concentrations in Water (C_w), Soil, and Sediment (C_s)*: EPCs are tailored to given receptors with respect to their primary exposure environment (i.e., terrestrial or aquatic) and foraging ranges. For example, large piscivorous birds and mammals are assumed to forage over the entire OU2 area and, therefore, fish data for the site ponds and portions of the river located on site are pooled for statistical analysis. In contrast, small birds and mammals are assumed to remain at one location and, therefore, data are grouped by EU. EPCs are also calculated for reference river and pond locations to determine the magnitude of residual risk, if any, due to exposures at OU2.

- *Concentrations in Food (C_f)*: Food item concentrations for omnivorous birds and mammals are estimated using earthworm Soil-to-Biota Accumulation Factors (BSoilAFs). Earthworms were selected as the primary dietary item for omnivorous species because they readily accumulate soil-borne constituents due to their permeable cuticle and gut, high rate of soil ingestion, and high lipid content. There is also a fair amount of earthworm bioaccumulation data in the literature.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Tables 7-2a to 7-2d provide the exposure parameters for the eight groups of wildlife receptors evaluated in the BERA.

The equation for estimating earthworm concentrations is as follows:

where:

$$C_f = C_s \cdot BSoilAF$$

C_f = Concentration of constituent in food (mg/kg)
C_s = Concentration of constituent in soil (mg/kg)
BSoilAF = soil-to-biota accumulation factor for earthworms (unitless)

Table 7-3 presents the BSoilAF values used to calculate food item EPCs.

For piscivorous species, COPEC concentrations in the dietary models are estimated using the whole-body fish tissue data collected by BBL in 2005. Fish data were sorted in two size classes (e.g., small fish and large fish) to reflect the fish sizes assumed to be consumed by representative species. For smaller piscivores (e.g., kingfishers), the EPC is based on residue data from fish measuring 15 centimeters (cm) or less. All of the fish tissue data are combined for larger piscivores (e.g., river otter). The assumption of a diet consisting solely of fish is considered conservative given that COPEC concentrations for other possible dietary items (e.g., frogs, small mammals) could be lower than fish.

Tissue samples were analyzed as whole-body samples of smaller forage fish and fillet and remaining carcass samples from larger fish. For larger fish, the fillet and remaining carcass data were subsequently used to calculate whole-body concentrations using the following equation:

where:

$$WholeBody\ (mg/kg) = [(FCxFW) + (CCxCW)]/(FW + CW)$$

FC = fillet concentration (mg/kg)
FW = fillet weight (grams)
CC = carcass concentration (mg/kg)
CW = carcass weight (grams)

Appendix BB presents a summary of whole-body fish tissue EPC values.

7.3.4 Effects Assessments

The effects assessment identifies effect levels used to evaluate the results of the exposure assessment. The BERA uses benchmarks obtained from various sources, including:

- USEPA Ambient Water Quality Criteria (AWQC) (USEPA, 2007).
- USEPA Ecotox Thresholds for Surface Water based on Great Lakes Water Quality Initiative Tier 2 methodology (USEPA, 1996b).
- Secondary Chronic Values (SCVs) for aquatic biota developed by Oak Ridge National Laboratory (ORNL) (Suter and Tsao, 1996; MacDonald et al., 2000).

US EPA ARCHIVE DOCUMENT

- Threshold Effect Concentrations (TECs) and Probable Effect Concentrations (PECs) and (MacDonald et al., 2000).
- USEPA Office of Solid Waste and Emergency Response Ecotox Thresholds (USEPA, 1996b).
- Sediment Quality Criteria, Sediment Quality Benchmarks, or National Oceanic Atmospheric Administration Effects Range - Low (ER-L) (USEPA, 1996b).
- Ontario Ministry of Environment and Energy Lowest Effects Levels (LELs) and Severe Effects Levels (SELs) (Persaud et al., 1993).
- USEPA Interim Ecological Soil Screening Levels (USEPA, 2003d).
- Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for Wildlife (Sample et al., 1996).

Survival, reproduction, and growth are used in this BERA as the preferred measures of adverse effect. Toxicological information for the actual feeding guild species is typically unavailable, and results for laboratory test species are often used as surrogates.

For wildlife exposure, the assessment focuses on TRVs based on No Observed Adverse Effects Levels (NOAELs) and Lowest Observed Adverse Effect Levels (LOAELs). The primary source of the NOAEL and LOAEL TRVs is *Toxicological Benchmarks for Wildlife* (Sample et al., 1996). **Table 7-4a** (avian toxicity benchmarks) and **Table 7-4b** (mammalian toxicity benchmarks) present the NOAEL and LOAEL TRVs used in the BERA. For SVOCs without measured effects levels, NOAELs were multiplied by a conservative safety factor of 2.0 to estimate corresponding effects levels (i.e., LOAELs).

Tables 7-5a through 7-5d present the sediment benchmarks, whereas **Tables 7-5e through 7-5h** present the surface-water benchmarks. Safety factors were applied to the sediment benchmarks to estimate effect or no-effect levels when one or the other was not available. Based on recommendations by the USEPA, conservative safety factors for sediment were 13 (for VOCs and PAHs), 25 (for pesticides and PCBs), and 5 (metals). For surface water, a safety factor of 10 was applied. These factors represent the assumed ratio of the effect level to the no-effect level.

7.3.5 Risk Characterization

A risk characterization is performed separately for each measurement endpoint. The results are first tabulated as COPEC-specific Hazard Quotients (HQs) for those measurement endpoints which use exposure estimates and benchmarks (i.e., all the measurement endpoints, except for those associated with sediment toxicity testing and the two field community surveys). The data from the sediment toxicity tests and the benthic community survey cannot be converted to HQs, but are instead interpreted statistically, when appropriate. The data from the fish survey are only evaluated semi-quantitatively.

COPEC-specific HQs are calculated as the exposure estimate (RME and CTE) divided by the benchmark (NOAEL and LOAEL benchmarks, or acute and chronic benchmarks for surface water [see further below]). This approach results in four separate HQs for each COPEC, ranging from “most conservative” HQ (RME/NOAEL) to “least conservative” HQ (CTE/LOAEL).

US EPA ARCHIVE DOCUMENT

An HQ above 1.0 indicates that the exposure to a COPEC exceeds that COPEC's toxicity benchmarks. It does not mean that an effect will occur, but simply that the benchmark has been exceeded. An HQ below 1.0 indicates that the exposure falls below the benchmark.

Besides the HQ approach described above, it is also necessary to distinguish between risks posed by site-related COPEC concentrations and risks associated with background-related COPEC concentrations not attributable to the site. For this purpose, the results of a Residual Risk (RR) analysis are presented in the risk tables next to the results of the HQ analysis. RRs are calculated for each EU, receptor group, and COPEC by subtracting the background HQs from the site HQs. A RR above 1.0 quantifies the extent to which a background-adjusted site exposure for a COPEC exceeds that COPEC's benchmark. Note that RRs are typically smaller than HQs, but only when a COPEC concentration is available for the background samples. Otherwise, the RRs equal the HQs

Two ranking schemes of possible risk outcomes and associated uncertainties were developed in consultation with the USEPA to help interpret the COPEC-specific HQ and RR values. The first ranking scheme (**Exhibit 8**) applies to the sediment benchmarks, the fish CBRs, and the wildlife TRVs, all of which are based on NOAEL ("no effect) and LOAEL ("effect") values.

Exhibit 8: Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	HQ ≤ 1	HQ ≤ 1	HQ ≤ 1	HQ ≤ 1	Adverse effects are unlikely	High
	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1		
2	HQ > 1	HQ ≤ 1	HQ ≤ 1	HQ ≤ 1	Adverse effects are unlikely	Moderate
	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1		
3	HQ > 1	HQ > 1	HQ ≤ 1	HQ ≤ 1	Adverse effects are unlikely	Low
	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1		
4	HQ > 1	HQ ≤ 1	HQ > 1	HQ ≤ 1	Adverse effects are possible	Low
	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1		
5	HQ > 1	HQ > 1	HQ > 1	HQ ≤ 1	Adverse effects are possible	Moderate
	RR > 1	RR > 1	RR > 1	RR ≤ 1		
6	HQ > 1	HQ > 1	HQ > 1	HQ > 1	Adverse effects are possible	High (increase with higher HQs)
	RR > 1	RR > 1	RR > 1	RR > 1		

HQ = hazard quotient derived from dividing a site exposure (RME or CTE) by a benchmark (no effect or effect)
RR = residual risk derived by subtracting the background HQ from the site HQ

Exhibit 8 shows six risk scenarios, each associated with a confidence level. This matrix is applied to every COPEC for each receptor group at each EU. Hence, all CTEs and RMEs which can be divided by benchmarks are assigned a risk scenario depending on the outcome of the risk characterization. Risk scenarios 1 to 3 in **Exhibit 8** result in the overall conclusion that a COPEC is unlikely to have adverse population-level effects because its site HQs and RRs do not exceed a LOAEL benchmark. Conversely, risk

US EPA ARCHIVE DOCUMENT

scenarios 4 to 6 in **Exhibit 8** result in the overall conclusion that population-level effects are possible because a LOAEL benchmark is exceeded by one or both of the exposures (RME or CTE) for a COPEC. The confidence level increases the more times a COPEC concentration exceeds its benchmarks. For example, a COPEC receives a risk scenario of 6 if both its RME and its CTE concentrations exceed both its NOAEL and LOAEL benchmarks.

The discussions in the risk characterization focus specifically on risk scenario six because it is the one most likely to result in actionable risk. It is also assumed that the risk associated with a CTE/LOAEL exceedance above 1 increases the more the CTE concentration exceeds the LOAEL benchmark. Hence, a CTE/LOAEL of 2 is considered less of a risk issue than a CTE/LOAEL of 30, even though both are classified as risk scenario 6 with a high level of confidence.

The second ranking scheme (**Exhibit 9**) follows the same general principles as outlined above but pertains specifically to the surface water benchmarks. It is deemed inappropriate to refer to chronic (or screening) benchmarks as no effect values and acute benchmarks as effect values. The reason is that both sets of values, if exceeded, are assumed to result in toxicity. The difference between acute and chronic is in the exposure duration, not the presence or absence of a response. Hence, the focus of the surface water interpretative risk matrix is on the (more conservative) chronic benchmarks, even though HQs and RRs for the acute benchmarks are also included in the risk tables for additional context.

Exhibit 9: Interpretive Risk Matrix for surface water

Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1, 2 & 3	HQ ≤ 1	HQ ≤ 1	Adverse effects are unlikely	High
	RR ≤ 1	RR ≤ 1		
4 & 5	HQ > 1	HQ ≤ 1	Adverse effects are possible	Moderate
	RR > 1	RR ≤ 1		
6	HQ > 1	HQ > 1	Adverse effects are possible	High (increase with higher HQs)
	RR > 1	RR > 1		

HQ = hazard quotient derived from dividing an exposure (RME or CTE) by a chronic surface water benchmark
RR = residual risk derived from subtracting the background HQ from the site HQ

These two ranking schemes provide a coherent framework to distinguish among the multiple COPECs, benchmarks, EUs, receptors, and exposure scenarios (RME and CTE) at the site. They also help to identify and focus the discussion on those issues that have the highest potential for population-level adverse effects and the highest confidence in results (i.e., risk scenario 6).

7.4 ASSESSMENT OF RISK TO BENTHIC MACROINVERTEBRATES

Maintain a stable and healthy benthic invertebrate community: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of the benthic invertebrate community in the Blackstone River, the wetlands, and the ponds at the site?*

US EPA ARCHIVE DOCUMENT

7.4.1 Introduction

The potential for ecological risk to the benthic community is assessed in all the aquatic EUs using up to three measurement endpoint (depending on the EU), as follows:

- Compare the RME and CTE COPEC levels in bulk sediment samples to no effect and effect sediment benchmarks (Blackstone River, Wetlands A through D, and Ponds A, B, C, D, E, F, I, N, and P). In addition, the bioavailability of divalent metals in selected sediment samples are assessed using measures of AVS and SEM (Blackstone River, and Ponds A, D, F, and I).

- Measure survival and growth in two benthic invertebrate test species exposed in the laboratory to select bulk sediment samples (Blackstone River, Pond A, Pond D, Pond F, and Pond I).

- Evaluate the structure and function of the invertebrate benthic community in select bulk sediment samples (Blackstone River, Pond A, Pond D, Pond F, and Pond I)

The first measurement endpoint is evaluated at each aquatic EU, independently from the results of the toxicity tests and benthic community surveys.

A small subset of the sediment samples used in chemical analyses (specifically, four samples from the Blackstone River [near site], two samples from Pond A, and one sample each from Ponds D, F, and I) were also used in toxicity testing and a benthic community survey. These three lines of evidence are assessed collectively using the Sediment Quality Triad (SQT) approach developed by the USEPA (1992b).

The data for the SQT evaluations were obtained during the 2005 ecological investigation. Bulk sediment samples were collected from 16 locations, including 10 locations from the Blackstone River (five near-site locations [including Pond I located along the shoreline of the Blackstone River] and five background locations) and six pond locations (four near-site locations and two background locations) (**Figure 2-4**). At each location, one petite ponar grab sample was collected for benthic community analysis and up to ten 0 to 6-inch sediment core samples were collected for sediment chemistry, sediment toxicity, and physical parameter testing (grain size and Total Organic Carbon [TOC]). The methods for sample collection and analyses are described in the *Fish Sampling and Habitat Assessment Work Plan* (BBL, 2005c). The results of each triad study component are presented below. More information is provided in the Benthic Community Species Abundance Report (**Appendix K**) and the Toxicity Testing Report (**Appendix L**).

Sediment sampling locations in the river next to the site were selected based on the availability of depositional areas and the known occurrence of contaminants. Background locations in the river were selected from areas upstream of the site with habitat characteristics similar to site locations (i.e., water quality and grain size). However, the availability of depositional areas was somewhat limited in the river and at both site and upstream background areas, and the best available habitats were sampled.

Selecting similar sampling locations in the ponds was more difficult. The ponds next to the site varied in size and had different water depths and water quality. In addition, background ponds were not available upstream of the site. Instead, samples were collected from backwater ponded areas (i.e., sloughs) next to the river upstream of the site (locations BL-003 and BL-004 on **Figure 2-4**). Similar to the site ponds, the upstream ponded areas are disconnected from the river channel during normal flow and are reconnected during higher flow. Although the conditions in the ponded areas may be different from the site ponds, the samples are assessed as background pond data.

US EPA ARCHIVE DOCUMENT

Less weight is given in the benthic community analysis portion of the SQT for those locations that show strong habitat differences between site and upstream background. Potential habitat differences are of less concern in interpreting the sediment chemistry and toxicity test results.

7.4.2 Measurement Endpoint 1.A

Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.

Sediment chemistry data are compared to no effect and effect sediment benchmarks to identify exceedances and the potential for site-related impacts. The sediment chemistry data used in the evaluation include the results from previous sediment sampling events. The data are grouped by EU. **Appendix AA** presents a summary of the data groupings with a list of samples

HQs were derived by dividing the COPEC- and EU-specific sediment RMEs or CTEs by the corresponding no effect and effect sediment benchmarks. COPEC-specific RR values are obtained by subtracting the background HQs from the near-site HQs to further evaluate the potential for site-related risks.

Tables 7-6a through 7-6l present the HQs and RRs calculated for each aquatic EU. **Table 7.7** focuses on the low molecular weight PAHs, high molecular weight PAHs, and total PAHs measured in the sediment in terms of the arithmetic mean concentration and the reasonable maximum concentration (either the 95% UCL or the maximum detected concentration, depending on the dataset)

Data on SEM, AVS, and organic carbon content are also used qualitatively in this assessment. Specifically, divalent metals data (expressed as $[\Sigma SEM\text{-}AVS]/f_{oc}$) were compared to benchmark values, as follows (US EPA, 2005c): below 130 µmol/g OC = toxicity is not likely, resulting in low risk of adverse biological effects; above 130 µmol/g OC but below 3,000 µmol/g OC = toxicity is uncertain, resulting in the potential for adverse biological effects; and above 3,000 µmol/g OC = toxicity is likely and adverse biological effects may be expected. **Table 7-8a** (Blackstone River) and **Table 7-8b** (Pond Areas) present the sediment SEM, AVS, and f_{oc} data. US EPA (2005c) states (p. 3-19) that including organic carbon in the equation significantly improves the prediction of mortality by accounting for partitioning of metals to sediment organic carbon, as well as the effect of AVS. Regardless, the SEM – AVS value for each sample is also included in **Tables 7-8a and 7-8b** for the sake of completeness.

A summary of the Blackstone River and Pond Area HQ and RR values is provided below.

- **Blackstone River (near-site)**

The site effect HQs from direct sediment exposure by benthic invertebrates in the Blackstone River (near-site) exceed 1.0 for eight SVOCs (2-methylphenol, benzo[a]pyrene, benzo(g,h,i)perylene, chrysene, fluoranthene, hexachlorobenzene, phenanthrene, and pyrene) and one metal (As) (**Table 7-6b)**.

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

The effect RRs at the Blackstone River (near-site) equal or exceed 1.0 for a single COPEC, namely As (RME RR = 1 and CTE RR < 1) (**Table 7-6b**).

US EPA ARCHIVE DOCUMENT

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a moderate level of confidence that a potential for ecological risk is unlikely for benthic invertebrates exposed to sediment in the Blackstone River (near-site) (risk scenario 2).

The (SEM-AVS/foc) values for four Blackstone River (near-site) sediment samples range from -33 to 46 µmol/goc and are all below the USEPA (2005c) threshold of 130 µmol/goc (**Table 7-8a**). This finding indicates that bioavailable concentrations of the SEM metals in those four samples are unlikely to cause toxicity, resulting in low risk of adverse biological effects.

- **Pond A**

The site effect HQs from direct sediment exposure by benthic invertebrates in Pond A exceeds 1.0 for one VOC (acetone), eight SVOCs (2-methylphenol, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, fluoranthene, hexachlorobenzene, phenanthrene, and pyrene), two pesticides (α-chlordane and heptachlor epoxide), one PCB (Acoclor-1254), and six metal (Cd, Cr, Cu, Pb, Ag, and Zn) (**Table 7-6c)**.

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

The effect RRs at Pond A equal or exceed 1.0 for acetone (RME RR = 4 and CTE RR = 2), α-chlordane (RME RR = 1 and CTE RR < 1), heptachlor epoxide (RME RR = 2 and CTE RR < 1), and Cd (RME RR = 2 and CTE RR < 1) (**Table 7-6c**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for benthic invertebrates exposed to sediment in Pond A (risk scenario 6). The risk driver is acetone.

The (SEM-AVS/foc) values for two Pond A sediment samples range from -855 to 98 µmol/goc, and are below the USEPA (2005c) threshold of 130 µmol/goc (**Table 7-8b**). This finding indicates that bioavailable concentrations of the SEM metals in those two samples are unlikely to cause toxicity, resulting in low risk of adverse biological effects.

- **Pond B**

The site effect HQs from direct sediment exposure by benthic invertebrates in Pond B exceeds 1.0 for eight SVOCs (2-methylphenol, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, fluoranthene, hexachlorobenzene, phenanthrene, and pyrene), and six metals (Cd, Cr, Cu, Fe, Pb, and Ag) (**Table 7-6d)**.

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

The effect RRs at Pond B equal or exceed 1.0 for 2-methylphenol (RME RR < 1 and CTE RR = 1), Cd (RME RR = 1 and CTE RR = 1), and Ag (RME RR = 1 and CTE RR = 1) (**Table 7-6d**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for benthic invertebrates exposed to sediment in Pond B (risk scenario 6). The risk drivers are 2-methylphenol, Cd, and Ag. The bioavailability of the two divalent metals is unknown because $(\Sigma SEM\text{-}AVS)/f_{oc}$ data are not available for Pond B.

US EPA ARCHIVE DOCUMENT

- **Pond C**

The site effect HQs from direct sediment exposure by benthic invertebrates in Pond C exceeds 1.0 for eight SVOCs (2-methylphenol, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, fluoranthene, hexachlorobenzene, phenanthrene, and pyrene), total PCBs, and four metals (Cd, Cr, Cu, and Pb) (**Table 7-6e)**.

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

The effect RRs at Pond C equal or exceed 1.0 for 2-methylphenol (RME RR < 1 and CTE RR = 1), fluoranthene (RME RR = 1 and CTE RR < 1), phenanthrene (RME RR = 1 and CTE RR < 1), and Cd (RME RR = 2 and CTE RR = 1) (**Table 7-6e**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for benthic invertebrates exposed to sediment in Pond C (risk scenario 6). The risk drivers are 2-methylphenol and Cd. The bioavailability of Cd is unknown because $(\Sigma SEM\text{-}AVS)/f_{oc}$ data are not available for Pond C.

- **Pond D**

The site effect HQs from direct sediment exposure by benthic invertebrates in Pond D exceeds 1.0 for one VOC (acetone), eight SVOCs (2-methylphenol, anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, fluoranthene, hexachlorobenzene, phenanthrene, and pyrene), and six metals (Cd, Cr, Cu, Pb, Ni, and Zn) (**Table 7-6f)**.

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

The effect RRs at Pond D equal or exceed 1.0 for anthracene (RME RR = 3 and CTE RR < 1), benzo[a]pyrene (RME RR = 4 and CTE RR < 1), chrysene (RME RR = 4 and CTE RR < 1), fluoranthene (RME RR = 3 and CTE RR < 1), phenanthrene (RME RR = 3 and CTE RR < 1), pyrene (RME RR = 7 and CTE RR = 1), and Cd (RME RR = 2 and CTE RR = 1) (**Table 7-6f**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for benthic invertebrates exposed to sediment in Pond D (risk scenario 6). The risk drivers are pyrene and Cd.

The (SEM-AVS/foc) value for one Pond D sediment sample is -13 µmol/goc, which is below the USEPA (2005c) threshold of 130 µmol/goc (**Table 7-8b**). This finding indicates that bioavailable concentrations of SEM metals in that one sample are unlikely to cause toxicity, resulting in low risk of adverse biological effects.

- **Pond E**

The site effect HQs from direct sediment exposure by benthic invertebrates in Pond E exceeds 1.0 for two VOC (acetone and carbon disulfide), eight SVOCs (2-methylphenol, anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, fluoranthene, phenanthrene, and pyrene), and eight metals (Cd, Cr, Cu, Fe, Pb, Ni, Ag, and Zn) (**Table 7-6g)**.

US EPA ARCHIVE DOCUMENT

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

The effect RRs at Pond E equal or exceed 1.0 for acetone (RME RR = 20 and CTE RR = 10), carbon disulfide (RME RR = 4 and CTE RR = 2), Cd (RME RR = 2 and CTE RR = 2), Cr (RME RR = 3 and CTE RR = 2), Cu (RME RR = 4 and CTE RR = 3), Pb (RME RR = 12 and CTE RR = 11), and Zn (RME RR = 3 and CTE RR = 3) (**Table 7-6g**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for benthic invertebrates exposed to sediment in Pond E (risk scenario 6). The major risk drivers are acetone and Pb; the other risk drivers are carbon disulfide, Cd, Cr, Cu, and Zn. The effect CTE RRs for acetone and Pb are high enough to result in severe impacts to the benthic invertebrate community in Pond E. The bioavailability of the divalent metals is unknown because $(\Sigma SEM\text{-}AVS)/f_{oc}$ data are not available for Pond E.

- **Pond F**

The site effect HQs from direct sediment exposure by benthic invertebrates in Pond F exceeds 1.0 for one VOC (acetone), nine SVOCs (2-methylphenol, anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, fluoranthene, hexachlorobenzene, phenanthrene, and pyrene), one pesticide (4,4'-DDE), and seven metals (Cd, Cr, Cu, Pb, Ni, Ag, and Zn) (**Table 7-6h)**.

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

The effect RRs at Pond F equal or exceed 1.0 for acetone (RME RR = 5 and CTE RR = 2), Cd (RME RR = 2 and CTE RR < 1), and Ag (RME RR = 1 and CTE RR < 1) (**Table 7-6h**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for benthic invertebrates exposed to sediment in Pond F (risk scenario 6). The risk driver is acetone.

The (SEM-AVS/foc) value for one Pond F sediment sample is -65 µmol/goc, and is below the USEPA (2005c) threshold of 130 µmol/goc (**Table 7-8b**). This finding indicates that bioavailable concentrations of SEM metals in that one sample are unlikely to cause toxicity, resulting in low risk of adverse biological effects.

- **Pond I**

The site effect HQs from direct sediment exposure by benthic invertebrates in Pond I exceeds 1.0 for two VOCs (acetone and carbon disulfide), eleven SVOCs (2-methylphenol, anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, fluoranthene, hexachlorobenzene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene), PCBs (Aroclor-1260 and total PCBs), and seven metals (Cd, Cr, Cu, Pb, Ni, Ag, and Zn) (**Table 7-6i)**.

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

US EPA ARCHIVE DOCUMENT

The effect RRs at Pond I equal or exceed 1.0 for acetone (RME RR = 9 and CTE RR = 3), benzo[a]pyrene (RME RR = 2 and CTE RR < 1), benzo[g,h,i]perylene (RME RR = 4 and CTE RR = 3), chrysene (RME RR = 2 and CTE RR = 1), fluoranthene (RME RR = 2 and CTE RR = 1), phenanthrene (RME RR = 1 and CTE RR < 1), pyrene (RME RR = 2 and CTE RR = 1), Cd (RME RR = 5 and CTE RR = 2), Cr (RME RR = 2 and CTE RR < 1), Cu (RME RR = 2 and CTE RR = 1), and Ag (RME RR = 2 and CTE RR < 1) (**Table 7-6i**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for benthic invertebrates exposed to sediment in Pond I (risk scenario 6). The major risk drivers are acetone, benzo[g,h,i]perylene, and Cd. The minor risk drivers are chrysene, fluoranthene, pyrene, and Cu. The effect CTE RRs are relatively small, but numerous, which may result in some risk to the benthic invertebrate community in Pond I.

The (SEM-AVS/foc) value for one Pond I sediment sample (BR-005) is 46 µmol/goc, and is below the USEPA (2005c) threshold of 130 µmol/goc (**Table 7-8a**). This finding indicates that bioavailable concentrations of SEM metals in that one sample are unlikely to cause toxicity, resulting in low risk of adverse biological effects.

- **Pond N**

The site effect HQs from direct sediment exposure by benthic invertebrates in Pond N exceeds 1.0 for four SVOCs (2-methylphenol, benzo[a]pyrene, benzo[g,h,i]perylene,, and pyrene), two pesticides (4,4'-DDD and dieldrin), one PCBs (Aroclor-1260), and seven metals (Cd, Cr, Cu, Pb, Ni, Ag, and Zn) (**Table 7-6j)**.

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

The effect RRs at Pond N equal or exceed 1.0 for 4,4'-DDD (RME RR < 1 and CTE RR = 1), dieldrin (RME RR = 1 and CTE RR = 1), Cd (RME RR = 1 and CTE RR = 2), and Cr (RME RR < 1 and CTE RR = 1) (**Table 7-6j**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for benthic invertebrates exposed to sediment in Pond N (risk scenario 6). The risk drivers are 4,4'-DDD, dieldrin, Cd, and Cr. The bioavailability of the two divalent metals is unknown because $(\Sigma SEM\text{-}AVS)/f_{oc}$ data are not available for Pond N.

- **Pond P**

The site effect HQs from direct sediment exposure by benthic invertebrates in Pond P exceeds 1.0 for a single COPEC, namely 2-methylphenol (**Table 7-6k)**.

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

The effect RRs for all sediment COPECs at Pond P fall below 1.0 (**Table 7-6k**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a low level of confidence that a potential for ecological risk is possible for benthic invertebrates exposed to sediment in Pond P (risk scenario 4). However, risk to the benthic community in Pond P is not expected because all the effect RRs are below 1.0.

US EPA ARCHIVE DOCUMENT

- **Wetlands A through D**

The site effect HQs from direct sediment exposure by benthic invertebrates in Wetlands A through D exceeds 1.0 for one VOC (carbon disulfide), and eight SVOCs (2-methylphenol, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, fluoranthene, hexachlorobenzene, phenanthrene, and pyrene) (**Table 7-6l)**.

The reference effect HQs for these same COPECs at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-6a**.

The effect RRs at Wetlands A through D equal or exceed 1.0 only for carbon disulfide (RME RR = 1 and CTE RR < 1) (**Table 7-6l**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a moderate level of confidence that a potential for ecological risk is possible for benthic invertebrates exposed to sediment in Wetlands a through D (risk scenario 5). No risk is expected because all the COPECs have effect CTE RR < 1.

Risk conclusion for measurement endpoint 1.A

Measurement endpoint 1.A identifies a serious potential for ecological risk to the benthic invertebrate community in Pond E. The major risk drivers in this EU are acetone and Pb. The RRs for these two COPECs are high enough to possibly result in severe impacts to the benthic invertebrate community in this EU.

Measurement endpoint 1.A identifies the potential for some ecological risk to the benthic community in the Blackstone River, Pond A, Pond B, Pond C, Pond D, Pond F, Pond I, and Pond N.

Measurement endpoint 1.A shows that ecological risk is possible but not expected in Pond P and Wetlands A through D.

7.4.3 Measurement Endpoint 1.B

Measure survival and growth in the benthic invertebrate species *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples

Sediment toxicity is evaluated in four samples from the Blackstone River (near-site), two samples from Pond A, and one sample each from Ponds D, F, and I using standard USEPA (2000b) laboratory toxicity tests. These sediment sample locations are identical to those used for chemical screening and benthic community assessment in the SQT. Test protocols followed guidance from the American Society for Testing and Materials (ASTM) (2001, 2005) and the USEPA (2000b), as follows:

- *Hyalella azteca* – ASTM Method E 1706-95, USEPA Method 100.4, 28-day survival and growth tests for sediments

US EPA ARCHIVE DOCUMENT

- *Chironomus dilutus* – ASTM Method E 1706-95, USEPA Method 100.5, 20-day survival and growth tests for sediments

Test results are considered acceptable based on adherence to test protocols and satisfactory laboratory control survival and growth. Acceptable control survival and growth rates are met for each test organism (**Tables 7-9a through 7-9c**), and the toxicity tests on river and pond sediments are considered valid.

Table 7-9a summarizes the survival and growth data for *H. azteca* and *C. dilutus* exposed to river and pond sediments. **Tables 7-9b and 7-9c** present the toxicity test results and sediment chemistry data for the river and pond locations, respectively. The toxicity test results for the site-related locations are discussed below in relation to the results from the upstream reference locations, to assess potential site-related impacts. Two of the reference samples, BL-003 (pond) and BL-005 (river), showed reduced survival of *H. azteca* relative to laboratory controls. These results may indicate that non-site-related sources of sediment toxicity are present, and should be considered when interpreting the sediment toxicity data for site-related samples.

- **Blackstone River (near-site)**

Four sediment samples were collected from the Blackstone River (near-site) for use in toxicity testing (a fifth sample - BR-005 - was collected from Pond I; see below). One sample (BR-006) shows severe toxicity (**Table 7-9a**). The survival of *H. azteca* and *C. dilutus* in this sample is significantly reduced compared to the background samples. Also, growth in *C. dilutus* is no different from background, but growth in *H. azteca* is significantly reduced. The chemistry data for BR-006 do not identify any COPECs which could readily explain the observed toxicity results (**Table 7-9b**).

The remaining three sediment samples collected from the Blackstone River (near-site), i.e., BR-001, BR-003, and BR-007, show no significant toxicity in either species when compared to the upstream background samples (**Table 7-9a**).

- **Pond A**

Two sediment samples were collected from Pond A for toxicity testing. Survival in both test species exposed to sediment samples PA-001 and PA-003 is statistically reduced compared to the upstream background samples. However, *H. azteca* survival in the two samples is much lower (8.8% and 1.3%) than that observed in *C. dilutus* (76.3% and 71.3%). *C. dilutus* growth in the two samples is not significantly different from that observed in the upstream background samples, whereas growth in *H. azteca* is significantly reduced in PA-003 compared to the upstream background samples.

The chemistry data for PA-001 and PA-003 do not identify COPECs which could readily explain the observed toxicity results, except perhaps for Cd in PA-003 (25 mg/kg), which is about 5 times above the effect benchmark of 4.98 mg/kg. The Cd levels in the two upstream background samples equal 9.9 mg/kg and 9.8 mg/kg, respectively. The Cd level in PA-001 equals 12 mg/kg (**Table 7-9c**).

- **Pond D**

One sediment sample was collected from Pond D (PD-002) for toxicity testing. Survival in both test species is significantly reduced compared to that observed in the upstream pond background samples. No significant differences exist in the growth of either species when compared the background samples.

US EPA ARCHIVE DOCUMENT

The chemistry data for PD-002 show that this sample has the highest PAH levels measured in the seven pond samples (Note: Two analysis results are available for PD0-002. The discussion in this paragraph refers to the higher of the two results). Total PAHs equal 61.9 mg/kg in PD-002, versus 20.2 mg/kg and 18 mg/kg in background samples BL-003 and BL-004, respectively (**Table 7-9c**). On the other hand, PD-002 consistently has the lowest metal levels measured in these same seven samples (**Table 7-9c**).

- **Pond F**

One sediment sample (PF-004) was collected from Pond F for toxicity testing. Neither survival nor growth in either test species differs statistically from that observed in the upstream background samples.

- **Pond I**

BR-005 shows toxicity (**Table 7-9a**). Survival in both test species is not significantly different from that observed in the upstream background samples, but growth in *C. dilutus* is significantly reduced compared to background. The chemistry data for BR-005 (**Table 7-9b**) show that this sample nearly always has the highest levels of PAHs (including total PAHs) and metals measured in the sediment from the Blackstone River at and upstream of the site. However, this observation may not, by itself, explain the toxicity response in BR-005, because the chemistry in BR-006 (collected further upstream in the main stem of the Blackstone River) is invariably better even though the toxic response in that sample was more severe.

Risk conclusion for measurement endpoint 1.B

Measurement endpoint 1.B identifies toxicity in sediment samples BR-005 (Pond I) and BR-006 collected in the Blackstone River (near-site). Toxicity in BR-006 is much more severe that that observed in BR-005, even though the COPEC levels in BR-006 are no different from that observed in the three non-toxic sediment samples collected from the river (near-site). BR-005 has the highest PAH and metal concentrations. The three other samples collected from the Blackstone River (near-site) were non toxic.

Measurement endpoint 1.B identifies severe toxicity in the two sediment samples collected from Pond A. Cd has the highest concentration (about five times above the effect benchmark) in one of the two samples collected from Pond D, but is similar to background in the second (also toxic) sample from Pond A.

Measurement endpoint 1.B identifies significant toxicity in both test species exposed to the one sediment sample collected from Pond D. The chemistry data shows that this sample has the highest PAH levels but lowest metal levels measured in the seven pond samples.

Finally, measurement endpoint 1.B does not identify significant toxicity in the one sediment sample collected from Pond F.

Also, low survival in *H. azteca* is observed in one of the five river background samples and one of the two pond background samples (all seven background samples come from upstream of the site) which decreases the reliability of the toxicity test results on the site sediment samples.

US EPA ARCHIVE DOCUMENT

7.4.4 Measurement Endpoint 1.C

Evaluate the structure and function of the benthic invertebrate community.

The relative percent abundance of higher-order taxa is determined in the same set of sediment samples used for toxicity testing. The goal is to examine general community composition, followed by a more detailed multi-metric evaluation (Barbour et al., 1999) to assess potential site-related impacts by comparing site data to data from upstream reference areas. Metrics are used to quantify aspects of benthic community structure and function that change with increased human influence and/or perturbation (Barbour et al., 1999). Metrics also provide a framework for analyzing complex assemblage data (Barbour et al., 1999).

The metrics used in this BERA are as follows:

1. *Total Organisms* – An abundance measure, which represents the count of all individuals in a sample. Also used as the denominator for several other metrics. Higher values are preferred, unless dominated by pollution-tolerant species (see below) or few taxa.

2. *Number of Taxa* – A richness measure, which represents the total number of distinct taxa per sample. Measures the overall variety of the species assemblage. Higher values are preferred.

3. *Diversity Index* – A composition measure, which represents the number of taxa and relative species abundance. Scores for this index typically range from 0 to 5 with larger numbers indicating greater diversity.

4. *Percent Tolerant Organisms* – A tolerance measure, which represents the relative percent of pollution-tolerant organisms (tubificids). Indicates community composition of organisms tolerant to environmental perturbation or disturbance. Lower percentages are preferred.

5. *Percent Gatherers* – A feeding guild measure, which identifies the dominant feeding strategy. Feeding groups can become skewed and unbalanced in response to changing environmental conditions (USEPA, 1999). Lower values, when skewed high, are often preferred.

6. *Percent Burrower* – An organism habit measure, which identifies the dominant mode of existence. This metric is similar to feeding guild in that it can become skewed and unbalanced in response to changing environmental conditions (USEPA, 1999). Lower values, when skewed high, are often preferred.

Multivariate statistical analyses are also performed on the water quality, grain size, and TOC data to determine potential habitat influences on the benthic community data collected from co-located samples. Analyses are performed on the Blackstone River and pond locations separately due to known ecological differences between these habitats. The statistical software, PRIMER v6, developed by Plymouth Marine Laboratory, Plymouth, UK was used to conduct the analyses, as described below:

- *Habitat* – The habitat variables are normalized for each river and pond dataset to adjust for differences in scale, and are then compared for similarity between locations using Euclidian distance resemblance matrices. The matrix data are plotted to show the similarity between locations using non-metric multidimensional scaling and hierarchical cluster analysis. Permutation tests are conducted to determine if locations are statistically different ($\alpha = 0.05$) from

US EPA ARCHIVE DOCUMENT

one another. Less weight is given in the benthic analysis of the SQT for locations showing strong habitat differences.

- *Benthic Community* – The community data are log transformed for each river and pond dataset, and are then compared for similarity between locations using Bray Curtis similarity resemblance matrices. Like the habitat data, the benthic matrix data are plotted to show the similarity between locations using non-metric multidimensional scaling and hierarchical cluster analysis. Permutation tests are conducted to determine if locations are statistically different ($\alpha = 0.05$) from one another.

- *Habitat and Community* – The habitat and benthic community resemblance matrices (Euclidian distance and Bray Curtis similarity, respectively) are compared to each other using Spearman rank correlation techniques to determine the habitat variable, or set of habitat variables, that are correlated most to the benthic community. Permutation tests are performed to determine if the correlation between the habitat and benthic community data is statistically significant ($\alpha = 0.05$).

Table 7-10a summarizes water quality data; **Table 7-10b** summarizes sediment grain size and TOC data. **Table 7-10c** presents the benthic community species identifications and organism counts. **Table 7-10d** presents the relative percent benthic order abundance data, and **Table 7-10e** presents the benthic community metrics. Attachments 1a through 1f of **Appendix FF** present the statistical reports for the multivariate analyses. The results of the benthic community assessment are summarized below.

- **Blackstone River**

Water quality is generally similar among site and upstream background locations, with some differences (**Table 7-10a**). Substrates consisted mostly of sand and silt with some clay and gravel, and up to 6% TOC content (**Table 7-10b**). Sample locations are generally in relatively shallow water (0.6 to 6.9 feet), with temperatures of 20 to 23°C (except BR-005 with a temperature of 14.2°C, indicating the possibility of a spring discharge).

Multivariate statistical analyses performed on the water quality, grain size, and TOC data indicate clustering of site locations with background locations, except for locations BR-005 (Pond I) and BL-006, and possibly BL-002 (**Figure 1a, Appendix FF**). The distances shown by these locations are due primarily to differences in grain size, TOC, and water temperature for location BR-005; differences in grain size, TOC, and dissolved oxygen for location BL-006; and differences in grain size and TOC for location BL-002. Locations BR-005 and BL-006 are statistically different ($p=0.047$) from the other locations based on these findings (**Figure 1b, Appendix FF**) (see **Appendix FF** [**Attachment 1a**] for statistical reports).

In general, the benthic diversity and abundance are low in both the river site and upstream background locations. This may be because samples were collected from depositional areas with finer-grained sediments to provide sufficient sediment mass for chemical analysis and toxicity testing, rather than coarser substrates where benthic abundance and diversity may be higher. Most organisms in the samples belong to the orders Tubificida and Diptera, both of which are adapted to live in finer-grained sediments (Merritt and Cummins, 1996; Thorp and Covich, 1991) (**Table 7-10c**). Other orders present in the site and background samples include Lumbriculida (<1% and 0% worms, respectively), Lumbricina (1% and 0% worms, respectively), Veneroida (1% and < 1% bivalves, respectively), Amphipoda (2% and < 1% crustaceans, respectively), Isopoda (<1%t and 0% sowbugs, respectively), Odonata (< 1% and < 1% dragonfly larva, respectively), and Coleoptera (< 1% and 2% beetle larva, respectively).

US EPA ARCHIVE DOCUMENT

The benthic metric results for site location BR-001 indicate some impairment relative to background (**Table 7-10e**). BR-001 differences from background include a lower diversity index and number of taxa, as well as percent tolerant organisms, percent gatherers, and percent burrowers outside the range of background conditions.

The metrics for locations BR-005 (Pond I) and BR-006 give mixed results. BR-005 has a lower diversity index and higher percent tolerant organisms, but the total organism, number of taxa, percent gatherer, and percent burrower metrics fall within the range of background. BR-006 has lower total organisms and number of taxa and higher percent burrowers, but the diversity index, percent tolerant organisms, and percent gatherers all fall within the range of background metrics.

All the metrics for site locations BR-003 and BR-007 fall within the range of background conditions. Multivariate statistical analyses performed on the benthic community data indicate some dispersion between locations with no clear clustering pattern (**Figure 1a, Appendix FF**). However, no statistical differences are observed between the individual locations (p=0.242, **Figure 1b, Appendix FF**), indicating general similarity between the benthic community assemblages (see Attachment 1b for statistical reports, **Appendix FF**). In addition, the benthic assemblage is weakly correlated to habitat (**Figure 1c, Appendix FF**). River flow is the habitat variable most correlated with the benthic community assemblage (Rho=0.437), followed by dissolved oxygen and flow (Rho=0.402), and depth, dissolved oxygen, and flow (Rho=0.385). However, the correlations are not statistically significant (p=0.257) (**see Appendix FF [Attachment 1c**] for statistical reports).

The results of the river benthic community assessment are summarized below:

- Benthic macroinvertebrate diversity and abundance is low in both river site and upstream background locations, with most organisms representing aquatic worms and midge larva, which are adapted to live in finer-grained sediments.

- Benthic metric results for site location BR-001 are generally lower than background, indicating some impairment. Differences do not appear to be habitat-related.

- Benthic metric results for site locations BR-005 (Pond I) and BR-006 varied. Differences for BR-005 may be habitat-related (e.g., water temperature, grain size). Differences for BR-006 do not appear to be habitat-related and may indicate some impairment.

- All the benthic metrics results for site locations BR-003 and BR-007 fall within the range of background conditions and do not indicate impacts.

- Benthic assemblage data are generally similar among individual locations. The assemblage data were weakly correlated with the habitat data.

Ponds

Water quality is generally similar among site and upstream background locations with some differences (**Table 7-10a**). Substrates consist mostly of sand and silt with some clay and gravel, and up to 10% TOC content (**Table 7-10b**). Sample locations generally occur in shallow to moderate water depths (2.1 to 9.4 feet) with water temperatures of 18.3 to 23.5°C (**Table 7-10a**). (Note: due to the absence of upstream ponds similar to the ponds on the Unnamed Island, upstream background locations were sampled from

US EPA ARCHIVE DOCUMENT

isolated side channels, resembling the site-related ponds in that both are connected to the river channel during periods of high flow and disconnected from the river channel during normal or low flows).

Multivariate statistical analyses performed on the water quality, grain size, and TOC data indicate clustering of location PA-003 with the upstream background locations, and clustering of location PA-001 with PF-004 (**Figure 1d, Appendix FF**). These locations cluster separately from one another due primarily to differences in grain size, water depth, dissolved oxygen, and conductivity (primarily grain size for PA-003). Location PD-002 shows fewer tendencies to cluster, but is more similar to locations PA-001 and PF-004 (**Figure 1e, Appendix FF**). Locations PD-002, PA-001, and PF-004 are statistically different (p=0.013) from the upstream background locations and PA-003 based on the habitat data (**Figure 1e, Appendix FF**) (see **Appendix FF** [**Attachment 1d**] for statistical reports).

In general, benthic diversity and abundance are at the reference pond and upstream background locations. As with the river samples, most organisms belong to the orders Tubificida and Diptera, which are adapted to live in finer-grained sediments (Merritt and Cummins, 1996; Thorp and Covich, 1991) (**Table 7-10d**). The few other benthic orders present in site and background samples are Lumbricina (< 1% and 0% worms, respectively), Amphipoda (< 1% and 0% crustaceans, respectively), and Coleoptera (0% and < 1% beetle larva, respectively).

- **Pond A**

The benthic metrics for location PA-001 are lower than background (**Table 7-10e**). PA-001 has much lower total organism counts, numbers of taxa, diversity index, % gatherers and % burrowers, and higher % tolerant organisms.

PA-003 is different from background in terms of lower total organisms and higher % tolerant organisms, % gatherers, and % burrowers. However, the number of taxa and diversity index for PA-003 fall within the range of background conditions.

- **Pond D**

The metric results for site location PD-002 fall within the range of background conditions, except for lower number of total organisms (67 vs. 91 to 92) (**Table 7-10e**).

- **Pond F**

The benthic metrics for PF-004 are all different from background (**Table 7-10e**). PF-004 shows lower total organisms; number of taxa; and diversity index; and higher percent tolerant organisms, percent gatherers, and percent burrowers.

Multivariate statistical analyses performed on the benthic community data indicate some clustering of site locations with background locations, except for locations PA-001 and PF-004 (**Figure 1d, Appendix FF**). PA-001 is statistically different (p=0.016) from the other locations at 0% similarity (**Figure 1e, Appendix FF**) (see **Appendix FF** [**Attachment 1e**] for statistical reports). The lack of similarity shown by these locations is due to differences in the benthic assemblage data, as reflected in the metrics above, but may also be due to habitat differences. As previously mentioned, PA-001 and PF-004 cluster separately from other locations based on habitat data (**Figure 1d, Appendix FF**). In addition, the benthic assemblage for all pond locations is strongly correlated to habitat, with water depth, temperature, and dissolved oxygen the habitat variables most correlated with the benthic community (Rho=0.798; **Figure 1f, Appendix FF**). However, the

US EPA ARCHIVE DOCUMENT

correlation between the assemblage data and habitat data is not statistically significant (p=0.145) (see **Appendix FF** [**Attachment 1f**] for statistical reports).

The results of the pond benthic community assessment are summarized below:

- Benthic macroinvertebrate diversity and abundance is low in both site and background pond locations with most organisms represented by aquatic worms and midge larva, which are organisms adapted to live in finer-grained sediments.
- Benthic metric results for site locations PA-001 and PF-004 are generally lower than the metric results from the background, indicating the potential for site-related impacts, but perhaps also to the effects of habitat differences (e.g., low dissolved oxygen).
- Benthic metric results for site location PA-003 vary from background and may indicate potential site-related impacts. Differences do not appear to be habitat-related.
- Benthic metrics results for site location PD-002 fall within the range of background conditions, except for total organisms, and do not appear to reflect potential site-related impacts.
- Benthic assemblage and habitat data vary between individual locations. The assemblage data are strongly correlated with the habitat data.

7.4.5 Sediment Quality Triad Analysis

Results from the triad study are used to evaluate potential site-related impacts. The results are summarized in a WOE table (**Table 7-10f**) following the USEPA (1992b) guidance. The results are categorized as: 1) site-related impacts appear to be present, 2) site-related impacts are not clear, and 3) site-related impacts do not appear to be present. The results are shown in the contingency table and summarized below.

The following site locations may show potential site-related impacts:

- *Pond Location PD-002* – Sediment chemistry and toxicity test results appear to show impacts, but benthic community results are not different from background.
- *Pond Location PA-003* – Sediment chemistry and toxicity test results appear to show impacts; the benthic community results are inconclusive, but may show impacts.
- *Pond Location PF-004* – Sediment chemistry and benthic community results appear to show impacts, but toxicity test results are inconclusive compared to background, and community results may be habitat-related (e.g., low dissolved oxygen).
- *River Location BR-005 (Pond I)* – Sediment chemistry results appear to show impacts; the toxicity test and benthic community results may indicate impacts, but community results may be habitat-related (e.g., water temperature, grain size).

The following site locations have inconclusive evidence of potential site-related impacts:

US EPA ARCHIVE DOCUMENT

- *River Location BR-006* – Toxicity test and benthic community results appear to show impairment, but sediment chemistry results do not.

- *Pond Location PA-001* – Toxicity test and benthic community results appear to show impairment, but sediment chemistry results do not.

The following site locations did not exhibit potential site-related impacts:

- *River Location BR-001* – Sediment chemistry and toxicity test results do not show impacts; differences in the benthic community results are probably not due to measured chemical concentrations.

- *River Location BR-003* – Sediment chemistry, toxicity test, and benthic community results do not show impacts.

- *River Location BR-007* – Sediment chemistry, toxicity test, and benthic community results do not show impacts.

Based on the results of the triad study and weight-of-evidence evaluation, it appears that potential site-related impacts are evident primarily in the ponds (Ponds A, D, and F), and possibly location BR-005, which was collected from Pond I, adjacent to the Blackstone River. These locations are similar in that they are depositional and disconnected or protected from the main river channel under normal flows. Higher levels of SVOCs, VOCs (acetone), and metals found in the sediments at these site locations may contribute to the observed differences. Site locations BR-006 (river) and PA-001 (pond), however, show some impairment, but its site-relatedness is inconclusive. These locations show few to no differences when compared to sediment chemistry results from the upstream background locations. No apparent site-related impacts are observed at site locations BR-001 and BR-003 in the main river channel or in BR-007, which appears to receive flow from the main river channel on a regular basis (i.e., is scoured and not highly depositional).

7.4.6 WOE integration for assessment endpoint 1

Table 7-6m summarizes the WOE integration for the three measurement endpoints evaluated under assessment endpoint 1. Note that the risk evidence derived from the SQT analysis is presented as an asterix (*) to indicate that this conclusion is derived from combining the three measurement endpoints. The preponderance of the evidence shows that the benthic invertebrate community is not at risk in the Blackstone River (near-site), Pond B, Pond C, Pond N, Pond P, and Wetlands A through D.

On the other hand, the potential for some impairment to the benthic invertebrate community exists in Pond A, Pond D, Pond E, Pond F, and Pond I. The exact cause behind this risk potential is unclear, but appears to be related to a combination of COPECs in sediment and habitat variables.

7.5 ASSESSMENT OF RISK TO FISH

Maintain a stable and healthy fish community: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of the fish community in the Blackstone River, the wetlands, and the ponds at the Site?*

US EPA ARCHIVE DOCUMENT

Up to three measurement endpoints are used to quantify the potential for ecological risks to the fish community in the aquatic EUs at the site:

7.5.1 Measurement Endpoint 2.A

Evaluate the structure and function of the fish community.

BBL surveyed the Blackstone River fish community in September 2005 in near-site and reference locations. The fish survey was performed in three river locations and three pond locations (**Figure 2-7**). The Blackstone River locations were a background location upstream of the site and upstream of Ashton Dam, a background location upstream of the site, but downstream of Ashton Dam, and a near-site location adjacent to the Unnamed Island and upstream of Pratt Dam. The pond locations were Pond A, Pond F, and Pond P-6 (the off-site background location for the ponds).

Fish were captured using boat electrofishing in the river and boat electrofishing and gill netting in the ponds. One complete pass of representative habitat in each area was conducted using standardized sampling times (approximately 1 hour of electrofishing and day-long gill net sets). Fish collected during the survey were identified to species, counted, and a sub-set (up to 25) were measured and weighed before being released.
A multimetric approach following the USEPA Rapid Bioassessment Protocol (Barbour et al., 1999) was used to characterize the fish community. Metrics are used to quantify aspects of community structure and function that change in predictable ways with increased human influence and/or perturbation (Barbour et al., 1999). Several metrics are typically used because community data are complex. The fish community metrics evaluated in this BERA are presented below. These metrics are used to compare the near-site and background fish community and evaluate potential site-related impacts.

1. *Number of Species*: The number of fish species is expected to decrease with increased degradation.

2. *Number of Benthic Insectivore Species*: Benthic insectivores are sensitive to degradation resulting from siltation and benthic oxygen depletion because they feed and reproduce in benthic habitat.

3. *Number of Water Column Species*: Fish species that feed in the water column are active swimmers that live in pools and feed on invertebrates. The number of pool species decreases with increased degradation of pools and reduced instream cover.

4. *Number of Sucker Species*: Suckers are a relatively long-lived species that integrate physicochemical conditions over time and are sensitive to physical and chemical habitat degradation.

5. *Number of Intolerant Species*: Species intolerant of chemical and physical disturbances are usually the first species to disappear following a disturbance. Tolerance values for each observed species were obtained from the USEPA (1999).

6. *Percent White Sucker*: This metric is the opposite of Metric #5, as white suckers often show increased distribution or abundance in response to degradation of surface-water quality.

7. *Percent Omnivores*: The percent omnivores (fish that feed on plant and animal material) in the fish community typically increases with increased physical and chemical habitat degradation.

US EPA ARCHIVE DOCUMENT

8. *Percent Insectivores*: Percent insectivores is a metric frequently used in the northeast, which typically decreases with increasing disturbance.

9. *Percent Top Carnivores*: Adult fish species considered top carnivores mostly eat fish, other vertebrates, or crayfish and typically decrease with increasing disturbance.

10. *Number of Individuals*: Fish abundance can vary by region and by water body size. Impaired sites generally have fewer individuals.

Table 7-11 summarizes the fish identified during the survey, and **Table 7-12** presents the results of the fish community metric calculations. The results are summarized below.

- **Blackstone River (near-site)**

Results indicate a moderately abundant and diverse fish community in the Blackstone River (near-site). Fifteen species are present in the main river channel north of the Unnamed Island, and 10 species are present in the backwater behind the Unnamed Island (**Table 7-11**). In comparison, 12 to 15 species are present in the upstream areas. The number of fish ranged from 152 to 162 individuals in near-site locations, and 159 to 261 individuals for the upstream background locations. Many of the fish are game fish species (largemouth bass) and forage fish species (e.g., common shiner, fallfish, white sucker). Total biomass ranges from 2.5 kg for the upstream background below Ashton Dam (BR-2) to 5.7 kg for the site river channel (BR-3).

The metrics based on fish counts (total number of species, number of benthic insectivores, number of water column species, number of sucker species, and number of intolerant species) indicate that the fish community in the river next to the site is generally similar to the upstream background locations (**Table 7-12**). However, the fish community metrics calculated on a *relative* basis (i.e., percent white suckers, percent omnivores, percent insectivores, percent top carnivores) indicate a greater percentage of white suckers and omnivores and a smaller percentage of top carnivores at the near-site areas. These community differences may be the results of site-related impacts or (more likely) the result of habitat differences. For instance, near-site reach BR-3 is divided by an island. The area behind the island is slower water with homogenous substrates (rocks covered in sand). The near-site area north of the island has swift flowing water with few slow side waters. By comparison, the upstream background reaches (BR-1 and BR-2) are typically wider, not divided by an island, and have better habitat characterized by more moderate gradients/flows, heterogeneous substrates, and several side waters.

- **Pond A**

The fish survey was conducted for Pond A, but background ponds with similar habitat are not present upstream of the site. The closest accessible pond (P-6) was surveyed as a potential background location, but this pond is stocked and contains primarily largemouth bass and bluegill. Pond P-6 also does not receive water from the Blackstone River during times of high flow as the ponds on Unnamed Island do. Therefore, data from Pond P-6 cannot be compared to Pond A.

Results indicate a low to moderate abundance and diversity of fish in Pond A. The survey identified 183 fish representing ten species (**Table 7-11**). Total biomass in Pond A is 4.7 kg. Three of the primary ecological fish feeding guilds (piscivores, omnivores, insectivores) are present (**Table 7-12**). Top carnivores and insectivores were the predominant organisms.

US EPA ARCHIVE DOCUMENT

- **Pond F**

Background data are not available because the data from Pond P-6 are unsuitable to compare to Pond F. The fish community in Pond F shows a low to moderate abundance and diversity. The survey identified 97 fish from ten different species (**Table 7-11**). Total biomass in Pond F is 1.1 kg. Each of the primary ecological fish feeding guilds is present (piscivores, omnivores, insectivores, and generalists) (**Table 7-12**). Omnivores and insectivores were the predominant organisms.

Risk conclusions for measurement endpoint 2.A:

The fisheries data collected from the Blackstone River (near-site) show a fish community which appears to respond to increased disturbance. However, the survey data do not lend themselves to determine if that disturbance reflects habitat differences with the upstream reference location or site-related chemical exposures. Hence, these data are not used to quantitatively evaluate the potential for ecological risk to the fish community in the Blackstone River (near-site).

No conclusions are possible using the fisheries data collected from Ponds A and F due to a lack of usable reference pond. Hence, the results are not be used to quantitatively evaluate the potential for ecological risk to the fish community in these two ponds.

7.5.2 Measurement Endpoint 2.B

Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.

The second measurement endpoint for evaluating the potential for ecological risks to fish compares surface-water analytical data to surface water benchmarks. Note that both the acute and chronic surface water benchmarks are presented in the risk tables, even though the risk conclusions are based only on the (more conservative) chronic benchmarks.

7.5.2.1 Exposure Assessment

The surface-water analytical data are used to calculate CTE and RME EPCs for each COPEC and aquatic EU as described in Section 7.2.3. Fish are assumed to be confined to each body of water for the duration of their lifespan. Data groupings for each aquatic EU are presented in **Appendix AA**, and the details for the EPC calculations are presented in **Appendix BB**. **Tables 7-13a through 7-13k** list the resulting EPCs.

7.5.2.2 Effects Assessment

The surface water benchmarks are the USEPA (2007) AWQC Criterion Maximum Concentrations (CMCs) to protect aquatic organisms from acute toxicity, and the Criterion Continuous Concentrations (CCCs) to protect aquatic organisms from chronic toxicity, when available. These benchmarks were derived based on data for many species of aquatic organisms and are considered protective of all aquatic receptors, including fish. Because the values must be protective of a wide range of species exposed under a variety of conditions, their application to assess risks in the BERA is considered conservative. Other similar criteria

(e.g., SCVs, obtained from Suter and Tsao [1996]) are used when AWQC CCC or CMC values are unavailable. **Tables 7-5e through 7-5g** present the surface-water criteria.

7.5.2.3 Risk Characterization

Risk characterization for fish integrates the results of the exposure and effect assessments to determine if risk may be associated with one or more surface water COPECs. HQs are calculated for each COPEC as the EPC (using both CTE and RME estimates) divided by the acute or chronic benchmarks. **Tables 7-13a through 7-13k** present the HQs and RRs at the various aquatic EUs. The RRs are then evaluated according to the relative risk ranking scheme for surface water presented in **Exhibit 9** in Section 7.3.5. **Tables 7-13l and 7-13m** summarize the acute and chronic HQs for all the COPECs across the aquatic EUs. Note that the risk conclusions are based solely on the (more conservative) chronic benchmarks.

- **Blackstone River (Near-Site)**

The site chronic HQs from surface water exposure in the Blackstone River (near-site) are exceeded by six metals (Al, Ba, Cd, Cu, Pb, and Mn) (**Table 7-13a**).

The reference chronic HQs for these same COPECs from surface water exposure in the Blackstone River (upstream) are presented in **Table 7-13b**.

The chronic RRs exceed 1.0 only for Mn (RME RR = 2 and CTE RR < 1) (**Table 7-13a**).

Based on the interpretive risk matrix for surface water presented in **Exhibit 9** (Section 7.3.5), it is concluded with a moderate level of confidence that risk to the fish community is possible in the Blackstone River (near-site) from exposure to Mn in surface water (risk scenario 4&5). However, the chronic RME RR for this COPEC equals 2, whereas the chronic CTE RR is below 1, which is not expected to result in risk.

- **Wetlands A through D**

The site chronic HQs from surface water exposure in Wetlands A through D are above 1.0 for three SVOCs (4-bromophenyl-phenylether, benzo[a]anthracene, and benzo[a]pyrene), two pesticides (4,4'-DDT and toxaphene), seven Aroclors (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260), cyanide, and nine metals (Al, Ba, Cd, Cu, Pb, Mn, Ni, Ag, and Zn) (**Table 7-13c**).

The reference chronic HQs for these same COPECs from surface water exposure in the Blackstone River (upstream) are presented in **Table 7-13b**.

The chronic RRs in Wetlands A through D equal or exceed 1.0 for toxaphene (RME RR < 1 and CTE RR = 134), Aroclor-1221 (RME RR < 1 and CTE RR = 1), Al (RME RR = 7 and CTE RR = 1), Cd (RME RR = 4 and CTE RR < 1), Mn (RME RR = 2 and CTE RR < 1), Ni (RME RR = 1 and CTE RR < 1), Ag (RME RR = 5 and CTE RR < 1), and Zn (RME RR = 2 and CTE RR < 1) (**Table 7-13c**).

Based on the interpretive risk matrix for surface water presented in **Exhibit 9** (Section 7.3.5), it is concluded with a high level of confidence that risk to the fish community is possible in the wetlands from exposure to toxaphene, Aroclor-1221, and Al in surface water (risk scenario 6). The EPCs for toxaphene and Aroclor-1221 represent one-half of the Maximum Reporting Limit (MRL) since neither COPEC was detected in the

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

17 surface water samples collected from the wetlands (see **Appendix BB**). The highest chronic CTE RR in a detected COPEC (i.e., Al) equals 1.0.

- **Pond A**

The chronic HQs from surface water exposure in Pond A are above 1.0 for three SVOCs (4-bromophenyl-phenylether, benzo[a]anthracene, and benzo[a]pyrene), two pesticides (4,4'-DDT and toxaphene), seven Aroclors (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260), and ten metals (Al, Ba, Cd, Co, Cu, Pb, Mn, Ni, Ag, and Zn) (**Table 7-13d**).

The reference chronic HQs for these same COPECs from surface water exposure in the Blackstone River (upstream) are presented in **Table 7-13b**.

The chronic RRs in Pond A equal or exceed 1.0 for benzo(a)anthracene (RME RR = 3 and CTE RR < 1), benzo(a)pyrene (RME RR = 4 and CTE RR < 1), toxaphene (RME RR < 1 and CTE RR = 134), Aroclor-1221 (RME RR < 1 and CTE RR = 1), Cd (RME RR = 16 and CTE RR < 1), Pb (RME RR = 10 and CTE RR < 1), Mn (RME RR = 3 and CTE RR = 3), Ni (RME RR = 1 and CTE RR < 1), Ag (RME RR = 11 and CTE RR = 2), and Zn (RME RR = 4 and CTE RR < 1) (**Table 7-13d**).

Based on the interpretive risk matrix for surface water presented in **Exhibit 9** (Section 7.3.5), it is concluded with a high level of confidence that risk to the fish community is possible in Pond A from exposure to toxaphene, Aroclor-1221, Mn, and Ag in surface water (risk scenario 6). The EPCs for toxaphene, Aroclor-1221, and Ag represent one-half of the MRL since none of these COPECs were detected in the 10 surface water samples collected from Pond A (see **Appendix BB**). Mn has the highest chronic CTE RR (3).

- **Pond C**

The chronic HQs from surface water exposure in Pond C are above 1.0 for three SVOCs (4-bromophenyl-phenylether, benzo[a]anthracene, and benzo[a]pyrene), three pesticides (4,4'-DDD, 4,4'-DDT, and toxaphene), seven Aroclors (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260), cyanide, and 12 metals (Al, Ba, Cd, Cr, Co, Cu, Pb, Mn, Ni, Ag, V, and Zn) (**Table 7-13e**).

The reference chronic HQs for these same COPECs from surface water exposure in the Blackstone River (upstream) are presented in **Table 7-13b**.

The chronic RRs in Pond C equal or exceed 1.0 for benzo(a)anthracene (RME RR = 6 and CTE RR = 2), benzo(a)pyrene (RME RR = 20 and CTE RR = 6), 4,4'-DDD (RME RR = 2 and CTE RR < 1), toxaphene (RME RR < 1 and CTE RR = 134), Aroclor-1221 (RME RR < 1 and CTE RR = 1), Aroclor-1260 (RME RR = 19 and CTE RR = 5), Al (RME RR = 235 and CTE RR = 21), Ba (RME RR = 128 and CTE RR = 40), Cd (RME RR = 214 and CTE RR = 31), Cr (RME RR = 23 and CTE RR = 2), Cu (RME RR = 166 and CTE RR = 15), CN (RME RR = 2 and CTE RR < 1), Pb (RME RR = 679 and CTE RR = 62), Mn (RME RR = 13 and CTE RR = 3), Ni (RME RR = 3 and CTE RR < 1), Ag (RME RR = 39 and CTE RR = 10), V (RME RR = 2 and CTE RR < 1), and Zn (RME RR = 22 and CTE RR = 4) (**Table 7-13e**).

Based on the interpretive risk matrix for surface water presented in **Exhibit 9** (Section 7.3.5), it is concluded with a high level of confidence that risk to the fish community is possible in Pond C from exposure to benzo(a)anthracene, benzo(a)pyrene, toxaphene, Aroclor-1221, Aroclor-1260, Al, Ba, Cd, Cr, Cu, Pb, Mn, Ag, and Zn in surface water (risk scenario 6). The EPCs for toxaphene and Aroclor-1221 represent one-half of the MRL since these COPECs were not detected in the two surface water samples collected from Pond C

US EPA ARCHIVE DOCUMENT

(see **Appendix BB**). The biggest risk concerns are with Al, Ba, Cd, Cu, and Pb which have RR chronic CTE HQs above 10. These COPECs could severely impair fish in Pond C.

- **Pond D**

The chronic HQs from surface water exposure in Pond D are exceeded by three SVOCs (4-bromophenyl-phenylether, benzo[a]anthracene, and benzo[a]pyrene), two pesticides (4,4,'-DDT and toxaphene), seven Aroclors (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260), and 11 metals (Al, Ba, Cd, Cr, Co, Cu, Pb, Mn, Ni, Ag, and Zn) (**Table 7-13f**).

The reference chronic HQs for these same COPECs from surface water exposure in the Blackstone River (upstream) are presented in **Table 7-13b**.

The chronic RRs in Pond D equal or exceed 1.0 for benzo(a)anthracene (RME RR = 3 and CTE RR = 1), benzo(a)pyrene (RME RR = 6 and CTE RR = 3), toxaphene (RME RR < 1 and CTE RR = 134), Aroclor-1221 (RME RR < 1 and CTE RR = 1), Al (RME RR = 45 and CTE RR = 22), Ba (RME RR < 1 and CTE RR = 11), Cd (RME RR = 44 and CTE RR = 22), Cr (RME RR = 5 and CTE RR = 2), Co (RME RR < 1 and CTE RR = 2), Cu (RME RR = 23 and CTE RR = 8), Pb (RME RR = 152 and CTE RR = 77), Mn (RME RR = 5 and CTE RR = 4), Ni (RME RR = 1 and CTE RR < 1), and Zn (RME RR = 6 and CTE RR = 3) (**Table 7-13f**).

Based on the interpretive risk matrix for surface water presented in **Exhibit 9** (Section 7.3.5), it is concluded with a high level of confidence that risk to the fish community is possible in Pond D from exposure to benzo(a)anthracene, benzo(a)pyrene, toxaphene, Aroclor-1221, Al, Ba, Cd, Cr, Co, Cu, Pb, Mn, and Zn in surface water (risk scenario 6). The EPCs for toxaphene, Aroclor-1221, and Co represent one-half of the MRL since these COPECs were not detected in the two surface water samples collected from Pond D (see **Appendix BB**). The biggest risk concerns are with Al, Ba, Cd, and Pb which have chronic CTE HQs above 10. These COPECs could severely impair fish residing in Pond D.

- **Pond E**

The chronic HQs from surface water exposure in Pond E are above 1.0 for three SVOCs (4-bromophenyl-phenylether, benzo[a]anthracene, and benzo[a]pyrene), two pesticides (4,4'-DDD and toxaphene), seven Aroclors (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260), and ten metals (Al, Ba, Cd, Co, Cu, Pb, Mn, Ni, Ag, and Zn) (**Table 7-13g**).

The reference chronic HQs for these same COPECs from surface water exposure in the Blackstone River (upstream) are presented in **Table 7-13b**.

The chronic RRs in Pond E equal or exceed 1.0 for toxaphene (RME RR < 1 and CTE RR = 134), Aroclor-1221 (RME RR < 1 and CTE RR = 1), Ba (RME RR = 45 and CTE RR = 55), Pb (RME RR = 7 and CTE RR = 8), Mn (RME RR = 9 and CTE RR = 7), Ni (RME RR = 1 and CTE RR < 1), Ag (RME RR = 11 and CTE RR = 6) and Zn (RME RR = 2 and CTE RR = 1) (**Table 7-13g**).

Based on the interpretive risk matrix for surface water presented in **Exhibit 9** (Section 7.3.5), it is concluded with a high level of confidence that risk to the fish community is possible in Pond D from exposure to toxaphene, Aroclor-1221, Ba, Pb, Mn, Ag, and Zn in surface water (risk scenario 6). The EPCs for toxaphene, Aroclor-1221, and Ag represent one-half of the MRL since these COPECs were not detected in the two surface water samples collected from Pond E (see **Appendix BB**). The biggest risk concerns are

with Ba, Pb and Mn. The reported chronic CTE RRs for these COPECs could severely impair fish residing in Pond E.

- **Pond F**

The chronic HQs from surface water exposure in Pond F are above 1.0 for three SVOCs (4-bromophenyl-phenylether, benzo[a]anthracene, and benzo[a]pyrene), two pesticides (4,4,'-DDT and toxaphene), seven Aroclors (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260), and nine metals (Al, Ba, Cd, Cu, Pb, Mn, Ni, Ag, and Zn) (**Table 7-13h**).

The reference chronic HQs for these same COPECs from surface water exposure in the Blackstone River (upstream) are presented in **Table 7-13b**.

The chronic RRs in Pond F equal or exceed 1.0 for benzo(a)pyrene (RME RR = 7 and CTE RR = 1), toxaphene (RME RR < 1 and CTE RR = 134), Aroclor-1221 (RME RR < 1 and CTE RR = 1), Al (RME RR = 7 and CTE RR < 1), Pb (RME RR = 18 and CTE RR < 1), Mn (RME RR = 11 and CTE RR = 2), Ni (RME RR = 1 and CTE RR < 1), and Ag (RME RR = 3 and CTE RR = 2) (**Table 7-13h**).

Based on the interpretive risk matrix for surface water presented in **Exhibit 9** (Section 7.3.5), it is concluded with a high level of confidence that risk to the fish community is possible in Pond F from exposure to toxaphene, Aroclor-1221, Mn, and Ag in surface water (risk scenario 6). The EPCs for toxaphene and Aroclor-1221 represent one-half of the MRL since these COPECs were not detected in the four surface water samples collected from Pond F (see **Appendix BB**). The chronic CTE RRs for Mn and Ag equal 2 and 2, respectively.

- **Pond I**

The chronic HQs from surface water exposure in Pond I are above 1.0 for three SVOCs (4-bromophenyl-phenylether, benzo[a]anthracene, and benzo[a]pyrene), two pesticides (4,4,'-DDT and toxaphene), four Aroclors (Aroclors 1016, 1221, 1232, and 1242), and eight metals (Al, Ba, Cd, Cu, Pb, Mn, Ag, and Zn) (**Table 7-13i**).

The reference chronic HQs for these same COPECs from surface water exposure in the Blackstone River (upstream) are presented in **Table 7-13b**.

The chronic RRs in Pond I equal or exceed 1.0 for benzo(a)anthracene (RME RR = 3 and CTE RR = 1), toxaphene (RME RR < 1 and CTE RR = 134), Aroclor-1221 (RME RR < 1 and CTE RR = 1), Al (RME RR < 1 and CTE RR = 2), Ba (RME RR < 1 and CTE RR = 4), Cd (RME RR < 1 and CTE RR = 1), Pb (RME RR < 1 and CTE RR = 10), and Mn (RME RR = 4 and CTE RR = 2) (**Table 7-13i**).

Based on the interpretive risk matrix for surface water presented in **Exhibit 9** (Section 7.3.5), it is concluded with a high level of confidence that risk to the fish community is possible in Pond I from exposure to benzo(a)anthracene, toxaphene, Aroclor-1221, Al, Ba, Cd, Pb, and Mn in surface water (risk scenario 6). The EPCs for toxaphene and Aroclor-1221 represent one-half of the MRL since these COPECs were not detected in the two surface water samples collected from Pond I (see **Appendix BB**). The chronic CTE RRs for the metals are below 5, except for Pb where it exceeds 10. Pb in surface water could severely impair fish residing in Pond I.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

- **Pond N**

The chronic HQs from surface water exposure in Pond N were above 1.0 for three SVOCs (4-bromophenyl-phenylether, benzo[a]anthracene, and benzo[a]pyrene), two pesticides (4,4,'-DDT and toxaphene), six Aroclors (Aroclors 1016, 1221, 1232, 1242, 1248, and 1260), and eight metals (Al, Ba, Cd, Cu, Pb, Mn, Ag, and Zn) (**Table 7-13j**).

The reference chronic HQs for these same COPECs from surface water exposure in the Blackstone River (upstream) are presented in **Table 7-13b**.

The chronic RRs in Pond N equal or exceed 1.0 for benzo(a)anthracene (RME RR = 2 and CTE RR = 2), benzo(a)pyrene (RME RR = 5 and CTE RR = 6), toxaphene (RME RR < 1 and CTE RR = 134), Aroclor-1221 (RME RR < 1 and CTE RR = 1), Al (RME RR = 20 and CTE RR = 22), Cd (RME RR < 1 and CTE RR = 2), Pb (RME RR < 1 and CTE RR = 12), Mn (RME RR = 2 and CTE RR = 3), and Ag (RME RR < 1 and CTE RR = 2) (**Table 7-13j**).

Based on the interpretive risk matrix for surface water presented in **Exhibit 9** (Section 7.3.5), it is concluded with a high level of confidence that risk to the fish community is possible in Pond N from exposure to benzo(a)anthracene, benzo(a)pyrene, toxaphene, Aroclor-1221, Al, Cd, Pb, Mn, and Ag in surface water (risk scenario 6). The EPCs for toxaphene, Aroclor-1221, and Ag represent one-half of the MRL since these COPECs were not detected in the single surface water sample collected from Pond N (see **Appendix BB**). The chronic CTE RRs for the metals are below 5, except for Al and Pb which have exceedances of 22 and 12, respectively. Al and Pb in surface water could severely impair fish residing in Pond N.

- **Pond P**

The chronic HQs from surface water exposure in Pond P are above 1.0 for three SVOCs (4-bromophenyl-phenylether, benzo[a]anthracene, and benzo[a]pyrene), three pesticides (4,4,'-DDT, heptachlor epoxide, and toxaphene), seven Aroclors (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260), and six metals (Al, Cd, Cu, Pb, Mn, and Ag) (**Table 7-13k**).

The reference chronic HQs for these same COPECs from surface water exposure in the Blackstone River (upstream) are presented in **Table 7-13b**.

The chronic RRs in Pond N equal or exceed 1.0 for 4,4'-DDT (RME RR = 6 and CTE RR = 8), heptachlor epoxide (RME RR < 1 and CTE RR = 1), toxaphene (RME RR < 1 and CTE RR = 134), Aroclor-1221 (RME RR < 1 and CTE RR = 1), Mn (RME RR = 13 and CTE RR = 13), and Ag (RME RR = 4 and CTE RR = 7) (**Table 7-13k**).

Based on the interpretive risk matrix for surface water presented in **Exhibit 9** (Section 7.3.5), it is concluded with a high level of confidence that risk to the fish community is possible in Pond P from exposure to 4,4'-DDT, heptachlor epoxide, toxaphene, Aroclor-1221, Mn, and Ag in surface water (risk scenario 6). The EPCs for toxaphene and Aroclor-1221 represent one-half of the MRL since these COPECs were not detected in the single surface water sample collected from Pond P (see **Appendix BB**). The chronic CTE RRs for 4,4'-DDT, Mn and Ag are 8, 13, and 7, respectively. These three COPECs in surface water could severely impair fish residing in Pond P.

US EPA ARCHIVE DOCUMENT

Risk conclusion for measurement endpoint 2.B

Measurement endpoint 2.B identified Al, Ba, and/or Pb in surface water as the most likely stressors to fish in Ponds C, D, E, I, N, and P. These six aquatic EUs appear likely to be impaired based on an evaluation of their surface water chemistry. No substantial risk to fish is expected in the Blackstone River (near-site), Wetlands A through D, Pond A, and Pond F. The WOE for this measurement endpoint is "low-medium".

7.5.3 Measurement Endpoint 2.C – Critical Body Residues

Compare COPEC levels measured in whole fish to no effect and effect CBRs.

The USEPA requested to compare fish tissue data tissue-based benchmarks as part of the BERA. Merely identifying a COPEC in tissue is not enough to conclude that it will produce an adverse effect. CBRs are chemical-specific tissue benchmarks at which fish show (or fail to show) a toxicological response. The assumption behind CBRs is that these values reflect a tissue-based concentration that caused the observed response.

7.5.3.1 Exposure Assessment

A total of 136 fish tissue samples were collected in September 2005 from six locations: two reference areas in the Blackstone River upstream of the site (BR-1 and BR-02), one area of the Blackstone River bordering the landfill (BR-3), Pond A (P-1), Pond F (P-2), and reference pond P-6.

Several species were sampled, including largemouth bass, white sucker, bluegill, pumpkinseed, golden shiner, and common shiner. The fish tissue samples were analyzed for SVOCs, pesticides, PCBs (homologs), metals, and cyanide. **Appendix HH** presents species-specific tissue concentrations, while **Appendix II** provides individual sample concentrations.

7.5.3.2 Effects Assessment

The CBR values used in the BERA were provided by the USEPA based on a compilation of values used at other Superfund sites in Region 1 (**Table 7-14**). The CBRs include one set of no-effect levels and one set of effect levels. CBRs are available for only a relatively small subset of COPECs.

7.5.3.3 Risk Characterization

Tables 7-15a through 7-15e provide the fish tissue data by fish species and aquatic EU, whereas **Tables 7-16a through 7-16c** summarize the RR in the Blackstone River (near-site), Pond A, and Pond F, respectively.

The results of the CBR comparison are summarized below:

- **Blackstone River (near-site)**

Fish residue data Are available for common shiner, largemouth bass, and white sucker collected from the Blackstone River (near-site).

US EPA ARCHIVE DOCUMENT

The site effect HQs for metals are exceeded in common shiners (five metals), largemouth bass (five metals), and white sucker (six metals) (**Table 7-15b)**. The site effect HQs for SVOCs (benzo(a)pyrene only), pesticides, and PCBs (total homologs only) in these three fish species are all below 1.0 (**Table 7-15b)**.

The reference effect HQs for those COPECs in the same three species collected from the Blackstone River (upstream) are presented in **Table 7-15a**.

The effect RRs in the Blackstone River (near-site) equal or exceed 1.0 only for Al (common shiner RME RR = 1 and CTE RR < 1; white sucker RME RR = 1 and CTE RR < 1), and Ba (common shiner RME RR = 1 and CTE RR < 1) (**Table 7-16a**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a moderate level of confidence that risk to the fish community is possible in the Blackstone River (near-site) from the presence of Al and Ba in whole fish (risk scenario 5). However, the effect CTE RRs for both metals are below 1.0, and the effect RME RRs equal 1 and 1, respectively. It is considered unlikely that these two COPECs in fish tissue could impair the fish in the Blackstone River (near-site).

- **Pond A**

Fish residue data are available for bluegill, largemouth bass, and white sucker collected from Pond A.

The site effect HQs for metals are exceeded in bluegill (four metals), largemouth bass (four metals), and white sucker (seven metals) (**Table 7-15c)**. The site effect HQs for SVOCs (benzo(a)pyrene only), pesticides, and PCBs (total homologs) in these three fish species are all below 1.0 (**Table 7-15c)**.

The reference effect HQs for those COPECs in the same three species collected from the Blackstone River (upstream) are presented in **Table 7-15a**.

The effect RRs are below 1.0 for all COPECs in the three fish species collected from Pond A (**Table 7-16b**). The no effect RRs exceed 1.0 in largemouth bass for Al (RME RR < 1 and CTE RR = 4) and V (RME RR = 3 and CTE RR = 2). The no effect values exceed 1.0 in white sucker for Al (RME RR < 1 and CTE RR = 4) and Cr (RME RR = 2 and CTE RR = 2) (**Table 7-16b**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a low level of confidence that risk to the fish community is possible in Pond A from the presence of Al, Cr, and V in whole fish (risk scenario 4). The effect RRs for all three metals are below 1.0. The highest no effect CTE RR equals 4 for Al in largemouth bass and white sucker. It is considered unlikely that these three COPECs in fish tissue could impair the fish in Pond A.

- **Pond F**

Fish residue data are available for bluegill, pumpkinseed, and white sucker collected from Pond F (Note: golden shiners were also collected from Pond F but could not be used in the evaluation because this species was not collected at the reference locations).

The site effect HQs for metals are exceeded in bluegill (seven metals), pumpkinseed (five metals), and white sucker (five metals) (**Table 7-15d)**. The site effect HQs for SVOCs (benzo(a)pyrene only), pesticides, and PCBs (total homologs only) in these three fish species are all below 1.0 (**Table 7-15d)**.

US EPA ARCHIVE DOCUMENT

The reference effect HQs for those COPECs in the same three species collected from the Blackstone River (upstream) are presented in **Table 7-15a**.

The effect RRs are below 1.0 for all COPECs, except for Ba (RME RR = 3 and CTE RR = 1) and Zn (RME RR = 1 and CTE RR < 1) in bluegill, and Ba (RME RR < 1 and CTE RR = 1) and Zn (RME RR < 1 and CTE RR = 1) in pumpkinseed in Pond F (**Table 7-16c**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that risk to the fish community is possible in Pond A from the presence of Ba and Zn in whole fish (risk scenario 6). However, the highest effect CTE RRs equal 1.0.

Risk conclusion for measurement endpoint 2C:

Measurement endpoint 2.C does not a show potential for risk from high COPEC residue levels in fish collected from the Blackstone River (near-site), Pond A and Pond F. No fish were collected from the other ponds at the site. The WOE for this endpoint is "medium".

7.5.3.4 WOE integration for assessment endpoint 2

Table 7-16d summarizes the WOE integration for the two measurement endpoints evaluated under assessment endpoint 2 (Note: measurement endpoint 2.A - fish community structure - is not used in the WOE integration due to ambiguous data or lack of reference data from a suitable background location). The preponderance of the evidence shows that the fish community is not at risk in the Blackstone River (near-site), Wetlands A through D, Pond A, and Pond F.

On the other hand, the potential for severe impairment to the fish community exists in Pond C, Pond D, Pond E, Pond I, Pond N, and Pond P. This risk is based on a single measurement endpoint (comparing surface water CTEs and RMEs to surface water benchmarks) with a "low-medium" WOE. Hence, much uncertainty is associated with this part of the conclusion.

7.6 ASSESSMENT OF RISK TO AMPHIBIANS

Maintain stable and healthy amphibian populations: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of the amphibian populations in the Blackstone River, the wetlands, and the ponds at the Site?*

One measurement endpoint is used to quantify the potential for ecological risks to amphibians in the aquatic EUs at the site:

7.6.1 Measurement endpoint 3.A

Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.

The risk evaluation of amphibians compares CTE and RME COPEC levels in surface water to generic surface water benchmarks. This approach is identical to the one used on fish (see measurement endpoint 2.B). The reason is that the surface water benchmarks apply to all aquatic receptors which could be exposed to COPECs in surface water. The discussion presented in Section 7.4.2 for fish is not repeated

US EPA ARCHIVE DOCUMENT

below, but should be consulted for details on COPECs and the potential for ecological risk at specific aquatic EUs.

Risk conclusion for measurement endpoint 3.A

Measurement endpoint 3.A identified Al, Ba, and/or Pb in surface water as the most likely stressors to amphibians in Ponds C, D, E, I, N, and P. These six aquatic EUs appear likely to be impaired based on an evaluation of their surface water chemistry. No significant risk to amphibians is present in the Blackstone River (near-site), Wetlands A through D, Pond A, and Pond F.

7.6.2 WOE integration for assessment endpoint 3

Table 7-16e summarizes the WOE integration for the single measurement endpoint evaluated under assessment endpoint 3. The preponderance of the evidence strongly indicates that amphibians in Ponds C, D, E, I, N and P are at risk from exposure to site-derived COPECs. No risk is identified to amphibians in the Blackstone River (near-site), Wetlands A through D, Pond A, and Pond F. This risk is based on a single measurement endpoint (comparing surface water CTEs and RMEs to surface water benchmarks) with a "low-medium" WOE. Hence, much uncertainty is associated with this conclusion.

7.7 ASSESSMENT OF RISK TO BIRDS

This section evaluates the potential for ecological risks to birds exposed to COPECs at the site. Omnivorous and piscivorous birds are selected as key species groups because they are commonly found at the site and represent potentially significant ecosystem components. Omnivorous birds are represented by the American robin and American woodcock, whereas piscivorous birds are represented by the belted kingfisher and the great blue heron.

As described in the *Ecological Risk Assessment Work Plan* (BBL, 2006d) and a subsequent USEPA (2007) technical memorandum, the exposure assessment assumes that small birds (i.e., American robin and belted kingfisher) have foraging ranges equal to the size of each EU. The larger birds (i.e., American woodcock and great blue heron) are assumed to forage over the entire site. Data for each exposure medium are pooled accordingly. **Appendix AA** presents the EU groupings for each EPC and receptor group (and the associated exposure media data). **Appendix BB** presents the EPCs.

7.7.1 Omnivorous Birds

The following assessment endpoints are used to evaluate the potential for ecological risk to omnivorous birds:

Maintain stable and healthy populations of large omnivorous birds: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large omnivorous birds foraging in the wetlands and terrestrial habitats at the site?*

Maintain stable and healthy populations of small omnivorous birds: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small omnivorous birds foraging in the wetlands and terrestrial habitats at the site?*

US EPA ARCHIVE DOCUMENT

Omnivorous birds are assumed to forage in the terrestrial habitats at the site. While they would normally feed on a variety of food items (e.g., earthworms, terrestrial insects, fruits, seeds, leaves), this assessment conservatively assumes that their diet consists of 100 % earthworms. The exposure assessment addresses two representative omnivorous species: American robin and American woodcock.

7.7.1.1 Exposure Assessment

Exposure of omnivorous birds is assessed using a dietary intake model (described in Section 7.2.3) that reflects ingestion of food, water, and soil. For each species, CTE and RME exposures are calculated using combinations of "average" and "reasonable maximum" exposure factors, respectively. For the proportion of contaminated diet, values of 0.5 and 1 were applied to represent the CTE and RME exposure scenarios, respectively. Food, water, and incidental soil intake rates for small and large omnivorous birds were obtained from the literature (**Table 7-2a**).

COPEC concentrations in dietary items were estimated by multiplying soil COPEC concentrations by earthworm BSoilAFs (**Table 7-3**). This approach is conservative because a portion of the diet of omnivorous birds would consist of other types of food items that may not bioaccumulate COPECs as much as earthworms, resulting in lower exposures.

Tables 7-17a through 7-18g present the COPEC EPCs for soil, water, and food, as well as the estimated intakes for the CTE and RME scenarios. **Appendix BB** describes the EPC calculations.

7.7.1.2 Effects Assessment

The BERA uses NOAEL- and LOAEL-based TRVs from Sample *et al*. (1996) to evaluate the potential for ecological risk to birds. Based on recommendations by the USEPA, a NOAEL TRV is multiplied by a conservative extrapolation factor of 2.0 to develop a LOAEL TRV when only a NOAEL TRV is available. **Table 7-4a** provides the TRVs used in the assessment.

7.7.1.3 Risk Characterization

The risk characterization consists of deriving NOAEL- and LOAEL-based HQs for CTE and RME exposures. RRs are also calculated by subtracting the background risk from the site risk. The HQs for small omnivorous birds are presented in **Tables 7-18a through 7-18g**.

7.7.1.4 Large omnivorous birds

One measurement endpoint is used to quantify the potential for ecological risks to large omnivorous birds in the terrestrial EUs at the site:

Measurement endpoint 4.A: Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses in large omnivorous birds from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.

US EPA ARCHIVE DOCUMENT

Table 7-17a presents the HQs for large omnivorous birds feeding at the upstream reference location, whereas **Table 7-17b** presents the HQs and RRs for the same receptor group feeding at the near-site terrestrial EUs combined. A summary of the potential for ecological risk is presented below:

- **All near-site terrestrial EUs combined**

The site effect HQs from ingesting soil, surface water, and earthworms from all the near-site terrestrial EUs combined exceeds 1.0 for two SVOCs (BEHP and di-n-octyl phthalate), two pesticides (4,4'-DDE and dieldrin), and six metals (Al, Cd, Cr, Pb, Hg, and Zn) (**Table 7-17b)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-17a**.

The effect RR for all the near-site terrestrial EUs combined equal or exceed 1.0 for five COPECs, namely BHEP (RME RR = 1332 and CTE RR = 5), di-n-octyl phthalate (RME RR = 14 and CTE RR < 1), Cd (RME RR = 3 and CTE RR < 1), Pb (RME RR = 293 and CTE RR = 17), and Zn (RME RR = 31 and CTE RR = 4) (**Table 7-17b**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible to large omnivorous birds feeding on earthworms across all of the on-site terrestrial EUs combined (risk scenario 6). The principal risk driver is Pb, with BEHP and Zn as secondary risk drivers.

Risk conclusion for measurement endpoint 4.A

Measurement endpoint 4.a identifies the potential for ecological risk to large omnivorous birds feeding across all of the on-site terrestrial EUs combined.

WOE integration for assessment endpoint 4

Table 7-17c summarizes the WOE integration for the measurement endpoint evaluated under assessment endpoint 4. The preponderance of the evidence shows that severe impairment to large omnivorous birds feeding on earthworms across all of the on-site terrestrial EUs is possible, mainly as a result from exposure to Pb. This risk is based on a single measurement endpoint with a "low-medium" WOE. Hence, much uncertainty is associated with this conclusion.

7.7.1.5 Small omnivorous birds

One measurement endpoint is used to quantify the potential for ecological risks to small omnivorous birds in the terrestrial EUs at the site:

Measurement endpoint 5.A: Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses in small omnivorous birds from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.

Table 7-18a presents the HQs for small omnivorous birds feeding on earthworms at the upstream reference location, whereas **Table 7-18b through 7-18g** presents the HQs and RRs for the same receptor group

feeding on earthworms at each of the on-site terrestrial EUs. A summary of the potential for ecological risk is presented below:

- **J.M. Mills Landfill**

The site effect HQs from ingesting soil, surface water, and earthworms from the J.M. Mills Landfill exceeds 1.0 for two SVOCs (BEHP and di-n-octyl phthalate), two pesticides (4,4'-DDE and 4,4'-DDT), and six metals (Al, Cd, Cr, Cu, Pb, and Zn) (**Table 7-18b)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-18a**.

The effect RRs equal or exceed 1.0 for six COPECs at the J.M. Mills Landfill, namely BHEP (RME RR = 103 and CTE RR = 7), di-n-octyl phthalate (RME RR = 28 and CTE RR < 1), 4,4'-DDT (RME RR = 1 and CTE RR < 1), Cd (RME RR = 7 and CTE RR = 1), Pb (RME RR = 160 and CTE RR = 41), and Zn (RME RR = 66 and CTE RR = 10) (**Table 7-18b**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible to small omnivorous birds feeding at the J.M. Mills Landfill (risk scenario 6). The major risk drivers are BEHP, Pb, and Zn.

- **Unnamed Island**

The site effect HQs from ingesting soil, surface water, and earthworms from the Unnamed Island exceeds 1.0 for two SVOCs (BEHP and di-n-octyl phthalate), two pesticides (4,4'-DDE and dieldrin), and seven metals (Al, Cd, Cr, Cu, Pb, Hg, and Zn) (**Table 7-18c)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-18a**.

The effect RRs equal or exceed 1.0 for eight COPECs at the Unnamed Island, namely BHEP (RME RR = 2340 and CTE RR = 14), di-n-octyl phthalate (RME RR = 77 and CTE RR = 1), dieldrin (RME RR = 2 and CTE RR < 1), Cd (RME RR = 2 and CTE RR < 1), Cr (RME RR = 2 and CTE RR < 1), Cu (RME RR = 1 and CTE RR < 1), Pb (RME RR = 2616 and CTE RR = 15) and Zn (RME RR = 173 and CTE RR = 3) (**Table 7-18c**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible to small omnivorous birds feeding at the Unnamed Island (risk scenario 6). The major risk drivers are BEHP and Pb.

- **Nunes Parcel**

The site effect HQs from ingesting soil, surface water, and earthworms from the Nunes Parcel exceeds 1.0 for two SVOCs (BEHP and di-n-octyl phthalate), two pesticides (4,4'-DDE and 4,4'-DDT), and seven metals (Al, Cd, Cr, Cu, Pb, Hg, and Zn) (**Table 7-18d)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-18a**.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

The effect RRs equal or exceed 1.0 for eight COPECs at the Nunes Parcel, namely BHEP (RME RR = 135 and CTE RR = 8), 4,4'-DDT (RME RR = 6 and CTE RR < 1), Al (RME RR = 1 and CTE RR < 1), Cd (RME RR = 7 and CTE RR < 1), Cr (RME RR = 3 and CTE RR < 1), Cu (RME RR = 1 and CTE RR < 1), Pb (RME RR = 1456 and CTE RR = 81), and Zn (RME RR = 54 and CTE RR = 8) (**Table 7-18d**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible to small omnivorous birds feeding at the Nunes Parcel (risk scenario 6). The major risk drivers are BEHP, Pb, and Zn.

- **Quinnville Well Field**

The site effect HQs from ingesting soil, surface water, and earthworms from the Quinville Well Field exceeds 1.0 for two SVOCs (BEHP and di-n-octyl phthalate), three pesticides (4,4'-DDE, 4,4'-DDT, and dieldrin), and seven metals (Al, Cd, Cr, Pb, Hg, and Zn) (**Table 7-18e)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-18a**.

The effect RRs equal or exceed 1.0 for nine COPECs at the Quinnville Well Field, namely BHEP (RME RR = 41 and CTE RR < 1), di-n-octyl phthalate (RME RR = 8 and CTE RR < 1), 4,4'-DDE (RME RR = 3 and CTE RR < 1), 4,4'-DDT (RME RR = 1 and CTE RR < 1), dieldrin (RME RR = 3 and CTE RR < 1), Cd (RME RR = 1 and CTE RR < 1), Cr (RME RR = 3 and CTE RR < 1), Pb (RME RR = 100 and CTE RR = 2), and Zn (RME RR = 11 and CTE RR = 2) (**Table 7-18e**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible to small omnivorous birds feeding at the Quinnville Well Field (risk scenario 6). The risk drivers are Pb and Zn.

- **Wetlands A through D**

The site effect HQs from ingesting soil, surface water, and earthworms from the Wetlands A through D exceed 1.0 for one SVOC (di-n-octyl phthalate) and three metals (Al, Pb, and Zn) (**Table 7-18f)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-18a**.

None of the COPECs at Wetlands A through D have effect RRs equal or above 1.0 (**Table 7-18f**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a moderate level of confidence that a potential for ecological risk is unlikely to small omnivorous birds feeding at the Wetlands A through D (risk scenario 2).

- **Pratt Dam**

The site effect HQs from ingesting soil, surface water, and earthworms from Pratt Dam exceed 1.0 for one SVOCs (di-n-octyl phthalate) and three metals (Cd, Cu, and Pb) (**Table 7-18g)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-18a**.

US EPA ARCHIVE DOCUMENT

The effect RRs equal or exceed 1.0 for two COPECs at Pratt Dam, namely Cd (RME RR = 4 and CTE RR < 1) and Pb (RME RR = 98 and CTE RR = 34) (**Table 7-18g**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible to small omnivorous birds feeding at Pratt Dam (risk scenario 6). The major risk driver is Pb.

Risk conclusion for measurement endpoint 5.A

Measurement endpoint 5.A identifies the potential for severe ecological risk to small omnivorous birds at J.M. Mills Landfill, Unnamed Island, Nunes Parcel, and Pratt Dam. Pb is the main risk driver at each of these terrestrial EUs. The potential for minimal risk exists at Quinnville Well Field. No risk is identified at the Wetlands A through D. The WOE for this measurement endpoint is "low-medium".

WOE integration for assessment endpoint 5

Table 7-18h summarizes the WOE integration for the single measurement endpoint evaluated under assessment endpoint 5. The preponderance of the evidence indicated that Pb, together with several other COPECs, could affect small omnivorous birds feeding at several of the terrestrial EUs. Wetlands A through D was the only terrestrial EU where no risk was identified.

7.7.2 Piscivorous Birds

The following assessment endpoints are used to evaluate the potential for ecological risk to piscivorous birds:

Maintain stable and healthy populations of large piscivorous birds: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large piscivorous birds foraging in targeted aquatic habitats at the site?*

Maintain stable and healthy populations of small piscivorous birds: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small piscivorous birds foraging in targeted aquatic habitats at the site?*

Piscivorous birds are assumed to forage on fish captured in the aquatic EUs at the site. The exposure assessment addresses two representative species: the great blue heron (representing large piscivorous birds) and the belted kingfisher (representing small piscivorous birds).

7.7.2.1 Exposure Assessment

Exposure of piscivorous birds is assessed using the dietary intake model presented in Section 7.2.3, which includes ingestion of fish, surface water, and sediment. CTE and RME exposures are calculated for each species. For the proportion of contaminated diet, values of 0.5 and 1 were applied to the CTE and RME exposure scenarios, respectively. Food, surface water, and incidental sediment intake rates for small and large piscivorous birds were obtained from the literature (**Table 7-2b**).

Fish tissue COPEC EPCs are based on the whole-body fish tissue data collected in 2005. Fish data were sorted into a small (< 15 cm) and a large (> 15 cm) size class to reflect the fish sizes most likely to be

consumed by the representative species. The EPCs for the small piscivorous birds are based on data for small fish, based on discussions with the USEPA, and available literature (Salyer and Lagler, 1946; Davis, 1982; Kirkpatrick, 1940; Alexander, 1977). Both the small and large fish were combined to quantify exposure to the large piscivorous birds. **Appendix BB** summarizes whole-body fish tissue EPCs. **Tables 7-19a through 7-20e** present the EPCs for fish, surface water, and sediment, together with the estimated dietary intakes for the CTE and RME scenarios.

7.7.2.2 Effects Assessment

Table 7-4a presents the NOAEL- and LOAEL-based benchmarks used for evaluating exposure of piscivorous birds.

7.7.2.3 Rick Characterization

The risk characterization for piscivorous birds consists of deriving NOAEL- and LOAEL-based HQs for CTE and RME exposures. COPEC-specific RRs are calculated by subtracting the background HQs from the site HQs.

7.7.2.4 Large piscivorous birds

One measurement endpoints is used to quantify the potential for ecological risk to this receptor group:

Measurement endpoint 6.A: Use food chain modeling to calculate daily doses for large piscivorous birds from ingesting surface water, sediment, and fish, and compare these values to no effect and effect avian TRVs.

Table 7-19a presents the HQs for large piscivorous birds feeding at the upstream reference location, whereas **Table 7-19b** presents the HQs and RRs for the same receptor group feeding at the Blackstone River (near-site), Pond A, and Pond F combined. A summary of the potential for ecological risk is presented below:

- **Blackstone River (near-site), Pond A, and Pond F combined**

The site effect HQs from ingesting sediment, surface water, and fish from the Blackstone River (near-site), Pond A, and Pond F combined exceed 1.0 only for Pb (**Table 7-19b)**.

The reference effect HQ for this and other COPECs from ingesting sediment, surface water, and fish at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-19a**.

None of the COPECs at the Blackstone River (near-site), Pond A, and Pond F combined have effect RRs above 1.0 (**Table 7-19b**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is unlikely to large piscivorous birds feeding at the Blackstone River (near-site), Pond A, and Pond F combined (risk scenario 1).

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Risk conclusion for measurement endpoint 6.A

Measurement endpoint 6.A did not identify the potential for ecological risk to large piscivorous birds feeding at the Blackstone River (near-site), Pond A, and Pond F combined. The WOE for this measurement endpoint is "medium".

WOE integration for assessment endpoint 6

Table 7-19c summarizes the WOE integration for the single measurement endpoint evaluated under assessment endpoint 6. The preponderance of the evidence indicated that adverse effects are unlikely to large piscivorous birds feeding at the Blackstone River (near-site), Pond A, and Pond F combined.

7.7.2.5 Small piscivorous birds

One measurement endpoints is used to quantify the potential for ecological risk to this receptor group:

Measurement endpoint 7.A: Use food chain modeling to calculate daily doses for small piscivorous birds from ingesting surface water, sediment, and fish, and compare these values to no effect and effect avian TRVs.

Table 7-20a presents the HQs for small piscivorous birds feeding at the upstream reference location, whereas **Tables 7-20b through 7-20-d** presents the HQs and RRs for the same receptor group feeding separately in each of the three largest on-site aquatic EUs. A summary of the potential for ecological risk is presented below:

- ***Blackstone River (near-site)***

The site effect HQs from ingesting sediment, surface water, and fish from the Blackstone River (near-site) exceed 1.0 for one pesticide (4,4'-DDE) and one metal (Pb) (**Table 7-20b)**.

The reference effect HQs for these same COPECs from ingesting sediment, surface water, and fish at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-20a**.

None of the COPECs at the Blackstone River (near-site) have effect RRs above 1.0 (**Table 7-20b**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that the potential for ecological risk is unlikely to small piscivorous birds feeding at the Blackstone River (near-site) (risk scenario 1).

- ***Pond A***

The site effect HQs from ingesting sediment, surface water, and fish from Pond A exceed 1.0 only for Pb (**Table 7-20c)**.

The reference effect HQs for this and other COPECs from ingesting sediment, surface water, and fish at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-20a**.

None of the COPECs from Pond A have effect RRs above 1.0 (**Table 7-20c**).

US EPA ARCHIVE DOCUMENT

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a low level of confidence that a potential for ecological risk is unlikely to small piscivorous birds feeding at Pond A (risk scenario 3).

- ***Pond F***

The site effect HQs from ingesting sediment, surface water, and fish from Pond F exceed 1.0 only for Pb (**Table 7-20d)**.

The reference effect HQs for this and other COPECs from ingesting sediment, surface water, and fish at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-20a**.

The effect RRs at Pond F equal or exceed 1.0 for one COPEC, namely Pb (RME RR = 1 and CTE RR < 1) (**Table 7-20d**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is unlikely to small piscivorous birds feeding at Pond A (risk scenario 1).

Risk conclusion for measurement endpoint 7.A

Measurement endpoint 7.A does not identify the potential for ecological risk to small piscivorous birds feeding at the Blackstone River (near-site), Pond A, or Pond F. The WOE for this measurement endpoint is "medium".

WOE integration for assessment endpoint 7

Table 70-20e summarizes the WOE integration for the single measurement endpoint evaluated under assessment endpoint 7. The preponderance of the evidence indicates that the potential for ecological risk is unlikely for small piscivorous birds feeding at the Blackstone River (near-site), Pond A, and Pond F.

7.8 ASSESSMENT OF RISK TO MAMMALS

Omnivorous and piscivorous mammals are selected because they are common and are an important part of an ecosystem. The omnivorous mammals feeding guild is represented by a small species (i.e., short-tailed shrew) and a large species (i.e. red fox), both of which feed in terrestrial habitats. The piscivorous mammals are represented by a small species (i.e., mink) and large species (i.e., river otter) which are assumed feed entirely in aquatic habitats.

In the exposure assessment, small mammals are assumed to forage within each of the three largest aquatic EUs at the site, whereas large mammals are assumed to forage across the three largest aquatic EUs at the site. Data for each exposure medium are pooled accordingly. **Appendix AA** presents EU groupings for each EPC and receptor group (and the associated exposure media data), whereas **Appendix BB** presents the EPCs.

US EPA ARCHIVE DOCUMENT

7.8.1 Omnivorous Mammals

The following assessment endpoints are used to evaluate the potential for ecological risk to omnivorous mammals:

Maintain stable and healthy populations of large omnivorous mammals: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large omnivorous birds foraging in the wetlands and terrestrial habitats at the site?*

Maintain stable and healthy populations of small omnivorous mammals: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small omnivorous birds foraging in the wetlands and terrestrial habitats at the site?*

Omnivorous mammals are assumed to forage in the terrestrial habitats (including the wetlands) at the site. While they would normally feed on a variety of food items (e.g., earthworms, terrestrial insects, fruits, plants), this assessment conservatively assumes that their diet consists of 100% earthworms. The exposure assessment addresses two representative species: the short-tailed shrew and the red fox.

7.8.1.1 Exposure Assessment

Exposure of omnivorous mammals is assessed using a dietary intake model (described in Section 7.2.3) that includes ingestion of food, water, and soil. The CTE and RME exposures are calculated for each species. For the proportion of contaminated diet, values of 0.5 and 1 were applied to represent the CTE and RME exposure scenarios, respectively. Food, water, and incidental soil ingestion rates for small and large omnivorous mammals were obtained from the literature (**Table 7-2c**).

COPEC concentrations in dietary items were estimated by multiplying soil concentrations by BSoilAFs (**Table 7-3**). It is conservative to use earthworm BSoilAFs to estimate food item concentrations for omnivorous mammals because the diet for omnivores would include other food items that may not bioaccumulate COPECs as much, and could therefore have lower COPEC concentrations.

Tables 7-22a through 7-23g present the COPEC EPCs for soil, water, and food, together with the intakes estimated based on the dietary intake model for the CTE and RME scenarios. **Appendix BB** describes the calculation of the EPCs.

7.8.1.2 Effects Assessment

The NOAEL- and LOAEL-based TRVs for omnivorous mammals were obtained from Sample et al.(1996) (**Table 7-4b**). Based on recommendations by the USEPA, a NOAEL TRV was multiplied by 2 to develop a LOAEL TRV when only a LOAEL TRV was available. **Table 7-4b** provides the mammalian TRVs used in the assessment

7.8.1.3 Risk Characterization

Risk characterization for omnivorous mammals consists of deriving NOAEL- and LOAEL-based HQs. The COPEC-specific RRs are calculated by subtracting the background HQs from the site HQs

US EPA ARCHIVE DOCUMENT

7.8.1.4 Large omnivorous mammals

One measurement endpoint is used to quantify the potential for ecological risks to large omnivorous mammals in the terrestrial EUs at the site:

Measurement endpoint 8.A: Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses for large omnivorous mammals from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.

Table 7-22a presents the HQs for large omnivorous mammals feeding at the upstream reference location, whereas **Table 7-22b** presents the HQs and RRs for the same receptor group feeding at the near-site terrestrial EUs combined. A summary of the potential for ecological risk is presented below:

- **All terrestrial habitats combined**

The site effect HQs from ingesting soil, surface water, and earthworms from all the near-site terrestrial EUs combined exceeds 1.0 for two SVOCs (BHEP and PCP) and three metals (Al, Hg, and Zn) (**Table 7-22b)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-22a**.

The effect RRs for all the near-site terrestrial EUs combined equal or exceed 1.0 for three COPECs, namely PCP (RME RR = 3 and CTE RR < 1), Al (RME RR = 9 and CTE RR < 1), and Zn (RME RR = 2 and CTE RR < 1) (**Table 7-22b**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a low level of confidence that the potential for ecological risk to large omnivorous mammals is unlikely across all terrestrial habitats combined (risk scenario 3).

Risk conclusion for measurement endpoint 8.A

Measurement endpoint 8.A does not identify the potential for ecological risk to large omnivorous mammals feeding across the terrestrial EUs combined. The WOE for this measurement endpoint is “low-medium”.

WOE integration for assessment endpoint 8

Table 7-22c summarizes the WOE integration for the single measurement endpoint evaluated under assessment endpoint 8. The preponderance of the evidence indicates that adverse effects are unlikely to large omnivorous mammals feeding at all of the on-site terrestrial EUs combined.

7.8.1.5 Small omnivorous mammals

One measurement endpoint is used to quantify the potential for ecological risks to small omnivorous mammals foraging at the terrestrial EUs at the site:

Measurement endpoint 9.A: Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses for small omnivorous mammals from ingesting surface water, soil, and terrestrial invertebrates, and compare these

values to no effect and effect mammalian TRVs.

Table 7-23a presents the HQs for small omnivorous mammals feeding on earthworms at the upstream reference location, whereas **Table 7-2b through 7-23g** presents the HQs and RRs for the same receptor group feeding on earthworms at each of the on-site terrestrial EUs. A summary of the potential for ecological risk is presented below:

- **J.M. Mills Landfill**

The site effect HQs from ingesting soil, surface water, and earthworms at the J.M. Mills Landfill exceeds 1.0 for two SVOCs (BEHP and PCP) and seven metals (Al, Sb, Cd, Cu, Hg, Th, and Zn) (**Table 7-23b)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-23a**.

The effect RRs at the J.M Mills Landfill equal or exceed 1.0 for seven COPECs, namely BEHP (RME RR = 1 and CTE RR < 1), PCP (RME RR = 6 and CTE RR < 1), Al (RME RR = 20 and CTE RR = 6), Sb (RME RR = 2 and CTE RR < 1), Cd (RME RR = 4 and CTE RR < 1), Th (RME RR = 2 and CTE RR < 1) and Zn (RME RR = 14 and CTE RR = 3) (**Table 7-23b**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for small omnivorous mammals foraging at the J.M. Mills Landfill (risk scenario 6). Al and Zn are the risk drivers.

- **Unnamed Island**

The site effect HQs from ingesting soil, surface water, and earthworms at Unnamed Island exceeds 1.0 for one SVOCs (BEHP), one pesticide (dieldrin), and eight metals (Al, Sb, Cd, Cu, Pb, Hg, Th, and Zn) (**Table 7-23c)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-23a**.

The effect RRs at Unnamed Island equal or exceed 1.0 for nine COPECs, namely BEHP (RME RR = 23 and CTE RR < 1), dieldrin RME RR = 2 and CTE RR < 1), Al (RME RR < 1 and CTE RR = 2), Sb (RME RR = 3 and CTE RR < 1), Cd (RME RR = 1 and CTE RR < 1), Cu (RME RR = 1 and CTE RR < 1), Pb (RME RR = 2 and CTE RR < 1), Th (RME RR = 2 and CTE RR < 1), and Zn (RME RR = 37 and CTE RR < 1) (**Table 7-23c**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for small omnivorous mammals feeding at Unnamed Island (risk scenario 6). Al is the COPEC showing the highest risk. However, the effect CTE RR for this COPEC equals 2 and is not matched with an effect RME RR > 1.0. This evidence suggests that risk from Al is not expected.

- **Nunes Parcel**

The site effect HQs from ingesting soil, surface water, and earthworms at Nunes Parcel exceeds 1.0 for two SVOCs (BEHP and fluoranthene) and eight metals (Al, Sb, Cd, Cu, Pb, Hg, Th, and Zn) (**Table 7-23d)**.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-23a**.

The effect RRs at Nunes Parcel equal or exceed 1.0 for seven COPECs, namely BEHP (RME RR = 1 and CTE RR < 1), Al (RME RR = 30 and CTE RR = 7), Sb (RME RR = 1 and CTE RR < 1), Cd (RME RR = 4 and CTE RR < 1), Cu (RME RR = 1 and CTE RR < 1), Th (RME RR = 3 and CTE RR < 1) and Zn (RME RR = 12 and CTE RR = 2) (**Table 7-23d**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for small omnivorous mammals feeding at Unnamed Island (risk scenario 6). The risk drivers are Al and Zn.

- **Quinnville Well Field**

The site effect HQs from ingesting soil, surface water, and earthworms at the Quinville Well Field exceeds 1.0 for one SVOCs (Pentachlorophenol [PCP]), one pesticide (dieldrin), and four metals (Al, Cd, Hg, and Zn) (**Table 7-23e)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-23a**.

The effect RRs at the Quinville Well Field equal or exceed 1.0 for four COPECs, namely PCP (RME RR = 4 and CTE RR < 1), dieldrin (RME RR = 3 and CTE RR < 1), Al (RME RR = 10 and CTE RR = 4), and Zn (RME RR = 2 and CTE RR < 1) (**Table 7-23e**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that a potential for ecological risk is possible for small omnivorous mammals feeding at the Quinnville Well Field (risk scenario 6). Al is the risk driver.

- **Wetlands A through D**

The site effect HQs from ingesting soil, surface water, and earthworms at Wetlands A through D exceed 1.0 for three metals (Al, Th, and Zn) (**Table 7-23f)**.

The reference effect HQs for these same COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-23a**.

The effect RRs at Wetlands A through D equal or exceed 1.0 for two COPECs, namely Al (RME RR = 8 and CTE RR < 1), and Th (RME RR = 1 and CTE RR < 1) (**Table 7-23f**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a moderate level of confidence that a potential for ecological risk is possible for small omnivorous mammals feeding at Wetlands A through D (risk scenario 5). Al is the COPEC with the highest risk. However, the likelihood that this potential risk is actually expressed in the field appears minimal given the lack of a CTE RR exceedance by Al.

US EPA ARCHIVE DOCUMENT

- **Pratt Dam**

The site effect HQs from ingesting soil, surface water, and earthworms at Pratt Dam exceed 1.0 only for Cd (**Table 7-23g)**.

The reference effect HQs for this and other COPECs from ingesting soil, surface water, and earthworms at the terrestrial background location (Blackstone River – upstream) are presented in **Table 7-23a**.
The effect RR at Pratt Dam exceeds 1.0 for Cd (RME RR = 2 and CTE RR < 1) (**Table 7-23g**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a moderate level of confidence that a potential for ecological risk is possible for small omnivorous mammals feeding at Pratt Dam (risk scenario 5). Cd is the COPEC with the highest risk. However, the likelihood that this potential risk is actually expressed in the field appears minimal given the lack of a RR effect CTE exceedance by Cd.

Risk conclusion for measurement endpoint 9.A

Measurement endpoint 9.A identifies the potential for minor ecological risk to small omnivorous mammals feeding at J.M. Mills Landfill, Nunes Parcel, and the Quinville Well Field. Al is the principal risk driver, and Zn is a secondary risk driver at these three EUs. No serious risk to small omnivorous mammals is identified at the Unnamed Island, Wetlands A through D, and Pratts Dam. The WOE for this measurement endpoint is "low-medium".

WOE integration for assessment endpoint 9

Table 7-22h summarizes the WOE integration for the single measurement endpoint evaluated under assessment endpoint 9. The preponderance of the evidence indicates that minimal risk is possible to small omnivorous mammals feeding at J.M. Mills Landfill, Nunes Parcel, and the Quinnville Well Field due to exposure to Al and Zn. The potential for ecological risk is unlikely for small omnivorous mammals feeding at the Unnamed Island, Wetlands A through D, and Pratts Dam.

7.8.2 Piscivorous Mammals

The following assessment endpoints are used to evaluate the potential for ecological risk to piscivorous mammals:

Maintain stable and healthy populations of large piscivorous mammals: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large piscivorous mammals foraging in targeted aquatic habitats at the site?*

Maintain stable and healthy populations of small piscivorous mammals: *Are the COPEC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small piscivorous mammals foraging in targeted aquatic habitats at the site?*

Piscivorous mammals are assumed to forage on fish captured in the three largest aquatic Eus at the site. The exposure assessment addresses large piscivores (represented by the river otter) and small piscivores (represented by the mink).

US EPA ARCHIVE DOCUMENT

7.8.2.1 Exposure Assessment

Exposure of piscivorous mammals is assessed using a dietary intake model (presented in Section 7.2.3) that includes ingestion of fish, water, and sediment under both CTE and RME exposures. For the proportion of contaminated diet, values of 0.5 and 1 were applied to represent the CTE and RME exposure scenarios, respectively. Food, water, and incidental sediment ingestion rates for small and large piscivorous mammals were obtained from the literature (**Table 7-2d**).

COPEC concentrations in dietary items are estimated using measured whole-body fish tissue data to calculate EPCs. Similar to the assessment for piscivorous birds, fish data are sorted into small (< 15 cm) and large (> 15 cm) size classes to reflect fish sizes most likely to be consumed by small and large mammals. Using fish tissue data to estimate food item concentrations is conservative because the diets of species, such as mink and river otter, consist of other food items (e.g., frogs, small mammals) that may not bioaccumulate COPECs as much as fish, and could have lower COPEC concentrations.

Tables 7-24a through 7-25e present I COPEC EPCs for sediment, water, and fish, as well as the intakes estimated using the dietary intake model for the CTE and RME scenarios. **Appendix BB** describes the calculation of the EPCs.

7.8.2.2 Effects Assessment

The NOAEL- and LOAEL-based benchmarks for piscivorous mammals are taken from *Toxicological Benchmarks for Wildlife* (Sample et al., 1996) (**Table 7-4b**).

7.8.2.3 Risk Characterization

Risk characterization for piscivorous mammals consists of deriving NOAEL- and LOAEL-based HQs for CTE and RME exposures. The RRs are then calculated by subtracting the background HQs from the site HQs. The HQs and RR are evaluated according to the relative risk ranking scheme presented in **Exhibit 8** in Section 7.3.5.

7.8.2.4 Large Piscivorous mammals

One measurement endpoints is used to quantify the potential for ecological risk to this receptor group:

Measurement endpoint 10.A: Use food chain modeling to calculate daily doses for large piscivorous mammals from ingesting surface water, sediment, and fish, and compare these values to no effect and effect mammalian TRVs.

Table 7-24a presents the HQs for large piscivorous mammals feeding at the upstream reference location, whereas **Table 7-24b** presents the HQs and RRs for the same receptor group feeding at the Blackstone River (near-site), Pond A, and Pond F combined. A summary of the potential for ecological risk is presented below:

Blackstone River (near-site), Pond A, and Pond F combined

US EPA ARCHIVE DOCUMENT

The site effect HQs from ingesting sediment, surface water, and fish from the Blackstone River (near-site), Pond A, and Pond F combined exceed 1.0 only for Al (**Table 7-24b)**.

The reference effect HQs for this and other COPECs from ingesting sediment, surface water, and fish at the aquatic background location are presented in **Table 7-24a**.

The effect RRs for the Blackstone River (near-site), Pond A, and Pond F combined are below 1.0 for all the COPECs (**Table 7-24b**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a high level of confidence that the potential for ecological risk to large piscivorous mammals feeding at the Blackstone River (near-site), Pond A, and Pond F combined is unlikely (risk scenario 1).

Risk conclusion for measurement endpoint 10.A

Measurement endpoint 10.A did not identify the potential for ecological risk to large piscivorous mammals feeding at the Blackstone River (near-site), Pond A, and Pond F combined. The WOE for this measurement endpoint is "medium".

WOE integration for assessment endpoint 10

Table 7-24c summarizes the WOE integration for the single measurement endpoint evaluated under assessment endpoint 10. The preponderance of the evidence indicates that adverse effects are unlikely to large piscivorous mammals feeding at the Blackstone River (near-site), Pond A, and Pond F combined.

7.8.2.5 Small piscivorous mammals

One measurement endpoints is used to quantify the potential for ecological risk to this receptor group:

Measurement endpoint 11.A: Use food chain modeling to calculate daily doses for small piscivorous mammals from ingesting surface water, sediment, and fish, and compare these values to no effect and effect mammalian TRVs.

Table 7-25a presents the HQs for small piscivorous mammals feeding at the upstream reference location, whereas **Tables 7-25b through 7-25d** presents the HQs and RRs for the same receptor group feeding separately in each of the three largest near-site aquatic EUs. A summary of the potential for ecological risk is presented below:

- **Blackstone River (near-site)**

The site effect HQs from ingesting sediment, surface water, and fish from the Blackstone River (near-site) exceed 1.0 only for Al (**Table 7-25b)**.

The reference effect HQs for this and other COPECs from ingesting sediment, surface water, and fish at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-25a**.

The effect RRs for the Blackstone River (near-site) are below 1.0 for all the COPECs (**Table 7-25b**).

US EPA ARCHIVE DOCUMENT

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a moderate level of confidence that the potential for ecological risk to small piscivorous mammals feeding at the Blackstone River (near-site) is unlikely (risk scenario 2).

- **Pond A**

The site effect HQs from ingesting sediment, surface water, and fish from Pond A exceed 1.0 only for Al (**Table 7-25c)**.

The reference effect HQs for this and other COPECs from ingesting sediment, surface water, and fish at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-25a**.

The effect RRs for the Blackstone River (near-site) are below 1.0 for all the COPECs (**Table 7-25c**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a low level of confidence that the potential for ecological risk to small piscivorous mammals feeding at Pond A is unlikely (risk scenario 3). No risk is expected because of the conservative nature of the evaluation and the fact that it is derived from a single COPEC (i.e., Al), with a no effect RME RR = 5.0 and no effect CTE RR = 1.0.

- **Pond F**

The site effect HQs from ingesting sediment, surface water, and fish from Pond F exceeds 1.0 only for Al (**Table 7-25d)**.

The reference effect HQs for this and other COPECs from ingesting sediment, surface water, and fish at the aquatic background location (Blackstone River – upstream) are presented in **Table 7-25a**.

The RR effect HQs for Pond F are below 1.0 for all the COPECs (**Table 7-25d**).

Based on the interpretive risk matrix presented in **Exhibit 8** (Section 7.3.5), it is concluded with a low level of confidence that the potential for ecological risk to small piscivorous mammals feeding at Pond F is unlikely (risk scenario 3). No risk is expected.

Risk conclusion for measurement endpoint 11.A

Measurement endpoint 11.A did not identify the potential for ecological risk to small piscivorous mammals feeding at the Blackstone River (near-site), Pond A, or Pond F. The WOE for this measurement endpoint is "medium".

WOE integration for assessment endpoint 11

Table 7-25e summarizes the WOE integration for the single measurement endpoint evaluated under assessment endpoint 11. The preponderance of the evidence indicated that the potential for ecological risk was negligible for small piscivorous mammals feeding at the Blackstone River (near-site), Pond A, and Pond F.

7.9 UNCERTAINTY ANALYSIS

US EPA ARCHIVE DOCUMENT

Various sources of uncertainty are inherent to the risk assessment process. These sources include, but are not limited to, uncertainties with site data, exposure scenarios, and toxicity benchmarks. The objective of an uncertainty analysis is to present key information on assumptions and uncertainties in the risk assessment process to place quantitative risk estimates in proper perspective (USEPA, 1989). The following sections discuss some of the more important sources of uncertainty in the BERA.

7.9.1 Selecting representative receptors

The ecological receptors and exposure pathways selected for evaluation in the BERA represent a variety of organisms and trophic levels. Nevertheless, as noted in the USEPA (1992) guidance, it is impractical for the BERA to evaluate all possible species. Focusing on a few target groups or species represents a potential source of uncertainty. For example, the USEPA, the trustee agencies, and the Group determined that terrestrial plants and soil invertebrates would not be quantitatively addressed in the BERA due to a lack of reliable benchmarks. The species evaluated in the BERA are intended to represent the major receptors classes considered most likely to be exposed at the terrestrial and aquatic EUs at the site.

7.9.2 Comparing site data to screening-level benchmarks

One type of measurement endpoint used in the BERA is to compare medium-specific analytical data (including AVS and SEM data) to ecological risk-based benchmarks for benthic macroinvertebrates, fish, and amphibians. This approach is simple and relatively straightforward, even though uncertainty is associated with some of the data and the benchmarks used for comparison.

The sediment and surface-water data were collected using established protocols, and focused (in part) on areas thought to have high COPEC levels. The samples were analyzed by an accredited laboratory, which resulted in high-quality data. The SEM-AVS data were collected in June 2005, which did not fall within the USEPA (2005) recommended sample collection period of November to early May. Sample data were evaluated as-is, but this issue should be noted in interpreting SEM-AVS results. Also, only a handful of sediment samples were collected from the Blackstone River (n = 4), Pond A (n = 2), Pond D (n = 1), Pond F (n = 1), and Pond I (n = 1) for AVS, SEM, and organic carbon analysis. All of these samples show (ΣSEM-AVS)/f_{oc} below 130 µmol/g oc, indicating a low risk of adverse biological effects from divalent metals (i.e., Cd, Cu, Pb, Ni, Ag, and Zn) in those samples. This limited AVS and SEM database suggests, but cannot prove conclusively, that the observed benchmark exceedances of divalent metals in sediment from these aquatic EUs may not be ecologically relevant. The reason for this uncertainty is that many more sediment samples were collected from these EUs but were not analyzed for AVS, SEM, and OC. It is not know how representative this smaller dataset is of divalent metal bioavailability in the larger dataset.

The benchmarks used to evaluate the sediment and surface-water data are compiled from the literature. These benchmarks are purposely conservative (i.e., to confirm that significant risks are not overlooked when used to screen environmental data) and non site-specific, which introduces some uncertainty. For example, every sediment and surface-water sample (including those from background locations) exceed the benchmarks for at least one COPEC. As noted in the text, ideally the exceedance of benchmarks should be evaluated together with one or more site-specific lines of evidence (e.g., sediment toxicity testing) to determine the magnitude and significance of potential site risks. However, for several receptors groups (i.e., amphibians, birds and mammals), the only line of evidence used to quantify risk is comparing EPCs to benchmarks. The results from these types of assessments have higher uncertainty.

An additional source of uncertainty is the fact that benchmarks are not available for every COPEC and every receptor/endpoint, such that the risk associated with a number of COPECs cannot be quantified. The

US EPA ARCHIVE DOCUMENT

(unproven) assumption, however, is that benchmarks are available for COPECs which have a potential for adverse effects. As such, missing benchmarks may not result in a large underestimation of "true" site risks.

7.9.3 Exposure Point Concentrations

EPCs are calculated using analytical data considered representative of current conditions at each EU. The geometric mean and the 95% UCL on the mean reflect CTE and RME, respectively. The one exception are the sediment CTEs used to estimate the potential for ecological risk to benthic invertebrates. Those CTEs are arithmetic means calculated specifically for the May 2009 BERA revision. The two earlier BERA versions assessed sediment risk on a sample-by-sample basis, instead of deriving a CTE for each aquatic EU.

In most cases, EPCs for the RME scenarios are calculated using USEPA (2006b) ProUCL software. This software produces upper-bound EPC estimates, such that "true" EPCs are unlikely to be higher and may in fact be lower than the values used in this BERA. For data sets with insufficient data to calculate 95% UCLs, the maximum observed concentration is used as the RME EPC instead. These conservative approaches ensure that the "true" EPCs are unlikely to be underestimated.

The USEPA requested a distributional analysis in 2008 to assess the potential effects of the across-the-board use of the geometric mean as the CTE EPC. A more time-consuming and data-intensive approach would have been to look at the underlying data distribution for each COPEC at each EU, and select an appropriate CTE EPC based on the underlying data distribution. Specifically, the arithmetic mean would be used as the CTE EPC if the underlying data distribution was normal, and the geometric mean would be used in all other cases. The distributional analysis was intended to determine if BERA results would have been greatly different if this approach had been used instead of consistently using the geometric mean as the CTE EPC. The results of the analysis showed that the BERA conclusions would not be greatly different if the arithmetic mean had been used as the CTE EPC for normally distributed data sets. 261 of 1,357 (19 percent) CTE HQs calculated in the BERA were based on at least one dataset fitting a normal distribution ($\alpha = 0.05$). However, most of these 261 HQs were much less than 1 (e.g., less than 0.01) or exceeded 1, and thus, the difference in HQ values between arithmetic and geometric mean EPCs would not change the conclusions (i.e., change HQ status relative to 1). For the minority of cases where the HQs were within an order of magnitude of 1 (i.e., 0.1 to 1), none of the arithmetic means exceeded their respective geometric means by a large enough margin to cause an HQ below 1 to exceed 1. Hence, the consistent use of geometric mean as the CTE EPC did not greatly change CTE risk conclusions as compared to those that would have been obtained using geometric mean or arithmetic mean depending on underlying data distribution. **Appendix GG** provides the distributional analysis.

Only one or two surface water samples are available from the smaller aquatic EUs. Such small data sets may not represent the full range of chemical conditions in surface water over time at these EUs. The risk may be over- or underestimated if the samples represent "worst case" or "best case" conditions, respectively.

Metals are identified as risk drivers in the smaller aquatic EUs. The surface water samples are not filtered, so that the data represent total metals. The BERA assumes that the inorganics are 100% bioavailable, even though metal toxicity is associated only with the dissolved (i.e., filtered) fraction, which can have much lower metal concentrations than the total fraction. The evaluation of risk using unfiltered surface water data is conservative and likely overestimates risk to fish and amphibians.

US EPA ARCHIVE DOCUMENT

7.9.4 Exposure Assumptions

Values representing the proportion of exposure were set at 1 and 0.5 for the RME and CTE scenarios, respectively. The RME value of 1 is the maximum possible, and is thus conservative if a receptor is exposed and/or forages in adjacent non-contaminated areas. For some receptors, home/foraging range could be larger than a target EU, in which cases the 0.5 value used in the CTE scenarios may be conservative. Using a value of 0.5 may underestimate CTE exposure and associated risk for receptors (e.g., short-tailed shrew) with foraging ranges smaller than the EU.

US EPA (2005c) recommends measuring AVS and SEM on surficial (0-2 cm) sediment samples collected between November and early May. This sampling approach ensures a conservative assessment by focusing on the top layer of the "biologically active zone" during cool weather seasons when AVS is most likely to be at a minimum. The sediment samples used in the triad approach were collected 0-6" deep in late June. It is prudent to assume that the AVS and SEM in those samples may not necessarily represent more conservative (= more toxic) conditions during colder months.

The BERA also uses conservative assumptions for dietary composition. For example, piscivorous birds and mammals are assumed to eat only fish, which may be the principal and most contaminated component of their diet. However, piscivorous wildlife can also feed on frogs and other food items that may have lower COPEC levels. Similarly, omnivorous birds and mammals are assumed to eat only earthworms, yet could be expected to also eat fruit, insects, small mammals or small birds with different COPEC concentrations (e.g., see Blankenship et al., 2005, which showed higher accumulation of soil COPECs in earthworms than in plants and terrestrial invertebrates). Using conservative assumptions ensures that actual dietary exposures are unlikely to be underestimated.

7.9.5 Toxicity Benchmarks

Toxicity benchmarks used in the BERA were generally selected based on their relevance to the modeled receptors and the adequacy of the studies to identify ecologically significant effects. However, in most cases these benchmarks were based on toxicity data for different species, which adds uncertainty to the process. In addition, toxicity criteria were not always available for each receptor group and COPEC, and thus, it was necessary to apply default safety factors to available benchmarks to estimate NOAELs and/or LOAELs. HQs could not be calculated when benchmarks were unavailable for a given class of compounds (e.g., VOCs for wildlife), which resulted in more uncertainty. However, in most cases, the lack of toxicity data coincides with a lack of concern for that COPEC/exposure route. For example, VOCs do not generally persist in the environment nor do they typically accumulate in food items, such that dietary exposure to VOCs is unlikely to be a concern.

7.9.6 Critical Body Residue Analysis

The CBRs used in this BERA were provided by the USEPA and were not independently verified or reviewed for accuracy/appropriateness. As such, there is some uncertainty associated with the CBR analysis and conclusions. In addition, CBRs were not available for all COPECs, and thus risks posed to fish by tissue residue concentrations of these COPECs cannot be quantified.

Additional uncertainties associated with CBR are associated with underlying data sets in that concentrations are rarely measured in the target organ where the effect occurs, and may not be measured as the toxicologically active form of the chemical in question. As such, results of CBR analyses should be interpreted with caution.

US EPA ARCHIVE DOCUMENT

7.9.7 Fish and Invertebrate Surveys

Fish and invertebrate surveys are useful for evaluating potential ecological risks because they involve direct observations of ecological communities in potentially site-affected areas. However, there is natural variability in these communities that may be difficult to distinguish from site-related effects. Specifically, species types and abundance is affected by habitat and other physical (e.g., flow) and chemical (e.g., dissolved oxygen) factors. To control for these types of variability, data from background locations are used in comparison, and these background locations were selected to be as similar as possible to the site-related locations. The potential uncertainties introduced by differences between site-related and background locations have been assessed by the multivariate analysis of benthic community and habitat data presented previously in the BERA. However, these habitat differences are likely to influence the biological metrics, and therefore, add a degree of uncertainty in the risk characterization.

7.9.8 Vernal Pools

The vernal pool survey (see **Appendix R**) was performed in April 2005 by BBL. As far as is known, no further sampling took place at the five vernal pools described in this appendix. Pre-2005 sampling generated sediment data from various locations on the Unnamed Island (and elsewhere), some of which may have come from one or more of the vernal pool. However, the sampling locations cannot be confirmed due to a lack of specific information in **Appendix R**.

Four of the five vernal pools in **Appendix R** are found on the Unnamed Island. Of the Unnamed Island sampling locations, SE-004-UI is the only sample labeled as sediment which is not inside a known pond (dry or wet) or a wetland area. This sample comes from the "Excavator Pond," although no surface water sample is available from that location. Surface water and sediment samples were collected from location SE-077-UI described as "small pond NW of Pond A" with no dimensions, but 2 feet of standing water. The figure prepared by Shield identified this pond as Pond P.

It is possible that these two samples come from two of the four vernal pools identified in **Appendix R**. This assumption is tentative and based primarily on a lack of other places they could have come from. Based solely on the location description, perhaps Pond N could be the last vernal pool identified north of the landfill that appeared to be an "abandoned stormwater outfall", which makes sense relative to the proximity to the discharge of unnamed streams in that area.

Similarly, samples SE-020-LF and SE-074-LF (Pond C); SE-019-LF, SE-070-LF, and SE-073-LF (Pond B); and SE-051-DF (Pond N) appear to represent dry or nearly dry ponds on the landfill. (Apparently a sample explained as an accumulation of rainwater was obtained from location SE-074-LF in Pond C a few days after the sediment sample was collected).

The BERA addresses ecological risk to amphibians in all the aquatic habitats for which surface water data are available, but not if only sediment data are available (e.g., if sample locations were dry ponds). For the Unnamed Island, Shield did not collect surface water from location SE-004-UI, but did collect one sample at location SE-077-UI. As such, risks to amphibians posed by COPECs in surface-water sample SW-077-UI were assessed in the BERA.

Of the samples described above that were collected around the landfill, surface-water samples were obtained at SE-020-LF and SE-074-LF (Pond C), and SE-051-DF (Pond N). Only sediment samples were collected (no surface water) from locations SE-019-LF, SE-070-LF, and SE-073-LF (Pond B).

US EPA ARCHIVE DOCUMENT

In summary, the BERA assesses risk to amphibians for all aquatic habitats at the Site with surface water data, whether or not these habitats were in fact vernal pools. However, some of the samples collected at the Unnamed Island by Shield in 2003 come from unknown locations. It is unclear if those surface water samples represent one or more of the vernal pools identified in **Appendix R**. Hence, uncertainty exists about whether or not all the vernal pools at the Site have been evaluated for risk to amphibians.

7.9.9 Uncertainty Conclusions

The information presented above highlights some of the principal areas of uncertainty in the BERA. There is uncertainty associated with each of the measurement endpoints (including if all vernal pools were assessed for risk to amphibians), and the degree of uncertainty is important to consider when interpreting the results. The endpoints with the highest degree of uncertainty are those which compare analytical data to benchmarks. Other lines of evidence are relatively less uncertain, including sediment toxicity tests, wildlife foodweb modeling using measured food item concentrations, SEM-AVS measurements, and field surveys, although each has its own limitations. Regardless of the measurement endpoint, in most cases, the BERA uses conservative approaches for data evaluation, exposure assessment, and toxicity assessment, such that actual risks are unlikely to be higher and may be lower than the risk estimates presented in this BERA.

7.10 SUMMARY AND CONCLUSIONS

The BERA evaluated potential ecological risks associated with COPECs in OU2. The BERA used a weight-of-evidence approach to evaluate risks for several representative receptors for each sub-area of the site. The potential receptors that were identified in the problem formulation (and subsequently evaluated in the BERA) are benthic macroinvertebrates, fish, amphibians, birds, and mammals.

Tables 7-26a to 7-26k and **Tables 7-27a to 7-27f** provide a general summary and conclusions of the potential for ecological risk at all of the aquatic and terrestrial EUs, respectively. These conclusions are discussed below by target receptor group.

7.10.1 Benthic invertebrates

The potential for ecological risk to the benthic community is assessed in all of the aquatic EUs using up to three measurement endpoints (depending on the EU), as follows:

- Compare the RME and CTE COPEC levels in bulk sediment samples to no effect and effect sediment benchmarks (Blackstone River, Wetlands A through D, and Ponds A, B, C, D, E, F, I, N, and P). In addition, the bioavailability of divalent metals in sediment is assessed based on measures of AVS and SEM (Blackstone River [near-site], Pond A, Pond D, Pond F, and Pond I).
- Measure survival and growth in two benthic invertebrate test species exposed to bulk sediment samples in the laboratory (Blackstone River [near-site], Pond A, Pond D, Pond F, and Pond I).
- Evaluate the structure and function of the invertebrate benthic community (Blackstone River, Pond A, Pond D, Pond F, and Pond I)

The first measurement endpoint is evaluated at each aquatic EUs, independently from the results of the toxicity tests and benthic community surveys. The RR analysis for this first measurement endpoint shows that severe ecological risk is possible to benthic invertebrates exposed to sediment in Pond E. The major risk driver at this EU is Pb, with an effect CTE RR equal to 11. This value indicates that the central tendency exposure to Pb at this EU, adjusted by subtracting background risk, exceeds the effect sediment benchmark for this COPEC (which equals 128 mg/kg) by 11 times. The RR analysis shows that some ecological risk is

US EPA ARCHIVE DOCUMENT

possible to the benthic community in the Blackstone River, Pond A, Pond B, Pond C, Pond D, Pond F, Pond I, and Pond N. Finally, ecological risk is possible but not expected in Pond P and Wetlands A through D.

A subset of the sediment samples (specifically, four samples from the Blackstone River [near site], two samples from Pond A, and one sample each from Ponds D, F, and I) are also used in chemical analyses, toxicity testing, and a benthic community survey. These three lines of evidence are assessed collectively using the Sediment Quality Triad (SQT) approach.

The SQT results are summarized below to identify locations that may show site-related impacts:

- *Pond D (sample PD-002)*: Sediment chemistry and toxicity test results appear to show impacts, but benthic community metrics are not different from background.
- *Pond A (sample PA-003)*: Sediment chemistry and toxicity test results appear to show impacts, and benthic community data are inconclusive but suggestive of impacts.
- *Pond F (sample PF-004)*: Sediment chemistry data indicate potential impacts, but toxicity test results are inconclusive compared to background, and observed benthic community differences may be habitat-related (e.g., low dissolved oxygen).
- *Pond I (sample BR-005)*: Sediment chemistry data and toxicity test results appear to show impacts; but benthic community differences may be habitat-related (e.g., water temperature, grain size).

The following site locations have inconclusive evidence of potential site-related impacts:

- *Blackstone River (sample BR-006*): Toxicity test and benthic community data appear to show impairment, but sediment chemistry does not show high levels of site-related COPECs.
- *Pond A (sample PA-001)*: Toxicity test and benthic community results appear to show impairment, but sediment chemistry does not show high levels of site-related COPECs.

The following site locations do not show evidence of site-related impacts:

- *Blackstone River (sample BR-001)*: Sediment chemistry and toxicity test results do not show impacts; differences in the benthic community metrics seem unrelated to COPECs.
- *Blackstone River (sample BR-003)*: Sediment chemistry, toxicity test, and benthic community results do not show impacts.
- *Blackstone River (sample BR-007)*: Sediment chemistry, toxicity test, and benthic community results do not show impacts.

The triad study indicates that potential site-related impacts are evident primarily in the ponds (Ponds A, D, and F) and possibly Pond I. These SQT results are not clear-cut, however, because a consistent link is not found between chemistry, toxicity, and community structure.

7.10.2 Fish

The potential for ecological risk to fish exposed to site-related contamination is assessed in all of the aquatic EUs (except for Pond B) using up to three measurement endpoint (depending on the EU), as follows:

- Evaluate the structure and function of the fish community in the field (Blackstone River, Pond A, and Pond F).

US EPA ARCHIVE DOCUMENT

- Compare RME and CTE COPEC levels in unfiltered surface water samples to acute and chronic surface water benchmarks (Blackstone River, Wetlands A through D, and Ponds A, C, D, E, F, I, N, and P). Note: the risk conclusions discussed below focus exclusively on the chronic benchmarks since they are the most conservative.

- Compare RME and CTE COPEC levels measured in whole fish to no effect and effect fish CBRs (Blackstone River, Pond A, and Pond F).

The first measurement endpoint is omitted from the risk characterization because the habitat structure of the upstream reference sections and the near-site locations is different enough to affect the species composition. Also, no suitable fish community data are available from an off-site reference pond to compare against the data collected from Pond A and Pond F. The reason is that the selected reference pond (Pond P-6) is actively managed as a fishery and does not provide "natural" fish community data.

The RR analysis shows that adverse effects to the fish community are possible but not expected at the Blackstone River (near-site), Pond A, Pond F, and Wetlands A through D. This conclusion is based on a lack of or only small exceedances of COPECs above background conditions in surface water or in whole fish collected from these EUs.

The RR analysis shows that severe ecological risk is possible to fish exposed to surface water in Pond C, Pond D, Pond E, Pond I, Pond N, and Pond P. The major risk drivers at each of these aquatic EUs are as follows: Pond C shows a chronic CTE RR for Pb equal to 62, Pond D shows a chronic CTE RR for Pb equal to 77, Pond E shows a chronic CTE RR for Ba equal to 55 (and 8 for Pb), Pond I shows a chronic CTE RR for Pb equal to 10, Pond N shows a chronic CTE RR for Al equal to 22 (and 12 for Pb), and Pond P shows a chronic CTE RR for Mn equal to 13. These findings are generally consistent with the location and disposal history of some of these aquatic EUs. For example, Pond C is next to the J.M. Mills Landfill, and Unnamed Island, where Ponds D and E are located, has a history of waste disposal.

7.10.3 Amphibians

The potential for ecological risk to amphibians exposed to site-related contamination is assessed in all of the aquatic EUs (except Pond B) using a single measurement endpoint:

- Compare RME and CTE COPEC levels in unfiltered surface water samples to acute and chronic surface water benchmarks (Blackstone River [near-site], Wetlands A through D, and Ponds A, C, D, E, F, I, N, and P).

The risk conclusions focus specifically on the chronic surface water benchmarks since they are the most conservative. The RR analysis shows that severe ecological risk is possible to amphibians exposed to surface water in Pond C, Pond D, Pond E, Pond I, Pond N, and Pond P. The major risk drivers at each of these aquatic EUs are as follows: Pond C shows a chronic CTE RR for Pb equal to 62, Pond D shows a chronic CTE RR for Pb equal to 77, Pond E shows a chronic CTE RR for Ba equal to 55 (and 8 for Pb), Pond I shows a chronic CTE RR for Pb equal to 10, Pond N shows a chronic CTE RR for Al equal to 22 (and 12 for Pb), and Pond P shows a chronic CTE RR for Mn equal to 13. These findings are generally consistent with the location and disposal history of some of these aquatic EUs. For example, Pond C is next to the J.M. Mills Landfill, and Unnamed Island, where Ponds D and E are located, has a history of waste disposal.

The RR analysis also shows that ecological risk is possible but not expected, or is unlikely, to amphibians exposed to surface water in the Blackstone River (near-site), Pond A, Pond F, and Wetlands A through D.

US EPA ARCHIVE DOCUMENT

7.10.4 Large omnivorous birds

The American woodcock is retained as a representative species of large omnivorous birds that may feed at the site. The evaluation assumes that this target species feeds across the six terrestrial EUs combined. These EUs are J.M. Mills Landfill, Unnamed Island, Nunes Parcel, Quinnville Well Field, Wetlands A through D, and Pratt dam. The woodcock is also assumed to have a diet consisting of 100% earthworms. The COPEC levels in earthworms are estimated based on site-specific soil analytical data and generic soil-to-biota Bioaccumulation Factors (BsoilAFs) for earthworms obtained from the literature. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect avian TRVs to estimate the potential for risk to this receptor group.

The RR analysis shows that severe ecological risk is possible to large omnivorous birds feeding across the six terrestrial EUs combined. Pb is the major risk driver, with an effect CTE RR of 17.

7.10.5 Small omnivorous birds

The American robin is retained as a representative species of small omnivorous birds that may feed at the site. The evaluation assumes that this target species feeds in each individual terrestrial EUs at the site. These EUs are the Blackstone River (near-site), J.M. Mills Landfill, Unnamed Island, Nunes Parcel, Quinville Well Field, Wetlands A through D, and Pratt dam. The robin is assumed to have a diet consisting of 100% earthworms. The COPEC levels in earthworms are estimated based on site-specific soil analytical data and generic BsoilAFs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect avian TRVs to estimate the potential for risk to this receptor group.

The RR analysis indicates that severe ecological risk is possible to small omnivorous birds feeding at four of the six terrestrial EUs at the site. Pb is the major risk driver in each EU, as follows: J.M. Mills Landfill shows an effect CTE RR for Pb of 41, Unnamed Island shows an effect CTE RR for Pb of 15, Nunes Parcel shows an effect CTE RR for Pb of 81, and Pratt Dam shows an effect CTE RR for Pb of 34.

The RR analysis also shows that ecological risk is possible but not expected at the Quinnville Well Field, or is unlikely at Wetlands A through D to small omnivorous birds feeding at these EUs.

7.10.6 Large piscivorous birds

The great blue heron is retained as a representative species of large piscivorous birds that may feed at the site. The evaluation assumes that this target species feeds across the three largest aquatic EUs combined. These EUs are the Blackstone River (near-site), Pond A, and Pond F. The heron is also assumed to have a diet consisting of 100% fish captured at these three EUs. The COPEC levels for the fish are measured values from fish collected at the EUs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect avian TRVs to estimate the potential for risk to this receptor group.

The RR analysis shows that ecological risk is unlikely to large piscivorous birds feeding across the three aquatic EUs combined.

7.10.7 Small piscivorous birds

The belted kingfisher is retained as a representative species of small piscivorous birds that may feed at the site. The evaluation assumes that this target species feeds in each of three aquatic EUs. These EUs are the Blackstone River (near-site), Pond A, and Pond F. The kingfisher is also assumed to have a diet consisting

of 100% fish captured at each of these three EUs. The COPEC levels for the fish are measured values from fish collected at the EUs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect avian TRVs to estimate the potential for risk to this receptor group.

The RR analysis shows that ecological risk is possible but not expected at Ponds A and F, and unlikely at the Blackstone River (near-site) to small piscivorous birds feeding at these EUs.

7.10.8 Large omnivorous mammals

The red fox is retained as a representative species of large omnivorous mammals that may feed at the site. The assessment assumes that this target species feeds across the six terrestrial EUs combined. These EUs are J.M. Mills Landfill, Unnamed Island, Nunes Parcel, Quinnville Well Field, Wetlands A through D, and Pratt dam. The red fox is also assumed to feed exclusively on earthworms. The COPEC levels in earthworms are estimated based on site-specific soil analytical data and generic BsoilAFs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect mammalian TRVs to estimate the potential for risk to this receptor group.

The RR analysis shows that ecological risk is unlikely to large omnivorous mammals feeding across the six terrestrial EUs combined.

7.10.9 Small omnivorous mammals

The short-tailed shrew is retained as a representative species of small omnivorous mammals that may feed at the site. The assessment assumes that this target species feeds in each individual terrestrial EUs at the site. These EUs are J.M. Mills Landfill, Unnamed Island, Nunes Parcel, Quinville Well Field, Wetlands A through D, and Pratt dam. The shrew is assumed to have a diet consisting of 100% earthworms. The COPEC levels in earthworms are estimated based on site-specific soil analytical data and generic BsoilAFs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect mammalian TRVs to estimate the potential for risk to this receptor group.

The RR analysis indicates that ecological risk is possible to small omnivorous mammals feeding at three of the six terrestrial EUs at the site. Al is the major risk driver at these three EUs, as follows: J.M. Mills Landfill shows an effect CTE RR for Al equal to 6, Nunes Parcel shows an effect CTE RR for Al equal to 7, and Quinnville Well Field shows an effect CTE RR for Al equal to 4.

The RR analysis indicates that ecological risk is possible, but not expected, or is unlikely, at Unnamed Island, Wetlands A through D, and Pratt Dam to small omnivorous mammals feeding at these EUs.

7.10.10 Large piscivorous mammals

The river otter is retained as a representative species of large piscivorous mammals that may feed at the site. The evaluation assumes that this target species feeds across the three largest aquatic EUs combined. These EUs are the Blackstone River (near-site), Pond A, and Pond F. The otter is also assumed to have a diet consisting of 100% fish captured at these three EUs. The COPEC levels for the fish are measured values from fish collected at the EUs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect mammalian TRVs to estimate the potential for risk to this receptor group.

US EPA ARCHIVE DOCUMENT

The RR analysis shows that ecological risk is unlikely to large piscivorous birds feeding across the three aquatic EUs combined.

7.10.11 Small piscivorous mammals

The mink is retained as a representative species of small piscivorous mammals that may feed at the site. The evaluation assumes that this target species feeds in each of the three largest aquatic EUs. These EUs are the Blackstone River (near-site), Pond A, and Pond F. The kingfisher is also assumed to have a diet consisting of 100% fish captured at these three EUs. The COPEC levels for the fish are measured values from fish collected at the EUs. A RME and CTE daily dose is calculated using food chain modeling and then compared to conservative no effect and effect avian TRV to estimate the potential for risk to this receptor group.

The RR analysis shows that ecological risk is possible, but not expected at Ponds A and F, and unlikely at the Blackstone River (near-site) to small piscivorous mammals feeding at these EUs.

7.10.12 CONCLUSIONS

The BERA has identified the potential for severe ecological risk to omnivorous birds feeding at the individual terrestrial EUs or at all the terrestrial EUs combined. Pb is the biggest risk driver. The WOE for this measurement endpoint is “low-medium”. The food chain modeling assumes a diet of 100% earthworms. Field-collected tissue residue data are not available for earthworms from any of the terrestrial EUs at OU2. Hence the COPEC levels in earthworm tissues are estimated using generic and conservative BsoilAF values.

The BERA has also identified the potential for severe ecological risk to fish and embryo-larval stages of amphibians exposed to surface water in Ponds C, D, E, I, N, and P. Pb is the biggest risk driver in three of these EUs, and a secondary risk driver in two others. The WOE for this measurement endpoint is “low-medium”. Only one measurement endpoint is available for evaluation at these six EUs, namely comparing surface water chemistry to generic benchmarks. None of the surface water samples used in the EPC calculations were filtered before chemical analyses. Hence, the metals data used in the evaluation represent (unfiltered) total metals, instead of (filtered) dissolved metals which are more representative of the toxic fraction. Also, only one surface water sample was collected from Ponds N, and P, and two surface water samples from Ponds C, D, E, and I. Such small datasets may not represent the full range of exposure conditions in surface water at these habitats.

Finally, some potential for ecological risk to the benthic invertebrate community is possible at one or more locations in Ponds A, D, E, F, and I from sediment exposure. However, the cause for this risk is unclear and may result from a combination of habitat disturbances/differences and COPEC exposures.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

8.0 REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR). Public Health Statement for Acetone. May 1994. Department of Health and Human Services, Public Health Service. 31 Oct. 2007 <http://www.atsdr.cdc.gov/toxprofiles/phs21.html>.

Alexander, G. 1977. *Food of vertebrate predators on trout waters in north central lower Michigan*. Michigan Academician 10: 181-195.

ARCADIS U.S., Inc. 2007a. *Summary of Remedial Investigation Activities of the Nunes Parcel., Peterson Puritan Superfund Site – Operable Unit 2 (OU2), Cumberland and Lincoln, Rhode Island.* January 2007.

ARCADIS U.S., Inc. 2007b. Letter: *Threatened and endangered species consultation with USFWS*. February 16, 2007.

ARCADIS U.S., Inc. 2007c. *Screening-Level Ecological Risk Assessment*. February 2, 2007.

ARCADIS G&M, Inc. 2003. *Waste Delineation Investigation Report, Un-named Island, Cumberland, Rhode Island. Report prepared for Owens Corning*. April 2003

American Society for Testing and Materials. 2001. *Annual Book of ASTM Standards. Volume 11.05. Test Methods for Measuring the Toxicity of sediment-Associated Contaminants with Freshwater Invertebrates*. E 1706-00.

American Society for Testing and Materials. 2005. *Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates*. E1706-05.

Ayotee, J.D., D. Montgomery, S. Flanagan, and K. Robinson. 2003. Aresenic in Groundwater in Eastern New England: Occurrence, Controls, and Human Health Implications. U.S. Geological Survey. Pembroke, NH. Environ. Sci. Technol. 2003, 37 pp. 2075-2083.

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition*. EPA 841-B-99-002. USEPA, Office of Water, Washington, DC.

Blankenship, A.L, M.J. Zwiernik, K.K. Coady, D.P. Kay, J.L. Newsted, K. Strause, C. Park, P.W. Bradley, A.M. Neigh, S.D. Millsap, P.D. Jones, and J.P. Giesy. 2005. *Differential Accumulation of Polychorinated Biphenyl Congeners in the Terrestrial Food Web of the Kalamazoo River Superfund Site, Michigan*. Environmental Science & Technology/Vol. 39. November 2005.

Blasland, Bouck & Lee, Inc. 2005a. *Soil, Sediment, and Hydrogeologic Assessment Work Plan and Field Sampling Plan Addendum*. Remedial Investigation and Feasibility Study for the Peterson Puritan Superfund Site – Operable Unit 2 Cumberland and Lincoln, Rhode Island. Phase 1B Work Plan. September 2005.

Blasland, Bouck & Lee, Inc. 2005b. *Quality Assurance Project Plan Addendum*. Remedial Investigation Feasibility Study for the Peterson/Puritan, Inc. Superfund Site – Operable Unit 2 (OU2). Cumberland and Lincoln, Rhode Island. CERCLA Docket No. 1-87-1064. September 2005.

US EPA ARCHIVE DOCUMENT

Blasland, Bouck & Lee, Inc. 2005c. *Fish Sampling and Habitat Assessment Work Plan*. Remedial Investigation and Feasibility Study for the Peterson Puritan Superfund Site – Operable Unit 2 (OU2) Cumberland and Lincoln, Rhode Island. Phase 1B Work Plan. September 2005.

Blasland, Bouck & Lee, Inc. 2006a. *Revised Phase 1A Database Summary Report*. *Remedial Investigation Feasibility Study for the Peterson Puritan Superfund Site – Operable Unit 2 Cumberland and Lincoln, Rhode Island* (original report written by Shield). February 2006.

Blasland, Bouck & Lee, Inc. 2006b. *Phase 1B Database Summary Report*. Remedial Investigation Feasibility Study for the Peterson Puritan Superfund Site – Operable Unit 2 Cumberland and Lincoln, Rhode Island. July 2006.

Blasland, Bouck & Lee, Inc. 2006c. *Revised Phase 1A Initial Site Characterization Report - Peterson Puritan Superfund Site – Operable Unit 2 (OU2), Cumberland and Lincoln, Rhode Island* (original report written by Shield).

Blasland, Bouck & Lee, Inc. 2006d. *Ecological Risk Assessment Work Plan*. Memorandum to B. Hoskins (USEPA). November 2, 2006

Brown, Virginia. 2004. Personal Communication with Shield. Rhode Island Natural History Survey. January 2004.

Bryan, G.W., and W.J. Langston. 1992. *Bioavailability, accumulation and effects of heavy metals in sediments with special reference to United Kingdom estuaries: a review.* Environ. Pollut. 76: 89-131.

Burton, D., S.D. Turley, D.J. Fisher, D.J. Green, and T.R. Shedd. 2006. Bioaccumulation of total mercury and monomethylmercury in the earthworm. Water Air Soil Pollut. 170:37-54.

Calabrese, 2003. Letter from Edward Calabrese Regarding Soil Ingestion Rates. Provided as an attachment to Comments of the *General Electric Company on the U.S. Environmental Protection Agency's Human Health Risk Assessment for the Housatonic River Site – Rest of River*. Prepared for General Electric by AMEC Earth and Environmental, Inc. and BBL Sciences. July 28, 2003

Campbell, P.G.C., A.G. Lewis, P.M. Chapman, A.A. Crowder, W.K. Fletcher, B. Imber, S.N. Luoma, P.M. Stokes, and M. Winfrey. 1988. *Biologically Available Metals in Sediments*. National Research Council of Canada, Associate Committee on Scientific Criteria for Environmental Quality and Committee on Marine Analytical Chemistry, Ottawa, Canada. Publication No. NRCC-27694.

C-E Environmental, Inc. 1990 *Remedial Investigation Report for the Peterson/Puritan Site, Cumberland, Rhode Island*. Report prepared for CPC International, Inc.

Chute, Newton E. 1949. Surficial Geology, Pawtucket Quadrangle, Rhode Island-Massachusetts. U.S. Geologic Survey, Geologic Quadrangle Map Series. Scale 1:31,680.

Davis, W.J. 1982. *The Belted Kingfisher, Megaceryle alcyon: its Ecology and Territoriality.* Cincinnati, OH: University of Cincinnati.

US EPA ARCHIVE DOCUMENT

EA Engineering, Science and Technology, Inc. 2003. Limited Investigation Report, Plat 14 Lots 2 and 4, Plat 15 Lot 1, Berkeley Commons/River Run Development, Cumberland, Rhode Island. Report prepared for Berkeley Commons/River Run Development. August 2003.

Efroymson, R.A., M.E. Will, G. W. Suter II, and A.C. Wooten. 1997. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*, ES/ER/TM-126-/R2. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Eisler, R. 1997. Polycyclic Aromatic Hydrocarbon Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Fish and Wildlife Service Biological Report 85(1.11).

Enser, Rickard W. 2004. Personal Communication. Rhode Island Department of Environmental Management, Natural Heritage Program. January 2004.

Environsystems, Inc. 2005. *Toxilogical Evaluation of Sediment Samples, Blackstone River Sediment Evaluation*.

Federal Emergency Management Agency. 1982. *Flood Insurance Rate Map, Town of Lincoln, Rhode Island, Providence County*, Community-Panel Number 445400 0003 B, Panel 3 of 9. Revised August 2, 1982.

Federal Emergency Management Agency. 1992. *Flood Insurance Rate Map*, *Town of Cumberland, Rhode Island, Providence County.* Community-Panel Number 4440016 0007 C, Panel 7 of 7. Revised June 6, 1992.

Fernald, J.D. 1983. *Geology of the Blackstone Series in the Pawtucket Quadrangle, Rhode Island*. Ph.D. Dissertation. Boston College, MA.

Friesz, P.J. 2004. *Delineation of areas contributing recharge to selected public-supply wells in glacial valley-fill and wetland settings, Rhode Island*: U.S. Geological Survey Scientific Investigations Report 2004-5070, 57 p.

Gebert, J. and A. Groengroeft. 2006. *Passive landfill gas emission – Influence of atmospheric pressure and implications for the operation of methane-oxidizing biofilters*. Waste Management, vol 26, pp. 245-251.

Goldberg-Zoino Associates Inc. 1982. *Lincoln/Cumberland Wellfield Contamination Study*. March. 1982.

Guerrero, N. R., and E.M. Kesten. 1993. *Levels of heavy metals in waters from the La Plata River, Argentina: An approach to assess bioavailability.* Bull. Environ. Contam. Toxicol. 52: 254-260.

Hare, L. 1992. *Aquatic insects and trace metals: bioavailability, bioaccumulation and toxicity*. Crit. Rev. Toxicol. 22: 327-369.

Hawley, J.K. 1995. *Assessment of health risk from exposure to contaminated soil*. Risk Analysis. 5:289-302.
Herbes, S.E., and L.R. Schwall. 1978. *Microbial transformation of polycyclic aromatic hydrocarbons in pristine and petroleum-contaminated sediments*. Appl. Environ. Microbiol. 35: 306-316.

Hem, John D. 1989. *Study and Interpretation of the Chemical Characteristics of Natural Water*, U.S. Geological Survey Water-Supply Paper 2254, 264 p.

US EPA ARCHIVE DOCUMENT

Hermes, O.D., L.P. Gromet, and D.P. Murray. 1994. *Bedrock Geologic Map of Rhode Island*. University of Rhode Island, Department of Geosciences, Kingston, RI. 1994.

Howard, P. (ed). 1991. *Handbook and Environmental Fate and Exposure Data.* Lewis Publishers. Michigan. 684 pp.

Ingersoll, C., Dillon, T., and G. Biddinger. 1995. *Ecological Risk Assessment of Contaminated Sediments*. SETAC Press, Pensacola, FL. 380 pp.

Jarvinen, A.W., and G.T. Ankley. 1998. *Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals*. SETAC Technical Publications Series. Pensacola, Florida. 364 pp.

Jones, D. S., G.W. Suter, and R.N. Hull. 1997. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision*. Lockheed Martin Energy Systems. ES/ER/TM-95/R4.

Karr, J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant, and I.L. Schlosser. 1986. *Assessing biological integrity in running waters: A method and its rationale*. Special publication 5. Illinois Natural History Survey.
Kirkpatrick, C.M. 1940. *Some foods of young great blue herons.* Am. Midl. Nat. 24: 594-601.

Kleinfelder. 2006. *Risk Assessment for Gas Vent VOC Data – Revision 1.1, Old Southington Landfill Superfund Project, Kleinfelder Project Number 0060201EA, Task 3.0*. Prepared for U.S. Environmental Protection Agency, Region 1. (June 14).

Laws, E.A. (ed). 1981. *Aquatic Pollution*. New York, NY: John Wiley & Sons.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. *Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems.* Arch. Environ. Contam. Toxicol. 39: 20-31.

Mackenzie, K.M., and D.M. Angevine. 1981. *Infertility in mice exposed in-utero to benzo(a)pyrene*. Biol. Reprod. 24: 183-191.

Mackie, G.L. 1989. *Tolerances of five benthic invertebrates to hydrogen ions and metals*. Arch. Environ. Contam. Toxicol. 18:215-223.

Malcolm-Pirnie, Inc. 1983. *Investigation of Volatile Organic Chemical Contamination: Peterson/Puritan, Inc. Cumberland, Rhode Island.* Report prepared for Peterson/Puritan, Inc. June 1983.

Massachusetts Department of Environmental Protection (MDEP). 2003. Technical Update: *Calculation of an Enhanced Soil Ingestion Rate*. http://www.state.ma.us/dep/ors/files/soiling.doc

McElroy, A.E., J.W. Farrington and J.M. Teal. 1989. *Bioavailability of polycyclic aromatic hydrocarbons in the aquatic environment*. In: Metabolism of Polycyclic Aromatic Hydrocarbons in the Aquatic Environment/ U. Varanasi (eds.), Boca Raton, FL: CRC Press. 1-39.

McElroy, A.E. 1985. *Benz(a)anthracene in Benthic Marine Environments Bioavailability, Metabolism, and Physiological Effects on the Polychaete 'Nereis virens'.* Woods Hole Oceanographic Institution Massachusetts Institute of Technology, Woods Hole, MA. PB89-203624. March.

US EPA ARCHIVE DOCUMENT

Menzie, C., M. Hope Henning, J. Cura, K. Finkelstein, J. Gentile, J. Maughan, D. Mitchell, S. Petron, B. Potocki, S. Svirsky and P. Tyler. 1996. Special report of the Massachusetts weigh-of-evidence workgroup: a weight-of-evidence approach for evaluating ecological risks. Human and Ecol. Risk Assess. 2:277-304.

Merritt, R.W., Cummins, K.W. 1996. *Trophic Relations of Macroinvertebrates*. Haur, F.R. and Lamberti, G.A Methods in Stream Ecology. Elsevier, London. pp 585-609.

National Climatic Data Center (NCDC). 2007. National Climatic Data Center Website. National Oceanic and Atmospheric Administration. http://www.ncdc.noaa.gov/oa/ncdc.html.

Navarro, H.A., C.J. Price. M.C. Marr, C.B. Myers, J.J. Heindel, and J.J. Schwetz. 1991. *Final report on the Developmental Toxicity of Naphthalene (CAS no. 91-20-3) in Sprague-Dawley rats on gestational days 6 through 15*. NTIS Technical Report (NTIS/PB92-135631). 242 pp.

Owens Corning, 2004. *Completion Report, Limited Removal Action, Un-named Island, Cumberland, Rhode Island.* January.

Persuad, D., R. Jaagumagi, and A. Hayton. 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. Ontario Ministry of the Environment and Energy. August 1993.

Patton, J.F., and M.P Dieter. 1980*. Effects of petroleum hydrocarbons on hepatic function in the duck.* Comp. Biochem. Physiol. 65C: 33-36.

Raven, P.J., N.T.H. Holmes, F.H. Dawson, P.J.A. Fox, M. Everard, I.R. Fozzard, and K.J. Rowen. 1998. *River Habitat Quality: The physical character of rivers and streams in the UK and Isle of Man*. Environment Agency. ISBN1 873760 42 9. Bristol, England.

Rhode Island Department of Administration, Statewide Planning Program (RISPP), 2000. *Rhode Island Land Use Trends and Analysis*. Technical Paper 149. July 2000.

Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. *Toxicological Benchmarks for Wildlife: 1996 revision.* ES/ER/TM-86-R3. U.S. Department of Energy, Office of Environmental Management.

Sayler, J.C., and K.F. Lagler. 1946. *The eastern belted kingfisher, Megaceryle alcyon, in relation to fish management.* Trans. Am. Fish. Soc. 76: 97-117.

Schropp, S.J., and H.L. Windom. 1988. *A Guide to the Interpretation of Metal Concentrations in Estuarine Sediments*. Skidaway Institute of Oceanography, Savannah, Georgia. April 1988.

Shield Environmental Associates, Inc., 2002. *Pre-Phase I Preparatory Assessment, Report of Findings*. Report prepared for Peterson/Puritan OU2 PRP Group. June 2002.

Shield Environmental Associates, Inc. 2003a. *Remedial Investigation/Feasibility Study Work Plan (Final), Peterson/Puritan Site – Operable Unit 2*. Report prepared for Peterson/Puritan OU2 PRP Group. June 2003.

Shield Environmental Associates, Inc. 2003b. *Remedial Investigation/Feasibility Study Phase 1A Data Base Summary Report, Peterson/Puritan Site – Operable Unit 2*. Report prepared for Peterson/Puritan OU2 PRP Group. December 2003.

US EPA ARCHIVE DOCUMENT

Shield Environmental Associates, Inc. 2004a. *RI/FS Phase 1A Initial Site Characterization Report, Peterson Puritan Superfund Site - Operable Unit 2*. Report prepared for Peterson Puritan OU2 PRP Group. February 2004.
Shield Environmental Associates, Inc. 2004b. *RI/FS Work Plan Addendum, Phase 1A Expanded Sampling Plan, Remedial Investigation/Feasibility Study, Peterson/Puritan Site - Operable Unit 2, Cumberland, Rhode Island*. Report prepared for Peterson/Puritan OU2 PRP Group. August 2004.

Sparling, D., G. Linder, and C. Bishop. 2000. *Ecotoxicology of Amphibians and Reptiles*. SETAC Press. 877 pp.

Stanek, E.J. III, E. J. Calabrese, R. Barnes, P. Pekow. 1997. *Soil ingestion in adults – Results of a second pilot study*. Ecotoxicology and Environmental Safety. 36: 249-257.

Suedel, B.C., J.A. Boraczek, R.K. Peddicord, P.A. Clifford, and T.M. Dillon. 1994. *Trophic transfer and biomagnification potential of contaminants in aquatic ecosystems*.

Suter, G.W. and C.L. Tsao. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota, 1996 revision*. Environmental Sciences Division. Oak Ridge National Laboratory. ES/ER/TM-96/R2.

Thorp, James R., Covich, Alan P. 1991. *Ecology and Classification of North American Freshwater Invertebrates*. Elsevier, London. Elsevier Science and Technology Books.

Todd, D.K. 1967. *Groundwater Hydrology*. John Wiley and Sons, Inc. 336p.

Trust, K.A., A. Fairbrother, and M.J. Hooper. 1994. *Effects of 7, 12-dimethylbenz[a]anthracene on immune function and mixed-function oxygenase activity in the European starling*. Environ. Toxicol. Chem. 13: 821-830.

Trust, K.A., J.R. Fowles, M.J. Hooper, and A. Fairbrother. 1994. *Cyclophosphamide effects on immune function of European starlings.* J. Wildl. Diseases 30: 328-334.

U.S. Army Corps of Engineers. 1994. Blackstone River Restoration Study. Department of the Army Corps of Engineers, New England District.

United States Department of Commerce. 1968. *Climatic Atlas of the United States.* Reprinted by the National Oceanic and Atmospheric Administration (NOAA) in 1983. Environmental Science Services Administration. June 1968.

United States Department of Navy. 2004. *Draft: Step 7 Baseline Ecological Risk Assessment Pearl Harbor Sediment Remedial Investigation.* Prepared by Earth Tech, Inc. under Comprehensive Long-Term Environmental Action Navy Contract Number N62742-94-D-0048, CTO 0115.

United States Environmental Protection Agency. 1987a. *Administrative Order on Consent (AOC) in the Matter of Peterson/Puritan NPL Site*. CERCLA Docket No. 1-8-1064. May 29. 1987.

United States Environmental Protection Agency. 1987b. Aerial Photographs.

US EPA ARCHIVE DOCUMENT

United States Environmental Protection Agency. 1988a. *CERCLA Compliance with Other Laws Manual: Draft Guidance*. EPA/540/G-89/006. August 1988.

United States Environmental Protection Agency. 1988b. *Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA*. EPA/540/G-89/004. OSWER Directive 9355.3-01. October 1988.

United States Environmental Protection Agency. 1988c. *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites.* OSWER Directive 9283.1-2. December 1988.

United States Environmental Protection Agency. 1988d. *Technology Screening Guide for Treatment of CERCLA Soils and Sludges*. EPA/540/2-88/004. September 1988.

United States Environmental Protection Agency. 1989. *Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual, Part A.* Interim Final. EPA/540/1-89/002. December 1989.

USEPA. 1991a. *Blackstone River Initiative - Phase I: Dry Weather Assessment Interim Report of Data 1991*. Region I - New England.

USEPA. 1991b. Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual, Part C, Risk Evaluation of Remedial Alternatives. PB92-963334. Office of Emergency and Remedial Response. Washington, D.C.

USEPA.1992a. *First Amendment to Administrative Order on Consent (AOC) in the Matter of Peterson/Puritan NPL Site.* CERCLA Docket No. 1-8-1064. March 10, 1992.

United States Environmental Protection Agency. 1992b. *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised*. EPA-454/R-92-019. Office of Air and Radiation, Office of Air Quality Planning and Standards. (October).

United States Environmental Protection Agency. 1992c. *Framework for Ecological Risk Assessment*. EPA/630/R-92/001.

United States Environmental Protection Agency. 1992d. *Sediment Classification Methods Compendium*. EPA 823-R-92-006.

United States Environmental Protection Agency. 1993. *Wildlife Exposure Factors Handbook*. EPA/600/R-93/187a.

United States Environmental Protection Agency. 1994. *USEPA Region 1 Risk Update No. 2*. August 1994.

United States Environmental Protection Agency. 1995a. *SCREEN3 Model User's Guide*. EPA-454/B-95-004. Office of Air Quality Planning and Standards .(September).

United States Environmental Protection Agency. 1995b. *Final Water Quality Guidance for the Great Lakes System, Final Rule*. Federal Register 60(56): 15366-15425.

United States Environmental Protection Agency.1996a. *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells. Region 1 - New England. SOP #: GW 00001,* Revision 2. July 30, 1996.

US EPA ARCHIVE DOCUMENT

United States Environmental Protection Agency. 1996b. *Ecotox Thresholds. Office of Solid Waste and Emergency Response*. ECO Update 3(2):1-12. January 1996.
United States Environmental Protection Agency. 1997a. *Exposure Factors Handbook, Volume I, General Factors.* EPA/600/P-95/002Fa. August 1997.

United States Environmental Protection Agency. 1997c. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conduction of Ecological Risk Assessments*. Interim Final. EPA 540-R-97-006. Solid Waste and Emergency Response.

United States Environmental Protection Agency. 1998. *National Sediment Bioaccumulation Conference*. EPA 823-R-98-002.

United States Environmental Protection Agency. 1999. *Appendix E, Toxicity Reference Values*. Screening Level Ecological Risk Assessment Protocol, August 1999.

United States Environmental Protection Agency. 2000a. *Statement of Work for Remedial Investigation and Feasibility Study for the Peterson/Puritan, Inc. Site, Operable Unit 2: J.M. Mills Landfill*. U.S. Environmental Protection Agency Region 1 – New England. November 2000.

United States Environmental Protection Agency. 2000b. Methods *for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*. Second Edition. EPAl600-R-991064.

United States Environmental Protection Agency. 2001a. *Second Amendment to Administrative Order on Consent (AOC) in the Matter of Peterson/Puritan NPL Site*. CERCLA Docket No. 1-8-1064. July 2001.
United States Environmental Protection Agency. 2001b. *Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual, Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments. Final*. 9285.7-47. December 2001.

United States Environmental Protection Agency. 2002a*. Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites*. EPA 540-R-01-003. OSWER 9285.7-41. September 2002.

United States Environmental Protection Agency. 2002b. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. EPA

United States Environmental Protection Agency. 2002c. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. Office of Solid Waste and Emergency Response. OSWER 9355.4-24. December 2002.

United States Environmental Protection Agency. 2003c. *40 CFR Part 300, National Contingency Plan*, *§300.430*. 7-1-03 Edition.

United States Environmental Protection Agency. 2003d. *Interim Ecological Soil Screening Levels*. http://www.epa.gov/ecotox./ecossl.

United States Environmental Protection Agency. 2004a. *Third Amendment to Administrative Order on Consent (AOC) in the Matter of Peterson/Puritan NPL Site*. CERCLA Docket No. 1-8-1064. October 2004.

United States Environmental Protection Agency. 2004b. *Region 9 Preliminary Remediation Goals (PRGs)*. Revised October 2004. Available at http://www.epa.gov/region09/waste/sfund/prg/revised02.htm.

United States Environmental Protection Agency. 2005a. http://www.ep.gov/enviro/html/icr/dbp.html.

United States Environmental Protection Agency. 2005b. *Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs).* OSWER Directive 9285.7-55. February 2005.

United States Environmental Protection Agency. 2005c. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmars (ESBs) for the Protection of Benthic Organisms: Metals Mixtures (Cadmium, Copper, Lead, Nickel, and Zinc). Office of Research and Development. Washington, DC. EPA-600-R-02-011.

United States Environmental Protection Agency. 2006a. *Region 3 Risk-Based Concentrations (RBCs)*. Revised April 2006. Available at http://www.epa.gov/reg3hwmd/risk/human/index.htm.

United States Environmental Protection Agency. 2006b. *ProUCL Version 4.0 Technical Guide*. Prepared for USEPA by Lockheed Martin. April 2006. EPA/600/R04/079.

United States Environmental Protection Agency. 2006c. *Integrated Risk Information System*. Available at http://www.epa.gov/iris/.

United States Environmental Protection Agency. 2007. *Current National Recommended Water Quality Criteria*. http://epa.gov/waterscience/criteria/wqcriteria.html. Last accessed 05/24/07.

United States Environmental Protection Agency. 2007. Framework for Metals Risk Assessment. EPA 120/R-07/001.

USEPA. 2008. E-mail from Bart Hoskins (USEPA) to Dave Hohreiter (ARCADIS) dated July 10, 2008 re: risk summary tables.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

TABLE ES-1a
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a moderate level of confidence, that adverse effects are unlikely to the benthic invertebrate community (***risk scenario 2***).	Sediment benchmarks are non-site specific & generic, but conservative, and were missing for some COPECs. Bioavailability (except for SEM) or cumulative risk from multiple COPECs are not considered.	No COPECs have effect CTE RRs > 1.0. Impairment is not expected. The evaluation uses 29 samples.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Severe toxicity is present for both test species in 1 (BR-006) of the 4 samples collected from the river for toxicity testing	The samples reflect only specific locations. Too few toxicity testing samples (n=4) for the entire EU. Survival is already reduced for 1 test species in 2 of 7 background samples. Sample handling changes the conditions found in the field. The samples come from select depositional areas in the river which maximizes contamination (= worst case) but may not represent non-depositional sections.	The observed toxicity in BR-006 cannot be readily linked to COPECs in the sample.
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Some impact is observed in 2 (BR-001 and BR-006) of the 4 samples collected for benthic community analysis.	Physical and chemical differences in habitat may affect structure and function of the community. Too few community samples (n=4) for the entire EU.The samples come from select depositional areas in the river which maximizes contamination (= worst case) but may not represent the non-depositional sections.	Benthic assemblage and habitat data vary between individual locations. The observed community responses do not appear to result from pollution-induced degradation.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic community in the Blackstone River, but are localized and do not appear strongly associated with site-derived COPECs.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	The fisheries data show a fish community which appears to respond to increased disturbance.	--	The data could not be used to determine if the disturbance reflects habitat differences with the upstream location or site-related chemical exposure. This measurement endpoint is not used to formulate the overall risk conclusion for fish.
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to the fish community (***risk scenario 5***).	Benchmarks are (a) non-species specific and generic, but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	No surface water COPECs have chronic CTE RRs > 1. Impairment is not expected. The evaluation uses 25 samples.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to the fish community (***risk scenario 5***).	CBRs are (a) non-species specific and generic, but conservative, (b) missing for many COPECs, and (c) do not consider cumulative risk.	No tissue COPECs have effect CTE RRs > 1. The only effect RME RRs at or above 1.0 are for Al (RR = 1) and Ba (RR = 1). Impairment is not expected.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to the fish community in the Blackstone River (near-site).***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to amphibians (***risk scenario 4 & 5***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	No surface water COPECs have chronic CTE RRs > 1. Impairment is not expected. The evaluation uses 25 samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to amphibians in the Blackstone River (near-site) .***		
Large Piscivorous Birds[b] (great blue heron)	6.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analaysis shows, with a high level of confidence, that adverse effects are unlikely to large piscivorous birds (***risk scenario 1***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect CTE RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to large piscivorous birds feeding at the Blackstone River (near-site), Pond A, and Pond F combined.***		

US EPA ARCHIVE DOCUMENT

TABLE ES-1a
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Small Piscivorous Birds (belted kingfisher)	7.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are unlikely to small piscivorous birds (***risk scenario 1***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect CTE RRs > 1.0. Impairment is not expected. The evaluation uses 3 fish samples, 30 sediment samples, and 25 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to small piscivorous birds feeding at the Blackstone River (near-site).***		
Large Piscivorous Mammals[b] (river otter)	10.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are unlikely to large piscivorous mammals (***risk scenario 2***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to large piscivorous mammals feeding at the Blackstone River (near-site), Pond A, and Pond F combined.***		
Small Piscivorous Mammals (mink)	11.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are unlikely to small piscivorous mammals (***risk scenario 2***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Impairment is not expected. The evaluation uses 3 fish samples, 30 sediment samples, and 25 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to small piscivorous mammals feeding at the Blackstone River (near-site).***		

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; SEM = simultaneously extracted metals; TRV = toxicity reference value; WOE = weight-of-evidence.

[b] The conclusion for this receptor group is based on risk from exposure to COPECs in the Blackstone River, Pond A, and Pond F combined.

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water

Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-1b
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability (except for SEM) or cumulative risk from multiple COPECs not considered.	Acetone is the only COPEC with an effect CTE RR > 1 (CTE RR = 2). This RR exceedance is small and not expected to cause severe impairment. The evaluation uses 12 sediment samples.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	The 2 samples (PA-001 & PA-003) collected from Pond A had significantly lower survival in both test species, which cannot be readily linked to COPECs, except perhaps for Cd (see comments).	A sample reflects only one specific location. Too few toxicity testing samples (n=2) for the entire EU. Survival is already reduced for 1 test species in 2 of 7 background samples. Sample handling changes the conditions found in the field.	Cd in PA-003 (25 mg/kg) is 5X above the effect benchmark of 4.98 mg/kg. However, Cd in PA-001, which is just as toxic as PA-003, is only 12 mg/kg. Cd in the two background samples equal 9.9 mg/kg and 9.8 mg/kg, respectively.
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Sample PA-001 shows severe community impairment, whereas sample PA-003 shows some community impairment.	Too few community samples (n=2) for the entire EU. Physical and chemical differences in habitat may affect structure and function of the community.	Benthic assemblage and habitat data vary between individual locations. Low dissolved oxygen could be a potential source of impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic community in Pond A. The source of impairment is unclear but may be related to COPECs and/or habitat issues.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	The fisheries data from Pond A are inconclusive because comparable data from a reference pond are unavailable.	--	This measurement endpoint is not used to formulate the overall risk conclusion for fish.
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	Mn is the only detected surface water COPEC with a chronic CTE RR > 1 (RR = 3). This RR exceedance is small and not expected to cause severe impairment. The evaluation uses 10 surface water samples.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to the fish community (***risk scenario 4***).	CBRs are (a) non-species specific and generic but conservative, (b) missing for many COPECs, and (c) do not consider cumulative risk.	No tissue COPECs have effect RME or CTE RRs > 1. Impairment is not expected.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to the fish community in Pond A.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	Mn is the only detected surface water COPEC with a chronic CTE RR > 1 (RR = 3). This RR exceedance is small and not expected to cause severe impairment. The evaluation uses 10 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond A .***		
Large Piscivorous Birds[b] (great blue heron)	6.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are unlikely to large piscivorous birds (***risk scenario 1***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to large piscivorous birds feeding at the Blackstone River (near-site), Pond A, and Pond F combined.***		

US EPA ARCHIVE DOCUMENT

TABLE ES-1b
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Small Piscivorous Birds (belted kingfisher)	7.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a low level of confidence, that adverse effects are unlikely to small piscivorous birds (***risk scenario 3***)	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Pb is the only COPEC with a no effect RR > 1 (RME RR < 1 and CTE RR = 3). This RR exceedance was small and not expected to cause impairment. The evaluation uses 8 fish samples, 12 sediment samples, and 10
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to small piscivorous birds feeding at Pond A.***		
Large Piscivorous Mammals[b] (river otter)	10.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are unlikely to large piscivorous mammals (***risk scenario 1***)	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect or no effect RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to large piscivorous mammals feeding at Ponds A and F combined.***		
Small Piscivorous Mammals (mink)	11.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a low level of confidence, that adverse effects are unlikely to small piscivorous mammals (***risk scenario 3***)	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Al is the only COPEC with a no effect RR > 1 (RME RR = 5 and CTE RR = 1). This RR exceedance was small and not expected to cause impairment. The evaluation uses 8 fish samples, 12 sediment samples, and 10 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to small piscivorous mammals feeding at Pond A.***		

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[b] The conclusion for this receptor group is based on risk from exposure to COPECs in the Blackstone River, Pond A, and Pond F combined.

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs

Risk Scenario	No effect (NOAEL) RME	No effect (NOAEL) CTE	Effect (LOAEL) RME	Effect (LOAEL) CTE	Potential for Adverse Population-level Effects	Confidence Level
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water

Risk Scenario	Chronic Toxicity RME	Chronic Toxicity CTE	Potential for Adverse Population-level Effects	Confidence Level
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-1c
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND B

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PUTITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs are not considered. Only 3 sediment samples are available for evaluation.	2-methylphenol, Cd and Ag are the only COPECs with an effect CTE RR $\geq$ 1 (1, 1, and 1, respectively). These RR exceedances are small and not expected to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Pond B	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Pond B	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic invertebrate community in Pond B.***		
Fish	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--
Amphibians	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water

Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-1d
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND C

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs are not considered. The exposures are "averages" for the entire EU. Only 2 sediment samples are available for evaluation.	2-methylphenol and Cd are the only two COPECs with an effect CTE RR $\geq$ 1 (1 and 1, respectively). These RR exceedances are small and not expected to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Pond C	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Pond C	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic invertebrate community in Pond C.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond C.	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***). Pb is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only two surface water samples are available for evaluation.	Al, Ba, Cd, Cu, and Pb are the detected surface water COPECs with the highest chronic CTE RRs (21 , 40, 31, 15, and 62, respectively). These RR exceedances could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBR.	medium	Measurement endpoint 2.C was not evaluated in Pond C.	--	--
	OVERALL RISK CONCLUSION		***Severe adverse effects are possible to the fish community in Pond C.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***). Pb is the main risk driver	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only two surface water samples are available for evaluation.	Al, Ba, Cd, Cu, and Pb are the detected surface water COPECs with the highest chronic CTE RRs (21 , 40, 31, 15, and 62, respectively). These RR exceedances could cause severe impairment.
	OVERALL RISK CONCLUSION		***Severe adverse effects are possible to amphibians in Pond C.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond C	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond C	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond C	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond C	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE ES-1d
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND C

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-1e
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs are not considered. Only 4 sediment samples are available for evaluation.	Pyrene and Cd are the only two COPECs with an effect CTE RR $\geq$ 1 (1 and 1, respectively). These RR exceedances are small and not expected to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	The 1 sample (PD-002) collected for toxicity testing shows severe effects to both test species.	A sample reflects only one specific location. Too few sediment samples (n=1) for the entire EU. Survival is already reduced for 1 test species in 2 of 7 background samples. Sample handling changes the conditions found in the field.	PD-002 has the highest PAHs measured in the 7 pond samples, with total PAHs of 61.9 mg/kg vs. 20.2 mg/kg and 18 mg/kg in the 2 background samples. On the other hand, PD-002 has the lowest metal levels measured in these same seven samples.
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	The results for PD-002 are in the range of background conditions, excep for lower number of total organisms (67 vs. 91 to 92)	Too few community samples (n=1) for the entire EU. Physical and chemical differences in habitat may affect structure and function of the community.	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic community in Pond D. The source of impairment is unclear but may be related to COPECs and/or habitat issues.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond D	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***). Pb is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Al, Ba, Cd, and Pb are the detected surface water COPECs with the highest chronic CTE RRs (22 , 11, 22, and 77, respectively). These RR exceedances could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	Measurement endpoint 2.C was not evaluated in Pond D	--	--
	OVERALL RISK CONCLUSION		***Severe adverse effects are possible to the fish community in Pond D.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***). Pb is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Al, Ba, Cd, and Pb are the detected surface water COPECs with the highest chronic CTE RRs (22 , 11, 22, and 77, respectively). These RR exceedances could cause severe impairment.
	OVERALL RISK CONCLUSION		***Severe adverse effects are possible to amphibians in Pond D.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond D	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond D	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond D	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond D	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE ES-1e
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-1f
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND E

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***). Pb is the main risk driver.	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs are not considered. Only 2 sediment samples are available for evaluation.	The COPECs with effect CTE RRs $\geq$ 1 are acetone (10), carbon disulfide (2), Cd (2), Cr (2), Cu (3), Pb (11), and Zn (3). Several of these RR exceedances are large enough to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Pond E	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Pond E	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic invertebrate community in Pond E.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond E	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***). Ba is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Ba, Pb and Mn are the detected surface water COPECs with the highest chronic CTE RRs (55, 8, and 7, respectively). These RR exceedances could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	Measurement endpoint 2.C was not evaluated in Pond E	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond E.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenrio 6***). Ba is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Ba, Pb and Mn are the detected surface water COPECs with the highest chronic CTE RRs (55, 8, and 7, respectively). These RR exceedances could cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond E.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond E	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond E	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond E	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond E	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE ES-1f
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND E

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-1g
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability (except for SEM) or cumulative risk from multiple COPECs are not considered. The exposures are "averages" for the entire EU. Only 5 sediment samples are available for evaluation.	The only COPEC with an effect CTE RR $\geq$ 1 is acetone (2). This RR exceedance is small and not expected to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	The 1 sample (PF-004) collected from Pond F for toxicity testing did not result in a significant reduction in survival or growth.	A sample reflects only one specific location. Too few toxicity testing samples (n=1) for the entire EU. Survival is already reduced for 1 test species in 2 of 7 background samples. Sample handling changes the conditions found in the field.	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Benthic metric results for PF-004 are generally lower than the metric results from the background, indicating the potential for site-related impacts.	Physical and chemical differences in habitat may affect structure and function of the community. Too few community samples (n=1) for the entire EU.	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic community in Pond F. The source of impairment is unclear but may be related to COPECs and/or habitat issues.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	The fisheries data from Pond F are inconclusive because comparable data from a reference pond are missing.	--	This measurement endpoint could not be used to formulate the overall risk conclusion for fish due to a lack of usable reference data.
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 4 surface water samples are available for evaluation.	Mn and Ag are the only detected surface water COPECs with chronic CTE RRs > 1 (RR of 2 and 2, respectively). These small RR exceedances are not expected to cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	CBRs are (a) non-species specific and generic but conservative, (b) missing for many COPECs, and (c) do not consider cumulative risk.	Ba and Zn are the only detected COPECs with effect CTE RRs > 1 (RR of 1 and 1, respectively). These small RR exceedances are not expected to cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond F.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 4 syrface water samples are available for evaluation.	Mn and Ag are the only detected surface water COPECs with chronic CTE RRs > 1 (RR of 2 and 2, respectively). These small RR exceedances are not expected to cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the amphibians in Pond F.***		
Large Piscivorous Birds[b] (great blue heron)	6.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are unlikely to large piscivorous birds (***risk scenario 1***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse are unlikely to large piscivorous birds feeding at the Blackstone River (near-site), Pond A, and Pond F combined.***		

US EPA ARCHIVE DOCUMENT

TABLE ES-1g
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Small Piscivorous Birds (belted kingfisher)	7.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to large piscivorous birds (***risk scenario 5***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	Pb is the only COPEC with effect RRs > 1.0 (effect RME RR = 1 and effect CTE RR < 1). This RR exceedance is small and not expected to cause impairment. The evaluation uses 3 fish samples, 5 sediment samples, and 4 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse are possible but not expected to small piscivorous birds feeding at Pond F.***		
Large Piscivorous Mammals[b] (river otter)	10.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are unlikely to large piscivorous mammals feeding across Ponds A and F combined (***risk scenario 1***)	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect or no effect RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to large piscivorous mammals feeding at Ponds A and F combined.***		
Small Piscivorous Mammals (mink)	11.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a low level of confidence, that adverse effects are unlikely to small piscivorous mammals feeding in Pond E (***risk scenario 3***)	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Impairment is not expected. The evaluation uses 3 fish samples, 5 sediment samples, and 4 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to small piscivorous mammals feeding at Pond F.***		

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[b] The conclusion for this receptor group is based on risk from exposure to COPECs in the Blackstone River, Pond A, and Pond F combined.

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water

Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-1h
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND I

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs are not considered. Only 3 sediment samples are available for evaluation.	The COPECs with effect CTE RRs $\geq$ 1 are acetone (3), benzo[g,h,i]perylene (3), chrysene (1), fluoranthene (1), pyrene (1), Cd (2), and Cu (1). These RR exceedances are small but numerous and might results in impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	The one sample (BR-005) collected from Pond I for toxicity testing shows reduced growth in *C. dilutus.*	A sample reflects only one specific location. Too few toxicity testing samples (n=1) for the entire EU. Survival is already reduced for 1 test species in 2 of 7 background samples. Sample handling changes the conditions found in the field.	BR-005 has the highest PAHs and metal levels in the Blackstone R., but is less toxic than sample BR-006 which has COPEC levels no different from the other 3 near-site river samples tested for toxicity.
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	BR-005 had a lower diversity index and higher % tolerant organisms, but the total organisms, No. of taxa, % gatherer, and % burrower metrics compared to the background range.	Physical and chemical differences in habitat may affect structure and function of the community. Too few community samples (n=1) for the entire EU.	The observed impairment may be habitat-related (e.g., water temperature, grain size)
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic community in Pond I. The source of impairment is unclear but may be related to COPECs and/or habitat issues.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond I	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Pb is the detected surface water COPEC with the highest chronic CTE RR (RR = 10). This RR exceedance could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	Measurement endpoint 2.C was not evaluated in Pond I	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond I.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***). Pb is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Pb is the detected surface water COPEC with the highest chronic CTE RR (RR = 10). This RR exceedance could cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond I.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond I	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond I	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond I	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond I	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE ES-1h
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND I

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-1i
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND N

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion"	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs not considered. Only 1 sediment sample is available for evaluation.	The COPECs with effect CTE RRs $\geq$ 1 are 4,4'-DDD (1), dieldrin (1), Cd (2), and Cr (1). These RR exceedances are small and not expected to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Pond N	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Pond N	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic invertebrate community in Pond N.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond N	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***). Al is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 1 surface water sample is available for evaluation.	Al and Pb are the detected surface water COPECs with the highest chronic CTE RRs (22 and 12, respectively). These RR exceedances could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	Measurement endpoint 2.C was not evaluated in Pond N	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond N.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibiams (***risk scenario 6***). Al is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 1 surface water sample is available for evaluation.	Al and Pb are the detected surface water COPECs with the highest chronic CTE RRs (22 and 12, respectively). These RR exceedances could cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond N.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond N	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond N	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond N	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond N	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE ES-1i
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND N

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-1j
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND P

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion"	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a low level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 4***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs not considered. Only 1 sediment sample is available for evaluation.	No COPECs have effect RRs > 1.0. Only 3 COPECs have no effect RRs $\geq$ 1. Impairment is not expected.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Pond P	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Pond P	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to the benthic invertebrate community in Pond P.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond P	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 1 surface water sample is available for evaluation.	4,4'-DDT, Mn, and Ag are the detected surface water COPECs with the highest chronic CTE RRs (8, 13, and 7, respectively). These RR exceedances could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect	medium	Measurement endpoint 2.C was not evaluated in Pond P	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond P.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 1 surface water sample is available for evaluation.	4,4'-DDT, Mn, and Ag are the detected surface water COPECs with the highest chronic CTE RRs (8, 13, and 7, respectively). These RR exceedances could cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond P.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond P	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond P	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond P	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond P	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE ES-1j
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND P

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-1k
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - WETLANDS A THROUGH D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 5***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability and cumulative risk from multiple COPECs are not considered.	No COPECs have effect CTE RRs > 1.0. The only COPEC with an effect RME RR $\geq$ 1 is carbon disulfide (1). Impairment is not expected. The evaluation uses 23 sediment samples.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Wetlands A through D	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Wetlands A through D	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to the benthic invertebrate community in Wetlands A through D.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Wetlands A through D	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	Toxaphene had the highest chronic CTE RR (134) but was not detected in any of the 17 surface water samples. None of the other COPECs had a chronic CTE RR > 1. Impairment is not expected. The evaluation uses 17 surface water samples.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	Measurement endpoint 2.C was not evaluated in Wetlands A through D	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to the fish community in Wetlands A through D.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	Toxaphene had a chronic CTE RR of 134 but was not detected in any of the 17 samples. None of the other COPECs had a chronic CTE RR > 1. Impairment is not expected. The evaluation uses 17 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to amphibians in Wetlands A through D.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Wetlands A through D	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Wetlands A through D	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Wetlands A through D	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Wetlands A through D	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE ES-1k
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - WETLANDS A THROUGH D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE ES-2a
SUMMARY OF ECOLOGICAL RISK IN TERRESTRIAL HABITATS - J.M. MILLS LANDFILL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE IN TERRESTRIAL HABITATS - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[b]	Major Uncertainties	Comments
Large omnivorous birds[a] (American woodcock)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to large omnivorous birds feeding across all the near-site terrestrial EUs combined (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RR $\geq$ 1 are BEHP (5), Pb (17), and Zn (4). These RR exceedances could cause severe impairment. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to large omnivorous birds feeding across the terrestrial EUs combined.***		
Small omnivorous birds (American robin)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous birds feeding at the J.M. Mills Landfill (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs $\geq$ 1 are BEHP (7), Cd (1), Pb (41), and Zn (10). These RR exceedances could cause severe impairment. The evaluation uses 16 soil samples and 9 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous birds feeding at the J.M. Mills Landfill.***		
Large omnivorous mammals[a] (red fox)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to large omnivorous mammals feeding across all terrestrial EUs combined (***risk scenario 4***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs $\geq$ 1. The red fox is assumed to have a 100% worm diet. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to large omnivorous mammals feeding across the terrestrial EUs combined.***		
Small omnivorous mammals (short-tailed shrew)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous mammals feeding at the J.M. Mills Landfill (***risk scenario 6***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs $\geq$ 1 are Al (6) and Zn (3). Some impairment is possible. The evaluation uses 16 soil samples and 9 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous mammals feeding at the J.M. Mills Landfill.***		

BAF = bioaccumulation factor; BEHP = bis(2-ethylhexyl)phthalate; CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; EU = exposure unit; PCP = pentachlorophenol; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a] The conclusion for this receptor group is based on risk from exposure to COPECs from all the terrestrial EUs combined.

[b] **Interpretive Risk Matrix**

Risk Scenario	No effect (NOAEL) RME	No effect (NOAEL) CTE	Effect (LOAEL) RME	Effect (LOAEL) CTE	Potential for Adverse Population-level Effects	Confidence Level
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

US EPA ARCHIVE DOCUMENT

TABLE ES-2b
SUMMARY OF ECOLOGICAL RISK IN TERRESTRIAL HABITATS - UNNAMED ISLAND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON-PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[b]	Major Uncertainties	Comments
Large omnivorous birds[a] (American woodcock)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to large omnivorous birds feeding across all the near-site terrestrial EUs combined ***(risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RR $\underline{\geq}$ 1 are BEHP (5), Pb (17), and Zn (4). These RR exceedances could cause severe impairment. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to large omnivorous birds feeding across the terrestrial EUs combined.***		
Small omnivorous birds (American robin)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous birds feeding at the Unnamed Island ***(risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs $\underline{\geq}$ 1 are BEHP (14), di-n-octyl phthalate (1), Pb (15), and Zn (3). The RR exceedances could cause severe impairment. The evaluation uses 25 soil samples and 15 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous birds feeding at the Unnamed Island.***		
Large omnivorous mammals[a] (red fox)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to large omnivorous mammals feeding across all terrestrial EUs combined ***(risk scenario 4***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs $\underline{\geq}$ 1. The red fox is assumed to have a 100% worm diet. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to large omnivorous mammals feeding across the terrestrial EUs combined.***		
Small omnivorous mammals (short-tailed shrew)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous mammals feeding at the Unnamed Island (***risk scenario 6***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The only COPEC with an effect CTE $\underline{\geq}$ 1 is Al (2). Severe impairment is not expected from this small RR exceedance. The evaluation uses 25 soil samples and 15 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous mammals feeding at the Unnamed Island.***		

BAF = bioaccumulation factor; BEHP = bis(2-ethylhexyl)phthalate; CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; EU = exposure unit; PCP = pentachlorophenol; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a] The conclusion for this receptor group is based on risk from exposure to COPECs from all the terrestrial EUs combined.

[b] **Interpretive Risk Matrix**

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

US EPA ARCHIVE DOCUMENT

TABLE ES-2c
SUMMARY OF ECOLOGICAL RISK IN TERRESTRIAL HABITATS - NUNES PARCEL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON-PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[b]	Major Uncertainties	Comments
Large omnivorous birds[a] (American woodcock)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR risk analysis shows, with a high level of confidence, that adverse effects are possible to large omnivorous birds feeding across all the near-site terrestrial EUs combined (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RR ≥ 1 are BEHP (5), Pb (17), and Zn (4). These RR exceedances could cause severe impairment. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to large omnivorous birds feeding across the terrestrial EUs combined.***		
Small omnivorous birds (American robin)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous birds feeding at the Nunes Parcel (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs ≥ are BEHP (8), Pb (81), and Zn (8). These RR exceedances could cause severe impairment. The evaluation uses 20 soil samples and 10 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous birds feeding at the Nunes Parcel.***		
Large omnivorous mammals[a] (red fox)		low-medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to large omnivorous mammals feeding across all terrestrial EUs combined (***risk scenario 4***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs ≥ 1. The red fox is assumed to have a 100% worm diet. The evaluation is based on 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to large omnivorous mammals feeding across the terrestrial EUs combined.***		
Small omnivorous mammals (short-tailed shrew)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous mammals feeding at the Nunes Parcel (***risk scenario 6***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs ≥ 1 are Al (7) and Zn (2). Severe impairment is not expected. The evaluation uses 20 soil samples and 10 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effecs are possible to small omnivorous mammals feeding at Nunes Parcel.***		

BAF = bioaccumulation factor; BEHP = bis(2-ethylhexyl)phthalate; CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; EU = exposure unit; PCP = pentachlorophenol; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a] The conclusion for this receptor group is based on risk from exposure to COPECs from all the terrestrial EUs combined.

[b] **Interpretive Risk Matrix**

Risk Scenario	No effect (NOAEL) RME	No effect (NOAEL) CTE	Effect (LOAEL) RME	Effect (LOAEL) CTE	Potential for Adverse Population-level Effects	Confidence Level
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

US EPA ARCHIVE DOCUMENT

TABLE ES-2d
SUMMARY OF ECOLOGICAL RISK IN TERRESTRIAL HABITATS - QUINNVILLE WELL FIELD

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON-PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN , RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[b]	Major Uncertainties	Comments
Large omnivorous birds[a] (American woodcock)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to large omnivorous birds feeding across all the near-site terrestrial EUs combined (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RR $\geq$ 1 are BEHP (5), Pb (17), and Zn (4). These RR exceedances could cause severe impairment. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to large omnivorous birds feeding across the terrestrial EUs combined.***		
Small omnivorous birds (American robin)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous birds feeding at the Quinville Well Field (***risk scenario 6***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs $\geq$ 1 are Pb (2) and Zn (2). Severe impairment is not expected. The evaluation uses 19 soil samples and 4 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous birds feeding at the Quinville Well Field.***		
Large omnivorous mammals[a] (red fox)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to large omnivorous mammals feeding across all terrestrial EUs combined (***risk scenario 4***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs $\geq$ 1. The red fox is assumed to have a 100% worm diet. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to large omnivorous mammals feeding across the terrestrial EUs combined.***		
Small omnivorous mammals (short-tailed shrew)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous mammals feeding at the Quinville Well Field (***risk scenario 6***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The only COPEC with an effect CTE RR $\geq$ 1 is Al (4). Severe impairment is not expected. The evaluation uses 19 soil samples and 4 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous mammals feeding at the Quinnville Well Field.***		

BAF = bioaccumulation factor; BEHP = bis(2-ethylhexyl)phthalate; CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; EU = exposure unit; PCP = pentachlorophenol; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a] The conclusion for this receptor group is based on risk from exposure to COPECs from all the terrestrial EUs combined.

[b] **Interpretive Risk Matrix**

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

US EPA ARCHIVE DOCUMENT

TABLE ES-2e
SUMMARY OF ECOLOGICAL RISK IN TERRESTRIAL HABITATS - WETLANDS A THROUGH D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERNON-PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[b]	Major Uncertainties	Comments
Large omnivorous birds[a] (American woodcock)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to large omnivorous birds feeding across all the near-site terrestrial EUs combined (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RR $\geq$ 1 are BEHP (5), Pb (17), and Zn (4). These RR exceedances could cause severe impairment. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to large omnivorous birds feeding across the terrestrial EUs combined.***		
Small omnivorous birds (American robin)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with moderate level of confidence, that adverse effects are unlikely to small omnivorous birds feeding at the Wetlands A through D (***risk scenario 2***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs $\geq$ 1. Impairment is not expected. The evaluation uses 5 soil samples and 17 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to small omnivorous birds feeding at Wetlands A through D.***		
Large omnivorous mammals[a] (red fox)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to large omnivorous mammals feeding across all terrestrial EUs combined (***risk scenario 4***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs $\geq$ 1. The red fox is assumed to have a 100% worm diet. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to large omnivorous mammals feeding across the terrestrial EUs combined.***		
Small omnivorous mammals (short-tailed shrew)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to omnivorous mammals feeding at Wetlands A through D (***risk scenario 5***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs $\geq$ 1. Impairment is not expected. The evaluation uses 5 soil samples and 17 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to small omnivorous mammals feeding at Wetlands A through D.***		

BAF = bioaccumulation factor; BEHP = bis(2-ethylhexyl)phthalate; CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; EU = exposure unit; PCP = pentachlorophenol; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a] The conclusion for this receptor group is based on risk from exposure to COPECs from all the terrestrial EUs combined.

[b] **Interpretive Risk Matrix**

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

US EPA ARCHIVE DOCUMENT

TABLE ES-2f
SUMMARY OF ECOLOGICAL RISK IN TERRESTRIAL HABITATS - PRATT DAM

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON-PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[b]	Major Uncertainties	Comments
Large omnivorous birds[a] (American woodcock)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to large omnivorous birds feeding across all the near-site terrestrial EUs combined (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RR $\geq$ 1 are BEHP (5), Pb (17), and Zn (4). These RR exceedances could cause severe impairment. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to large omnivorous birds feeding across the terrestrial EUs combined.***		
Small omnivorous birds (American robin)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous birds feeding at Pratt Dam (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The risk driver is Pb with a effect CTE RR = 34. This RR exceedance could cause severe impairment. The evaluation uses 8 soil samples and 16 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous birds feeding at Pratt Dam.***		
Large omnivorous mammals[a] (red fox)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to large omnivorous mammals feeding across all terrestrial EUs combined (***risk scenario 4***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs $\geq$ 1. The red fox is assumed to have a 100% worm diet. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to large omnivorous mammals feeding across the terrestrial EUs combined.***		
Small omnivorous mammals (short-tailed shrew)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to small omnivorous mammals feeding at Pratt Dam (***risk scenario 5***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs $\geq$ 1. Cd is the only COPEC with an effect RME RR $\geq$ 1 (RR = 2). Impairment is not expected. The evaluation uses 8 soil samples and 16 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to small omnivorous mammals feeding at Pratt Dam.***		

BAF = bioaccumulation factor; BEHP = bis(2-ethylhexyl)phthalate; CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; EU = exposure unit; PCP = pentachlorophenol; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a] The conclusion for this receptor group is based on risk from exposure to COPECs from all the terrestrial EUs combined.

[b]**Interpretive Risk Matrix**

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

TABLE 7-1a
SUMMARY OF COPECs FORWARDED TO THE BERA - AQUATIC AREAS

BASELINE HUMAN HEALTH RISK ASSESSMENT
PETERSON PURITAN SUPERFUND SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

	Blackstone River		Pond A		Pond B[1]		Pond C		Pond D		Pond E		Pond F		Pond I		Pond N		Pond P	
COPEC	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water
VOCs																				
1,1,1 -Trichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2 - Tetrachloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone	--	--	x	--	x	--	--	--	--	--	x	--	--	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	x	--	--	--	--	--	--	--	--	--
Acetone	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	--	--
Carbon Disulfide	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	--	--	x	--
Chloromethane	--	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
cis-1,2-Dichloroethene	--	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--
cis-1,3-Dichloropropene	--	--	--	x	x	--	--	x	--	x	--	x	--	x	--	x	--	x	--	--
Isopropylbenzene	--	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Methyl Acetate	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Methylcyclohexane	--	--	x	--	x	--	x	--	x	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	--	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	--	x
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	x	x	--	--	x	--	x	--	x	--	x	--	x	--	x	--	--
Trichlorofluoromethane	--	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Xylene (Total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCs																				
1,1'-Biphenyl	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	x	--	--	--	--	--
2-Methylphenol	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--
4-Bromophenyl-phenylether	--	--	--	x	--	--	--	x	--	x	--	x	--	x	--	x	--	x	--	x
4-Chloroaniline	--	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
4-Methylphenol	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
4-Nitroaniline	--	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Acenaphthene	x	x	--	x	--	--	--	x	--	x	--	x	--	x	--	x	--	x	--	x
Acenaphthylene	x	x	x	x	--	--	x	x	--	x	--	x	--	x	x	x	--	x	--	x
Acetophenone	--	--	x	x	x	--	x	x	--	x	x	x	x	x	x	x	x	x	x	x
Anthracene	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--
Benzaldehyde	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Benzo(a)anthracene	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Benzo(a)pyrene	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Benzo(b)fluoranthene	x	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Benzo(g,h,i)perylene	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Benzo(k)fluoranthene	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
bis(2-Ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Butylbenzylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbazole	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--
Chrysene	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cyclohexane	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dibenzo(a,h)anthracene	x	--	x	x	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x
Dibenzofuran	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-octylphthalate	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fluoranthene	x	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fluorene	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	--	--
Hexachlorobenzene	--	--	x	x	--	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Hexachlorobutadiene	--	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x

US EPA ARCHIVE DOCUMENT

TABLE 7-1a
SUMMARY OF COPECs FORWARDED TO THE BERA - AQUATIC AREAS

BASELINE HUMAN HEALTH RISK ASSESSMENT
PETERSON PURITAN SUPERFUND SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

	Blackstone River		Pond A		Pond B[1]		Pond C		Pond D		Pond E		Pond F		Pond I		Pond N		Pond P	
COPEC	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water
Indeno(1,2,3-cd)pyrene	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	--	x
Isophorone	--	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Naphthalene	x	--	x	--	--	--	--	--	x	--	--	--	x	--	x	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--
Pentachlorophenol	--	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--
Phenanthrene	x	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Phenol	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pyrene	x	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pesticides																				
4,4'-DDD	x	--	x	--	x	--	x	x	x	--	x	x	x	--	x	--	x	--	--	--
4,4'-DDE	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	--	--
4,4'-DDT	--	--	--	x	--	--	--	x	--	x	x	--	x	x	--	x	--	x	--	x
alpha-Chlordane	x	--	x	x	x	--	x	x	--	x	x	x	x	x	x	x	x	x	--	x
Dieldrin	x	--	x	--	x	--	x	--	--	--	x	--	x	--	x	--	x	--	--	--
Endosulfan I	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan II	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan sulfate	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	--	x	x	x
Endrin	--	--	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endrin aldehyde	--	--	x	x	--	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Endrin ketone	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
gamma-BHC (Lindane)	--	--	--	x	--	--	--	x	--	x	--	x	--	x	--	x	--	x	--	x
gamma-Chlordane	x	--	x	x	x	--	--	x	x	x	x	x	x	x	x	x	x	x	x	x
Heptachlor epoxide	--	--	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	x
Methoxychlor	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene	--	--	x	x	x	--	x	x	x	x	--	x	x	x	x	x	--	x	--	x
PCBs																				
PCBs	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	--	x
Metals																				
Aluminum	x	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	--
Antimony	--	--	--	--	--	--	--	--	--	--	x	--	--	--	--	--	--	--	--	--
Arsenic	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	--	--	--	--
Barium	x	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Beryllium	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--
Cadmium	x	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Chromium	x	--	x	--	x	--	x	x	x	x	x	--	x	--	x	--	x	--	--	--
Cobalt	x	--	x	x	x	--	x	x	x	x	x	x	x	--	x	--	x	--	x	--
Copper	x	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	--	x
Cyanide	--	--	x	--	x	--	x	x	x	--	x	--	x	--	x	--	x	--	x	--
Iron	x	x	x	x	x	--	--	x	--	x	x	x	x	x	x	x	--	x	--	x
Lead	x	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	--	x
Manganese	x	x	x	x	x	--	--	x	--	x	--	x	x	x	--	x	--	x	--	x
Mercury	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	--	--
Nickel	x	--	x	x	x	--	--	x	x	x	x	x	x	x	x	--	x	--	--	--
Selenium	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--
Silver	x	--	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Thallium	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--	x	--
Vanadium	x	x	x	--	x	--	x	x	x	--	x	--	x	--	x	--	x	--	x	--
Zinc	x	x	x	x	x	--	x	x	x	x	x	x	x	x	x	x	x	x	--	--

Notes:
[1] Surface-water data not available for Pond B.

US EPA ARCHIVE DOCUMENT

TABLE 7-1b
SUMMARY OF COPECs FORWARDED TO THE BERA - TERRESTRIAL AREAS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

	Blackstone River		J.M.Mills Landfill		Nunes Parcel		Quinnville Well Field		Unnamed Island		Wetlands A - D		Pratt Dam	
COPEC	**Sediment**	**Water**	**Soil**	**Water**	**Soil**	**Water**	**Soil**	**Water**	**Soil**	**Water**	**Sediment**	**Water**	**Soil**	**Water**
VOCs														
1,1,1 -Trichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2 - Tetrachloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	x	--	--	--	x	--	x	--	--	--	--	--
2-Butanone	--	--	x	--	x	--	x	--	x	--	--	--	--	--
2-Hexanone	--	--	x	--	x	--	x	--	x	--	--	--	--	--
4-Methyl-2-pentanone	--	--	x	--	--	--	x	--	x	--	--	--	--	--
Acetone	x	--	x	--	x	--	x	--	x	--	x	--	--	--
Carbon Disulfide	x	--	x	--	--	--	x	--	x	--	--	--	--	--
Chloromethane	--	x	--	--	--	--	x	--	x	--	--	x	--	--
cis-1,2-Dichloroethene	--	--	x	--	--	--	x	--	x	--	x	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	x	--	--
Isopropylbenzene	--	--	x	--	--	--	x	--	x	--	x	x	--	--
Methyl Acetate	x	--	x	--	x	--	x	--	x	--	--	x	--	--
Methylcyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	--	--	x	--	x	--	x	--	x	--	--	--	--	--
Styrene	--	--	--	--	--	--	--	--	--	--	x	x	--	--
Tetrachloroethene	--	--	x	--	x	--	x	--	x	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	x	--	--
Trichlorofluoromethane	--	--	x	--	x	--	x	--	x	--	--	x	--	--
Xylene (Total)	--	--	x	--	x	--	x	--	x	--	--	--	--	--
SVOCs														
1,1'-Biphenyl	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	x	--	x	--	x	--	x	--	--	--	--	--
2-Methylphenol	x	--	x	--	--	--	x	--	--	--	x	--	--	--
4-Bromophenyl-phenylether	--	--	x	--	--	x	x	x	--	x	--	x	x	x
4-Chloroaniline	--	--	x	--	x	x	x	x	--	x	--	x	x	x
4-Methylphenol	x	--	x	--	--	x	x	x	--	x	--	x	x	x
4-Nitroaniline	--	--	x	--	--	x	x	x	--	x	--	x	x	x
Acenaphthene	x	x	--	--	--	x	--	x	--	x	--	x	x	x
Acenaphthylene	x	x	x	--	x	x	x	x	x	x	--	x	x	x
Acetophenone	--	--	x	--	--	x	x	x	x	x	--	x	x	x
Anthracene	x	--	x	--	x	--	x	--	x	--	x	--	--	--
Benzaldehyde	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Benzo(a)anthracene	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Benzo(a)pyrene	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Benzo(b)fluoranthene	x	x	x	--	x	x	x	x	x	x	x	x	x	x
Benzo(g,h,i)perylene	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Benzo(k)fluoranthene	x	--	x	--	x	x	x	x	x	x	x	x	x	x
bis(2-Ethylhexyl)phthalate	--	--	x	--	x	--	x	--	x	--	--	--	--	--
Butylbenzylphthalate	--	--	x	--	x	--	x	--	x	--	--	--	--	--
Carbazole	x	--	x	--	x	--	x	--	x	--	x	--	--	--
Chrysene	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Cyclohexane	x	--	x	--	--	--	x	--	x	--	--	x	--	--
Dibenzo(a,h)anthracene	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Dibenzofuran	--	--	x	--	x	--	x	--	x	--	--	--	--	--
Di-n-octylphthalate	x	--	x	--	x	x	x	x	x	x	--	x	x	x
Fluoranthene	x	x	x	--	x	x	x	x	x	x	x	x	x	x
Fluorene	x	--	--	--	--	--	--	--	--	--	x	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-1b
SUMMARY OF COPECs FORWARDED TO THE BERA - TERRESTRIAL AREAS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

	Blackstone River		J.M.Mills Landfill		Nunes Parcel		Quinnville Well Field		Unnamed Island		Wetlands A - D		Pratt Dam	
COPEC	**Sediment**	**Water**	**Soil**	**Water**	**Soil**	**Water**	**Soil**	**Water**	**Soil**	**Water**	**Sediment**	**Water**	**Soil**	**Water**
Hexachlorobenzene	--	--	--	--	--	x	--	x	--	x	--	x	x	x
Hexachlorobutadiene	--	--	x	--	--	x	--	x	--	x	--	x	x	x
Indeno(1,2,3-cd)pyrene	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Isophorone	--	--	x	--	x	x	x	x	--	x	--	x	x	x
Naphthalene	x	--	x	--	x	--	x	--	x	--	x	--	--	--
N-Nitrosodiphenylamine	--	--	x	--	--	--	x	--	--	--	--	--	--	--
Pentachlorophenol	--	--	x	--	--	--	x	--	--	--	--	--	--	--
Phenanthrene	x	x	x	--	x	x	x	x	x	x	x	x	x	x
Phenol	x	--	--	--	--	x	--	x	--	x	x	x	x	x
Pyrene	x	x	x	--	x	x	x	x	x	x	x	x	x	x
Pesticides														
4,4'-DDD	x	--	x	--	x	--	x	--	x	--	x	--	--	--
4,4'-DDE	x	--	x	--	x	--	x	--	x	--	x	--	--	--
4,4'-DDT	--	--	x	--	x	x	x	x	x	x	x	x	x	x
alpha-Chlordane	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Dieldrin	x	--	x	--	x	--	x	--	x	--	--	--	--	--
Endosulfan I	--	--	x	--	x	--	x	--	--	--	--	--	--	--
Endosulfan II	--	--	x	--	x	--	x	--	x	--	--	--	--	--
Endosulfan sulfate	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Endrin	--	--	x	--	x	--	x	--	--	--	--	--	--	--
Endrin aldehyde	--	--	x	--	x	x	x	x	x	x	x	x	x	x
Endrin ketone	x	--	x	--	x	x	x	x	x	x	x	x	x	x
gamma-BHC (Lindane)	--	--	x	--	x	x	x	x	--	x	--	x	x	x
gamma-Chlordane	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Heptachlor epoxide	--	--	x	--	x	x	x	x	x	x	--	--	x	x
Methoxychlor	--	--	x	--	x	--	x	--	x	--	--	--	--	--
Toxaphene	--	--	x	--	x	x	x	x	--	x	--	x	x	x
PCBs														
PCBs	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals														
Aluminum	x	x	x	--	x	--	x	--	x	--	x	x	--	--
Antimony	--	--	x	--	x	--	x	--	x	--	x	--	--	--
Arsenic	x	--	x	--	x	--	x	--	x	--	x	--	--	--
Barium	x	x	x	--	x	x	--	x	--	x	x	x	x	x
Beryllium	x	--	--	--	--	--	--	--	--	--	x	--	--	--
Cadmium	x	x	x	--	x	x	x	x	x	x	x	x	x	x
Chromium	x	--	x	--	x	--	x	--	x	--	x	--	--	--
Cobalt	x	--	--	--	x	--	--	--	--	--	x	x	--	--
Copper	x	x	x	--	x	x	x	x	x	x	x	x	x	x
Cyanide	--	--	x	--	x	--	x	--	x	--	x	x	--	--
Iron	x	x	x	--	x	x	x	x	x	x	x	x	x	x
Lead	x	x	x	--	x	x	x	x	x	x	x	x	x	x
Manganese	x	x	x	--	x	x	x	x	--	x	x	x	x	x
Mercury	x	--	x	--	x	--	x	--	x	--	x	--	--	--
Nickel	x	--	x	--	x	--	--	--	--	--	x	x	--	--
Selenium	x	--	--	--	x	--	x	--	--	--	x	--	--	--
Silver	x	--	x	--	x	x	x	x	x	x	x	x	x	x
Thallium	x	--	x	--	x	--	--	--	x	--	x	--	--	--
Vanadium	x	x	x	--	x	--	x	--	x	--	x	--	--	--
Zinc	x	x	x	--	x	--	x	--	x	--	x	x	--	--

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Table 7-1c: Weight-of-Evidence Documentation														
				Attributes[a]										
Assessment Endpoints	**Measures of effects**	*Descriptive Score*[b]	*Numeric Score*[c]	*Biological Linkage*	*Correlation of Stressor/Response*	*Utility of Measure*	*Quality of Data*	*Site-Specificity*	*Sensitivity*	*Spatial representativeness*	*Temporal Representativeness*	*Quantitativeness*	*Standard Measure*
1. Maintain a stable and healthy benthic invertebrate community	1.A: Compare COPEC levels in sediment samples to conservative benchmarks	L	27	2	2	2	7	1	2	2	3	2	4
	1.B: Measure toxicity in *H. azteca* and *C. dilutus* exposed to bulk sediment	M-H	64	6	7	8	7	8	6	5	7	7	8
	1.F: Evaluate the structure and function of the benthic invertebrate community	M-H	74	9	7	7	7	8	7	5	8	8	8
2. Maintain a stable and healthy fish community	2.A: Evaluate the structure and function of the fish community	H	79	9	7	9	7	8	7	8	8	8	8
	2.B: Compare COPEC levels in surface water samples to conservative benchmarks	L-M	36	4	4	5	7	1	2	4	3	2	4
	2.C: Measure COPEC levels in whole fish to compare against CBRs	M	57	5	4	5	6	8	5	6	8	8	5

US EPA ARCHIVE DOCUMENT

Table 7-1c: Weight-of-Evidence Documentation													
				Attributes[a]									
Assessment Endpoints	**Measures of effects**	*Descriptive Score*[b]	*Numeric Score*[c]	*Biological Linkage*	*Correlation of Stressor/Response*	*Utility of Measure*	*Quality of Data*	*Site-Specificity*	*Sensitivity*	*Spatial representativeness*	*Temporal Representativeness*	*Quantitativeness*	*Standard Measure*
3. Maintain stable and healthy amphibian populations	3.A: Compare COPEC levels in surface water samples to conservative benchmarks	L-M	36	4	4	5	7	1	2	4	3	2	4
4 & 5. Maintain stable and healthy populations of large and small omnivorous birds	4.A & 5.A: Use estimated COPEC levels in earthworms plus food chain modeling to calculate mean and maximum daily doses for comparison to bird TRVs	L-M	41	4	7	3	5	5	2	4	4	2	5
6 & 7. Maintain stable and healthy populations of large and small piscivorous birds	6.A & 7.A: Use measured COPEC levels in fish plus food chain modeling to calculate mean and maximum daily doses for comparison to bird TRVs	M	57	7	7	6	7	7	6	4	4	2	7
8 & 9. Maintain stable and healthy populations of large and small omnivorous mammals	8.A and 9.A: Use estimated COPEC levels in earthworms plus food chain modeling to calculate mean and maximum daily doses for comparison to mammal TRVs	L-M	41	4	7	3	5	5	2	4	4	2	5

US EPA ARCHIVE DOCUMENT

Table 7-1c: Weight-of-Evidence Documentation													
				Attributes[a]									
Assessment Endpoints	**Measures of effects**	*Descriptive Score*[b]	*Numeric Score*[c]	*Biological Linkage*	*Correlation of Stressor/Response*	*Utility of Measure*	*Quality of Data*	*Site-Specificity*	*Sensitivity*	*Spatial representativeness*	*Temporal Representativeness*	*Quantitativeness*	*Standard Measure*
10 & 11. Maintain stable and healthy populations of large and small piscivorous mammals	10.A & 11.A: Use measured COPEC levels in fish plus food chain modeling to calculate mean and maximum daily doses for comparison to mammal TRVs	M	57	7	7	6	7	7	6	4	4	2	7

[a] The attributes are discussed in Menzie et al. (1996) who provide the following guidance for scoring:

Biological Linkage: correlation and/or applicability of the measures of effect with respect to assessment endpoint; linkage based on known biological processes; similarity of effect; target organ, mechanism of action, and level of ecological organization.
Correlation of Stressor/Response: ability of the endpoint to demonstrate effects from chronic exposure to stressor and to correlate effects with degree of exposure; susceptibility and magnitude of effects.
Utility of Measure: applicability, certainty and scientific basis of measure that is used to judge environmental harm; sensitivity of benchmark in detecting environmental harm.
Quality of Data: extent to which data quality objectives (DQOs) are met.
Site-Specificity: representativeness of chemical or biological data, environmental media, species, environmental conditions, benchmark (or reference), and habitat types that are used in the measure of effect relative to those present at the site.
Sensitivity: the percentage of the total possible variability that the endpoint is able to detect; the ability of the measure of effect to detect effects from stressor, rather than from natural or design variability or uncertainty.

US EPA ARCHIVE DOCUMENT

Spatial Representativeness: spatial overlap of study area, measurement or sampling locations, locations of stressors, locations or receptors, and points of potential exposure to those receptors.
Temporal Representativeness: temporal overlap between the measurement period and the period during which chronic effects would likely be detected (daily, weekly, seasonally, annually).
Quantitativeness: results are quantitative/qualitative, subjective/objective, sufficient to test for statistical significance, and extent to which biological significance can be evaluated.
Standard Measure: method availability; ASTM approval, suitability and applicability to endpoint and site; need for modification of method; relationship to impact assessment, field survey, toxicity test, benchmark, toxicity quotient, or tissue residue analysis methodologies.

[b] The overall score derived for each measure of effect is a qualitative measure of its relative importance in characterizing risk at a given assessment endpoint using multiple lines of evidence. The overall score is determined by the *a priori* assignments for the 10 attributes. The scores are defined as follows: Low = 10-30; Low-Medium = 31-45; Medium = 46-60; Medium-High = 61-75; High = 76-100.

[C] The numeric scores represent the sum of all the individual attribute scores for each measure of effect.

US EPA ARCHIVE DOCUMENT

TABLE 7-2a
EXPOSURE PARAMETERS FOR OMNIVOROUS BIRDS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Exposure Variable	Distribution	Parameters		Source
		CTE	RME	
Food intake rate (*FIR* ; kg food ww/kg bw/day)				
Small	Point estimate	0.890 [a]	1.62 [b]	USEPA (1993)
Large	Point estimate	0.770 [g]	1.43 [h]	USEPA (1993)
Proportion of ingested food that is soil (PS_s ; ww basis; unitless)				
Small	Point estimate	0.0166 [f]	0.0249 [d]	USEPA (1993)
Large	Point estimate	0.0166 [f]	0.0250 [d]	USEPA (1993)
Soil intake rate normalized to body weight (*SIR* ; kg sediment/kg bw-day)				
Small	Point estimate	0.015 [f]	0.040 [d]	USEPA (1993)
Large	Point estimate	0.013 [f]	0.036 [d]	USEPA (1993)
Water ingestion rate (*WIR* ; L ww/kg bw/day)				
Small	Point estimate	0.140 [c]	0.210 [d]	USEPA (1993)
Large	Point estimate	0.100 [c]	0.150 [d]	USEPA (1993)
Proportion of contaminated food (P_f ; unitless)	Point Estimate	0.500 [e]	1.00 [e]	Assumption
Proportion of contaminated soil (P_s ; unitless)	Point Estimate	0.500 [e]	1.00 [e]	Assumption
Proportion of contaminated water (P_w ; unitless)	Point Estimate	0.500 [e]	1.00 [e]	Assumption

Notes:
United States Environmental Protection Agency (USEPA) (1993). Wildlife Exposure Factors Handbook. USEPA/600/R-93/187a.
ww - wet weight
Small - represented by the American robin
Large - represented by the American woodcock
CTE - central tendency exposure scenario
RME - reasonable maximum exposure scenario
[a] free-living bird stomach content analysis (average)
[b] average plus one standard deviation
[c] single estimated value
[d] multiplied by an arbitrary factor of 1.5
[e] scenario assumption
[f] converted from dry weight (10.4 percent for American woodcock) using earthworm water content of 84 percent (i.e., conversion factor of 6.25; USEPA, 1993)
[g] based on average earthworm diet
[h] reported 95 percent upper confidence limit

US EPA ARCHIVE DOCUMENT

TABLE 7-2b
EXPOSURE PARAMETERS FOR PISCIVOROUS BIRDS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Exposure Variable		Distribution	Parameters		Source
			CTE	RME	
Food intake rate (*FIR*; kg food ww/kg bw/day)					
	Small	Point estimate	0.500 [c]	0.750 [d]	USEPA (1993)
	Large	Point estimate	0.180 [c]	0.270 [d]	USEPA (1993)
Proportion of ingested food that is sediment (PS_{sed}; ww basis; unitless)					
	Small	Point estimate	0.00500 [f]	0.00750 [d]	USEPA (1993)
	Large	Point estimate	0.00500 [f]	0.00750 [d]	USEPA (1993)
Sediment intake rate normalized to body weight (*SIR*; kg sediment/kg bw-day)					
	Small	Point estimate	0.00250 [f]	0.00563 [d]	USEPA (1993)
	Large	Point estimate	0.00090 [f]	0.00203 [d]	USEPA (1993)
Water ingestion rate (*WIR*; L ww/kg bw/day)					
	Small	Point estimate	0.110 [c]	0.165 [d]	USEPA (1993)
	Large	Point estimate	0.0450 [c]	0.0660 [d]	USEPA (1993)
Proportion of contaminated food (P_f; unitless)		Point Estimate	0.500 [e]	1.00 [e]	Assumption
Proportion of contaminated sediment (P_{sed}; unitless)		Point Estimate	0.500 [e]	1.00 [e]	Assumption
Proportion of contaminated water (P_w; unitless)		Point Estimate	0.500 [e]	1.00 [e]	Assumption

Notes:
United States Environmental Protection Agency (USEPA) (1993). Wildlife Exposure Factors Handbook. USEPA/600/R-93/187a.
ww - wet weight
Small - represented by the belted kingfisher
Large - represented by the great blue heron
CTE - central tendency exposure scenario
RME - reasonable maximum exposure scenario
[b] average plus one standard deviation
[c] single value reported by the USEPA (1993)
[d] multiplied by an arbitrary factor of 1.5
[e] scenario assumption
[f] converted from dry weight (2 percent for teals and ducks) using fish water content of 75 percent (i.e., conversion factor of 4; USEPA, 1993)

US EPA ARCHIVE DOCUMENT

TABLE 7-2c
EXPOSURE PARAMETERS FOR OMNIVOROUS MAMMALS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Exposure Variable	Distribution	Parameters		Source
		CTE	RME	
Food intake rate (*FIR*; kg food ww/kg bw/day)				
Small	Point estimate	0.555 [i]	0.840 [d]	USEPA (1993)
Large	Point estimate	0.110 [i]	0.165 [d]	USEPA (1993)
Proportion of ingested food that is soil (PS_s; ww basis; unitless)				
Small	Point estimate	0.00384 [af]	0.00576 [d]	USEPA (1993)
Large	Point estimate	0.00448 [f]	0.00672 [d]	USEPA (1993)
Soil intake rate normalized to body weight (*SIR*; kg sediment/kg bw-day)				
Small	Point estimate	0.0021 [f]	0.0048 [d]	USEPA (1993)
Large	Point estimate	0.0005 [f]	0.0011 [d]	USEPA (1993)
Water ingestion rate (*WIR*; L ww/kg bw/day)				
Small	Point estimate	0.223 [c]	0.330 [d]	USEPA (1993)
Large	Point estimate	0.0850 [i]	0.128 [d]	USEPA (1993)
Proportion of contaminated food (P_f; unitless)	Point Estimate	0.500 [e]	1.00 [e]	Assumption
Proportion of contaminated soil (P_s; unitless)	Point Estimate	0.500 [e]	1.00 [e]	Assumption
Proportion of contaminated water (P_w; unitless)	Point Estimate	0.500 [e]	1.00 [e]	Assumption

Notes:
United States Environmental Protection Agency (USEPA) (1993). Wildlife Exposure Factors Handbook. USEPA/600/R-93/187a.
ww - wet weight
Small - represented by the short-tailed shrew
Large - represented by the red fox
CTE - central tendency exposure scenario
RME - reasonable maximum exposure scenario
[a] based on meadow vole
[c] single estimated value
[d] multiplied by an arbitrary factor of 1.5
[e] scenario assumption
[f] converted from dry weight using earthworm water content of 85 percent (i.e., conversion factor of 6.25; USEPA, 1993)
[l] average value

US EPA ARCHIVE DOCUMENT

TABLE 7-2d
EXPOSURE PARAMETERS FOR PISCIVOROUS MAMMALS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETRSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Exposure Variable		Distribution	Parameters		Source
			CTE	RME	
Food intake rate (*FIR*; kg food ww/kg bw/day)					
	Small	Point estimate	0.158 [i]	0.240 [d]	USEPA (1993)
	Large	Point estimate	0.0545 [c]	0.0825 [d]	USEPA (1993)
Proportion of ingested food that is sediment (PS_{sed}; ww basis; unitless)					
	Small	Point estimate	0.0235 [f]	0.0353 [d]	WSDE (2007)
	Large	Point estimate	0.0235 [f]	0.0353 [d]	USEPA (1993)
Sediment intake rate normalized to body weight (*SIR*; kg sediment/kg bw-day)					
	Small	Point estimate	0.0037 [f]	0.0085 [d]	WSDE (2007)
	Large	Point estimate	0.0013 [f]	0.0029 [d]	USEPA (1993)
Water ingestion rate (*WIR*; L ww/kg bw/day)					
	Small	Point estimate	0.0790 [i]	0.119 [d]	USEPA (1993)
	Large	Point estimate	0.0810 [i]	0.122 [d]	USEPA (1993)
Proportion of contaminated food (P_f; unitless)		Point Estimate	0.500 [e]	1.00 [e]	Assumption
Proportion of contaminated sediment (P_{sed}; unitless)		Point Estimate	0.500 [e]	1.00 [e]	Assumption
Proportion of contaminated water (P_w; unitless)		Point Estimate	0.500 [e]	1.00 [e]	Assumption

Notes:
United States Environmental Protection Agnecy (USEPA) (1993). Wildlife Exposure Factors Handbook. USEPA/600/R-93/187a.
ww - wet weight
Small - represented by the mink
Large - represented by the river otter
CTE - central tendency exposure scenario
RME - reasonable maximum exposure scenario
[c] estimated using allometric model (Nagy, 1987) for carnivorous mammals, fish metabolizable energy of 4.47 kcal/g, and dw-ww conversion factor of 4
[d] multiplied by an arbitrary factor of 1.5
[e] scenario assumption
[f] converted from dry weight (9.4 percent for raccoon) using fish water content of 75 percent (i.e., conversion factor of 4; USEPA, 1993)
[I] average value
Nagy (1987). Field metabolic rate and food requirements scaling in mammals and birds. Ecol. Monogr. 57:111-128

TABLE 7-3
BIOTA-SOIL ACCUMULATION FACTORS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	Log Kow	Kd	foc	Log Koc	Source	BSoilAF (ww/dw)	Source
VOCs[6]							
1,1-Dichloroethene	2.13	--	--	--	--	0.00	Assumption
2-Butanone	0.29	--	--	--	--	0.00	Assumption
2-Hexanone	1.38	--	--	--	--	0.00	Assumption
4-Methyl-2-pentanone	1.31	--	--	--	--	0.00	Assumption
Acetone	-0.24	--	--	--	--	0.00	Assumption
Carbon disulfide	2.16	--	--	--	--	0.00	Assumption
Chloromethane	0.91	--	--	--	--	0.00	Assumption
cis-1,2-Dichloroethene	1.86	--	--	--	--	0.00	Assumption
Cyclohexane	3.44	--	--	--	--	0.00	Assumption
Isopropylbenzene	3.66	--	--	--	--	0.00	Assumption
Methyl acetate	0.18	--	--	--	--	0.00	Assumption
Methylene chloride	1.25	--	--	--	--	0.00	Assumption
Tetrachloroethene	3.40	--	--	--	--	0.00	Assumption
Trichlorofluoromethane	2.53	--	--	--	--	0.00	Assumption
Xylene (Total)	3.12	--	--	--	--	0.00	Assumption
SVOCs							
2-Methylnaphthalene	3.86	64.5	0.01	3.81	HSDB (2007)	0.354	USEPA (2005)
2-Methylphenol	1.95	0.2	0.01	1.34	HSDB (2007)	2.27	USEPA (2005)
4-Bromophenyl-phenylether	4.94	42.0	0.01	3.62	HSDB (2007)	4.73	USEPA (2005)
4-Chloroaniline	1.83	8.1	0.01	2.91	HSDB (2007)	0.0481	USEPA (2005)
4-Methylphenol	1.94	1.6	0.01	2.20	HSDB (2007)	0.307	USEPA (2005)
4-Nitroaniline	1.39	0.3	0.01	1.49	HSDB (2007)	0.524	USEPA (2005)
Acenaphthylene	--	--	--	--	--	3.66	USEPA (2005)
Acetophenone	1.58	0.1	0.01	1.00	HSDB (2007)	2.37	USEPA (2005)
Anthracene	--	--	--	--	--	0.387	USEPA (2005)
Benzaldehyde	1.48	0.3	0.01	1.53	HSDB (2007)	0.570	USEPA (2005)
Benzo(a)anthracene	--	--	--	--	--	0.254	USEPA (2005)
Benzo(a)pyrene	--	--	--	--	--	0.213	USEPA (2005)
Benzo(b)fluoranthene	--	--	--	--	--	0.416	USEPA (2005)
Benzo(g,h,i)perylene	--	--	--	--	--	0.470	USEPA (2005)
Benzo(k)fluoranthene	--	--	--	--	--	0.416	USEPA (2005)
bis(2-Ethylhexyl)phthalate	7.60	316.2	0.01	4.50	HSDB (2007)	129	USEPA (2005)
Butylbenzylphthalate	4.73	501.2	0.01	4.70	HSDB (2007)	0.260	USEPA (2005)
Carbazole	3.72	6.4	0.01	2.80	HSDB (2007)	2.71	USEPA (2005)
Chrysene	--	--	--	--	--	0.366	USEPA (2005)
Dibenzo(a,h)anthracene	--	--	--	--	--	0.370	USEPA (2005)
Dibenzofuran	4.12	42.0	0.01	3.62	HSDB (2007)	0.914	USEPA (2005)
Di-n-octylphthalate	8.10	6100.0	0.01	5.79	HSDB (2007)	18.3	USEPA (2005)
Fluoranthene	--	--	--	--	--	0.486	USEPA (2005)
Hexachlorobutadiene	4.78	1400.0	0.01	5.15	HSDB (2007)	0.103	USEPA (2005)
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	0.458	USEPA (2005)
Isophorone	1.70	2.0	0.01	2.30	HSDB (2007)	0.151	USEPA (2005)
Naphthalene	--	--	--	--	--	0.704	USEPA (2005)
N-Nitrosodiphenylamine	3.13	12.0	0.01	3.08	HSDB (2007)	0.440	USEPA (2005)
Pentachlorophenol	--	--	--	--	--	41.0	USEPA (2005)
Phenanthrene	--	--	--	--	--	0.275	USEPA (2005)
Pyrene	--	--	--	--	--	0.280	USEPA (2005)
Pesticides							
4,4'-DDD	--	--	--	--	--	0.511	USEPA (2005)
4,4'-DDE	--	--	--	--	--	1.90	USEPA (2005)
4,4'-DDT	--	--	--	--	--	1.34	USEPA (2005)
alpha-Chlordane[3]	--	--	--	--	--	2.85	WSDE (2007)
Dieldrin	--	--	--	--	--	1.56	WSDE (2007)
Endosulfan I	3.83	26.9	0.01	3.43	Howard (1989)	0.798	USEPA (2005)
Endosulfan II[5]	3.83	26.9	0.01	3.43	Howard (1989)	0.798	USEPA (2005)
Endosulfan sulfate[5]	3.83	26.9	0.01	3.43	Howard (1989)	0.798	USEPA (2005)
Endrin	--	--	--	--	--	0.576	WSDE (2007)
Endrin aldehyde[4]	--	--	--	--	--	0.576	WSDE (2007)
Endrin ketone[4]	--	--	--	--	--	0.576	WSDE (2007)
gamma-BHC (Lindane)	--	--	--	--	--	1.62	WSDE (2007)
gamma-Chlordane[3]	--	--	--	--	--	2.85	WSDE (2007)
Heptachlor epoxide	--	--	--	--	--	1.74	WSDE (2007)
Methoxychlor	4.88	825	0.01	4.92	Howard (1989)	0.213	USEPA (2005)
Toxaphene	4.82	2,100	0.01	5.32	Howard (1989)	0.0743	USEPA (2005)

US EPA ARCHIVE DOCUMENT

TABLE 7-3
BIOTA-SOIL ACCUMULATION FACTORS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	Log Kow	Kd	foc	Log Koc	Source	BSoilAF (ww/dw)	Source
Metals							
Aluminum	--	--	--	--	--	0.154	Assumption
Antimony	--	--	--	--	--	0.154	USEPA (2005)
Arsenic	--	--	--	--	--	0.0386	USEPA (2005)
Barium	--	--	--	--	--	0.0146	USEPA (2005)
Cadmium	--	--	--	--	--	1.32	USEPA (2005)
Chromium	--	--	--	--	--	0.0490	USEPA (2005)
Cobalt	--	--	--	--	--	0.0195	USEPA (2005)
Copper	--	--	--	--	--	0.0824	USEPA (2005)
Cyanide	--	--	--	--	--	0.154	Assumption
Iron	--	--	--	--	--	0.154	Assumption
Lead	--	--	--	--	--	0.129	USEPA (2005)
Manganese	--	--	--	--	--	0.0713	USEPA (2005)
Mercury[2]	--	--	--	--	--	0.31	Burton et al. (2006)
Nickel	--	--	--	--	--	0.169	USEPA (2005)
Selenium	--	--	--	--	--	0.148	USEPA (2005)
Silver	--	--	--	--	--	0.327	USEPA (2005)
Thallium	--	--	--	--	--	0.154	Assumption
Vanadium	--	--	--	--	--	0.00672	USEPA (2005)
Zinc	--	--	--	--	--	13.7	USEPA (2005)

Notes:
BSoilAF - biota-to-soil accumulation factor
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
USEPA (2005) BSoilAF values were converted from dry weight to wet weight basis assumingn 84% earthworm moisture content.
[1] log K_{ow} values from Hazardous Substance Database
[2] as total methylmercury for earthworms; reflects conversion of maximum reported BAF (3.1) from dry weight to wet weight value assumi 90% earthworm moisture content.
[3] adopted from chlordane
[4] adopted from endrin
[5] adopted from endosulfan and calculated using a relationship of Jager (1998)
[6] VOCs are not expected to accumulate in biota due to their volatility and limited persistence in the environment

Sources:
USEPA (2005) Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs). OSWER Directive 9285.7-55. February, 2005. Based on data for earthworms.
WSDE (2007). http://www.ecy.wa.gov/programs/tcp/policies
Burton et al. (2006). Bioaccumulation of total mercury and monomethylmercury in the eathworm. Water Air Soil Pollut. 170: 37-54
Howard (1989). Handbook of environmental fate and exposure data. Lewis Publishing.
HSDB (2007). Hazardous Substances Data Base. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB
USEPA (2005) used the following hierarchy of approaches to derive earthworm BSoilAFs depending on availability.
1) Existing Regression (R): If regression models were available and the r-square values were >0.2, then these were preferentially us
2) New Regression (R): If paired data (contaminant concentrations in soil organism or plant versus soil) were sufficient to establish regression models and these models were significant with r-square values >0.2, then these regression models were developed a
3) Ratio (BAF): BAFs (or ratios of the contaminant in soil to the contaminant l the food item) were available from the scientific literatu If reported ratios were not available, then paired data (contaminant in soil versus contaminant in food item) were collected from th literature to derive these ratios.
4) Estimating BAFs or Bi (M for modeled): If BAFs were not available in the literature or the paired data were not available to derive then the Bį was estimated using existing relationships that estimated Bį based on the physical or chemical parameters of the COC. Existing or new models associating contaminant parameters of the contaminant with the potential for accumulation in biota or pla tissue were used to estimate Bį.

US EPA ARCHIVE DOCUMENT

TABLE 7-4a
AVIAN TOXICITY BENCHMARKS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Chemical Name	CAS No.	NOAEL (mg/kgBW/day)	LOAEL (mg/kgBW/day)	Test Species	Source
VOCs					
1,1,1-Trichloroethane	71-55-6	--	--		
1,1,2,2-Tetrachloroethane	79-34-5	--	--		
1,1-Dichloroethene	75-35-4	--	--		
2-Butanone	78-93-3	--	--		
2-Hexanone	591-78-6	--	--		
4-Methyl-2-pentanone	108-10-1	--	--		
Acetone	67-64-1	--	--		
Carbon Disulfide	75-15-0	--	--		
Chloromethane	74-87-3	--	--		
cis-1,2-Dichloroethene	156-59-2	--	--		
cis-1,3-Dichloropropene	10061-01-5	--	--		
Isopropylbenzene	98-82-8	--	--		
Methyl Acetate	79-20-9	--	--		
Methylcyclohexane	108-87-2	--	--		
Methylene chloride	75-09-2	--	--		
Styrene	100-42-5	--	--		
trans-1,3-Dichloropropene	10061-02-6	--	--		
Tetrachloroethene	127-18-4	--	--		
Trichlorofluoromethane	75-69-4	--	--		
Xylene (Total)	1330-20-7	22.8	45.6		Patton & Dieter (1980)
SVOCs					
1,1'-Biphenyl	92-52-4	--	--		
2-Methylnaphthalene	91-57-6	2.86	28.6	bounded NOAEL & lowest LOAEL	USDON (2004)
2-Methylphenol	95-48-7	0.96	9.6	bounded NOAEL & lowest LOAEL	USDON (2004)
4-Bromophenyl-phenylether	101-55-3	--	--		
4-Chloroaniline	106-47-8	1	10	bounded NOAEL & lowest LOAEL	USDON (2004)
4-Methylphenol	106-44-5	0.96	9.6	bounded NOAEL & lowest LOAEL	USDON (2004)
4-Nitroaniline	100-01-6	0.75	7.5	bounded NOAEL & lowest LOAEL	USDON (2004)
Acenaphthene	83-32-9	1.11	11.1	bounded NOAEL & lowest LOAEL	USDON (2004)
Acenaphthylene	208-96-8	1.11	11.1	bounded NOAEL & lowest LOAEL	USDON (2004)
Acetophenone	98-86-2	--	--		
Anthracene	120-12-7	1.11	11.1	bounded NOAEL & lowest LOAEL	USDON (2004)
Benzaldehyde	100-52-7	--	--		
Benzo(a)anthracene	56-55-3	2	20	bounded NOAEL & lowest LOAEL	Trust et al. (1994)/USDON (2004)
Benzo(a)pyrene	50-32-8	10	20		Trust et al. (1994)
Benzo(b)fluoranthene	205-99-2	2	20	bounded NOAEL & lowest LOAEL	Trust et al. (1994)/ USDON (2004)
Benzo(g,h,i)perylene	191-24-2	2	20	bounded NOAEL & lowest LOAEL	Trust et al. (1994)/USDON (2004)
Benzo(k)fluoranthene	207-08-9	2	20	bounded NOAEL & lowest LOAEL	USDON (2004)
bis(2-Ethylhexyl)phthalate	117-81-7	1.1	3.51	ringed dove/bounded NOAEL & lowest LOAEL	Sample et al. (1996)/ USDON (2004)
Butylbenzylphthalate	85-68-7	0.111	1.11	bounded NOAEL & lowest LOAEL	USDON (2004)

US EPA ARCHIVE DOCUMENT

TABLE 7-4a
AVIAN TOXICITY BENCHMARKS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Chemical Name	CAS No.	NOAEL (mg/kgBW/day)	LOAEL (mg/kgBW/day)	Test Species	Source
Carbazole	86-74-8	--	--		
Chrysene	218-01-9	2	20	bounded NOAEL & lowest LOAEL	Trust et al. (1994)/USDON (2004)
Cyclohexane	110-82-7	--	--		
Dibenzo(a,h)anthracene	53-70-3	2	20	bounded NOAEL & lowest LOAEL	Trust et al. (1994)/USDON (2004)
Dibenzofuran	132-64-9	--	--		
Di-N-Octyl phthalate	117-84-0	0.111	1.11	bounded NOAEL & lowest LOAEL	USDON (2004)
Fluoranthene	206-44-0	2	20	bounded NOAEL & lowest LOAEL	Trust et al. (1994)/USDON (2004)
Fluorene	86-73-7	1.11	11.1	bounded NOAEL & lowest LOAEL	USDON (2004)
Hexachlorobenzene	118-74-1	--	--		
Hexachlorobutadiene	87-68-3	--	--		
Indeno(1,2,3-cd)pyrene	193-39-5	2	20	bounded NOAEL & lowest LOAEL	Trust et al. (1994)/USDON (2004)
Isophorone	78-59-1	--	--		
Naphthalene	91-20-3	2.86	28.6	bounded NOAEL & lowest LOAEL	USDON (2004)
N-Nitrosodiphenylamine	86-30-6	--	--		
Pentachlorophenol	87-86-5	--	--		
Phenanthrene	85-01-8	1.11	11.1	bounded NOAEL & lowest LOAEL	USDON (2004)
Phenol	108-95-2	--	--		
Pyrene	129-00-0	2	20	bounded NOAEL & lowest LOAEL	Trust et al. (1994)/ USDON (2004)
Pesticides					
4,4'-DDD	72-54-8	0.0028	0.028	brown pelican (DDT & metabolites)	Sample et al. (1996)
4,4'-DDE	72-55-9	0.0028	0.028	brown pelican (DDT & metabolites)	Sample et al. (1996)
4,4'-DDT	50-29-3	0.0028	0.028	brown pelican (DDT & metabolites)	Sample et al. (1996)
alpha-Chlordane	5103-71-9	0.211	2.11	bounded NOAEL & lowest LOAEL	USDON (2004)
Dieldrin	60-57-1	0.077	0.37	barn owl/bounded NOAEL & lowest LOAEL	Sample et al. (1996)/USDON (2004)
Endosulfan I	959-98-8	0.31	3.1	gray partridge (no I or II designation)/bounded NOAEL & lowest LOAEL	Sample et al. (1996)/USDON (2004)
Endosulfan II	33213-65-9	0.31	3.1	bounded NOAEL & lowest LOAEL	USDON (2004)
Endosulfan sulfate	1031-07-8	0.31	3.1	bounded NOAEL & lowest LOAEL	USDON (2004)
Endrin	72-20-8	0.01	0.1	screech owl/bounded NOAEL & lowest LOAEL	Sample et al. (1996)/USDON (2004)
Endrin aldehyde	7421-93-4	0.0232	0.232	bounded NOAEL & lowest LOAEL	USDON (2004)
Endrin ketone	53494-70-5	0.0232	0.232	bounded NOAEL & lowest LOAEL	USDON (2004)
gamma-BHC (Lindane)	58-89-9	0.563	5.3	bounded NOAEL & lowest LOAEL	USDON (2004)
gamma-Chlordane	5103-74-2	0.211	2.11	bounded NOAEL & lowest LOAEL	USDON (2004)
Heptachlor epoxide	1024-57-3	0.211	2.11	bounded NOAEL & lowest LOAEL	USDON (2004)
Methoxychlor	72-43-5	--	--		
Toxaphene	8001-35-2	0.0531	0.531	bounded NOAEL & lowest LOAEL	USDON (2004)

US EPA ARCHIVE DOCUMENT

TABLE 7-4a
AVIAN TOXICITY BENCHMARKS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Chemical Name	CAS No.	NOAEL (mg/kgBW/day)	LOAEL (mg/kgBW/day)	Test Species	Source
PCBs					
Aroclor 1016	12674-11-2	--	--		
Aroclor 1221	11104-28-2	--	--		
Aroclor 1232	11141-16-5	--	--		
Aroclor 1242	53469-21-9	0.41	0.82	screech owl	Sample et al. (1996)
Aroclor 1248	12672-29-6	--	--		
Aroclor 1254	11097-69-1	0.18	1.8	ring-necked pheasant	Sample et al. (1996)
Aroclor 1260	11096-82-5	--	--		
Metals					
Aluminum	7429-90-5	109.7	1,097	ringed dove	Sample et al. (1996)
Antimony	7440-36-0	--	--		
Arsenic	7440-38-2	1.85	3.88	brown-headed cow bird	USDON (2004)
Barium	7440-39-3	20.8	41.7	1-day old chicks	Sample et al. (1996)
Beryllium	7440-41-7	--	--		
Cadmium	7440-43-9	1.45	3.05	mallard duck	Sample et al. (1996)/USDON (2004)
Chromium	7440-47-3	1	5	black duck	Sample et al. (1996)/USDON (2004)
Cobalt	7440-48-4	--	--		
Copper	7440-50-8	22.3	31.5	1-day old chicks	USDON (2004)
Cyanide	57-12-5	--	--		
Iron	7439-89-6	--	--		
Lead	7439-92-1	0.0114	0.114	American kestrel	USDON (2004)
Manganese	7439-96-5	77.6	776	Japanese quail	USDON (2004)
Mercury	7439-97-6	0.0064	0.064	Japanese quail	Sample et al. (1996)
Nickel	7440-02-0	25.1	45.3	mallard duckling	USDON (2004)
Selenium	7782-49-2	0.4	0.603	mallard duck/black-crowned night heron	Sample et al. (1996)/USDON (2004)
Silver	7440-22-4	9.36	19.2	bounded NOAEL & lowest LOAEL	USDON (2004)
Thallium	7440-28-0	--	--		
Vanadium	7440-62-2	11.4	22.8	mallard duck	Sample et al. (1996)
Zinc	7440-66-6	14.5	131	white leghorn hen	Sample et al. (1996)/USDON (2004)

Notes:
Shaded cells indicates a LOAEL is not available for birds. Value is estimated as 2 times the NOAEL value.
-- - not listed
CAS - chemical abstract number
NOAEL - no observable adverse effect level
LOAEL - lowest observable adverse effect level

US EPA ARCHIVE DOCUMENT

TABLE 7-4b
MAMMALIAN TOXICITY BENCHMARKS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Chemical Name	CAS No.	NOAEL (mg/kgBW/day)	LOAEL (mg/kgBW/day)	Test Species	Source
VOCs					
1,1,1-Trichloroethane	71-55-6	1000	2000	mouse	Sample et al. (1996)
1,1,2,2-Tetrachloroethane	79-34-5	--	--		
1,1-Dichloroethene	75-35-4	--	--		
2-Butanone	78-93-3	--	--		
2-Hexanone	591-78-6	--	--		
4-Methyl-2-pentanone	108-10-1	25	50	rat	Sample et al. (1996)
Acetone	67-64-1	10	50	rat	Sample et al. (1996)
Carbon Disulfide	75-15-0	--	--		
Chloromethane	74-87-3	--	--		
cis-1,2-Dichloroethene	156-59-2	--	--		
cis-1,3-Dichloropropene	10061-01-5	--	--		
Isopropylbenzene	98-82-8	--	--		
Methyl Acetate	79-20-9	--	--		
Methylcyclohexane	108-87-2	--	--		
Methylene chloride	75-09-2	5.85	50	rat	Sample et al. (1996)
Styrene	100-42-5	--	--		
trans-1,3-Dichloropropene	10061-02-6	--	--		
Tetrachloroethene	127-18-4	--	--		
Trichlorofluoromethane	75-69-4	--	--		
Xylene (Total)	1330-20-7	2.1	2.6	mouse	Sample et al. (1996)/IRIS (2005)
SVOCs					
1,1'-Biphenyl	92-52-4	--	--		
2-Methylnaphthalene	91-57-6	5	10		Navarro et al. (1991)
2-Methylphenol	95-48-7	--	--		
4-Bromophenyl-phenylether	101-55-3	--	--		
4-Chloroaniline	106-47-8	--	--		
4-Methylphenol	106-44-5	--	--		
4-Nitroaniline	100-01-6	--	--		
Acenaphthene	83-32-9	5	10		Navarro et al. (1991)
Acenaphthylene	208-96-8	5	10		Navarro et al. (1991)
Acetophenone	98-86-2	--	--		
Anthracene	120-12-7	5	10		Navarro et al. (1991)
Benzaldehyde	100-52-7	--	--		
Benzo(a)anthracene	56-55-3	1	2		McKenzie and Angevine (1981)
Benzo(a)pyrene	50-32-8	1	10	mouse	Sample et al. (1996)
Benzo(b)fluoranthene	205-99-2	1	2		McKenzie and Angevine (1981)
Benzo(g,h,i)perylene	191-24-2	1	2		McKenzie and Angevine (1981)
Benzo(k)fluoranthene	207-08-9	--	--		
bis(2-Ethylhexyl)phthalate	117-81-7	18.3	183	mouse	Sample et al. (1996)
Butylbenzylphthalate	85-68-7	--	--		
Carbazole	86-74-8	--	--		
Chrysene	218-01-9	1	2		McKenzie and Angevine (1981)
Cyclohexane	110-82-7	--	--		
Dibenzo(a,h)anthracene	53-70-3	1	2		McKenzie and Angevine (1981)
Dibenzofuran	132-64-9	--	--		
Di-N-Octyl phthalate	117-84-0	7500	15000	mouse	USEPA (1999)
Fluoranthene	206-44-0	1	2		McKenzie and Angevine (1981)
Fluorene	86-73-7	5	10		Navarro et al. (1991)
Hexachlorobenzene	118-74-1	1.6	3.2	rat	USEPA (1999)
Hexachlorobutadiene	87-68-3	0.2	0.4	rat	USEPA (1999)
Indeno(1,2,3-cd)pyrene	193-39-5	1	--		McKenzie and Angevine (1981)
Isophorone	78-59-1	--	--		
Naphthalene	91-20-3	5	10		Navarro et al. (1991)
N-Nitrosodiphenylamine	86-30-6	--	--		
Pentachlorophenol	87-86-5	0.24	2.4	rat	Sample et al. (1996)
Phenanthrene	85-01-8	5	10		Navarro et al. (1991)
Phenol	108-95-2	--	--		
Pyrene	129-00-0	1	2		McKenzie and Angevine (1981)

US EPA ARCHIVE DOCUMENT

TABLE 7-4b
MAMMALIAN TOXICITY BENCHMARKS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Chemical Name	CAS No.	NOAEL (mg/kgBW/day)	LOAEL (mg/kgBW/day)	Test Species	Source
Pesticides					
4,4'-DDD	72-54-8	0.8	4	rat (DDT & metabolites)	Sample et al. (1996)
4,4'-DDE	72-55-9	0.8	4	rat (DDT & metabolites)	Sample et al. (1996)
4,4'-DDT	50-29-3	0.8	4	rat (DDT & metabolites)	Sample et al. (1996)
alpha-Chlordane	5103-71-9	--	--		
Dieldrin	60-57-1	0.02	0.2	rat	Sample et al. (1996)
Endosulfan I	959-98-8	0.15	0.3	designation)	Sample et al. (1996)
Endosulfan II	33213-65-9	--	--		
Endosulfan sulfate	1031-07-8	--	--		
Endrin	72-20-8	0.092	0.92	mouse	Sample et al. (1996)
Endrin aldehyde	7421-93-4	--	--		
Endrin ketone	53494-70-5	--	--		
gamma-BHC (Lindane)	58-89-9	--	--		
gamma-Chlordane	5103-74-2	--	--		
Heptachlor epoxide	1024-57-3	--	--		
Methoxychlor	72-43-5	4	8	rat	Sample et al. (1996)
Toxaphene	8001-35-2	8	16	rat	Sample et al. (1996)
PCBs					
Aroclor 1016	12674-11-2	1.37	3.43	mink	Sample et al. (1996)
Aroclor 1221	11104-28-2	--	--		
Aroclor 1232	11141-16-5	--	--		
Aroclor 1242	53469-21-9	0.069	0.69	mink	Sample et al. (1996)
Aroclor 1248	12672-29-6	0.01	0.1	Rhesus monkey	Sample et al. (1996)
Aroclor 1254	11097-69-1	0.068	0.68	mouse	Sample et al. (1996)
Aroclor 1260	11096-82-5	--	--		
Metals					
Aluminum	7429-90-5	1.93	19.3	mouse	Sample et al. (1996)
Antimony	7440-36-0	0.125	0.66	mouse/rat	Sample et al. (1996)/USEPA (1999)
Arsenic	7440-38-2	0.126	1.26	mouse	Sample et al. (1996)
Barium	7440-39-3	0.51	19.8	rat	USEPA (1999)/Sample et al. (1996)
Beryllium	7440-41-7	0.66	1.32	rat	Sample et al. (1996)
Cadmium	7440-43-9	1	2.52	rat/mouse	Sample et al. (1996)/USEPA (1999)
Chromium	7440-47-3	3.28	13.14	rat	Sample et al. (1996)
Cobalt	7440-48-4	--	--		
Copper	7440-50-8	11.7	15.14	mink	Sample et al. (1996)
Cyanide	57-12-5	24	48	rat/rat	USEPA (1999)
Iron	7439-89-6	--	--		
Lead	7439-92-1	8	80	rat/rat	USEPA (1999)/Sample et al. (1996)
Manganese	7439-96-5	88	284	rat	Sample et al. (1996)
Mercury	7439-97-6	0.015	0.025	mink	Sample et al. (1996)
Nickel	7440-02-0	40	80	rat/rat	Sample et al. (1996)
Selenium	7782-49-2	0.2	0.33	rat	Sample et al. (1996)
Silver	7440-22-4	N/A	3.75	mouse	USEPA (1999)
Thallium	7440-28-0	0.0074	0.074	rat	Sample et al. (1996)
Vanadium	7440-62-2	0.21	2.1	rat	Sample et al. (1996)
Zinc	7440-66-6	160	320	rat	Sample et al. (1996)

Notes:
Shaded cells indicates a LOAEL is not available for mammals. Value is estimated as 2 times the NOAEL value.
-- - not listed
CAS - chemical abstract number
NOAEL - no observable adverse effect level
LOAEL - lowest observable adverse effects level

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

TABLE 7-5a
SELECTION OF SCREENING CRITERIA FOR VOLATILE ORGANIC COMPOUNDS IN SEDIMENT

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	Threshold Effect Concentrations[a] (µg/kg)	Probable Effect Concentrations[a] (µg/kg)	USEPA OSWER Values[b] (µg/kg)	OMEE Lowest Effects Levels[c] (µg/kg)	OMEE Severe Effects Levels[c] (µg/kg)	ORNL Sediment Secondary Chronic Values[d] (µg/kg)	USEPA Region IV[e] (µg/kg)	SLERA Screening Criteria (µg/kg)	Effect Benchmark[f] (µg/kg)
	Primary		Secondary	Tertiary		Quaternary			
1,1,1-Trichloroethane	--	--	170	--	--	30	--	170	2,210
1,1,2,2-Tetrachloroethane	--	--	940	--	--	1,400	--	940	12,220
1,1,2-Trichloro-1,2,2-trifluoroeth	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	1,200	--	1,200	15,600
1,1-Dichloroethane	--	--	--	--	--	27	--	27	351
1,1-Dichloroethene	--	--	--	--	--	31	--	31	403
1,2,4-Trichlorobenzene	--	--	9,200	--	--	9,600	--	9,200	119,600
1,2-Dibromo-3-chloropropane	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	340	--	--	330	--	340	4,420
1,2-Dichloroethane	--	--	--	--	--	250	--	250	3250
1,2-Dichloropropane	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	--	--	1,700	--	--	1,700	--	1,700	22,100
1,4-Dichlorobenzene	--	--	350	--	--	340	--	350	4,550
2-Butanone	--	--	--	--	--	270	--	270	3510
2-Hexanone	--	--	--	--	--	22	--	22	286
4-Methyl-2-pentanone	--	--	--	--	--	33	--	33	429
Acetone	--	--	--	--	--	8.7	--	8.7	113.1
Benzene	--	--	57	--	--	160	--	57	741
Bromodichloromethane	--	--	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--	--	--
Bromomethane	--	--	--	--	--	--	--	--	--
Carbon Disulfide	--	--	--	--	--	0.85	--	0.85	11.05
Carbon Tetrachloride	--	--	--	--	--	47	--	47	611
Chlorobenzene	--	--	820	--	--	410	--	820	10,660
Chloroethane	--	--	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	22	--	22	286
Chloromethane	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--
Cyclohexane	--	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-5a
SELECTION OF SCREENING CRITERIA FOR VOLATILE ORGANIC COMPOUNDS IN SEDIMENT

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	Threshold Effect Concentrations[a] (µg/kg)	Probable Effect Concentrations[a] (µg/kg)	USEPA OSWER Values[b] (µg/kg)	OMEE Lowest Effects Levels[c] (µg/kg)	OMEE Severe Effects Levels[c] (µg/kg)	ORNL Sediment Secondary Chronic Values[d] (µg/kg)	USEPA Region IV[e] (µg/kg)	SLERA Screening Criteria (µg/kg)	Effect Benchmark[f] (µg/kg)
	Primary		Secondary	Tertiary		Quaternary			
Dibromochloromethane	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	3,600	--	--	89	--	3,600	46,800
Isopropylbenzene	--	--	--	--	--	--	--	--	--
Methyl Acetate	--	--	--	--	--	--	--	--	--
Methyl tert-Butyl Ether	--	--	--	--	--	--	--	--	--
Methylcyclohexane	--	--	--	--	--	--	--	--	--
Methylene Chloride	--	--	--	--	--	370	--	370	4810
Styrene	--	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	410	--	410	5,330
Toluene	--	--	670	--	--	50	--	670	8,710
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	220	--	220	2,860
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--
Xylene (total)	--	--	25	--	--	160	--	25	325

Notes:
SLERA - screening level ecological risk assessment
USEPA - United States Environmental Protection Agency
OSWER - Office of Solid Waste and Emergency Response
OMEE - Ontario Ministry of Environment and Energy
ORNL - Oak Ridge National Laboratory
NA - not available
µg/kg - micrograms per kilogram
Criteria are based on assumed 1% organic carbon content
Criteria selected based on heirarchy and sources presented in Attachment 1 of the enclosure to the March 2004 Agency Comment Letter
Database Summary Report (DBSR)
Peterson Puritan Superfund Site - OU2 RI/FS - Comments to the draft Shield Environmental Associates, Inc.
Initial Site Characterization Report (ISCR) submittals.
and
a - MacDonald, D.D., C.G. Ingersoll and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwate
ystems. Arch. Environ. Contam. Toxicol. 39:20-31
b - USEPA. 1996. ECO Update: Ecotox Thresholds. USEPA OSWER. EPA-540/F-95/038. January 1996
c - Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario
gust 1993.
d - Jones, D.S., G.W. Suter, and R.N. Hull. 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated
gy. ES/ER/TM-95/R4. November 1997
e - USEPA Region IV. 1995. EPA Region IV Ecological Screening Values for Sediments (as resported in Jones et al. 1997)
f - Effect benchmarks are consensus based PECs if available or SELs in the absence of PECs. Per Agency comments, for benchmarks
guidance which do not provide an "effect" benchmark, the effect benchmark is equal to the no-effect benchmark (SLERA screening criteria) multiplied
derived from the median PEC/TEC and SEL/LEL ratios for PAHs from Persaud et al., or 13
b

US EPA ARCHIVE DOCUMENT

TABLE 7-5b
SELECTION OF SCREENING CRITERIA FOR SEMIVOLATILE ORGANIC COMPOUNDS IN SEDIMENT

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	Threshold Effect Concentrations[a] (µg/kg)	Probable Effect Concentrations[a] (µg/kg)	USEPA OSWER Values[b] (µg/kg)	OMEE Lowest Effects Levels[c] (µg/kg)	OMEE Severe Effects Levels[c] (µg/kg)	ORNL Sediment Secondary Chronic Values[d] (µg/kg)	USEPA Region IV[e] (µg/kg)	SLERA Screening Criteria (µg/kg)	Effect Benchmark[f] (µg/kg)
	Primary		Secondary	Tertiary		Quaternary			
1,1'-Biphenyl	--	--	--	--	--	--	--	--	--
2,2'-oxybis(1-Chloropropane)	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	--	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	--	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	--	--	--	--	--	--	--	--	--
2-Chlorophenol	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	330	330	4290
2-Methylphenol	--	--	--	--	--	12	--	12	156
2-Nitroaniline	--	--	--	--	--	--	--	--	--
2-Nitrophenol	--	--	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	--	--	--	--	--	--	--	--	--
3-Nitroaniline	--	--	--	--	--	--	--	--	--
4,6-Dinitro-2-methylphenol	--	--	--	--	--	--	--	--	--
4-Bromophenyl-phenylether	--	--	1,300	--	--	1,200	--	1,300	16,900
4-Chloro-3-methylphenol	--	--	--	--	--	--	--	--	--
4-Chloroaniline	--	--	--	--	--	--	--	--	--
4-Chlorophenyl-phenylether	--	--	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	--	--	--	--
4-Nitroaniline	--	--	--	--	--	--	--	--	--
4-Nitrophenol	--	--	--	--	--	--	--	--	--
Acenaphthene	--	--	620	--	--	--	330	620	8060
Acenaphthylene	--	--	--	--	--	--	330	330	4290
Acetophenone	--	--	--	--	--	--	--	--	--
Anthracene	57.2	845	--	220	3,700	220	330	57.2	845
Atrazine	--	--	--	--	--	--	--	--	--
Benzaldehyde	--	--	--	--	--	--	--	--	--
Benzo[a]anthracene	108	1,050	--	320	14,800	110	330	108	1050
Benzo(a)pyrene	150	1,450	430	370	14,400	140	330	150	1450
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	--	--	--	170	320	--	--	170	320
Benzo(k)fluoranthene	--	--	--	--	--	--	--	--	--
bis(2-Chloroethoxy)methane	--	--	--	--	--	--	--	--	--
bis(2-Chloroethyl)ether	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	--	--	--	890,000	182	890,000	11,570,000
Butyl benzyl phthalate	--	--	11,000	--	--	11,000	--	11,000	143,000
Caprolactum	--	--	--	--	--	--	--	--	--
Carbazole	--	--	--	--	--	--	--	--	--
Chrysene	166	1,290	--	340	4,600	--	--	166	1,290

US EPA ARCHIVE DOCUMENT

TABLE 7-5b
SELECTION OF SCREENING CRITERIA FOR SEMIVOLATILE ORGANIC COMPOUNDS IN SEDIMENT

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	Threshold Effect Concentrations[a] (µg/kg)	Probable Effect Concentrations[a] (µg/kg)	USEPA OSWER Values[b] (µg/kg)	OMEE Lowest Effects Levels[c] (µg/kg)	OMEE Severe Effects Levels[c] (µg/kg)	ORNL Sediment Secondary Chronic Values[d] (µg/kg)	USEPA Region IV[e] (µg/kg)	SLERA Screening Criteria (µg/kg)	Effect Benchmark[f] (µg/kg)
	Primary		Secondary	Tertiary		Quaternary			
Dibenz[a,h]anthracene	33	429	--	60	780	--	330	33	429
Dibenzofuran	--	--	2,000	--	--	420	--	2,000	26,000
Diethylphthalate	--	--	630	--	--	600	--	630	8190
Dimethylphthalate	--	--	--	--	--	--	--	--	--
Di-n-butylphthalate	--	--	11,000	--	--	11,000	--	11,000	143,000
Di-n-octylphthalate	--	--	--	--	--	--	--	--	--
Fluoranthene	420	2,230	2,900	750	10,200	--	330	420	2,230
Fluorene	77.4	536	--	190	1,600	540	330	77.4	536
Hexachlorobenzene	--	--	--	20	260	--	--	20	260
Hexachlorobutadiene	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	--	--	--	--	--	--	--	--	--
Hexachloroethane	--	--	1,000	--	--	1,000	--	1,000	13,000
Indeno(1,2,3-cd)pyrene	--	--	--	200	2,600	--	--	200	2600
Isophorone	--	--	--	--	--	--	--	--	--
Naphthalene	176	561	480	--	--	240	330	176	561
Nitrobenzene	--	--	--	--	--	--	--	--	--
N-Nitroso-di-n-propylamine	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--
Pentachlorophenol	--	--	--	--	--	--	--	--	--
Phenanthrene	204	1,170	850	560	9,500	--	330	204	1,170
Phenol	--	--	--	--	--	--	--	--	--
Pyrene	195	1,520	660	490	8,500	--	330	195	1520

Notes:
SLERA - screening level ecological risk assessment
USEPA - United States Environmental Protection Agency
OSWER - Office of Solid Waste and Emergency Response
OMEE - Ontario Ministry of Environment and Energy
ORNL - Oak Ridge National Laboratory
NA - not available
µg/kg - micrograms per kilogram
Criteria are based on assumed 1% organic carbon content.
Criteria selected based on heirarchy and sources presented in Attachment 1 of the enclosure to the March 2004 Agency Comment Letter - Peterson Puritan Superfund Site - OU2 RI/FS - Comments to the draft Shield Environmental Associates, Inc. *Initial Site Characterization Report* (ISCR) submittals.
Database Summary Report (DBSR)
and
a - MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.
b - USEPA. 1996. ECO Update. Ecotox Thresholds. USEPA OSWER. EPA-540/F-95/038. January 1996.
c - Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. OMEE. August 1993.
d - Jones, D.S., G.W. Suter, and R.N. Hull. 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision. Prepared for the U.S. Department of Energy. ES/ER/TM-95/R4. November 1997
e - USEPA Region IV. 1995. EPA Region IV Ecological Screening Values for Sediments (as resported in Jones et al. 1997)
f - Effect benchmarks are consensus based PECs if available or SELs in the absence of PECs. Per Agency comments, for benchmarks derived from guidance which do not provide an "effect" benchmark, the effect benchmark is equal to the no-effect benchmark (SLERA screening criteria) multiplied by the median PEC/TEC and SEL/LEL ratios for PAHs from Persaud et al., or 13

US EPA ARCHIVE DOCUMENT

TABLE 7-5c
SELECTION OF SCREENING CRITERIA FOR PESTICIDES AND PCBS IN SEDIMENT

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	Threshold Effect Concentrations[a] (µg/kg)	Probable Effect Concentrations[a] (µg/kg)	USEPA OSWER Values[b] (µg/kg)	OMEE Lowest Effects Levels[c] (µg/kg)	OMEE Severe Effects Levels[c] (µg/kg)	ORNL Sediment Secondary Chronic Values[d] (µg/kg)	USEPA Region IV[e] (µg/kg)	SLERA Screening Criteria (µg/kg)	Effect Benchmark[f] (µg/kg)
Pesticides									
4,4'-DDD	4.9	28.0	--	8	60	110	3.3	4.9	28.0
4,4'-DDE	3.2	31.3	--	5	190	--	3.3	3.2	31.3
4,4'-DDT	4.2	62.9	1.6 (total DDT)	7 (total DDT)	120	340	3.3	4.2	62.9
Aldrin	--	--	--	2	80	--	--	2	80
alpha-BHC	--	--	--	6	100	120	--	6	100
alpha-Chlordane	3.2 (chlordane)	17.6	--	7 (chlordane)	60	--	1.7 (chlordane)	3.2	17.6
beta-BHC	--	--	--	5	210	120	--	5	210
delta-BHC	--	--	--	--	10	120	--	120	10
Dieldrin	1.9	61.8	52	2	910	--	3.3	1.9	61.8
Endosulfan I	--	--	2.9	--	--	5.5	--	2.9	72.5
Endosulfan II	--	--	--	--	--	5.5	--	5.5	137.5
Endosulfan sulfate	--	--	--	--	--	--	--	--	--
Endrin	2.2	207	20	3	1300	--	3.3	2.2	207.0
Endrin aldehyde	--	--	--	--	--	--	--	--	--
Endrin ketone	--	--	--	--	--	--	--	--	--
gamma-BHC (Lindane)	2.4	5.0	3.7	3	10	120	3.3	2.4	5.0
gamma-Chlordane	--	--	--	--	--	--	--	--	--
Heptachlor	--	--	--	--	--	68	--	68	1700
Heptachlor epoxide	2.5	16.0	--	5	50	--	--	2.5	16.0
Methoxychlor	--	--	19	--	--	--	--	19	475
Toxaphene	--	--	28	--	--	--	--	28	700
PCBs									
Aroclor-1016	60	676	23	7	530	--	33	60	676
Aroclor-1221	60	676	23	--	--	120	33	60	676
Aroclor-1232	60	676	23	--	--	600	33	60	676
Aroclor-1242	60	676	23	--	--	170	33	60	676
Aroclor-1248	60	676	23	30	1500	1,000	33	60	676
Aroclor-1254	60	676	23	60	340	810	33	60	676
Aroclor-1260	60	676	23	5	240	4,500,000	33	60	676
Total PCBs	60	676	23	--	5,300	--	33	60	676

Notes:
SLERA - screening level ecological risk assessment
USEPA - United States Environmental Protection Agency
OSWER - Office of Solid Waste and Emergency Response
OMEE - Ontario Ministry of Environment and Energy
ORNL - Oak Ridge National Laboratory
NA - not available
µg/kg - micrograms per kilogram
Criteria are based on assumed 1% organic carbon content.
Criteria selected based on heirarchy and sources presented in Attachment 1 of the enclosure to the March 2004 Agency Comment Letter - Peterson Puritan Superfund Site, OU2 RI/FS - Comments to the Draft Shield Environmental Associates, Inc. *Database Summary Report* (DBSR) and *Initial Site Charaterization Report* (ISCR) submittals.

a - MacDonald, D.D., C.G. Ingersoll and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.
b - USEPA. 1996. ECO Update: Ecotox Thresholds. USEPA OSWER. EPA-540/F-95/038. January 1996.
c - Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. OMEE. August 1993.
d - Jones, D.S., G.W. Suter, and R.N. Hull. 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision. Prepared for the U.S. Department of Energy. ES/ER/TM-95/R4. November 1997.
e - USEPA Region IV. 1995. EPA Region IV Ecological Screening Values for Sediments (as resported in Jones et al. 1997).
f - Effect benchmarks are consensus based PECs if available or SELs in the absence of PECs. Per Agency comments, for benchmarks derived from guidance which do not provide an "effect" benchmark, the effect benchmark is equal to the no-effect benchmark (SLERA screening criteria) multiplied by the median PEC/TEC and SEL/LEL ratios for pesticides from Persaud et al., or 25.

US EPA ARCHIVE DOCUMENT

TABLE 7-5d
SELECTION OF SCREENING CRITERIA FOR METALS IN SEDIMENT

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	Threshold Effect Concentrations[a] (mg/kg)	Probable Effect Concentrations[a] (mg/kg)	USEPA OSWER Values[b] (mg/kg)	OMEE Lowest Effects Levels[c] (mg/kg)	OMEE Severe Effects Levels[c] (mg/kg)	ORNL Sediment Secondary Chronic Values[d] (mg/kg)	USEPA Region IV[e] (mg/kg)	SLERA Screening Criteria (mg/kg)	Effect Benchmark[f] (mg/kg)
	Primary		Secondary	Tertiary		Quaternary			
Aluminum	--	--	--	--	--	--	--	--	--
Antimony	--	--	--	--	--	--	12	12	60
Arsenic	9.8	33	8.2	6	33	--	7.2	9.8	33.0
Barium	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--
Cadmium	0.99	5.0	1.2	0.6	10	--	1	1	4.98
Chromium	43	111	81	26	110	--	52	43	111
Cobalt	--	--	--	--	--	--	--	--	--
Copper	32	149	34	16	110	--	19	32	149
Iron	--	--	--	20,000	40,000	--	--	20,000	40,000
Lead	36	128	47	31	250	--	30	36	128
Manganese	--	--	--	1100	5500	--	--	460	5500
Mercury	0.18	1.1	0.15	0.2	2	--	0.13	0.18	1.06
Nickel	23	49	21	16	75	--	16	23	48.6
Selenium	--	--	--	--	--	--	--	--	--
Silver	--	--	--	--	--	--	2	2	10
Thallium	--	--	--	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--	--	--	--
Zinc	121	459	150	120	820	--	124	120	459
Cyanide	--	--	--	--	--	--	--	--	--

Notes:
SLERA - screening level ecological risk assessment
USEPA - United States Environmental Protection Agency
OSWER - Office of Solid Waste and Emergency Response
OMEE - Ontario Ministry of Environment and Energy
ORNL - Oak Ridge National Laboratory
NA - not available
mg/kg - miligrams per kilogram
Criteria are based on assumed 1% organic carbon content.
Criteria selected based on heirarchy and sources presented in Attachment 1 of the enclosure to the March 2004 Agency Comment Letter -
Peterson Puritan Superfund Site, OU2 RI/FS - Comments to the draft Shield Environmental Associates, Inc. *Database Summary Report* (DBSR) and *Initial Site Characterization Report* (ISCR) submittals.
a - MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.
b - USEPA. 1996. ECO Update: Ecotox Thresholds. USEPA OSWER. EPA-540/F-95/038. January 1996.
c - Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. OMEE. August 1993.
d - Jones, D.S., G.W. Suter, and R.N. Hull. 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision. Prepared for the U.S. Department of Energy. ES/ER/TM-95/R4. November 1997
e - USEPA Region IV. 1995. EPA Region IV Ecological Screening Values for Sediments (as resported in Jones et al. 1997)
f - Effect benchmarks are consensus based PECs if available or SELs in the absence of PECs. Per Agency comments, for benchmarks derived from guidance which do not provide an "effect" benchmark, the effect benchmark is equal to the no-effect benchmark (SLERA screening criteria) multiplied by the median PEC/TEC and SEL/LEL ratios for metals from Persaud et al., or 5

US EPA ARCHIVE DOCUMENT

TABLE 7-5e
SELECTION OF SCREENING CRITERIA FOR VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	USEPA Ambient Water Quality Criteria - Chronic[a] (µg/L)	USEPA Ambient Water Quality Criteria - Acute[a] (µg/L)	USEPA Ecotox Thresholds for Surface Water[b] (µg/L)	ORNL Secondary Chronic Values for Aquatic Biota[c] (µg/L)	Acute Benchmarks[d] (µg/L)	Chronic Benchmarks (µg/L)
	Primary		Secondary	Tertiary		
1,1,1-Trichloroethane	NA	NA	62	11	620	62
1,1,2,2-Tetrachloroethane	NA	NA	420	610	4200	420
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	1,200	12,000	1,200
1,1-Dichloroethane	NA	NA	47	47	470	47
1,1-Dichloroethene	NA	NA	NA	25	250	25
1,2,4-Trichlorobenzene	NA	NA	110	110	1100	110
1,2-Dibromo-3-chloropropane	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	14	14	140	14
1,2-Dichloroethane	NA	NA	NA	910	9100	910
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	71	71	710	71
1,4-Dichlorobenzene	NA	NA	15	15	150	15
2-Butanone	NA	NA	NA	14,000	140,000	14,000
2-Hexanone	NA	NA	NA	99	990	99
4-Methyl-2-pentanone	NA	NA	NA	170	1700	170
Acetone	NA	NA	NA	1,500	15,000	1,500
Benzene	NA	NA	46	130	460	46
Bromodichloromethane	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA
Carbon Disulfide	NA	NA	NA	0.92	9.2	0.92
Carbon Tetrachloride	NA	NA	NA	9.8	98	9.8
Chlorobenzene	NA	NA	130	64	1300	130
Chloroethane	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	28	280	28
Chloromethane	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	NA	NA	NA	590	5900	590
cis-1,3-Dichloropropene	NA	NA	NA	0.06	0.55	0.06
Cyclohexane	NA	NA	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA

US EPA ARCHIVE DOCUMENT

TABLE 7-5e
SELECTION OF SCREENING CRITERIA FOR VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	USEPA Ambient Water Quality Criteria - Chronic[a] (µg/L)	USEPA Ambient Water Quality Criteria - Acute[a] (µg/L)	USEPA Ecotox Thresholds for Surface Water[b] (µg/L)	ORNL Secondary Chronic Values for Aquatic Biota[c] (µg/L)	Acute Benchmarks[d] (µg/L)	Chronic Benchmarks (µg/L)
	Primary		Secondary	Tertiary		
Ethylbenzene	NA	NA	290	7.3	2900	290
Isopropylbenzene	NA	NA	NA	NA	NA	NA
Methyl Acetate	NA	NA	NA	NA	NA	NA
Methyl tert-Butyl Ether	NA	NA	NA	NA	NA	NA
Cyclohexane, methyl-	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	2,200	22,000	2,200
Styrene	NA	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	98	980	98
Toluene	NA	NA	130	9.8	1300	130
trans-1,2-Dichloroethene	NA	NA	NA	590	5900	590
trans-1,3-Dichloropropene	NA	NA	NA	0.06	0.55	0.06
Trichloroethene	NA	NA	NA	47	470	47
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA
Xylene (total)	NA	NA	1.8	13	18	1.8

Notes:
SLERA - screening level ecological risk assessment
USEPA - United States Environmental Protection Agency
ORNL - Oak Ridge National Laboratory
NA - not available
µg/L - micrograms per liter
Criteria selected based on hierarchy and sources presented in Attachment 1 of the enclosure to the March 2004 Agency Comment Letter - Comments to the draft Shield Environmental Associates, Inc. *Database Summary Report* (DBSR) and *Initial Site Characterization Report* (ISCR) submittals.
Peterson Puritan Superfund Site, OU2 RI/FS
a - USEPA. 2002. Nationally recommended water quality criteria: 2002. Office of Water, Science, and Technology. EPA 822-R-02-047.
b - USEPA. 1996. ECO Update: Ecotox Thresholds. USEPA Office of Solid Waste and Emergency Response. EPA-540/F-95/038. January 1996.
c - Suter, G.W., II. and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota, Environmental Sciences Division. ORNL. ES/ER/TM-96/R2.
1996 revision.
d - For constituents without a corresponding effects level, the SLERA screening value was conservatively multiplied by a factor of 10 to estimate the potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-5f
SELECTION OF SCREENING CRITERIA FOR SEMIVOLATILE ORGANIC COMPOUNDS IN SURFACE WATER

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	USEPA Ambient Water Quality Criteria[a] - Criterion Continuous Concentration (µg/L)	USEPA Ambient Water Quality Criteria - Criterion Maximum Concentration[a] (µg/L)	USEPA Ecotox Thresholds for Surface Water[b] (µg/L)	ORNL Secondary Chronic Values for Aquatic Biota[c] (µg/L)	SLERA Screening Criteria (µg/L)	Effects Benchmark[d] (µg/L)
	Primary		Secondary	Tertiary		
1,1'-Biphenyl	NA	NA	14	14	14	140
2,2'-oxybis(1-Chloropropane)	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
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	2.1	2.1	21
2-Methylphenol	NA	NA	NA	13	13	130
2-Nitroaniline	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	NA	NA	1.5	1.5	1.5	15
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA
4-Chlorophenyl-phenylether	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	300	300	3000
Acenaphthene	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	0.73	0.73	7.30
Atrazine	NA	NA	NA	NA	NA	NA
Benzaldehyde	NA	NA	NA	NA	NA	NA
Benzo[a]anthracene	NA	NA	NA	0.03	0.03	0.27
Benzo(a)pyrene	NA	NA	0.01	0.01	0.01	0.14
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl)ether	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	NA	NA	32	3	32	320
Butyl benzyl phthalate	NA	NA	19	19	19	190

US EPA ARCHIVE DOCUMENT

TABLE 7-5f
SELECTION OF SCREENING CRITERIA FOR SEMIVOLATILE ORGANIC COMPOUNDS IN SURFACE WATER

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	USEPA Ambient Water Quality Criteria[a] - Criterion Continuous Concentration (µg/L)	USEPA Ambient Water Quality Criteria - Criterion Maximum Concentration[a] (µg/L)	USEPA Ecotox Thresholds for Surface Water[b] (µg/L)	ORNL Secondary Chronic Values for Aquatic Biota[c] (µg/L)	SLERA Screening Criteria (µg/L)	Effects Benchmark[d] (µg/L)
	Primary		Secondary	Tertiary		
Caprolactum	NA	NA	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	20	3.7	20	200
Diethylphthalate	NA	NA	220	210	220	2,200
Dimethylphthalate	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	NA	NA	33	35	33	330
Di-N-Octyl phthalate	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	3.9	3.9	3.9	39.0
Hexachlorobenzene	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	12	12	12	120
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	24	12	24	240
Nitrobenzene	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	210	210	2100
Pentachlorophenol	15	19	NA	NA	15	19
Phenanthrene	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA

Notes:
SLERA - screening level ecological risk assessment
USEPA - United States Environmental Protection Agency
ORNL - Oak Ridge National Laboratory
NA - not available
µg/L - micrograms per liter
Criteria selected based on heirarchy and sources presented in Attachment 1 of the enclosure to the March 2004 Agency Comment Letter - Peterson Puritan Superfund Site, OU2 RI/FS - Comments to the draft Shield Environmental Associates, Inc. *Database Summary Report* (DBSR) and *Initial Site Charaterization Report* (ISCR) submittals.
a - USEPA. 2002. Nationally recommended water quality criteria: 2002. Office of Water, Science, and Technology. EPA 822-R-02-047.
b - USEPA. 1996. ECO Update: Ecotox Thresholds. USEPA Office of Solid Waste and Emergency Response. EPA-540/F-95/038. January 1996.
c - Suter, G.W., II. and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota, 1996 revision. Environmental Sciences Division. ORNL. ES/ER/TM-96/R2.
d - For constituents without a corresponding effects level, the SLERA screening value was conservatively multiplied by a factor of 10 to estimate the potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-5g
SELECTION OF SCREENING CRITERIA FOR PESTICIDES AND PCBs IN SURFACE WATER

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	USEPA Ambient Water Quality Criteria - Criterion Continuous Concentration[a] (µg/L)	USEPA Ambient Water Quality Criteria - Criterion Maximum Concentration[a] (µg/L)	USEPA Ecotox Thresholds for Surface Water[b] (µg/L)	ORNL Secondary Chronic Values for Aquatic Biota[c] (µg/L)	SLERA Screening Criteria (µg/L)	Effects Benchmark[d] (µg/L)
Pesticides	**Primary**		**Secondary**	**Tertiary**		
alpha-BHC	NA	NA	NA	2.2	2.2	22
beta-BHC	NA	NA	NA	2.2	2.2	22
delta-BHC	NA	NA	NA	2.2	2.2	22
gamma-BHC	NA	NA	NA	NA	NA	NA
Heptachlor	0.0038	0.52	0.0069	0.0069	0.0038	0.52
Aldrin	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	0.0038	0.52	NA	NA	0.0038	0.52
Endosulfan I	0.056	0.22	0.051	0.051	0.056	0.22
Dieldrin	0.056	0.24	NA	NA	0.056	0.24
4,4'-DDE	NA	NA	NA	0.011	0.011	0.11
Endrin	0.036	0.086	NA	NA	0.036	0.086
Endosulfan II	0.056	0.22	0.051	0.051	0.056	0.22
4,4'-DDD	NA	NA	NA	0.011	0.011	0.11
Endosulfan sulfate	NA	NA	NA	NA	NA	NA
4,4'-DDT	0.001	1.1	0.013	0.013	0.001	1.1
Methoxychlor	0.03	NA	0.019	0.019	0.03	0.3
Endrin ketone	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA
alpha-Chlordane	NA	NA	NA	NA	NA	NA
gamma-Chlordane	NA	NA	NA	NA	NA	NA
Toxaphene	0.0002	0.73	0.011	NA	0.0002	0.73
PCBs	**Primary**	**Primary**	**Secondary**	**Tertiary**		
Aroclor-1016	0.014	NA	0.19	0.14	0.014	0.14
Aroclor-1221	0.014	NA	0.19	0.14	0.014	0.14
Aroclor-1232	0.014	NA	0.19	0.14	0.014	0.14
Aroclor-1242	0.014	NA	0.19	0.14	0.014	0.14
Aroclor-1248	0.014	NA	0.19	0.14	0.014	0.14
Aroclor-1254	0.014	NA	0.19	0.14	0.014	0.14
Aroclor-1260	0.014	NA	0.19	0.14	0.014	0.14

Notes:
SLERA - screening level ecological risk assessment
USEPA - United States Environmental Protection Agency
ORNL - Oak Ridge National Laboratory
NA - not available
µg/L - micrograms per liter
Criteria selected based on heirarchy and sources presented in Attachment 1 of the enclosure to the March 2004 Agency Comment Letter - Peterson Puritan Superfund Site, OU2 RI/FS - Comments to the draft Shield Environmental Associates, Inc. *Database Summary Report* (DBSR) and *Initial Site Characterization Report* (ISCR) submittals.
a - USEPA. 2002. Nationally recommended water quality criteria: 2002. Office of Water, Science, and Technology. EPA 822-R-02-047
b - USEPA. 1996. ECO Update: Ecotox Thresholds. USEPA Office of Solid Waste and Emergency Response. EPA-540/F-95/038. January 1996
c - Suter, G.W., II. and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota, Environmental Sciences Division. ORNL. ES/ER/TM-96/R2. 1996 revision.
d - For constituents without a corresponding effects level, the SLERA screening value was conservatively multiplied by a factor of 10 to estimate the potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-5h
SELECTION OF SCREENING CRITERIA FOR METALS IN SURFACE WATER

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Constituent	USEPA Ambient Water Quality Criteria - Criterion Continuous Concentration[a] (µg/L)	USEPA Ambient Water Quality Criteria - Criterion Maximum Concentration[a] (µg/L)	USEPA Ecotox Thresholds for Surface Water[b] (µg/L)	ORNL Secondary Chronic Values for Aquatic Biota[c] (µg/L)	SLERA Screening Criteria (µg/L)	Effects Benchmark[e] (µg/L)
	Primary		Secondary	Tertiary		
Aluminum	87	750	NA	NA	87	750
Antimony	NA	NA	NA	30	30	300
Arsenic	150	340	8.1	3.1	150	340
Barium	NA	NA	3.9	4	3.9	39
Beryllium	NA	NA	5.1	0.66	5.1	51
Cadmium[d]	0.086	0.46	NA	NA	0.089	0.46
Chromium[d]	11(hex), 21(Tri)	16(hex), 165(Tri)	NA	NA	11	16
Cobalt	NA	NA	3	23	3	30
Copper[d]	2.5	15	NA	NA	2.5	15
Iron	NA	NA	NA	NA	NA	NA
Lead[d]	0.47	12	NA	NA	0.47	12
Manganese	NA	NA	80	120	80	800
Mercury	0.77	1.4	.003 (methyl)	1.3/0.0028 (methyl)	0.77	1.4
Nickel[d]	14	130	NA	NA	14	130
Selenium	5	NA	NA	NA	5	50
Silver	NA	0.24	NA	0.36	0.36	0.24
Thallium	NA	NA	NA	12	12	120
Vanadium	NA	NA	19	20	19	190
Zinc[d]	33	33	NA	NA	33	33
Cyanide	5.2	22	NA	NA	5.2	22

Notes:
SLERA - screening level ecological risk assessment
USEPA - United States Environmental Protection Agency
ORNL - Oak Ridge National Laboratory
NA - not available
µg/L - micrograms per liter
Criteria selected based on heirarchy and sources presented in Attachment 1 of the enclosure to the March 2004 Agency Comment Letter - Peterson Puritan Superfund Site, OU2 RI/FS - Comments to the draft Shield Environmental Associates, Inc. *Initial Site Charaterization Report* (ISCR) submittals: *Database Summary Report* (DBSR) and

a - USEPA. 2006. National Recommended Water Quality Criteria: 2006. Office of Water, Science, and Technology. www.epa.gov/waterscience/criteria/nrwqc-2006
b - USEPA. 1996. ECO Update: Ecotox Thresholds. USEPA Office of Solid Waste and Emergency Response. EPA-540/F-95/038. January 1996.
c - Suter, G.W., II. and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota, 1996 revision. Environmental Sciences Division. ORNL. ES/ER/TM-96/R2.
d - Criterion adjusted to site-specific water hardness of 22 milligrams per liter $CaCO_3$
e - For constituents without a corresponding effects level, the SLERA screening value was conservatively multiplied by a factor of 10 to estimate the potential effects level.

TABLE 7-6a
CALCULATED HAZARD QUOTIENTS FOR BENTHIC INVERTEBRATES - Blackstone River (Upstream)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ	
						RME	CTE	RME	CTE
VOCs									
1,1,1-Trichloroethane	0/16	7.50E-03	3.48E-03	0.17	2.2	0.04	0.02	0.003	0.002
1,1,2,2-Tetrachloroethane	0/16	7.50E-03	3.48E-03	0.94	12.2	0.008	0.004	0.0006	0.0003
1,1-Dichloroethene	1/16	6.00E-03	3.13E-03	0.031	0.40	0.2	0.1	0.01	0.008
2-Butanone	8/16	2.68E-02	1.62E-02	0.27	3.5	0.1	0.06	0.008	0.005
2-Hexanone	0/16	7.50E-03	3.48E-03	0.022	0.29	0.3	0.2	0.03	0.01
4-Methyl-2-pentanone	0/16	7.50E-03	3.48E-03	0.033	0.43	0.2	0.1	0.02	0.01
Acetone	8/16	9.24E-02	5.56E-02	0.0087	0.11	11	6	0.8	0.5
Carbon disulfide	10/16	5.00E-03	4.00E-03	0.00085	0.011	6	5	0.5	0.4
Chloromethane	0/16	7.50E-03	3.48E-03	--	--	--	--	--	--
cis-1,2-Dichloroethene	0/16	7.50E-03	3.48E-03	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/16	7.50E-03	3.48E-03	--	--	--	--	--	--
Isopropylbenzene	0/16	7.50E-03	3.48E-03	--	--	--	--	--	--
Methyl acetate	1/16	7.50E-03	3.23E-03	--	--	--	--	--	--
Methylene chloride	0/16	2.05E-02	6.95E-03	0.37	4.8	0.06	0.02	0.004	0.001
Styrene	1/16	7.50E-03	3.40E-03	--	--	--	--	--	--
Tetrachloroethene	0/16	7.50E-03	3.48E-03	0.41	5.3	0.02	0.008	0.001	0.0007
trans-1,3-Dichloropropene	0/16	7.50E-03	3.48E-03	--	--	--	--	--	--
Trichlorofluoromethane	0/16	7.50E-03	3.48E-03	--	--	--	--	--	--
Xylene (Total)	1/16	1.00E-02	4.75E-03	0.025	0.33	0.4	0.2	0.03	0.01
SVOCs									
1,1'-Biphenyl	1/15	2.30E-01	1.43E-01	--	--	--	--	--	--
2-Methylnaphthalene	10/15	1.77E-01	1.10E-01	0.33	4.3	0.5	0.3	0.04	0.03
2-Methylphenol	4/15	2.30E-01	1.18E-01	0.012	0.16	19	10	1	0.8
4-Bromophenyl-phenylether	0/15	2.30E-01	1.42E-01	1.3	16.9	0.2	0.1	0.01	0.01
4-Chloroaniline	0/15	2.30E-01	1.42E-01	--	--	--	--	--	--
4-Methylphenol	2/15	2.30E-01	1.44E-01	--	--	--	--	--	--
4-Nitroaniline	0/15	5.50E-01	3.06E-01	--	--	--	--	--	--
Acenaphthene	12/15	1.09E-01	7.62E-02	0.62	8.1	0.2	0.1	0.01	0.01
Acenaphthylene	13/15	3.63E-01	1.73E-01	0.33	4.3	1	0.5	0.1	0.04
Acetophenone	0/15	2.30E-01	1.42E-01	--	--	--	--	--	--
Anthracene	14/15	4.67E-01	3.28E-01	0.057	0.85	8	6	0.6	0.4
Benzaldehyde	5/15	2.22E-01	1.96E-01	--	--	--	--	--	--
Benzo(a)pyrene	15/15	1.33E+00	9.59E-01	0.15	1.5	9	6	0.9	0.7
Benzo(b)fluoranthene	15/15	1.48E+00	1.08E+00	--	--	--	--	--	--
Benzo(g,h,i)perylene	15/15	1.47E+00	7.39E-01	0.17	0.32	9	4	5	2
Benzo(k)fluoranthene	15/15	1.72E+00	8.46E-01	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	11/15	2.81E+00	1.07E+00	890	11570	0.003	0.001	0.0002	0.0001
Carbazole	7/15	2.51E-01	1.93E-01	--	--	--	--	--	--
Chrysene	15/15	1.46E+00	1.04E+00	0.17	1.3	9	6	1	0.8
Cyclohexane	0/16	7.50E-03	3.48E-03	--	--	--	--	--	--
Dibenzofuran	3/15	2.30E-01	1.37E-01	2.0	26	0.1	0.07	0.01	0.01
Fluoranthene	15/15	2.35E+00	1.68E+00	0.42	2.2	6	4	1	0.8
Fluorene	12/15	1.60E-01	1.11E-01	0.077	0.54	2	1	0.3	0.2
Hexachlorobenzene	0/15	2.30E-01	1.12E-01	0.02	0.26	12	6	0.9	0.4
Hexachlorobutadiene	0/15	2.30E-01	1.42E-01	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	15/15	1.36E+00	6.84E-01	0.2	2.6	7	3	0.5	0.3
Isophorone	0/15	2.30E-01	1.42E-01	--	--	--	--	--	--
Naphthalene	10/15	1.67E-01	1.11E-01	0.18	0.56	0.9	0.6	0.3	0.2
N-Nitrosodiphenylamine	0/15	2.30E-01	1.42E-01	--	--	--	--	--	--
Pentachlorophenol	0/12	5.50E-01	3.61E-01	--	--	--	--	--	--
Phenanthrene	15/15	1.30E+00	9.29E-01	0.20	1.2	6	5	1	0.8
Phenol	3/15	2.30E-01	1.59E-01	--	--	--	--	--	--
Pyrene	15/15	2.22E+00	1.59E+00	0.20	1.52	11	8	1	1
Pesticides/PCBs									
4,4'-DDD	13/15	1.24E-02	5.21E-03	0.0049	0.028	3	1	0.4	0.2
4,4'-DDE	11/14	1.06E-02	4.27E-03	0.0032	0.031	3	1	0.3	0.1
4,4'-DDT	1/12	2.70E-03	9.92E-04	0.0042	0.063	0.6	0.2	0.04	0.02
alpha-Chlordane	9/15	2.92E-03	1.79E-03	0.0032	0.018	0.9	0.6	0.2	0.1
Aroclor-1016	0/15	1.90E-02	6.66E-03	0.06	0.7	0.3	0.1	0.03	0.01
Aroclor-1221	0/15	1.90E-02	8.94E-03	0.06	0.7	0.3	0.1	0.03	0.01
Aroclor-1232	0/15	1.90E-02	6.66E-03	0.06	0.7	0.3	0.1	0.03	0.01
Aroclor-1242	0/15	1.90E-02	6.66E-03	0.06	0.7	0.3	0.1	0.03	0.01
Aroclor-1248	0/15	1.90E-02	6.66E-03	0.06	0.7	0.3	0.1	0.03	0.01
Aroclor-1254	5/15	4.43E-01	2.10E-01	0.06	0.7	7	4	0.7	0.3
Aroclor-1260	12/14	4.50E-01	1.89E-01	0.06	0.7	8	3	0.7	0.3

US EPA ARCHIVE DOCUMENT

TABLE 7-6a
CALCULATED HAZARD QUOTIENTS FOR BENTHIC INVERTEBRATES - Blackstone River (Upstream)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ	
						RME	CTE	RME	CTE
Dieldrin	11/15	6.23E-03	4.05E-03	0.0019	0.062	3	2	0.1	0.07
Endosulfan I	0/15	4.20E-04	2.86E-04	0.0029	0.073	0.1	0.1	0.01	0.004
Endosulfan II	0/15	4.60E-04	3.94E-04	0.0055	0.14	0.08	0.07	0.003	0.003
Endosulfan Sulfate	1/11	1.30E-02	1.54E-03	--	--	--	--	--	--
Endrin	0/15	4.60E-04	3.94E-04	0.002	0.21	0.2	0.2	0.002	0.002
Endrin Aldehyde	1/14	2.70E-03	1.00E-03	--	--	--	--	--	--
Endrin Ketone	4/15	2.00E-02	3.22E-03	--	--	--	--	--	--
Gamma-Chlordane	8/10	4.11E-03	2.72E-03	--	--	--	--	--	--
Heptachlor Epoxide	0/15	4.20E-04	2.86E-04	0.0025	0.016	0.2	0.1	0.03	0.02
Methoxychlor	0/14	2.40E-03	1.26E-03	0.019	0.48	0.1	0.07	0.005	0.003
Total PCBs	14/15	9.18E-01	4.10E-01	0.06	0.68	15	7	1	0.6
Toxaphene	0/15	5.00E-02	3.28E-02	0.028	0.70	2	1	0.07	0.05
Metals									
Aluminum	15/15	8.96E+03	5.18E+03	--	--	--	--	--	--
Antimony	6/15	5.98E-01	4.72E-01	12	60	0.05	0.04	0.01	0.01
Arsenic	15/15	6.45E+00	4.98E+00	9.8	33.0	0.7	0.5	0.2	0.2
Barium	11/15	6.72E+01	4.91E+01	--	--	--	--	--	--
Beryllium	10/15	5.42E-01	4.41E-01	--	--	--	--	--	--
Cadmium	15/15	7.22E+00	3.68E+00	1	4.98	7	4	1	0.7
Chromium	15/15	6.70E+01	4.08E+01	43	111	2	0.9	0.6	0.4
Cobalt	10/15	6.82E+00	5.40E+00	--	--	--	--	--	--
Copper	15/15	1.13E+02	6.72E+01	32	149	4	2	0.8	0.5
Cyanide	0/8	3.30E-01	2.15E-01	--	--	--	--	--	--
Iron	15/15	1.28E+04	9.83E+03	20000	40000	0.6	0.5	0.3	0.2
Lead	15/15	2.03E+02	8.94E+01	36	128	6	2	2	0.7
Manganese	15/15	2.07E+02	1.69E+02	460	5500	0.5	0.4	0.04	0.03
Mercury	10/15	2.59E-01	1.74E-01	0.18	1.06	1	0.97	0.2	0.2
Nickel	12/15	2.57E+01	1.80E+01	23	48.6	1	0.8	0.5	0.4
Selenium	8/15	1.04E+00	7.26E-01	--	--	--	--	--	--
Silver	13/15	2.43E+00	1.80E+00	2	10	1	0.9	0.2	0.2
Thallium	7/15	2.46E-01	2.26E-01	--	--	--	--	--	--
Vanadium	12/15	1.54E+01	1.15E+01	--	--	--	--	--	--
Zinc	15/15	3.12E+02	1.84E+02	120	459	3	2	0.7	0.4

US EPA ARCHIVE DOCUMENT

TABLE 7-6b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Blackstone River (Near-Site)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/29	7.00E-03	3.92E-03	0.17	2.2	0.04	0.02	0.003	0.002	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/29	7.00E-03	3.92E-03	0.94	12.2	0.01	0.004	0.001	0.0003	<1	<1	<1	<1
1,1-Dichloroethene	0/29	7.00E-03	3.92E-03	0.031	0.40	0.2	0.1	0.02	0.01	<1	<1	<1	<1
2-Butanone	14/29	1.70E-02	1.15E-02	0.27	3.5	0.1	0.04	0.005	0.003	<1	<1	<1	<1
2-Hexanone	0/29	7.00E-03	3.92E-03	0.022	0.29	0.3	0.2	0.02	0.01	<1	<1	<1	<1
4-Methyl-2-pentanone	0/29	7.00E-03	3.92E-03	0.033	0.43	0.2	0.1	0.02	0.01	<1	<1	<1	<1
Acetone	10/29	4.97E-02	3.21E-02	0.0087	0.11	6	4	0.4	0.3	<1	<1	<1	<1
Carbon disulfide	8/29	2.21E-03	3.81E-03	0.00085	0.011	3	4	0.2	0.3	<1	<1	<1	<1
Chloromethane	0/29	7.00E-03	3.92E-03	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	1/29	7.00E-03	3.95E-03	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/29	7.00E-03	3.92E-03	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	1/29	7.00E-03	3.83E-03	--	--	--	--	--	--	--	--	--	--
Methyl acetate	3/29	7.00E-03	3.66E-03	--	--	--	--	--	--	--	--	--	--
Methylene chloride	1/29	2.20E-02	7.50E-03	0.37	4.8	0.1	0.02	0.005	0.002	<1	<1	<1	<1
Styrene	0/29	7.00E-03	3.92E-03	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	1/29	1.10E-02	4.12E-03	0.41	5.3	0.03	0.01	0.002	0.001	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/29	7.00E-03	3.92E-03	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	1/29	1.15E-02	4.12E-03	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	2/29	7.00E-03	4.28E-03	0.025	0.33	0.3	0.2	0.02	0.01	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	3/29	3.05E-01	1.62E-01	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	18/29	7.60E-02	6.59E-02	0.33	4.3	0.2	0.2	0.02	0.02	<1	<1	<1	<1
2-Methylphenol	2/29	3.05E-01	1.65E-01	0.012	0.16	25	14	2	1	6	4	<1	<1
4-Bromophenyl-phenylether	0/29	3.05E-01	1.75E-01	1.3	16.9	0.2	0.1	0.02	0.01	<1	<1	<1	<1
4-Chloroaniline	0/29	3.05E-01	1.75E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	1/29	3.05E-01	1.70E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/29	7.50E-01	4.21E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	20/29	1.84E-01	1.30E-01	0.62	8.1	0.3	0.2	0.02	0.02	<1	<1	<1	<1
Acenaphthylene	23/29	1.53E-01	8.99E-02	0.33	4.3	0.5	0.3	0.04	0.02	<1	<1	<1	<1
Acetophenone	0/29	3.05E-01	1.75E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	27/29	7.46E-01	3.84E-01	0.057	0.85	13	7	0.9	0.5	5	<1	<1	<1
Benzaldehyde	7/29	1.53E-01	1.71E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	28/29	1.62E+00	8.20E-01	0.15	1.5	11	5	1	0.6	2	<1	<1	<1
Benzo(b)fluoranthene	27/28	1.67E+00	8.71E-01	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	28/29	6.77E-01	3.69E-01	0.17	0.32	4	2	2	1	<1	<1	<1	<1
Benzo(k)fluoranthene	28/29	9.93E-01	4.86E-01	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	19/29	2.25E+00	1.36E+00	890	11570	0.003	0.002	0.0002	0.0001	<1	<1	<1	<1
Carbazole	14/29	2.35E-01	2.17E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	29/29	1.36E+00	8.94E-01	0.17	1.3	8	5	1	0.7	<1	<1	<1	<1
Cyclohexane	2/29	7.00E-03	3.80E-03	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	8/29	1.54E-01	1.71E-01	2.0	26	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Fluoranthene	28/29	3.16E+00	1.60E+00	0.42	2.2	8	4	1	0.7	2	<1	<1	<1
Fluorene	23/29	2.53E-01	1.23E-01	0.077	0.54	3	2	0.5	0.2	1	<1	<1	<1
Hexachlorobenzene	0/29	3.05E-01	1.64E-01	0.02	0.26	15	8	1	0.6	4	3	<1	<1
Hexachlorobutadiene	0/29	3.05E-01	1.75E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	28/29	7.22E-01	3.86E-01	0.2	2.6	4	2	0.3	0.1	<1	<1	<1	<1
Isophorone	0/29	3.05E-01	1.75E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	18/29	1.61E-01	1.16E-01	0.18	0.56	0.9	0.7	0.3	0.2	<1	<1	<1	<1
N-Nitrosodiphenylamine	1/29	3.05E-01	1.72E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	1/29	7.50E-01	4.20E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	28/29	2.30E+00	1.13E+00	0.20	1.2	11	6	2	1	5	<1	<1	<1
Phenol	1/29	3.05E-01	1.76E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	29/29	2.44E+00	1.58E+00	0.20	1.52	13	8	2	1	1	<1	<1	<1
Pesticides/PCBs													
4,4'-DDD	18/28	2.55E-03	1.83E-03	0.0049	0.028	1	0.4	0.1	0.1	<1	<1	<1	<1
4,4'-DDE	14/26	1.75E-03	1.20E-03	0.0032	0.031	1	0.4	0.1	0.04	<1	<1	<1	<1
4,4'-DDT	2/25	4.00E-03	7.69E-04	0.0042	0.063	1	0.2	0.1	0.01	<1	<1	<1	<1
alpha-Chlordane	5/27	9.79E-04	5.03E-04	0.0032	0.018	0.3	0.2	0.1	0.03	<1	<1	<1	<1
Aroclor-1016	0/29	1.60E-02	4.49E-03	0.06	0.7	0.3	0.08	0.02	0.01	<1	<1	<1	<1
Aroclor-1221	0/29	1.60E-02	7.83E-03	0.06	0.7	0.3	0.1	0.02	0.01	<1	<1	<1	<1
Aroclor-1232	0/29	1.60E-02	4.49E-03	0.06	0.7	0.3	0.08	0.02	0.01	<1	<1	<1	<1
Aroclor-1242	1/29	2.50E-01	1.30E-02	0.06	0.7	4	0.2	0.4	0.02	4	<1	<1	<1
Aroclor-1248	2/29	1.30E-01	9.93E-03	0.06	0.7	2	0.2	0.2	0.01	2	<1	<1	<1
Aroclor-1254	8/29	3.92E-01	6.81E-02	0.06	0.7	7	1	0.6	0.1	<1	<1	<1	<1
Aroclor-1260	16/29	9.82E-02	5.48E-02	0.06	0.7	2	1	0.1	0.1	<1	<1	<1	<1
Dieldrin	16/26	3.68E-03	2.46E-03	0.0019	0.062	2	1	0.06	0.04	<1	<1	<1	<1
Endosulfan I	0/29	2.10E-03	2.80E-04	0.0029	0.073	0.7	0.1	0.03	0.004	<1	<1	<1	<1
Endosulfan II	1/29	1.40E-03	4.39E-04	0.0055	0.14	0.3	0.08	0.01	0.003	<1	<1	<1	<1
Endosulfan Sulfate	4/28	4.30E-03	6.88E-04	--	--	--	--	--	--	--	--	--	--
Endrin	0/29	6.00E-04	4.04E-04	0.002	0.21	0.3	0.2	0.003	0.002	<1	<1	<1	<1
Endrin Aldehyde	0/28	2.25E-03	6.87E-04	--	--	--	--	--	--	--	--	--	--
Endrin Ketone	4/26	1.20E-02	1.20E-03	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	8/18	1.40E-03	8.63E-04	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0/29	4.50E-04	2.47E-04	0.0025	0.016	0.2	0.1	0.03	0.02	<1	<1	<1	<1
Methoxychlor	0/28	3.15E-03	1.75E-03	0.019	0.48	0.2	0.1	0.007	0.004	<1	<1	<1	<1
Total PCBs	24/29	3.64E-01	1.60E-01	0.06	0.68	6	3	0.5	0.2	<1	<1	<1	<1
Toxaphene	0/29	5.50E-02	2.66E-02	0.028	0.70	2	1	0.08	0.04	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Blackstone River (Near-Site)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Metals													
Aluminum	29/29	3.89E+03	3.54E+03	--	--	--	--	--	--	--	--	--	--
Antimony	11/29	7.23E-01	5.50E-01	12	60	0.06	0.05	0.01	0.01	<1	<1	<1	<1
Arsenic	29/29	4.85E+01	1.17E+01	9.8	33.0	5	1	1	0.4	4	<1	1	<1
Barium	15/29	3.46E+01	2.81E+01	--	--	--	--	--	--	--	--	--	--
Beryllium	16/29	2.11E-01	3.56E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	28/29	2.00E+00	1.12E+00	1	4.98	2	1	0.4	0.2	<1	<1	<1	<1
Chromium	29/29	4.90E+01	2.41E+01	43	111	1	0.6	0.4	0.2	<1	<1	<1	<1
Cobalt	17/29	3.67E+00	4.21E+00	--	--	--	--	--	--	--	--	--	--
Copper	29/29	3.22E+01	2.54E+01	32	149	1	0.8	0.2	0.2	<1	<1	<1	<1
Cyanide	1/23	1.30E+00	2.50E-01	--	--	--	--	--	--	--	--	--	--
Iron	29/29	1.01E+04	8.62E+03	20,000	40,000	0.5	0.4	0.3	0.2	<1	<1	<1	<1
Lead	29/29	4.25E+01	3.11E+01	36	128	1	0.9	0.3	0.2	<1	<1	<1	<1
Manganese	29/29	1.93E+02	1.55E+02	460	5500	0.4	0.3	0.04	0.03	<1	<1	<1	<1
Mercury	13/29	1.41E-01	9.49E-02	0.18	1.06	1	0.5	0.1	0.1	<1	<1	<1	<1
Nickel	14/29	8.80E+00	6.84E+00	23	48.6	0.4	0.3	0.2	0.1	<1	<1	<1	<1
Selenium	20/29	8.47E+00	1.29E+00	--	--	--	--	--	--	--	--	--	--
Silver	27/29	4.12E+00	2.42E+00	2	10	2	1	0.4	0.2	<1	<1	<1	<1
Thallium	8/29	2.32E-01	2.92E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	16/29	9.17E+00	7.52E+00	--	--	--	--	--	--	--	--	--	--
Zinc	29/29	8.71E+01	7.16E+01	120	459	0.7	0.6	0.2	0.2	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/12	2.30E-02	7.87E-03	0.17	2.2	0.1	0.05	0.01	0.004	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/12	2.30E-02	7.87E-03	0.94	12.2	0.02	0.008	0.002	0.0006	<1	<1	<1	<1
1,1-Dichloroethene	0/12	2.30E-02	7.87E-03	0.031	0.40	0.7	0.3	0.06	0.02	<1	<1	<1	<1
2-Butanone	10/12	2.66E-01	9.18E-02	0.27	3.5	0.99	0.3	0.08	0.03	<1	<1	<1	<1
2-Hexanone	0/12	2.30E-02	7.87E-03	0.022	0.29	1	0.4	0.08	0.03	<1	<1	<1	<1
4-Methyl-2-pentanone	0/12	2.30E-02	7.87E-03	0.033	0.43	0.7	0.2	0.05	0.02	<1	<1	<1	<1
Acetone	8/12	5.16E-01	2.54E-01	0.0087	0.11	59	29	5	2	49	23	4	2
Carbon disulfide	6/12	6.56E-03	6.07E-03	0.00085	0.011	8	7	0.6	0.5	2	2	<1	<1
Chloromethane	0/12	2.30E-02	7.87E-03	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	0/12	2.30E-02	7.87E-03	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/12	2.30E-02	7.87E-03	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	0/12	2.30E-02	7.87E-03	--	--	--	--	--	--	--	--	--	--
Methyl acetate	1/12	3.80E-02	8.62E-03	--	--	--	--	--	--	--	--	--	--
Methylene chloride	2/12	6.10E-02	1.19E-02	0.37	4.8	0.2	0.03	0.01	0.002	<1	<1	<1	<1
Styrene	1/12	2.30E-02	7.82E-03	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	0/12	2.30E-02	7.87E-03	0.41	5.3	0.06	0.02	0.004	0.001	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/12	2.30E-02	7.87E-03	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	2/12	2.30E-02	7.29E-03	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	0/12	2.30E-02	8.34E-03	0.025	0.33	0.9	0.3	0.07	0.03	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	1/12	3.30E-01	1.95E-01	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	8/12	1.96E-01	1.57E-01	0.33	4.3	0.6	0.5	0.05	0.04	<1	<1	<1	<1
2-Methylphenol	0/12	3.30E-01	1.95E-01	0.012	0.16	28	16	2	1	8	6	<1	<1
4-Bromophenyl-phenylether	0/12	3.30E-01	2.05E-01	1.3	16.9	0.3	0.2	0.02	0.01	<1	<1	<1	<1
4-Chloroaniline	0/12	3.30E-01	2.05E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	1/12	3.30E-01	1.94E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/12	8.50E-01	4.94E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	9/12	1.11E-01	1.19E-01	0.62	8.1	0.2	0.2	0.01	0.01	<1	<1	<1	<1
Acenaphthylene	10/12	2.91E-01	2.08E-01	0.33	4.3	0.9	0.6	0.07	0.05	<1	<1	<1	<1
Acetophenone	1/12	3.30E-01	1.95E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	11/12	5.55E-01	3.74E-01	0.057	0.85	10	7	0.7	0.4	2	<1	<1	<1
Benzaldehyde	6/12	5.51E-01	3.46E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	11/12	1.84E+00	1.30E+00	0.15	1.5	12	9	1	0.9	3	2	<1	<1
Benzo(b)fluoranthene	10/11	2.30E+00	1.55E+00	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	11/12	9.38E-01	6.51E-01	0.17	0.32	6	4	3	2	<1	<1	<1	<1
Benzo(k)fluoranthene	11/12	1.00E+00	6.87E-01	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	12/12	3.72E+00	1.58E+00	890	11570	0.004	0.002	0.0003	0.0001	<1	<1	<1	<1
Carbazole	7/12	1.98E-01	1.69E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	11/12	1.90E+00	1.33E+00	0.17	1.3	11	8	1	1	3	2	<1	<1
Cyclohexane	0/12	2.30E-02	7.87E-03	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	4/12	3.15E-01	1.54E-01	2.0	26	0.2	0.1	0.01	0.01	<1	<1	<1	<1
Fluoranthene	11/12	3.14E+00	2.22E+00	0.42	2.2	7	5	1	1	2	1	<1	<1
Fluorene	9/12	1.84E-01	1.58E-01	0.077	0.54	2	2	0.3	0.3	<1	<1	<1	<1
Hexachlorobenzene	0/12	3.30E-01	1.93E-01	0.02	0.26	17	10	1	0.7	5	4	<1	<1
Hexachlorobutadiene	0/12	3.30E-01	2.05E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	11/12	1.41E+00	6.93E-01	0.2	2.6	7	3	0.5	0.3	<1	<1	<1	<1
Isophorone	0/12	3.30E-01	2.05E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	9/12	1.87E-01	1.51E-01	0.18	0.56	1	0.9	0.3	0.3	<1	<1	<1	<1
N-Nitrosodiphenylamine	0/12	3.30E-01	2.05E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	0/11	1.50E+00	6.61E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	11/12	1.51E+00	1.05E+00	0.20	1.2	7	5	1	1	1	<1	<1	<1
Phenol	3/12	3.30E-01	1.99E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	11/12	2.58E+00	1.85E+00	0.20	1.52	13	9	2	1	2	1	<1	<1
Pesticides/PCBs													
4,4'-DDD	6/10	9.86E-03	6.01E-03	0.0049	0.028	2	1	0.4	0.2	<1	<1	<1	<1
4,4'-DDE	6/8	1.64E-02	9.64E-03	0.0032	0.031	5	3	0.5	0.3	2	2	<1	<1
4,4'-DDT	2/8	4.05E-03	1.09E-03	0.0042	0.063	1	0.3	0.1	0.02	<1	<1	<1	<1
alpha-Chlordane	6/10	2.19E-02	9.26E-03	0.0032	0.018	7	3	1	0.5	6	2	1	<1
Aroclor-1016	0/12	1.70E-02	6.16E-03	0.06	0.7	0.3	0.1	0.03	0.01	<1	<1	<1	<1
Aroclor-1221	0/12	1.70E-02	9.83E-03	0.06	0.7	0.3	0.2	0.03	0.01	<1	<1	<1	<1
Aroclor-1232	0/12	1.70E-02	6.16E-03	0.06	0.7	0.3	0.1	0.03	0.01	<1	<1	<1	<1
Aroclor-1242	0/12	1.70E-02	6.16E-03	0.06	0.7	0.3	0.1	0.03	0.01	<1	<1	<1	<1
Aroclor-1248	0/12	1.70E-02	6.16E-03	0.06	0.7	0.3	0.1	0.03	0.01	<1	<1	<1	<1
Aroclor-1254	4/12	6.50E-01	8.67E-02	0.06	0.7	11	1	1	0.1	3	<1	<1	<1
Aroclor-1260	6/11	3.02E-01	1.54E-01	0.06	0.7	5	3	0.4	0.2	<1	<1	<1	<1
Dieldrin	4/11	2.10E-02	4.28E-03	0.0019	0.062	11	2	0.3	0.07	8	<1	<1	<1
Endosulfan I	0/11	3.35E-04	2.36E-04	0.0029	0.073	0.1	0.1	0.005	0.003	<1	<1	<1	<1
Endosulfan II	0/11	6.50E-04	4.10E-04	0.0055	0.14	0.1	0.07	0.005	0.003	<1	<1	<1	<1
Endosulfan Sulfate	3/9	1.00E-02	2.28E-03	--	--	--	--	--	--	--	--	--	--
Endrin	1/12	8.60E-03	1.09E-03	0.002	0.21	4	0.5	0.04	0.005	4	<1	<1	<1
Endrin Aldehyde	3/9	5.80E-03	1.33E-03	--	--	--	--	--	--	--	--	--	--
Endrin Ketone	2/9	2.10E-03	6.16E-04	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	4/10	3.50E-02	3.29E-03	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	1/12	2.70E-02	2.47E-03	0.0025	0.016	11	1	2	0.2	11	<1	2	<1
Methoxychlor	3/11	1.00E-02	3.31E-03	0.019	0.48	0.5	0.2	0.02	0.007	<1	<1	<1	<1
Total PCBs	8/12	6.00E-01	3.75E-01	0.06	0.68	10	6	0.9	0.6	<1	<1	<1	<1
Toxaphene	0/12	4.20E-02	2.47E-02	0.028	0.70	2	1	0.06	0.04	<1	<1	<1	<1
Metals													
Aluminum	12/12	1.02E+04	7.44E+03	--	--	--	--	--	--	--	--	--	--
Antimony	7/12	2.01E+00	1.18E+00	12	60	0.2	0.1	0.03	0.02	<1	<1	<1	<1
Arsenic	11/12	1.68E+01	1.21E+01	9.8	33.0	2	1	1	0.4	1	<1	<1	<1
Barium	9/12	1.24E+02	8.33E+01	--	--	--	--	--	--	--	--	--	--
Beryllium	8/12	9.26E-01	6.50E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	12/12	1.82E+01	8.41E+00	1	5	18	8	4	2	11	5	2	<1
Chromium	12/12	1.48E+02	1.02E+02	43	111	3	2	1	0.9	2	1	<1	<1
Cobalt	4/12	1.60E+01	8.43E+00	--	--	--	--	--	--	--	--	--	--
Copper	11/12	1.83E+02	1.23E+02	32	149	6	4	1	0.8	2	2	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Cyanide	6/10	2.38E+00	1.05E+00	--	--	--	--	--	--	--	--	--	--
Iron	12/12	2.17E+04	1.59E+04	20,000	40,000	1	0.8	0.5	0.4	<1	<1	<1	<1
Lead	12/12	1.76E+02	1.22E+02	36	128	5	3	1	0.95	<1	<1	<1	<1
Manganese	12/12	4.88E+02	2.94E+02	460	5500	1	0.6	0.09	0.05	<1	<1	<1	<1
Mercury	11/12	6.29E-01	4.41E-01	0.18	1.06	3	2	0.6	0.4	2	1	<1	<1
Nickel	7/12	4.13E+01	2.41E+01	23	48.6	2	1	0.8	0.5	<1	<1	<1	<1
Selenium	10/12	2.58E+00	1.77E+00	--	--	--	--	--	--	--	--	--	--
Silver	12/12	1.12E+01	6.05E+00	2	10	6	3	1.1	0.6	4	2	<1	<1
Thallium	3/12	8.30E-01	2.68E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	9/12	2.40E+01	1.69E+01	--	--	--	--	--	--	--	--	--	--
Zinc	12/12	6.92E+02	3.66E+02	120	459	6	3	2	0.8	3	2	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS **FOR BENTHIC INVERTEBRATES - Pond B**

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/3	9.00E-03	8.17E-03	0.17	2.2	0.1	0.05	0.004	0.004	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/3	9.00E-03	8.17E-03	0.94	12.2	0.01	0.009	0.001	0.0007	<1	<1	<1	<1
1,1-Dichloroethene	1/3	8.50E-03	5.83E-03	0.031	0.40	0.3	0.2	0.02	0.01	<1	<1	<1	<1
2-Butanone	1/3	1.60E-02	1.05E-02	0.27	3.5	0.06	0.04	0.005	0.003	<1	<1	<1	<1
2-Hexanone	0/3	9.00E-03	8.17E-03	0.022	0.29	0.4	0.4	0.03	0.03	<1	<1	<1	<1
4-Methyl-2-pentanone	0/3	9.00E-03	8.17E-03	0.033	0.43	0.3	0.2	0.02	0.02	<1	<1	<1	<1
Acetone	1/3	4.00E-02	2.15E-02	0.0087	0.11	5	2	0.4	0.2	<1	<1	<1	<1
Carbon disulfide	0/3	9.00E-03	8.17E-03	0.00085	0.011	11	10	0.8	0.7	5	5	<1	<1
Chloromethane	0/3	9.00E-03	8.17E-03	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	0/3	9.00E-03	8.17E-03	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/3	9.00E-03	8.17E-03	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	0/3	9.00E-03	8.17E-03	--	--	--	--	--	--	--	--	--	--
Methyl acetate	0/3	9.00E-03	8.17E-03	--	--	--	--	--	--	--	--	--	--
Methylene chloride	0/3	9.00E-03	8.83E-03	0.37	4.8	0.02	0.02	0.002	0.002	<1	<1	<1	<1
Styrene	0/3	9.00E-03	8.17E-03	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	0/3	9.00E-03	8.17E-03	0.41	5.3	0.02	0.02	0.002	0.002	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/3	9.00E-03	8.17E-03	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	0/3	9.00E-03	8.17E-03	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	0/3	9.00E-03	8.17E-03	0.025	0.33	0.4	0.3	0.03	0.03	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	0/3	3.15E-01	2.80E-01	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	1/3	3.15E-01	2.09E-01	0.33	4.3	0.95	0.6	0.07	0.05	<1	<1	<1	<1
2-Methylphenol	0/3	3.15E-01	2.80E-01	0.012	0.16	26	23	2	2	7	14	<1	1
4-Bromophenyl-phenylether	0/3	3.15E-01	2.80E-01	1.3	16.9	0.2	0.2	0.02	0.02	<1	<1	<1	<1
4-Chloroaniline	0/3	3.15E-01	2.80E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	0/3	3.15E-01	2.80E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/3	8.00E-01	7.00E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	2/3	3.15E-01	1.57E-01	0.62	8.1	0.5	0.3	0.04	0.02	<1	<1	<1	<1
Acenaphthylene	3/3	3.00E-01	2.00E-01	0.33	4.3	0.9	0.6	0.07	0.05	<1	<1	<1	<1
Acetophenone	0/3	3.15E-01	2.80E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	3/3	4.40E-01	3.10E-01	0.057	0.85	8	5	0.5	0.4	<1	<1	<1	<1
Benzaldehyde	1/3	3.15E-01	2.18E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	3/3	1.80E+00	1.26E+00	0.15	1.5	12	8	1	0.9	3	2	<1	<1
Benzo(b)fluoranthene	3/3	2.40E+00	1.77E+00	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	3/3	1.10E+00	7.67E-01	0.17	0.32	6	5	3	2	<1	<1	<1	<1
Benzo(k)fluoranthene	3/3	1.20E+00	8.37E-01	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	1/3	1.40E+00	6.42E-01	890	11570	0.002	0.001	0.0001	0.0001	<1	<1	<1	<1
Carbazole	3/3	2.00E-01	1.36E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	3/3	2.00E+00	1.40E+00	0.17	1.3	12	8	2	1	3	2	<1	<1
Cyclohexane	0/3	9.00E-03	8.17E-03	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	1/3	3.15E-01	2.06E-01	2.0	26	0.2	0.1	0.01	0.01	<1	<1	<1	<1
Fluoranthene	3/3	3.50E+00	2.50E+00	0.42	2.2	8	6	2	1	3	2	<1	<1
Fluorene	2/3	3.15E-01	1.69E-01	0.077	0.54	4	2	0.6	0.3	2	<1	<1	<1
Hexachlorobenzene	0/3	3.15E-01	2.80E-01	0.02	0.26	16	14	1	1	4	8	<1	<1
Hexachlorobutadiene	0/3	3.15E-01	2.80E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	3/3	9.30E-01	6.93E-01	0.2	2.6	5	3	0.4	0.3	<1	<1	<1	<1
Isophorone	0/3	3.15E-01	2.80E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	3/3	8.50E-02	7.53E-02	0.18	0.56	0.5	0.4	0.2	0.1	<1	<1	<1	<1
N-Nitrosodiphenylamine	0/3	3.15E-01	2.80E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	0/3	8.00E-01	7.00E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	3/3	1.60E+00	1.08E+00	0.20	1.2	8	5	1	0.9	1	<1	<1	<1
Phenol	0/3	3.15E-01	2.80E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	3/3	2.60E+00	1.70E+00	0.20	1.52	13	9	2	1	2	<1	<1	<1
Pesticides/PCBs													
4,4'-DDD	3/3	5.90E-03	5.17E-03	0.0049	0.028	1	1	0.2	0.2	<1	<1	<1	<1
4,4'-DDE	3/3	4.30E-03	3.97E-03	0.0032	0.031	1	1	0.1	0.1	<1	<1	<1	<1
4,4'-DDT	0/1	5.50E-04	5.50E-04	0.0042	0.063	0.1	0.1	0.01	0.01	<1	<1	<1	<1
alpha-Chlordane	3/3	3.80E-03	3.40E-03	0.0032	0.018	1	1	0.2	0.2	<1	<1	<1	<1
Aroclor-1016	0/3	6.50E-03	5.62E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1221	0/3	1.25E-02	1.13E-02	0.06	0.7	0.2	0.2	0.02	0.02	<1	<1	<1	<1
Aroclor-1232	0/3	6.50E-03	5.62E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1242	0/3	6.50E-03	5.62E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1248	0/3	6.50E-03	5.62E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1254	0/3	6.50E-03	5.62E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1260	3/3	1.80E-01	1.43E-01	0.06	0.7	3	2	0.3	0.2	<1	<1	<1	<1
Dieldrin	3/3	1.50E-02	1.27E-02	0.0019	0.062	8	7	0.2	0.2	5	5	<1	<1
Endosulfan I	0/3	3.25E-04	2.90E-04	0.0029	0.073	0.1	0.1	0.004	0.004	<1	<1	<1	<1
Endosulfan II	0/3	6.50E-04	5.62E-04	0.0055	0.14	0.1	0.1	0.005	0.004	<1	<1	<1	<1
Endosulfan Sulfate	0/2	5.50E-04	5.18E-04	--	--	--	--	--	--	--	--	--	--
Endrin	0/3	6.50E-04	5.62E-04	0.002	0.21	0.3	0.3	0.003	0.003	<1	<1	<1	<1
Endrin Aldehyde				--	--	--	--	--	--	--	--	--	--
Endrin Ketone	0/1	6.50E-04	6.50E-04	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	3/3	4.00E-03	3.47E-03	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0/3	3.25E-04	2.90E-04	0.0025	0.016	0.1	0.1	0.02	0.02	<1	<1	<1	<1
Methoxychlor	0/3	3.25E-03	2.90E-03	0.019	0.48	0.2	0.2	0.01	0.006	<1	<1	<1	<1
Total PCBs	3/3	1.80E-01	1.43E-01	0.06	0.68	3	2	0.3	0.2	<1	<1	<1	<1
Toxaphene	0/3	3.25E-02	2.90E-02	0.028	0.70	1	1	0.05	0.04	<1	<1	<1	<1
Metals													
Aluminum	3/3	2.33E+04	1.46E+04	--	--	--	--	--	--	--	--	--	--
Antimony	3/3	3.50E+00	2.55E+00	12	60	0.3	0.2	0.06	0.04	<1	<1	<1	<1
Arsenic	3/3	2.38E+01	1.67E+01	9.8	33.0	2	2	0.7	0.5	2	1	<1	<1
Barium	3/3	2.03E+02	1.77E+02	--	--	--	--	--	--	--	--	--	--
Beryllium	1/3	1.20E+00	9.17E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	3/3	1.33E+01	1.03E+01	1	5	13	10	3	2	6	7	1	1
Chromium	3/3	1.53E+02	1.34E+02	43	111	4	3	1	1	2	2	<1	<1
Cobalt	1/3	1.60E+01	1.05E+01	--	--	--	--	--	--	--	--	--	--
Copper	3/3	2.13E+02	1.76E+02	32	149	7	6	1	1	3	3	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS **FOR BENTHIC INVERTEBRATES - Pond B**

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Cyanide	1/3	4.40E-01	3.88E-01	--	--	--	--	--	--	--	--	--	--
Iron	3/3	4.63E+04	3.17E+04	20,000	40,000	2	2	1	0.8	2	1	<1	<1
Lead	3/3	2.06E+02	1.75E+02	36	128	6	5	2	1	<1	2	<1	<1
Manganese	3/3	4.84E+02	4.30E+02	460	5500	1	0.9	0.09	0.08	<1	<1	<1	<1
Mercury	3/3	5.80E-01	4.73E-01	0.18	1.06	3	3	0.5	0.4	2	2	<1	<1
Nickel	3/3	4.34E+01	3.74E+01	23	48.6	2	2	0.9	0.8	<1	<1	<1	<1
Selenium	3/3	3.40E+00	3.10E+00	--	--	--	--	--	--	--	--	--	--
Silver	3/3	1.43E+01	1.20E+01	2	10	7	6	1	1	6	5	1	1
Thallium	0/3	3.40E-01	3.15E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	3/3	4.89E+01	3.46E+01	--	--	--	--	--	--	--	--	--	--
Zinc	3/3	3.63E+02	3.26E+02	120	459	3	3	0.8	0.7	<1	1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6e
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond C

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/2	9.50E-03	8.00E-03	0.17	2.2	0.1	0.05	0.004	0.004	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/2	9.50E-03	8.00E-03	0.94	12.2	0.01	0.009	0.001	0.0007	<1	<1	<1	<1
1,1-Dichloroethene	0/2	9.50E-03	8.00E-03	0.031	0.40	0.3	0.3	0.02	0.02	<1	<1	<1	<1
2-Butanone	1/2	3.60E-02	2.13E-02	0.27	3.5	0.1	0.1	0.01	0.006	<1	<1	<1	<1
2-Hexanone	0/2	9.50E-03	8.00E-03	0.022	0.29	0.4	0.4	0.03	0.03	<1	<1	<1	<1
4-Methyl-2-pentanone	0/2	9.50E-03	8.00E-03	0.033	0.43	0.3	0.2	0.02	0.02	<1	<1	<1	<1
Acetone	1/2	7.60E-02	4.20E-02	0.0087	0.11	9	5	0.7	0.4	<1	<1	<1	<1
Carbon disulfide	1/2	6.50E-03	5.75E-03	0.00085	0.011	8	7	0.6	0.5	2	2	<1	<1
Chloromethane	0/2	9.50E-03	8.00E-03	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	0/2	9.50E-03	8.00E-03	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/2	9.50E-03	8.00E-03	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	1/2	6.50E-03	4.75E-03	--	--	--	--	--	--	--	--	--	--
Methyl acetate	1/2	6.50E-03	5.25E-03	--	--	--	--	--	--	--	--	--	--
Methylene chloride	0/2	9.50E-03	8.00E-03	0.37	4.8	0.03	0.02	0.002	0.002	<1	<1	<1	<1
Styrene	0/2	9.50E-03	8.00E-03	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	0/2	9.50E-03	8.00E-03	0.41	5.3	0.02	0.02	0.002	0.002	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/2	9.50E-03	8.00E-03	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	0/2	9.50E-03	8.00E-03	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	1/2	6.50E-03	4.75E-03	0.025	0.33	0.3	0.2	0.02	0.01	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	0/2	3.00E-01	2.88E-01	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	1/2	3.00E-01	1.83E-01	0.33	4.3	0.9	0.6	0.07	0.04	<1	<1	<1	<1
2-Methylphenol	0/2	3.00E-01	2.88E-01	0.012	0.16	25	24	2	2	6	14	<1	1
4-Bromophenyl-phenylether	0/2	3.00E-01	2.88E-01	1.3	16.9	0.2	0.2	0.02	0.02	<1	<1	<1	<1
4-Chloroaniline	0/2	3.00E-01	2.88E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	0/2	3.00E-01	2.88E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/2	7.50E-01	7.25E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	2/2	2.30E-01	2.25E-01	0.62	8.1	0.4	0.4	0.03	0.03	<1	<1	<1	<1
Acenaphthylene	2/2	3.40E-01	2.80E-01	0.33	4.3	1	0.8	0.08	0.07	<1	<1	<1	<1
Acetophenone	0/2	3.00E-01	2.88E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	2/2	6.70E-01	5.35E-01	0.057	0.85	12	9	0.8	0.6	4	4	<1	<1
Benzaldehyde	1/2	2.75E-01	1.82E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	2/2	1.70E+00	1.55E+00	0.15	1.5	11	10	1	1	2	4	<1	<1
Benzo(b)fluoranthene	2/2	2.30E+00	2.10E+00	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	2/2	9.90E-01	9.25E-01	0.17	0.32	6	5	3	3	<1	1	<1	<1
Benzo(k)fluoranthene	2/2	8.30E-01	7.30E-01	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	2/2	5.80E+01	3.12E+01	890	11570	0.07	0.04	0.01	0.003	<1	<1	<1	<1
Carbazole	2/2	2.40E-01	2.20E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	2/2	1.90E+00	1.70E+00	0.17	1.3	11	10	1	1	3	4	<1	<1
Cyclohexane	1/2	6.50E-03	5.75E-03	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	2/2	8.70E-02	8.50E-02	2.0	26	0.04	0.04	0.003	0.003	<1	<1	<1	<1
Fluoranthene	2/2	4.60E+00	3.60E+00	0.42	2.2	11	9	2	2	5	5	1	<1
Fluorene	2/2	2.20E-01	2.15E-01	0.077	0.54	3	3	0.4	0.4	<1	1	<1	<1
Hexachlorobenzene	0/2	3.00E-01	2.88E-01	0.02	0.26	15	14	1	1	4	9	<1	<1
Hexachlorobutadiene	0/2	3.00E-01	2.88E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	2/2	9.10E-01	8.15E-01	0.2	2.6	5	4	0.4	0.3	<1	<1	<1	<1
Isophorone	0/2	3.00E-01	2.88E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	2/2	1.10E-01	1.01E-01	0.18	0.56	1	0.6	0.2	0.2	<1	<1	<1	<1
N-Nitrosodiphenylamine	1/2	3.00E-01	2.75E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	0/2	7.50E-01	7.25E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	2/2	2.60E+00	2.05E+00	0.20	1.2	13	10	2	2	6	5	1	<1
Phenol	0/2	3.00E-01	2.88E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	2/2	2.50E+00	2.45E+00	0.20	1.52	13	13	2	2	1	4	<1	<1
Pesticides/PCBs													
4,4'-DDD	2/2	1.30E-02	1.15E-02	0.0049	0.028	3	2	0.5	0.4	<1	1	<1	<1
4,4'-DDE	2/2	9.40E-03	8.70E-03	0.0032	0.031	3	3	0.3	0.3	<1	1	<1	<1
4,4'-DDT	0/1	6.00E-04	6.00E-04	0.0042	0.063	0.1	0.1	0.01	0.01	<1	<1	<1	<1
alpha-Chlordane	1/1	5.00E-03	5.00E-03	0.0032	0.018	2	2	0.3	0.3	<1	1	<1	<1
Aroclor-1016	0/2	6.00E-03	5.75E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1221	0/2	1.20E-02	1.15E-02	0.06	0.7	0.2	0.2	0.02	0.02	<1	<1	<1	<1
Aroclor-1232	0/2	6.00E-03	5.75E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1242	0/2	6.00E-03	5.75E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1248	0/2	6.00E-03	5.75E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1254	2/2	5.50E-01	3.90E-01	0.06	0.7	9	7	0.8	0.6	2	3	<1	<1
Aroclor-1260	1/2	3.10E-01	1.58E-01	0.06	0.7	5	3	0.5	0.2	<1	<1	<1	<1
Dieldrin	2/2	3.30E-02	1.87E-02	0.0019	0.062	17	10	0.5	0.3	14	8	<1	<1
Endosulfan I	0/2	3.10E-04	2.98E-04	0.0029	0.073	0.1	0.1	0.004	0.004	<1	<1	<1	<1
Endosulfan II	0/2	6.00E-04	5.75E-04	0.0055	0.14	0.1	0.1	0.004	0.004	<1	<1	<1	<1
Endosulfan Sulfate	0/1	6.00E-04	6.00E-04	--	--	--	--	--	--	--	--	--	--
Endrin	0/2	6.00E-04	5.75E-04	0.002	0.21	0.3	0.3	0.003	0.003	<1	<1	<1	<1
Endrin Aldehyde	1/1	9.20E-03	9.20E-03	--	--	--	--	--	--	--	--	--	--
Endrin Ketone	0/1	5.50E-04	5.50E-04	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0/2	3.10E-04	2.98E-04	0.0025	0.016	0.1	0.1	0.02	0.02	<1	<1	<1	<1
Methoxychlor	0/2	3.10E-03	2.98E-03	0.019	0.48	0.2	0.2	0.01	0.006	<1	<1	<1	<1
Total PCBs	2/2	8.60E-01	5.45E-01	0.06	0.68	14	9	1	0.8	<1	2	<1	<1
Toxaphene	0/2	3.10E-02	2.98E-02	0.028	0.70	1	1	0.04	0.04	<1	<1	<1	<1
Metals													
Aluminum	2/2	8.31E+03	7.56E+03	--	--	--	--	--	--	--	--	--	--
Antimony	2/2	2.70E+00	2.10E+00	12	60	0.2	0.2	0.05	0.04	<1	<1	<1	<1
Arsenic	2/2	2.54E+01	2.53E+01	9.8	33.0	3	3	0.8	0.8	2	2	<1	<1
Barium	2/2	9.56E+01	9.33E+01	--	--	--	--	--	--	--	--	--	--
Beryllium	1/2	8.00E-01	7.10E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	2/2	1.47E+01	1.10E+01	1	5	15	11	3	2	7	7	2	1
Chromium	2/2	1.32E+02	1.10E+02	43	111	3	3	1	1	1	2	<1	<1
Cobalt	1/2	8.00E+00	6.05E+00	--	--	--	--	--	--	--	--	--	--
Copper	2/2	2.18E+02	1.92E+02	32	149	7	6	1	1	3	4	<1	<1
Cyanide	0/2	4.20E-01	2.70E-01	--	--	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-6e
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond C

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Iron	2/2	1.48E+04	1.39E+04	20,000	40,000	0.7	0.7	0.4	0.3	<1	<1	<1	<1
Lead	2/2	2.01E+02	1.73E+02	36	128	6	5	2	1	<1	2	<1	<1
Manganese	2/2	1.69E+02	1.68E+02	460	5500	0.4	0.4	0.03	0.03	<1	<1	<1	<1
Mercury	2/2	5.30E-01	4.90E-01	0.18	1.06	3	3	0.5	0.5	2	2	<1	<1
Nickel	1/2	1.43E+01	1.04E+01	23	48.6	0.6	0.5	0.3	0.2	<1	<1	<1	<1
Selenium	2/2	2.10E+00	2.00E+00	--	--	--	--	--	--	--	--	--	--
Silver	2/2	8.80E+00	7.05E+00	2	10	4	4	0.9	0.7	3	3	<1	<1
Thallium	0/2	3.25E-01	3.10E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	2/2	2.70E+01	2.36E+01	--	--	--	--	--	--	--	--	--	--
Zinc	2/2	2.80E+02	2.62E+02	120	459	2	2	0.6	0.6	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6f
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/4	1.30E-02	7.63E-03	0.17	2.2	0.1	0.04	0.01	0.003	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/4	1.30E-02	7.63E-03	0.94	12.2	0.01	0.008	0.001	0.0006	<1	<1	<1	<1
1,1-Dichloroethene	0/4	1.30E-02	7.63E-03	0.031	0.40	0.4	0.2	0.03	0.02	<1	<1	<1	<1
2-Butanone	4/4	6.90E-02	4.96E-02	0.27	3.5	0.3	0.2	0.02	0.01	<1	<1	<1	<1
2-Hexanone	0/4	1.30E-02	7.63E-03	0.022	0.29	0.6	0.3	0.05	0.03	<1	<1	<1	<1
4-Methyl-2-pentanone	0/4	1.30E-02	7.63E-03	0.033	0.43	0.4	0.2	0.03	0.02	<1	<1	<1	<1
Acetone	4/4	2.00E-01	1.34E-01	0.0087	0.11	23	15	2	1	12	9	<1	<1
Carbon disulfide	3/4	7.00E-03	3.93E-03	0.00085	0.011	8	5	0.6	0.4	2	<1	<1	<1
Chloromethane	0/4	1.30E-02	7.63E-03	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	0/4	1.30E-02	7.63E-03	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/4	1.30E-02	7.63E-03	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	0/4	1.30E-02	7.63E-03	--	--	--	--	--	--	--	--	--	--
Methyl acetate	0/4	1.30E-02	7.63E-03	--	--	--	--	--	--	--	--	--	--
Methylene chloride	0/4	1.30E-02	8.38E-03	0.37	4.8	0.04	0.02	0.003	0.002	<1	<1	<1	<1
Styrene	0/4	1.30E-02	7.63E-03	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	0/4	1.30E-02	7.63E-03	0.41	5.3	0.03	0.02	0.002	0.001	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/4	1.30E-02	7.63E-03	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	0/4	1.30E-02	7.63E-03	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	1/4	1.30E-02	7.79E-03	0.025	0.33	0.5	0.3	0.04	0.02	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	1/4	2.65E-01	1.89E-01	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	3/4	2.65E-01	1.44E-01	0.33	4.3	0.8	0.4	0.06	0.03	<1	<1	<1	<1
2-Methylphenol	1/4	2.65E-01	1.73E-01	0.012	0.16	22	14	2	1	3	5	<1	<1
4-Bromophenyl-phenylether	0/4	2.65E-01	1.84E-01	1.3	16.9	0.2	0.1	0.02	0.01	<1	<1	<1	<1
4-Chloroaniline	0/4	2.65E-01	1.84E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	0/4	2.65E-01	1.84E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/4	6.50E-01	4.38E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	3/4	2.65E-01	1.29E-01	0.62	8.1	0.4	0.2	0.03	0.02	<1	<1	<1	<1
Acenaphthylene	4/4	2.50E-01	1.81E-01	0.33	4.3	0.8	0.5	0.06	0.04	<1	<1	<1	<1
Acetophenone	0/4	2.65E-01	1.84E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	4/4	2.90E+00	7.10E-01	0.057	0.85	51	12	3	0.8	43	7	3	<1
Benzaldehyde	3/4	2.40E-01	1.28E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	4/4	6.70E+00	2.04E+00	0.15	1.5	45	14	5	1	36	7	4	<1
Benzo(b)fluoranthene	4/4	3.20E+00	1.98E+00	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	4/4	9.10E-01	6.43E-01	0.17	0.32	5	4	3	2	<1	<1	<1	<1
Benzo(k)fluoranthene	4/4	3.60E+00	1.11E+00	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	3/4	2.20E+00	8.48E-01	890	11570	0.002	0.001	0.0002	0.0001	<1	<1	<1	<1
Carbazole	4/4	1.80E-01	1.08E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	4/4	6.90E+00	2.18E+00	0.17	1.3	42	13	5	2	33	7	4	<1
Cyclohexane	0/4	1.30E-02	7.63E-03	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	3/4	2.65E-01	1.11E-01	2.0	26	0.1	0.06	0.01	0.004	<1	<1	<1	<1
Fluoranthene	4/4	1.00E+01	3.18E+00	0.42	2.2	24	8	4	1	18	4	3	<1
Fluorene	4/4	3.60E-01	1.25E-01	0.077	0.54	5	2	0.7	0.2	3	<1	<1	<1
Hexachlorobenzene	0/4	2.65E-01	1.72E-01	0.02	0.26	13	9	1	0.7	2	3	<1	<1
Hexachlorobutadiene	0/4	2.65E-01	1.84E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	4/4	8.00E-01	6.41E-01	0.2	2.6	4	3	0.3	0.2	<1	<1	<1	<1
Isophorone	0/4	2.65E-01	1.84E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	3/4	2.65E-01	1.64E-01	0.18	0.56	2	0.9	0.5	0.3	<1	<1	<1	<1
N-Nitrosodiphenylamine	0/4	2.65E-01	1.84E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	0/4	6.50E-01	4.38E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	4/4	4.80E+00	1.49E+00	0.20	1.2	24	7	4	1	17	3	3	<1
Phenol	0/4	2.65E-01	1.84E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	4/4	1.30E+01	3.76E+00	0.20	1.52	67	19	9	2	55	11	7	1
Pesticides/PCBs													
4,4'-DDD	3/3	7.30E-03	4.70E-03	0.0049	0.028	1	1	0.3	0.2	<1	<1	<1	<1
4,4'-DDE	3/3	5.10E-03	4.72E-03	0.0032	0.031	2	1	0.2	0.2	<1	<1	<1	<1
4,4'-DDT	0/3	5.50E-04	4.42E-04	0.0042	0.063	0.1	0.1	0.01	0.01	<1	<1	<1	<1
alpha-Chlordane	3/3	1.50E-03	1.08E-03	0.0032	0.018	0.5	0.3	0.1	0.1	<1	<1	<1	<1
Aroclor-1016	0/4	5.50E-03	4.55E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1221	0/4	1.10E-02	8.16E-03	0.06	0.7	0.2	0.1	0.02	0.01	<1	<1	<1	<1
Aroclor-1232	0/4	5.50E-03	4.54E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1242	0/4	5.50E-03	4.54E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1248	0/4	5.50E-03	4.54E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1254	0/4	5.50E-03	4.54E-03	0.06	0.7	0.1	0.1	0.01	0.0	<1	<1	<1	<1
Aroclor-1260	4/4	2.50E-01	1.43E-01	0.06	0.7	4	2	0.4	0.2	<1	<1	<1	<1
Dieldrin	1/3	2.20E-03	9.70E-04	0.0019	0.062	1	0.5	0.04	0.0	<1	<1	<1	<1
Endosulfan I	0/4	4.20E-04	2.81E-04	0.0029	0.073	0.1	0.1	0.006	0.004	<1	<1	<1	<1
Endosulfan II	0/4	5.50E-04	4.54E-04	0.0055	0.14	0.1	0.1	0.004	0.003	<1	<1	<1	<1
Endosulfan Sulfate	1/4	8.00E-03	2.33E-03	--	--	--	--	--	--	--	--	--	--
Endrin	0/4	5.50E-04	4.54E-04	0.002	0.21	0.2	0.2	0.003	0.002	<1	<1	<1	<1
Endrin Aldehyde	1/2	2.10E-03	1.89E-03	--	--	--	--	--	--	--	--	--	--
Endrin Ketone	1/1	9.10E-03	8.65E-03	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	2/2	5.60E-03	3.63E-03	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0/4	4.20E-04	2.81E-04	0.0025	0.016	0.2	0.1	0.03	0.02	<1	<1	<1	<1
Methoxychlor	0/4	2.75E-03	1.88E-03	0.019	0.48	0.1	0.1	0.01	0.004	<1	<1	<1	<1
Total PCBs	4/4	2.50E-01	1.43E-01	0.06	0.68	4	2	0.4	0.2	<1	<1	<1	<1
Toxaphene	0/4	5.00E-02	3.03E-02	0.028	0.70	2	1	0.07	0.04	<1	<1	<1	<1
Metals													
Aluminum	4/4	8.67E+03	6.40E+03	--	--	--	--	--	--	--	--	--	--
Antimony	4/4	2.00E+00	1.19E+00	12	60	0.2	0.1	0.03	0.02	<1	<1	<1	<1
Arsenic	4/4	1.23E+01	7.66E+00	9.8	33.0	1	0.8	0.4	0.2	<1	<1	<1	<1
Barium	4/4	1.19E+02	8.11E+01	--	--	--	--	--	--	--	--	--	--
Beryllium	2/4	6.50E-01	5.16E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	4/4	1.56E+01	9.23E+00	1	5	16	9	3	2	8	6	2	1
Chromium	4/4	1.41E+02	9.93E+01	43	111	3	2	1	0.9	2	1	<1	<1
Cobalt	1/4	7.00E+00	5.90E+00	--	--	--	--	--	--	--	--	--	--
Copper	4/4	1.79E+02	1.19E+02	32	149	6	4	1	0.8	2	2	<1	<1
Cyanide	1/3	7.20E-01	4.28E-01	--	--	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-6f
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Iron	4/4	1.35E+04	1.04E+04	20,000	40,000	0.7	0.5	0.3	0.3	<1	<1	<1	<1
Lead	4/4	1.96E+02	1.30E+02	36	128	5	4	2	1	<1	1	<1	<1
Manganese	4/4	2.97E+02	2.11E+02	460	5500	0.6	0.5	0.05	0.04	<1	<1	<1	<1
Mercury	4/4	6.00E-01	3.94E-01	0.18	1.06	3	2	0.6	0.4	2	1	<1	<1
Nickel	4/4	4.67E+01	2.90E+01	23	48.6	2	1	1	0.6	<1	<1	<1	<1
Selenium	3/4	2.00E+00	1.16E+00	--	--	--	--	--	--	--	--	--	--
Silver	4/4	8.60E+00	4.22E+00	2	10	4	2	0.9	0.4	3	1	<1	<1
Thallium	1/4	2.80E-01	2.13E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	3/4	2.12E+01	1.45E+01	--	--	--	--	--	--	--	--	--	--
Zinc	4/4	5.90E+02	3.89E+02	120	459	5	3	1.3	0.8	2	2	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6g
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond E

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/2	1.35E-02	1.25E-02	0.17	2.2	0.1	0.07	0.01	0.006	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/2	1.35E-02	1.25E-02	0.94	12.2	0.01	0.01	0.001	0.001	<1	<1	<1	<1
1,1-Dichloroethene	0/2	1.35E-02	1.25E-02	0.031	0.40	0.4	0.4	0.03	0.03	<1	<1	<1	<1
2-Butanone	1/2	7.50E-01	3.82E-01	0.27	3.5	3	1	0.2	0.1	3	1	<1	<1
2-Hexanone	0/2	1.35E-02	1.25E-02	0.022	0.29	0.6	0.6	0.05	0.04	<1	<1	<1	<1
4-Methyl-2-pentanone	1/2	1.30E-01	7.18E-02	0.033	0.43	4	2	0.3	0.2	4	2	<1	<1
Acetone	1/2	2.30E+00	1.16E+00	0.0087	0.11	264	133	20	10	254	127	20	10
Carbon disulfide	1/2	4.40E-02	2.88E-02	0.00085	0.011	52	34	4	3	46	29	4	2
Chloromethane	0/2	1.35E-02	1.25E-02	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	0/2	1.35E-02	1.25E-02	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/2	1.35E-02	1.25E-02	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	0/2	1.35E-02	1.25E-02	--	--	--	--	--	--	--	--	--	--
Methyl acetate	0/2	1.35E-02	1.25E-02	--	--	--	--	--	--	--	--	--	--
Methylene chloride	0/2	4.35E-02	2.85E-02	0.37	4.8	0.1	0.08	0.009	0.006	<1	<1	<1	<1
Styrene	0/2	1.35E-02	1.25E-02	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	0/2	1.35E-02	1.25E-02	0.41	5.3	0.03	0.03	0.003	0.002	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/2	1.35E-02	1.25E-02	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	0/2	1.35E-02	1.25E-02	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	1/2	1.35E-02	8.75E-03	0.025	0.33	0.5	0.4	0.04	0.03	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	0/2	2.35E-01	2.08E-01	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	2/2	6.10E-02	6.05E-02	0.33	4.3	0.2	0.2	0.01	0.01	<1	<1	<1	<1
2-Methylphenol	0/2	2.35E-01	2.08E-01	0.012	0.16	20	17	2	1	<1	8	<1	<1
4-Bromophenyl-phenylether	0/2	2.35E-01	2.08E-01	1.3	16.9	0.2	0.2	0.01	0.01	<1	<1	<1	<1
4-Chloroaniline	0/2	2.35E-01	2.08E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	0/2	2.35E-01	2.08E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/2	6.00E-01	5.28E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	2/2	9.10E-02	8.20E-02	0.62	8.1	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Acenaphthylene	2/2	1.80E-01	1.70E-01	0.33	4.3	0.5	0.5	0.04	0.04	<1	<1	<1	<1
Acetophenone	1/2	2.35E-01	1.40E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	2/2	4.80E-01	3.95E-01	0.057	0.85	8	7	1	0.5	<1	1	<1	<1
Benzaldehyde	1/2	3.50E-01	2.93E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	2/2	2.20E+00	1.85E+00	0.15	1.5	15	12	2	1	6	6	<1	<1
Benzo(b)fluoranthene	1/1	2.20E+00	2.20E+00	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	2/2	1.10E+00	8.20E-01	0.17	0.32	6	5	3	3	<1	<1	<1	<1
Benzo(k)fluoranthene	2/2	1.40E+00	1.14E+00	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	2/2	2.00E+01	1.55E+01	890	11570	0.02	0.02	0.002	0.001	<1	<1	<1	<1
Carbazole	2/2	1.60E-01	1.55E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	2/2	1.90E+00	1.80E+00	0.17	1.3	11	11	1	1	3	5	<1	<1
Cyclohexane	1/2	1.35E-02	9.75E-03	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	1/2	2.35E-01	1.62E-01	2.0	26	0.1	0.08	0.009	0.006	<1	<1	<1	<1
Fluoranthene	2/2	2.90E+00	2.55E+00	0.42	2.2	7	6	1	1	1	2	<1	<1
Fluorene	2/2	1.30E-01	1.00E-01	0.077	0.54	2	1	0.2	0.2	<1	<1	<1	<1
Hexachlorobenzene	0/2	2.35E-01	2.08E-01	0.02	0.26	12	10	0.9	0.8	<1	5	<1	<1
Hexachlorobutadiene	0/2	2.35E-01	2.08E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	2/2	1.40E+00	1.02E+00	0.2	2.6	7	5	0.5	0.4	<1	2	<1	<1
Isophorone	0/2	2.35E-01	2.08E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	2/2	9.00E-02	8.55E-02	0.18	0.56	1	0.5	0.2	0.2	<1	<1	<1	<1
N-Nitrosodiphenylamine	1/2	1.40E+00	8.18E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	0/2	6.00E-01	5.28E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	2/2	1.80E+00	1.50E+00	0.20	1.2	9	7	2	1	2	3	<1	<1
Phenol	1/2	2.35E-01	1.38E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	2/2	3.10E+00	2.65E+00	0.20	1.52	16	14	2	2	5	5	<1	<1
Pesticides/PCBs													
4,4'-DDD	2/2	1.00E-02	9.60E-03	0.0049	0.028	2	2	0.4	0.3	<1	<1	<1	<1
4,4'-DDE	1/1	9.60E-03	9.60E-03	0.0032	0.031	3	3	0.3	0.3	<1	2	<1	<1
4,4'-DDT	0/1	4.65E-03	4.65E-03	0.0042	0.063	1	1	0.1	0.07	<1	<1	<1	<1
alpha-Chlordane	1/2	4.30E-03	2.24E-03	0.0032	0.018	1.3	0.7	0.2	0.1	<1	<1	<1	<1
Aroclor-1016	0/2	4.65E-03	4.15E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1221	0/2	9.50E-03	8.50E-03	0.06	0.7	0.2	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1232	0/2	4.65E-03	4.15E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1242	0/2	4.65E-03	4.15E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1248	0/2	4.65E-03	4.15E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1254	1/2	2.30E-01	1.17E-01	0.06	0.7	4	2	0.3	0.2	<1	<1	<1	<1
Aroclor-1260	1/2	1.20E-01	6.23E-02	0.06	0.7	2	1	0.2	0.1	<1	<1	<1	<1
Dieldrin	1/2	1.90E-02	9.68E-03	0.0019	0.062	10	5	0.3	0.2	7	3	<1	<1
Endosulfan I	0/2	2.40E-04	2.13E-04	0.0029	0.073	0.1	0.1	0.003	0.003	<1	<1	<1	<1
Endosulfan II	0/2	4.65E-04	4.15E-04	0.0055	0.14	0.1	0.1	0.003	0.003	<1	<1	<1	<1
Endosulfan Sulfate	1/2	4.80E-03	4.73E-03	--	--	--	--	--	--	--	--	--	--
Endrin	0/2	4.65E-04	4.15E-04	0.002	0.21	0.2	0.2	0.002	0.002	<1	<1	<1	<1
Endrin Aldehyde	2/2	7.60E-03	6.05E-03	--	--	--	--	--	--	--	--	--	--
Endrin Ketone	0/1	4.65E-03	4.65E-03	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	1/1	5.60E-03	5.60E-03	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0/2	2.40E-04	2.13E-04	0.0025	0.016	0.1	0.1	0.02	0.01	<1	<1	<1	<1
Methoxychlor	1/2	8.10E-03	5.25E-03	0.019	0.48	0.4	0.3	0.02	0.01	<1	<1	<1	<1
Total PCBs	2/2	2.30E-01	1.75E-01	0.06	0.68	4	3	0.3	0.3	<1	<1	<1	<1
Toxaphene	0/2	2.40E-02	2.13E-02	0.028	0.70	1	1	0.03	0.03	<1	<1	<1	<1
Metals													
Aluminum	2/2	1.09E+04	9.47E+03	--	--	--	--	--	--	--	--	--	--
Antimony	2/2	1.89E+01	1.23E+01	12	60	2	1	0.3	0.2	2	<1	<1	<1
Arsenic	2/2	2.11E+01	1.82E+01	9.8	33.0	2	2	0.6	0.6	1	1	<1	<1
Barium	2/2	6.17E+02	5.34E+02	--	--	--	--	--	--	--	--	--	--
Beryllium	1/2	7.20E-01	6.00E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	2/2	1.59E+01	1.46E+01	1	5	16	15	3	3	9	11	2	2
Chromium	2/2	3.54E+02	2.79E+02	43	111	8	6	3	3	7	5	3	2
Cobalt	0/2	6.50E+00	5.65E+00	--	--	--	--	--	--	--	--	--	--
Copper	2/2	6.53E+02	5.46E+02	32	149	21	17	4	4	17	15	4	3

US EPA ARCHIVE DOCUMENT

TABLE 7-6g
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond E

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Cyanide	2/2	5.00E-01	4.00E-01	--	--	--	--	--	--	--	--	--	--
Iron	2/2	4.96E+04	3.54E+04	20,000	40,000	2	2	1	0.9	2	1	<1	<1
Lead	2/2	1.76E+03	1.53E+03	36	128	49	43	14	12	43	40	12	11
Manganese	2/2	3.26E+02	2.90E+02	460	5500	0.7	0.6	0.06	0.05	<1	<1	<1	<1
Mercury	2/2	7.80E-01	6.60E-01	0.18	1.06	4	4	0.7	0.6	3	3	<1	<1
Nickel	2/2	6.17E+01	6.13E+01	23	48.6	3	3	1	1	2	2	<1	<1
Selenium	2/2	3.20E+00	2.85E+00	--	--	--	--	--	--	--	--	--	--
Silver	2/2	1.17E+01	1.16E+01	2	10	6	6	1	1	5	5	<1	<1
Thallium	1/2	9.60E-01	5.75E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	2/2	3.43E+01	3.27E+01	--	--	--	--	--	--	--	--	--	--
Zinc	2/2	1.46E+03	1.44E+03	120	459	12	12	3	3	10	10	3	3

US EPA ARCHIVE DOCUMENT

TABLE 7-6h
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/5	1.20E-02	6.17E-03	0.17	2.2	0.1	0.04	0.01	0.003	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/5	1.20E-02	6.17E-03	0.94	12.2	0.01	0.01	0.001	0.0005	<1	<1	<1	<1
1,1-Dichloroethene	0/5	1.20E-02	6.17E-03	0.031	0.40	0.4	0.2	0.03	0.02	<1	<1	<1	<1
2-Butanone	4/5	1.40E-01	5.27E-02	0.27	3.5	0.5	0.2	0.04	0.02	<1	<1	<1	<1
2-Hexanone	0/5	1.20E-02	6.17E-03	0.022	0.29	0.5	0.3	0.04	0.02	<1	<1	<1	<1
4-Methyl-2-pentanone	0/5	1.20E-02	6.17E-03	0.033	0.43	0.4	0.2	0.03	0.01	<1	<1	<1	<1
Acetone	4/5	6.90E-01	2.57E-01	0.0087	0.11	79	30	6	2	69	23	5	2
Carbon disulfide	4/5	7.00E-03	4.08E-03	0.00085	0.011	8	5	0.6	0.4	2	<1	<1	<1
Chloromethane	0/5	1.20E-02	6.17E-03	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	0/5	1.20E-02	6.17E-03	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/5	1.20E-02	6.17E-03	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	0/5	1.20E-02	6.17E-03	--	--	--	--	--	--	--	--	--	--
Methyl acetate	0/5	1.20E-02	6.17E-03	--	--	--	--	--	--	--	--	--	--
Methylene chloride	2/5	1.90E-02	9.42E-03	0.37	4.8	0.1	0.03	0.004	0.002	<1	<1	<1	<1
Styrene	0/5	1.20E-02	6.17E-03	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	0/5	1.20E-02	6.17E-03	0.41	5.3	0.03	0.02	0.002	0.001	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/5	1.20E-02	6.17E-03	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	0/5	1.20E-02	6.17E-03	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	0/5	1.20E-02	6.90E-03	0.025	0.33	0.5	0.3	0.04	0.02	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	0/5	2.95E-01	2.11E-01	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	2/5	2.55E-01	1.86E-01	0.33	4.3	0.8	0.6	0.06	0.04	<1	<1	<1	<1
2-Methylphenol	0/5	2.95E-01	2.00E-01	0.012	0.16	25	17	2	1	5	7	<1	<1
4-Bromophenyl-phenylether	0/5	2.95E-01	2.11E-01	1.3	16.9	0.2	0.2	0.02	0.01	<1	<1	<1	<1
4-Chloroaniline	0/5	2.95E-01	2.11E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	1/5	2.55E-01	1.64E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/5	7.50E-01	5.15E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	5/5	9.60E-02	7.78E-02	0.62	8.1	0.2	0.1	0.01	0.01	<1	<1	<1	<1
Acenaphthylene	5/5	3.00E-01	1.32E-01	0.33	4.3	0.9	0.4	0.07	0.03	<1	<1	<1	<1
Acetophenone	0/5	2.95E-01	2.11E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	5/5	4.70E-01	3.26E-01	0.057	0.85	8	6	1	0.4	<1	<1	<1	<1
Benzaldehyde	3/5	2.10E-01	1.14E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	5/5	1.80E+00	9.98E-01	0.15	1.5	12	7	1	0.7	3	<1	<1	<1
Benzo(b)fluoranthene	5/5	2.60E+00	1.30E+00	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	5/5	9.60E-01	5.16E-01	0.17	0.32	6	3	3	2	<1	<1	<1	<1
Benzo(k)fluoranthene	5/5	1.10E+00	7.22E-01	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	5/5	2.80E+01	6.55E+00	890	11570	0.03	0.007	0.002	0.0006	<1	<1	<1	<1
Carbazole	4/5	2.95E-01	1.50E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	5/5	2.10E+00	1.13E+00	0.17	1.3	13	7	2	0.9	4	<1	<1	<1
Cyclohexane	0/5	1.20E-02	6.17E-03	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	3/5	2.20E-01	9.28E-02	2.0	26	0.1	0.05	0.008	0.004	<1	<1	<1	<1
Fluoranthene	5/5	4.00E+00	2.36E+00	0.42	2.2	10	6	2	1	4	2	<1	<1
Fluorene	5/5	1.50E-01	1.20E-01	0.077	0.54	2	2	0.3	0.2	<1	<1	<1	<1
Hexachlorobenzene	0/5	2.95E-01	1.97E-01	0.02	0.26	15	10	1	0.8	3	4	<1	<1
Hexachlorobutadiene	0/5	2.95E-01	2.11E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	5/5	1.10E+00	5.66E-01	0.2	2.6	6	3	0.4	0.2	<1	<1	<1	<1
Isophorone	0/5	2.95E-01	2.11E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	2/5	2.55E-01	1.90E-01	0.18	0.56	1	1	0.5	0.3	<1	<1	<1	<1
N-Nitrosodiphenylamine	0/5	2.95E-01	2.11E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	0/4	7.50E-01	6.25E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	5/5	1.70E+00	1.14E+00	0.20	1.2	8	6	1	1	2	1	<1	<1
Phenol	1/5	2.95E-01	2.09E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	5/5	2.70E+00	1.76E+00	0.20	1.52	14	9	2	1	2	<1	<1	<1
Pesticides/PCBs													
4,4'-DDD	3/3	8.20E-03	5.37E-03	0.0049	0.028	2	1	0.3	0.2	<1	<1	<1	<1
4,4'-DDE	3/3	3.70E-02	2.87E-02	0.0032	0.031	12	9	1	0.9	8	8	<1	<1
4,4'-DDT	1/3	4.80E-03	1.85E-03	0.0042	0.063	1	0.4	0.1	0.03	<1	<1	<1	<1
alpha-Chlordane	1/4	4.30E-03	1.27E-03	0.0032	0.018	1	0.4	0.2	0.1	<1	<1	<1	<1
Aroclor-1016	0/5	1.55E-02	7.05E-03	0.06	0.7	0.3	0.1	0.02	0.01	<1	<1	<1	<1
Aroclor-1221	0/5	1.55E-02	1.12E-02	0.06	0.7	0.3	0.2	0.02	0.02	<1	<1	<1	<1
Aroclor-1232	0/5	1.55E-02	7.05E-03	0.06	0.7	0.3	0.1	0.02	0.01	<1	<1	<1	<1
Aroclor-1242	0/5	1.55E-02	7.05E-03	0.06	0.7	0.3	0.1	0.02	0.01	<1	<1	<1	<1
Aroclor-1248	0/5	1.55E-02	7.05E-03	0.06	0.7	0.3	0.1	0.02	0.01	<1	<1	<1	<1
Aroclor-1254	1/5	2.60E-01	5.60E-02	0.06	0.7	4	0.9	0.4	0.1	<1	<1	<1	<1
Aroclor-1260	5/5	3.40E-01	1.70E-01	0.06	0.7	6	3	0.5	0.3	<1	<1	<1	<1
Dieldrin	3/3	3.60E-02	2.11E-02	0.0019	0.062	19	11	0.6	0.3	16	9	<1	<1
Endosulfan I	0/4	3.10E-04	2.76E-04	0.0029	0.073	0.1	0.1	0.004	0.004	<1	<1	<1	<1
Endosulfan II	0/5	6.00E-04	4.57E-04	0.0055	0.14	0.1	0.1	0.004	0.003	<1	<1	<1	<1
Endosulfan Sulfate	3/4	5.10E-03	2.73E-03	--	--	--	--	--	--	--	--	--	--
Endrin	0/4	6.00E-04	4.94E-04	0.002	0.21	0.3	0.2	0.003	0.002	<1	<1	<1	<1
Endrin Aldehyde	2/4	9.50E-03	3.89E-03	--	--	--	--	--	--	--	--	--	--
Endrin Ketone	0/2	4.40E-04	3.75E-04	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	1/3	3.70E-03	1.42E-03	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0/5	3.10E-04	2.66E-04	0.0025	0.016	0.1	0.1	0.02	0.02	<1	<1	<1	<1
Methoxychlor	2/5	1.10E-02	4.84E-03	0.019	0.48	0.6	0.3	0.02	0.01	<1	<1	<1	<1
Total PCBs	5/5	6.00E-01	2.22E-01	0.06	0.68	10	4	0.9	0.3	<1	<1	<1	<1
Toxaphene	0/5	3.85E-02	2.81E-02	0.028	0.70	1	1	0.06	0.04	<1	<1	<1	<1
Metals													
Aluminum	5/5	1.11E+04	6.08E+03	--	--	--	--	--	--	--	--	--	--
Antimony	3/5	2.40E+00	7.73E-01	12	60	0.2	0.1	0.04	0.01	<1	<1	<1	<1
Arsenic	5/5	1.73E+01	8.28E+00	9.8	33.0	2	0.8	0.5	0.3	1	<1	<1	<1
Barium	3/5	2.02E+02	8.38E+01	--	--	--	--	--	--	--	--	--	--
Beryllium	2/5	8.50E-01	5.96E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	5/5	1.48E+01	6.52E+00	1	5	15	7	3	1	8	3	2	<1
Chromium	5/5	1.49E+02	7.07E+01	43	111	3	2	1	0.6	2	<1	<1	<1
Cobalt	1/5	8.50E+00	7.04E+00	--	--	--	--	--	--	--	--	--	--
Copper	5/5	2.34E+02	1.04E+02	32	149	7	3	2	0.7	4	1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6h
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Cyanide	1/4	3.60E-01	2.88E-01	--	--	--	--	--	--	--	--	--	--
Iron	5/5	2.45E+04	1.24E+04	20,000	40,000	1	0.6	0.6	0.3	<1	<1	<1	<1
Lead	5/5	2.07E+02	1.06E+02	36	128	6	3	2	1	<1	<1	<1	<1
Manganese	5/5	6.72E+02	2.82E+02	460	5500	1	0.6	0.1	0.05	1	<1	<1	<1
Mercury	5/5	6.10E-01	2.63E-01	0.18	1.06	3	1	0.6	0.2	2	<1	<1	<1
Nickel	4/5	3.77E+01	2.07E+01	23	48.6	2	0.9	1	0.4	<1	<1	<1	<1
Selenium	3/5	3.60E+00	1.29E+00	--	--	--	--	--	--	--	--	--	--
Silver	4/5	1.46E+01	4.92E+00	2	10	7	2	1	0.5	6	2	1	<1
Thallium	1/5	3.45E-01	2.48E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	3/5	2.71E+01	1.41E+01	--	--	--	--	--	--	--	--	--	--
Zinc	5/5	4.77E+02	2.30E+02	120	459	4	2	1	0.5	1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6i
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond I

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/3	1.45E-02	8.18E-03	0.17	2.2	0.1	0.05	0.01	0.004	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/3	1.45E-02	8.18E-03	0.94	12.2	0.02	0.01	0.001	0.0007	<1	<1	<1	<1
1,1-Dichloroethene	0/3	1.45E-02	8.18E-03	0.031	0.40	0.5	0.3	0.04	0.02	<1	<1	<1	<1
2-Butanone	3/3	3.80E-01	1.43E-01	0.27	3.5	1	0.5	0.1	0.0	1	<1	<1	<1
2-Hexanone	0/3	1.45E-02	8.18E-03	0.022	0.29	0.7	0.4	0.05	0.03	<1	<1	<1	<1
4-Methyl-2-pentanone	0/3	1.45E-02	8.18E-03	0.033	0.43	0.4	0.2	0.03	0.02	<1	<1	<1	<1
Acetone	3/3	1.10E+00	3.97E-01	0.0087	0.11	126	46	10	4	116	39	9	3
Carbon disulfide	2/3	1.20E-02	7.37E-03	0.00085	0.011	14	9	1	0.7	8	4	<1	<1
Chloromethane	0/3	1.45E-02	8.18E-03	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	0/3	1.45E-02	8.18E-03	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/3	1.45E-02	8.18E-03	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	0/3	1.45E-02	8.18E-03	--	--	--	--	--	--	--	--	--	--
Methyl acetate	1/3	2.20E-02	1.04E-02	--	--	--	--	--	--	--	--	--	--
Methylene chloride	0/3	2.10E-02	1.06E-02	0.37	4.8	0.1	0.03	0.004	0.002	<1	<1	<1	<1
Styrene	0/3	1.45E-02	8.18E-03	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	0/3	1.45E-02	8.18E-03	0.41	5.3	0.04	0.02	0.003	0.002	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/3	1.45E-02	8.18E-03	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	0/3	1.45E-02	8.18E-03	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	0/3	1.45E-02	9.75E-03	0.025	0.33	0.6	0.4	0.04	0.03	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	0/3	2.80E-01	1.81E-01	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	3/3	4.70E-01	2.18E-01	0.33	4.3	1	0.7	0.1	0.05	<1	<1	<1	<1
2-Methylphenol	0/3	2.80E-01	1.58E-01	0.012	0.16	23	13	2	1	4	3	<1	<1
4-Bromophenyl-phenylether	0/3	2.80E-01	1.81E-01	1.3	16.9	0.2	0.1	0.02	0.01	<1	<1	<1	<1
4-Chloroaniline	0/3	2.80E-01	1.81E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	0/3	2.80E-01	1.81E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/3	7.00E-01	4.07E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	3/3	1.80E-01	1.55E-01	0.62	8.1	0.3	0.3	0.02	0.02	<1	<1	<1	<1
Acenaphthylene	3/3	5.60E-01	3.70E-01	0.33	4.3	2	1	0.1	0.09	<1	<1	<1	<1
Acetophenone	1/3	2.80E-01	1.65E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	3/3	8.80E-01	5.95E-01	0.057	0.85	15	10	1	0.7	7	5	<1	<1
Benzaldehyde	3/3	7.20E-01	3.98E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	3/3	3.60E+00	2.30E+00	0.15	1.5	24	15	2	2	15	9	2	<1
Benzo(b)fluoranthene	3/3	3.80E+00	2.82E+00	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	3/3	2.70E+00	1.59E+00	0.17	0.32	16	9	8	5	7	5	4	3
Benzo(k)fluoranthene	3/3	3.20E+00	1.62E+00	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	3/3	4.70E+00	3.80E+00	890	11570	0.005	0.004	0.0004	0.0003	<1	<1	<1	<1
Carbazole	3/3	4.60E-01	3.05E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	3/3	3.70E+00	2.55E+00	0.17	1.3	22	15	3	2	13	9	2	1
Cyclohexane	2/3	3.60E-02	1.40E-02	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	2/3	9.00E-02	7.63E-02	2.0	26	0.05	0.04	0.003	0.003	<1	<1	<1	<1
Fluoranthene	3/3	6.60E+00	4.42E+00	0.42	2.2	16	11	3	2	10	7	2	1
Fluorene	3/3	3.60E-01	2.38E-01	0.077	0.54	5	3	0.7	0.4	3	2	<1	<1
Hexachlorobenzene	0/3	2.80E-01	1.52E-01	0.02	0.26	14	8	1	0.6	3	2	<1	<1
Hexachlorobutadiene	0/3	2.80E-01	1.81E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	3/3	2.50E+00	1.48E+00	0.2	2.6	13	7	1	0.6	6	4	<1	<1
Isophorone	0/3	2.80E-01	1.81E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	3/3	6.80E-01	3.10E-01	0.18	0.56	4	2	1	0.6	3	1	<1	<1
N-Nitrosodiphenylamine	0/3	2.80E-01	1.81E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	0/2	7.00E-01	5.65E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	3/3	2.80E+00	1.98E+00	0.20	1.2	14	10	2	2	7	5	1	<1
Phenol	2/3	2.80E-01	1.62E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	3/3	5.40E+00	3.42E+00	0.20	1.52	28	18	4	2	16	9	2	1
Pesticides/PCBs													
4,4'-DDD	2/2	1.90E-02	1.00E-02	0.0049	0.028	4	2	0.7	0.4	1	<1	<1	<1
4,4'-DDE	2/2	1.50E-02	8.18E-03	0.0032	0.031	5	3	0.5	0.3	1	1	<1	<1
4,4'-DDT	0/1	3.55E-04	3.55E-04	0.0042	0.063	0.1	0.1	0.01	0.01	<1	<1	<1	<1
alpha-Chlordane	3/3	1.10E-02	4.86E-03	0.0032	0.018	3	2	0.6	0.3	3	<1	<1	<1
Aroclor-1016	0/2	1.80E-02	1.18E-02	0.06	0.7	0.3	0.2	0.03	0.02	<1	<1	<1	<1
Aroclor-1221	0/2	1.80E-02	1.45E-02	0.06	0.7	0.3	0.2	0.03	0.02	<1	<1	<1	<1
Aroclor-1232	0/2	1.80E-02	1.18E-02	0.06	0.7	0.3	0.2	0.03	0.02	<1	<1	<1	<1
Aroclor-1242	0/2	1.80E-02	1.18E-02	0.06	0.7	0.3	0.2	0.03	0.02	<1	<1	<1	<1
Aroclor-1248	0/2	1.80E-02	1.18E-02	0.06	0.7	0.3	0.2	0.03	0.02	<1	<1	<1	<1
Aroclor-1254	1/2	3.60E-01	1.83E-01	0.06	0.7	6	3	0.5	0.3	<1	<1	<1	<1
Aroclor-1260	3/3	7.60E-01	3.27E-01	0.06	0.7	13	5	1	0.5	5	2	<1	<1
Dieldrin	2/2	9.40E-03	4.91E-03	0.0019	0.062	5	3	0.2	0.1	2	<1	<1	<1
Endosulfan I	0/2	3.55E-04	3.20E-04	0.0029	0.073	0.1	0.1	0.005	0.004	<1	<1	<1	<1
Endosulfan II	0/2	5.50E-04	4.53E-04	0.0055	0.14	0.1	0.1	0.004	0.003	<1	<1	<1	<1
Endosulfan Sulfate	1/2	6.60E-03	3.48E-03	--	--	--	--	--	--	--	--	--	--
Endrin	0/2	5.50E-04	4.53E-04	0.002	0.21	0.2	0.2	0.003	0.002	<1	<1	<1	<1
Endrin Aldehyde	0/1	3.55E-04	3.55E-04	--	--	--	--	--	--	--	--	--	--
Endrin Ketone	0/1	3.55E-04	3.55E-04	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	2/2	7.40E-03	4.04E-03	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0/2	3.55E-04	3.20E-04	0.0025	0.016	0.1	0.1	0.02	0.02	<1	<1	<1	<1
Methoxychlor	0/2	2.85E-03	1.60E-03	0.019	0.48	0.2	0.1	0.01	0.003	<1	<1	<1	<1
Total PCBs	3/3	1.12E+00	4.47E-01	0.06	0.68	19	7	2	0.7	3	<1	<1	<1
Toxaphene	0/2	4.45E-02	3.65E-02	0.028	0.70	2	1	0.06	0.05	<1	<1	<1	<1
Metals													
Aluminum	3/3	1.24E+04	9.98E+03	--	--	--	--	--	--	--	--	--	--
Antimony	3/3	4.50E+00	1.62E+00	12	60	0.4	0.1	0.08	0.03	<1	<1	<1	<1
Arsenic	3/3	1.30E+01	1.07E+01	9.8	33.0	1	1	0.4	0.3	<1	<1	<1	<1
Barium	3/3	2.19E+02	1.71E+02	--	--	--	--	--	--	--	--	--	--
Beryllium	3/3	1.20E+00	7.22E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	3/3	3.02E+01	1.54E+01	1	5	30	15	6	3	23	12	5	2
Chromium	3/3	2.57E+02	1.47E+02	43	111	6	3	2	1	4	2	2	<1
Cobalt	3/3	8.60E+00	6.32E+00	--	--	--	--	--	--	--	--	--	--
Copper	3/3	3.55E+02	2.22E+02	32	149	11	7	2	1	8	5	2	1
Cyanide	2/2	2.00E+00	1.26E+00	--	--	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-6i
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond I

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Iron	3/3	3.10E+04	2.43E+04	20,000	40,000	2	1	0.8	0.6	<1	<1	<1	<1
Lead	3/3	3.00E+02	1.91E+02	36	128	8	5	2	1	3	3	<1	<1
Manganese	3/3	3.80E+02	3.08E+02	460	5500	0.8	0.7	0.07	0.06	<1	<1	<1	<1
Mercury	3/3	6.60E-01	4.88E-01	0.18	1.06	4	3	0.6	0.5	2	2	<1	<1
Nickel	3/3	7.06E+01	3.77E+01	23	48.6	3	2	1	0.8	2	<1	<1	<1
Selenium	3/3	3.70E+00	2.25E+00	--	--	--	--	--	--	--	--	--	--
Silver	3/3	1.88E+01	7.90E+00	2	10	9	4	2	0.8	8	3	2	<1
Thallium	2/3	9.20E-01	4.12E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	3/3	3.35E+01	2.34E+01	--	--	--	--	--	--	--	--	--	--
Zinc	3/3	6.66E+02	4.13E+02	120	459	6	3	1	0.9	3	2	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6j
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond N

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/1	6.00E-03	6.00E-03	0.17	2.2	0.04	0.04	0.003	0.003	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/1	6.00E-03	6.00E-03	0.94	12.2	0.01	0.01	0.000	0.0005	<1	<1	<1	<1
1,1-Dichloroethene	0/1	6.00E-03	6.00E-03	0.031	0.40	0.2	0.2	0.01	0.01	<1	<1	<1	<1
2-Butanone	1/1	1.00E-02	1.00E-02	0.27	3.5	0.04	0.04	0.003	0.003	<1	<1	<1	<1
2-Hexanone	0/1	6.00E-03	6.00E-03	0.022	0.29	0.3	0.3	0.02	0.02	<1	<1	<1	<1
4-Methyl-2-pentanone	0/1	6.00E-03	6.00E-03	0.033	0.43	0.2	0.2	0.01	0.01	<1	<1	<1	<1
Acetone	1/1	8.70E-02	8.70E-02	0.0087	0.11	10	10	0.8	0.8	<1	4	<1	<1
Carbon disulfide	0/1	6.00E-03	6.00E-03	0.00085	0.011	7	7	0.5	0.5	1	2	<1	<1
Chloromethane	0/1	6.00E-03	6.00E-03	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	0/1	6.00E-03	6.00E-03	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/1	6.00E-03	6.00E-03	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	0/1	6.00E-03	6.00E-03	--	--	--	--	--	--	--	--	--	--
Methyl acetate	0/1	6.00E-03	6.00E-03	--	--	--	--	--	--	--	--	--	--
Methylene chloride	0/1	6.00E-03	6.00E-03	0.37	4.8	0.02	0.02	0.001	0.001	<1	<1	<1	<1
Styrene	0/1	6.00E-03	6.00E-03	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	0/1	6.00E-03	6.00E-03	0.41	5.3	0.01	0.01	0.001	0.001	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/1	6.00E-03	6.00E-03	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	0/1	6.00E-03	6.00E-03	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	0/1	6.00E-03	6.00E-03	0.025	0.33	0.2	0.2	0.02	0.02	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	1/1	4.20E-02	4.20E-02	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	1/1	6.90E-02	6.90E-02	0.33	4.3	0.2	0.2	0.02	0.02	<1	<1	<1	<1
2-Methylphenol	0/1	1.65E-01	1.65E-01	0.012	0.16	14	14	1	1	<1	4	<1	<1
4-Bromophenyl-phenylether	0/1	1.65E-01	1.65E-01	1.3	16.9	0.1	0.1	0.01	0.01	<1	<1	<1	<1
4-Chloroaniline	0/1	1.65E-01	1.65E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	0/1	1.65E-01	1.65E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/1	4.15E-01	4.15E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	1/1	9.20E-02	9.20E-02	0.62	8.1	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Acenaphthylene	1/1	1.90E-01	1.90E-01	0.33	4.3	0.6	0.6	0.04	0.04	<1	<1	<1	<1
Acetophenone	0/1	1.65E-01	1.65E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	1/1	4.00E-01	4.00E-01	0.057	0.85	7	7	0.5	0.5	<1	1	<1	<1
Benzaldehyde	1/1	1.30E-01	1.30E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	1/1	9.80E-01	9.80E-01	0.15	1.5	7	7	1	1	<1	<1	<1	<1
Benzo(b)fluoranthene	1/1	1.20E+00	1.20E+00	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	1/1	3.50E-01	3.50E-01	0.17	0.32	2	2	1	1	<1	<1	<1	<1
Benzo(k)fluoranthene	1/1	5.80E-01	5.80E-01	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	1/1	1.30E+01	1.30E+01	890	11570	0.01	0.01	0.001	0.001	<1	<1	<1	<1
Carbazole	1/1	1.30E-01	1.30E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	1/1	1.10E+00	1.10E+00	0.17	1.3	7	7	0.9	0.9	<1	<1	<1	<1
Cyclohexane	0/1	6.00E-03	6.00E-03	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	1/1	7.20E-02	7.20E-02	2.0	26	0.04	0.04	0.003	0.003	<1	<1	<1	<1
Fluoranthene	1/1	1.90E+00	1.90E+00	0.42	2.2	5	5	0.9	0.9	<1	<1	<1	<1
Fluorene	1/1	1.30E-01	1.30E-01	0.077	0.54	2	2	0.2	0.2	<1	<1	<1	<1
Hexachlorobenzene	0/1	1.65E-01	1.65E-01	0.02	0.26	8	8	0.6	0.6	<1	3	<1	<1
Hexachlorobutadiene	0/1	1.65E-01	1.65E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	1/1	4.10E-01	4.10E-01	0.2	2.6	2	2	0.2	0.2	<1	<1	<1	<1
Isophorone	0/1	1.65E-01	1.65E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	1/1	7.80E-02	7.80E-02	0.18	0.56	0.4	0.4	0.1	0.1	<1	<1	<1	<1
N-Nitrosodiphenylamine	0/1	1.65E-01	1.65E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	0/1	4.15E-01	4.15E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	1/1	1.10E+00	1.10E+00	0.20	1.2	5	5	0.9	0.9	<1	<1	<1	<1
Phenol	0/1	1.65E-01	1.65E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	1/1	1.50E+00	1.50E+00	0.20	1.52	8	8	1	1	<1	<1	<1	<1
Pesticides/PCBs													
4,4'-DDD	1/1	3.50E-02	3.50E-02	0.0049	0.028	7	7	1	1	5	6	<1	1
4,4'-DDE	1/1	2.10E-02	2.10E-02	0.0032	0.031	7	7	0.7	0.7	3	5	<1	<1
4,4'-DDT	--	--	--	0.0042	0.063	--	--	--	--	--	--	--	--
alpha-Chlordane	1/1	6.60E-03	6.60E-03	0.0032	0.018	2	2	0.4	0.4	1	2	<1	<1
Aroclor-1016	0/1	3.30E-03	3.30E-03	0.06	0.7	0.1	0.1	0.005	0.005	<1	<1	<1	<1
Aroclor-1221	0/1	6.50E-03	6.50E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1232	0/1	3.30E-03	3.30E-03	0.06	0.7	0.1	0.1	0.005	0.005	<1	<1	<1	<1
Aroclor-1242	0/1	3.30E-03	3.30E-03	0.06	0.7	0.1	0.1	0.005	0.005	<1	<1	<1	<1
Aroclor-1248	0/1	3.30E-03	3.30E-03	0.06	0.7	0.1	0.1	0.005	0.005	<1	<1	<1	<1
Aroclor-1254	0/1	3.30E-03	3.30E-03	0.06	0.7	0.1	0.1	0.005	0.005	<1	<1	<1	<1
Aroclor-1260	1/1	5.50E-01	5.50E-01	0.06	0.7	9	9	1	0.8	2	6	<1	<1
Dieldrin	1/1	7.40E-02	7.40E-02	0.0019	0.062	39	39	1	1	36	37	1	1
Endosulfan I	--	--	--	0.0029	0.073	--	--	--	--	--	--	--	--
Endosulfan II	0/1	3.30E-04	3.30E-04	0.0055	0.14	0.1	0.1	0.002	0.002	<1	<1	<1	<1
Endosulfan Sulfate	--	--	--	--	--	--	--	--	--	--	--	--	--
Endrin	0/1	3.30E-04	3.30E-04	0.002	0.21	0.1	0.1	0.002	0.002	<1	<1	<1	<1
Endrin Aldehyde	1/1	2.20E-03	2.20E-03	--	--	--	--	--	--	--	--	--	--
Endrin Ketone	0/1	3.30E-04	3.30E-04	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	1/1	1.10E-02	1.10E-02	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0/1	1.70E-04	1.70E-04	0.0025	0.016	0.07	0.07	0.01	0.01	<1	<1	<1	<1
Methoxychlor	1/1	1.60E-02	1.60E-02	0.019	0.48	0.8	0.8	0.03	0.03	<1	<1	<1	<1
Total PCBs	1/1	5.50E-01	5.50E-01	0.06	0.68	9	9	0.8	0.8	<1	2	<1	<1
Toxaphene	0/1	1.70E-02	1.70E-02	0.028	0.70	0.6	0.6	0.02	0.02	<1	<1	<1	<1
Metals													
Aluminum	1/1	9.09E+03	9.09E+03	--	--	--	--	--	--	--	--	--	--
Antimony	0/1	1.05E+00	1.05E+00	12	60	0.1	0.1	0.02	0.02	<1	<1	<1	<1
Arsenic	1/1	9.00E+00	9.00E+00	9.8	33.0	0.9	0.9	0.3	0.3	<1	<1	<1	<1
Barium	1/1	1.13E+02	1.13E+02	--	--	--	--	--	--	--	--	--	--
Beryllium	0/1	4.60E-01	4.60E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	1/1	1.38E+01	1.38E+01	1	5	14	14	3	3	7	10	1	2
Chromium	1/1	1.63E+02	1.63E+02	43	111	4	4	1	1	2	3	<1	1
Cobalt	0/1	4.60E+00	4.60E+00	--	--	--	--	--	--	--	--	--	--
Copper	1/1	2.10E+02	2.10E+02	32	149	7	7	1	1	3	5	<1	<1
Cyanide	1/1	4.00E+00	4.00E+00	--	--	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-6j
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond N

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Iron	1/1	1.22E+04	1.22E+04	20,000	40,000	1	0.6	0.3	0.3	<1	<1	<1	<1
Lead	1/1	1.85E+02	1.85E+02	36	128	5	5	1	1	<1	3	<1	<1
Manganese	1/1	1.60E+02	1.60E+02	460	5500	0.3	0.3	0.03	0.03	<1	<1	<1	<1
Mercury	1/1	4.30E-01	4.30E-01	0.18	1.06	2	2	0.4	0.4	<1	1	<1	<1
Nickel	1/1	4.92E+01	4.92E+01	23	48.6	2	2	1	1	1	1	<1	<1
Selenium	1/1	1.40E+00	1.40E+00	--	--	--	--	--	--	--	--	--	--
Silver	1/1	1.05E+01	1.05E+01	2	10	5	5	1	1	4	4	<1	<1
Thallium	1/1	6.00E-01	6.00E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	1/1	2.39E+01	2.39E+01	--	--	--	--	--	--	--	--	--	--
Zinc	1/1	4.78E+02	4.78E+02	120	459	4	4	1	1	1	2	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6k
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond P

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/1	6.50E-03	6.50E-03	0.17	2.2	0.04	0.04	0.003	0.003	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/1	6.50E-03	6.50E-03	0.94	12.2	0.01	0.01	0.001	0.0005	<1	<1	<1	<1
1,1-Dichloroethene	0/1	6.50E-03	6.50E-03	0.031	0.40	0.2	0.2	0.02	0.02	<1	<1	<1	<1
2-Butanone	0/1	6.50E-03	6.50E-03	0.27	3.5	0.02	0.02	0.002	0.002	<1	<1	<1	<1
2-Hexanone	0/1	6.50E-03	6.50E-03	0.022	0.29	0.3	0.3	0.02	0.02	<1	<1	<1	<1
4-Methyl-2-pentanone	0/1	6.50E-03	6.50E-03	0.033	0.43	0.2	0.2	0.02	0.02	<1	<1	<1	<1
Acetone	1/1	6.00E-03	6.00E-03	0.0087	0.11	0.7	0.7	0.1	0.1	<1	<1	<1	<1
Carbon disulfide	0/1	6.50E-03	6.50E-03	0.00085	0.011	8	8	0.6	0.6	2	3	<1	<1
Chloromethane	0/1	6.50E-03	6.50E-03	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	0/1	6.50E-03	6.50E-03	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/1	6.50E-03	6.50E-03	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	0/1	6.50E-03	6.50E-03	--	--	--	--	--	--	--	--	--	--
Methyl acetate	1/1	6.00E-03	6.00E-03	--	--	--	--	--	--	--	--	--	--
Methylene chloride	0/1	1.35E-02	1.35E-02	0.37	4.8	0.04	0.04	0.003	0.003	<1	<1	<1	<1
Styrene	0/1	6.50E-03	6.50E-03	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	0/1	6.50E-03	6.50E-03	0.41	5.3	0.02	0.02	0.001	0.001	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/1	6.50E-03	6.50E-03	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	0/1	6.50E-03	6.50E-03	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	0/1	6.50E-03	6.50E-03	0.025	0.33	0.3	0.3	0.02	0.02	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	0/1	2.00E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	1/1	1.10E-02	1.10E-02	0.33	4.3	0.03	0.03	0.003	0.003	<1	<1	<1	<1
2-Methylphenol	0/1	2.00E-01	2.00E-01	0.012	0.16	17	17	1	1	<1	7	<1	<1
4-Bromophenyl-phenylether	0/1	2.00E-01	2.00E-01	1.3	16.9	0.2	0.2	0.01	0.01	<1	<1	<1	<1
4-Chloroaniline	0/1	2.00E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	0/1	2.00E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/1	5.00E-01	5.00E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	1/1	4.90E-02	4.90E-02	0.62	8.1	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Acenaphthylene	1/1	2.80E-02	2.80E-02	0.33	4.3	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Acetophenone	0/1	2.00E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	1/1	1.20E-01	1.20E-01	0.057	0.85	2	2	0.1	0.1	<1	<1	<1	<1
Benzaldehyde	0/1	2.00E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	1/1	4.00E-01	4.00E-01	0.15	1.5	3	3	0.3	0.3	<1	<1	<1	<1
Benzo(b)fluoranthene	1/1	4.70E-01	4.70E-01	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	1/1	1.10E-01	1.10E-01	0.17	0.32	0.6	0.6	0.3	0.3	<1	<1	<1	<1
Benzo(k)fluoranthene	1/1	1.90E-01	1.90E-01	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	1/1	3.70E-01	3.70E-01	890	11570	0.0004	0.0004	0.00003	0.00003	<1	<1	<1	<1
Carbazole	0/1	2.00E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	1/1	3.80E-01	3.80E-01	0.17	1.3	2	2	0.3	0.3	<1	<1	<1	<1
Cyclohexane	0/1	6.50E-03	6.50E-03	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	0/1	2.00E-01	2.00E-01	2.0	26	0.1	0.1	0.008	0.008	<1	<1	<1	<1
Fluoranthene	1/1	9.10E-01	9.10E-01	0.42	2.2	2	2	0.4	0.4	<1	<1	<1	<1
Fluorene	1/1	5.10E-02	5.10E-02	0.077	0.54	0.7	0.7	0.1	0.1	<1	<1	<1	<1
Hexachlorobenzene	0/1	2.00E-01	2.00E-01	0.02	0.26	10	10	0.8	0.8	<1	4	<1	<1
Hexachlorobutadiene	0/1	2.00E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	1/1	1.30E-01	1.30E-01	0.2	2.6	0.7	0.7	0.1	0.1	<1	<1	<1	<1
Isophorone	0/1	2.00E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	1/1	1.70E-02	1.70E-02	0.18	0.56	0.1	0.1	0.03	0.03	<1	<1	<1	<1
N-Nitrosodiphenylamine	0/1	2.00E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	0/1	5.00E-01	5.00E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	1/1	7.30E-01	7.30E-01	0.20	1.2	4	4	0.6	0.6	<1	<1	<1	<1
Phenol	0/1	2.00E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	1/1	8.90E-01	8.90E-01	0.20	1.52	5	5	0.6	0.6	<1	<1	<1	<1
Pesticides/PCBs													
4,4'-DDD	0/1	4.00E-04	4.00E-04	0.0049	0.028	0.1	0.1	0.01	0.01	<1	<1	<1	<1
4,4'-DDE	0/1	4.00E-04	4.00E-04	0.0032	0.031	0.1	0.1	0.01	0.01	<1	<1	<1	<1
4,4'-DDT	0/1	4.00E-04	4.00E-04	0.0042	0.063	--	--	--	--	--	--	--	--
alpha-Chlordane	0/1	2.05E-04	2.05E-04	0.0032	0.018	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1016	0/1	4.00E-03	4.00E-03	0.06	0.7	0.1	0.1	0.006	0.006	<1	<1	<1	<1
Aroclor-1221	0/1	8.00E-03	8.00E-03	0.06	0.7	0.1	0.1	0.01	0.01	<1	<1	<1	<1
Aroclor-1232	0/1	4.00E-03	4.00E-03	0.06	0.7	0.1	0.1	0.006	0.006	<1	<1	<1	<1
Aroclor-1242	0/1	4.00E-03	4.00E-03	0.06	0.7	0.1	0.1	0.006	0.006	<1	<1	<1	<1
Aroclor-1248	0/1	4.00E-03	4.00E-03	0.06	0.7	0.1	0.1	0.006	0.006	<1	<1	<1	<1
Aroclor-1254	0/1	4.00E-03	4.00E-03	0.06	0.7	0.1	0.1	0.006	0.006	<1	<1	<1	<1
Aroclor-1260	1/1	1.00E-02	1.00E-02	0.06	0.7	0.2	0.2	0.01	0.01	<1	<1	<1	<1
Dieldrin	0/1	4.00E-04	4.00E-04	0.0019	0.062	0.2	0.2	0.01	0.01	<1	<1	<1	<1
Endosulfan I	0/1	2.05E-04	2.05E-04	0.0029	0.073	--	--	--	--	--	--	--	--
Endosulfan II	0/1	4.00E-04	4.00E-04	0.0055	0.14	0.1	0.1	0.003	0.003	<1	<1	<1	<1
Endosulfan Sulfate	0/1	4.00E-04	4.00E-04	--	--	--	--	--	--	--	--	--	--
Endrin	0/1	4.00E-04	4.00E-04	0.002	0.21	0.2	0.2	0.002	0.002	<1	<1	<1	<1
Endrin Aldehyde	0/1	4.00E-04	4.00E-04	--	--	--	--	--	--	--	--	--	--
Endrin Ketone	0/1	4.00E-04	4.00E-04	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	0/1	2.05E-04	2.05E-04	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0/1	2.05E-04	2.05E-04	0.0025	0.016	0.08	0.083	0.01	0.013	<1	<1	<1	<1
Methoxychlor	0/1	2.05E-03	2.05E-03	0.019	0.48	0.1	0.1	0.004	0.004	<1	<1	<1	<1
Total PCBs	1/1	1.00E-02	1.00E-02	0.06	0.68	0.2	0.2	0.01	0.01	<1	<1	<1	<1
Toxaphene	0/1	2.05E-02	2.05E-02	0.028	0.70	0.7	0.7	0.03	0.03	<1	<1	<1	<1
Metals													
Aluminum	1/1	3.08E+03	3.08E+03	--	--	--	--	--	--	--	--	--	--
Antimony	0/1	2.15E-01	2.15E-01	12	60	0.02	0.02	0.004	0.004	<1	<1	<1	<1
Arsenic	1/1	1.90E+00	1.90E+00	9.8	33.0	0.2	0.2	0.1	0.1	<1	<1	<1	<1
Barium	0/1	2.15E+01	2.15E+01	--	--	--	--	--	--	--	--	--	--
Beryllium	0/1	5.50E-01	5.50E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	1/1	2.20E+00	2.20E+00	1	5	2	2	0.4	0.4	<1	<1	<1	<1
Chromium	1/1	8.50E+00	8.50E+00	43	111	0.2	0.2	0.1	0.1	<1	<1	<1	<1
Cobalt	0/1	5.50E+00	5.50E+00	--	--	--	--	--	--	--	--	--	--
Copper	1/1	1.27E+01	1.27E+01	32	149	0.4	0.4	0.1	0.1	<1	<1	<1	<1
Cyanide	0/1	2.60E-01	2.60E-01	--	--	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-6k
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - Pond P

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Iron	1/1	6.07E+03	6.07E+03	20,000	40,000	0.3	0.3	0.2	0.2	<1	<1	<1	<1
Lead	1/1	1.05E+01	1.05E+01	36	128	0.3	0.3	0.1	0.1	<1	<1	<1	<1
Manganese	1/1	7.58E+01	7.58E+01	460	5500	0.2	0.2	0.01	0.01	<1	<1	<1	<1
Mercury	0/1	2.40E-02	2.40E-02	0.18	1.06	0.1	0.1	0.02	0.02	<1	<1	<1	<1
Nickel	0/1	4.25E+00	4.25E+00	23	48.6	0.2	0.2	0.1	0.1	<1	<1	<1	<1
Selenium	0/1	5.50E-01	5.50E-01	--	--	--	--	--	--	--	--	--	--
Silver	1/1	2.80E+00	2.80E+00	2	10	1	1	0.3	0.3	<1	<1	<1	<1
Thallium	0/1	2.15E-01	2.15E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	0/1	5.50E+00	5.50E+00	--	--	--	--	--	--	--	--	--	--
Zinc	1/1	8.42E+01	8.42E+01	120	459	0.7	0.7	0.2	0.2	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6l
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - WETLANDS A-D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs													
1,1,1-Trichloroethane	0/23	1.90E-02	6.84E-03	0.17	2.2	0.1	0.04	0.009	0.003	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	0/23	1.90E-02	6.84E-03	0.94	12.2	0.02	0.007	0.002	0.0006	<1	<1	<1	<1
1,1-Dichloroethene	0/23	1.90E-02	6.84E-03	0.031	0.40	0.6	0.2	0.05	0.02	<1	<1	<1	<1
2-Butanone	12/23	6.15E-02	1.88E-02	0.27	3.5	0.2	0.07	0.02	0.005	<1	<1	<1	<1
2-Hexanone	0/23	1.90E-02	6.84E-03	0.022	0.29	0.9	0.3	0.07	0.02	<1	<1	<1	<1
4-Methyl-2-pentanone	0/23	1.90E-02	6.84E-03	0.033	0.43	0.6	0.2	0.04	0.02	<1	<1	<1	<1
Acetone	8/23	9.34E-02	5.23E-02	0.0087	0.11	11	6	0.8	0.5	<1	<1	<1	<1
Carbon disulfide	0/23	1.90E-02	6.84E-03	0.00085	0.011	22	8	2	0.6	16	3	1	<1
Chloromethane	0/23	1.90E-02	6.84E-03	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	1/23	1.90E-02	6.69E-03	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0/23	1.90E-02	6.84E-03	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	0/23	1.90E-02	6.84E-03	--	--	--	--	--	--	--	--	--	--
Methyl acetate	0/23	1.90E-02	6.84E-03	--	--	--	--	--	--	--	--	--	--
Methylene chloride	1/23	4.20E-02	1.12E-02	0.37	4.8	0.1	0.03	0.009	0.002	<1	<1	<1	<1
Styrene	1/23	1.90E-02	6.81E-03	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	1/23	1.90E-02	6.47E-03	0.41	5.3	0.05	0.02	0.004	0.001	<1	<1	<1	<1
trans-1,3-Dichloropropene	0/23	1.90E-02	6.84E-03	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	0/23	1.90E-02	6.84E-03	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	1/23	1.90E-02	7.12E-03	0.025	0.33	0.8	0.3	0.06	0.02	<1	<1	<1	<1
SVOCs													
1,1'-Biphenyl	0/23	3.10E-01	2.15E-01	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	10/23	7.37E-02	8.31E-02	0.33	4.3	0.2	0.3	0.02	0.02	<1	<1	<1	<1
2-Methylphenol	1/23	3.10E-01	2.08E-01	0.012	0.16	26	17	2	1	7	8	<1	<1
4-Bromophenyl-phenylether	0/23	3.10E-01	2.15E-01	1.3	16.9	0.2	0.2	0.02	0.01	<1	<1	<1	<1
4-Chloroaniline	0/23	3.10E-01	2.15E-01	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	0/23	3.10E-01	2.15E-01	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	0/23	8.00E-01	5.26E-01	--	--	--	--	--	--	--	--	--	--
Acenaphthene	8/23	2.47E-02	5.81E-02	0.62	8.1	0.04	0.1	0.003	0.01	<1	<1	<1	<1
Acenaphthylene	21/23	1.75E-01	9.54E-02	0.33	4.3	1	0.3	0.04	0.02	<1	<1	<1	<1
Acetophenone	0/23	3.10E-01	2.15E-01	--	--	--	--	--	--	--	--	--	--
Anthracene	21/23	2.75E-01	1.13E-01	0.057	0.85	5	2	0.3	0.1	<1	<1	<1	<1
Benzaldehyde	6/23	1.57E-01	1.99E-01	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	23/23	1.51E+00	5.43E-01	0.15	1.5	10	4	1	0.4	1	<1	<1	<1
Benzo(b)fluoranthene	21/21	1.69E+00	6.34E-01	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	22/23	1.14E+00	3.18E-01	0.17	0.32	7	2	4	1	<1	<1	<1	<1
Benzo(k)fluoranthene	23/23	1.20E+00	3.81E-01	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	5/23	4.59E-01	3.56E-01	890	11570	0.001	0.0004	0.00004	0.00003	<1	<1	<1	<1
Carbazole	6/23	1.69E-01	1.97E-01	--	--	--	--	--	--	--	--	--	--
Chrysene	23/23	1.56E+00	5.80E-01	0.17	1.3	9	3	1	0.4	<1	<1	<1	<1
Cyclohexane	0/23	1.90E-02	6.84E-03	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	0/23	3.10E-01	2.15E-01	2.0	26	0.2	0.1	0.01	0.01	<1	<1	<1	<1
Fluoranthene	23/23	3.53E+00	1.06E+00	0.42	2.2	8	3	2	0.5	3	<1	<1	<1
Fluorene	16/23	4.66E-02	5.08E-02	0.077	0.54	1	1	0.1	0.1	<1	<1	<1	<1
Hexachlorobenzene	0/23	3.10E-01	2.07E-01	0.02	0.26	16	10	1	0.8	4	5	<1	<1
Hexachlorobutadiene	0/23	3.10E-01	2.15E-01	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	22/23	1.01E+00	2.94E-01	0.2	2.6	5	1	0.4	0.1	<1	<1	<1	<1
Isophorone	0/23	3.10E-01	2.15E-01	--	--	--	--	--	--	--	--	--	--
Naphthalene	9/23	8.62E-02	8.52E-02	0.18	0.56	0.5	0.5	0.2	0.2	<1	<1	<1	<1
N-Nitrosodiphenylamine	0/23	3.10E-01	2.15E-01	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	0/22	8.00E-01	5.46E-01	--	--	--	--	--	--	--	--	--	--
Phenanthrene	23/23	1.25E+00	3.97E-01	0.20	1.2	6	2	1	0.3	<1	<1	<1	<1
Phenol	1/23	1.60E+00	2.81E-01	--	--	--	--	--	--	--	--	--	--
Pyrene	23/23	2.86E+00	8.94E-01	0.20	1.52	15	5	2	1	3	<1	<1	<1
Pesticides/PCBs													
4,4'-DDD	0/23	5.32E-03	3.49E-03	0.0049	0.028	1	1	0.2	0.1	<1	<1	<1	<1
4,4'-DDE	0/23	5.09E-03	3.44E-03	0.0032	0.031	2	1	0.2	0.1	<1	<1	<1	<1
4,4'-DDT	14/23	2.10E-03	1.30E-03	0.0042	0.063	0.5	0.3	0.03	0.02	<1	<1	<1	<1
alpha-Chlordane	1/23	2.60E-03	1.54E-03	0.0032	0.018	0.8	0.5	0.1	0.1	<1	<1	<1	<1
Aroclor-1016	14/22	1.50E-02	5.19E-03	0.06	0.7	0.3	0.09	0.02	0.01	<1	<1	<1	<1
Aroclor-1221	17/22	1.50E-02	9.42E-03	0.06	0.7	0.3	0.2	0.02	0.01	<1	<1	<1	<1
Aroclor-1232	8/15	1.50E-02	5.19E-03	0.06	0.7	0.3	0.09	0.02	0.01	<1	<1	<1	<1
Aroclor-1242	13/22	1.50E-02	5.19E-03	0.06	0.7	0.3	0.09	0.02	0.01	<1	<1	<1	<1
Aroclor-1248	0/23	1.50E-02	5.19E-03	0.06	0.7	0.3	0.09	0.02	0.01	<1	<1	<1	<1
Aroclor-1254	0/23	1.50E-02	5.19E-03	0.06	0.7	0.3	0.1	0.02	0.01	<1	<1	<1	<1
Aroclor-1260	0/23	7.39E-02	3.77E-02	0.06	0.7	1	0.6	0.1	0.1	<1	<1	<1	<1
Dieldrin	0/23	1.10E-03	5.02E-04	0.0019	0.062	0.6	0.3	0.02	0.01	<1	<1	<1	<1
Endosulfan I	0/23	4.10E-04	2.63E-04	0.0029	0.073	0.1	0.1	0.01	0.004	<1	<1	<1	<1
Endosulfan II	2/21	6.50E-04	4.67E-04	0.0055	0.14	0.1	0.08	0.005	0.003	<1	<1	<1	<1
Endosulfan Sulfate	0/23	2.70E-03	6.65E-04	--	--	--	--	--	--	--	--	--	--
Endrin	2/22	6.50E-04	4.67E-04	0.002	0.21	0.3	0.2	0.003	0.002	<1	<1	<1	<1
Endrin Aldehyde	1/19	2.05E-03	7.05E-04	--	--	--	--	--	--	--	--	--	--
Endrin Ketone	6/20	8.80E-03	1.04E-03	--	--	--	--	--	--	--	--	--	--
Gamma-Chlordane	0/23	2.29E-03	1.09E-03	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0/21	4.10E-04	2.63E-04	0.0025	0.016	0.2	0.1	0.03	0.02	<1	<1	<1	<1
Methoxychlor	14/23	3.10E-03	2.17E-03	0.019	0.48	0.2	0.1	0.007	0.005	<1	<1	<1	<1
Total PCBs	0/23	1.05E-01	5.89E-02	0.06	0.68	2	1	0.2	0.1	<1	<1	<1	<1
Toxaphene	0/23	5.00E-02	2.74E-02	0.028	0.70	2	1	0.07	0.04	<1	<1	<1	<1
Metals													
Aluminum	23/23	1.72E+04	1.32E+04	--	--	--	--	--	--	--	--	--	--
Antimony	5/23	1.11E+00	4.20E+00	12	60	0.09	0.4	0.02	0.07	<1	<1	<1	<1
Arsenic	23/23	7.58E+00	5.70E+00	9.8	33.0	0.8	0.6	0.2	0.2	<1	<1	<1	<1
Barium	13/23	1.18E+02	8.71E+01	--	--	--	--	--	--	--	--	--	--
Beryllium	12/23	7.27E-01	5.96E-01	--	--	--	--	--	--	--	--	--	--
Cadmium	16/23	1.01E+00	7.01E-01	1	5	1	0.7	0.2	0.1	<1	<1	<1	<1
Chromium	23/23	5.50E+01	4.02E+01	43	111	1	0.9	0.5	0.4	<1	<1	<1	<1
Cobalt	15/23	1.28E+01	1.00E+01	--	--	--	--	--	--	--	--	--	--
Copper	22/23	4.75E+01	3.81E+01	32	149	2	1	0.3	0.3	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-6I
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR BENTHIC INVERTEBRATES - WETLANDS A-D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

COPECs mg/kg dry wt	Frequency of Detection	RME	CTE	No Effect Sediment Benchmark	Effect Sediment Benchmark	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
						RME	CTE	RME	CTE	RME	CTE	RME	CTE
Cyanide	1/20	4.00E-01	2.13E-01	--	--	--	--	--	--	--	--	--	--
Iron	23/23	2.69E+04	2.01E+04	20,000	40,000	1	1	0.7	0.5	<1	<1	<1	<1
Lead	23/23	9.61E+01	6.89E+01	36	128	3	2	0.8	0.5	<1	<1	<1	<1
Manganese	23/23	6.32E+02	4.50E+02	460	5500	1	1	0.1	0.08	<1	<1	<1	<1
Mercury	11/23	1.34E-01	9.96E-02	0.18	1.06	0.7	0.6	0.1	0.1	<1	<1	<1	<1
Nickel	20/23	3.23E+01	2.43E+01	23	48.6	1	1	0.7	0.5	<1	<1	<1	<1
Selenium	17/23	1.87E+00	1.48E+00	--	--	--	--	--	--	--	--	--	--
Silver	23/23	7.38E+00	5.02E+00	2	10	4	3	0.7	0.5	2	2	<1	<1
Thallium	4/23	5.20E-01	2.88E-01	--	--	--	--	--	--	--	--	--	--
Vanadium	22/23	3.91E+01	3.17E+01	--	--	--	--	--	--	--	--	--	--
Zinc	23/23	1.33E+02	1.12E+02	120	459	1	0.9	0.3	0.2	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

Table 7-6m: Weight-of-Evidence Integration for benthic invertebrates
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:
Maintain a stable and healthy benthic invertebrate community
Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of the benthic invertebrate community in the Blackstone River and selected ponds at the site?

Measurement Endpoints
1.A: compare the COPEC levels in sediment samples to no effect and effect sediment benchmarks
1.B: measure survival and growth in two benthic invertebrate species exposed in the laboratory to bulk sediment samples
1.C: evaluate the structure and function of the benthic invertebrate community
***** = overal conclusion from the Sediment Quality Triad (SQT)

Note: the results of the measurement endpoints for the sub-set of samples from the Blacbstone River (near-site), and Ponds A, D, F, and I used in the SQT are combined to provide one "pooled" risk estimate

Weight-of-Evidence Integration

Blackstone River (near-site)

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low	**1.A**		*****		
Undeterminate					
No Harm					

Pond A

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low	**1.A**		*****		
Undeterminate					
No Harm					

Pond B

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low	**1.A**				
Undeterminate					
No Harm					

Pond C

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low	**1.A**				
Undeterminate					

US EPA ARCHIVE DOCUMENT

Table 7-6m: Weight-of-Evidence Integration for benthic invertebrates
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

No Harm					

Pond D

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low	**1.A**		*		
Undeterminate					
No Harm					

Pond E

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High	**1.A**				
Yes/Low					
Undeterminate					
No Harm					

Pond F

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low	**1.A**		*		
Undeterminate					
No Harm					

Pond I

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low	**1.A**		*		
Undeterminate					
No Harm					

Pond N

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low	**1.A**				
Undeterminate					
No Harm					

US EPA ARCHIVE DOCUMENT

Table 7-6m: Weight-of-Evidence Integration for benthic invertebrates
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Pond P	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm	**1.A**				

Wetlands A through D	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm	**1.A**				

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

TABLE 7.7
LMW PAHS, HMW PAHS, AND TOTAL PAHS IN SEDIMENT COLLECTED FROM AQUATIC HABITATS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

	Upstream & Pond 6		Near Site		Pond A		Pond B		Pond C		Pond D		Pond E		Pond F		Pond I		Pond N		Pond P		Wetland A-D	
PAHs	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**	**Avg**	**Reas. Max**
LMW PAHs (mg/kg dry wt)																								
2-Methylnaphthalene	0.11	0.18	0.07	0.08	0.16	0.20	0.21	0.32	0.18	0.30	0.14	0.27	0.06	0.06	0.19	0.26	0.22	0.47	0.07	0.07	0.01	0.01	0.08	0.07
Acenaphthene	0.08	0.11	0.13	0.18	0.12	0.11	0.16	0.32	0.23	0.23	0.13	0.27	0.08	0.09	0.08	0.10	0.16	0.18	0.09	0.09	0.05	0.05	0.06	0.02
Acenaphthylene	0.17	0.36	0.09	0.15	0.21	0.29	0.20	0.30	0.28	0.34	0.18	0.25	0.17	0.18	0.13	0.30	0.37	0.56	0.19	0.19	0.03	0.03	0.10	0.18
Anthracene	0.33	0.47	0.38	0.75	0.37	0.56	0.31	0.44	0.54	0.67	0.71	2.90	0.40	0.48	0.33	0.47	0.60	0.88	0.40	0.40	0.12	0.12	0.11	0.28
Fluorene	0.11	0.16	0.12	0.25	0.16	0.18	0.17	0.32	0.22	0.22	0.13	0.36	0.10	0.13	0.12	0.15	0.24	0.36	0.13	0.13	0.05	0.05	0.05	0.05
Naphthalene	0.11	0.17	0.12	0.16	0.15	0.19	0.08	0.09	0.10	0.11	0.16	0.27	0.09	0.09	0.19	0.26	0.31	0.68	0.08	0.08	0.02	0.02	0.09	0.09
Phenanthrene	0.93	1.30	1.13	2.30	1.05	1.51	1.08	1.60	2.05	2.60	1.49	4.80	1.50	1.80	1.14	1.70	1.98	2.80	1.10	1.10	0.73	0.73	0.40	1.25
HMW PAHs (mg/kg dry wt)																								
Benzo(a)pyrene	0.96	1.33	0.82	1.62	1.30	1.84	1.26	1.80	1.55	1.70	2.04	6.70	1.85	2.20	1.00	1.80	2.30	3.60	0.98	0.98	0.40	0.40	0.54	1.51
Benzo(b)fluoranthene	1.08	1.48	0.87	1.67	1.55	2.30	1.77	2.40	2.10	2.30	1.98	3.20	2.20	2.20	1.30	2.60	2.82	3.80	1.20	1.20	0.47	0.47	0.63	1.69
Benzo(g,h,i)perylene	0.74	1.47	0.37	0.68	0.65	0.94	0.77	1.10	0.93	0.99	0.64	0.91	0.82	1.10	0.52	0.96	1.59	2.70	0.35	0.35	0.11	0.11	0.32	1.14
Benzo(k)fluoranthene	0.85	1.72	0.49	0.99	0.69	1.00	0.84	1.20	0.73	0.83	1.11	3.60	1.14	1.40	0.72	1.10	1.62	3.20	0.58	0.58	0.19	0.19	0.38	1.20
Chrysene	1.04	1.46	0.89	1.36	1.33	1.90	1.40	2.00	1.70	1.90	2.18	6.90	1.80	1.90	1.13	2.10	2.55	3.70	1.10	1.10	0.38	0.38	0.58	1.56
Fluoranthene	1.68	2.35	1.60	3.16	2.22	3.14	2.50	3.50	3.60	4.60	3.18	10.00	2.55	2.90	2.36	4.00	4.42	6.60	1.90	1.90	0.91	0.91	1.06	3.53
Indeno(1,2,3-cd)pyrene	0.68	1.36	0.39	0.72	0.69	1.41	0.69	0.93	0.82	0.91	0.64	0.80	1.02	1.40	0.57	1.10	1.48	2.50	0.41	0.41	0.13	0.13	0.29	1.01
Pyrene	1.59	2.22	1.58	2.44	1.85	2.58	1.70	2.60	2.45	2.50	3.76	13.00	2.65	3.10	1.76	2.70	3.42	5.40	1.50	1.50	0.89	0.89	0.89	2.86
LMW PAHs	1.84	2.74	2.04	3.87	2.22	3.03	2.20	3.37	3.59	4.47	2.94	9.11	2.39	2.83	2.17	3.23	3.87	5.93	2.06	2.06	1.01	1.01	0.88	1.93
HMW PAHs	8.62	13.39	7.01	12.64	10.28	15.11	10.93	15.53	13.87	15.73	15.53	45.11	14.03	16.20	9.35	16.36	20.20	31.50	8.02	8.02	3.48	3.48	4.70	14.50
Total PAHs	10.46	16.13	9.04	16.52	12.50	18.14	13.13	18.90	17.46	20.20	18.48	54.22	16.42	19.03	11.52	19.59	24.07	37.43	10.08	10.08	4.49	4.49	5.59	16.43

Source: Appendix BB
Notes:
LMW - Low Molecular Weight
HMW - High Molecular Weight
Avg - Arithmetic mean concentration
Reas Max - Reasonable maximum concentration (either the 95% UCL or the maximum detected concentration, depending on the dataset)

US EPA ARCHIVE DOCUMENT

TABLE 7-8a
SUMMARY OF SEDIMENT AVS/SEM RESULTS - BLACKSTONE RIVER

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

		Blackstone River									
		Site					Background				
Sample Name:		**T05BR-001**	**T05BR-003**	**T05BR-005**	**T05BR-006**	**T05BR-007**	**T05BL-001**	**T05BL-002**	**T05BL-005**	**T05BL-006**	**T05BL-007**
Sample Depth (Feet):		**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Date Collected:		**06/21/05**	**06/21/05**	**06/22/05**	**06/22/05**	**06/23/05**	**06/23/05**	**06/23/05**	**06/23/05**	**06/23/05**	**06/23/05**
Location ID:	**Units**			**(Pond I)**							
AVS/SEM											
Acid volatile sulfide (AVS)	µmol/g	0.55 UJ	1.9 J	3.9 J	0.54 UJ	1.9 J	1.5 J	0.6 UJ	8.1 J	12 J	2.4 J
Simultaneously extracted metals (SE	µmol/g	0.8	2.4	6.6	0.57	1.5	1.6	1.5	2.3	4.6	1.6
SEM-Cadmium	µmol/g	0.016 U	0.026 U	0.079	0.015 U	0.023 U	0.019 U	0.017 U	0.036	0.061	0.017
SEM-Copper	µmol/g	0.17	0.4	1.5	0.17	0.32	0.32	0.48	0.32	0.68	0.26
SEM-Lead	µmol/g	0.1	0.32	0.72	0.1	0.18	0.18	0.32	0.23	0.46	0.17
SEM-Nickel	µmol/g	0.15 U	0.25 U	0.63 U	0.15 U	0.22 U	0.18 U	0.16 U	0.21 U	0.46 U	0.14 U
SEM-Zinc	µmol/g	0.53	1.6	4.2	0.3	1	1.1	0.74	1.7	3.4	1.1
SEM-AVS[a]	µmol/g	0.25	0.5	2.7	0.03	-0.4	0.1	0.94	-5.8	-7.4	-0.8
(ΣSEM-AVS)/foc[b]	µmol/goc	19	42	46	3	-33	10	138	-322	-161	-73
TOC	%	1.3	1.2	5.9	1.1	1.2	1	0.65	1.8	4.6	1.1

Notes:

[a] shaded value shows that SEM-AVS exceeds 0, indicating the potential for toxicity from one or more divalent metals

[b] shaded value shows that Σ(SEM-AVS)/foc is above 130 µmol/goc but below 3,000 µmol/goc, indicating that toxicity is uncertain

Data Qualifiers:

(Inorganic) The analyte has been positively identified. The concentration is between the instrument detection limit and the required reporting limit.

(Inorganic) The reported value is estimated due to the presence of interference.

J = The compound/constituent was positively identified; however, the associated numerical value is an estimated concentration only.

U = The compound/constituent was analyzed for but not detected. The associated value is the compound/constituent quantitation limit.

US EPA ARCHIVE DOCUMENT

TABLE 7-8b
SUMMARY OF SEDIMENT AVS/SEM RESULTS - POND AREAS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

		Pond A		Pond D	Pond F	Background	
Sample Name:		**T05PA-001**	**T05PA-003**	**T05PD-002**	**T05PF-004**	**T05BL-003**	**T05BL-004**
Sample Depth(Feet):		**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Date Collected:		**06/21/05**	**06/21/05**	**06/21/05**	**06/21/05**	**06/23/05**	**06/23/05**
Location ID:	**Units**						
AVS/SEM							
Acid volatile sulfide (AVS)	µmol/g	26 J	7 J	1.7 J [1.9 J]	11 J	16 J	8.4 J
Simultaneously extracted metals (SE	µmol/g	7.2	13	1.3 [1.4]	6	12 J	6.2 J
SEM-Cadmium	µmol/g	0.12	0.17	0.016 U [0.018 U	0.075	0.077 UJ	0.092 UJ
SEM-Copper	µmol/g	0.45 U	1.9	0.18 [0.18]	1.2	1.1 J	0.82 UJ
SEM-Lead	µmol/g	0.58	0.84	0.17 [0.21 J]	0.69	1.6 J	0.97 J
SEM-Nickel	µmol/g	0.49 U	0.47 U	0.16 U [0.17 U]	0.47 U	0.73 UJ	0.88 UJ
SEM-Zinc	µmol/g	6.5	10	0.94 [1]	4.1	9.7 J	5.2 J
SEM-AVS[a]	µmol/g	-18.8	6	-0.4 [-0.5]	-5	-4	-2.2
(ΣSEM-AVS)/foc	µmol/goc	-855	98	-13 [-29]	-65	-40	-25
TOC	%	2.2	6.1	3.1 [1.7]	7.7	10	8.7

Notes:
[a] shaded value shows that SEM-AVS exceeds 0, indicating the potential for toxicity from one or more divalent metals

Data Qualifiers:
(Inorganic) The analyte has been positively identified. The concentration is between the instrument detection limit and the required reporting limit
(Inorganic) The reported value is estimated due to the presence of interference.
J = The compound/constituent was positively identified; however, the associated numerical value is an estimated concentration only.
U = The compound/constituent was analyzed for but not detected. The associated value is the compound/constituent quantitation limit.

US EPA ARCHIVE DOCUMENT

TABLE 7-9a
SEDIMENT TOXICITY TEST RESULTS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

			Species	*Chironomus dilutus*		*Hyalella azteca*	
Location		**Sample ID**	**Collection Date**	**Survival (%)**	**Growth (mg/larvae)**	**Survival (%)**	**Growth (mg/amphipod)**
Lab Control				83.75	1.79	91.25	0.597
Site	River	T05BR-001	6/21/05	85.00	2.03	90.00	0.416*
		T05BR-003	6/21/05	85.00	1.4*	88.75	0.401*
		T05BR-005	6/22/05	88.75	**1.2***	86.25	0.314*
		T05BR-006	6/22/05	**56.25***	1.84	**2.5***	**0.140***
		T05BR-007	6/23/05	85.00	2.03	92.50	0.494*
	Pond A	T05PA-001	6/21/05	**76.25**	1.68	**8.75***	0.300*
		T05PA-003	6/21/05	**71.25**	1.47*	**1.25***	**0.080*** [1]
	Pond D	T05PD-002	6/21/05	**77.50**	1.81	**16.25***	0.528
	Pond F	T05PF-004	6/21/05	86.25	1.63	67.5*	0.439*
Background	River	T05BL-001	6/23/05	88.75	2.20	91.25	0.475*
		T05BL-002	6/23/05	81.25	1.42*	95.00	0.352*
		T05BL-005	6/23/05	92.50	1.22*	17.5*	0.315*
		T05BL-006	6/23/05	78.75	1.47*	82.5*	0.282*
		T05BL-007	6/23/05	98.75	1.57	87.50	0.399*
	Pond	T05BL-003	6/23/05	86.25	1.39*	51.25*	0.237*
		T05BL-004	6/23/05	93.75	1.56*	88.75	0.290*

Notes:
* = result is statistically lower than lab control results
Bold Font = result is statistically lower (one-tailed t-test) than background results
1. Estimated statistical result due to lack of degrees of freedom; n=1 replicate
% = percent
mg/larvae = milligram/larvae ash free dry weight
mg/amphipod = milligram/amphipod dry weight

US EPA ARCHIVE DOCUMENT

TABLE 7-9b
TRIAD SEDIMENT CHEMISTRY AND TOXICITY RESULTS - RIVER

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

				River									
				Site					Background				
			Sample Name:	T05BR-001	T05BR-003	T05BR-005	T05BR-006	T05BR-007	T05BL-001	T05BL-002	T05BL-005	T05BL-006	T05BL-007
			Sample Depth (Feet):	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
			Date Collected:	06/21/05	06/21/05	06/22/05	06/22/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05
			Location ID:	T05BR-001	T05BR-003	T05BR-005	T05BR-006	T05BR-007	T05BL-001	T05BL-002	T05BL-005	T05BL-006	T05BL-007
Species	**Test**	**Lab Control Result**	**Units**	**TOXICITY**									
Chironomus dilutus	Survival	83.75	%	85.00	85.00	88.75	**56.25**	85.00	88.75	81.25	92.50	78.75	98.75
Chironomus dilutus	Growth	1.79	mg/larvae	2.03	1.40	1.20	1.84	2.03	2.20	1.42	1.22	1.47	1.57
Hyalella azteca	Survival	91.25	%	90.00	88.75	86.25	**2.50**	92.50	91.25	95.00	**17.50**	82.50	87.50
Hyalella azteca	Growth	0.597	mg/amphipod	0.416	0.401	0.314	0.140	0.494	0.475	0.352	0.315	0.282	0.399
Constituent	**No Effect Criteria (Bold)**	**Effect Criteria (Shaded)**	**Units**	**SEDIMENT CHEMISTRY**									
VOC													
1,4-Dichlorobenzene	0.35	4.55	mg/kg dry wt	0.0018 U	0.0036 U	0.0046 U	0.0017 U	0.002 U	0.00046 J	0.0014 U	0.0022 U	0.0036 U	0.0018 U
2-Butanone	0.27	3.51	mg/kg dry wt	0.012	0.075	0.077	0.0017 U	0.02	0.016	0.0014 U	0.048	0.056	0.02
Acetone	0.0087	0.1131	mg/kg dry wt	**0.046 JEB**	**0.18 J**	**0.2 J**	**0.024 JEB**	**0.12 J**	**0.11 J**	**0.093 J**	**0.12 J**	**0.13 J**	**0.071 J**
Carbon disulfide	0.00085	0.01105	mg/kg dry wt	**0.00088 J**	**0.0032 J**	**0.0026 J**	0.0017 U	**0.0013 J**	**0.0021**	0.0014 U	**0.0035**	**0.0021 J**	**0.0019**
Chlorobenzene	0.82	10.66	mg/kg dry wt	0.0018 U	0.0036 U	0.0029 J	0.0017 U	0.002 U	0.0015 U	0.0014 U	0.0022 U	0.0036 U	0.0018 U
Cyclohexane	- -	- -	mg/kg dry wt	0.0018 U	0.0036 U	0.003 J	0.0017 U	0.002 U	0.0015 U	0.0014 U	0.0022 U	0.0036 U	0.0018 U
Ethylbenzene	3.6	46.8	mg/kg dry wt	0.0018 U	0.0016 J	0.0046 U	0.0017 U	0.002 U	0.0015 U	0.0014 U	0.0022 U	0.0036 U	0.0018 U
Methyl tert butyl ether	- -	- -	mg/kg dry wt	0.0018 U	0.0036 U	0.0046 U	0.0017 U	0.002 U	0.0015 U	0.0014 U	0.0013 J	0.0036 U	0.00056 J
Toluene	0.67	8.71	mg/kg dry wt	0.0045	0.0036 U	0.0046 U	0.0017 U	0.0022	0.00051 J	0.0014 U	0.0022 U	0.0036 U	0.0018 U
Trichloroethene	0.22	2.86	mg/kg dry wt	0.0018 U	0.0036 U	0.0046 U	0.0017 U	0.002 U	0.0015 U	0.0024	0.0022 U	0.0036 U	0.0018 U
SVOC													
1,1'-Biphenyl	- -	- -	mg/kg dry wt	0.051 J	0.15 U	0.18 U	0.1 U	0.12 U	0.1 U	0.095 U	0.065 J	0.15 U	0.1 U
2-Methylnaphthalene	0.33	4.29	mg/kg dry wt	0.088 J	0.32	**0.47**	0.075 J	0.0023 U	0.054 J	0.011 J	0.094 J	**0.38**	0.051 J
2-Methylphenol	0.012	0.156	mg/kg dry wt	0.002 U	0.038 U	0.045 U	**0.015 EB**	0.0023 U	0.01 EB	0.0024 EB	**0.016 EB**	0.037 U	0.0066 EB
4-Methylphenol	- -	- -	mg/kg dry wt	0.1 U	0.15 U	0.18 U	0.1 U	0.12 U	0.056 J	0.095 U	0.12 U	0.15 U	0.074 J
4-Nitrophenol	- -	- -	mg/kg dry wt	0.1 U	0.26 J	0.89 U	0.1 U	0.12 U	0.1 U	0.095 U	0.12 U	0.74 U	0.1 U
Acenaphthene	0.62	8.06	mg/kg dry wt	0.28	0.2	0.18	0.069 J	0.0023 U	0.15	0.018	0.18	0.17	0.12
Acenaphthylene	0.33	4.29	mg/kg dry wt	0.18	0.27	**0.56**	0.24 J	0.0023 U	**0.45**	0.095	0.24	**0.43**	0.16
Anthracene	0.0572	0.845	mg/kg dry wt	**0.79 J**	**0.72**	**0.88**	**0.61 J**	0.0023 U	**0.96**	**0.4**	**0.72**	**0.75**	**0.47**
Benzaldehyde	- -	- -	mg/kg dry wt	0.09 J	0.31 J	0.34 J	0.057 J	0.12 UJ	0.06 J	0.095 UJ	0.11 J	0.48 J	0.082 J
Benzo(a)pyrene	0.15	1.45	mg/kg dry wt	**1.9 J**	**2.1**	**3.6**	**1.9 J**	0.0023 UJ	**1.4**	**0.99 J**	**1.8 J**	**2.7**	**1.7**
Benzo(b)fluoranthene	- -	- -	mg/kg dry wt	1.4 J	2	3.8	1.5 J	0.0023 UJ	1.8	0.67 J	2	2.6	1.6
Benzo(g,h,i)perylene	0.17	0.32	mg/kg dry wt	**1.1 J**	**1.4**	**2.7**	**0.91 J**	0.0023 UJ	**1.8**	**0.61 J**	**1.5**	**1.9**	**1.2**
Benzo(k)fluoranthene	- -	- -	mg/kg dry wt	1.5 J	1.9	3.2	1.6 J	0.0023 UJ	1.4	0.76 J	2.1	2.4	1.5
Benzo[a]anthracene	0.11	1.05	mg/kg dry wt	**1.6 J**	**2.1**	**2.8**	**1.9 J**	0.0023 UJ	**2.8**	**0.89 J**	**2**	**2.2**	**1.7 J**
bis(2-Ethylhexyl)phthalate	890	11,570	mg/kg dry wt	0.37	2.8	3.6	0.12	0.48	0.7	0.11	1.1	2.7	1.1
Butyl benzyl phthalate	11	143	mg/kg dry wt	0.1 U	0.15 U	0.18 U	0.1 U	0.12 U	0.1 U	0.095 U	0.12 U	0.18	0.058 J
Carbazole	- -	- -	mg/kg dry wt	0.12	0.4	0.46	0.12	0.097 J	0.24	0.095 U	0.23	0.33	0.17
Chrysene	0.17	1.29	mg/kg dry wt	**1.9 J**	**2.2**	**3.7**	**1.9 J**	0.034 J	**2.8**	**0.95 J**	**1.9**	**2.6**	**1.6**
Dibenz[a,h]anthracene	0.033	0.429	mg/kg dry wt	**0.32 J**	**0.47**	**0.87**	**0.34 J**	0.0023 UJ	**0.7**	**0.18 J**	**0.51**	**0.6**	**0.41**
Dibenzofuran	2	26	mg/kg dry wt	0.059 J	0.15 U	0.18 U	0.1 U	0.12 U	0.081 J	0.095 U	0.12 U	0.15 U	0.064 J
Di-N-Butyl phthalate	11	143	mg/kg dry wt	0.1 U	0.4	0.18 U	0.1 U	0.12 U	0.1 U	0.095 U	0.12 U	0.15 U	0.1 U
Di-N-Octyl phthalate	- -	- -	mg/kg dry wt	0.1 U	0.15 U	0.18 U	0.1 UJ	0.12 U	0.1 U	0.095 U	0.12 UJ	0.15 U	0.15
Fluoranthene	0.42	2.23	mg/kg dry wt	**2.1**	**4.7**	**6.6**	**2.3**	0.0023 U	**3.7**	**1.3**	**2.8**	**4.9**	**2.5**
Fluorene	0.077	0.536	mg/kg dry wt	**0.26**	**0.3**	**0.36**	**0.11 J**	0.0023 U	**0.19**	0.036	**0.25**	**0.32**	**0.15**
Indeno(1,2,3-cd)pyrene	0.2	2.6	mg/kg dry wt	**1 J**	**1.3**	**2.5**	**1 J**	0.0023 UJ	**1.8**	**0.55 J**	**1.5**	**1.7**	**1.1**
Naphthalene	0.18	0.561	mg/kg dry wt	0.095 J	**0.68**	**0.68**	0.11 J	0.0023 U	0.098 J	0.027 J	0.16 J	**0.34**	0.085 J
Pentachlorophenol	- -	- -	mg/kg dry wt	0.1 U	0.18 J	R	0.1 U	0.12 U	0.1 U	0.095 U	0.12 U	R	0.1 U
Phenanthrene	0.2	1.17	mg/kg dry wt	**2.2**	**2.7**	**2.8**	**1.4 J**	0.0023 U	**1.8**	**0.68**	**2.2**	**2.4**	**1.7**
Phenol	- -	- -	mg/kg dry wt	0.1 U	0.11	0.16	0.1 U	0.12 U	0.1 U	0.095 U	0.12 U	0.17	0.1 U
Pyrene	0.2	1.52	mg/kg dry wt	**2.7**	**4**	**5.4**	**2.4**	0.0038 J	**4**	**1.3**	**3.2**	**4.2**	**2.2**
Total PAHs	- -	- -	mg/kg dry wt	19.4 J	27.4	41.1	18.4 J	0.0378 J	25.9 J	9.47 J	23.2 J	30.6	18.2 J

US EPA ARCHIVE DOCUMENT

TABLE 7-9b
TRIAD SEDIMENT CHEMISTRY AND TOXICITY RESULTS - RIVER

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

				River									
				Site					Background				
			Sample Name:	T05BR-001	T05BR-003	T05BR-005	T05BR-006	T05BR-007	T05BL-001	T05BL-002	T05BL-005	T05BL-006	T05BL-007
			Sample Depth (Feet):	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
			Date Collected:	06/21/05	06/21/05	06/22/05	06/22/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05
			Location ID:	T05BR-001	T05BR-003	T05BR-005	T05BR-006	T05BR-007	T05BL-001	T05BL-002	T05BL-005	T05BL-006	T05BL-007
Species	**Test**	**Lab Control Result**	**Units**	**TOXICITY**									
Chironomus dilutus	Survival	83.75	%	85.00	85.00	88.75	**56.25**	85.00	88.75	81.25	92.50	78.75	98.75
Chironomus dilutus	Growth	1.79	mg/larvae	2.03	1.40	1.20	1.84	2.03	2.20	1.42	1.22	1.47	1.57
Hyalella azteca	Survival	91.25	%	90.00	88.75	86.25	**2.50**	92.50	91.25	95.00	**17.50**	82.50	87.50
Hyalella azteca	Growth	0.597	mg/amphipod	0.416	0.401	0.314	0.140	0.494	0.475	0.352	0.315	0.282	0.399
Constituent	**No Effect Criteria (Bold)**	**Effect Criteria (Shaded)**	**Units**	**SEDIMENT CHEMISTRY**									
Pesticides													
4,4'-DDD	0.00488	0.028	mg/kg dry wt	**0.0063**	**0.0088**	**0.019**	**0.0074**	0.0045 U	**0.0059**	0.0021	**0.0056**	**0.016**	0.0037
4,4'-DDE	0.00316	0.0313	mg/kg dry wt	**0.0037**	**0.0062 J**	**0.015 J**	**0.0036**	**0.0032 J**	**0.0045 J**	0.0007 U	**0.0095 J**	**0.015 J**	**0.0055 J**
4,4'-DDT	0.00416	0.0629	mg/kg dry wt	0.008 UJ	0.00063 UJ	0.00071 UJ	0.00081 UJ	0.0045 UJ	0.004 UJ	0.0027 J	0.0042 UJ	0.00059 UJ	0.004 UJ
alpha-Chlordane	0.0032	0.0176	mg/kg dry wt	0.0008 U	**0.0039**	**0.011 J**	0.0014	0.0017	0.0023	0.0007 U	**0.0033**	**0.0063**	0.0025
Delta-BHC	0.12	0.01	mg/kg dry wt	0.0008 U	0.00063 U	0.0016	0.00081 U	0.0009 U	0.0017 J	0.0007 U	0.00084 U	0.00059 U	0.0008 U
Dieldrin	0.0019	0.0618	mg/kg dry wt	**0.0066**	**0.008**	**0.0094**	**0.009**	**0.003**	**0.017**	**0.0031**	**0.0053**	**0.0067**	**0.003**
Endrin Ketone	- -	- -	mg/kg dry wt	0.0008 U	0.00063 U	0.00071 U	0.012	0.0066 J	0.02 J	0.0044 J	0.01 J	0.00059 U	0.0096 J
Gamma-Chlordane	- -	- -	mg/kg dry wt	0.0025	0.0031	0.0074	0.0014	0.0027 J	0.0033	0.0007 U	0.0034	0.006 J	0.0027
PCBs													
Aroclor-1254	0.0598	0.676	mg/kg dry wt	0.008 U	**0.3 JEB**	**0.36 JEB**	0.0081 U	0.009 U	0.0079 U	0.007 U	0.0084 U	**0.48 JEB**	0.008 U
Aroclor-1260	0.0598	0.676	mg/kg dry wt	**0.58 J**	**0.24**	**0.76**	**0.12 J**	**0.11 J**	**0.3 J**	0.043 J	**0.19 J**	**0.65 J**	**0.2 J**
Total PCBs	0.0598	0.676	mg/kg dry wt	**0.58 J**	**0.54 J**	**1.12 J**	**0.12 J**	**0.11 J**	**0.3 J**	0.043 J	**0.19 J**	**1.13 J**	**0.2 J**
Metals and Cyanide													
Aluminum	- -	- -	mg/kg dry wt	3,100	4,800	12,000	3,300	3,500	2,900	2,400	6,300	8,100	3,300
Antimony	12	60	mg/kg dry wt	0.76 J	0.26 J	0.6 J	0.32 J	0.2 J	0.76 J	0.12 UJ	0.59 J	0.6 J	0.26 J
Arsenic	9.79	33	mg/kg dry wt	8.8	5.7	**13**	3.6	3.8	4.5	1.3	**12**	8	3.4
Barium	- -	- -	mg/kg dry wt	46	73	200	29	37	35	12	100	140	52
Beryllium	- -	- -	mg/kg dry wt	0.27	0.38	0.9	0.2	0.29	0.22	0.16	0.53	0.66	0.27
Cadmium	1	4.98	mg/kg dry wt	**1.6**	**4.1**	**12**	**2.9**	**2.6**	**2**	0.2	**11**	**12**	**3.1**
Calcium	- -	- -	mg/kg dry wt	670	1,300 J	2,100 J	580	810	870	470	1,800	2,200 J	960
Chromium	43.4	111	mg/kg dry wt	33	38	**140**	**47**	24	19	10	**86**	**110**	21
Cobalt	- -	- -	mg/kg dry wt	3.1	4	7.1	2	2.8	2.4	1.2	8.1	7.5	3.5
Copper	31.6	149	mg/kg dry wt	**41**	**65**	**220**	**43**	**39**	**38**	13	**140**	**180**	**47**
Iron	20,000	40,000	mg/kg dry wt	9,500	11,000	**31,000**	5,100	7,300	5,500	4,200	15,000	16,000	7,200
Lead	36	128	mg/kg dry wt	**46**	**73**	**190**	**52**	**44**	34	18	**160**	**160**	**48**
Magnesium	- -	- -	mg/kg dry wt	1,100	1,700	3,400	990	1,200	1,100	820	2,200	2,800	1,200
Manganese	460	5,500	mg/kg dry wt	290	210 J	380 J	58	110	62	49	290	300 J	160
Mercury	0.18	1.06	mg/kg dry wt	0.097 J	0.14	**0.6**	**0.2 J**	0.095 J	**0.32 J**	0.024 J	**0.28 J**	**0.41**	0.11 J
Nickel	23	48.6	mg/kg dry wt	7.8	15	**31**	6.7	9.3	8	4.3	**36**	**34**	11
Potassium	- -	- -	mg/kg dry wt	440	510	1,300	370	420	440	290	1,100	1,000	500
Selenium	- -	- -	mg/kg dry wt	0.22	0.37	1.2	0.24	0.36	0.13 U	0.18	0.58	0.99	0.21
Silver	2	10	mg/kg dry wt	0.37	0.71	**3.3**	0.59	0.47	0.33	0.18	0.84	**2.7**	0.43
Sodium	- -	- -	mg/kg dry wt	76	110	210	57	84	63	55	150	160	92
Thallium	- -	- -	mg/kg dry wt	0.051	0.1	0.25	0.054	0.063	0.059	0.026	0.16	0.2	0.075
Vanadium	- -	- -	mg/kg dry wt	7	11	23	7.2	7.3	6.6	4.6	15	18	7.1
Zinc	120	459	mg/kg dry wt	95	**160 J**	**390 J**	**150**	100	96	24	**410**	**380 J**	120

Notes:
Toxicity:
Shaded cells = result is statistically lower than lab control results
Bold font = survival and growth below minimum acceptable results for laboratory controls; 70 percent survival and 0.48 mg/larvae for Chironomus, 80 percent survival for Hyalella (USEPA, 2000). No standard is given for growth in lab controls for Hyalella other than weight gain must be recorded.
1. Estimated statistical result due to lack of degrees of freedom; n=1 replicate
Sediment Chemistry:

US EPA ARCHIVE DOCUMENT

TABLE 7-9b
TRIAD SEDIMENT CHEMISTRY AND TOXICITY RESULTS - RIVER

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

				River									
				Site					Background				
			Sample Name:	T05BR-001	T05BR-003	T05BR-005	T05BR-006	T05BR-007	T05BL-001	T05BL-002	T05BL-005	T05BL-006	T05BL-007
			Sample Depth (Feet):	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
			Date Collected:	06/21/05	06/21/05	06/22/05	06/22/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05
			Location ID:	T05BR-001	T05BR-003	T05BR-005	T05BR-006	T05BR-007	T05BL-001	T05BL-002	T05BL-005	T05BL-006	T05BL-007
Species	**Test**	**Lab Control Result**	**Units**	**TOXICITY**									
Chironomus dilutus	Survival	83.75	%	85.00	85.00	88.75	**56.25**	85.00	88.75	81.25	92.50	78.75	98.75
Chironomus dilutus	Growth	1.79	mg/larvae	2.03	1.40	1.20	1.84	2.03	2.20	1.42	1.22	1.47	1.57
Hyalella azteca	Survival	91.25	%	90.00	88.75	86.25	**2.50**	92.50	91.25	95.00	**17.50**	82.50	87.50
Hyalella azteca	Growth	0.597	mg/amphipod	0.416	0.401	0.314	0.140	0.494	0.475	0.352	0.315	0.282	0.399
Constituent	**No Effect Criteria (Bold)**	**Effect Criteria (Shaded)**	**Units**	**SEDIMENT CHEMISTRY**									

Bold font and shaded cells = constituent result above screening criteria

US EPA ARCHIVE DOCUMENT

TABLE 7-9c
TRIAD SEDIMENT CHEMISTRY AND TOXICITY RESULTS - POND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

				Pond						
				Site					Background	
			Sample Name:	T05PA-001	T05PA-003	T05PD-002	BD062105	T05PF-004	T05BL-003	T05BL-004
			Sample Depth(Feet):	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
			Date Collected:	06/21/05	06/21/05	06/21/05	06/21/05	06/21/05	06/23/05	06/23/05
			Location ID:	T05PA-001	T05PA-003	T05PD-002	T05PD-002	T05PF-004	T05BL-003	T05BL-004
Species	**Test**	**Lab Control Result**	**Units**	**TOXICITY**						
Chironomus dilutus	Survival	83.75	%	76.25	71.25	77.50		86.25	86.25	93.75
Chironomus dilutus	Growth	1.79	mg/larvae	1.68	1.47	1.81		1.63	1.39	1.56
Hyalella azteca	Survival	91.25	%	**8.75**	**1.25**	**16.25**		**67.50**	**51.25**	88.75
Hyalella azteca	Growth	0.597	mg/amphipod	0.300	0.080 [1]	0.528		0.439	0.237	0.290
Constituent	**No Effect Criteria (Bold)**	**Effect Criteria (Shaded)**	**Units**	**SEDIMENT CHEMISTRY**						
VOC										
2-Butanone	0.27	3.51	mg/kg dry wt	0.05	0.067	0.023 J	0.02	0.052	0.038 J	0.029 J
Acetone	0.0087	0.1131	mg/kg dry wt	**0.12 J**	**0.18 J**	**0.058 JEB**	**0.074 J**	**0.69 J**	**0.13 JEB**	**0.15 JEB**
Carbon disulfide	0.00085	0.01105	mg/kg dry wt	**0.0032**	**0.0046**	**0.0016 J**	**0.0018 J**	**0.0029 J**	**0.013 J**	**0.0057 J**
Ethylbenzene	3.6	46.8	mg/kg dry wt	0.0018 J	0.001 J	0.00069 J	0.00054 J	0.0037 U	0.0053 J	0.0062 UJ
Methyl tert butyl ether	- -	- -	mg/kg dry wt	0.0024 U	0.0035 U	0.002 U	0.0021 U	0.0037 U	0.0041 J	0.0062 UJ
Styrene	- -	- -	mg/kg dry wt	0.00061 J	0.0035 U	0.002 UJ	0.0021 U	0.0037 U	0.002 J	0.0062 UJ
Toluene	0.67	8.71	mg/kg dry wt	0.0024 U	0.0035 U	0.001 J	0.00088 J	0.0037 U	0.0068 UJ	0.0062 UJ
Xylene (Total)	0.025	0.325	mg/kg dry wt	0.0071 U	0.01 U	0.0021 J	0.0012 J	0.011 U	0.02 UJ	0.019 UJ
SVOC										
1,1'-Biphenyl	- -	- -	mg/kg dry wt	0.15 U	0.17 U	0.11 UJ	0.088 J	0.15 U	0.19 U	0.17 U
2-Methylnaphthalene	0.33	4.29	mg/kg dry wt	0.24	**0.4**	0.077 J	0.25 J	0.18	**0.36**	**0.43**
2-Methylphenol	0.012	0.156	mg/kg dry wt	0.037 U	0.042 U	**0.016 JEB**	0.0021 UJ	0.039 U	0.046 U	0.043 U
Acenaphthene	0.62	8.06	mg/kg dry wt	0.092	0.15	0.052 J	0.13 J	0.087	0.097	0.084
Acenaphthylene	0.33	4.29	mg/kg dry wt	0.22	**0.43**	0.16 J	0.087 J	0.11	0.31	**0.47**
Anthracene	0.0572	0.845	mg/kg dry wt	**0.42**	**0.68**	**0.48 J**	**2.9 J**	**0.32**	**0.44**	**0.46**
Benzaldehyde	- -	- -	mg/kg dry wt	0.22 J	0.3 J	0.082 J	0.078 J	0.15 UJ	0.41 J	0.17 UJ
Benzo(a)pyrene	0.15	1.45	mg/kg dry wt	**1.2**	**2.3**	**1.2 J**	**6.7 J**	**0.89**	**1.7**	**1.5**
Benzo(b)fluoranthene	- -	- -	mg/kg dry wt	1.1	2.1	0.84 J	3.2 J	0.92	2.3	1.8
Benzo(g,h,i)perylene	0.17	0.32	mg/kg dry wt	**0.82**	**1.6**	**0.81 J**	**0.91 J**	**0.62**	**1.8**	**1.3**
Benzo(k)fluoranthene	- -	- -	mg/kg dry wt	0.95	1.9	0.89 J	3.6 J	0.83	1.8	1.6
Benzo[a]anthracene	0.11	1.05	mg/kg dry wt	**1**	**2**	**0.97 J**	**7.1 J**	**0.84**	**1.3**	**1.3**
bis(2-Ethylhexyl)phthalate	890	11,570	mg/kg dry wt	1.2	3.2	0.21 J	0.26 J	0.72	5.9	1.9
Carbazole	- -	- -	mg/kg dry wt	0.15 U	0.2	0.11 UJ	0.093 J	0.18	0.22	0.17 U
Chrysene	0.17	1.29	mg/kg dry wt	**1.2**	**2.2**	**1.1 J**	**6.9 J**	**0.98**	**1.8**	**1.5**
Dibenz[a,h]anthracene	0.033	0.429	mg/kg dry wt	**0.25**	**0.49**	**0.24 J**	**0.92 J**	**0.21**	**0.5**	**0.4**
Dibenzofuran	2	26	mg/kg dry wt	0.15 U	0.17 U	0.11 UJ	0.09 J	0.15 U	0.19 U	0.17 U
Fluoranthene	0.42	2.23	mg/kg dry wt	**1.9**	**3.6**	**1.4 J**	**10 J**	**2**	**2.6**	**2.4**
Fluorene	0.077	0.536	mg/kg dry wt	**0.15**	**0.27**	**0.089 J**	**0.36 J**	**0.15**	**0.22**	**0.18**
Indeno(1,2,3-cd)pyrene	0.2	2.6	mg/kg dry wt	**0.73**	**1.4**	**0.71 J**	**0.8 J**	**0.59**	**1.5**	**1.2**
Naphthalene	0.18	0.561	mg/kg dry wt	**0.27**	**0.36**	0.13 J	**0.25 J**	0.18	**0.27**	**0.35**
Phenanthrene	0.2	1.17	mg/kg dry wt	**0.96 J**	**1.8**	**0.75 J**	**4.8 J**	**1.1**	**0.97**	**0.84**
Phenol	- -	- -	mg/kg dry wt	0.082	0.14	0.11 U	0.1 U	0.066	0.18	0.16
Pyrene	0.2	1.52	mg/kg dry wt	**1.8**	**3.5**	**1.7 J**	**13 J**	**1.6**	**2.2**	**2.2**
Total PAHs	- -	- -	mg/kg dry wt	13.3 J	25.2	11.6 J	61.9 J	11.6	20.2	18
Pesticides										
4,4'-DDD	0.00488	0.028	mg/kg dry wt	**0.013**	**0.015**	**0.0073**	**0.0061**	**0.0082**	**0.018**	**0.017**
4,4'-DDE	0.00316	0.0313	mg/kg dry wt	**0.0097 J**	**0.019 J**	**0.0048**	**0.0051 J**	**0.014 J**	R	**0.016 J**
alpha-Chlordane	0.0032	0.0176	mg/kg dry wt	**0.0041 J**	**0.0041**	0.0015	0.0015	**0.0043**	**0.0055**	**0.0034**
Delta-BHC	0.12	0.01	mg/kg dry wt	0.00059 U	0.00097 J	0.00082 U	0.00084 U	0.00062 U	0.00076 U	0.00068 U
Dieldrin	0.0019	0.0618	mg/kg dry wt	**0.004 J**	**0.0042**	0.0018	**0.0022**	**0.0062**	0.00076 U	**0.0052 J**
Endosulfan Sulfate	- -	- -	mg/kg dry wt	0.00059 UJ	0.00067 U	0.00082 U	0.00084 U	0.00062 U	0.00076 U	0.013 J
Endrin Ketone	- -	- -	mg/kg dry wt	0.00059 U	0.00067 U	0.0082 J	0.0091 J	0.00062 U	0.00076 U	0.00068 U
Gamma-Chlordane	- -	- -	mg/kg dry wt	0.0031	0.0042	0.0013	0.002 J	0.0037	0.0065	0.0036

US EPA ARCHIVE DOCUMENT

TABLE 7-9c
TRIAD SEDIMENT CHEMISTRY AND TOXICITY RESULTS - POND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

				Pond						
				Site					Background	
			Sample Name:	T05PA-001	T05PA-003	T05PD-002	BD062105	T05PF-004	T05BL-003	T05BL-004
			Sample Depth(Feet):	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
			Date Collected:	06/21/05	06/21/05	06/21/05	06/21/05	06/21/05	06/23/05	06/23/05
			Location ID:	T05PA-001	T05PA-003	T05PD-002	T05PD-002	T05PF-004	T05BL-003	T05BL-004
Species	**Test**	**Lab Control Result**	**Units**	**TOXICITY**						
Chironomus dilutus	Survival	83.75	%	76.25	71.25	77.50		86.25	86.25	93.75
Chironomus dilutus	Growth	1.79	mg/larvae	1.68	1.47	1.81		1.63	1.39	1.56
Hyalella azteca	Survival	91.25	%	**8.75**	**1.25**	**16.25**		**67.50**	**51.25**	88.75
Hyalella azteca	Growth	0.597	mg/amphipod	0.300	0.080 [1]	0.528		0.439	0.237	0.290
Constituent	**No Effect Criteria (Bold)**	**Effect Criteria (Shaded)**	**Units**	**SEDIMENT CHEMISTRY**						
PCBs										
Aroclor-1254	0.0598	0.676	mg/kg dry wt	**0.21 EB**	**0.42 EB**	0.0082 U	0.0084 U	**0.26 EB**	**1.4 JEB**	**1.1 JEB**
Aroclor-1260	0.0598	0.676	mg/kg dry wt	**0.42 J**	**0.55**	**0.13 J**	**0.12 J**	**0.34**	**0.57 J**	**0.46**
Total PCBs	0.0598	0.676	mg/kg dry wt	**0.63 J**	**0.97**	**0.13 J**	**0.12 J**	**0.6**	**1.97 J**	**1.56 J**
Metals and Cyanide										
Aluminum	- -	- -	mg/kg dry wt	8,900	12,000	5,200	4,700	7,400	12,000	12,000
Antimony	12	60	mg/kg dry wt	0.27 J	0.73 J	0.47 J	0.46 J	0.42 J	0.52 J	0.47 J
Arsenic	9.79	33	mg/kg dry wt	**12**	**18**	5.8	5.5	**12**	**10**	8.1
Barium	- -	- -	mg/kg dry wt	80	150	51	44	120	82	79
Beryllium	- -	- -	mg/kg dry wt	0.63	0.91	0.35	0.3	0.65	0.88	0.73
Cadmium	1	4.98	mg/kg dry wt	**12**	**25**	**4.6**	**4**	**8.9**	**9.9**	**9.8**
Calcium	- -	- -	mg/kg dry wt	1,400 J	2,000 J	1,100	950	1,800 J	3,300 J	3,100 J
Chromium	43.4	111	mg/kg dry wt	**98**	**210**	**86**	**70**	**96**	**110**	**120**
Cobalt	- -	- -	mg/kg dry wt	9.1	14	4.8	4.4	7.7	12	11
Copper	31.6	149	mg/kg dry wt	**130**	**260**	**72**	**69**	**150**	**170**	**160**
Iron	20,000	40,000	mg/kg dry wt	17,000	**24,000**	8,200	7,300	15,000	**25,000**	17,000
Lead	36	128	mg/kg dry wt	**120**	**240**	**96**	**94**	**180**	**450**	**300**
Magnesium	- -	- -	mg/kg dry wt	2,900	3,600	1,600	1,500	2,600	4,100	2,900
Manganese	460	5,500	mg/kg dry wt	280 J	450 J	140	120	360 J	200 J	160 J
Mercury	0.18	1.06	mg/kg dry wt	**0.31**	**0.67**	**0.26 J**	**0.29 J**	**0.35**	**0.54**	**0.47**
Nickel	23	48.6	mg/kg dry wt	**33**	**54**	19	18	**26**	**52**	**46**
Potassium	- -	- -	mg/kg dry wt	1,200	1,300	480	420	910	1,500	1,100
Selenium	- -	- -	mg/kg dry wt	0.54	1	0.29	0.26	0.76	1.5	1.3
Silver	2	10	mg/kg dry wt	1.4	**3**	0.44	0.49	**2.1**	1.7	**2.1**
Sodium	- -	- -	mg/kg dry wt	130	130	99	86	190	2,500	2,100
Thallium	- -	- -	mg/kg dry wt	0.15	0.25	0.1	0.087	0.15	0.4	0.26
Vanadium	- -	- -	mg/kg dry wt	21	27	12	9.9	18	31	24
Zinc	120	459	mg/kg dry wt	**400 J**	**950 J**	**220**	**200**	**290 J**	**680 J**	**490 J**

Notes:
Toxicity:
Shaded cells = result is statistically lower than lab control results

Bold font = survival and growth below minimum acceptable results for laboratory controls; 70 percent survival and 0.48 mg/larvae for Chironomus, 80 percent survival for Hyalella (USEPA, 2000). No standard is given for growth in lab controls for Hyalella other than weight gain must be recorded.
1. Estimated statistical result due to lack of degrees of freedom; n=1 replicate
Sediment Chemistry:
Bold font = COPEC exceeds its no-effect criterion only
Bold font and shaded = COPEC exceeds both its no-effect and effect criterion

US EPA ARCHIVE DOCUMENT

TABLE 7-10a
SEDIMENT TRIAD STUDY - WATER QUALITY MEASUREMENTS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Location		Sample ID	Collection Date	Water Depth (ft)	Water Temperature (^{o}C)	pH	Dissolved Oxygen (mg/L)	Conductivity (mS/cm)	Velocity (ft/s)
River	Site	T05BR-001	6/21/05	2.0	22.0	7.20	15.0	0.30	0.71
		T05BR-003	6/21/05	0.6	22.0	7.40	15.6	0.30	0.35
		T05BR-005	6/22/05	0.7	14.2	6.50	12.8	0.36	0.00
		T05BR-006	6/22/05	2.6	20.0	7.20	12.3	0.30	-0.01
		T05BR-007	6/23/05	1.4	21.0	7.00	12.5	0.29	0.00
	Background	T05BL-001	6/23/05	1.9	20.0	7.30	12.7	0.31	0.00
		T05BL-002	6/23/05	1.2	23.0	7.50	13.5	0.33	-0.01
		T05BL-005	6/23/05	6.1	22.0	7.60	12.4	0.32	0.03
		T05BL-006	6/23/05	1.7	21.2	6.51	5.9	0.27	0.00
		T05BL-007	6/23/05	6.9	22.0	7.50	11.7	0.32	0.03
Ponds	Pond A	T05PA-001	6/21/05	9.4	19.9	6.74	2.8	0.27	NA
		T05PA-003	6/21/05	5.3	21.8	7.17	7.1	0.26	NA
	Pond D	T05PD-002	6/21/05	2.1	22.3	6.75	7.1	0.26	NA
	Pond F	T05PF-004	6/21/05	8.9	18.3	6.41	4.0	0.36	NA
	Background	T05BL-003	6/23/05	2.1	22.2	6.89	6.6	1.83	NA
		T05BL-004	6/23/05	2.9	23.5	6.93	5.5	1.70	NA

Notes:
NA = not applicable; data not collected at the pond sites
ft = feet
^{o}C = degrees Celsius
mg/L = milligrams per liter
mS/cm = milliSiemens per centimeter
ft/s = feet per second

US EPA ARCHIVE DOCUMENT

TABLE 7-10b
SEDIMENT TRIAD STUDY - GRAIN SIZE AND TOC RESULTS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Location		Sample ID	Collection Date	Grain Size				% Total Organic Carbon (TOC)
				% Gravel	% Sand	% Silt	% Clay	
River	Site	T05BR-001	6/21/05	0	84.3	6.8	8.9	1.3
		T05BR-003	6/21/05	1	78.4	13.2	7.4	1.2
		T05BR-005	6/22/05	0	18.5	75.3	6.1	5.9
		T05BR-006	6/22/05	0	80.5	10.6	8.9	1.1
		T05BR-007	6/23/05	0	83.9	9.8	6.3	1.2
	Background	T05BL-001	6/23/05	0.2	80.1	14	5.6	1
		T05BL-002	6/23/05	8	89.5	2.4	0	0.65
		T05BL-005	6/23/05	0	80.1	10.8	9.2	1.8
		T05BL-006	6/23/05	0	48.7	43.3	8	4.6
		T05BL-007	6/23/05	0	84.1	10.1	5.8	1.1
Ponds	Pond A	T05PA-001	6/21/05	1.1	61.3	28.4	9.2	2.2
		T05PA-003	6/21/05	0	20.8	68.5	10.8	6.1
	Pond D	T05PD-002	6/21/05	0 [0.1]	78.8 [79.9]	13.8 [12.6]	7.4 [7.4]	3.1 [1.7]
	Pond F	T05PF-004	6/21/05	1.8	67.6	23.6	7.1	7.7
	Background	T05BL-003	6/23/05	0.1	20.8	60.9	18.2	10
		T05BL-004	6/23/05	0.1	20.3	70.9	8.6	8.7

Notes:
% = percent
[ ] = duplicate result

TABLE 7-10c
SEDIMENT TRIAD STUDY - BENTHIC ORGANISM COUNTS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Location			River										Ponds					
			Site					Background (BG)					A		D	F	BG	
Sample ID			BR-001	BR-003	BR-005	BR-006	BR-007	BL-001	BL-002	BL-005	BL-006	BL-007	PA-001	PA-003	PD-002	PF-004	BL-003	BL-004
Sample Date			06/21/05	06/21/05	06/22/05	06/22/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/21/05	06/21/05	06/21/05	06/21/05	06/23/05	06/23/05
Invertebrate Species	**Feeding Guild**	**Organism Habit**	**Number of Organisms**															
Lumbriculida																		
Lumbriculidae																		
Lumbriculus variegatus	Gatherer	Burrower		1														
Lumbricina																		
Lumbricidae	Gatherer	Burrower	1	1		1									1			
Tubificida																		
Naididae																		
Dero sp.	Gatherer	Burrower					4											
Ophiodonais serpentina	Gatherer	Burrower									2							
Tubificidae																		
Aulodrilus pleuriseta	Gatherer	Burrower	1		7	6	5		4	5								
Bothrioneurum vejdovskyanum	Gatherer	Burrower	1	34				5				10						
Brachiura sowerbyi	Gatherer	Burrower										1		2				
Ilydrilus templetoni	Gatherer	Burrower		1	6		16	11		5	1	14		2				
immature tubificid with hair chaetae	Gatherer	Burrower												3				
Limnodrilus claparedianus	Gatherer	Burrower														3		
Limnodrilus hoffmeisteri	Gatherer	Burrower	76	6	106	2	52		5	16	6	79		11	50		9	
Limnodrilus sp.	Gatherer	Burrower	19	18	53	5	6	52	38	72	5	66		23		3	4	
Veneroida																		
Sphaeriidae																		
Pisidium sp.	Filterer	Burrower				1		1	1									
Amphipoda																		
Gammaridae																		
Gammarus fasciatus	Gatherer	Swimmer		10			2	1	1	1								
Talitridae																		
Hyalella azteca	Gatherer	Swimmer													1			
Isopoda																		
Asellidae																		
Caecidotea sp..	Gatherer	Sprawler					1											
Odonata																		
Gomphidae																		
Dromogomphus spinosus	Predator	Burrower										2						
Stylurus spiniceps	Predator	Sprawler		1														
Coleoptera																		
Dytiscidae																		
Hydroporus sp.	Predator	Swimmer															1	
Elmidae																		
Ancyronyx variegatus	Gatherer	Clinger										1						
Dubiraphia vittata	Gatherer	Clinger					1		1			8						
Haliplidae																		
Peltodytes sp.	Shredder	Climber									1							
Diptera																		
Ceratopogonidae																		
Culicoides sp.	Predator	Burrower													1			
Mallochohelia sp.	Predator	Burrower												1				
Sphaeromias sp.	Predator	Burrower			1										6			

US EPA ARCHIVE DOCUMENT

TABLE 7-10c
SEDIMENT TRIAD STUDY - BENTHIC ORGANISM COUNTS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Location			River										Ponds					
			Site					Background (BG)					A		D	F	BG	
		Sample ID	BR-001	BR-003	BR-005	BR-006	BR-007	BL-001	BL-002	BL-005	BL-006	BL-007	PA-001	PA-003	PD-002	PF-004	BL-003	BL-004
		Sample Date	06/21/05	06/21/05	06/22/05	06/22/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/21/05	06/21/05	06/21/05	06/21/05	06/23/05	06/23/05
Invertebrate Species	Feeding Guild	Organism Habit	Number of Organisms															
Chaoboridae																		
Chaoborus punctipennis	Predator	Sprawler											3					
Chironomidae																		
Chironomini	Gatherer	Burrower												1				
Chironomus sp.	Gatherer	Burrower		22	12	21	49	40	82	1	38	1		2			53	82
Cladopelma sp.	Gatherer	Burrower				1		2	2	8								
Cladotanytarsus sp.	Gatherer	Climber		1														
Cryptochironomus fulvus gr.	Predator	Burrower		2			3	5	1			2			1			
Dicrotendipes sp.	Gatherer	Burrower							1						1			
Enfeldia sp.	Gatherer	Burrower												2				
Glyptotendipes sp.	Filterer	Burrower					1								1			
Paralaterborniella nigrohalteralis	Gatherer	Clinger							1	1								
Paratanytarsus sp.	Filterer	Clinger													1		2	3
Parachironomus tenuicaudatus gr.	Predator	Sprawler													2			
Polypedilum scalaenum gr.	Shredder	Climber							1									
Polypedilum sp.	Shredder	Climber			1													
Procladius sp.	Predator	Sprawler			5		5			1	1	1			1		2	1
Stictochironomus sp.	Gatherer	Burrower																1
Tanypus sp.	Predator	Sprawler									1						5	1
Tanytarsus sp.	Filterer	Climber		7			3		9	1		3			1		16	3
Ephydridae																		
nr. Hydrellia sp.	Shredder	Burrower	1															
Total Organisms			99	104	191	37	148	117	147	111	55	188	3	47	67	6	92	91
Biomass (mg)			22	123	35	19	26	15	31	19	19	61	0.4	15	22	1.0	50	63

Sources for Feeding Guild and Habit:
(1) United States Environmental Agency. 1999. Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers. US EPA (EPA 841-B-99-002), Washington DC.
(2) Merrit, R.W. and K.W. Cummins. 1996. An Introduction to the Aquatic Insects of North America. Kendall/Hunt Publishing, Dubuque, IA.
(3) New York State Department of Environmental Conservation (Bode, et.al.). 1991. Quality Assurance Work Plan for Biological Stream Monitoring in New York State. NY DEC, Albany, New York.
mg = milligram wet weight

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

TABLE 7-10d
SEDIMENT TRIAD STUDY - BENTHIC PERCENT HIGHER ORDER ABUNDANCE

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

	Location	River										Ponds					
		Site					Background (BG)					A		D	F	BG	
	Sample ID	BR-001	BR-003	BR-005	BR-006	BR-007	BL-001	BL-002	BL-005	BL-006	BL-007	PA-001	PA-003	PD-002	PF-004	BL-003	BL-004
Percent Abundance (Higher Order Taxa)	Sample Date	06/21/05	06/21/05	06/22/05	06/22/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/21/05	06/21/05	06/21/05	06/21/05	06/23/05	06/23/05
Lumbriculida		0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lumbricina		1	<1	0	3	0	0	0	0	0	0	0	0	1	0	0	0
Tubificida		98	57	90	35	56	58	32	88	25	90	0	87	75	100	14	0
Veneroida		0	0	0	3	0	<1	<1	0	0	0	0	0	0	0	0	0
Amphipoda		0	10	0	0	1	<1	<1	<1	0	0	0	0	1	0	0	0
Isopoda		0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0
Odonata		0	<1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Coleoptera		0	0	0	0	<1	0	<1	0	2	5	0	0	0	0	1	0
Diptera		1	31	10	59	41	40	66	11	73	4	100	13	22	0	85	100

Notes:
Percentage data may not add to exactly 100% due to rounding

US EPA ARCHIVE DOCUMENT

TABLE 7-10e
SEDIMENT TRIAD STUDY - BENTHIC COMMUNITY METRIC RESULTS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Location			River										Ponds					
			Site					Background (BG)					A		D	F	BG	
		Sample ID	BR-001	BR-003	BR-005	BR-006	BR-007	BL-001	BL-002	BL-005	BL-006	BL-007	PA-001	PA-003	PD-002	PF-004	BL-003	BL-004
		Sample Date	06/21/05	06/21/05	06/22/05	06/22/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/23/05	06/21/05	06/21/05	06/21/05	06/21/05	06/23/05	06/23/05
Benthic Metrics	Abundance	Total Organisms	99	104	191	37	148	117	147	111	55	188	3	47	67	6	92	91
	Richness	Number of Taxa	6	12	8	7	13	8	13	10	8	12	1	9	12	2	8	6
	Composition	Diversity Index	0.2	1.7	0.7	1.2	1.6	1.4	1.3	0.9	1.0	1.0	0	1.1	1.1	0	1.3	0.5
	Tolerance	% Tol. Organisms	99	83	99	97	96	98	91	98	95	93	100	96	88	100	79	93
	Feeding	% Gatherer	99	90	96	97	92	95	92	98	95	96	0	98	79	100	72	91
	Habit	% Burrower	100	82	97	100	92	99	91	96	95	93	0	100	91	100	72	91

Notes:
Tol. = tolerant

US EPA ARCHIVE DOCUMENT

TABLE 7-10f
SEDIMENT TRIAD STUDY - WEIGHT-OF-EVIDENCE TABLE

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

		Sediment Quality Triad			
Location	Sample ID	Sediment Chemistry	Toxicity Test	Benthic Community	Possible Conclusions (USEPA, 1992d)
Site-related impacts appear to be present					
Pond D	PD-002	+	+	-	Toxic chemicals are stressing the system.
Pond A	PA-003	+	+	+/-	Strong evidence for pollution-induced degradation.
Pond F	PF-004	+	+/-	+	Strong evidence for pollution-induced degradation.
River	BR-005	+	+/-	+/-	Strong evidence for pollution-induced degradation or conditions exist that could cause degradation.
Site-related impacts are inconclusive					
River	BR-006	-	+	+/-	Unmeasured toxic chemicals are causing degradation or conditions exist that could cause degradation.
Pond A	PA-001	-	+	+	Unmeasured toxic chemicals are causing degradation
Site-related impacts do not appear to be present					
River	BR-001	-	-	+	Alteration is probably not due to toxic chemical contamination.
River	BR-003	-	-	-	Strong evidence for absence of pollution-induced degradation.
River	BR-007	-	-	-	Strong evidence for absence of pollution-induced degradation.

Notes:
+ = location is different from screening criteria, laboratory controls, and/or background
- = location is not different from screening criteria, laboratory controls, and/or background
+/ - = location may be different from screening criteria, laboratory controls, and/or background, but evidence is not clear

Key (USEPA 1992d):
Each symbol in the following key code represents the results of the sediment chemistry (+ or -), toxicity (+ or -), and benthic community tests (+ or -)
1. +, +, + = strong evidence for polltion-induced degradation
2. -, -, - = strong evidence for absence of pollution-induced degradation
3. +, -, - = contaminants are not bioavailable
4. -, +, - = unmeasured chemicals or conditions exist that have the potential to cause degradation
5. -, -, + = alteration is probably not due to toxic chemical contamination
6. +, +, - = toxic chemicals are stressing the system
7. -, +, + = unmeasured toxic chemicals are causing degradation

US EPA ARCHIVE DOCUMENT

8. +, -, + = chemicals are not bioavailable or alteration is not due to toxic chemicals

US EPA ARCHIVE DOCUMENT

TABLE 7-11
FISH COMMUNITY ORGANISM COUNTS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

				Location	Blackstone River				Pond Areas		
					Site		Background (BG)		Site		BG
					BR-3		BR-1	BR-2	Pond A	Pond F	P-6
				Survey Date	9/27/05	9/28/05	9/29/05	9/28/05	9/27/05	9/27/05	9/29/05
Fish Species	**Scientific Name**	**Habitat**	**Trophic**	**Tolerance**	**Number of Organisms**						
American Eel	*Anguila rostrata*	B	P	M	5	2	3	7			
Black Crappie	*Pomoxis nigromaculatus*	WC	P	M					2	2	
Blacknose Dace	*Rhinichthys atratulus*	B	G	T	2						
Bluegill	*Lepomis macrochirus*	ALL	I	M		23	10	2	50	13	51
Carp	*Cyprinus carpio*	B	O	T	8	6	2	2	6	6	
Chain Pickerel	*Esox niger*	WC	P	M	1	2		1	1		
Common Shiner	*Notropis cornutus*	ALL	I	M	25	27	28	38			
Fallfish	*Semotilus corporalis*	All	G	M	10		44	13		3	
Golden Shiner	*Notemigonus crysoleucas*	WC	O	T		1	16	3	1	9	
Johnny Darter	*Etheostoma nigrum*	B	I	M				3			
Largemouth Bass	*Micropterus salmoides*	All	P	M	20	21	63	35	71	9	144
Longnose Dace	*Rhinichthys cataractae*	B	I	I	2			3			
Northern Pike	*Esox lucius*	WC	P	M							1
Pumpkinseed	*Lepomis gibbosus*	All	I	M	2	13	78	2	3	13	
Rockbass	*Ambloplites rupestris*	All	P	M			2	5			
Smallmouth Bass	*Micropterus dolomieui*	All	P	M	6		2	18			
Tessellated Darter	*Etheostoma olmstedi*	B	I	M	2						
White Perch	*Morone americana*	ALL	P	M	4	1			11		
White Sucker	*Catostomus commersoni*	B	O	T	62	66	12	25	11	32	
Yellow Bullhead	*Ictalurus natalis*	B	I	T	1			2		1	
Yellow Perch	*Perca flavescens*	All	I	M	2		1		27	9	1

Notes:
BR-3 9/27/05 survey data are from the main channel of the Blackstone River.
BR-3 9/28/05 survey data are from the backwater behind the island.
Habitat: B=Benthic; WC=Water Column; ALL=Both
Trophic: P=Piscivore; G=Generalist; I=Insectivore; O=Omnivore
Tolerance: M=Intermediate; T=Tolerant; I=Intolerant

US EPA ARCHIVE DOCUMENT

TABLE 7-12
FISH COMMUNITY METRIC RESULTS

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Fish Community Metrics	Expected Response to Increased Disturbance	River				Pond		
		Site		Background (BG)		Site		BG
		BR-3		BR-1	BR-2	Pond A	Pond F	P-6
		9/27/05	9/28/05	9/29/05	9/28/05	9/27/05	9/27/05	9/29/05
Total Number of Species	Decrease	15	10	12	15	10	10	4
Number of Benthic Insectivores	Decrease	3	0	0	3	0	1	0
Number of Water Column Species	Decrease	1	2	1	2	3	2	1
Number of Sucker Species	Decrease	1	1	1	1	1	1	0
Number of Intolerant Species	Decrease	1	0	0	1	0	0	0
Percent White Sucker of All Fish	Increase	41	41	5	16	6	33	0
Percent Omnivores of All Fish	Increase	46	45	11	19	10	48	0
Percent Insectivores of All Fish	Decrease	22	39	45	31	44	37	26
Percent Top Carnivores of All Fish	Decrease	20	15	26	37	46	11	74
Total Number of Fish	Decrease	152	162	261	159	183	97	197

Notes:
BR-3 9/27/05 survey data are from the main channel of the Blackstone River.
BR-3 9/28/05 survey data are from the backwater behind the island.

US EPA ARCHIVE DOCUMENT

TABLE 7-13a
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
River - Site	Surface Water	VOCs	Chloromethane	3.40E-01	2.57E-01	NA	NA	--	--	--	--	--	--	--	--
		SVOCs	Acenaphthene	5.00E-02	4.23E-02	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthylene	5.00E-02	4.44E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(b)fluoranthene	1.40E-01	5.18E-02	NA	NA	--	--	--	--	--	--	--	--
			Fluoranthene	1.20E-01	5.44E-02	NA	NA	--	--	--	--	--	--	--	--
			Phenanthrene	1.10E-01	5.11E-02	NA	NA	--	--	--	--	--	--	--	--
			Pyrene	1.70E-01	5.45E-02	NA	NA	--	--	--	--	--	--	--	--
		Metals	Aluminum	1.51E+02	8.07E+01	750	87	0.2	0.1	**2**	0.9	<1	<1	<1	<1
			Barium	4.12E+01	3.35E+01	39	3.9	**1**	0.9	**11**	**9**	<1	<1	<1	<1
			Cadmium	3.72E-01	2.20E-01	0.46	0.089	0.8	0.5	**4**	**2**	<1	<1	<1	<1
			Copper	1.25E+01	5.21E+00	15	2.5	0.8	0.3	**5**	**2**	<1	<1	<1	<1
			Iron	8.94E+02	5.93E+02	NA	NA	--	--	--	--	--	--	--	--
			Lead	3.69E+00	1.69E+00	12	0.47	0.3	0.1	**8**	**4**	<1	<1	<1	<1
			Manganese	3.10E+02	1.41E+02	800	80	0.4	0.2	**4**	**2**	<1	<1	**2**	<1
			Vanadium	1.04E+00	7.86E-01	190	19	0.01	0.00	0.1	0.04	<1	<1	<1	<1
			Zinc	2.17E+01	1.15E+01	33	33	0.7	0.3	0.7	0.3	<1	<1	<1	<1

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects level.

TABLE 7-13b
CALCULATED HAZARD QUOTIENTS FOR FISH AND AMPHIBIANS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE
River-Upstream	Surface Water	VOCs	1,1,1-Trichloroethane	2.50E-01	2.50E-01	62	620	0.004	0.004	0.0004	0.0004
			1,1,2,2-Tetrachloroethane	2.50E-01	2.50E-01	420	4200	0.001	0.001	0.0001	0.0001
			1,1-Dichloroethene	2.50E-01	2.50E-01	25	250	0.01	0.01	0.0010	0.0010
			2-Butanone	2.50E+00	2.50E+00	14000	140000	0.0002	0.0002	0.00002	0.00002
			2-Hexanone	2.50E+00	2.50E+00	99	990	0.03	0.03	0.003	0.003
			4-Methyl-2-pentanone	2.50E+00	2.50E+00	170	1700	0.01	0.01	0.001	0.001
			Acetone	4.95E+00	2.97E+00	1500	15000	0.003	0.002	0.0003	0.0002
			Carbon disulfide	2.50E-01	2.50E-01	0.92	9.2	0.27	0.27	0.03	0.03
			Chloromethane	3.70E-01	2.76E-01	NA	NA	--	--	--	--
			cis-1,2-Dichloroethene	2.50E-01	2.50E-01	590	5900	0.0004	0.0004	0.00004	0.00004
			cis-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.55	**5**	**5**	0.5	0.5
			Cyclohexane	2.50E-01	2.50E-01	NA	NA	--	--	--	--
			Cyclohexane, methyl-	2.50E-01	2.50E-01	NA	NA	--	--	--	--
			Isopropylbenzene	2.50E-01	2.50E-01	NA	NA	--	--	--	--
			Methyl acetate	2.50E-01	2.50E-01	NA	NA	--	--	--	--
			Methylene chloride	4.20E-01	3.13E-01	2200	22000	0.0002	0.0001	0.00002	0.00001
			Styrene	2.50E-01	2.50E-01	NA	NA	--	--	--	--
			Tetrachloroethene	2.50E-01	2.50E-01	98	980	0.003	0.003	0.0003	0.0003
			trans-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.55	**5**	**5**	0.5	0.5
			Trichlorofluoromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--
			Xylene (Total)	2.50E-01	2.50E-01	1.800	18.000	0.14	0.14	0.01	0.01
		SVOCs	1,1'-Biphenyl	2.50E+00	2.50E+00	140	14	0.02	0.02	0.2	0.2
			2-Methylnaphthalene	5.00E-02	2.35E-02	21	2.1	0.002	0.001	0.02	0.01
			2-Methylphenol	2.50E+00	2.50E+00	130	13	0.02	0.02	0.2	0.2
			4-Bromophenyl-phenylether	2.50E+00	2.50E+00	15	1.5	0.2	0.2	**2**	**2**
			4-Chloroaniline	2.50E+00	2.50E+00	NA	NA	--	--	--	--
			4-Methylphenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--
			4-Nitroaniline	1.00E+01	1.00E+01	NA	NA	--	--	--	--
			Acenaphthene	5.00E-02	2.39E-02	NA	NA	--	--	--	--
			Acenaphthylene	5.00E-02	2.92E-02	NA	NA	--	--	--	--
			Acetophenone	2.50E+00	2.50E+00	NA	NA	--	--	--	--
			Anthracene	5.00E-02	3.19E-02	7.3	0.73	0.01	0.004	0.1	0.04
			Benzaldehyde	2.50E+00	2.50E+00	NA	NA	--	--	--	--
			Benzo(a)pyrene	6.70E-02	5.14E-02	0.14	0.014	0.5	0.4	**5**	**4**
			Benzo(b)fluoranthene	8.60E-02	5.05E-02	NA	NA	--	--	--	--
			Benzo(g,h,i)perylene	1.30E-01	5.24E-02	NA	NA	--	--	--	--
			Benzo(k)fluoranthene	6.90E-02	4.21E-02	NA	NA	--	--	--	--
			Benzo[a]anthracene	5.00E-02	4.11E-02	0.27	0.027	0.2	0.2	**2**	**2**
			bis(2-Ethylhexyl)phthalate	2.50E+00	2.50E+00	320	32	0.01	0.01	0.1	0.1
			Butyl benzyl phthalate	2.50E+00	2.50E+00	190	19	0.01	0.01	0.1	0.1
			Chrysene	7.40E-02	4.82E-02	NA	NA	--	--	--	--
			Dibenz[a,h]anthracene	1.40E-01	4.28E-02	NA	NA	--	--	--	--
			Dibenzofuran	2.50E+00	2.50E+00	200	20	0.01	0.01	0.1	0.1
			Di-N-Octyl phthalate	2.50E+00	2.50E+00	NA	NA	--	--	--	--
			Fluoranthene	8.30E-02	5.91E-02	NA	NA	--	--	--	--
			Fluorene	5.00E-02	2.48E-02	39	3.9	0.001	0.001	0.01	0.01
			Hexachlorobenzene	2.50E+00	2.50E+00	NA	NA	--	--	--	--
			Hexachlorobutadiene	2.50E+00	2.50E+00	NA	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.30E-01	4.95E-02	NA	NA	--	--	--	--
			Isophorone	2.50E+00	2.50E+00	NA	NA	--	--	--	--
			Naphthalene	5.00E-02	2.67E-02	240	24	0.0002	0.0001	0.002	0.001
			N-Nitrosodiphenylamine	2.50E+00	2.50E+00	2100	210	0.001	0.001	0.01	0.01
			Pentachlorophenol	2.50E+00	2.50E+00	19	15	0.1	0.1	0.2	0.2
			Phenanthrene	5.00E-02	4.63E-02	NA	NA	--	--	--	--
			Phenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--
			Pyrene	8.70E-02	5.76E-02	NA	NA	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-13b
CALCULATED HAZARD QUOTIENTS FOR FISH AND AMPHIBIANS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE
River-Upstream	Surface Water	Pesticides	4,4'-DDD	2.80E-03	1.56E-03	0.11	0.011	0.03	0.01	0.3	0.1
			4,4'-DDE	2.80E-03	1.82E-03	0.11	0.011	0.03	0.02	0.3	0.2
			4,4'-DDT	2.80E-03	1.56E-03	1.1	0.001	0.003	0.001	**3**	**2**
			alpha-Chlordane	1.40E-03	9.83E-04	NA	NA	--	--	--	--
			Dieldrin	2.80E-03	2.05E-03	0.24	0.056	0.01	0.01	0.1	0.04
			Endosulfan I	1.40E-03	9.83E-04	0.22	0.056	0.01	0.004	0.03	0.02
			Endosulfan II	2.80E-03	1.56E-03	0.22	0.056	0.01	0.01	0.1	0.03
			Endosulfan Sulfate	2.80E-03	1.56E-03	NA	NA	--	--	--	--
			Endrin	2.80E-03	1.56E-03	0.086	0.036	0.03	0.02	0.1	0.04
			Endrin Aldehyde	2.80E-03	1.56E-03	NA	NA	--	--	--	--
			Endrin Ketone	2.80E-03	1.56E-03	NA	NA	--	--	--	--
			Gamma-BHC	1.40E-03	9.83E-04	NA	NA	--	--	--	--
			Gamma-Chlordane	1.40E-03	9.83E-04	NA	NA	--	--	--	--
			Heptachlor Epoxide	1.40E-03	9.83E-04	0.52	0.0038	0.003	0.002	0.4	0.3
			Methoxychlor	1.40E-02	4.56E-03	0.3	0.03	0.05	0.02	0.5	0.2
			Toxaphene	1.40E-01	9.83E-02	0.73	0.0002	0.2	0.1	**700**	**492**
		PCBs	Aroclor-1016	2.80E-02	1.98E-02	0.14	0.014	0.2	0.1	**2**	**1**
			Aroclor-1221	5.50E-02	3.13E-02	0.14	0.014	0.4	0.2	**4**	**2**
			Aroclor-1232	2.80E-02	1.98E-02	0.14	0.014	0.2	0.1	**2**	**1**
			Aroclor-1242	2.80E-02	1.98E-02	0.14	0.014	0.2	0.1	**2**	**1**
			Aroclor-1248	2.80E-02	1.98E-02	0.14	0.014	0.2	0.1	**2**	**1**
			Aroclor-1254	2.80E-02	1.98E-02	0.14	0.014	0.2	0.1	**2**	**1**
			Aroclor-1260	2.80E-02	1.98E-02	0.14	0.014	0.2	0.1	**2**	**1**
		Metals	Aluminum	3.60E+02	1.33E+02	750	87	0.5	0.2	**4**	**2**
			Antimony	1.50E+00	8.25E-01	300	30	0.01	0.003	0.1	0.03
			Arsenic	2.29E+00	1.76E+00	340	150	0.01	0.01	0.02	0.01
			Barium	1.00E+02	4.64E+01	39	3.9	**3**	**1**	**26**	**12**
			Beryllium	1.50E-01	1.16E-01	51	5.1	0.003	0.002	0.03	0.02
			Cadmium	8.20E-01	2.86E-01	0.46	0.089	**2**	1	**9**	**3**
			Chromium	5.00E+00	2.57E+00	16	11	0.3	0.2	0.5	0.2
			Cobalt	2.50E+01	1.75E+00	30	3	0.8	0.1	**8**	0.6
			Copper	1.25E+01	9.79E+00	15	2.5	0.8	0.7	**5**	**4**
			Cyanide	2.40E+00	2.09E+00	22	5.2	0.1	0.1	0.5	0.4
			Iron	8.40E+02	5.43E+02	NA	NA	--	--	--	--
			Lead	1.10E+01	3.16E+00	12	0.47	0.9	0.3	**23**	**7**
			Manganese	1.26E+02	9.40E+01	800	80	0.2	0.1	**2**	**1**
			Mercury	7.50E-02	4.36E-02	1.4	0.77	0.1	0.03	0.1	0.1
			Nickel	4.10E+00	3.21E+00	130	14	0.03	0.02	0.3	0.2
			Selenium	3.70E+00	8.78E-01	50	5	0.1	0.02	0.7	0.2
			Silver	1.00E+00	2.20E-01	0.24	0.36	**4**	1	**3**	0.6
			Thallium	2.00E+00	5.57E-01	120	12	0.02	0.005	0.2	0.05
			Vanadium	2.50E+01	2.91E+00	190	19	0.1	0.02	**1**	0.2
			Zinc	2.08E+01	1.34E+01	33	33	0.6	0.4	0.6	0.4

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA Table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

TABLE 7-13c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - WETLANDS A THROUGH

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Wetlands	Surface Water	VOCs	Chloromethane	4.60E-01	3.17E-01	NA	NA	--	--	--	--	--	--	--	--
			cis-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Cyclohexane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Isopropylbenzene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Methyl acetate	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Styrene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			trans-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Trichlorofluoromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
		SVOCs	4-Bromophenyl-phenylether	2.50E+00	2.50E+00	15	1.5	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			4-Chloroaniline	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Methylphenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Nitroaniline	1.00E+01	1.00E+01	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acetophenone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzaldehyde	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzo[a]anthracene	5.00E-02	5.00E-02	0.27	0.027	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Benzo(a)pyrene	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	<1
			Benzo(b)fluoranthene	1.00E-01	5.21E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(g,h,i)perylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(k)fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Chrysene	1.10E-01	5.24E-02	NA	NA	--	--	--	--	--	--	--	--
			Dibenz[a,h]anthracene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Di-N-Octyl phthalate	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Fluoranthene	2.00E-01	5.65E-02	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobenzene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobutadiene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Indeno(1,2,3-cd)pyrene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Isophorone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Phenanthrene	1.20E-01	5.51E-02	NA	NA	--	--	--	--	--	--	--	--
			Phenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Pyrene	2.10E-01	5.78E-02	NA	NA	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-13c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - WETLANDS A THROUGH

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
		Pesticides	4,4'-DDT	2.50E-03	2.50E-03	1.1	0.001	0.002	0.002	**3**	**3**	<1	<1	<1	<1
			alpha-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Endosulfan Sulfate	1.30E-02	2.77E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Aldehyde	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Ketone	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-BHC	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Toxaphene	1.25E-01	1.25E-01	0.73	0.0002	0.2	0.2	**625**	**625**	<1	<1	<1	**134**
		PCBs	Aroclor-1016	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1221	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	**1**
			Aroclor-1232	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1242	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1248	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1254	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1260	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
		Metals	Aluminum	9.52E+02	2.22E+02	750	87	**1**	0.3	**11**	**3**	<1	<1	**7**	**1**
			Barium	1.00E+02	4.89E+01	39	3.9	**3**	**1**	**26**	**13**	<1	<1	<1	<1
			Cadmium	1.20E+00	1.23E-01	0.46	0.089	**3**	0.3	**13**	**1**	<1	<1	**4**	<1
			Cobalt	1.91E+00	7.52E-01	30	3	0.1	0.03	0.6	0.3	<1	<1	<1	<1
			Copper	1.25E+01	2.31E+00	15	2.5	0.8	0.2	**5**	0.9	<1	<1	<1	<1
			Cyanide	1.79E+02	3.05E+00	22	5.2	**8**	0.1	**34**	0.6	**8**	<1	<1	<1
			Iron	1.62E+03	8.84E+02	NA	NA	--	--	--	--	--	--	--	--
			Lead	3.26E+00	1.83E+00	12	0.47	0.3	0.2	**7**	**4**	<1	<1	<1	<1
			Manganese	3.22E+02	8.13E+01	800	80	0.4	0.1	**4**	**1**	<1	<1	**2**	<1
			Nickel	2.00E+01	5.41E+00	130	14	0.2	0.04	**1**	0.4	<1	<1	**1**	<1
			Silver	2.80E+00	5.11E-01	0.24	0.36	**12**	**2**	**8**	**1**	**8**	<1	**5**	<1
			Zinc	9.84E+01	1.16E+01	33	33	**3**	0.4	**3**	0.4	**2**	<1	**2**	<1

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA Table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-13d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - POND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond A	Surface Water	VOC	Chloromethane	4.40E-01	2.69E-01	NA	NA	--	--	--	--	--	--	--	--
			cis-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Cyclohexane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Isopropylbenzene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Methyl acetate	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Styrene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			trans-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Trichlorofluoromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
		SVOC	4-Bromophenyl-phenylether	2.50E+00	2.50E+00	15	1.5	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			4-Chloroaniline	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Methylphenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Nitroaniline	1.00E+01	1.00E+01	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acetophenone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzaldehyde	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzo[a]anthracene	1.40E-01	5.54E-02	0.27	0.027	0.5	0.2	**5**	**2**	<1	<1	**3**	<1
			Benzo(a)pyrene	1.20E-01	5.91E-02	0.14	0.014	0.9	0.4	**9**	**4**	<1	<1	**4**	<1
			Benzo(b)fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(g,h,i)perylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(k)fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Chrysene	1.30E-01	5.50E-02	NA	NA	--	--	--	--	--	--	--	--
			Dibenz[a,h]anthracene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Di-N-Octyl phthalate	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Fluoranthene	2.20E-01	5.80E-02	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobenzene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobutadiene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Indeno(1,2,3-cd)pyrene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Isophorone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Phenanthrene	2.00E-01	6.21E-02	NA	NA	--	--	--	--	--	--	--	--
			Phenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Pyrene	2.10E-01	5.77E-02	NA	NA	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-13d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - POND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
		Pesticides	4,4'-DDT	2.50E-03	2.50E-03	1.1	0.001	0.002	0.002	**3**	**3**	<1	<1	<1	<1
			alpha-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Endosulfan Sulfate	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Aldehyde	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Ketone	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-BHC	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Toxaphene	1.25E-01	1.25E-01	0.73	0.0002	0.2	0.2	**625**	**625**	<1	<1	<1	**134**
		PCBs	Aroclor-1016	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1221	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	**1**
			Aroclor-1232	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1242	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1248	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1254	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1260	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
		Metals	Aluminum	1.95E+02	7.41E+01	750	87	0.3	0.1	**2**	0.9	<1	<1	<1	<1
			Barium	1.00E+02	3.42E+01	39	3.9	**3**	0.9	**26**	**9**	<1	<1	<1	<1
			Cadmium	2.20E+00	1.55E-01	0.46	0.089	**5**	0.3	**25**	**2**	**3**	<1	**16**	<1
			Cobalt	2.50E+01	1.85E+00	30	3	0.8	0.1	**8**	0.6	<1	<1	<1	<1
			Copper	1.25E+01	3.93E+00	15	2.5	0.8	0.3	**5**	**2**	<1	<1	<1	<1
			Iron	4.18E+03	1.51E+03	NA	NA	--	--	--	--	--	--	--	--
			Lead	1.55E+01	1.79E+00	12	0.47	**1**	0.1	**33**	**4**	<1	<1	**10**	<1
			Manganese	3.97E+02	3.63E+02	800	80	0.5	0.5	**5**	**5**	<1	<1	**3**	**3**
			Nickel	2.00E+01	3.88E+00	130	14	0.2	0.03	**1**	0.3	<1	<1	**1**	<1
			Silver	5.00E+00	8.19E-01	0.24	0.36	**21**	**3**	**14**	**2**	**17**	**2**	**11**	**2**
			Zinc	1.55E+02	1.45E+01	33	33	**5**	0.4	**5**	0.4	**4**	<1	**4**	<1

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA Table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-13e
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - POND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond C	Surface Water	VOCs	Chloromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			cis-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Cyclohexane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Isopropylbenzene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Methyl acetate	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Styrene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			trans-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Trichlorofluoromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
		SVOCs	4-Bromophenyl-phenylether	2.50E+00	2.50E+00	15	1.5	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			4-Chloroaniline	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Methylphenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Nitroaniline	1.00E+01	1.00E+01	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acetophenone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzaldehyde	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzo[a]anthracene	2.00E-01	1.00E-01	0.27	0.027	0.7	0.4	**7**	**4**	<1	<1	**6**	**2**
			Benzo(a)pyrene	3.40E-01	1.30E-01	0.14	0.014	**2**	0.9	**24**	**9**	**2**	<1	**20**	**6**
			Benzo(b)fluoranthene	3.60E-01	1.34E-01	NA	NA	--	--	--	--	--	--	--	--
			Benzo(g,h,i)perylene	2.30E-01	1.07E-01	NA	NA	--	--	--	--	--	--	--	--
			Benzo(k)fluoranthene	2.60E-01	1.14E-01	NA	NA	--	--	--	--	--	--	--	--
			Chrysene	3.00E-01	1.22E-01	NA	NA	--	--	--	--	--	--	--	--
			Dibenz[a,h]anthracene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Di-N-Octyl phthalate	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Fluoranthene	3.90E-01	1.40E-01	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobenzene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobutadiene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.90E-01	9.75E-02	NA	NA	--	--	--	--	--	--	--	--
			Isophorone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Phenanthrene	2.00E-01	1.00E-01	NA	NA	--	--	--	--	--	--	--	--
			Phenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Pyrene	4.20E-01	1.45E-01	NA	NA	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-13e
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - POND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
		Pesticides	4,4'-DDD	2.50E-02	7.91E-03	0.11	0.011	0.2	0.1	**2**	0.7	<1	<1	**2**	<1
			4,4'-DDT	2.50E-03	2.50E-03	1.1	0.001	0.002	0.002	**3**	**3**	<1	<1	<1	<1
			alpha-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Endosulfan Sulfate	1.10E-02	5.24E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Aldehyde	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Ketone	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-BHC	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Toxaphene	1.25E-01	1.25E-01	0.73	0.0002	0.2	0.2	**625**	**625**	<1	<1	<1	**134**
		PCBs	Aroclor-1016	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1221	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	**1**
			Aroclor-1232	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1242	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1248	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1254	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1260	3.00E-01	8.66E-02	0.14	0.014	**2**	0.6	**21**	**6**	**2**	<1	**19**	**5**
		Metals	Aluminum	2.08E+04	1.98E+03	750	87	**28**	**3**	**239**	**23**	**27**	**2**	**235**	**21**
			Barium	5.98E+02	2.03E+02	39	3.9	**15**	**5**	**153**	**52**	**13**	**4**	**128**	**40**
			Cadmium	1.99E+01	3.01E+00	0.46	0.089	**43**	**7**	**224**	**34**	**41**	**6**	**214**	**31**
			Chromium	2.60E+02	2.65E+01	16	11	**16**	**2**	**24**	**2**	**16**	**1**	**23**	**2**
			Cobalt	9.20E+00	1.72E+00	30	3	0.3	0.1	**3**	0.6	<1	<1	<1	<1
			Copper	4.28E+02	4.81E+01	15	2.5	**29**	**3**	**171**	**19**	**28**	**3**	**166**	**15**
			Cyanide	1.06E+01	3.99E+00	22	5.2	0.5	0.2	**2**	0.8	<1	<1	**2**	<1
			Iron	5.47E+04	8.20E+03	NA	NA	--	--	--	--	--	--	--	--
			Lead	3.30E+02	3.25E+01	12	0.47	**28**	**3**	**702**	**69**	**27**	**2**	**679**	**62**
			Manganese	1.20E+03	3.20E+02	800	80	**2**	0.4	**15**	**4**	**1**	<1	**13**	**3**
			Nickel	4.41E+01	1.03E+01	130	14	0.3	0.1	**3**	0.7	<1	<1	**3**	<1
			Silver	1.52E+01	3.90E+00	0.24	0.36	**63**	**16**	**42**	**11**	**59**	**15**	**39**	**10**
			Vanadium	6.04E+01	9.20E+00	190	19	0.3	0.05	**3**	0.5	<1	<1	**2**	<1
			Zinc	7.51E+02	1.43E+02	33	33	**23**	**4**	**23**	**4**	**22**	**4**	**22**	**4**

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA Table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-13f
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - POND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond D	Surface Water	VOCs	Chloromethane	2.50E-01	2.00E-01	NA	NA	--	--	--	--	--	--	--	--
			cis-1,3-Dichloropropene	2.50E-01	2.50E-01	0	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Cyclohexane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Isopropylbenzene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Methyl acetate	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Styrene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			trans-1,3-Dichloropropene	2.50E-01	2.50E-01	0	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Trichlorofluoromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
		SVOCs	4-Bromophenyl-phenylether	2.50E+00	2.50E+00	15	1.5	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			4-Chloroaniline	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Methylphenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Nitroaniline	1.00E+01	1.00E+01	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acetophenone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzaldehyde	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzo[a]anthracene	1.20E-01	7.75E-02	0	0.027	0.4	0.3	**4**	**3**	<1	<1	**3**	**1**
			Benzo(a)pyrene	1.50E-01	8.66E-02	0	0.014	**1**	0.6	**11**	**6**	<1	<1	**6**	**3**
			Benzo(b)fluoranthene	2.50E-01	1.12E-01	NA	NA	--	--	--	--	--	--	--	--
			Benzo(g,h,i)perylene	1.10E-01	7.42E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(k)fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Chrysene	1.60E-01	8.94E-02	NA	NA	--	--	--	--	--	--	--	--
			Di-N-Octyl phthalate	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Fluoranthene	1.90E-01	9.75E-02	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobenzene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobutadiene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.10E-01	7.42E-02	NA	NA	--	--	--	--	--	--	--	--
			Isophorone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Phenanthrene	2.10E-01	1.02E-01	NA	NA	--	--	--	--	--	--	--	--
			Phenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Pyrene	3.80E-01	1.95E-01	NA	NA	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-13f
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - POND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
		Pesticides	4,4'-DDT	2.50E-03	2.50E-03	1	0.001	0.002	0.002	**3**	**3**	<1	<1	<1	<1
			alpha-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Endosulfan Sulfate	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Aldehyde	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Ketone	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-BHC	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-Chlordane	2.70E-03	1.84E-03	NA	NA	--	--	--	--	--	--	--	--
			Toxaphene	1.25E-01	1.25E-01	1	0.0002	0.2	0.2	**625**	**625**	<1	<1	<1	**134**
		PCBs	Aroclor-1016	2.50E-02	2.50E-02	0	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1221	5.00E-02	5.00E-02	0	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	**1**
			Aroclor-1232	2.50E-02	2.50E-02	0	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1242	2.50E-02	2.50E-02	0	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1248	2.50E-02	2.50E-02	0	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1254	2.50E-02	2.50E-02	0	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1260	2.50E-02	2.50E-02	0	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
		Metals	Aluminum	4.25E+03	2.05E+03	750	87	**6**	**3**	**49**	**24**	**5**	**3**	**45**	**22**
			Barium	1.00E+02	9.03E+01	39	3.9	**3**	**2**	**26**	**23**	<1	**1**	<1	**11**
			Cadmium	4.70E+00	2.27E+00	0	0.089	**10**	**5**	**53**	**26**	**8**	**4**	**44**	**22**
			Chromium	5.87E+01	2.64E+01	16	11	**4**	**2**	**5**	**2**	**3**	**1**	**5**	**2**
			Cobalt	2.50E+01	6.42E+00	30	3	0.8	0.2	**8**	**2**	<1	<1	<1	**2**
			Copper	7.03E+01	2.96E+01	15	2.5	**5**	**2**	**28**	**12**	**4**	**1**	**23**	**8**
			Iron	9.35E+03	5.59E+03	NA	NA	--	--	--	--	--	--	--	--
			Lead	8.26E+01	3.95E+01	12	0.47	**7**	**3**	**176**	**84**	**6**	**3**	**152**	**77**
			Manganese	5.05E+02	3.91E+02	800	80	0.6	0.5	**6**	**5**	<1	<1	**5**	**4**
			Nickel	2.00E+01	1.64E+01	130	14	0.2	0.1	**1**	**1**	<1	<1	**1**	<1
			Silver	1.00E+00	5.48E-01	0	0.36	**4**	**2**	**3**	**2**	<1	**1**	<1	<1
			Zinc	2.09E+02	1.11E+02	33	33	**6**	**3**	**6**	**3**	**6**	**3**	**6**	**3**

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA Table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-13g
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - POND E

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond E	Surface Water	VOCs	Chloromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			cis-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Cyclohexane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Isopropylbenzene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Methyl acetate	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Styrene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			trans-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Trichlorofluoromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
		SVOCs	4-Bromophenyl-phenylether	2.50E+00	2.50E+00	15	1.5	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			4-Chloroaniline	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Methylphenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Nitroaniline	1.00E+01	1.00E+01	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acetophenone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzaldehyde	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzo[a]anthracene	5.00E-02	5.00E-02	0.27	0.027	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Benzo(a)pyrene	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	<1
			Benzo(b)fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(g,h,i)perylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(k)fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Chrysene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Dibenz[a,h]anthracene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Di-N-Octyl phthalate	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Fluoranthene	5.90E-02	5.43E-02	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobenzene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobutadiene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Indeno(1,2,3-cd)pyrene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Isophorone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Phenanthrene	1.40E-01	1.40E-01	NA	NA	--	--	--	--	--	--	--	--
			Phenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Pyrene	1.20E-01	7.75E-02	NA	NA	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-13g
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - POND E

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
		Pesticides	4,4'-DDD	1.20E-02	5.48E-03	0.11	0.011	0.1	0.05	**1**	0.5	<1	<1	<1	<1
			alpha-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Endosulfan Sulfate	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Aldehyde	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Ketone	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-BHC	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-Chlordane	4.70E-03	2.42E-03	NA	NA	--	--	--	--	--	--	--	--
			Toxaphene	1.25E-01	1.25E-01	0.73	0.0002	0.2	0.2	**625**	**625**	<1	<1	<1	**134**
		PCBs	Aroclor-1016	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1221	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	**1**
			Aroclor-1232	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1242	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1248	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1254	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1260	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
		Metals	Aluminum	1.00E+02	4.97E+01	750	87	0.1	0.1	**1**	0.6	<1	<1	<1	<1
			Barium	2.75E+02	2.61E+02	39	3.9	**7**	**7**	**71**	**67**	**4**	**6**	**45**	**55**
			Cadmium	6.40E-01	2.53E-01	0.46	0.089	**1**	0.6	**7**	**3**	<1	<1	<1	<1
			Cobalt	2.50E+01	3.06E+00	30	3	0.8	0.1	**8**	**1**	<1	<1	<1	<1
			Copper	1.25E+01	9.68E+00	15	2.5	0.8	0.6	**5**	**4**	<1	<1	<1	<1
			Iron	2.12E+04	1.20E+04	NA	NA	--	--	--	--	--	--	--	--
			Lead	1.43E+01	6.87E+00	12	0.47	**1**	0.6	**30**	**15**	<1	<1	**7**	**8**
			Manganese	8.15E+02	6.71E+02	800	80	**1**	0.8	**10**	**8**	<1	<1	**9**	**7**
			Nickel	2.00E+01	2.24E+00	130	14	0.2	0.02	**1**	0.2	<1	<1	**1**	<1
			Silver	5.00E+00	2.24E+00	0.24	0.36	**21**	**9**	**14**	**6**	**17**	**8**	**11**	**6**
			Zinc	7.51E+01	4.91E+01	33	33	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA Table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-13h
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMBHIBIANS - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond F	Surface Water	VOCs	Chloromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			cis-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Cyclohexane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Isopropylbenzene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Methyl acetate	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Styrene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			trans-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Trichlorofluoromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
		SVOCs	4-Bromophenyl-phenylether	2.50E+00	2.50E+00	15	1.5	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			4-Chloroaniline	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Methylphenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Nitroaniline	1.00E+01	1.00E+01	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acetophenone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzaldehyde	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzo[a]anthracene	5.00E-02	5.00E-02	0.27	0.027	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Benzo(a)pyrene	1.70E-01	6.79E-02	0.14	0.014	**1**	0.5	**12**	**5**	<1	<1	**7**	**1**
			Benzo(b)fluoranthene	1.60E-01	6.69E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(g,h,i)perylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(k)fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Chrysene	1.40E-01	6.47E-02	NA	NA	--	--	--	--	--	--	--	--
			Dibenz[a,h]anthracene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Di-N-Octyl phthalate	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Fluoranthene	1.80E-01	6.89E-02	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobenzene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobutadiene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Indeno(1,2,3-cd)pyrene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Isophorone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Phenanthrene	1.70E-01	8.07E-02	NA	NA	--	--	--	--	--	--	--	--
			Phenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Pyrene	2.50E-01	7.48E-02	NA	NA	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-13h
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMBHIBIANS - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
		Pesticides	4,4'-DDT	2.50E-03	2.50E-03	1.1	0.001	0.002	0.002	**3**	**3**	<1	<1	<1	<1
			alpha-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Endosulfan Sulfate	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Aldehyde	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Ketone	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-BHC	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Toxaphene	1.25E-01	1.25E-01	0.73	0.0002	0.2	0.2	**625**	**625**	<1	<1	<1	**134**
		PCBs	Aroclor-1016	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1221	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	**1**
			Aroclor-1232	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1242	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1248	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1254	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1260	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
		Metals	Aluminum	9.95E+02	1.23E+02	750	87	**1**	0.2	**11**	**1**	<1	<1	**7**	<1
			Barium	1.00E+02	4.03E+01	39	3.9	**3**	**1**	**26**	**10**	<1	<1	<1	<1
			Cadmium	6.00E-01	1.57E-01	0.46	0.089	**1**	0.3	**7**	**2**	<1	<1	<1	<1
			Copper	1.25E+01	5.48E+00	15	2.5	0.8	0.4	**5**	**2**	<1	<1	<1	<1
			Iron	4.91E+03	2.11E+03	NA	NA	--	--	--	--	--	--	--	--
			Lead	1.96E+01	3.29E+00	12	0.47	**2**	0.3	**42**	**7**	<1	<1	**18**	<1
			Manganese	1.01E+03	2.24E+02	800	80	**1**	0.3	**13**	**3**	**1**	<1	**11**	**2**
			Nickel	2.00E+01	3.60E+00	130	14	0.2	0.03	**1**	0.3	<1	<1	**1**	<1
			Silver	2.10E+00	8.91E-01	0.24	0.36	**9**	**4**	**6**	**2**	**5**	**3**	**3**	**2**
			Zinc	4.64E+01	1.47E+01	33	33	**1**	0.4	**1**	0.4	<1	<1	<1	<1

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA Table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-13i
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - POND I

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond I	Surface Water	VOCs	Chloromethane	3.60E-01	3.00E-01	NA	NA	--	--	--	--	--	--	--	--
			cis-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Cyclohexane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Isopropylbenzene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Methyl acetate	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Styrene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			trans-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Trichlorofluoromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
		SVOCs	4-Bromophenyl-phenylether	2.50E+00	2.50E+00	15	1.5	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			4-Chloroaniline	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Methylphenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Nitroaniline	1.00E+01	1.00E+01	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acetophenone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzaldehyde	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzo[a]anthracene	1.20E-01	7.75E-02	0.27	0.027	0.4	0.3	**4**	**3**	<1	<1	**3**	**1**
			Benzo(a)pyrene	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	<1
			Benzo(b)fluoranthene	1.80E-01	9.49E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(g,h,i)perylene	1.00E-01	7.07E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(k)fluoranthene	1.00E-01	7.07E-02	NA	NA	--	--	--	--	--	--	--	--
			Chrysene	1.50E-01	8.66E-02	NA	NA	--	--	--	--	--	--	--	--
			Dibenz[a,h]anthracene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Di-N-Octyl phthalate	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Fluoranthene	2.40E-01	1.10E-01	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobenzene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobutadiene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Indeno(1,2,3-cd)pyrene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Isophorone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Phenanthrene	1.40E-01	1.35E-01	NA	NA	--	--	--	--	--	--	--	--
			Phenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Pyrene	2.20E-01	1.66E-01	NA	NA	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-13i
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMPHIBIANS - POND I

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
		Pesticides	4,4'-DDT	2.50E-03	2.50E-03	1.1	0.001	0.002	0.002	**3**	**3**	<1	<1	<1	<1
			alpha-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Endosulfan Sulfate	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Aldehyde	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Ketone	6.00E-03	3.87E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-BHC	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Toxaphene	1.25E-01	1.25E-01	0.73	0.0002	0.2	0.2	**625**	**625**	<1	<1	<1	**134**
		PCBs	Aroclor-1016	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1221	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	**1**
			Aroclor-1232	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1242	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
		Metals	Aluminum	3.49E+02	3.10E+02	750	87	0.5	0.4	**4**	**4**	<1	<1	<1	**2**
			Barium	7.47E+01	6.20E+01	39	3.9	**2**	**2**	**19**	**16**	<1	<1	<1	**4**
			Cadmium	7.10E-01	4.00E-01	0.46	0.089	**2**	0.9	**8**	**4**	<1	<1	<1	**1**
			Copper	1.25E+01	7.35E+00	15	2.5	0.8	0.5	**5**	**3**	<1	<1	<1	<1
			Iron	8.60E+03	7.43E+03	NA	NA	--	--	--	--	--	--	--	--
			Lead	8.70E+00	7.82E+00	12	0.47	0.7	0.7	**19**	**17**	<1	<1	<1	**10**
			Manganese	4.18E+02	2.87E+02	800	80	0.5	0.4	**5**	**4**	<1	<1	**4**	**2**
			Silver	1.00E+00	5.48E-01	0.24	0.36	**4**	**2**	**3**	**2**	<1	**1.4**	<1	<1
			Zinc	3.87E+01	1.97E+01	33	33	**1**	0.6	**1**	0.6	<1	<1	<1	<1

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA Table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-13j
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMBHIBIANS - POND N

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond N	Surface Water	VOCs	Chloromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			cis-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Cyclohexane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Isopropylbenzene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Methyl acetate	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Styrene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			trans-1,3-Dichloropropene	2.50E-01	2.50E-01	0.055	0.550	**5**	**5**	0.5	0.5	<1	<1	<1	<1
			Trichlorofluoromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
		SVOCs	4-Bromophenyl-phenylether	2.50E+00	2.50E+00	15	1.5	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			4-Chloroaniline	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Methylphenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Nitroaniline	1.00E+01	1.00E+01	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acetophenone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzaldehyde	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzo[a]anthracene	1.00E-01	1.00E-01	0.27	0.027	0.4	0.4	**4**	**4**	<1	<1	**2**	**2**
			Benzo(a)pyrene	1.40E-01	1.40E-01	0.14	0.014	**1**	**1**	**10**	**10**	<1	<1	**5**	**6**
			Benzo(b)fluoranthene	2.00E-01	2.00E-01	NA	NA	--	--	--	--	--	--	--	--
			Benzo(g,h,i)perylene	1.00E-01	1.00E-01	NA	NA	--	--	--	--	--	--	--	--
			Benzo(k)fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Chrysene	1.50E-01	1.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Dibenz[a,h]anthracene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Di-N-Octyl phthalate	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Fluoranthene	2.10E-01	2.10E-01	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobenzene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobutadiene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.00E-01	1.00E-01	NA	NA	--	--	--	--	--	--	--	--
			Isophorone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Phenanthrene	1.70E-01	1.70E-01	NA	NA	--	--	--	--	--	--	--	--
			Phenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Pyrene	2.70E-01	2.70E-01	NA	NA	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-13j
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMBHIBIANS - POND N

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
		Pesticides	4,4'-DDT	2.50E-03	2.50E-03	1.1	0.001	0.002	0.002	**3**	**3**	<1	<1	<1	<1
			alpha-Chlordane	4.40E-03	4.40E-03	NA	NA	--	--	--	--	--	--	--	--
			Endosulfan Sulfate	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Aldehyde	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Ketone	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-BHC	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-Chlordane	1.25E-03	1.25E-03	NA	NA	--	--	--	--	--	--	--	--
			Toxaphene	1.25E-01	1.25E-01	0.73	0.0002	0.2	0.2	**625**	**625**	<1	<1	<1	**134**
		PCBs	Aroclor-1016	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1221	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	**1**
			Aroclor-1232	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1242	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1248	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1260	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
		Metals	Aluminum	2.07E+03	2.07E+03	750	87	**3**	**3**	**24**	**24**	**2**	**3**	**20**	**22**
			Barium	4.67E+01	4.67E+01	39	3.9	**1**	**1**	**12**	**12**	<1	<1	<1	<1
			Cadmium	4.70E-01	4.70E-01	0.46	0.089	**1**	**1**	**5**	**5**	<1	<1	<1	**2**
			Copper	6.65E+00	6.65E+00	15	2.5	0.4	0.4	**3**	**3**	<1	<1	<1	<1
			Iron	3.70E+03	3.70E+03	NA	NA	--	--	--	--	--	--	--	--
			Lead	8.60E+00	8.60E+00	12	0.47	0.7	0.7	**18**	**18**	<1	<1	<1	**12**
			Manganese	2.95E+02	2.95E+02	800	80	0.4	0.4	**4**	**4**	<1	<1	**2**	**3**
			Silver	1.00E+00	1.00E+00	0.24	0.36	**4**	**4**	**3**	**3**	<1	**3**	<1	**2**
			Zinc	3.79E+01	3.79E+01	33	33	**1**	**1**	**1**	**1**	<1	<1	<1	<1

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA Table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-13k
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMBHIBIANS - POND P

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond P	Surface Water	VOCs	Chloromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Cyclohexane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Isopropylbenzene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Methyl acetate	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Styrene	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
			Trichlorofluoromethane	2.50E-01	2.50E-01	NA	NA	--	--	--	--	--	--	--	--
		SVOCs	4-Bromophenyl-phenylether	2.50E+00	2.50E+00	15.000	1.500	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			4-Chloroaniline	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Methylphenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			4-Nitroaniline	1.00E+01	1.00E+01	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acenaphthylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Acetophenone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzaldehyde	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Benzo[a]anthracene	5.00E-02	5.00E-02	0.27	0.027	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Benzo(a)pyrene	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	<1
			Benzo(b)fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(g,h,i)perylene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Benzo(k)fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Chrysene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Dibenz[a,h]anthracene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Di-N-Octyl phthalate	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Fluoranthene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobenzene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Hexachlorobutadiene	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Indeno(1,2,3-cd)pyrene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Isophorone	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Phenanthrene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--
			Phenol	2.50E+00	2.50E+00	NA	NA	--	--	--	--	--	--	--	--
			Pyrene	5.00E-02	5.00E-02	NA	NA	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-13k
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR FISH AND AMBHIBIANS - POND P

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Medium	Chemical Group	Chemical	Exposure Point Concentration (µg/L)		Surface Water Benchmarks (µg/L)		Acute HQ		Chronic HQ		Acute RR		Chronic RR	
				RME	CTE	Acute	Chronic	RME	CTE	RME	CTE	RME	CTE	RME	CTE
		Pesticides	4,4'-DDT	9.20E-03	9.20E-03	1.1	0.001	0.01	0.01	**9**	**9**	<1	<1	**6**	**8**
			alpha-Chlordane	3.30E-03	3.30E-03	NA	NA	--	--	--	--	--	--	--	--
			Endosulfan Sulfate	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Aldehyde	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Endrin Ketone	2.50E-03	2.50E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-BHC	4.30E-03	4.30E-03	NA	NA	--	--	--	--	--	--	--	--
			Gamma-Chlordane	9.40E-03	9.40E-03	NA	NA	--	--	--	--	--	--	--	--
			Heptachlor Epoxide	5.10E-03	5.10E-03	0.52	0.0038	0.01	0.01	**1**	**1**	<1	<1	<1	**1**
			Toxaphene	1.25E-01	1.25E-01	0.73	0.0002	0.2	0.2	**625**	**625**	<1	<1	<1	**134**
		PCBs	Aroclor-1016	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1221	5.00E-02	5.00E-02	0.14	0.014	0.4	0.4	**4**	**4**	<1	<1	<1	**1**
			Aroclor-1232	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1242	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1248	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1254	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
			Aroclor-1260	2.50E-02	2.50E-02	0.14	0.014	0.2	0.2	**2**	**2**	<1	<1	<1	<1
		Metals	Barium	1.91E+01	1.91E+01	39	3.9	0.5	0.5	**5**	**5**	<1	<1	<1	<1
			Cadmium	1.00E-01	1.00E-01	0.46	0.089	0.2	0.2	**1**	**1**	<1	<1	<1	<1
			Copper	3.10E+00	3.10E+00	15	2.5	0.2	0.2	**1**	**1**	<1	<1	<1	<1
			Iron	5.67E+03	5.67E+03	NA	NA	--	--	--	--	--	--	--	--
			Lead	1.00E+00	1.00E+00	12	0.47	0.1	0.1	**2**	**2**	<1	<1	<1	<1
			Manganese	1.16E+03	1.16E+03	800	80	**1**	**1**	**15**	**15**	**1.3**	**1.3**	**13**	**13**
			Silver	2.60E+00	2.60E+00	0.24	0.36	**11**	**11**	**7**	**7**	**7**	**10**	**4**	**7**

Notes:
Benchmarks are based on SLERA screening criteria presented in SLERA Table 3a.
Surface Water Benchmarks are USEPA Ambient Water Quality Criteria
In cases where an acute water quality criteria is not available, the chronic value is conservatively multiplied by a factor of 10 to estimate the corresponding potential effects level.

US EPA ARCHIVE DOCUMENT

TABLE 7-14
CRITICAL BODY RESIDUES FOR FISH

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

	Hatheway Patterson[1]		CT Yankee[2]		Beede Waste Oil[3]		Fort Devens[4]		Centredale[5]		Proposed CBRs		
	no effect	effect	no effect	effect	no effect	effect	no effect	effect	no effect	effect	no effect	effect	source
Inorganics (mg/kg)													
Aluminum	1	<8.0	-	-	0.8	8	8.53	25.59	1.0	8.0	0.8	8.0	3
Antimony	5	9	5	9	-	-	-	-	-	-	5.0	9.0	1, 2
Arsenic	1	3	0.53	1.7	0.47	4.7	1.8	2.24	-	-	0.53	1.7	2
Barium	-	-	-	-	-	-	-	-	-	0.41	-	0.41	5
Beryllium	-	-	5.1	-	5.13	-	-	-	-	-	5.1	-	2
Cadmium	0.06	0.12	0.32	0.91	14.4	144	0.036	0.35	-	-	0.06	0.12	1
Chromium	0.58	-	3.6	9.4	0.18	-	0.58	1.74	-	-	0.58	1.74	4
Copper	0.28	0.3	7.6[a]	5.9[a]	0.222	2.22	0.28	0.3	-	-	0.28	0.3	1, 4
Lead	0.34	0.4	2.2	4.0	2.55	-	0.34	0.4	-	-	0.34	0.4	1, 4
Mercury	-	2.2	0.54	2.6	0.34	3.4	1.07	10.7	-	-	0.54	2.6	2
Nickel	46.7	118.1	-	-	-	-	0.82	2.46	-	-	0.82	2.46	4
Selenium	0.28	0.32	0.83	1.4	0.066	0.66	0.8	1.08	0.14	0.18	0.066	0.18	3, 5
Silver	0.06	-	-	-	-	-	-	-	-	-	0.06	-	1
Thallium	-	-	2.72	-	-	-	-	-	-	-	2.72	-	2
Vanadium	0.02	0.41	0.16	1.5	0.041	0.41	0.7	2.7	0.02	0.41	0.02	0.41	1, 5
Zinc	34	40	8.3	18	19.3	-	34	40	3.9	4.5	3.9	4.5	5
Pesticides (mg/kg)													
2,4-DDE	-	-	-	-	1.96	19.6	-	-	-	-	1.96	19.6	3
4,4-DDD	-	-	1.3[a]	0.6[a]	0.06	0.6	0.06	0.6	0.008	0.6	0.008	0.6	5
4,4-DDE	-	-	2.4[a]	0.87[a]	0.109	1.09	0.029	0.29	0.042	0.29	0.029	0.29	4
4,4-DDT	-	-	4.6	6.7	0.2	2	0.42	4.3	-	-	0.2	2.0	3
Aldrin	-	-	-	-	0.01	0.1	-	-	-	-	0.01	0.1	3
Chlordane	-	-	0.20	3.2	1.38	-	-	-	0.01	0.01	0.01	0.01	5
Dieldrin	-	-	1.0	5.7	0.37	3.7	-	-	-	-	0.37	3.7	3
Endrin	-	-	-	-	0.34	3.4	-	-	-	-	0.34	3.4	3
Gamma-BHC/Lindane	-	-	-	-	6.13	-	-	-	-	-	6.13	-	3
Heptachlor epoxide	-	-	0.20	4.3	-	-	-	-	-	-	0.2	4.3	2
Mirex	-	-	-	-	6.3	63	-	-	-	-	6.3	63	3
PCBs (mg/kg)													
Aroclor-1254	-	-	19	34	-	-	-	-	0.98	1.53	0.98	1.53	5
Aroclor-1260	-	-	106[a]	7.6[a]	-	-	8.2	24.6	-	-	8.2	24.6	4
PCB (total)	-	-	2.2	6.7	11.6	-	10.9	32.7	-	-	2.2	6.7	2
PAHs (mg/kg)													
Benzo(a)pyrene	10.2	12.3	-	-	-	-	-	-	-	-	10.2	12.3	1

Notes:

The final critical body residues (CBRs) were compiled by the USEPA based on previously-reviewed information sources for the purposes of evaluating fish tissue residue data from the Peterson Puritan site only. This compilation does not represent an endorsement of these CBRs by the USEPA for any other purpose than the one stated here.

[a] = The no effect and effect CBRs were reported in the source as indicated even though they appear to be reversed.

Sources:

1. Lockheed Martin Information Technologies. 2004. Draft Baseline Ecological Risk Assessment. Hatheway and Patterson Superfund Site, Mansfield, Massachusetts. July 2004.

2. MACTEC. 2006. Response to USEPA Comments on the Baseline Ecological Risk Assessment. Connecticut Yankee Atomic Power Company, Haddam Neck Plant, Haddam, Connecticut. October 2006.

3. Menzie-Cura and Associates. 2000. Final Ecological Baseline Risk Assessment. Beede Waste Oil/Cash Energy Site, Plaistow, New Hampshire. November, 2000.

4. Gannett Fleming. 2006. Expanded Site Investigation. Remedial Oversight of Activities at Fort Devens Plow Shop and Grove Ponds, Ayer, Massachusetts. February 2006.

5. MACTEC. 2004. Baseline Ecological Risk Assessment - Interim Final. Centredale manor Restoration Project Superfund Site, North Providence, Rhode Island. Prepared under contract to Battelle for USACOE, Contract No. DACW33-01-D-004.

US EPA ARCHIVE DOCUMENT

TABLE 7-15a
COMPARISON OF FISH TISSUE DATA TO CBRs - EFFECT AND NO-EFFECT HQs - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area:	Blackstone River (Upstream)																							
Fish Species:	Bluegill				Common Shiner				Golden Shiner				Largemouth Bass				Pumpkinseed				White Sucker			
CBR Effect Level:	No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect	
	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE
SVOCs																								
Benzo(a)pyrene	--	--	--	--	0.04	0.04	0.03	0.03	--	--	--	--	--	--	--	--	--	--	--	--	0.03	0.02	0.02	0.02
Pesticides																								
4,4'-DDD	**2.4**	**1.8**	0.03	0.02	**2.3**	**2.3**	0.03	0.03	--	--	--	--	**3.5**	**3.1**	0.05	0.04	**1.6**	**1.5**	0.02	0.02	**3.5**	**2.9**	0.05	0.04
4,4'-DDE	**2.1**	**1.3**	0.21	0.13	**2.0**	**1.9**	0.20	0.19	--	--	--	--	**2.9**	**2.5**	0.29	0.25	**1.4**	**1.1**	0.14	0.11	**2.9**	**2.3**	0.29	0.23
4,4'-DDT	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	--	--	--	--	0.04	0.01	0.00	0.00	0.06	0.02	0.01	0.00	0.07	0.02	0.01	0.00
Aldrin	--	--	--	--	0.03	0.03	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	0.06	0.06	0.01	0.01
Dieldrin	0.15	0.10	0.01	0.01	0.10	0.09	0.01	0.01	--	--	--	--	0.14	0.12	0.01	0.01	0.11	0.10	0.01	0.01	0.09	0.08	0.01	0.01
Endrin	--	--	--	--	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gamma-BHC	0.00	0.00	--	--	0.00	0.00	--	--	--	--	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--
Heptachlor Epoxide	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	--	--	--	--	0.01	0.01	0.00	0.00	0.03	0.03	0.00	0.00	0.01	0.00	0.00	0.00
PCBs																								
Total Homologs	0.77	0.38	0.25	0.13	0.73	0.68	0.24	0.22	--	--	--	--	**1.14**	1.00	0.37	0.33	0.34	0.34	0.11	0.11	**1.2**	0.91	0.39	0.30
Metals																								
Aluminum	**22.5**	**7.6**	**2.3**	0.76	**11**	**9.3**	**1.1**	0.93	--	--	--	--	**9.9**	**3.1**	0.99	0.31	**25**	**9.6**	**2.5**	0.96	**20.0**	**9.0**	**2.0**	0.90
Antimony	--	--	--	--	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	0.25	0.19	0.08	0.06	0.18	0.17	0.06	0.05	--	--	--	--	0.13	0.12	0.04	0.04	0.34	0.30	0.11	0.09	0.23	0.19	0.07	0.06
Barium	--	--	**3.4**	**2.7**	--	--	**4.4**	**3.9**	--	--	--	--	--	--	**1.5**	**1.2**	--	--	**2.2**	**1.6**	--	--	**2.1**	**1.9**
Beryllium	--	--	--	--	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	**3.3**	**1.7**	**1.7**	0.83	0.95	0.88	0.48	0.44	--	--	--	--	**1.3**	**1.0**	0.63	0.52	**2.0**	**1.7**	1.00	0.83	**3.8**	**3.2**	**1.9**	**1.6**
Chromium	**12**	**7.2**	**4.0**	**2.4**	**2.4**	**1.5**	0.80	0.50	--	--	--	--	**3.8**	**3.4**	**1.3**	**1.1**	**10**	**4.8**	**3.3**	**1.6**	**4.8**	**3.6**	**1.6**	**1.2**
Copper	**2.6**	**2.4**	**2.4**	**2.3**	**2.3**	**2.2**	**2.2**	**2.1**	--	--	--	--	**3.6**	**2.9**	**3.3**	**2.7**	**2.9**	**2.3**	**2.7**	**2.1**	**3.5**	**3.2**	**3.3**	**3.0**
Lead	0.71	0.56	0.60	0.48	0.41	0.38	0.35	0.33	--	--	--	--	0.29	0.09	0.25	0.07	**1.6**	0.71	**1.4**	0.60	0.53	0.41	0.45	0.35
Mercury	0.24	0.13	0.05	0.03	0.06	0.05	0.01	0.01	--	--	--	--	0.14	0.12	0.03	0.03	0.14	0.10	0.03	0.02	0.19	0.11	0.04	0.02
Nickel	**5.2**	**3.3**	**1.7**	**1.1**	**1.1**	0.96	0.38	0.32	--	--	--	--	**1.7**	**1.6**	0.57	0.53	**4.3**	**2.3**	**1.4**	0.77	**2.0**	**1.6**	0.65	0.53
Selenium	**11**	**9.2**	**3.9**	**3.4**	**10**	**9.8**	**3.8**	**3.6**	--	--	--	--	**9.7**	**9.1**	**3.6**	**3.3**	**8.0**	**7.7**	**2.9**	**2.8**	**9.2**	**8.3**	**3.4**	**3.1**
Silver	--	--	--	--	0.12	0.11	--	--	--	--	--	--	0.22	0.22	--	--	--	--	--	--	--	--	--	--
Thallium	--	--	--	--	0.00	0.00	--	--	--	--	--	--	0.00	0.00	--	--	--	--	--	--	--	--	--	--
Vanadium	**8.0**	**7.0**	0.39	0.34	**3.1**	**2.9**	0.15	0.14	--	--	--	--	**1.7**	**1.6**	0.08	0.08	**12**	**9.0**	0.56	0.44	**6.0**	**5.5**	0.29	0.27
Zinc	**4.6**	**4.1**	**4.0**	**3.5**	**10**	**9.8**	**9.0**	**8.5**	--	--	--	--	**3.1**	**2.9**	**2.7**	**2.6**	**4.4**	**3.7**	**3.8**	**3.2**	**3.7**	**3.5**	**3.2**	**3.0**

Notes:
CBR = critical body residue
CTE = central tendency exposure
RME = reasonable maximum exposure
-- = No CBR proposed or data for given species and location not available
Shaded cells in bold type indicate HQs greater than 1.0.

US EPA ARCHIVE DOCUMENT

TABLE 7-15b
COMPARISON OF FISH TISSUE DATA TO CBRs - EFFECT AND NO-EFFECT HQs - BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area:					Blackstone River (Near-Site)																			
Fish Species:	Bluegill				Common Shiner				Golden Shiner				Largemouth Bass				Pumpkinseed				White Sucker			
CBR Effect Level:	No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect	
	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE
SVOCs																								
Benzo(a)pyrene	--	--	--	--	0.04	0.04	0.03	0.03	--	--	--	--	0.02	0.02	0.02	0.02	--	--	--	--	--	--	--	--
Pesticides																								
4,4'-DDD	--	--	--	--	**1.8**	**1.5**	0.02	0.02	--	--	--	--	**3.0**	**2.6**	0.04	0.04	--	--	--	--	**5.0**	**3.4**	0.07	0.05
4,4'-DDE	--	--	--	--	**1.7**	**1.4**	0.17	0.14	--	--	--	--	**1.9**	**1.7**	0.19	0.17	--	--	--	--	**2.2**	**1.7**	0.22	0.17
4,4'-DDT	--	--	--	--	0.00	0.00	0.00	0.00	--	--	--	--	0.11	0.05	0.01	0.00	--	--	--	--	0.01	0.01	0.00	0.00
Aldrin	--	--	--	--	0.03	0.03	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	--	--	--	--	0.06	0.05	0.01	0.01	--	--	--	--	0.11	0.09	0.01	0.01	--	--	--	--	0.14	0.11	0.01	0.01
Endrin	--	--	--	--	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gamma-BHC	--	--	--	--	0.00	0.00	--	--	--	--	--	--	0.00	0.00	--	--	--	--	--	--	0.00	0.00	--	--
Heptachlor Epoxide	--	--	--	--	0.00	0.00	0.00	0.00	--	--	--	--	0.01	0.01	0.00	0.00	--	--	--	--	0.01	0.00	0.00	0.00
PCBs																								
Total Homologs	--	--	--	--	0.59	0.50	0.19	0.16	--	--	--	--	**1.1**	0.82	0.36	0.27	--	--	--	--	**1.1**	0.95	0.37	0.31
Metals																								
Aluminum	--	--	--	--	**22**	**16**	**2.2**	**1.6**	--	--	--	--	**3.8**	**2.3**	0.38	0.23	--	--	--	--	**30.0**	**9.6**	**3.0**	0.96
Antimony	--	--	--	--	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	--	--	--	--	0.36	0.30	0.11	0.09	--	--	--	--	0.08	0.07	0.02	0.02	--	--	--	--	0.14	0.12	0.04	0.04
Barium	--	--	--	--	--	--	**5.6**	**4.9**	--	--	--	--	--	--	**1.6**	**1.2**	--	--	--	--	--	--	**1.9**	**1.6**
Beryllium	--	--	--	--	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	**1.1**	**1.0**	0.57	0.51	--	--	--	--	**1.4**	**1.1**	0.68	0.55	--	--	--	--	**2.0**	**1.5**	1.00	0.73
Chromium	--	--	--	--	**2.2**	**1.7**	0.75	0.57	--	--	--	--	**3.6**	**2.9**	**1.2**	0.98	--	--	--	--	**3.8**	**2.6**	**1.3**	0.86
Copper	--	--	--	--	**2.9**	**2.5**	**2.7**	**2.4**	--	--	--	--	**2.8**	**2.4**	**2.6**	**2.2**	--	--	--	--	**3.3**	**2.9**	**3.0**	**2.7**
Lead	--	--	--	--	0.91	0.68	0.78	0.58	--	--	--	--	0.15	0.11	0.13	0.10	--	--	--	--	0.47	0.32	0.40	0.28
Mercury	--	--	--	--	0.05	0.05	0.01	0.01	--	--	--	--	0.18	0.15	0.04	0.03	--	--	--	--	0.13	0.10	0.03	0.02
Nickel	--	--	--	--	**1.3**	**1.2**	0.45	0.39	--	--	--	--	**2.1**	**1.7**	0.69	0.57	--	--	--	--	**2.0**	**1.3**	0.65	0.45
Selenium	--	--	--	--	**10**	**9.4**	**3.7**	**3.4**	--	--	--	--	**9.4**	**8.9**	**3.4**	**3.3**	--	--	--	--	**7.0**	**6.4**	**2.6**	**2.3**
Silver	--	--	--	--	0.12	0.11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	--	--	--	--	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	--	--	--	--	**5.5**	**4.1**	0.27	0.20	--	--	--	--	**2.0**	**1.8**	0.10	0.09	--	--	--	--	**4.3**	**3.7**	0.21	0.18
Zinc	--	--	--	--	**10**	**9.2**	**8.6**	**8.0**	--	--	--	--	**3.3**	**3.2**	**2.8**	**2.7**	--	--	--	--	**3.9**	**3.4**	**3.4**	**2.9**

Notes:
CBR = critical body residue
CTE = central tendency exposure
RME = reasonable maximum exposure
-- = No CBR proposed or data for given species and location not available
Shaded cells in bold type indicate HQs greater than 1.0.

US EPA ARCHIVE DOCUMENT

TABLE 7-15c
COMPARISON OF FISH TISSUE DATA TO CBRs - EFFECT AND NO-EFFECT HQs - POND A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area:	Pond A																							
Fish Species:	**Bluegill**				**Common Shiner**				**Golden Shiner**				**Largemouth Bass**				**Pumpkinseed**				**White Sucker**			
CBR Effect Level:	**No effect**		**Effect**		**No effect**		**Effect**		**No effect**		**Effect**		**No effect**		**Effect**		**No effect**		**Effect**		**No effect**		**Effect**	
	RME	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**
SVOCs																								
Benzo(a)pyrene	0.04	0.04	0.03	0.03	--	--	--	--	--	--	--	--	0.02	0.02	0.02	0.02	--	--	--	--	--	--	--	--
Pesticides																								
4,4'-DDD	0.84	0.74	0.01	0.01	--	--	--	--	--	--	--	--	**2.6**	**2.1**	0.04	0.03	--	--	--	--	**2.5**	**2.1**	0.03	0.03
4,4'-DDE	0.45	0.38	0.04	0.04	--	--	--	--	--	--	--	--	**2.6**	**1.9**	0.26	0.19	--	--	--	--	**1.5**	**1.2**	0.15	0.12
4,4'-DDT	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.00	0.00	0.00	0.00
Aldrin	0.03	0.03	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	0.04	0.04	0.00	0.00	--	--	--	--	--	--	--	--	0.06	0.04	0.01	0.00	--	--	--	--	0.05	0.04	0.01	0.00
Endrin	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gamma-BHC	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																								
Total Homologs	0.17	0.16	0.06	0.05	--	--	--	--	--	--	--	--	0.68	0.59	0.22	0.19	--	--	--	--	0.55	0.43	0.18	0.14
Metals																								
Aluminum	**5.5**	**4.6**	0.55	0.46	--	--	--	--	--	--	--	--	**6.9**	**6.9**	0.69	0.69	--	--	--	--	**19**	**13**	**1.9**	**1.3**
Antimony	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	0.25	0.13	0.08	0.04	--	--	--	--	--	--	--	--	0.08	0.07	0.02	0.02	--	--	--	--	0.53	0.17	0.16	0.05
Barium	--	--	**3.2**	**2.9**	--	--	--	--	--	--	--	--	--	--	**1.1**	0.93	--	--	--	--	--	--	**2.7**	**2.2**
Beryllium	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	0.48	0.43	0.24	0.22	--	--	--	--	--	--	--	--	**1.6**	**1.2**	0.80	0.62	--	--	--	--	**2.2**	**1.2**	**1.1**	0.61
Chromium	**2.2**	**1.4**	0.75	0.46	--	--	--	--	--	--	--	--	**2.6**	**2.1**	0.86	0.69	--	--	--	--	**6.7**	**5.3**	**2.2**	**1.8**
Copper	**1.3**	**1.2**	**1.2**	**1.1**	--	--	--	--	--	--	--	--	**1.5**	**1.3**	**1.4**	**1.2**	--	--	--	--	**3.0**	**2.6**	**2.8**	**2.5**
Lead	0.53	0.44	0.45	0.38	--	--	--	--	--	--	--	--	0.18	0.14	0.16	0.12	--	--	--	--	0.79	0.53	0.68	0.45
Mercury	0.03	0.03	0.01	0.01	--	--	--	--	--	--	--	--	0.20	0.17	0.04	0.03	--	--	--	--	0.11	0.08	0.02	0.02
Nickel	**1.1**	0.90	0.37	0.30	--	--	--	--	--	--	--	--	**1.8**	**1.5**	0.61	0.49	--	--	--	--	**2.9**	**2.4**	0.98	0.81
Selenium	**4.7**	**4.2**	**1.7**	**1.6**	--	--	--	--	--	--	--	--	**7.3**	**6.8**	**2.7**	**2.5**	--	--	--	--	**6.4**	**5.9**	**2.3**	**2.2**
Silver	0.12	0.11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.23	0.23	--	--
Thallium	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	**2.4**	**1.9**	0.11	0.09	--	--	--	--	--	--	--	--	**5.0**	**3.7**	0.24	0.18	--	--	--	--	**4.6**	**4.0**	0.22	0.19
Zinc	**5.1**	**4.5**	**4.4**	**3.9**	--	--	--	--	--	--	--	--	**3.7**	**3.5**	**3.2**	**3.0**	--	--	--	--	**4.5**	**4.0**	**3.9**	**3.5**

Notes:
CBR = critical body residue
CTE = central tendency exposure
RME = reasonable maximum exposure
-- = No CBR proposed or data for given species and location not available
Shaded cells in bold type indicate HQs greater than 1.0.

US EPA ARCHIVE DOCUMENT

TABLE 7-15d
COMPARISON OF FISH TISSUE DATA TO CBRs - EFFECT AND NO-EFFECT HQs - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area:	Pond F																							
Fish Species:	**Bluegill**				**Common Shiner**				**Golden Shiner**				**Largemouth Bass**				**Pumpkinseed**				**White Sucker**			
CBR Effect Level:	**No effect**		**Effect**		**No effect**		**Effect**		**No effect**		**Effect**		**No effect**		**Effect**		**No effect**		**Effect**		**No effect**		**Effect**	
	RME	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**
SVOCs																								
Benzo(a)pyrene	--	--	--	--	--	--	--	--	0.04	0.04	0.03	0.03	--	--	--	--	--	--	--	--	--	--	--	--
Pesticides																								
4,4'-DDD	**1.6**	**1.1**	0.02	0.01	--	--	--	--	**2.1**	**1.9**	0.03	0.03	--	--	--	--	**1.5**	**1.5**	0.02	0.02	**3.9**	**3.0**	0.05	0.04
4,4'-DDE	**1.1**	0.72	0.11	0.07	--	--	--	--	0.76	0.69	0.08	0.07	--	--	--	--	1.00	1.00	0.10	0.10	**1.7**	**1.3**	0.17	0.13
4,4'-DDT	--	--	--	--	--	--	--	--	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--
Aldrin	--	--	--	--	--	--	--	--	0.03	0.03	0.00	0.00	--	--	--	--	--	--	--	--	0.06	0.06	0.01	0.01
Dieldrin	0.09	0.06	0.01	0.01	--	--	--	--	0.07	0.07	0.01	0.01	--	--	--	--	0.06	0.06	0.01	0.01	0.14	0.11	0.01	0.01
Endrin	--	--	--	--	--	--	--	--	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--
Gamma-BHC	--	--	--	--	--	--	--	--	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	--	--	--	--	--	--	--	--	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																								
Total Homologs	0.50	0.30	0.16	0.10	--	--	--	--	0.34	0.31	0.11	0.10	--	--	--	--	0.44	0.44	0.14	0.14	0.77	0.55	0.25	0.18
Metals																								
Aluminum	**7.5**	**3.9**	0.75	0.39	--	--	--	--	**12.1**	**5.9**	**1.2**	0.59	--	--	--	--	**13.8**	**13.8**	**1.4**	**1.4**	**17.5**	**4.5**	**1.8**	0.45
Antimony	--	--	--	--	--	--	--	--	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	0.26	0.17	0.08	0.05	--	--	--	--	0.16	0.14	0.05	0.04	--	--	--	--	0.23	0.23	0.07	0.07	0.19	0.16	0.06	0.05
Barium	--	--	**6.3**	**3.9**	--	--	--	--	--	--	**4.4**	**3.9**	--	--	--	--	--	--	**2.7**	**2.7**	--	--	**1.7**	**1.5**
Beryllium	--	--	--	--	--	--	--	--	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	**5.2**	**1.7**	**2.6**	0.83	--	--	--	--	0.47	0.42	0.23	0.21	--	--	--	--	**2.0**	**2.0**	1.00	1.00	**1.2**	0.97	0.61	0.48
Chromium	**10**	**3.6**	**3.4**	**1.2**	--	--	--	--	0.95	0.76	0.32	0.25	--	--	--	--	**1.7**	**1.7**	0.57	0.57	**1.4**	**1.1**	0.48	0.36
Copper	**2.8**	**1.8**	**2.6**	**1.7**	--	--	--	--	**2.0**	**1.8**	**1.9**	**1.7**	--	--	--	--	**2.6**	**2.6**	**2.4**	**2.4**	**2.4**	**2.1**	**2.2**	**2.0**
Lead	0.74	0.44	0.63	0.38	--	--	--	--	0.35	0.27	0.30	0.23	--	--	--	--	0.97	0.97	0.83	0.83	0.47	0.26	0.40	0.22
Mercury	0.17	0.13	0.03	0.03	--	--	--	--	0.09	0.09	0.02	0.02	--	--	--	--	0.08	0.08	0.02	0.02	0.16	0.11	0.03	0.02
Nickel	**4.9**	**2.1**	**1.6**	0.69	--	--	--	--	**1.0**	0.93	0.34	0.31	--	--	--	--	**1.2**	**1.2**	0.41	0.41	0.73	0.63	0.24	0.21
Selenium	**7.6**	**7.1**	**2.8**	**2.6**	--	--	--	--	**6.7**	**6.4**	**2.4**	**2.3**	--	--	--	--	**8.5**	**8.5**	**3.1**	**3.1**	**7.1**	**6.8**	**2.6**	**2.5**
Silver	--	--	--	--	--	--	--	--	0.12	0.11	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	0.00	0.00	--	--	--	--	--	--	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	**5.5**	**4.5**	0.27	0.22	--	--	--	--	**2.1**	**1.6**	0.10	0.08	--	--	--	--	**6.0**	**6.0**	0.29	0.29	**3.2**	**2.7**	0.16	0.13
Zinc	**5.9**	**4.9**	**5.1**	**4.3**	--	--	--	--	**6.9**	**6.6**	**6.0**	**5.7**	--	--	--	--	**4.9**	**4.9**	**4.2**	**4.2**	**4.0**	**3.7**	**3.5**	**3.2**

Notes:
CBR = critical body residue
CTE = central tendency exposure
RME = reasonable maximum exposure
-- = No CBR proposed or data for given species and location not available
Shaded cells in bold type indicate HQs greater than 1.0.

US EPA ARCHIVE DOCUMENT

TABLE 7-15e
COMPARISON OF FISH TISSUE DATA TO CBRs - EFFECT AND NO-EFFECT HQs - REFERENCE POND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area:					Reference Pond																			
Fish Species:	Bluegill				Common Shiner				Golden Shiner				Largemouth Bass				Pumpkinseed				White Sucker			
CBR Effect Level:	No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect	
	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE
SVOCs																								
Benzo(a)pyrene	0.04	0.04	0.03	0.03	--	--	--	--	--	--	--	--	0.01	0.01	0.01	0.01	--	--	--	--	--	--	--	--
Pesticides																								
4,4'-DDD	0.28	0.25	0.00	0.00	--	--	--	--	--	--	--	--	0.38	0.33	0.01	0.00	--	--	--	--	--	--	--	--
4,4'-DDE	0.31	0.29	0.03	0.03	--	--	--	--	--	--	--	--	0.62	0.55	0.06	0.06	--	--	--	--	--	--	--	--
4,4'-DDT	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	0.01	0.01	0.00	0.00	--	--	--	--	--	--	--	--
Aldrin	0.03	0.03	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endrin	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gamma-BHC	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																								
Total Homologs	0.04	0.04	0.01	0.01	--	--	--	--	--	--	--	--	0.20	0.07	0.06	0.02	--	--	--	--	--	--	--	--
Metals																								
Aluminum	**6.50**	**5.38**	0.65	0.54	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Antimony	0.00	0.00	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	0.07	0.06	0.02	0.02	--	--	--	--	--	--	--	--	0.06	0.05	0.02	0.02	--	--	--	--	--	--	--	--
Barium	--	--	**8.05**	**7.32**	--	--	--	--	--	--	--	--	--	--	**1.61**	**1.51**	--	--	--	--	--	--	--	--
Beryllium	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	0.06	0.06	0.03	0.03	--	--	--	--	--	--	--	--	**1.83**	0.53	0.92	0.27	--	--	--	--	--	--	--	--
Chromium	**2.41**	**1.14**	0.80	0.38	--	--	--	--	--	--	--	--	**1.24**	**1.12**	0.41	0.37	--	--	--	--	--	--	--	--
Copper	**1.21**	**1.14**	**1.13**	**1.07**	--	--	--	--	--	--	--	--	**1.04**	1.00	0.97	0.93	--	--	--	--	--	--	--	--
Lead	0.29	0.26	0.25	0.22	--	--	--	--	--	--	--	--	0.05	0.05	0.04	0.04	--	--	--	--	--	--	--	--
Mercury	0.09	0.09	0.02	0.02	--	--	--	--	--	--	--	--	0.61	0.50	0.13	0.10	--	--	--	--	--	--	--	--
Nickel	**1.34**	**1.16**	0.45	0.39	--	--	--	--	--	--	--	--	**1.22**	**1.18**	0.41	0.39	--	--	--	--	--	--	--	--
Selenium	**4.24**	**3.94**	**1.56**	**1.44**	--	--	--	--	--	--	--	--	**5.91**	**5.61**	**2.17**	**2.06**	--	--	--	--	--	--	--	--
Silver	0.12	0.11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	0.00	0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	**2.65**	**2.10**	0.13	0.10	--	--	--	--	--	--	--	--	**1.80**	**1.70**	0.09	0.08	--	--	--	--	--	--	--	--
Zinc	**5.41**	**5.03**	**4.69**	**4.36**	--	--	--	--	--	--	--	--	**3.38**	**3.23**	**2.93**	**2.80**	--	--	--	--	--	--	--	--

Notes:
CBR = critical body residue
CTE = central tendency exposure
RME = reasonable maximum exposure
-- = No CBR proposed or data for given species and location not available
Shaded cells in bold type indicate HQs greater than 1.0.

US EPA ARCHIVE DOCUMENT

TABLE 7-16a
SUMMARY OF RESIDUAL RISKS FOR FISH COLLECTED FROM THE BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area:	Blackstone River (Near-Site)																							
Fish Species:	Bluegill				Common Shiner				Golden Shiner				Largemouth Bass				Pumpkinseed				White Sucker			
CBR Effect Level:	No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect	
	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE
SVOCs																								
Benzo(a)pyrene					<1	<1	<1	<1					--	--	--	--					--	--	--	--
Pesticides																								
4,4'-DDD					<1	<1	<1	<1					<1	<1	<1	<1					**2**	<1	<1	<1
4,4'-DDE					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
4,4'-DDT					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Aldrin					<1	<1	<1	<1					--	--	--	--					--	--	--	--
Dieldrin					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Endrin					<1	<1	<1	<1					--	--	--	--					--	--	--	--
Gamma-BHC					<1	<1	--	--					<1	<1	--	--					<1	<1	--	--
Heptachlor Epoxide					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
PCBs																								
Total Homologs					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Metals																								
Aluminum					**11**	**6**	**1**	<1					<1	<1	<1	<1					**10**	<1	**1**	<1
Antimony					<1	<1	<1	<1					--	--	--	--					--	--	--	--
Arsenic					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Barium					--	--	**1**	<1					--	--	<1	<1					--	--	<1	<1
Beryllium					<1	<1	--	--					--	--	--	--					--	--	--	--
Cadmium					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Chromium					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Copper					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Lead					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Mercury					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Nickel					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Selenium					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Silver					<1	<1	--	--					--	--	--	--					--	--	--	--
Thallium					<1	<1	--	--					--	--	--	--					--	--	--	--
Vanadium					**2**	**1**	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1
Zinc					<1	<1	<1	<1					<1	<1	<1	<1					<1	<1	<1	<1

"--" - Residual risk could not be calculated because there was either no CBR proposed or data for given species and location was not available

US EPA ARCHIVE DOCUMENT

TABLE 7-16b
SUMMARY OF RESIDUAL RISKS FOR FISH COLLECTED FROM Pond A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

rea:	Pond A																							
ish Species:	Bluegill				Common Shiner				Golden Shiner				Largemouth Bass				Pumpkinseed				White Sucker			
BR Effect Level:	No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect	
	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE
VOCs																								
enzo(a)pyrene	--	--	--	--									--	--	--	--					--	--	--	--
esticides																								
,4'-DDD	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
,4'-DDE	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
,4'-DDT	<1	<1	<1	<1									--	--	--	--					<1	<1	<1	<1
ldrin	--	--	--	--									--	--	--	--					--	--	--	--
ieldrin	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
ndrin	--	--	--	--									--	--	--	--					--	--	--	--
amma-BHC	<1	<1	--	--									--	--	--	--					--	--	--	--
eptachlor Epoxide	<1	<1	<1	<1									--	--	--	--					--	--	--	--
CBs																								
otal Homologs	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
letals																								
luminum	<1	<1	<1	<1									<1	**4**	<1	<1					<1	**4**	<1	<1
ntimony	--	--	--	--									--	--	--	--					--	--	--	--
rsenic	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
arium	--	--	<1	<1									--	--	<1	<1					--	--	<1	<1
eryllium	--	--	--	--									--	--	--	--					--	--	--	--
admium	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
hromium	<1	<1	<1	<1									<1	<1	<1	<1					**2**	**2**	<1	<1
opper	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
ead	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
lercury	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
ickel	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
elenium	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1
ilver	--	--	--	--									--	--	--	--					--	--	--	--
hallium	--	--	--	--									--	--	--	--					--	--	--	--
anadium	<1	<1	<1	<1									**3**	**2**	<1	<1					<1	<1	<1	<1
inc	<1	<1	<1	<1									<1	<1	<1	<1					<1	<1	<1	<1

-" - Residual risk could not be calculated because there was either no CBR proposed or data for given species and location was not available

US EPA ARCHIVE DOCUMENT

TABLE 7-16c
SUMMARY OF RESIDUAL RISKS FOR FISH COLLECTED FROM Pond F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area:	Pond F																							
Fish Species:	Bluegill				Common Shiner				Golden Shiner				Largemouth Bass				Pumpkinseed				White Sucker			
CBR Effect Level:	No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect		No effect		Effect	
	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE
SVOCs																								
Benzo(a)pyrene	--	--	--	--													--	--	--	--	--	--	--	--
Pesticides																								
4,4'-DDD	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDE	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDT	--	--	--	--													--	--	--	--	--	--	--	--
Aldrin	--	--	--	--													--	--	--	--	<1	<1	<1	<1
Dieldrin	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Endrin	--	--	--	--													--	--	--	--	--	--	--	--
Gamma-BHC	--	--	--	--													--	--	--	--	--	--	--	--
Heptachlor Epoxide	--	--	--	--													--	--	--	--	--	--	--	--
PCBs																								
Total Homologs	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Metals																								
Aluminum	<1	<1	<1	<1													<1	**4**	<1	<1	<1	<1	<1	<1
Antimony	--	--	--	--													--	--	--	--	--	--	--	--
Arsenic	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Barium	--	--	**3**	**1**													--	--	<1	**1**	--	--	<1	<1
Beryllium	--	--	--	--													--	--	--	--	--	--	--	--
Cadmium	**2**	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Chromium	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Copper	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Lead	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Mercury	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Nickel	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Selenium	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Silver	--	--	--	--													--	--	--	--	--	--	--	--
Thallium	--	--	--	--													--	--	--	--	--	--	--	--
Vanadium	<1	<1	<1	<1													<1	<1	<1	<1	<1	<1	<1	<1
Zinc	**1**	<1	**1**	<1													<1	**1**	<1	**1**	<1	<1	<1	<1

"--" - Residual risk could not be calculated because there was either no CBR proposed or data for given species and location was not available

Table 7-16d: Weight-of-Evidence Integration for Fish
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:
Maintain a stable and healthy fish community
Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of the fish community in the Blackstone River and selected ponds at the site?

Measurement Endpoints
2.A. Evaluate the structure and function of the fish community
Note: Measurement endpoint 2.A was not used in the WOE evaluation (see BERA write-up)
2.B. Compare the COPC levels in surface water samples to acute and chronic benchmarks
2.C. Compare the COPEC levels measured in whole fish to no effect and effect CBRs

Weight-of-Evidence Integration

Blackstone River (near-site)

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**2.B**	**2.C**		

Wetlands A through D

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**2.B**	**2.C**		

Pond A

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**2.B**	**2.C**		

Pond C

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**2.B**			
Yes/Low					
Undeterminate					
No Harm					

US EPA ARCHIVE DOCUMENT

Table 7-16d: Weight-of-Evidence Integration for Fish
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Pond D

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**2.B**			
Yes/Low					
Undeterminate					
No Harm					

Pond E

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**2.B**			
Yes/Low					
Undeterminate					
No Harm					

Pond F

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**2.B**	**2.C**		

Pond I

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**2.B**			
Yes/Low					
Undeterminate					
No Harm					

Pond N

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**2.B**			
Yes/Low					
Undeterminate					
No Harm					

Pond P

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**2.B**			
Yes/Low					
Undeterminate					
No Harm					

US EPA ARCHIVE DOCUMENT

Table 7-16e: Weight-of-Evidence Integration for amphibians
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:
Maintain stable and healthy amphibian populations
Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of amphibians in the Blackstone River and selected ponds at the site?

Measurement Endpoints
3.A: Compare the COPC levels in surface water samples to acute and chronic benchmarks

Weight-of-Evidence Integration

Blackstone River (near-site)

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**3.A**			

Wetlands A through D

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**3.A**			

Pond A

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**3.A**			

Pond C

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**3.A**			
Yes/Low					
Undeterminate					
No Harm					

Pond D

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**3.A**			
Yes/Low					
Undeterminate					
No Harm					

US EPA ARCHIVE DOCUMENT

Table 7-16e: Weight-of-Evidence Integration for amphibians
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Pond E

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**3.A**			
Yes/Low					
Undeterminate					
No Harm					

Pond F

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**3.A**			

Pond I

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**3.A**			
Yes/Low					
Undeterminate					
No Harm					

Pond N

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**3.A**			
Yes/Low					
Undeterminate					
No Harm					

Pond P

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**3.A**			
Yes/Low					
Undeterminate					
No Harm					

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

TABLE 7-17a
CALCULATED HAZARD QUOTIENTS FOR LARGE OMNIVOROUS BIRDS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)									NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water (sw)		Soil (dw)		Food (ww)										
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE
River - Upstream	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	4.34E-05	2.16E-04	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.56E-04	5.54E-04	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.56E-04	5.54E-04	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.56E-04	5.54E-04	--	--	--	--	--	--
		Acetone	2.97E-03	4.95E-03	5.57E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	1.84E-04	9.93E-04	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	4.34E-05	2.16E-04	--	--	--	--	--	--
		Chloromethane	2.76E-04	3.70E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	4.47E-05	2.34E-04	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	4.34E-05	2.16E-04	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	4.34E-05	2.16E-04	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	4.34E-05	2.16E-04	--	--	--	--	--	--
		Methylene chloride	3.13E-04	4.20E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	4.65E-05	2.42E-04	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	--	--	--	--	--	--	--	--	--	--	--
		Tetrachloroethene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	4.34E-05	2.16E-04	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	4.34E-05	2.16E-04	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.79E-01	2.40E-01	--	--	--	--	--	--	--	--	--	--	--
		2-Methylnaphthalene	2.35E-05	5.00E-05	1.11E-01	2.70E-01	3.54E-01	3.93E-02	9.55E-02	1.58E-02	1.46E-01	2.86	28.6	0.05	0.01	0.01	0.001
		2-Methylphenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.27E+00	4.66E-01	5.45E-01	1.81E-01	7.89E-01	0.96	9.6	0.8	0.2	0.08	0.02
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.73E+00	9.69E-01	1.13E+00	3.74E-01	1.63E+00	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.81E-02	9.86E-03	1.15E-02	5.23E-03	2.55E-02	1	10	0.03	0.01	0.003	0.001
		4-Methylphenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	3.07E-01	6.30E-02	7.38E-02	2.57E-02	1.14E-01	0.96	9.6	0.1	0.03	0.01	0.003
		4-Nitroaniline	1.00E-02	1.00E-02	5.15E-01	6.00E-01	5.24E-01	2.70E-01	3.14E-01	1.08E-01	4.73E-01	0.75	7.5	0.63	0.1	0.06	0.01
		Acenaphthene	2.39E-05	5.00E-05	2.69E-01	8.80E-01	--	--	--	--	--	1.11	11.1	--	--	--	--
		Acenaphthylene	2.92E-05	5.00E-05	2.81E-01	7.30E-01	3.66E+00	1.03E+00	2.67E+00	3.98E-01	3.85E+00	1.11	11.1	**3**	0.4	0.3	0.04
		Acetophenone	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.37E+00	4.86E-01	5.69E-01	1.88E-01	8.22E-01	--	--	--	--	--	--
		Anthracene	3.19E-05	5.00E-05	1.26E+00	4.00E+00	3.87E-01	4.88E-01	1.55E+00	1.96E-01	2.36E+00	1.11	11.1	**2**	0.2	0.2	0.02
		Benzaldehyde	2.50E-03	2.50E-03	1.72E-01	2.00E-01	5.70E-01	9.81E-02	1.14E-01	3.90E-02	1.71E-01	--	--	--	--	--	--
		Benzo[a]anthracene	4.11E-05	5.00E-05	2.91E+00	9.30E+00	2.54E-01	7.40E-01	2.37E+00	3.04E-01	3.72E+00	--	--	--	--	--	--
		Benzo(a)pyrene	5.14E-05	6.70E-05	2.82E+00	7.50E+00	2.13E-01	6.00E-01	1.60E+00	2.49E-01	2.55E+00	10	20	0.3	0.02	0.1	0.01
		Benzo(b)fluoranthene	5.05E-05	8.60E-05	3.04E+00	7.80E+00	4.16E-01	1.26E+00	3.24E+00	5.06E-01	4.92E+00	2	20	**2**	0.3	0.2	0.03
		Benzo(g,h,i)perylene	5.24E-05	1.30E-04	1.71E+00	4.40E+00	4.70E-01	8.04E-01	2.07E+00	3.21E-01	3.12E+00	2	20	**2**	0.2	0.2	0.02
		Benzo(k)fluoranthene	4.21E-05	6.90E-05	1.28E+00	3.40E+00	4.16E-01	5.32E-01	1.41E+00	2.13E-01	2.14E+00	2	20	**1**	0.1	0.1	0.01
		bis(2-Ethylhexyl)phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.29E+02	2.65E+01	3.11E+01	1.02E+01	4.44E+01	1.1	3.51	**40**	**9**	**13**	**3**
		Butyl benzyl phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.60E-01	5.33E-02	6.24E-02	2.20E-02	9.82E-02	--	--	--	--	--	--
		Carbazole	--	--	2.88E-01	5.50E-01	2.71E+00	7.79E-01	1.49E+00	--	--	--	--	--	--	--	--
		Chrysene	4.82E-05	7.40E-05	3.07E+00	8.90E+00	3.66E-01	1.12E+00	3.26E+00	4.53E-01	4.98E+00	2	20	**2**	0.2	0.2	0.02
		Cyclohexane	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	4.34E-05	2.16E-04	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.28E-05	1.40E-04	4.59E-01	9.40E-01	3.70E-01	1.70E-01	3.47E-01	6.82E-02	5.30E-01	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.69E-01	4.40E-01	9.14E-01	1.55E-01	4.02E-01	6.07E-02	5.91E-01	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.83E+01	3.74E+00	4.38E+00	1.44E+00	6.28E+00	0.111	1.11	**57**	**13**	**6**	**1**
		Fluoranthene	5.91E-05	8.30E-05	4.63E+00	1.50E+01	4.86E-01	2.25E+00	7.30E+00	8.97E-01	1.10E+01	2	20	**5**	0.4	0.5	0.04
		Fluorene	2.48E-05	5.00E-05	3.30E-01	1.20E+00	--	--	--	--	--	1.11	11.1	--	--	--	--
		Hexachlorobenzene	2.50E-03	2.50E-03	2.05E-01	2.40E-01	--	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.03E-01	2.11E-02	2.47E-02	9.56E-03	4.43E-02	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	4.95E-05	1.30E-04	1.25E+00	2.60E+00	4.58E-01	5.72E-01	1.19E+00	2.28E-01	1.79E+00	2	20	0.9	0.1	0.09	0.01
		Isophorone	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.51E-01	3.09E-02	3.62E-02	1.33E-02	6.07E-02	--	--	--	--	--	--
		Naphthalene	2.67E-05	5.00E-05	1.83E-01	2.80E-01	7.04E-01	1.29E-01	1.97E-01	5.08E-02	2.92E-01	2.86	28.6	0.1	0.02	0.01	0.002
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.40E-01	9.03E-02	1.06E-01	3.62E-02	1.60E-01	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	5.15E-01	6.00E-01	4.10E+01	2.11E+01	2.46E+01	8.13E+00	3.52E+01	--	--	--	--	--	--
		Phenanthrene	4.63E-05	5.00E-05	3.98E+00	1.40E+01	2.75E-01	1.10E+00	3.85E+00	4.47E-01	6.01E+00	1.11	11.1	**5**	0.4	0.5	0.04
		Phenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.76E-05	8.70E-05	4.79E+00	1.90E+01	2.80E-01	1.34E+00	5.32E+00	5.47E-01	8.29E+00	2	20	**4**	0.3	0.4	0.03

US EPA ARCHIVE DOCUMENT

TABLE 7-17a
CALCULATED HAZARD QUOTIENTS FOR LARGE OMNIVOROUS BIRDS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)									NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water (sw)		Soil (dw)		Food (ww)										
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	1.56E-06	2.80E-06	3.38E-03	8.10E-03	5.11E-01	1.73E-03	4.14E-03	6.87E-04	6.21E-03	0.0028	0.028	**2**	0.2	0.2	0.02
		4,4'-DDE	1.82E-06	2.80E-06	5.27E-03	5.90E-03	1.90E+00	1.00E-02	1.12E-02	3.90E-03	1.63E-02	0.0028	0.028	**6**	**1**	0.6	0.1
			1.56E-06	2.80E-06	4.26E-03	9.80E-03	1.34E+00	5.70E-03	1.31E-02	2.22E-03	1.91E-02	0.0028	0.028	**7**	0.8	0.7	0.08
		alpha-Chlordane	9.83E-07	1.40E-06	1.06E-03	1.25E-03	2.85E+00	3.02E-03	3.56E-03	1.17E-03	5.14E-03	0.211	2.11	0.02	0.01	0.002	0.001
		Dieldrin	2.05E-06	2.80E-06	1.42E-02	3.30E-02	1.56E+00	2.21E-02	5.14E-02	8.60E-03	7.47E-02	0.077	0.37	0.97	0.1	0.2	0.02
		Endosulfan I	9.83E-07	1.40E-06	1.06E-03	1.25E-03	7.98E-01	8.46E-04	9.98E-04	3.33E-04	1.47E-03	0.31	3.1	0.005	0.001	0.0005	0.0001
		Endosulfan II	1.56E-06	2.80E-06	2.07E-03	2.45E-03	7.98E-01	1.65E-03	1.96E-03	6.49E-04	2.88E-03	0.31	3.1	0.01	0.002	0.001	0.0002
	4,4'-DDT	Endosulfan Sulfate	1.56E-06	2.80E-06	1.85E-03	1.85E-03	7.98E-01	1.48E-03	1.48E-03	5.80E-04	2.18E-03	0.31	3.1	0.01	0.002	0.001	0.0002
		Endrin	1.56E-06	2.80E-06	2.07E-03	2.45E-03	5.76E-01	1.19E-03	1.41E-03	4.72E-04	2.11E-03	0.01	0.1	0.2	0.05	0.02	0.005
		Endrin Aldehyde	1.56E-06	2.80E-06	2.95E-03	7.10E-03	5.76E-01	1.70E-03	4.09E-03	6.73E-04	6.10E-03	0.0232	0.232	0.3	0.03	0.03	0.003
		Endrin Ketone	1.56E-06	2.80E-06	2.07E-03	2.45E-03	5.76E-01	1.19E-03	1.41E-03	4.72E-04	2.11E-03	0.0232	0.232	0.09	0.02	0.01	0.002
		Gamma-BHC	9.83E-07	1.40E-06	1.06E-03	1.25E-03	1.62E+00	1.71E-03	2.02E-03	6.66E-04	2.93E-03	--	--	--	--	--	--
		Gamma-Chlordane	9.83E-07	1.40E-06	9.75E-04	1.00E-03	2.85E+00	2.78E-03	2.85E-03	1.08E-03	4.11E-03	0.211	2.11	0.02	0.01	0.002	0.001
		Heptachlor Epoxide	9.83E-07	1.40E-06	1.06E-03	1.25E-03	1.74E+00	1.85E-03	2.18E-03	7.19E-04	3.16E-03	0.211	2.11	0.01	0.003	0.001	0.0003
		Methoxychlor	4.56E-06	1.40E-05	1.83E-02	3.40E-02	2.13E-01	3.90E-03	7.25E-03	1.62E-03	1.16E-02	--	--	--	--	--	--
		Toxaphene	9.83E-05	1.40E-04	1.06E-01	1.25E-01	7.43E-02	7.88E-03	9.29E-03	3.72E-03	1.78E-02	0.0531	0.531	0.3	0.1	0.03	0.01
	Metals	Aluminum	1.33E-01	3.60E-01	4.64E+03	6.35E+03	1.54E-01	7.14E+02	9.77E+02	3.04E+02	1.62E+03	109.7	1097	**15**	**3**	**1**	0.3
		Antimony	8.25E-04	1.50E-03	9.52E-01	1.15E+00	1.54E-01	1.46E-01	1.77E-01	6.25E-02	2.94E-01	--	--	--	--	--	--
		Arsenic	1.76E-03	2.29E-03	5.66E+00	9.50E+00	3.86E-02	2.19E-01	3.67E-01	1.20E-01	8.65E-01	1.85	3.88	0.5	0.07	0.2	0.03
		Barium	4.64E-02	1.00E-01	2.93E+01	4.96E+01	1.46E-02	4.27E-01	7.22E-01	3.54E-01	2.82E+00	20.8	41.7	0.1	0.02	0.07	0.01
		Beryllium	1.16E-04	1.50E-04	3.87E-01	5.00E-01	--	--	--	--	--	--	--	--	--	--	--
		Cadmium	2.86E-04	8.20E-04	1.14E+00	1.90E+00	1.32E+00	1.51E+00	2.52E+00	5.89E-01	3.67E+00	1.45	3.05	**3**	0.4	**1**	0.2
		Chromium	2.57E-03	5.00E-03	4.98E+01	8.96E+01	4.90E-02	2.44E+00	4.39E+00	1.26E+00	9.48E+00	1	5	**9**	**1**	**2**	0.3
		Cobalt	1.75E-03	2.50E-02	5.48E+00	6.00E+00	1.95E-02	1.07E-01	1.17E-01	7.63E-02	3.86E-01	--	--	--	--	--	--
		Copper	9.79E-03	1.25E-02	4.70E+01	7.51E+01	8.24E-02	3.87E+00	6.19E+00	1.79E+00	1.15E+01	22.3	31.5	0.5	0.1	0.4	0.1
		Cyanide	2.09E-03	2.40E-03	1.21E-01	3.15E-01	1.54E-01	1.86E-02	4.85E-02	8.04E-03	8.09E-02	--	--	--	--	--	--
		Iron	5.43E-01	8.40E-01	8.33E+03	1.18E+04	1.54E-01	1.28E+03	1.82E+03	5.47E+02	3.02E+03	--	--	--	--	--	--
		Lead	3.16E-03	1.10E-02	9.28E+01	1.61E+02	1.29E-01	1.19E+01	2.07E+01	5.19E+00	3.54E+01	0.0114	0.114	**3103**	**455**	**310**	**46**
		Manganese	9.40E-02	1.26E-01	1.10E+02	1.36E+02	7.13E-02	7.84E+00	9.69E+00	3.73E+00	1.87E+01	77.6	776	0.2	0.05	0.02	0.005
		Mercury	4.36E-05	7.50E-05	3.09E-01	7.00E-01	3.12E-01	9.64E-02	2.18E-01	3.91E-02	3.37E-01	0.0064	0.064	**53**	**6**	**5**	0.6
		Nickel	3.21E-03	4.10E-03	4.36E+00	4.70E+00	1.69E-01	7.39E-01	7.96E-01	3.12E-01	1.31E+00	25.1	45.3	0.05	0.01	0.03	0.01
		Selenium	8.78E-04	3.70E-03	2.18E-01	2.35E-01	1.48E-01	3.24E-02	3.49E-02	1.39E-02	5.88E-02	--	--	--	--	--	--
		Silver	2.20E-04	1.00E-03	5.03E+00	7.30E+00	3.27E-01	1.65E+00	2.39E+00	6.66E-01	3.68E+00	9.36	19.2	0.4	0.1	0.2	0.03
		Thallium	5.57E-04	2.00E-03	2.18E-01	2.35E-01	1.54E-01	3.35E-02	3.62E-02	1.43E-02	6.04E-02	--	--	--	--	--	--
		Vanadium	2.91E-03	2.50E-02	1.38E+01	2.12E+01	6.72E-03	9.27E-02	1.42E-01	1.24E-01	9.65E-01	11.4	22.8	0.08	0.01	0.04	0.01
		Zinc	1.34E-02	2.08E-02	4.04E+01	5.17E+01	1.37E+01	5.53E+02	7.07E+02	2.13E+02	1.01E+03	14.5	131	**70**	**15**	**8**	**2**

Notes:

NA = BSoilAF and/or LOAEL toxicity reference values not available. CTE/RME and associated HQs cannot be calculated.
-- = Benchmark not reported
VOCs = Volatile Organic Chemicals
SVOCs = Semi-volatile Organic Chemical
PCBs = Polychlorinated Biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure
HQ = Hazard Quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = Body Weight
dw = dry weight
ww = wet weight
LOAEL = Lowest Observable Adverse Effects Level

US EPA ARCHIVE DOCUMENT

TABLE 7-17b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR LARGE OMNIVOROUS BIRDS - ALL ON-SITE TERRESTRIAL HABITATS COMBINED

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)									NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
ver-All Areas	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	4.41E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	4.07E-05	2.33E-02	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	4.72E-03	4.29E-03	0.00E+00	0.00E+00	0.00E+00	1.55E-04	5.28E-04	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	4.41E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.53E-04	2.36E-02	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	4.42E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.53E-04	2.36E-02	--	--	--	--	--	--	--	--	--	--
		Acetone	2.60E-03	1.20E-02	1.10E-02	2.87E-02	0.00E+00	0.00E+00	0.00E+00	2.00E-04	2.83E-03	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	4.41E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	4.07E-05	2.33E-02	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.72E-04	3.97E-04	4.42E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	4.18E-05	2.33E-02	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	4.42E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	4.07E-05	2.33E-02	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	4.42E-03	6.50E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	4.56E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	4.16E-05	2.33E-02	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	4.43E-03	9.38E-02	0.00E+00	0.00E+00	0.00E+00	4.08E-05	3.39E-03	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	2.92E-04	7.00E-04	5.56E-03	3.60E-01	0.00E+00	0.00E+00	0.00E+00	5.01E-05	1.30E-02	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	4.88E-03	6.50E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Tetrachloroethene	2.50E-04	2.50E-04	4.49E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	4.12E-05	2.33E-02	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	4.42E-03	6.50E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.34E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	4.02E-05	2.33E-02	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.60E-01	8.84E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		2-Methylnaphthalene	4.68E-05	5.00E-05	1.14E-01	1.29E-01	3.54E-01	4.03E-02	4.56E-02	1.63E-02	6.99E-02	2.86	28.6	0.02	0.01	0.002	0.001	<1	<1	<1	<1
		2-Methylphenol	2.50E-03	2.50E-03	1.82E-01	4.15E-01	2.27E+00	4.14E-01	9.43E-01	1.61E-01	1.36E+00	0.96	9.6	**1**	0.2	0.1	0.02	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.82E-01	4.15E-01	4.73E+00	8.60E-01	1.96E+00	3.32E-01	2.82E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.00E-01	2.66E-01	4.81E-02	9.62E-03	1.28E-02	5.11E-03	2.82E-02	1	10	0.03	0.01	0.003	0.001	<1	<1	<1	<1
		4-Methylphenol	2.50E-03	2.50E-03	1.79E-01	4.15E-01	3.07E-01	5.50E-02	1.28E-01	2.25E-02	1.98E-01	0.96	9.6	0.2	0.02	0.02	0.002	<1	<1	<1	<1
		4-Nitroaniline	1.00E-02	1.00E-02	3.93E-01	1.05E+00	5.24E-01	2.06E-01	5.50E-01	8.23E-02	8.26E-01	0.75	7.5	**1**	0.1	0.1	0.01	<1	<1	<1	<1
		Acenaphthene	4.69E-05	5.00E-05	1.27E-01	1.91E-01	--	--	--	--	--	1.11	11.1	--	--	--	--	--	--	--	--
		Acenaphthylene	4.78E-05	5.00E-05	1.55E-01	2.39E-01	3.66E+00	5.68E-01	8.76E-01	2.20E-01	1.26E+00	1.11	11.1	**1**	0.2	0.1	0.02	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.78E-01	9.19E-02	2.37E+00	4.22E-01	2.18E-01	1.64E-01	3.15E-01	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.01E-05	1.90E-04	2.60E-01	4.67E-01	3.87E-01	1.01E-01	1.81E-01	4.04E-02	2.75E-01	1.11	11.1	0.2	0.04	0.02	0.004	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.79E-01	3.97E-01	5.70E-01	1.02E-01	2.26E-01	4.06E-02	3.38E-01	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.19E-05	2.00E-04	7.38E-01	1.73E+00	2.54E-01	1.88E-01	4.40E-01	7.70E-02	6.91E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.36E-05	1.22E-04	7.30E-01	1.67E+00	2.13E-01	1.55E-01	3.55E-01	6.45E-02	5.68E-01	10	20	0.1	0.01	0.03	0.003	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.62E-05	1.18E-04	1.05E+00	2.69E+00	4.16E-01	4.37E-01	1.12E+00	1.75E-01	1.70E+00	2	20	0.8	0.1	0.08	0.01	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.13E-05	2.30E-04	5.20E-01	1.15E+00	4.70E-01	2.45E-01	5.41E-01	9.75E-02	8.15E-01	2	20	0.4	0.05	0.04	0.005	<1	<1	<1	<1
		Benzo(k)fluoranthene	4.98E-05	2.60E-04	3.88E-01	8.51E-01	4.16E-01	1.61E-01	3.54E-01	6.46E-02	5.37E-01	2	20	0.3	0.03	0.03	0.003	<1	<1	<1	<1
		bis(2-Ethylhexyl)phthalate	2.46E-03	2.50E-03	5.73E-01	2.55E+01	1.29E+02	7.42E+01	3.30E+03	2.86E+01	4.72E+03	1.1	3.51	**4291**	**26**	**1345**	**8**	**4251**	**17**	**1332**	**5**
		Butyl benzyl phthalate	2.50E-03	2.50E-03	1.36E-01	1.40E-01	2.60E-01	3.54E-02	3.64E-02	1.46E-02	5.74E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.65E-01	2.44E-01	2.71E+00	4.46E-01	6.60E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.53E-05	8.80E-05	7.98E-01	1.90E+00	3.66E-01	2.92E-01	6.96E-01	1.18E-01	1.06E+00	2	20	0.5	0.1	0.05	0.01	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	4.37E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	4.04E-05	2.33E-02	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.70E-05	5.00E-05	1.85E-01	2.79E-01	3.70E-01	6.84E-02	1.03E-01	2.75E-02	1.57E-01	--	--	--	--	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.34E-01	1.47E-01	9.14E-01	1.23E-01	1.34E-01	4.82E-02	1.98E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.40E-01	8.13E-01	1.83E+01	4.38E+00	1.49E+01	1.69E+00	2.13E+01	0.111	1.11	**192**	**15**	**19**	**2**	**135**	**2**	**14**	<1
		Fluoranthene	6.02E-05	1.17E-04	1.20E+00	2.62E+00	4.86E-01	5.84E-01	1.27E+00	2.32E-01	1.92E+00	2	20	0.96	0.1	0.1	0.01	<1	<1	<1	<1
		Fluorene	4.71E-05	5.00E-05	1.31E-01	2.04E-01	--	--	--	--	--	1.11	11.1	--	--	--	--	--	--	--	--
		Hexachlorobenzene	2.50E-03	2.50E-03	1.82E-01	4.15E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.82E-01	4.15E-01	1.03E-01	1.87E-02	4.27E-02	8.50E-03	7.63E-02	--	--	--	--	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	5.02E-05	1.90E-04	4.82E-01	1.05E+00	4.58E-01	2.21E-01	4.80E-01	8.80E-02	7.25E-01	2	20	0.4	0.04	0.04	0.004	<1	<1	<1	<1
		Isophorone	2.50E-03	2.50E-03	1.80E-01	4.15E-01	1.51E-01	2.71E-02	6.25E-02	1.17E-02	1.05E-01	--	--	--	--	--	--	--	--	--	--
		Naphthalene	4.90E-05	1.90E-04	1.18E-01	1.75E-01	7.04E-01	8.31E-02	1.23E-01	3.27E-02	1.82E-01	2.86	28.6	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.48E-03	2.50E-03	1.86E-01	1.80E+00	4.40E-01	8.19E-02	7.93E-01	3.29E-02	1.20E+00	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	4.82E-01	1.05E+00	4.10E+01	1.98E+01	4.30E+01	7.61E+00	6.16E+01	--	--	--	--	--	--	--	--	--	--
		Phenanthrene	6.12E-05	7.44E-05	7.64E-01	2.74E+00	2.75E-01	2.10E-01	7.54E-01	8.58E-02	1.18E+00	1.11	11.1	**1**	0.1	0.1	0.01	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.74E-01	4.15E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	6.38E-05	1.30E-04	1.33E+00	4.32E+00	2.80E-01	3.72E-01	1.21E+00	1.52E-01	1.88E+00	2	20	0.9	0.1	0.09	0.01	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-17b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR LARGE OMNIVOROUS BIRDS - ALL ON-SITE TERRESTRIAL HABITATS COMBINED

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)									NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	3.05E-06	2.50E-05	3.86E-03	7.94E-03	5.11E-01	1.97E-03	4.06E-03	7.84E-04	6.09E-03	0.0028	0.028	**2**	0.3	0.2	0.03	<1	<1	<1	<1
		4,4'-DDE	2.68E-06	1.50E-05	5.36E-03	1.17E-02	1.90E+00	1.02E-02	2.23E-02	3.96E-03	3.23E-02	0.0028	0.028	**12**	**1**	**1**	0.1	**6**	<1	<1	<1
			2.52E-06	9.20E-06	5.03E-03	1.24E-02	1.34E+00	6.74E-03	1.66E-02	2.63E-03	2.42E-02	0.0028	0.028	**9**	0.9	0.9	0.09	**2**	<1	<1	<1
		alpha-Chlordane	1.26E-06	3.30E-06	3.02E-03	6.19E-03	2.85E+00	8.60E-03	1.76E-02	3.33E-03	2.54E-02	0.211	2.11	0.1	0.02	0.01	0.002	<1	<1	<1	<1
		Dieldrin	1.25E-06	2.78E-06	2.51E-02	1.71E-01	1.56E+00	3.91E-02	2.66E-01	1.52E-02	3.87E-01	0.077	0.37	**5**	0.2	**1**	0.04	**4**	<1	<1	<1
		Endosulfan I	1.25E-06	1.40E-06	1.00E-03	4.60E-03	7.98E-01	7.98E-04	3.67E-03	3.14E-04	5.42E-03	0.31	3.1	0.02	0.001	0.002	0.0001	<1	<1	<1	<1
		Endosulfan II	2.48E-06	2.80E-06	2.19E-03	3.53E-03	7.98E-01	1.75E-03	2.82E-03	6.87E-04	4.16E-03	0.31	3.1	0.01	0.002	0.001	0.0002	<1	<1	<1	<1
		Endosulfan Sulfate	2.58E-06	1.30E-05	3.33E-03	4.11E-03	7.98E-01	2.66E-03	3.28E-03	1.04E-03	4.84E-03	0.31	3.1	0.02	0.003	0.002	0.0003	<1	<1	<1	<1
	4,4'-DDT	Endrin	2.48E-06	2.80E-06	1.87E-03	9.00E-03	5.76E-01	1.08E-03	5.18E-03	4.27E-04	7.74E-03	0.01	0.1	0.8	0.04	0.08	0.004	<1	<1	<1	<1
		Endrin Aldehyde	2.44E-06	2.80E-06	2.51E-03	7.92E-03	5.76E-01	1.45E-03	4.56E-03	5.73E-04	6.81E-03	0.0232	0.232	0.3	0.02	0.03	0.002	<1	<1	<1	<1
		Endrin Ketone	2.47E-06	6.00E-06	1.98E-03	1.40E-02	5.76E-01	1.14E-03	8.06E-03	4.52E-04	1.20E-02	0.0232	0.232	0.5	0.02	0.05	0.002	<1	<1	<1	<1
		Gamma-BHC	1.26E-06	4.30E-06	9.67E-04	4.60E-03	1.62E+00	1.56E-03	7.43E-03	6.08E-04	1.08E-02	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.32E-06	9.40E-06	2.81E-03	5.88E-03	2.85E+00	8.00E-03	1.67E-02	3.10E-03	2.42E-02	0.211	2.11	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		Heptachlor Epoxide	1.31E-06	5.10E-06	1.10E-03	1.30E-02	1.74E+00	1.92E-03	2.27E-02	7.46E-04	3.29E-02	0.211	2.11	0.2	0.004	0.02	0.0004	<1	<1	<1	<1
		Methoxychlor	1.23E-05	1.40E-05	8.46E-03	5.62E-03	2.13E-01	1.81E-03	1.20E-03	7.50E-04	1.92E-03	--	--	--	--	--	--	--	--	--	--
		Toxaphene	1.24E-04	1.40E-04	9.68E-02	4.60E-01	7.43E-02	7.20E-03	3.42E-02	3.40E-03	6.54E-02	0.0531	0.531	**1**	0.06	0.1	0.01	<1	<1	<1	<1
	Metals	Aluminum	1.31E-01	2.01E+00	2.04E+03	7.59E+03	1.54E-01	3.14E+02	1.17E+03	1.34E+02	1.94E+03	109.7	1097	**18**	**1**	**2**	0.1	**3**	<1	<1	<1
		Antimony	1.41E-03	1.50E-03	2.00E+00	5.88E+00	1.54E-01	3.08E-01	9.05E-01	1.31E-01	1.50E+00	--	--	--	--	--	--	--	--	--	--
		Arsenic	1.57E-03	3.15E-03	8.33E+00	1.16E+01	3.86E-02	3.22E-01	4.48E-01	1.77E-01	1.06E+00	1.85	3.88	0.6	0.1	0.3	0.05	<1	<1	<1	<1
			4.77E-02	6.90E-02	7.01E+01	1.28E+02	1.46E-02	1.02E+00	1.86E+00	8.43E-01	7.25E+00	20.8	41.7	0.3	0.04	0.2	0.02	<1	<1	<1	<1
		Beryllium	1.53E-04	1.60E-03	4.62E-01	7.28E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Cadmium	2.06E-04	1.33E-03	2.61E+00	7.08E+00	1.32E+00	3.46E+00	9.38E+00	1.35E+00	1.37E+01	1.45	3.05	**9**	0.9	**4**	0.4	**7**	<1	**3**	<1
		Chromium	8.98E-04	2.42E-02	7.09E+01	1.33E+02	4.90E-02	3.47E+00	6.51E+00	1.79E+00	1.41E+01	1	5	**14**	**2**	**3**	0.4	**5**	<1	<1	<1
		Cobalt	7.46E-04	1.24E-03	5.10E+00	5.42E+00	1.95E-02	9.96E-02	1.06E-01	7.10E-02	3.45E-01	--	--	--	--	--	--	--	--	--	--
		Copper	4.67E-03	4.28E-01	9.63E+01	1.95E+02	8.24E-02	7.94E+00	1.61E+01	3.67E+00	3.00E+01	22.3	31.5	**1**	0.2	0.95	0.1	<1	<1	<1	<1
	Barium	Cyanide	2.22E-03	1.46E-02	4.80E-01	1.03E+00	1.54E-01	7.38E-02	1.58E-01	3.16E-02	2.66E-01	--	--	--	--	--	--	--	--	--	--
		Iron	1.17E+00	6.77E+00	2.04E+03	2.07E+04	1.54E-01	3.14E+02	3.18E+03	1.34E+02	5.30E+03	--	--	--	--	--	--	--	--	--	--
		Lead	2.38E-03	3.26E-02	1.28E+02	3.13E+02	1.29E-01	1.65E+01	4.03E+01	7.16E+00	6.88E+01	0.0114	0.114	**6034**	**628**	**603**	**63**	**2930**	**173**	**293**	**17**
		Manganese	1.71E-01	3.62E-01	2.72E+02	5.56E+02	7.13E-02	1.94E+01	3.96E+01	9.21E+00	7.66E+01	77.6	776	0.99	0.1	0.1	0.01	<1	<1	<1	<1
		Mercury	6.93E-05	4.60E-04	2.71E-01	4.89E-01	3.12E-01	8.46E-02	1.53E-01	3.43E-02	2.36E-01	0.0064	0.064	**37**	**5**	**4**	0.5	<1	<1	<1	<1
		Nickel	3.52E-03	4.71E-03	1.53E+01	2.52E+01	1.69E-01	2.59E+00	4.27E+00	1.10E+00	7.01E+00	25.1	45.3	0.3	0.04	0.2	0.02	<1	<1	<1	<1
		Selenium	1.37E-03	1.50E-03	3.68E-01	5.38E-01	1.48E-01	5.46E-02	7.99E-02	2.35E-02	1.34E-01	--	--	--	--	--	--	--	--	--	--
		Silver	6.45E-04	1.52E-02	1.43E+00	3.03E+00	3.27E-01	4.68E-01	9.91E-01	1.89E-01	1.53E+00	9.36	19.2	0.2	0.02	0.08	0.01	<1	<1	<1	<1
		Thallium	1.53E-03	2.00E-03	4.67E-01	7.23E-01	1.54E-01	7.18E-02	1.11E-01	3.07E-02	1.85E-01	--	--	--	--	--	--	--	--	--	--
		Vanadium	9.41E-04	4.04E-03	1.71E+01	2.10E+01	6.72E-03	1.15E-01	1.41E-01	1.54E-01	9.53E-01	11.4	22.8	0.1	0.01	0.04	0.01	<1	<1	<1	<1
		Zinc	1.49E-02	6.25E-02	1.29E+02	2.60E+02	1.37E+01	1.76E+03	3.56E+03	6.80E+02	5.10E+03	14.5	131	**351**	**47**	**39**	**5**	**282**	**32**	**31**	**4**

Notes:
- = BSoilAF or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOCs = Volatile Organic Chemicals
SVOCs = Semi-volatile Organic Chemical
PCBs = Polychlorinated Biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = Central Tendency Exposure

RME = Reasonable Maximum Exposure
HQ = Hazard Quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = Body Weight
dw = dry weight
ww = wet weight
LOAEL = Lowest Observable Adverse Effects Level

Table 7-17c: Weight-of-Evidence Integration for large omnivorous birds
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:
Maintain a stable and healthy population of large omnivorous birds
Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large omnivorous birds foraging in the terrestrial habitats at the site?

Measurement Endpoint
4.A: use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.

Weight-of-Evidence Integration

All terrestrial habitats combined[a]	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**4.A**			
Yes/Low					
Undeterminate					
No Harm					

[a] The terrestrial habitats consist of J.M. Mills Landfill, Unnamed Island, Nunes Parcel, Quinville Well Field, Wetlands A through D, and Pratt Dam

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

TABLE 7-18a
CALCULATED HAZARD QUOTIENTS FOR SMALL OMNIVOROUS BIRDS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water (sw)		Soil (dw)		Food (ww)										
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE
River-Upstream	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.32E-05	2.54E-04	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	2.11E-04	7.27E-04	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	2.11E-04	7.27E-04	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	2.11E-04	7.27E-04	--	--	--	--	--	--
		Acetone	2.97E-03	4.95E-03	5.57E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	2.49E-04	1.32E-03	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.32E-05	2.54E-04	--	--	--	--	--	--
		Chloromethane	2.76E-04	3.70E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.50E-05	2.79E-04	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.32E-05	2.54E-04	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.32E-05	2.54E-04	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.32E-05	2.54E-04	--	--	--	--	--	--
		Methylene chloride	3.13E-04	4.20E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.76E-05	2.90E-04	--	--	--	--	--	--
		Tetrachloroethene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.32E-05	2.54E-04	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.32E-05	2.54E-04	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.32E-05	2.54E-04	22.8	45.6	0.00001	0.000002	0.00001	0.000001
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.79E-01	2.40E-01	--	--	--	--	--	--	--	--	--	--	--
		2-Methylnaphthalene	2.35E-05	5.00E-05	1.11E-01	2.70E-01	3.54E-01	3.93E-02	9.55E-02	1.83E-02	1.66E-01	2.86	28.6	0.06	0.01	0.01	0.001
		2-Methylphenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.27E+00	4.66E-01	5.45E-01	2.09E-01	8.94E-01	0.96	9.6	0.9	0.2	0.09	0.02
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.73E+00	9.69E-01	1.13E+00	4.33E-01	1.85E+00	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.81E-02	9.86E-03	1.15E-02	6.08E-03	2.89E-02	1	10	0.03	0.01	0.003	0.001
		4-Methylphenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	3.07E-01	6.30E-02	7.38E-02	2.97E-02	1.30E-01	0.96	9.6	0.1	0.03	0.01	0.003
		4-Nitroaniline	1.00E-02	1.00E-02	5.15E-01	6.00E-01	5.24E-01	2.70E-01	3.14E-01	1.25E-01	5.36E-01	0.75	7.5	0.7	0.2	0.07	0.02
		Acenaphthene	2.39E-05	5.00E-05	2.69E-01	8.80E-01	--	--	--	--	--	1.11	11.1	--	--	--	--
		Acenaphthylene	2.92E-05	5.00E-05	2.81E-01	7.30E-01	3.66E+00	1.03E+00	2.67E+00	4.60E-01	4.36E+00	1.11	11.1	**4**	0.4	0.4	0.04
		Acetophenone	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.37E+00	4.86E-01	5.69E-01	2.18E-01	9.31E-01	--	--	--	--	--	--
		Anthracene	3.19E-05	5.00E-05	1.26E+00	4.00E+00	3.87E-01	4.88E-01	1.55E+00	2.26E-01	2.67E+00	1.11	11.1	**2**	0.2	0.2	0.02
		Benzaldehyde	2.50E-03	2.50E-03	1.72E-01	2.00E-01	5.70E-01	9.81E-02	1.14E-01	4.51E-02	1.93E-01	--	--	--	--	--	--
		Benzo[a]anthracene	4.11E-05	5.00E-05	2.91E+00	9.30E+00	2.54E-01	7.40E-01	2.37E+00	3.51E-01	4.21E+00	--	--	--	--	--	--
		Benzo(a)pyrene	5.14E-05	6.70E-05	2.82E+00	7.50E+00	2.13E-01	6.00E-01	1.60E+00	2.88E-01	2.89E+00	10	20	0.3	0.03	0.1	0.01
		Benzo(b)fluoranthene	5.05E-05	8.60E-05	3.04E+00	7.80E+00	4.16E-01	1.26E+00	3.24E+00	5.85E-01	5.57E+00	2	20	**3**	0.3	0.3	0.03
		Benzo(g,h,i)perylene	5.24E-05	1.30E-04	1.71E+00	4.40E+00	4.70E-01	8.04E-01	2.07E+00	3.71E-01	3.53E+00	2	20	**2**	0.2	0.2	0.02
		Benzo(k)fluoranthene	4.21E-05	6.90E-05	1.28E+00	3.40E+00	4.16E-01	5.32E-01	1.41E+00	2.46E-01	2.43E+00	2	20	**1**	0.1	0.1	0.01
		bis(2-Ethylhexyl)phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.29E+02	2.65E+01	3.11E+01	1.18E+01	5.03E+01	1.1	3.51	**46**	**11**	**14**	**3**
		Butyl benzyl phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.60E-01	5.33E-02	6.24E-02	2.54E-02	1.11E-01	--	--	--	--	--	--
		Carbazole	--	--	2.88E-01	5.50E-01	2.71E+00	7.79E-01	1.49E+00	--	--	--	--	--	--	--	--
		Chrysene	4.82E-05	7.40E-05	3.07E+00	8.90E+00	3.66E-01	1.12E+00	3.26E+00	5.23E-01	5.64E+00	2	20	**3**	0.3	0.3	0.03
		Cyclohexane	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	5.32E-05	2.54E-04	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.28E-05	1.40E-04	4.59E-01	9.40E-01	3.70E-01	1.70E-01	3.47E-01	7.89E-02	6.01E-01	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.69E-01	4.40E-01	9.14E-01	1.55E-01	4.02E-01	7.02E-02	6.70E-01	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.83E+01	3.74E+00	4.38E+00	1.67E+00	7.11E+00	0.111	1.11	**64**	**15**	**6**	**2**
		Fluoranthene	5.91E-05	8.30E-05	4.63E+00	1.50E+01	4.86E-01	2.25E+00	7.30E+00	1.04E+00	1.24E+01	2	20	**6**	0.5	0.6	0.05
		Fluorene	2.48E-05	5.00E-05	3.30E-01	1.20E+00	--	--	--	--	--	1.11	11.1	--	--	--	--
		Hexachlorobenzene	2.50E-03	2.50E-03	2.05E-01	2.40E-01	--	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.03E-01	2.11E-02	2.47E-02	1.11E-02	5.02E-02	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	4.95E-05	1.30E-04	1.25E+00	2.60E+00	4.58E-01	5.72E-01	1.19E+00	2.64E-01	2.03E+00	2	20	**1**	0.1	0.1	0.01
		Isophorone	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.51E-01	3.09E-02	3.62E-02	1.54E-02	6.88E-02	--	--	--	--	--	--
		Naphthalene	2.67E-05	5.00E-05	1.83E-01	2.80E-01	7.04E-01	1.29E-01	1.97E-01	5.87E-02	3.31E-01	2.86	28.6	0.1	0.02	0.01	0.002
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.40E-01	9.03E-02	1.06E-01	4.19E-02	1.81E-01	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	5.15E-01	6.00E-01	4.10E+01	2.11E+01	2.46E+01	9.40E+00	3.99E+01	--	--	--	--	--	--
		Phenanthrene	4.63E-05	5.00E-05	3.98E+00	1.40E+01	2.75E-01	1.10E+00	3.85E+00	5.17E-01	6.81E+00	1.11	11.1	**6**	0.5	0.6	0.05
		Phenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.76E-05	8.70E-05	4.79E+00	1.90E+01	2.80E-01	1.34E+00	5.32E+00	6.32E-01	9.38E+00	2	20	**5**	0.3	0.5	0.03

US EPA ARCHIVE DOCUMENT

TABLE 7-18a
CALCULATED HAZARD QUOTIENTS FOR SMALL OMNIVOROUS BIRDS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water (sw)		Soil (dw)		Food (ww)										
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	1.56E-06	2.80E-06	3.38E-03	8.10E-03	5.11E-01	1.73E-03	4.14E-03	7.94E-04	7.03E-03	0.0028	0.028	**3**	0.3	0.3	0.03
		4,4'-DDE	1.82E-06	2.80E-06	5.27E-03	5.90E-03	1.90E+00	1.00E-02	1.12E-02	4.51E-03	1.84E-02	0.0028	0.028	**7**	**2**	0.7	0.2
			1.56E-06	2.80E-06	4.26E-03	9.80E-03	1.34E+00	5.70E-03	1.31E-02	2.57E-03	2.17E-02	0.0028	0.028	**8**	0.9	0.8	0.09
		alpha-Chlordane	9.83E-07	1.40E-06	1.06E-03	1.25E-03	2.85E+00	3.02E-03	3.56E-03	1.35E-03	5.82E-03	0.211	2.11	0.03	0.01	0.003	0.001
		Dieldrin	2.05E-06	2.80E-06	1.42E-02	3.30E-02	1.56E+00	2.21E-02	5.14E-02	9.94E-03	8.46E-02	0.077	0.37	**1**	0.1	0.2	0.03
		Endosulfan I	9.83E-07	1.40E-06	1.06E-03	1.25E-03	7.98E-01	8.46E-04	9.98E-04	3.84E-04	1.67E-03	0.31	3.1	0.01	0.001	0.001	0.0001
		Endosulfan II	1.56E-06	2.80E-06	2.07E-03	2.45E-03	7.98E-01	1.65E-03	1.96E-03	7.51E-04	3.27E-03	0.31	3.1	0.01	0.002	0.001	0.0002
	4,4'-DDT	Endosulfan Sulfate	1.56E-06	2.80E-06	1.85E-03	1.85E-03	7.98E-01	1.48E-03	1.48E-03	6.71E-04	2.47E-03	0.31	3.1	0.01	0.002	0.001	0.0002
		Endrin	1.56E-06	2.80E-06	2.07E-03	2.45E-03	5.76E-01	1.19E-03	1.41E-03	5.46E-04	2.39E-03	0.01	0.1	0.2	0.1	0.02	0.01
		Endrin Aldehyde	1.56E-06	2.80E-06	2.95E-03	7.10E-03	5.76E-01	1.70E-03	4.09E-03	7.78E-04	6.91E-03	0.0232	0.232	0.3	0.03	0.03	0.003
		Endrin Ketone	1.56E-06	2.80E-06	2.07E-03	2.45E-03	5.76E-01	1.19E-03	1.41E-03	5.46E-04	2.39E-03	0.0232	0.232	0.1	0.02	0.01	0.002
		Gamma-BHC	9.83E-07	1.40E-06	1.06E-03	1.25E-03	1.62E+00	1.71E-03	2.02E-03	7.70E-04	3.32E-03	--	--	--	--	--	--
		Gamma-Chlordane	9.83E-07	1.40E-06	9.75E-04	1.00E-03	2.85E+00	2.78E-03	2.85E-03	1.24E-03	4.65E-03	0.211	2.11	0.02	0.01	0.002	0.001
		Heptachlor Epoxide	9.83E-07	1.40E-06	1.06E-03	1.25E-03	1.74E+00	1.85E-03	2.18E-03	8.31E-04	3.58E-03	0.211	2.11	0.02	0.004	0.002	0.0004
		Methoxychlor	4.56E-06	1.40E-05	1.83E-02	3.40E-02	2.13E-01	3.90E-03	7.25E-03	1.87E-03	1.31E-02	--	--	--	--	--	--
		Toxaphene	9.83E-05	1.40E-04	1.06E-01	1.25E-01	7.43E-02	7.88E-03	9.29E-03	4.30E-03	2.01E-02	0.0531	0.531	0.4	0.08	0.04	0.01
	Metals	Aluminum	1.33E-01	3.60E-01	4.64E+03	6.35E+03	1.54E-01	7.14E+02	9.77E+02	3.52E+02	1.84E+03	109.7	1097	**17**	**3**	**2**	0.3
		Antimony	8.25E-04	1.50E-03	9.52E-01	1.15E+00	1.54E-01	1.46E-01	1.77E-01	7.23E-02	3.33E-01	--	--	--	--	--	--
		Arsenic	1.76E-03	2.29E-03	5.66E+00	9.50E+00	3.86E-02	2.19E-01	3.67E-01	1.39E-01	9.78E-01	1.85	3.88	0.5	0.08	0.3	0.04
			4.64E-02	1.00E-01	2.93E+01	4.96E+01	1.46E-02	4.27E-01	7.22E-01	4.10E-01	3.19E+00	20.8	41.7	0.2	0.02	0.08	0.01
		Beryllium	1.16E-04	1.50E-04	3.87E-01	5.00E-01	--	--	--	--	--	--	--	--	--	--	--
		Cadmium	2.86E-04	8.20E-04	1.14E+00	1.90E+00	1.32E+00	1.51E+00	2.52E+00	6.80E-01	4.15E+00	1.45	3.05	**3**	0.5	**1**	0.2
		Chromium	2.57E-03	5.00E-03	4.98E+01	8.96E+01	4.90E-02	2.44E+00	4.39E+00	1.45E+00	1.07E+01	1	5	**11**	**1**	**2**	0.3
		Cobalt	1.75E-03	2.50E-02	5.48E+00	6.00E+00	1.95E-02	1.07E-01	1.17E-01	8.82E-02	4.37E-01	--	--	--	--	--	--
	Barium	Copper	9.79E-03	1.25E-02	4.70E+01	7.51E+01	8.24E-02	3.87E+00	6.19E+00	2.07E+00	1.31E+01	22.3	31.5	0.6	0.1	0.4	0.1
		Iron	5.43E-01	8.40E-01	8.33E+03	1.18E+04	1.54E-01	1.28E+03	1.82E+03	6.32E+02	3.42E+03	--	--	--	--	--	--
		Lead	3.16E-03	1.10E-02	9.28E+01	1.61E+02	1.29E-01	1.19E+01	2.07E+01	6.00E+00	4.01E+01	0.0114	0.114	**3514**	**526**	**351**	**53**
		Manganese	9.40E-02	1.26E-01	1.10E+02	1.36E+02	7.13E-02	7.84E+00	9.69E+00	4.31E+00	2.12E+01	77.6	776	0.3	0.1	0.03	0.01
		Mercury	4.36E-05	7.50E-05	3.09E-01	7.00E-01	3.12E-01	9.64E-02	2.18E-01	4.52E-02	3.82E-01	0.0064	0.064	**60**	**7**	**6**	1
		Nickel	3.21E-03	4.10E-03	4.36E+00	4.70E+00	1.69E-01	7.39E-01	7.96E-01	3.61E-01	1.48E+00	25.1	45.3	0.1	0.01	0.03	0.01
		Selenium	8.78E-04	3.70E-03	2.18E-01	2.35E-01	1.48E-01	3.24E-02	3.49E-02	1.61E-02	6.68E-02	--	--	--	--	--	--
		Silver	2.20E-04	1.00E-03	5.03E+00	7.30E+00	3.27E-01	1.65E+00	2.39E+00	7.70E-01	4.16E+00	9.36	19.2	0.4	0.1	0.2	0.04
		Thallium	5.57E-04	2.00E-03	2.18E-01	2.35E-01	1.54E-01	3.35E-02	3.62E-02	1.66E-02	6.85E-02	--	--	--	--	--	--
		Vanadium	2.91E-03	2.50E-02	1.38E+01	2.12E+01	6.72E-03	9.27E-02	1.42E-01	1.43E-01	1.09E+00	11.4	22.8	0.1	0.01	0.05	0.01
		Zinc	1.34E-02	2.08E-02	4.04E+01	5.17E+01	1.37E+01	5.53E+02	7.07E+02	2.46E+02	1.15E+03	14.5	131	**79**	**17**	**9**	**2**

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOCs = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RME = reasonable maximum exposure

HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-18b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - J.M. MILLS LANDFILL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
dfill	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	5.89E-05	4.36E-04	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	5.93E-03	1.40E-02	0.00E+00	0.00E+00	0.00E+00	2.19E-04	1.09E-03	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	2.16E-04	9.08E-04	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	2.16E-04	9.08E-04	--	--	--	--	--	--	--	--	--	--
		Acetone	2.50E-03	2.50E-03	1.49E-02	1.70E-01	0.00E+00	0.00E+00	0.00E+00	2.85E-04	7.38E-03	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	5.89E-05	4.36E-04	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.61E-04	3.40E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	5.96E-05	4.55E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	5.89E-05	4.36E-04	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	5.89E-05	4.36E-04	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	5.89E-05	4.36E-04	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	3.08E-04	7.00E-04	5.67E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	6.34E-05	5.30E-04	--	--	--	--	--	--	--	--	--	--
		Tetrachloroethene	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	5.89E-05	4.36E-04	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	5.89E-05	4.36E-04	--	--	--	--	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	5.89E-05	4.36E-04	22.8	45.6	0.00002	0.000003	0.00001	0.000001	<1	<1	<1	<1
	SVOCs	2-Methylnaphthalene	5.00E-05	5.00E-05	1.14E-01	1.49E-01	3.54E-01	4.03E-02	5.27E-02	1.88E-02	9.14E-02	2.86	28.6	0.03	0.01	0.003	0.001	<1	<1	<1	<1
		2-Methylphenol	2.50E-03	2.50E-03	2.23E-01	4.15E-01	2.27E+00	5.07E-01	9.43E-01	2.27E-01	1.55E+00	0.96	9.6	**2**	0.2	0.2	0.02	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	2.23E-01	4.15E-01	4.73E+00	1.05E+00	1.96E+00	4.71E-01	3.19E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.47E-01	1.20E+00	4.81E-02	1.19E-02	5.77E-02	7.28E-03	1.42E-01	1	10	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		4-Methylphenol	2.50E-03	2.50E-03	2.23E-01	4.15E-01	3.07E-01	6.86E-02	1.28E-01	3.23E-02	2.24E-01	0.96	9.6	0.2	0.03	0.02	0.003	<1	<1	<1	<1
		4-Nitroaniline	1.00E-02	1.00E-02	4.88E-01	1.05E+00	5.24E-01	2.56E-01	5.50E-01	1.18E-01	9.36E-01	0.75	7.5	**1**	0.2	0.1	0.02	<1	<1	<1	<1
		Acenaphthylene	5.00E-05	5.00E-05	1.44E-01	2.25E-01	3.66E+00	5.28E-01	8.24E-01	2.36E-01	1.34E+00	1.11	11.1	**1**	0.2	0.1	0.02	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	2.23E-01	4.15E-01	2.37E+00	5.28E-01	9.83E-01	2.37E-01	1.61E+00	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.76E-05	1.80E-04	3.46E-01	9.54E-01	3.87E-01	1.34E-01	3.69E-01	6.22E-02	6.37E-01	1.11	11.1	0.6	0.06	0.06	0.01	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.45E-01	8.90E-02	5.70E-01	8.27E-02	5.08E-02	3.80E-02	8.63E-02	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.83E-05	2.00E-04	1.04E+00	2.08E+00	2.54E-01	2.65E-01	5.29E-01	1.25E-01	9.41E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	6.19E-05	3.40E-04	8.59E-01	1.88E+00	2.13E-01	1.83E-01	4.00E-01	8.77E-02	7.24E-01	10	20	0.1	0.01	0.04	0.004	<1	<1	<1	<1
		Benzo(b)fluoranthene	6.23E-05	3.60E-04	1.47E+00	2.45E+00	4.16E-01	6.12E-01	1.02E+00	2.83E-01	1.75E+00	2	20	0.9	0.1	0.09	0.01	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.92E-05	2.30E-04	5.64E-01	1.19E+00	4.70E-01	2.65E-01	5.60E-01	1.22E-01	9.55E-01	2	20	0.5	0.1	0.0	0.01	<1	<1	<1	<1
		Benzo(k)fluoranthene	6.01E-05	2.60E-04	5.36E-01	8.27E-01	4.16E-01	2.23E-01	3.44E-01	1.03E-01	5.91E-01	2	20	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		bis(2-Ethylhexyl)phthalate	2.50E-03	2.50E-03	6.59E-01	1.97E+00	1.29E+02	8.53E+01	2.55E+02	3.80E+01	4.13E+02	1.1	3.51	**376**	**35**	**118**	**11**	**330**	**24**	**103**	**7**
		Butyl benzyl phthalate	2.50E-03	2.50E-03	1.28E-01	5.56E-01	2.60E-01	3.33E-02	1.45E-01	1.59E-02	2.57E-01	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.74E-01	2.84E-01	2.71E+00	4.71E-01	7.68E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	6.10E-05	3.00E-04	1.13E+00	2.34E+00	3.66E-01	4.14E-01	8.57E-01	1.93E-01	1.48E+00	2	20	0.7	0.1	0.07	0.01	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	5.89E-05	4.36E-04	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	2.36E-01	3.26E-01	3.70E-01	8.72E-02	1.20E-01	4.06E-02	2.08E-01	--	--	--	--	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.41E-01	1.62E-01	9.14E-01	1.29E-01	1.48E-01	5.86E-02	2.47E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.33E-01	1.30E+00	1.83E+01	4.26E+00	2.37E+01	1.90E+00	3.85E+01	0.111	1.11	**347**	**17**	**35**	**2**	**283**	**2**	**28**	<1
		Fluoranthene	6.28E-05	3.90E-04	1.84E+00	3.60E+00	4.86E-01	8.95E-01	1.75E+00	4.12E-01	2.98E+00	2	20	**1**	0.2	0.1	0.02	<1	<1	<1	<1
		Hexachlorobutadiene	2.50E-03	2.50E-03	2.23E-01	4.15E-01	1.03E-01	2.29E-02	4.27E-02	1.20E-02	8.65E-02	--	--	--	--	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	5.80E-05	1.90E-04	6.54E-01	1.14E+00	4.58E-01	2.99E-01	5.22E-01	1.38E-01	8.91E-01	2	20	0.4	0.07	0.04	0.01	<1	<1	<1	<1
		Isophorone	2.50E-03	2.50E-03	2.23E-01	4.15E-01	1.51E-01	3.36E-02	6.25E-02	1.68E-02	1.19E-01	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.00E-05	5.00E-05	9.18E-02	1.07E-01	7.04E-01	6.46E-02	7.53E-02	2.94E-02	1.26E-01	2.86	28.6	0.04	0.01	0.004	0.001	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	2.23E-01	4.15E-01	4.40E-01	9.82E-02	1.83E-01	4.55E-02	3.13E-01	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	5.60E-01	1.05E+00	4.10E+01	2.30E+01	4.30E+01	1.02E+01	6.98E+01	--	--	--	--	--	--	--	--	--	--
		Phenanthrene	5.83E-05	2.00E-04	1.17E+00	3.01E+00	2.75E-01	3.22E-01	8.28E-01	1.52E-01	1.46E+00	1.11	11.1	**1**	0.1	0.1	0.01	<1	<1	<1	<1
		Pyrene	6.33E-05	4.20E-04	1.84E+00	3.98E+00	2.80E-01	5.15E-01	1.11E+00	2.43E-01	1.97E+00	2	20	1	0.1	0.1	0.01	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-18b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - J.M. MILLS LANDFILL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	3.60E-06	2.50E-05	2.94E-03	1.90E-02	5.11E-01	1.50E-03	9.71E-03	6.91E-04	1.65E-02	0.0028	0.028	**6**	0.2	1	0.02	**3**	<1	<1	<1
		4,4'-DDE	3.17E-06	1.50E-05	5.07E-03	1.37E-02	1.90E+00	9.66E-03	2.61E-02	4.33E-03	4.28E-02	0.0028	0.028	**15**	**2**	**2**	0.2	**9**	<1	<1	<1
			2.60E-06	2.80E-06	3.60E-03	2.50E-02	1.34E+00	4.82E-03	3.35E-02	2.17E-03	5.52E-02	0.0028	0.028	**20**	1	**2**	0.1	**12**	<1	**1**	<1
		alpha-Chlordane	1.30E-06	1.40E-06	3.24E-03	5.28E-03	2.85E+00	9.23E-03	1.50E-02	4.13E-03	2.46E-02	0.211	2.11	0.1	0.02	0.01	0.002	<1	<1	<1	<1
		Dieldrin	3.14E-06	1.40E-05	1.26E-02	2.20E-02	1.56E+00	1.96E-02	3.43E-02	8.82E-03	5.64E-02	0.077	0.37	0.7	0.1	0.2	0.02	<1	<1	<1	<1
		Endosulfan I	1.30E-06	1.40E-06	1.16E-03	4.35E-03	7.98E-01	9.26E-04	3.47E-03	4.21E-04	5.80E-03	0.31	3.1	0.02	0.001	0.002	0.0001	<1	<1	<1	<1
		Endosulfan II	2.60E-06	2.80E-06	2.04E-03	2.90E-03	7.98E-01	1.63E-03	2.31E-03	7.40E-04	3.87E-03	0.31	3.1	0.0	0.002	0.001	0.0002	<1	<1	<1	<1
		Endosulfan Sulfate	3.24E-06	1.10E-05	6.73E-03	1.10E-02	7.98E-01	5.37E-03	8.78E-03	2.44E-03	1.47E-02	0.31	3.1	0.05	0.01	0.005	0.001	<1	<1	<1	<1
	4,4'-DDT	Endrin	2.60E-06	2.80E-06	2.04E-03	2.90E-03	5.76E-01	1.18E-03	1.67E-03	5.38E-04	2.82E-03	0.01	0.1	0.3	0.05	0.03	0.01	<1	<1	<1	<1
		Endrin Aldehyde	2.60E-06	2.80E-06	3.78E-03	5.80E-02	5.76E-01	2.18E-03	3.34E-02	9.97E-04	5.65E-02	0.0232	0.232	**2**	0.04	0.2	0.004	**2**	<1	<1	<1
		Endrin Ketone	2.60E-06	2.80E-06	2.08E-03	2.90E-03	5.76E-01	1.20E-03	1.67E-03	5.49E-04	2.82E-03	0.0232	0.232	0.1	0.02	0.01	0.002	<1	<1	<1	<1
		Gamma-BHC	1.30E-06	1.40E-06	1.04E-03	1.50E-03	1.62E+00	1.68E-03	2.42E-03	7.56E-04	3.99E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.30E-06	1.40E-06	3.68E-03	7.40E-03	2.85E+00	1.05E-02	2.11E-02	4.69E-03	3.44E-02	0.211	2.11	0.2	0.02	0.02	0.002	<1	<1	<1	<1
		Heptachlor Epoxide	1.46E-06	3.70E-06	1.05E-03	1.50E-03	1.74E+00	1.83E-03	2.62E-03	8.23E-04	4.30E-03	0.211	2.11	0.02	0.004	0.002	0.0004	<1	<1	<1	<1
		Methoxychlor	1.30E-05	1.40E-05	1.05E-02	1.50E-02	2.13E-01	2.24E-03	3.20E-03	1.08E-03	5.79E-03	--	--	--	--	--	--	--	--	--	--
		Toxaphene	1.30E-04	1.40E-04	1.05E-01	1.50E-01	7.43E-02	7.80E-03	1.11E-02	4.26E-03	2.41E-02	0.0531	0.531	0.5	0.1	0.05	0.01	<1	<1	<1	<1
	Metals	Aluminum	1.12E-01	2.55E+01	7.36E+03	9.17E+03	1.54E-01	1.13E+03	1.41E+03	5.58E+02	2.66E+03	109.7	1097	**24**	**5**	**2**	0.5	**7**	**2**	<1	<1
		Antimony	1.50E-03	1.50E-03	5.10E+00	1.05E+01	1.54E-01	7.85E-01	1.62E+00	3.87E-01	3.04E+00	--	--	--	--	--	--	--	--	--	--
		Arsenic	2.36E-03	1.12E-02	1.19E+01	1.53E+01	3.86E-02	4.60E-01	5.91E-01	2.93E-01	1.58E+00	1.85	3.88	0.9	0.2	0.4	0.08	<1	<1	<1	<1
			6.32E-02	5.98E-01	1.17E+02	1.68E+02	1.46E-02	1.70E+00	2.45E+00	1.63E+00	1.09E+01	20.8	41.7	0.5	0.08	0.3	0.04	<1	<1	<1	<1
		Cadmium	4.69E-04	2.43E-02	6.77E+00	1.15E+01	1.32E+00	8.97E+00	1.52E+01	4.04E+00	2.51E+01	1.45	3.05	**17**	**3**	**8**	**1**	**14**	**2**	**7**	**1**
		Chromium	1.62E-03	3.26E-01	8.02E+01	1.30E+02	4.90E-02	3.93E+00	6.36E+00	2.34E+00	1.56E+01	1	5	**16**	**2**	**3**	0.5	**5**	1	<1	<1
		Copper	1.02E-02	4.28E-01	1.40E+02	2.08E+02	8.24E-02	1.15E+01	1.71E+01	6.17E+00	3.62E+01	22.3	31.5	**2**	0.3	**1**	0.2	**1**	<1	<1	<1
		Cyanide	2.37E-03	1.06E-02	7.30E-01	1.27E+00	1.54E-01	1.12E-01	1.95E-01	5.55E-02	3.70E-01	--	--	--	--	--	--	--	--	--	--
	Barium	Iron	9.26E-01	6.84E+01	1.85E+04	2.45E+04	1.54E-01	2.85E+03	3.77E+03	1.40E+03	7.11E+03	--	--	--	--	--	--	--	--	--	--
		Lead	3.05E-03	4.13E-01	1.65E+02	2.34E+02	1.29E-01	2.12E+01	3.01E+01	1.07E+01	5.83E+01	0.0114	0.114	**5114**	**936**	**511**	**94**	**1600**	**409**	**160**	**41**
		Manganese	1.30E-01	7.55E-01	4.57E+02	6.92E+02	7.13E-02	3.26E+01	4.93E+01	1.79E+01	1.08E+02	77.6	776	**1**	0.2	0.1	0.02	**1**	<1	<1	<1
		Nickel	3.94E-03	3.78E-02	2.54E+01	3.48E+01	1.69E-01	4.30E+00	5.90E+00	2.10E+00	1.10E+01	25.1	45.3	0.4	0.08	0.2	0.05	<1	<1	<1	<1
		Silver	7.92E-04	1.52E-02	2.73E+00	4.71E+00	3.27E-01	8.93E-01	1.54E+00	4.18E-01	2.69E+00	9.36	19.2	0.3	0.04	0.1	0.02	<1	<1	<1	<1
		Thallium	1.76E-03	2.00E-03	5.25E-01	1.50E+00	1.54E-01	8.08E-02	2.31E-01	3.99E-02	4.35E-01	--	--	--	--	--	--	--	--	--	--
		Vanadium	1.12E-03	7.38E-02	1.99E+01	2.59E+01	6.72E-03	1.34E-01	1.74E-01	2.07E-01	1.34E+00	11.4	22.8	0.1	0.02	0.1	0.01	<1	<1	<1	<1
		Zinc	2.16E-02	7.51E-01	2.52E+02	4.42E+02	1.37E+01	3.45E+03	6.05E+03	1.54E+03	9.81E+03	14.5	131	**677**	**106**	**75**	**12**	**598**	**89**	**66**	**10**

es:
= BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
OC = volatile organic compound
VOC = semivolatile organic compound
CBs = polychlorinated biphenyls
CL = Upper Confidence Limit
soilAF = Biota-Soil Accumulation Factor
TE = central tendency exposure
R = residual risk

RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-18c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - UNNAMED ISLAND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Island	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	4.86E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.34E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	5.55E-03	4.40E-02	0.00E+00	0.00E+00	0.00E+00	2.16E-04	2.30E-03	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	2.11E-04	8.07E-04	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	2.11E-04	8.07E-04	--	--	--	--	--	--	--	--	--	--
		Acetone	2.63E-03	5.50E-03	9.26E-03	2.70E-02	0.00E+00	0.00E+00	0.00E+00	2.53E-04	2.24E-03	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	4.89E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.36E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.55E-04	4.40E-04	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.43E-05	3.75E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.39E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	4.94E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.40E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.39E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	2.89E-04	7.00E-04	5.91E-03	1.25E-02	0.00E+00	0.00E+00	0.00E+00	6.39E-05	6.51E-04	--	--	--	--	--	--	--	--	--	--
		Tetrachloroethene	2.50E-04	2.50E-04	5.03E-03	2.50E-02	0.00E+00	0.00E+00	0.00E+00	5.47E-05	1.06E-03	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.39E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	5.13E-03	1.50E-02	0.00E+00	0.00E+00	0.00E+00	5.54E-05	6.58E-04	22.8	45.6	0.00003	0.000002	0.00001	0.000001	<1	<1	<1	<1
Island	SVOCs	2-Methylnaphthalene	5.00E-05	5.00E-05	1.61E-01	1.73E-01	3.54E-01	5.69E-02	6.12E-02	2.65E-02	1.06E-01	2.86	28.6	0.04	0.01	0.004	0.001	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.92E-01	2.55E-01	4.73E+00	9.08E-01	1.21E+00	4.05E-01	1.96E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.92E-01	2.55E-01	4.81E-02	9.23E-03	1.23E-02	5.70E-03	3.07E-02	1	10	0.03	0.01	0.003	0.001	<1	<1	<1	<1
		4-Methylphenol	2.50E-03	2.50E-03	1.82E-01	2.55E-01	3.07E-01	5.60E-02	7.84E-02	2.64E-02	1.38E-01	0.96	9.6	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		4-Nitroaniline	1.00E-02	1.00E-02	4.86E-01	6.50E-01	5.24E-01	2.55E-01	3.41E-01	1.18E-01	5.80E-01	0.75	7.5	0.8	0.2	0.1	0.02	<1	<1	<1	<1
		Acenaphthene	5.00E-05	5.00E-05	1.78E-01	2.90E-01	--	--	--	--	--	1.11	11.1	--	--	--	--	--	--	--	--
		Acenaphthylene	5.00E-05	5.00E-05	1.12E-01	1.27E-01	3.66E+00	4.10E-01	4.65E-01	1.83E-01	7.59E-01	1.11	11.1	0.7	0.2	0.07	0.02	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.90E-01	8.60E-01	2.37E+00	4.50E-01	2.04E+00	2.02E-01	3.34E+00	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.00E-05	5.00E-05	1.94E-01	3.78E-01	3.87E-01	7.51E-02	1.46E-01	3.49E-02	2.52E-01	1.11	11.1	0.2	0.03	0.02	0.003	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.49E-01	1.63E-01	5.70E-01	8.50E-02	9.30E-02	3.91E-02	1.58E-01	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.68E-05	1.40E-04	5.98E-01	1.39E+00	2.54E-01	1.52E-01	3.54E-01	7.21E-02	6.29E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	6.01E-05	1.50E-04	6.02E-01	1.29E+00	2.13E-01	1.28E-01	2.75E-01	6.15E-02	4.97E-01	10	20	0.05	0.01	0.02	0.003	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.57E-05	2.50E-04	8.01E-01	2.11E+00	4.16E-01	3.33E-01	8.78E-01	1.54E-01	1.51E+00	2	20	0.8	0.08	0.08	0.01	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.27E-05	1.10E-04	4.15E-01	9.34E-01	4.70E-01	1.95E-01	4.39E-01	8.99E-02	7.49E-01	2	20	0.4	0.04	0.04	0.004	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	2.95E-01	6.98E-01	4.16E-01	1.23E-01	2.90E-01	5.68E-02	4.99E-01	2	20	0.2	0.03	0.02	0.003	<1	<1	<1	<1
		bis(2-Ethylhexyl)phthalate	2.37E-03	2.50E-03	1.03E+00	3.94E+01	1.29E+02	1.33E+02	5.10E+03	5.93E+01	8.26E+03	1.1	3.51	**7511**	**54**	**2354**	**17**	**7465**	**43**	**2340**	**14**
		Butyl benzyl phthalate	2.50E-03	2.50E-03	1.65E-01	1.74E-01	2.60E-01	4.29E-02	4.53E-02	2.05E-02	8.09E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.53E-01	2.41E-01	2.71E+00	4.14E-01	6.52E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.76E-05	1.60E-04	6.46E-01	2.01E+00	3.66E-01	2.37E-01	7.36E-01	1.10E-01	1.27E+00	2	20	0.6	0.06	0.06	0.01	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	4.73E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.24E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	1.60E-01	2.52E-01	3.70E-01	5.91E-02	9.31E-02	2.75E-02	1.61E-01	--	--	--	--	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.68E-01	2.37E-01	9.14E-01	1.54E-01	2.17E-01	6.98E-02	3.61E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	3.73E-01	3.11E+00	1.83E+01	6.81E+00	5.68E+01	3.03E+00	9.22E+01	0.111	1.11	**830**	**27**	**83**	**3**	**766**	**12**	**77**	**1**
		Fluoranthene	6.10E-05	2.20E-04	8.91E-01	2.30E+00	4.86E-01	4.33E-01	1.12E+00	1.99E-01	1.91E+00	2	20	0.95	0.1	0.1	0.01	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	1.92E-01	2.55E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.92E-01	2.55E-01	1.03E-01	1.98E-02	2.62E-02	1.04E-02	5.33E-02	--	--	--	--	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	5.27E-05	1.10E-04	3.35E-01	7.71E-01	4.58E-01	1.53E-01	3.53E-01	7.07E-02	6.03E-01	2	20	0.3	0.04	0.03	0.004	<1	<1	<1	<1
		Isophorone	2.50E-03	2.50E-03	1.92E-01	2.55E-01	1.51E-01	2.89E-02	3.84E-02	1.45E-02	7.30E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.47E-05	1.90E-04	1.56E-01	2.50E-01	7.04E-01	1.10E-01	1.76E-01	5.00E-02	2.95E-01	2.86	28.6	0.1	0.02	0.01	0.002	<1	<1	<1	<1
		Phenanthrene	7.30E-05	1.58E-04	5.93E-01	2.35E+00	2.75E-01	1.63E-01	6.47E-01	7.70E-02	1.14E+00	1.11	11.1	**1**	0.1	0.1	0.01	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.65E-01	2.55E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	6.99E-05	3.80E-04	1.23E+00	3.59E+00	2.80E-01	3.44E-01	1.01E+00	1.62E-01	1.77E+00	2	20	0.9	0.1	0.1	0.01	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-18c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - UNNAMED ISLAND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.78E-06	1.20E-05	3.21E-03	9.28E-03	5.11E-01	1.64E-03	4.74E-03	7.54E-04	8.06E-03	0.0028	0.028	**3**	0.27	0	0.03	<1	<1	<1	<1
		4,4'-DDE	2.50E-06	2.50E-06	4.02E-03	1.35E-02	1.90E+00	7.66E-03	2.57E-02	3.44E-03	4.22E-02	0.0028	0.028	**15**	**1**	**2**	0.1	**8**	<1	<1	<1
			2.73E-06	9.20E-06	3.21E-03	6.67E-03	1.34E+00	4.30E-03	8.93E-03	1.94E-03	1.47E-02	0.0028	0.028	**5**	0.7	0.5	0.07	<1	<1	<1	<1
		alpha-Chlordane	1.33E-06	3.30E-06	1.60E-03	3.55E-03	2.85E+00	4.56E-03	1.01E-02	2.04E-03	1.65E-02	0.211	2.11	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		Dieldrin	2.50E-06	2.50E-06	2.79E-02	2.95E-01	1.56E+00	4.34E-02	4.59E-01	1.95E-02	7.56E-01	0.077	0.37	**10**	0.3	**2**	0.05	**9**	<1	**2**	<1
		Endosulfan II	2.50E-06	2.50E-06	2.03E-03	6.10E-03	7.98E-01	1.62E-03	4.87E-03	7.36E-04	8.13E-03	0.31	3.1	0.03	0.002	0.003	0.0002	<1	<1	<1	<1
		Endosulfan Sulfate	2.50E-06	2.50E-06	3.39E-03	4.86E-03	7.98E-01	2.71E-03	3.88E-03	1.23E-03	6.48E-03	0.31	3.1	0.02	0.004	0.002	0.0004	<1	<1	<1	<1
	4,4'-DDT	Endrin Aldehyde	2.50E-06	2.50E-06	2.75E-03	7.62E-03	5.76E-01	1.58E-03	4.39E-03	7.25E-04	7.42E-03	0.0232	0.232	0.3	0.03	0.03	0.003	<1	<1	<1	<1
		Endrin Ketone	2.50E-06	2.50E-06	2.11E-03	1.40E-02	5.76E-01	1.22E-03	8.06E-03	5.57E-04	1.36E-02	0.0232	0.232	0.6	0.02	0.06	0.002	<1	<1	<1	<1
		Gamma-BHC	1.36E-06	4.30E-06	9.97E-04	1.35E-03	1.62E+00	1.61E-03	2.18E-03	7.24E-04	3.59E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.64E-06	9.40E-06	1.51E-03	1.80E-02	2.85E+00	4.30E-03	5.13E-02	1.92E-03	8.38E-02	0.211	2.11	0.4	0.01	0.04	0.001	<1	<1	<1	<1
		Heptachlor Epoxide	1.37E-06	5.10E-06	1.11E-03	1.30E-02	1.74E+00	1.94E-03	2.27E-02	8.70E-04	3.73E-02	0.211	2.11	0.2	0.004	0.02	0.0004	<1	<1	<1	<1
		Methoxychlor	1.25E-05	1.25E-05	1.08E-02	2.80E-02	2.13E-01	2.30E-03	5.97E-03	1.11E-03	1.08E-02	--	--	--	--	--	--	--	--	--	--
		Toxaphene	1.25E-04	1.25E-04	9.97E-02	1.35E-01	7.43E-02	7.41E-03	1.00E-02	4.04E-03	2.17E-02	0.0531	0.531	0.4	0.08	0.04	0.01	<1	<1	<1	<1
	Metals	Aluminum	1.02E-01	3.26E+00	5.34E+03	6.00E+03	1.54E-01	8.22E+02	9.23E+02	4.05E+02	1.74E+03	109.7	1097	**16**	**4**	**2**	0.4	<1	<1	<1	<1
		Antimony	1.50E-03	1.50E-03	3.31E+00	1.57E+01	1.54E-01	5.09E-01	2.42E+00	2.51E-01	4.55E+00	--	--	--	--	--	--	--	--	--	--
		Arsenic	1.77E-03	3.20E-03	6.46E+00	1.11E+01	3.86E-02	2.50E-01	4.29E-01	1.59E-01	1.14E+00	1.85	3.88	0.6	0.09	0.3	0.04	<1	<1	<1	<1
		Barium	4.91E-02	2.75E-01	5.10E+01	1.67E+02	1.46E-02	7.43E-01	2.43E+00	7.11E-01	1.07E+01	20.8	41.7	0.5	0.03	0.3	0.02	<1	<1	<1	<1
		Cadmium	2.30E-04	1.42E-03	2.00E+00	4.61E+00	1.32E+00	2.65E+00	6.11E+00	1.19E+00	1.01E+01	1.45	3.05	**7**	0.8	**3**	0.4	**4**	<1	**2**	<1
		Chromium	7.64E-04	1.35E-02	7.18E+01	1.53E+02	4.90E-02	3.52E+00	7.49E+00	2.09E+00	1.83E+01	1	5	**18**	**2**	**4**	0.4	**8**	<1	**2**	<1
		Copper	5.71E-03	7.03E-02	8.98E+01	3.33E+02	8.24E-02	7.40E+00	2.74E+01	3.96E+00	5.79E+01	22.3	31.5	**3**	0.2	**2**	0.1	**2**	<1	**1**	<1
		Cyanide	1.91E-03	4.80E-03	3.94E-01	9.33E-01	1.54E-01	6.06E-02	1.44E-01	3.00E-02	2.71E-01	--	--	--	--	--	--	--	--	--	--
		Iron	2.59E+00	1.04E+01	1.20E+04	2.45E+04	1.54E-01	1.85E+03	3.77E+03	9.10E+02	7.10E+03	--	--	--	--	--	--	--	--	--	--
		Lead	3.11E-03	2.20E-02	1.20E+02	1.36E+03	1.29E-01	1.54E+01	1.75E+02	7.76E+00	3.38E+02	0.0114	0.114	**29678**	**680**	**2968**	**68**	**26165**	**154**	**2616**	**15**
		Manganese	4.30E-01	5.79E-01	1.72E+02	2.89E+02	7.13E-02	1.23E+01	2.06E+01	6.75E+00	4.51E+01	77.6	776	0.6	0.1	0.1	0.01	<1	<1	<1	<1
		Mercury	6.84E-05	7.50E-05	2.56E-01	5.45E-01	3.12E-01	7.99E-02	1.70E-01	3.74E-02	2.97E-01	0.0064	0.064	**46**	**6**	**5**	0.6	<1	<1	<1	<1
		Silver	9.58E-04	5.00E-03	2.09E+00	4.59E+00	3.27E-01	6.84E-01	1.50E+00	3.20E-01	2.62E+00	9.36	19.2	0.3	0.03	0.1	0.02	<1	<1	<1	<1
		Thallium	1.68E-03	2.00E-03	3.65E-01	1.20E+00	1.54E-01	5.62E-02	1.85E-01	2.78E-02	3.48E-01	--	--	--	--	--	--	--	--	--	--
		Vanadium	6.37E-04	2.54E-03	1.35E+01	1.66E+01	6.72E-03	9.07E-02	1.12E-01	1.40E-01	8.51E-01	11.4	22.8	0.07	0.01	0.04	0.01	<1	<1	<1	<1
		Zinc	2.18E-02	7.96E-02	1.05E+02	1.07E+03	1.37E+01	1.44E+03	1.46E+04	6.40E+02	2.38E+04	14.5	131	**1638**	**44**	**181**	**5**	**1559**	**27**	**173**	**3**

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RR = residual risk
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-18d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - NUNES PARCEL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
es	VOCs	2-Butanone	2.50E-03	2.50E-03	5.80E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	2.18E-04	2.67E-02	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	5.28E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	2.14E-04	2.67E-02	--	--	--	--	--	--	--	--	--	--
		Acetone	3.04E-03	1.20E-02	1.28E-02	6.50E-01	0.00E+00	0.00E+00	0.00E+00	3.07E-04	2.87E-02	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	5.75E-03	1.10E+00	0.00E+00	0.00E+00	0.00E+00	6.00E-05	4.44E-02	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	3.04E-04	4.35E-04	6.19E-03	3.60E-01	0.00E+00	0.00E+00	0.00E+00	6.70E-05	1.46E-02	--	--	--	--	--	--	--	--	--	--
		Tetrachloroethene	2.50E-04	2.50E-04	5.56E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	5.86E-05	2.63E-02	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.86E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	5.34E-05	2.63E-02	--	--	--	--	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	5.86E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	6.08E-05	2.63E-02	22.8	45.6	0.001	0.000003	0.001	0.000001	<1	<1	<1	<1
es	SVOCs	2-Methylnaphthalene	3.27E-05	5.00E-05	9.74E-02	1.10E-01	3.54E-01	3.45E-02	3.89E-02	1.61E-02	6.75E-02	2.86	28.6	0.02	0.006	0.002	0.001	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.74E-01	2.70E-01	4.73E+00	8.22E-01	1.28E+00	3.67E-01	2.08E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.33E-01	2.40E+00	4.81E-02	1.12E-02	1.15E-01	6.88E-03	2.84E-01	1	10	0.3	0.01	0.03	0.001	<1	<1	<1	<1
		4-Methylphenol	2.50E-03	2.50E-03	1.74E-01	2.70E-01	3.07E-01	5.35E-02	8.30E-02	2.53E-02	1.46E-01	0.96	9.6	0.2	0.03	0.02	0.003	<1	<1	<1	<1
		4-Nitroaniline	1.00E-02	1.00E-02	3.81E-01	7.00E-01	5.24E-01	2.00E-01	3.67E-01	9.23E-02	6.25E-01	0.75	7.5	0.8	0.1	0.1	0.01	<1	<1	<1	<1
		Acenaphthene	3.29E-05	5.00E-05	1.53E-01	3.44E-01	--	--	--	--	--	1.11	11.1	--	--	--	--	--	--	--	--
		Acenaphthylene	3.72E-05	5.00E-05	2.22E-01	3.51E-01	3.66E+00	8.13E-01	1.29E+00	3.64E-01	2.10E+00	1.11	11.1	**2**	0.3	0.2	0.03	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.74E-01	2.70E-01	2.37E+00	4.12E-01	6.40E-01	1.85E-01	1.05E+00	--	--	--	--	--	--	--	--	--	--
		Anthracene	3.92E-05	5.00E-05	3.72E-01	7.41E-01	3.87E-01	1.44E-01	2.87E-01	6.68E-02	4.95E-01	1.11	11.1	0.4	0.06	0.04	0.01	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.09E-01	7.86E-02	5.70E-01	6.22E-02	4.48E-02	2.86E-02	7.63E-02	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	4.57E-05	1.20E-04	1.15E+00	2.49E+00	2.54E-01	2.93E-01	6.33E-01	1.39E-01	1.13E+00	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	4.34E-05	5.00E-05	1.22E+00	2.58E+00	2.13E-01	2.60E-01	5.49E-01	1.25E-01	9.94E-01	10	20	0.1	0.01	0.05	0.01	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.59E-05	1.80E-04	1.74E+00	3.11E+00	4.16E-01	7.24E-01	1.29E+00	3.35E-01	2.22E+00	2	20	**1**	0.2	0.1	0.02	<1	<1	<1	<1
		Benzo(g,h,i)perylene	4.68E-05	1.00E-04	9.03E-01	1.55E+00	4.70E-01	4.25E-01	7.29E-01	1.96E-01	1.24E+00	2	20	0.6	0.1	0.1	0.01	<1	<1	<1	<1
		Benzo(k)fluoranthene	4.14E-05	1.00E-04	5.71E-01	1.56E+00	4.16E-01	2.38E-01	6.49E-01	1.10E-01	1.11E+00	2	20	0.6	0.1	0.06	0.01	<1	<1	<1	<1
		bis(2-Ethylhexyl)phthalate	2.50E-03	2.50E-03	6.81E-01	2.50E+00	1.29E+02	8.81E+01	3.24E+02	3.92E+01	5.24E+02	1.1	3.51	**477**	**36**	**149**	**11**	**431**	**25**	**135**	**8**
		Butyl benzyl phthalate	2.50E-03	2.50E-03	1.27E-01	1.78E-01	2.60E-01	3.30E-02	4.63E-02	1.58E-02	8.27E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	2.08E-01	4.57E-01	2.71E+00	5.63E-01	1.24E+00	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.41E-05	1.50E-04	1.37E+00	2.82E+00	3.66E-01	5.02E-01	1.03E+00	2.33E-01	1.79E+00	2	20	0.9	0.1	0.09	0.01	<1	<1	<1	<1
		Dibenz[a,h]anthracene	3.37E-05	5.00E-05	2.85E-01	4.81E-01	3.70E-01	1.05E-01	1.78E-01	4.90E-02	3.07E-01	--	--	--	--	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.16E-01	2.17E-01	9.14E-01	1.06E-01	1.98E-01	4.82E-02	3.31E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.64E-01	2.70E-01	1.83E+01	3.00E+00	4.93E+00	1.33E+00	8.00E+00	0.111	1.11	**72**	**12**	**7**	**1**	**8**	<1	<1	<1
		Fluoranthene	6.63E-05	2.40E-04	2.04E+00	5.27E+00	4.86E-01	9.92E-01	2.56E+00	4.57E-01	4.37E+00	2	20	**2**	0.2	0.2	0.02	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	1.74E-01	2.70E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.74E-01	2.70E-01	1.03E-01	1.79E-02	2.78E-02	9.43E-03	5.64E-02	--	--	--	--	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	4.18E-05	5.00E-05	8.16E-01	1.43E+00	4.58E-01	3.73E-01	6.54E-01	1.72E-01	1.12E+00	2	20	0.6	0.09	0.06	0.01	<1	<1	<1	<1
		Isophorone	2.50E-03	2.50E-03	1.66E-01	2.35E-01	1.51E-01	2.50E-02	3.54E-02	1.25E-02	6.74E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	3.72E-05	1.40E-04	1.21E-01	2.03E-01	7.04E-01	8.52E-02	1.43E-01	3.88E-02	2.40E-01	2.86	28.6	0.08	0.01	0.01	0.001	<1	<1	<1	<1
		Phenanthrene	5.95E-05	1.40E-04	1.25E+00	6.79E+00	2.75E-01	3.44E-01	1.87E+00	1.62E-01	3.30E+00	1.11	11.1	**3**	0.1	0.3	0.01	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.74E-01	2.70E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	6.98E-05	2.20E-04	2.10E+00	5.40E+00	2.80E-01	5.88E-01	1.51E+00	2.77E-01	2.67E+00	2	20	**1**	0.1	0.1	0.01	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-18d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - NUNES PARCEL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.07E-06	5.20E-06	6.75E-03	1.17E-02	5.11E-01	3.45E-03	5.98E-03	1.58E-03	1.02E-02	0.0028	0.028	**4**	0.6	0.4	0.06	**1**	<1	<1	<1
		4,4'-DDE	2.12E-06	2.80E-06	6.44E-03	1.02E-02	1.90E+00	1.23E-02	1.94E-02	5.51E-03	3.19E-02	0.0028	0.028	**11**	**2**	**1**	0.2	**5**	<1	<1	<1
			2.16E-06	2.80E-06	5.26E-03	8.70E-02	1.34E+00	7.04E-03	1.16E-01	3.17E-03	1.92E-01	0.0028	0.028	**69**	**1**	**7**	0.1	**61**	<1	**6**	<1
		alpha-Chlordane	1.11E-06	1.40E-06	7.35E-03	1.24E-02	2.85E+00	2.09E-02	3.53E-02	9.37E-03	5.77E-02	0.211	2.11	0.3	0.04	0.03	0.004	<1	<1	<1	<1
		Dieldrin	2.63E-06	1.20E-05	2.21E-02	1.34E-01	1.56E+00	3.44E-02	2.09E-01	1.55E-02	3.43E-01	0.077	0.37	**4**	0.2	0.9	0.04	**3**	<1	<1	<1
		Endosulfan I	1.11E-06	1.40E-06	1.05E-03	1.40E-03	7.98E-01	8.38E-04	1.12E-03	3.81E-04	1.87E-03	0.31	3.1	0.01	0.001	0.001	0.0001	<1	<1	<1	<1
		Endosulfan II	1.93E-06	2.80E-06	2.19E-03	6.80E-03	7.98E-01	1.75E-03	5.43E-03	7.94E-04	9.07E-03	0.31	3.1	0.03	0.003	0.003	0.0003	<1	<1	<1	<1
		Endosulfan Sulfate	1.93E-06	2.80E-06	3.46E-03	9.50E-03	7.98E-01	2.76E-03	7.58E-03	1.25E-03	1.27E-02	0.31	3.1	0.04	0.004	0.004	0.0004	<1	<1	<1	<1
	4,4'-DDT	Endrin	1.93E-06	2.80E-06	2.04E-03	2.70E-03	5.76E-01	1.18E-03	1.56E-03	5.38E-04	2.63E-03	0.01	0.1	0.3	0.05	0.03	0.01	<1	<1	<1	<1
		Endrin Aldehyde	1.93E-06	2.80E-06	2.46E-03	1.00E-02	5.76E-01	1.42E-03	5.76E-03	6.49E-04	9.74E-03	0.0232	0.232	0.4	0.03	0.04	0.003	<1	<1	<1	<1
		Endrin Ketone	2.10E-06	6.00E-06	2.45E-03	1.00E-02	5.76E-01	1.41E-03	5.76E-03	6.46E-04	9.74E-03	0.0232	0.232	0.4	0.03	0.04	0.003	<1	<1	<1	<1
		Gamma-BHC	1.11E-06	1.40E-06	1.05E-03	1.40E-03	1.62E+00	1.70E-03	2.26E-03	7.63E-04	3.72E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.09E-06	1.40E-06	7.34E-03	1.10E-02	2.85E+00	2.09E-02	3.13E-02	9.36E-03	5.12E-02	0.211	2.11	0.2	0.04	0.02	0.004	<1	<1	<1	<1
		Heptachlor Epoxide	1.08E-06	1.40E-06	1.05E-03	1.40E-03	1.74E+00	1.83E-03	2.44E-03	8.23E-04	4.01E-03	0.211	2.11	0.02	0.004	0.002	0.0004	<1	<1	<1	<1
		Methoxychlor	6.98E-06	1.40E-05	1.06E-02	1.40E-02	2.13E-01	2.26E-03	2.99E-03	1.09E-03	5.41E-03	--	--	--	--	--	--	--	--	--	--
		Toxaphene	1.11E-04	1.40E-04	1.05E-01	1.40E-01	7.43E-02	7.80E-03	1.04E-02	4.26E-03	2.25E-02	0.0531	0.531	0.4	0.1	0.04	0.01	<1	<1	<1	<1
	Metals	Aluminum	1.30E-01	2.40E-01	7.94E+03	1.06E+04	1.54E-01	1.22E+03	1.63E+03	6.02E+02	3.07E+03	109.7	1097	**28**	**5**	**3**	0.5	**11**	**2**	**1**	<1
		Antimony	1.05E-03	1.50E-03	1.88E+00	8.00E+00	1.54E-01	2.89E-01	1.23E+00	1.43E-01	2.32E+00	--	--	--	--	--	--	--	--	--	--
		Arsenic	2.31E-03	3.07E-03	1.15E+01	1.66E+01	3.86E-02	4.44E-01	6.41E-01	2.83E-01	1.71E+00	1.85	3.88	0.9	0.2	0.4	0.1	<1	<1	<1	<1
			4.62E-02	1.00E-01	1.17E+02	2.76E+02	1.46E-02	1.70E+00	4.02E+00	1.63E+00	1.77E+01	20.8	41.7	0.8	0.08	0.4	0.04	<1	<1	<1	<1
		Cadmium	3.28E-04	5.12E-04	3.47E+00	1.14E+01	1.32E+00	4.60E+00	1.51E+01	2.07E+00	2.49E+01	1.45	3.05	**17**	**1**	**8**	0.7	**14**	<1	**7**	<1
		Chromium	1.08E-03	2.87E-03	8.34E+01	2.22E+02	4.90E-02	4.08E+00	1.09E+01	2.43E+00	2.66E+01	1	5	**27**	**2**	**5**	0.5	**16**	<1	**3**	<1
		Cobalt	4.62E-04	9.21E-04	7.16E+00	1.15E+01	1.95E-02	1.40E-01	2.24E-01	1.15E-01	8.28E-01	--	--	--	--	--	--	--	--	--	--
		Copper	7.94E-03	1.25E-02	1.45E+02	3.35E+02	8.24E-02	1.19E+01	2.76E+01	6.39E+00	5.82E+01	22.3	31.5	**3**	0.3	**2**	0.2	**2**	<1	**1**	<1
		Cyanide	2.10E-03	5.00E-03	5.50E-01	2.03E+00	1.54E-01	8.46E-02	3.12E-01	4.19E-02	5.89E-01	--	--	--	--	--	--	--	--	--	--
	Barium	Iron	8.97E-01	7.92E+00	1.81E+04	2.46E+04	1.54E-01	2.78E+03	3.78E+03	1.37E+03	7.13E+03	--	--	--	--	--	--	--	--	--	--
		Lead	3.16E-03	5.98E-03	2.36E+02	8.28E+02	1.29E-01	3.04E+01	1.07E+02	1.53E+01	2.06E+02	0.0114	0.114	**18069**	**1338**	**1807**	**134**	**14555**	**812**	**1456**	**81**
		Manganese	1.39E-01	4.42E-01	4.28E+02	9.52E+02	7.13E-02	3.05E+01	6.78E+01	1.67E+01	1.48E+02	77.6	776	**2**	0.2	0.2	0.02	**2**	<1	<1	<1
		Mercury	5.10E-05	7.50E-05	3.47E-01	6.21E-01	3.12E-01	1.08E-01	1.94E-01	5.07E-02	3.39E-01	0.0064	0.064	**53**	**8**	**5**	0.8	<1	<1	<1	<1
		Nickel	2.82E-03	3.63E-03	2.05E+01	3.43E+01	1.69E-01	3.47E+00	5.81E+00	1.70E+00	1.08E+01	25.1	45.3	0.4	0.1	0.2	0.04	<1	<1	<1	<1
		Selenium	1.03E-03	1.50E-03	4.71E-01	9.95E-01	1.48E-01	6.99E-02	1.48E-01	3.47E-02	2.80E-01	--	--	--	--	--	--	--	--	--	--
		Silver	3.17E-04	1.00E-03	1.08E+00	2.34E+00	3.27E-01	3.53E-01	7.66E-01	1.65E-01	1.33E+00	9.36	19.2	0.1	0.02	0.07	0.01	<1	<1	<1	<1
		Thallium	8.77E-04	2.00E-03	8.53E-01	1.91E+00	1.54E-01	1.31E-01	2.94E-01	6.48E-02	5.53E-01	--	--	--	--	--	--	--	--	--	--
		Vanadium	1.26E-03	2.20E-03	1.97E+01	2.80E+01	6.72E-03	1.32E-01	1.88E-01	2.05E-01	1.43E+00	11.4	22.8	0.1	0.02	0.06	0.01	<1	<1	<1	<1
		Zinc	1.23E-02	3.87E-02	2.16E+02	3.72E+02	1.37E+01	2.95E+03	5.09E+03	1.32E+03	8.26E+03	14.5	131	**570**	**91**	**63**	**10**	**490**	**74**	**54**	**8**

es:
= BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
OC = volatile organic compound
VOC = semivolatile organic compound
CB = polychlorinated biphenyl
CL = Upper Confidence Limit
soilAF = Biota-Soil Accumulation Factor
TE = central tendency exposure
R = residual risk

RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-18e
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - QUINNVILLE WELL FIELD

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Well Field	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.50E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	2.42E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	1.93E-04	8.07E-04	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	1.93E-04	8.07E-04	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	1.93E-04	8.07E-04	--	--	--	--	--	--	--	--	--	--
		Acetone	3.70E-03	1.20E-02	1.13E-02	4.76E-02	0.00E+00	0.00E+00	0.00E+00	3.42E-04	4.44E-03	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.50E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.68E-04	3.30E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.63E-05	3.52E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.50E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.50E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.50E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	2.98E-04	4.15E-04	4.03E-03	1.35E-02	0.00E+00	0.00E+00	0.00E+00	5.06E-05	6.32E-04	--	--	--	--	--	--	--	--	--	--
		Tetrachloroethene	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.50E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.50E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	4.21E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	4.86E-05	3.35E-04	22.8	45.6	0.00001	0.000002	0.000007	0.000001	<1	<1	<1	<1
Well Fields	SVOCs	2-Methylnaphthalene	5.00E-05	5.00E-05	9.49E-02	2.25E-01	3.54E-01	3.36E-02	7.96E-02	1.56E-02	1.38E-01	2.86	28.6	0.05	0.01	0.005	0.001	<1	<1	<1	<1
		2-Methylphenol	2.50E-03	2.50E-03	1.39E-01	2.35E-01	2.27E+00	3.16E-01	5.34E-01	1.42E-01	8.75E-01	0.96	9.6	0.9	0.1	0.09	0.01	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.39E-01	2.35E-01	4.73E+00	6.57E-01	1.11E+00	2.94E-01	1.81E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.39E-01	2.35E-01	4.81E-02	6.68E-03	1.13E-02	4.18E-03	2.83E-02	1	10	0.03	0.004	0.003	0.0004	<1	<1	<1	<1
		4-Methylphenol	2.50E-03	2.50E-03	1.39E-01	2.35E-01	3.07E-01	4.27E-02	7.23E-02	2.02E-02	1.27E-01	0.96	9.6	0.1	0.02	0.01	0.002	<1	<1	<1	<1
		4-Nitroaniline	1.00E-02	1.00E-02	2.14E-01	6.00E-01	5.24E-01	1.12E-01	3.14E-01	5.22E-02	5.36E-01	0.75	7.5	0.7	0.1	0.07	0.007	<1	<1	<1	<1
		Acenaphthene	5.00E-05	5.00E-05	5.55E-02	9.25E-02	--	--	--	--	--	1.11	11.1	--	--	--	--	--	--	--	--
		Acenaphthylene	5.00E-05	5.00E-05	1.34E-01	6.11E-01	3.66E+00	4.91E-01	2.24E+00	2.19E-01	3.65E+00	1.11	11.1	**3**	0.2	0.3	0.02	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.36E-01	2.35E-01	2.37E+00	3.22E-01	5.57E-01	1.45E-01	9.12E-01	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.00E-05	5.00E-05	1.57E-01	6.42E-01	3.87E-01	6.08E-02	2.49E-01	2.82E-02	4.29E-01	1.11	11.1	0.4	0.03	0.04	0.003	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	5.42E-01	2.13E+00	5.70E-01	3.09E-01	1.21E+00	1.42E-01	2.05E+00	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.00E-05	5.00E-05	5.42E-01	1.23E+00	2.54E-01	1.38E-01	3.13E-01	6.54E-02	5.57E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.00E-05	5.00E-05	5.61E-01	1.21E+00	2.13E-01	1.19E-01	2.57E-01	5.73E-02	4.66E-01	10	20	0.05	0.01	0.02	0.003	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.00E-05	5.00E-05	7.94E-01	1.76E+00	4.16E-01	3.30E-01	7.32E-01	1.53E-01	1.26E+00	2	20	0.6	0.1	0.1	0.01	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.00E-05	5.00E-05	4.32E-01	1.08E+00	4.70E-01	2.03E-01	5.08E-01	9.36E-02	8.67E-01	2	20	0.4	0.05	0.04	0.005	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	2.89E-01	6.65E-01	4.16E-01	1.20E-01	2.77E-01	5.56E-02	4.75E-01	2	20	0.2	0.03	0.02	0.003	<1	<1	<1	<1
		bis(2-Ethylhexyl)phthalate	2.50E-03	2.50E-03	2.18E-01	9.25E-01	1.29E+02	2.82E+01	1.20E+02	1.26E+01	1.94E+02	1.1	3.51	**176**	**11**	**55**	**4**	**131**	<1	**41**	<1
		Butyl benzyl phthalate	2.50E-03	2.50E-03	1.25E-01	2.10E-01	2.60E-01	3.25E-02	5.46E-02	1.56E-02	9.75E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.19E-01	1.47E-01	2.71E+00	3.22E-01	3.98E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.00E-05	5.00E-05	5.57E-01	1.21E+00	3.66E-01	2.04E-01	4.43E-01	9.49E-02	7.67E-01	2	20	0.4	0.05	0.04	0.005	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.50E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	8.94E-02	1.83E-01	3.70E-01	3.30E-02	6.76E-02	1.54E-02	1.17E-01	--	--	--	--	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.27E-01	2.35E-01	9.14E-01	1.16E-01	2.15E-01	5.28E-02	3.58E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.33E-01	5.40E-01	1.83E+01	4.26E+00	9.86E+00	1.90E+00	1.60E+01	0.111	1.11	**144**	**17**	**14**	**2**	**80**	**2**	**8**	<1
		Fluoranthene	5.00E-05	5.00E-05	8.88E-01	2.39E+00	4.86E-01	4.32E-01	1.16E+00	1.99E-01	1.98E+00	2	20	0.99	0.1	0.1	0.01	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	1.39E-01	2.35E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.39E-01	2.35E-01	1.03E-01	1.43E-02	2.42E-02	7.57E-03	4.92E-02	--	--	--	--	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	5.00E-05	5.00E-05	3.81E-01	1.02E+00	4.58E-01	1.74E-01	4.67E-01	8.04E-02	7.97E-01	2	20	0.4	0.04	0.04	0.004	<1	<1	<1	<1
		Isophorone	2.50E-03	2.50E-03	1.39E-01	2.35E-01	1.51E-01	2.09E-02	3.54E-02	1.05E-02	6.74E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.00E-05	5.00E-05	9.87E-02	5.44E-01	7.04E-01	6.95E-02	3.83E-01	3.17E-02	6.42E-01	2.86	28.6	0.2	0.01	0.02	0.001	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.39E-01	2.35E-01	4.40E-01	6.12E-02	1.04E-01	2.84E-02	1.78E-01	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	5.52E-01	8.50E-01	4.10E+01	2.26E+01	3.48E+01	1.01E+01	5.65E+01	--	--	--	--	--	--	--	--	--	--
		Phenanthrene	5.00E-05	5.00E-05	5.03E-01	1.17E+00	2.75E-01	1.38E-01	3.22E-01	6.53E-02	5.69E-01	1.11	11.1	0.5	0.1	0.1	0.01	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.39E-01	2.35E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.00E-05	5.00E-05	1.02E+00	2.11E+00	2.80E-01	2.86E-01	5.91E-01	1.35E-01	1.04E+00	2	20	0.5	0.07	0.05	0.01	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-18e
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - QUINNVILLE WELL FIELD

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.65E-06	2.80E-06	3.78E-03	1.50E-02	5.11E-01	1.93E-03	7.66E-03	8.88E-04	1.30E-02	0.0028	0.028	**5**	0.3	0.5	0.03	**2**	<1	<1	<1
		4,4'-DDE	2.65E-06	2.80E-06	8.36E-03	2.86E-02	1.90E+00	1.59E-02	5.45E-02	7.15E-03	8.94E-02	0.0028	0.028	**32**	**3**	**3**	0.3	**25**	<1	**3**	<1
			2.65E-06	2.80E-06	1.26E-02	2.66E-02	1.34E+00	1.69E-02	3.56E-02	7.60E-03	5.88E-02	0.0028	0.028	**21**	**3**	**2**	0.3	**13**	**2**	**1**	<1
		alpha-Chlordane	1.32E-06	1.40E-06	3.55E-03	9.76E-03	2.85E+00	1.01E-02	2.78E-02	4.53E-03	4.54E-02	0.211	2.11	0.2	0.02	0.02	0.002	<1	<1	<1	<1
		Dieldrin	2.65E-06	2.80E-06	5.22E-02	4.52E-01	1.56E+00	8.13E-02	7.04E-01	3.66E-02	1.16E+00	0.077	0.37	**15**	0.5	**3**	0.1	**14**	<1	**3**	<1
		Endosulfan I	1.32E-06	1.40E-06	7.65E-04	4.20E-03	7.98E-01	6.11E-04	3.35E-03	2.77E-04	5.60E-03	0.31	3.1	0.02	0.001	0.002	0.0001	<1	<1	<1	<1
		Endosulfan II	2.65E-06	2.80E-06	2.41E-03	7.46E-03	7.98E-01	1.92E-03	5.95E-03	8.74E-04	9.95E-03	0.31	3.1	0.03	0.003	0.003	0.0003	<1	<1	<1	<1
	4,4'-DDT	Endosulfan Sulfate	2.65E-06	2.80E-06	3.03E-03	3.39E-03	7.98E-01	2.42E-03	2.71E-03	1.10E-03	4.52E-03	0.31	3.1	0.01	0.004	0.001	0.0004	<1	<1	<1	<1
		Endrin	2.65E-06	2.80E-06	1.35E-03	5.50E-03	5.76E-01	7.78E-04	3.17E-03	3.56E-04	5.35E-03	0.01	0.1	0.5	0.04	0.05	0.004	<1	<1	<1	<1
		Endrin Aldehyde	2.65E-06	2.80E-06	1.72E-03	2.10E-02	5.76E-01	9.91E-04	1.21E-02	4.54E-04	2.04E-02	0.0232	0.232	0.9	0.02	0.09	0.002	<1	<1	<1	<1
		Endrin Ketone	2.65E-06	2.80E-06	1.52E-03	6.50E-03	5.76E-01	8.76E-04	3.74E-03	4.01E-04	6.33E-03	0.0232	0.232	0.3	0.02	0.03	0.002	<1	<1	<1	<1
		Gamma-BHC	1.32E-06	1.40E-06	7.13E-04	1.20E-03	1.62E+00	1.15E-03	1.94E-03	5.18E-04	3.19E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.32E-06	1.40E-06	2.89E-03	8.10E-03	2.85E+00	8.23E-03	2.31E-02	3.68E-03	3.77E-02	0.211	2.11	0.2	0.02	0.02	0.002	<1	<1	<1	<1
		Heptachlor Epoxide	1.72E-06	2.90E-06	1.12E-03	6.50E-03	1.74E+00	1.95E-03	1.13E-02	8.78E-04	1.86E-02	0.211	2.11	0.1	0.004	0.01	0.0004	<1	<1	<1	<1
		Methoxychlor	1.32E-05	1.40E-05	3.50E-03	1.20E-02	2.13E-01	7.47E-04	2.56E-03	3.59E-04	4.64E-03	--	--	--	--	--	--	--	--	--	--
		Toxaphene	1.32E-04	1.40E-04	7.13E-02	1.20E-01	7.43E-02	5.30E-03	8.92E-03	2.89E-03	1.93E-02	0.0531	0.531	0.4	0.1	0.04	0.01	<1	<1	<1	<1
	Metals	Aluminum	8.00E-02	1.00E-01	6.44E+03	7.74E+03	1.54E-01	9.91E+02	1.19E+03	4.88E+02	2.24E+03	109.7	1097	**20**	**4**	**2**	0.4	**4**	**1**	<1	<1
		Antimony	1.50E-03	1.50E-03	1.13E+00	1.12E+00	1.54E-01	1.74E-01	1.72E-01	8.58E-02	3.25E-01	--	--	--	--	--	--	--	--	--	--
		Arsenic	2.19E-03	4.04E-03	7.12E+00	1.18E+01	3.86E-02	2.75E-01	4.56E-01	1.75E-01	1.22E+00	1.85	3.88	0.7	0.09	0.3	0.05	<1	<1	<1	<1
			6.18E-02	1.00E-01	4.71E+01	7.34E+01	1.46E-02	6.86E-01	1.07E+00	6.57E-01	4.71E+00	20.8	41.7	0.2	0.03	0.1	0.02	<1	<1	<1	<1
		Cadmium	2.20E-04	3.10E-04	1.62E+00	3.84E+00	1.32E+00	2.15E+00	5.09E+00	9.67E-01	8.40E+00	1.45	3.05	**6**	0.7	**3**	0.3	**3**	<1	**1**	<1
		Chromium	5.06E-04	1.00E-03	7.40E+01	2.23E+02	4.90E-02	3.62E+00	1.09E+01	2.16E+00	2.67E+01	1	5	**27**	**2**	**5**	0.4	**16**	<1	**3**	<1
		Copper	8.23E-03	1.25E-02	7.62E+01	1.34E+02	8.24E-02	6.28E+00	1.10E+01	3.36E+00	2.33E+01	22.3	31.5	**1**	0.2	0.7	0.1	<1	<1	<1	<1
		Cyanide	2.43E-03	5.00E-03	3.68E-01	8.53E-01	1.54E-01	5.66E-02	1.31E-01	2.81E-02	2.48E-01	--	--	--	--	--	--	--	--	--	--
	Barium	Iron	5.38E-01	1.25E+00	1.21E+04	1.59E+04	1.54E-01	1.86E+03	2.45E+03	9.18E+02	4.60E+03	--	--	--	--	--	--	--	--	--	--
		Lead	2.01E-03	3.40E-03	9.62E+01	2.07E+02	1.29E-01	1.24E+01	2.66E+01	6.22E+00	5.15E+01	0.0114	0.114	**4517**	**546**	**452**	**55**	**1004**	**19**	**100**	**2**
		Manganese	1.52E-01	6.22E-01	2.11E+02	4.68E+02	7.13E-02	1.50E+01	3.33E+01	8.26E+00	7.30E+01	77.6	776	0.9	0.1	0.09	0.01	<1	<1	<1	<1
		Mercury	7.12E-05	7.50E-05	2.74E-01	7.87E-01	3.12E-01	8.55E-02	2.46E-01	4.01E-02	4.30E-01	0.0064	0.064	**67**	**6**	**7**	0.6	**7**	<1	<1	<1
		Selenium	1.50E-03	1.50E-03	3.79E-01	8.62E-01	1.48E-01	5.63E-02	1.28E-01	2.79E-02	2.42E-01	--	--	--	--	--	--	--	--	--	--
		Silver	4.05E-04	1.00E-03	1.30E+00	6.28E+00	3.27E-01	4.25E-01	2.05E+00	1.99E-01	3.58E+00	9.36	19.2	0.4	0.02	0.2	0.01	<1	<1	<1	<1
		Vanadium	1.67E-03	2.50E-02	1.85E+01	2.53E+01	6.72E-03	1.24E-01	1.70E-01	1.92E-01	1.30E+00	11.4	22.8	0.1	0.02	0.06	0.01	<1	<1	<1	<1
		Zinc	6.22E-03	1.00E-02	7.46E+01	1.19E+02	1.37E+01	1.02E+03	1.63E+03	4.55E+02	2.64E+03	14.5	131	**182**	**31**	**20**	**3**	**103**	**14**	**11**	**2**

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compounds
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RR = residual risk
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-18f
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - WETLANDS A THROUGH D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Wetlands A-D	VOCs	Acetone	2.50E-03	2.50E-03	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	2.09E-04	8.07E-04	--	--	--	--	--	--	--	--	--	--
		Chloromethane	3.17E-04	4.61E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.66E-05	3.79E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.19E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	4.66E-03	7.00E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Cyclohexane	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.19E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.19E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Methyl acetate	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.19E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	4.66E-03	7.00E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	4.66E-03	7.00E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.19E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
Wetlands A-D	SVOCs	2-Methylphenol	2.50E-03	2.50E-03	1.88E-01	2.00E-01	2.27E+00	4.27E-01	4.54E-01	1.92E-01	7.45E-01	0.96	9.6	0.8	0.2	0.1	0.02	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.88E-01	2.00E-01	4.73E+00	8.89E-01	9.45E-01	3.97E-01	1.54E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.88E-01	2.00E-01	4.81E-02	9.04E-03	9.62E-03	5.59E-03	2.42E-02	1	10	0.02	0.01	0.002	0.001	<1	<1	<1	<1
		4-Methylphenol	2.50E-03	2.50E-03	1.88E-01	2.00E-01	3.07E-01	5.78E-02	6.15E-02	2.73E-02	1.08E-01	0.96	9.6	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		4-Nitroaniline	1.00E-02	1.00E-02	4.71E-01	5.00E-01	5.24E-01	2.47E-01	2.62E-01	1.14E-01	4.47E-01	0.75	7.5	0.6	0.2	0.06	0.02	<1	<1	<1	<1
		Acenaphthene	5.00E-05	5.00E-05	1.88E-01	2.00E-01	--	--	--	--	--	1.11	11.1	--	--	--	--	--	--	--	--
		Acenaphthylene	5.00E-05	5.00E-05	1.88E-01	2.00E-01	3.66E+00	6.89E-01	7.33E-01	3.08E-01	1.20E+00	1.11	11.1	**1**	0.3	0.1	0.03	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.88E-01	2.00E-01	2.37E+00	4.45E-01	4.74E-01	2.00E-01	7.76E-01	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.41E-05	1.90E-04	1.88E-01	2.00E-01	3.87E-01	7.28E-02	7.74E-02	3.38E-02	1.34E-01	1.11	11.1	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.88E-01	2.00E-01	5.70E-01	1.07E-01	1.14E-01	4.93E-02	1.93E-01	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.00E-05	5.00E-05	9.40E-02	1.70E-01	2.54E-01	2.39E-02	4.32E-02	1.13E-02	7.69E-02	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.00E-05	5.00E-05	9.96E-02	1.70E-01	2.13E-01	2.12E-02	3.62E-02	1.02E-02	6.55E-02	10	20	0.007	0.001	0.003	0.001	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.21E-05	1.00E-04	7.71E-02	1.30E-01	4.16E-01	3.21E-02	5.41E-02	1.48E-02	9.29E-02	2	20	0.05	0.01	0.005	0.001	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.00E-05	5.00E-05	7.60E-02	1.70E-01	4.70E-01	3.58E-02	8.00E-02	1.65E-02	1.36E-01	2	20	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	1.00E-01	1.90E-01	4.16E-01	4.16E-02	7.90E-02	1.93E-02	1.36E-01	2	20	0.07	0.01	0.01	0.001	<1	<1	<1	<1
		Carbazole	--	--	1.88E-01	2.00E-01	2.71E+00	5.09E-01	5.41E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.24E-05	1.10E-04	7.78E-02	1.60E-01	3.66E-01	2.85E-02	5.86E-02	1.33E-02	1.01E-01	2	20	0.05	0.01	0.01	0.001	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.19E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	1.88E-01	2.00E-01	3.70E-01	6.95E-02	7.39E-02	3.23E-02	1.28E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.88E-01	2.00E-01	1.83E+01	3.43E+00	3.65E+00	1.53E+00	5.93E+00	0.111	1.11	**53**	**14**	**5**	**1**	<1	<1	<1	<1
		Fluoranthene	5.65E-05	2.00E-04	1.13E-01	2.30E-01	4.86E-01	5.50E-02	1.12E-01	2.53E-02	1.91E-01	2	20	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		Fluorene	5.00E-05	5.00E-05	1.88E-01	2.00E-01	--	--	--	--	--	1.11	11.1	--	--	--	--	--	--	--	--
		Hexachlorobenzene	2.50E-03	2.50E-03	1.88E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.88E-01	2.00E-01	1.03E-01	1.93E-02	2.06E-02	1.02E-02	4.19E-02	--	--	--	--	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	5.00E-05	5.00E-05	9.96E-02	1.90E-01	4.58E-01	4.56E-02	8.69E-02	2.10E-02	1.49E-01	2	20	0.07	0.01	0.01	0.001	<1	<1	<1	<1
		Isophorone	2.50E-03	2.50E-03	1.88E-01	2.00E-01	1.51E-01	2.83E-02	3.01E-02	1.42E-02	5.74E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.00E-05	5.00E-05	1.88E-01	2.00E-01	7.04E-01	1.32E-01	1.41E-01	6.03E-02	2.36E-01	2.86	28.6	0.08	0.02	0.01	0.002	<1	<1	<1	<1
		Phenanthrene	5.51E-05	1.20E-04	1.09E-01	1.90E-01	2.75E-01	3.00E-02	5.23E-02	1.42E-02	9.24E-02	1.11	11.1	0.08	0.01	0.01	0.001	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.88E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.78E-05	2.10E-04	1.13E-01	1.90E-01	2.80E-01	3.16E-02	5.32E-02	1.49E-02	9.39E-02	2	20	0.05	0.01	0.005	0.001	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-18f
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - WETLANDS A THROUGH D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.50E-06	2.50E-06	1.86E-03	1.95E-03	5.11E-01	9.50E-04	9.96E-04	4.37E-04	1.69E-03	0.0028	0.028	1	0.2	0.06	0.02	<1	<1	<1	<1
		4,4'-DDE	2.50E-06	2.50E-06	1.86E-03	1.95E-03	1.90E+00	3.54E-03	3.71E-03	1.59E-03	6.10E-03	0.0028	0.028	**2**	0.6	0.2	0.06	<1	<1	<1	<1
		4,4'-DDT	2.50E-06	2.50E-06	1.86E-03	1.95E-03	1.34E+00	2.49E-03	2.61E-03	1.12E-03	4.31E-03	0.0028	0.028	**2**	0.4	0.2	0.04	<1	<1	<1	<1
		alpha-Chlordane	1.25E-06	1.25E-06	9.59E-04	1.00E-03	2.85E+00	2.73E-03	2.85E-03	1.22E-03	4.65E-03	0.211	2.11	0.02	0.01	0.002	0.001	<1	<1	<1	<1
		Endosulfan Sulfate	2.77E-06	1.30E-05	1.86E-03	1.95E-03	7.98E-01	1.48E-03	1.56E-03	6.75E-04	2.60E-03	0.31	3.1	0.01	0.002	0.001	0.0002	<1	<1	<1	<1
		Endrin Aldehyde	2.50E-06	2.50E-06	1.86E-03	1.95E-03	5.76E-01	1.07E-03	1.12E-03	4.91E-04	1.90E-03	0.0232	0.232	0.08	0.02	0.01	0.002	<1	<1	<1	<1
		Endrin Ketone	2.50E-06	2.50E-06	1.86E-03	1.95E-03	5.76E-01	1.07E-03	1.12E-03	4.91E-04	1.90E-03	0.0232	0.232	0.08	0.02	0.01	0.002	<1	<1	<1	<1
		Gamma-BHC	1.25E-06	1.25E-06	9.59E-04	1.00E-03	1.62E+00	1.55E-03	1.62E-03	6.97E-04	2.66E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.25E-06	1.25E-06	9.59E-04	1.00E-03	2.85E+00	2.73E-03	2.85E-03	1.22E-03	4.65E-03	0.211	2.11	0.02	0.01	0.002	0.001	<1	<1	<1	<1
		Toxaphene	1.25E-04	1.25E-04	9.59E-02	1.00E-01	7.43E-02	7.13E-03	7.43E-03	3.89E-03	1.61E-02	0.0531	0.531	0.3	0.07	0.03	0.01	<1	<1	<1	<1
	Metals	Aluminum	2.22E-01	9.52E-01	5.02E+03	7.57E+03	1.54E-01	7.72E+02	1.16E+03	3.81E+02	2.19E+03	109.7	1097	**20**	**3**	**2**	0.3	**3**	<1	<1	<1
		Antimony	1.46E-03	1.50E-03	3.74E-01	5.50E-01	1.54E-01	5.75E-02	8.46E-02	2.85E-02	1.60E-01	--	--	--	--	--	--	--	--	--	--
		Arsenic	9.23E-04	1.61E-03	3.68E+00	7.20E+00	3.86E-02	1.42E-01	2.78E-01	9.05E-02	7.41E-01	1.85	3.88	0.4	0.05	0.2	0.02	<1	<1	<1	<1
		Barium	4.89E-02	1.00E-01	2.21E+01	3.46E+01	1.46E-02	3.22E-01	5.04E-01	3.10E-01	2.23E+00	20.8	41.7	0.1	0.01	0.05	0.01	<1	<1	<1	<1
		Beryllium	1.46E-04	1.50E-04	5.60E-01	8.40E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Cadmium	1.23E-04	1.20E-03	4.82E-01	5.50E-01	1.32E+00	6.39E-01	7.29E-01	2.88E-01	1.20E+00	1.45	3.05	0.8	0.2	0.4	0.09	<1	<1	<1	<1
		Chromium	6.90E-04	1.71E-03	1.14E+01	1.89E+01	4.90E-02	5.58E-01	9.25E-01	3.33E-01	2.26E+00	1	5	**2**	0.3	0.5	0.07	<1	<1	<1	<1
		Cobalt	7.52E-04	1.91E-03	4.82E+00	5.50E+00	1.95E-02	9.41E-02	1.07E-01	7.75E-02	3.96E-01	--	--	--	--	--	--	--	--	--	--
		Copper	2.31E-03	1.25E-02	1.11E+01	1.74E+01	8.24E-02	9.15E-01	1.43E+00	4.89E-01	3.03E+00	22.3	31.5	0.1	0.02	0.1	0.02	<1	<1	<1	<1
		Cyanide	3.05E-03	1.79E-01	2.40E-01	2.70E-01	1.54E-01	3.69E-02	4.15E-02	1.84E-02	1.16E-01	--	--	--	--	--	--	--	--	--	--
		Iron	8.84E-01	1.62E+00	7.87E+03	9.47E+03	1.54E-01	1.21E+03	1.46E+03	5.97E+02	2.74E+03	--	--	--	--	--	--	--	--	--	--
		Lead	1.83E-03	3.28E-03	1.52E+01	2.39E+01	1.29E-01	1.96E+00	3.08E+00	9.83E-01	5.95E+00	0.0114	0.114	**522**	**86**	**52**	**9**	<1	<1	<1	<1
		Manganese	8.13E-02	3.22E-01	1.02E+02	1.17E+02	7.13E-02	7.27E+00	8.34E+00	3.99E+00	1.83E+01	77.6	776	0.2	0.1	0.02	0.01	<1	<1	<1	<1
		Mercury	6.94E-05	7.50E-05	4.58E-02	8.10E-02	3.12E-01	1.43E-02	2.53E-02	6.70E-03	4.42E-02	0.0064	0.064	**7**	**1**	0.7	0.1	<1	<1	<1	<1
		Nickel	5.41E-03	2.00E-02	4.56E+00	8.20E+00	1.69E-01	7.73E-01	1.39E+00	3.78E-01	2.59E+00	25.1	45.3	0.1	0.02	0.1	0.01	<1	<1	<1	<1
		Selenium	1.50E-03	1.50E-03	--	--	1.48E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Silver	5.11E-04	2.80E-03	2.21E-01	3.70E-01	3.27E-01	7.23E-02	1.21E-01	3.38E-02	2.12E-01	9.36	19.2	0.02	0.004	0.01	0.002	<1	<1	<1	<1
		Thallium	1.75E-03	2.00E-03	5.70E-01	9.80E-01	1.54E-01	8.77E-02	1.51E-01	4.34E-02	2.84E-01	--	--	--	--	--	--	--	--	--	--
		Vanadium	1.35E-03	2.31E-03	1.12E+01	1.63E+01	6.72E-03	7.53E-02	1.10E-01	1.16E-01	8.35E-01	11.4	22.8	0.1	0.01	0.04	0.01	<1	<1	<1	<1
		Zinc	1.16E-02	9.84E-02	3.30E+01	4.09E+01	1.37E+01	4.51E+02	5.60E+02	2.01E+02	9.08E+02	14.5	131	**63**	**14**	**7**	**2**	<1	<1	<1	<1

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RR = residual risk
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-18g
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - PRATT DAM

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pratt Dam	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	5.65E-05	4.16E-04	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	2.14E-04	8.88E-04	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	2.14E-04	8.88E-04	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	2.14E-04	8.88E-04	--	--	--	--	--	--	--	--	--	--
		Acetone	2.76E-03	1.20E-02	1.09E-02	3.10E-02	0.00E+00	0.00E+00	0.00E+00	2.74E-04	3.77E-03	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	5.65E-05	4.16E-04	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.54E-04	3.30E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	5.68E-05	4.32E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	5.65E-05	4.16E-04	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	5.65E-05	4.16E-04	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	4.40E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	5.00E-05	3.35E-04	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	2.67E-04	4.15E-04	6.61E-03	1.45E-02	0.00E+00	0.00E+00	0.00E+00	6.75E-05	6.72E-04	--	--	--	--	--	--	--	--	--	--
		Tetrachloroethene	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	5.65E-05	4.16E-04	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	5.65E-05	4.16E-04	--	--	--	--	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	5.65E-05	4.16E-04	22.8	45.6	0.00002	0.000002	0.000009	0.000001	<1	<1	<1	<1
Pratt Dam	SVOCs	4-Bromophenyl-phenylether	2.50E-03	2.50E-03	2.09E-01	2.55E-01	4.73E+00	9.88E-01	1.21E+00	4.41E-01	1.96E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.42E-01	3.59E-01	4.81E-02	1.16E-02	1.73E-02	7.14E-03	4.30E-02	1	10	0.04	0.01	0.004	0.001	<1	<1	<1	<1
		4-Methylphenol	2.50E-03	2.50E-03	2.09E-01	2.55E-01	3.07E-01	6.43E-02	7.84E-02	3.03E-02	1.38E-01	0.96	9.6	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		4-Nitroaniline	1.00E-02	1.00E-02	5.31E-01	6.50E-01	5.24E-01	2.78E-01	3.41E-01	1.28E-01	5.80E-01	0.75	7.5	0.8	0.2	0.08	0.02	<1	<1	<1	<1
		Acenaphthene	5.00E-05	5.00E-05	1.31E-01	1.45E-01	--	--	--	--	--	1.11	11.1	--	--	--	--	--	--	--	--
		Acenaphthylene	5.00E-05	5.00E-05	2.66E-01	3.24E-01	3.66E+00	9.75E-01	1.19E+00	4.36E-01	1.94E+00	1.11	11.1	**2**	0.4	0.2	0.04	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.73E-01	2.55E-01	2.37E+00	4.10E-01	6.04E-01	1.84E-01	9.90E-01	--	--	--	--	--	--	--	--	--	--
		Benzaldehyde	2.50E-03	2.50E-03	1.20E-01	2.55E-01	5.70E-01	6.84E-02	1.45E-01	3.15E-02	2.46E-01	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.00E-05	5.00E-05	1.77E+00	2.09E+00	2.54E-01	4.50E-01	5.32E-01	2.13E-01	9.46E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.40E-05	1.70E-04	1.73E+00	2.05E+00	2.13E-01	3.68E-01	4.36E-01	1.77E-01	7.89E-01	10	20	0.1	0.02	0.04	0.01	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.73E-05	1.60E-04	2.24E+00	2.81E+00	4.16E-01	9.32E-01	1.17E+00	4.31E-01	2.01E+00	2	20	**1**	0.2	0.1	0.02	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.00E-05	5.00E-05	1.17E+00	1.42E+00	4.70E-01	5.50E-01	6.68E-01	2.54E-01	1.14E+00	2	20	0.6	0.1	0.1	0.01	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	8.43E-01	1.02E+00	4.16E-01	3.51E-01	4.24E-01	1.62E-01	7.29E-01	2	20	0.4	0.1	0.04	0.01	<1	<1	<1	<1
		Chrysene	5.33E-05	1.40E-04	1.98E+00	2.33E+00	3.66E-01	7.25E-01	8.54E-01	3.37E-01	1.48E+00	2	20	0.7	0.2	0.1	0.02	<1	<1	<1	<1
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	3.48E-01	4.12E-01	3.70E-01	1.29E-01	1.52E-01	5.98E-02	2.63E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.09E-01	2.55E-01	1.83E+01	3.82E+00	4.66E+00	1.70E+00	7.56E+00	0.111	1.11	**68**	**15**	**7**	**2**	**4**	<1	<1	<1
		Fluoranthene	5.72E-05	1.80E-04	2.96E+00	3.68E+00	4.86E-01	1.44E+00	1.79E+00	6.63E-01	3.05E+00	2	20	**2**	0.3	0.2	0.03	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	2.09E-01	2.55E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	2.09E-01	2.55E-01	1.03E-01	2.15E-02	2.62E-02	1.13E-02	5.33E-02	--	--	--	--	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	5.00E-05	5.00E-05	1.02E+00	1.23E+00	4.58E-01	4.67E-01	5.63E-01	2.15E-01	9.61E-01	2	20	0.5	0.1	0.05	0.01	<1	<1	<1	<1
		Isophorone	2.50E-03	2.50E-03	2.09E-01	2.55E-01	1.51E-01	3.15E-02	3.84E-02	1.57E-02	7.30E-02	--	--	--	--	--	--	--	--	--	--
		Phenanthrene	5.92E-05	1.70E-04	1.90E+00	2.19E+00	2.75E-01	5.23E-01	6.03E-01	2.47E-01	1.06E+00	1.11	11.1	0.96	0.2	0.1	0.02	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	2.09E-01	2.55E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.97E-05	2.50E-04	2.54E+00	3.09E+00	2.80E-01	7.11E-01	8.65E-01	3.35E-01	1.53E+00	2	20	0.8	0.2	0.1	0.02	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-18g
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS BIRDS - PRATT DAM

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDT	2.57E-06	2.80E-06	5.01E-03	1.10E-02	1.34E+00	6.71E-03	1.47E-02	3.02E-03	2.43E-02	0.0028	0.028	**9**	**1**	0.9	0.1	<1	<1	<1	<1
		alpha-Chlordane	1.29E-06	1.40E-06	6.68E-03	9.75E-03	2.85E+00	1.90E-02	2.78E-02	8.52E-03	4.54E-02	0.211	2.11	0.2	0.04	0.02	0.004	<1	<1	<1	<1
		Endosulfan Sulfate	2.57E-06	2.80E-06	3.91E-03	9.00E-03	7.98E-01	3.12E-03	7.18E-03	1.42E-03	1.20E-02	0.31	3.1	0.04	0.005	0.004	0.0005	<1	<1	<1	<1
		Endrin Aldehyde	2.57E-06	2.80E-06	4.10E-03	4.10E-03	5.76E-01	2.36E-03	2.36E-03	1.08E-03	3.99E-03	0.0232	0.232	0.2	0.05	0.02	0.005	<1	<1	<1	<1
		Endrin Ketone	2.57E-06	2.80E-06	9.00E-03	9.00E-03	5.76E-01	5.18E-03	5.18E-03	2.37E-03	8.76E-03	0.0232	0.232	0.4	0.1	0.04	0.01	<1	<1	<1	<1
		Gamma-BHC	1.29E-06	1.40E-06	1.31E-03	4.60E-03	1.62E+00	2.12E-03	7.43E-03	9.52E-04	1.22E-02	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.29E-06	1.40E-06	5.55E-03	5.70E-03	2.85E+00	1.58E-02	1.62E-02	7.07E-03	2.65E-02	0.211	2.11	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		Heptachlor Epoxide	1.28E-06	1.40E-06	1.31E-03	4.60E-03	1.74E+00	2.28E-03	8.02E-03	1.03E-03	1.32E-02	0.211	2.11	0.1	0.005	0.01	0.0005	<1	<1	<1	<1
		Toxaphene	1.29E-04	1.40E-04	1.31E-01	4.60E-01	7.43E-02	9.74E-03	3.42E-02	5.31E-03	7.40E-02	0.0531	0.531	**1**	0.1	0.1	0.01	**1**	<1	<1	<1
	Metals	Barium	4.86E-02	4.63E-02	9.98E+01	1.26E+02	1.46E-02	1.45E+00	1.83E+00	1.39E+00	8.06E+00	20.8	41.7	0.4	0.1	0.2	0.03	<1	<1	<1	<1
		Cadmium	1.47E-04	6.70E-04	3.92E+00	6.94E+00	1.32E+00	5.19E+00	9.19E+00	2.34E+00	1.52E+01	1.45	3.05	**10**	**2**	**5**	0.8	**8**	**1**	**4**	<1
		Copper	4.74E-03	1.25E-02	1.35E+02	1.82E+02	8.24E-02	1.11E+01	1.50E+01	5.95E+00	3.16E+01	22.3	31.5	**1**	0.3	**1**	0.2	<1	<1	<1	<1
		Iron	1.05E+00	1.78E+00	1.61E+04	1.94E+04	1.54E-01	2.48E+03	2.98E+03	1.22E+03	5.62E+03	--	--	--	--	--	--	--	--	--	--
		Lead	1.90E-03	6.48E-03	1.53E+02	2.06E+02	1.29E-01	1.97E+01	2.65E+01	9.89E+00	5.12E+01	0.0114	0.114	**4495**	**868**	**450**	**87**	**982**	**341**	**98**	**34**
		Manganese	2.14E-01	4.27E-01	4.42E+02	6.67E+02	7.13E-02	3.15E+01	4.75E+01	1.73E+01	1.04E+02	77.6	776	**1**	0.2	0.1	0.02	**1**	<1	<1	<1
		Silver	6.67E-04	2.10E-03	1.01E+00	1.31E+00	3.27E-01	3.30E-01	4.29E-01	1.55E-01	7.48E-01	9.36	19.2	0.1	0.02	0.04	0.01	<1	<1	<1	<1

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RR = residual risk
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

Table 7-18h: Weight-of-Evidence Integration for small omnivorous birds
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:
Maintain stable and healthy populations of small omnivorous birds
Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small omnivorous birds foraging in the terrestrial habitats at the site?

Measurement Endpoint
5.A: use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.

Weight-of-Evidence Integration

J.M. Mills	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**5.A**			
Yes/Low					
Undeterminate					
No Harm					

Unnamed Island	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**5.A**			
Yes/Low					
Undeterminate					
No Harm					

Nunes Parcel	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**5.A**			
Yes/Low					
Undeterminate					
No Harm					

Quinville Wellfield	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low		**5.A**			
Undeterminate					
No Harm					

US EPA ARCHIVE DOCUMENT

Table 7-18h: Weight-of-Evidence Integration for small omnivorous birds
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Wetland A through D	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**5.A**			

Pratt Dam	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High		**5.A**			
Yes/Low					
Undeterminate					
No Harm					

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

DRAFT
BERA
JUNE 2007
REVISED NOVEMBER 2007
REVISED SEPTEMBER 2008
REVISED MAY 2009

TABLE 7-19a
CALCULATED HAZARD QUOTIENTS FOR LARGE PISCIVOROUS BIRDS - BLACKSTONE RIVER (UPSTREAM AND POND P-6)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group		Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water (sw)		Sediment (dw)		Fish (ww)									
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE
iver-Upstream and Pond -6	VOCs	2-Butanone	2.50E-03	2.50E-03	9.03E-03	2.69E-02	--	--	--	--	--	--	--	--	--	--
			2.97E-03	4.95E-03	2.22E-02	9.24E-02	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	3.06E-03	4.99E-03	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.76E-04	3.70E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	2.48E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	2.66E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.21E-01	2.30E-01	3.70E-01	3.75E-01	3.34E-02	1.02E-01	--	--	--	--	--	--
		2-Methylnaphthalene	2.35E-05	5.00E-05	2.63E-02	1.75E-01	2.56E-01	3.75E-01	2.31E-02	1.02E-01	2.86	28.6	0.04	0.008	0.004	0.001
		2-Methylphenol	2.50E-03	2.50E-03	5.34E-02	2.30E-01	3.70E-01	3.75E-01	3.34E-02	1.02E-01	0.96	9.6	0.1	0.03	0.01	0.003
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.70E-01	3.75E-01	3.34E-02	1.02E-01	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.70E-01	3.75E-01	3.34E-02	1.02E-01	1	10	0.1	0.03	0.01	0.003
cetone		4-Methylphenol	2.50E-03	2.50E-03	1.24E-01	2.30E-01	3.70E-01	3.75E-01	3.34E-02	1.02E-01	0.96	9.6	0.1	0.03	0.01	0.003
		4-Nitroaniline	1.00E-02	1.00E-02	1.94E-01	5.50E-01	3.70E-01	3.75E-01	3.36E-02	1.03E-01	0.75	7.5	0.1	0.04	0.01	0.004
		Acenaphthene	2.39E-05	5.00E-05	3.05E-02	1.09E-01	2.40E-01	2.30E-01	2.16E-02	6.23E-02	1.11	11.1	0.1	0.02	0.01	0.002
		Acenaphthylene	2.92E-05	5.00E-05	7.86E-02	3.63E-01	2.28E-01	2.07E-01	2.06E-02	5.66E-02	1.11	11.1	0.1	0.02	0.01	0.002
		Acetophenone	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.56E-01	3.75E-01	3.22E-02	1.02E-01	--	--	--	--	--	--
		Anthracene	3.19E-05	5.00E-05	1.35E-01	4.67E-01	2.54E-01	3.75E-01	2.29E-02	1.02E-01	1.11	11.1	0.1	0.02	0.01	0.002
		Benzaldehyde	2.50E-03	2.50E-03	1.63E-01	2.08E-01	1.18E+00	2.57E+00	1.06E-01	6.94E-01	--	--	--	--	--	--
		Benzo[a]anthracene	4.11E-05	5.00E-05	4.17E-01	1.36E+00	2.54E-01	3.75E-01	2.30E-02	1.04E-01	--	--	--	--	--	--
		Benzo(a)pyrene	5.14E-05	6.70E-05	4.69E-01	1.33E+00	2.55E-01	3.75E-01	2.32E-02	1.04E-01	10	20	0.01	0.002	0.01	0.001
		Benzo(b)fluoranthene	5.05E-05	8.60E-05	5.53E-01	1.48E+00	2.50E-01	3.75E-01	2.27E-02	1.04E-01	2	20	0.1	0.01	0.01	0.001
		Benzo(g,h,i)perylene	5.24E-05	1.30E-04	2.79E-01	1.47E+00	2.54E-01	3.75E-01	2.30E-02	1.04E-01	2	20	0.1	0.01	0.01	0.001
		Benzo(k)fluoranthene	4.21E-05	6.90E-05	3.00E-01	1.72E+00	2.50E-01	3.75E-01	2.26E-02	1.05E-01	2	20	0.1	0.01	0.01	0.001
		Carbazole	--	--	1.72E-01	2.51E-01	3.70E-01	3.75E-01	--	--	--	--	--	--	--	--
		Chrysene	4.82E-05	7.40E-05	4.78E-01	1.46E+00	2.45E-01	2.23E-01	2.23E-02	6.32E-02	2	20	0.03	0.01	0.003	0.001
		Cyclohexane	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.28E-05	1.40E-04	8.45E-02	5.22E-01	2.45E-01	2.29E-01	2.21E-02	6.29E-02	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.29E-01	2.30E-01	3.70E-01	3.75E-01	3.34E-02	1.02E-01	0.111	1.11	0.9	0.3	0.1	0.03
		Fluoranthene	5.91E-05	8.30E-05	7.63E-01	2.35E+00	2.76E-01	3.75E-01	2.52E-02	1.06E-01	2	20	0.1	0.01	0.01	0.001
		Fluorene	2.48E-05	5.00E-05	4.35E-02	1.60E-01	2.54E-01	3.75E-01	2.29E-02	1.02E-01	1.11	11.1	0.1	0.02	0.01	0.002
		Hexachlorobenzene	2.50E-03	2.50E-03	2.32E-02	2.30E-01	2.50E-01	3.75E-01	2.26E-02	1.02E-01	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.70E-01	3.75E-01	3.34E-02	1.02E-01	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	4.95E-05	1.30E-04	2.58E-01	1.36E+00	2.55E-01	3.75E-01	2.31E-02	1.04E-01	2	20	0.1	0.01	0.01	0.001
		Isophorone	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.39E-01	3.58E-01	3.06E-02	9.73E-02	--	--	--	--	--	--
		Naphthalene	2.67E-05	5.00E-05	3.40E-02	1.68E-01	2.43E-01	2.28E-01	2.19E-02	6.19E-02	2.86	28.6	0.02	0.01	0.002	0.001
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.70E-01	3.75E-01	3.34E-02	1.02E-01	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	2.39E-01	5.50E-01	9.30E-01	9.50E-01	8.39E-02	2.58E-01	--	--	--	--	--	--
		Phenanthrene	4.63E-05	5.00E-05	3.88E-01	1.30E+00	2.44E-01	2.36E-01	2.21E-02	6.64E-02	1.11	11.1	0.1	0.02	0.01	0.002
		Phenol	2.50E-03	2.50E-03	1.38E-01	2.30E-01	3.70E-01	3.75E-01	3.34E-02	1.02E-01	--	--	--	--	--	--
		Pyrene	5.76E-05	8.70E-05	7.35E-01	2.22E+00	2.49E-01	3.75E-01	2.27E-02	1.06E-01	2	20	0.1	0.01	0.01	0.001

US EPA ARCHIVE DOCUMENT

TABLE 7-19a
CALCULATED HAZARD QUOTIENTS FOR LARGE PISCIVOROUS BIRDS - BLACKSTONE RIVER (UPSTREAM AND POND P-6)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group		Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water (sw)		Sediment (dw)		Fish (ww)									
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	1.56E-06	2.80E-06	2.48E-03	1.24E-02	1.32E-02	2.46E-02	1.19E-03	6.67E-03	0.0028	0.028	**2**	0.4	0.2	0.04
		4,4'-DDE	1.82E-06	2.80E-06	1.95E-03	1.06E-02	4.15E-02	6.13E-02	3.74E-03	1.66E-02	0.0028	0.028	**6**	**1**	0.6	0.1
		4,4'-DDT	1.56E-06	2.80E-06	6.86E-04	2.70E-03	1.97E-03	8.57E-03	1.78E-04	2.32E-03	0.0028	0.028	0.8	0.1	0.1	0.01
		alpha-Chlordane	9.83E-07	1.40E-06	8.51E-04	2.95E-03	7.69E-03	2.21E-02	6.93E-04	5.97E-03	0.211	2.11	0.03	0.003	0.003	0.0003
		Dieldrin	2.05E-06	2.80E-06	2.28E-03	6.29E-03	3.32E-02	3.88E-02	2.99E-03	1.05E-02	0.077	0.37	0.1	0.04	0.03	0.01
		Endosulfan Sulfate	1.56E-06	2.80E-06	5.38E-04	1.30E-02	4.34E-03	7.57E-03	3.91E-04	2.07E-03	0.31	3.1	0.01	0.001	0.001	0.0001
		Endrin	1.56E-06	2.80E-06	3.91E-04	4.60E-04	3.12E-04	3.20E-04	2.83E-05	8.75E-05	0.01	0.1	0.01	0.003	0.001	0.0003
		Endrin Aldehyde	1.56E-06	2.80E-06	7.04E-04	2.70E-03	3.23E-04	3.80E-04	2.94E-05	1.08E-04	0.0232	0.232	0.005	0.001	0.0005	0.0001
		Endrin Ketone	1.56E-06	2.80E-06	9.19E-04	2.00E-02	3.12E-04	3.20E-04	2.85E-05	1.27E-04	0.0232	0.232	0.01	0.001	0.001	0.0001
		Gamma-BHC	9.83E-07	1.40E-06	2.75E-04	4.20E-04	7.77E-04	9.10E-04	7.01E-05	2.47E-04	--	--	--	--	--	--
		Gamma-Chlordane	9.83E-07	1.40E-06	1.58E-03	4.09E-03	7.48E-03	9.81E-03	6.74E-04	2.66E-03	0.211	2.11	0.01	0.003	0.001	0.0003
		Heptachlor Epoxide	9.83E-07	1.40E-06	2.75E-04	4.20E-04	1.14E-03	3.74E-03	1.03E-04	1.01E-03	0.211	2.11	0.005	0.000	0.0005	0.00005
		Toxaphene	9.83E-05	1.40E-04	3.04E-02	5.00E-02	3.12E-02	3.20E-02	2.82E-03	8.75E-03	0.0531	0.531	0.2	0.1	0.02	0.01
	PCBs	Total PCBs	3.13E-05	5.50E-05	1.19E-01	9.18E-01	9.40E-01	1.83E+00	8.47E-02	4.96E-01	--	--	--	--	--	--
	Metals	Aluminum	1.33E-01	3.60E-01	4.35E+03	8.96E+03	6.09E+00	1.11E+01	2.51E+00	2.12E+01	109.7	1097	0.2	0.02	0.02	0.002
		Antimony	8.25E-04	1.50E-03	4.10E-01	6.00E-01	1.70E-02	1.70E-02	1.73E-03	5.90E-03	--	--	--	--	--	--
		Arsenic	1.76E-03	2.29E-03	3.99E+00	6.45E+00	7.42E-02	9.83E-02	8.51E-03	3.98E-02	1.85	3.88	0.02	0.005	0.01	0.002
		Barium	4.64E-02	1.00E-01	3.81E+01	6.72E+01	7.28E-01	8.92E-01	8.37E-02	3.84E-01	20.8	41.7	0.02	0.004	0.01	0.002
		Beryllium	1.16E-04	1.50E-04	3.51E-01	5.42E-01	7.00E-03	7.00E-03	7.91E-04	3.00E-03	--	--	--	--	--	--
		Cadmium	2.86E-04	8.20E-04	1.43E+00	7.22E+00	9.82E-02	1.48E-01	9.49E-03	5.46E-02	1.45	3.05	0.04	0.01	0.02	0.003
		Chromium	2.57E-03	5.00E-03	2.48E+01	6.70E+01	1.71E+00	2.52E+00	1.65E-01	8.16E-01	1	5	0.8	0.2	0.2	0.03
		Cobalt	1.75E-03	2.50E-02	4.43E+00	6.82E+00	5.33E-02	5.83E-02	6.83E-03	3.12E-02	--	--	--	--	--	--
		Copper	9.79E-03	1.25E-02	3.87E+01	1.13E+02	6.40E-01	7.73E-01	7.52E-02	4.38E-01	22.3	31.5	0.02	0.003	0.01	0.002
		Cyanide	2.09E-03	2.40E-03	1.96E-01	3.30E-01	--	--	--	--	--	--	--	--	--	--
		Iron	5.43E-01	8.40E-01	8.56E+03	1.28E+04	1.19E+02	1.38E+02	1.46E+01	6.32E+01	--	--	--	--	--	--
		Lead	3.16E-03	1.10E-02	4.12E+01	2.03E+02	7.13E-02	2.75E-01	2.50E-02	4.86E-01	0.0114	0.114	**43**	**2**	**4**	0.2
		Manganese	9.40E-02	1.26E-01	1.47E+02	2.07E+02	6.55E+00	1.43E+01	6.58E-01	4.29E+00	77.6	776	0.1	0.01	0.01	0.001
		Mercury	4.36E-05	7.50E-05	9.36E-02	2.64E-01	7.47E-02	1.67E-01	6.77E-03	4.56E-02	0.0064	0.064	**7**	**1**	0.7	0.1
		Nickel	3.21E-03	4.10E-03	1.21E+01	2.57E+01	1.28E+00	1.63E+00	1.21E-01	4.92E-01	25.1	45.3	0.02	0.005	0.01	0.003
		Selenium	8.78E-04	3.70E-03	5.14E-01	1.05E+00	5.31E-01	5.76E-01	4.80E-02	1.58E-01	--	--	--	--	--	--
		Silver	2.20E-04	1.00E-03	1.30E+00	2.43E+00	7.76E-03	1.30E-02	1.29E-03	8.50E-03	9.36	19.2	0.001	0.0001	0.0004	0.0001
		Thallium	5.57E-04	2.00E-03	1.84E-01	2.46E-01	3.59E-03	4.60E-03	4.18E-04	1.87E-03	--	--	--	--	--	--
		Vanadium	2.91E-03	2.50E-02	9.64E+00	1.54E+01	6.97E-02	1.19E-01	1.07E-02	6.50E-02	11.4	22.8	0.01	0.001	0.003	0.0005
		Zinc	1.34E-02	2.08E-02	1.04E+02	3.12E+02	1.47E+01	1.77E+01	1.37E+00	5.41E+00	14.5	131	0.4	0.1	0.04	0.01

otes:
-- = Fish tissue or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compounds
SVOC = semi-olatile organic chemical
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = Central Tendency Exposure
RME = reasonable maximum exposure
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-19b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR LARGE PISCIVOROUS BIRDS - BLACKSTONE RIVER, POND A, AND POND F COMBINED

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Site and Ponds A and F	VOCs	2-Butanone	2.50E-03	2.50E-03	1.19E-02	6.02E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2.61E-03	1.20E-02	2.47E-02	1.75E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	3.75E-03	3.69E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.60E-04	4.40E-04	3.98E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	3.99E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	3.98E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	3.91E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	3.74E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	3.92E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	3.98E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	3.81E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.52E-01	6.60E-01	3.72E-01	3.85E-01	3.36E-02	1.05E-01	--	--	--	--	--	--	--	--	--	--
		2-Methylnaphthalene	4.48E-05	5.00E-05	3.64E-02	1.11E-01	3.00E-01	2.37E-01	2.70E-02	6.42E-02	2.86	28.6	0.02	0.01	0.002	0.001	<1	<1	<1	<1
		2-Methylphenol	2.50E-03	2.50E-03	1.05E-01	6.60E-01	3.79E-01	4.80E-01	3.42E-02	1.31E-01	0.96	9.6	0.1	0.04	0.01	0.004	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.65E-01	3.30E-01	3.72E-01	3.85E-01	3.36E-02	1.05E-01	--	--	--	--	--	--	--	--	--	--
Acetone		4-Chloroaniline	2.50E-03	2.50E-03	1.65E-01	3.30E-01	3.72E-01	3.85E-01	3.36E-02	1.05E-01	1	10	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		4-Methylphenol	2.50E-03	2.50E-03	1.52E-01	6.60E-01	3.72E-01	3.85E-01	3.36E-02	1.05E-01	0.96	9.6	0.1	0.04	0.01	0.004	<1	<1	<1	<1
		4-Nitroaniline	1.00E-02	1.00E-02	3.41E-01	8.50E-01	3.72E-01	3.85E-01	3.39E-02	1.06E-01	0.75	7.5	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Acenaphthene	4.49E-05	5.00E-05	4.75E-02	2.04E-01	3.33E-01	3.85E-01	3.00E-02	1.04E-01	1.11	11.1	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		Acenaphthylene	4.63E-05	5.00E-05	6.14E-02	2.15E-01	3.72E-01	3.85E-01	3.35E-02	1.04E-01	1.11	11.1	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.62E-01	6.60E-01	3.72E-01	3.85E-01	3.36E-02	1.05E-01	--	--	--	--	--	--	--	--	--	--
		Anthracene	4.70E-05	5.00E-05	1.55E-01	6.38E-01	3.29E-01	3.85E-01	2.97E-02	1.05E-01	1.11	11.1	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.69E-01	2.38E-01	4.26E+00	9.52E+00	3.84E-01	2.57E+00	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	4.91E-05	1.40E-04	4.24E-01	1.57E+00	3.29E-01	3.85E-01	2.98E-02	1.07E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.19E-05	1.70E-04	4.49E-01	1.68E+00	3.29E-01	3.85E-01	2.98E-02	1.07E-01	10	20	0.01	0.003	0.01	0.001	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.27E-05	1.60E-04	5.09E-01	1.89E+00	3.41E-01	3.85E-01	3.09E-02	1.08E-01	2	20	0.1	0.02	0.01	0.002	<1	<1	<1	<1
		Benzo(g,h,i)perylene	4.83E-05	5.00E-05	2.19E-01	8.48E-01	3.27E-01	3.85E-01	2.95E-02	1.06E-01	2	20	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		Benzo(k)fluoranthene	4.68E-05	5.00E-05	2.52E-01	1.07E+00	3.20E-01	3.85E-01	2.89E-02	1.06E-01	2	20	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		Carbazole	--	--	1.66E-01	2.13E-01	3.72E-01	3.85E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.22E-05	1.40E-04	5.08E-01	1.77E+00	3.29E-01	3.85E-01	2.98E-02	1.08E-01	2	20	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	3.89E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.52E-05	5.00E-05	7.88E-02	2.90E-01	3.11E-01	2.08E-01	2.80E-02	5.68E-02	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.83E-01	4.76E-01	3.72E-01	3.85E-01	3.36E-02	1.05E-01	0.111	1.11	0.9	0.3	0.1	0.03	<1	<1	<1	<1
		Fluoranthene	5.67E-05	1.02E-04	8.18E-01	3.16E+00	3.20E-01	3.85E-01	2.92E-02	1.10E-01	2	20	0.1	0.01	0.006	0.001	<1	<1	<1	<1
		Fluorene	4.53E-05	5.00E-05	5.84E-02	2.18E-01	3.03E-01	2.11E-01	2.73E-02	5.74E-02	1.11	11.1	0.1	0.02	0.005	0.002	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	7.91E-02	3.30E-01	3.72E-01	3.85E-01	3.36E-02	1.05E-01	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.65E-01	3.30E-01	3.72E-01	3.85E-01	3.36E-02	1.05E-01	--	--	--	--	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	4.77E-05	5.00E-05	2.21E-01	8.75E-01	3.20E-01	3.85E-01	2.89E-02	1.06E-01	2	20	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		Isophorone	2.50E-03	2.50E-03	1.65E-01	3.30E-01	3.69E-01	4.10E-01	3.33E-02	1.12E-01	--	--	--	--	--	--	--	--	--	--
		Naphthalene	4.54E-05	6.50E-05	4.66E-02	1.61E-01	2.91E-01	2.09E-01	2.62E-02	5.68E-02	2.86	28.6	0.02	0.01	0.002	0.001	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.63E-01	6.60E-01	3.72E-01	3.85E-01	3.36E-02	1.05E-01	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	4.06E-01	3.00E+00	3.65E+00	3.65E+00	3.29E-01	9.92E-01	--	--	--	--	--	--	--	--	--	--
		Phenanthrene	5.63E-05	6.72E-05	4.37E-01	1.93E+00	2.56E-01	2.11E-01	2.32E-02	6.09E-02	1.11	11.1	0.1	0.02	0.01	0.002	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.66E-01	1.06E-01	3.72E-01	3.85E-01	3.36E-02	1.04E-01	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.71E-05	1.06E-04	8.21E-01	2.86E+00	3.43E-01	3.85E-01	3.12E-02	1.10E-01	2	20	0.1	0.02	0.01	0.002	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-19b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR LARGE PISCIVOROUS BIRDS - BLACKSTONE RIVER, POND A, AND POND F COMBINED

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.41E-06	4.70E-06	1.70E-03	4.65E-03	1.68E-02	2.06E-02	1.51E-03	5.57E-03	0.0028	0.028	**2**	0.5	0.2	0.1	<1	<1	<1	<1
		4,4'-DDE	2.43E-06	2.80E-06	1.61E-03	8.64E-03	3.57E-02	4.39E-02	3.21E-03	1.19E-02	0.0028	0.028	**4**	**1**	0.4	0.1	<1	<1	<1	<1
			2.44E-06	2.80E-06	5.99E-04	1.63E-03	8.15E-04	4.02E-03	7.37E-05	1.09E-03	0.0028	0.028	0.4	0.03	0.04	0.003	<1	<1	<1	<1
		alpha-Chlordane	1.23E-06	1.40E-06	5.77E-04	5.74E-03	8.94E-03	1.16E-02	8.05E-04	3.14E-03	0.211	2.11	0.01	0.004	0.001	0.0004	<1	<1	<1	<1
		Dieldrin	2.47E-06	2.80E-06	1.69E-03	6.92E-03	2.41E-02	3.04E-02	2.17E-03	8.22E-03	0.077	0.37	0.1	0.03	0.02	0.01	<1	<1	<1	<1
		Endosulfan Sulfate	2.37E-06	2.80E-06	6.53E-04	2.11E-03	3.71E-03	4.74E-03	3.34E-04	1.28E-03	0.31	3.1	0.004	0.001	0.0004	0.0001	<1	<1	<1	<1
		Endrin	2.37E-06	2.80E-06	4.35E-04	8.60E-03	3.13E-04	3.20E-04	2.84E-05	1.04E-04	0.01	0.1	0.01	0.003	0.001	0.0003	<1	<1	<1	<1
	4,4'-DDT	Endrin Aldehyde	2.37E-06	2.80E-06	6.31E-04	2.26E-03	3.13E-04	3.20E-04	2.85E-05	9.12E-05	0.0232	0.232	0.004	0.001	0.0004	0.0001	<1	<1	<1	<1
		Endrin Ketone	2.37E-06	2.80E-06	5.33E-04	1.95E-03	3.13E-04	3.20E-04	2.85E-05	9.05E-05	0.0232	0.232	0.004	0.001	0.0004	0.0001	<1	<1	<1	<1
		Gamma-BHC	1.23E-06	1.40E-06	2.40E-04	4.50E-04	4.59E-04	9.92E-04	4.14E-05	2.69E-04	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.23E-06	1.40E-06	6.58E-04	4.51E-03	6.12E-03	7.64E-03	5.51E-04	2.07E-03	0.211	2.11	0.01	0.003	0.001	0.0003	<1	<1	<1	<1
		Heptachlor Epoxide	1.29E-06	3.70E-06	2.66E-04	2.70E-02	4.76E-04	8.11E-04	4.30E-05	2.74E-04	0.211	2.11	0.001	0.0002	0.0001	0.00002	<1	<1	<1	<1
		Toxaphene	1.23E-04	1.40E-04	2.51E-02	5.50E-02	3.13E-02	3.20E-02	2.83E-03	8.76E-03	0.0531	0.531	0.2	0.1	0.02	0.01	<1	<1	<1	<1
	PCBs	Total PCBs	4.73E-05	5.50E-05	8.85E-02	3.51E-01	1.13E+00	1.42E+00	1.02E-01	3.84E-01	--	--	--	--	--	--	--	--	--	--
	Metals	Aluminum	8.25E-02	1.76E-01	4.17E+03	7.23E+03	4.76E+00	1.07E+01	2.31E+00	1.75E+01	109.7	1097	0.2	0.02	0.02	0.002	<1	<1	<1	<1
		Antimony	1.37E-03	1.50E-03	4.64E-01	9.64E-01	1.64E-02	1.80E-02	1.72E-03	6.91E-03	--	--	--	--	--	--	--	--	--	--
		Arsenic	1.79E-03	1.97E-03	6.18E+00	2.19E+01	6.61E-02	8.77E-02	8.77E-03	6.81E-02	1.85	3.88	0.04	0.005	0.02	0.002	<1	<1	<1	<1
			3.92E-02	3.24E-02	3.50E+01	6.65E+01	7.94E-01	1.15E+00	8.81E-02	4.47E-01	20.8	41.7	0.02	0.004	0.01	0.002	<1	<1	<1	<1
		Beryllium	1.44E-04	1.50E-04	3.54E-01	4.51E-01	6.57E-03	7.00E-03	7.54E-04	2.81E-03	--	--	--	--	--	--	--	--	--	--
		Cadmium	1.94E-04	4.38E-04	1.34E+00	7.65E+00	6.16E-02	8.33E-02	6.15E-03	3.80E-02	1.45	3.05	0.03	0.004	0.01	0.002	<1	<1	<1	<1
		Chromium	6.53E-04	1.84E-03	2.73E+01	1.44E+02	1.17E+00	1.99E+00	1.18E-01	8.29E-01	1	5	0.8	0.1	0.2	0.02	<1	<1	<1	<1
		Cobalt	5.87E-04	6.40E-04	4.76E+00	5.51E+00	6.50E-02	7.29E-02	8.01E-03	3.09E-02	--	--	--	--	--	--	--	--	--	--
	Barium	Copper	4.87E-03	1.25E-02	3.22E+01	1.14E+02	5.85E-01	6.51E-01	6.72E-02	4.08E-01	22.3	31.5	0.02	0.003	0.01	0.002	<1	<1	<1	<1
		Cyanide	1.89E-03	5.00E-03	2.62E-01	7.17E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Iron	8.59E-01	2.03E+00	9.25E+03	1.66E+04	1.52E+02	1.73E+02	1.79E+01	8.04E+01	--	--	--	--	--	--	--	--	--	--
		Lead	1.84E-03	4.50E-03	3.42E+01	1.04E+02	8.47E-02	1.31E-01	2.31E-02	2.46E-01	0.0114	0.114	**22**	**2**	**2**	0.2	<1	<1	<1	<1
		Manganese	1.89E-01	3.81E-01	1.52E+02	2.59E+02	7.38E+00	1.74E+01	7.37E-01	5.25E+00	77.6	776	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		Mercury	6.94E-05	4.60E-04	9.73E-02	3.87E-01	5.38E-02	6.67E-02	4.89E-03	1.88E-02	0.0064	0.064	**3**	0.8	0.3	0.1	<1	<1	<1	<1
		Nickel	2.70E-03	2.86E-03	8.91E+00	1.74E+01	1.08E+00	1.48E+00	1.01E-01	4.35E-01	25.1	45.3	0.02	0.004	0.01	0.002	<1	<1	<1	<1
		Selenium	1.29E-03	1.50E-03	8.40E-01	3.19E+00	4.63E-01	4.91E-01	4.21E-02	1.39E-01	--	--	--	--	--	--	--	--	--	--
		Silver	5.99E-04	5.00E-03	2.15E+00	6.45E+00	6.97E-03	1.40E-02	1.61E-03	1.72E-02	9.36	19.2	0.002	0.0002	0.001	0.0001	<1	<1	<1	<1
		Thallium	1.41E-03	2.00E-03	2.24E-01	2.42E-01	3.52E-03	5.90E-03	4.49E-04	2.22E-03	--	--	--	--	--	--	--	--	--	--
		Vanadium	6.84E-04	1.04E-03	8.78E+00	1.35E+01	5.90E-02	7.18E-02	9.28E-03	4.67E-02	11.4	22.8	0.004	0.001	0.002	0.0004	<1	<1	<1	<1
		Zinc	1.25E-02	2.99E-02	9.60E+01	5.01E+02	1.65E+01	1.93E+01	1.53E+00	6.23E+00	14.5	131	0.4	0.1	0.05	0.01	<1	<1	<1	<1

Notes:

-- = Fish tissue or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compounds
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = central tendency exposure
RME = reasonable maximum exposure
RR = residual risk

HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

Table 7-19c: Weight-of-Evidence Integration for large piscivorous birds
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:
Maintain stable and healthy populations of large piscivorous birds
Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large piscivorous birds foraging in selected aquatic habitats at the site?

Measurement Endpoint
6.A: use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to no effect and effect avian TRVs.

Weight-of-Evidence Integration

Blackstone R. & Ponds A & F combined	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm			**6.A**		

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

DRAFT
BERA
JUNE 2007
REVISED NOVEMBER 2007
REVISED SEPTEMBER 2008
REVISED MAY 2009

TABLE 7-20a
CALCULATED HAZARD QUOTIENTS FOR SMALL PISCIVOROUS BIRDS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water (sw)		Sediment (dw)		Fish (ww)									
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE
River-Upstream	VOCs	Acetone	2.97E-03	4.95E-03	2.22E-02	9.24E-02	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	9.03E-03	2.69E-02	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Acetone	2.97E-03	4.95E-03	2.22E-02	9.24E-02	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	3.06E-03	5.05E-03	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.76E-04	3.70E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	2.48E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
			2.50E-04	2.50E-04	2.66E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.21E-01	2.30E-01	3.75E-01	3.85E-01	9.40E-02	2.90E-01	--	--	--	--	--	--
		2-Methylnaphthalene	2.35E-05	5.00E-05	2.63E-02	1.77E-01	3.75E-01	3.85E-01	9.38E-02	2.90E-01	2.86	28.6	0.1	0.03	0.01	0.003
		2-Methylphenol	2.50E-03	2.50E-03	5.34E-02	2.30E-01	3.75E-01	3.85E-01	9.40E-02	2.90E-01	0.96	9.6	0.3	0.1	0.03	0.01
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	9.40E-02	2.90E-01	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	9.40E-02	2.90E-01	1	10	0.3	0.1	0.03	0.01
		4-Methylphenol	2.50E-03	2.50E-03	1.24E-01	2.30E-01	3.75E-01	3.85E-01	9.40E-02	2.90E-01	0.96	9.6	0.3	0.1	0.03	0.01
		4-Nitroaniline	1.00E-02	1.00E-02	1.94E-01	5.50E-01	3.75E-01	3.85E-01	9.45E-02	2.93E-01	0.75	7.5	0.4	0.1	0.04	0.01
		Acenaphthene	2.39E-05	5.00E-05	3.05E-02	1.09E-01	3.75E-01	3.85E-01	9.38E-02	2.89E-01	1.11	11.1	0.3	0.1	0.03	0.01
		Acenaphthylene	2.92E-05	5.00E-05	7.86E-02	3.63E-01	3.75E-01	3.85E-01	9.38E-02	2.91E-01	1.11	11.1	0.3	0.1	0.03	0.01
		Acetophenone	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	9.40E-02	2.90E-01	--	--	--	--	--	--
		Anthracene	3.19E-05	5.00E-05	1.35E-01	4.67E-01	3.75E-01	3.85E-01	9.39E-02	2.91E-01	1.11	11.1	0.3	0.1	0.03	0.01
		Benzaldehyde	2.50E-03	2.50E-03	1.63E-01	2.24E-01	1.99E+00	3.28E+00	4.98E-01	2.46E+00	--	--	--	--	--	--
Styrene		Benzo[a]anthracene	4.11E-05	5.00E-05	4.17E-01	1.36E+00	3.75E-01	3.85E-01	9.43E-02	2.96E-01	--	--	--	--	--	--
		Benzo(a)pyrene	5.14E-05	6.70E-05	4.69E-01	1.33E+00	3.75E-01	3.85E-01	9.43E-02	2.96E-01	10	20	0.03	0.01	0.01	0.005
		Benzo(b)fluoranthene	5.05E-05	8.60E-05	5.53E-01	1.48E+00	3.75E-01	3.85E-01	9.44E-02	2.97E-01	2	20	0.1	0.05	0.01	0.005
		Benzo(g,h,i)perylene	5.24E-05	1.30E-04	2.79E-01	1.47E+00	3.75E-01	3.85E-01	9.41E-02	2.97E-01	2	20	0.1	0.05	0.01	0.005
		Benzo(k)fluoranthene	4.21E-05	6.90E-05	3.00E-01	1.72E+00	3.75E-01	3.85E-01	9.41E-02	2.98E-01	2	20	0.1	0.05	0.01	0.005
		Carbazole	--	--	1.72E-01	2.54E-01	3.75E-01	3.85E-01	--	--	--	--	--	--	--	--
		Chrysene	4.82E-05	7.40E-05	4.78E-01	1.46E+00	3.75E-01	3.85E-01	9.44E-02	2.97E-01	2	20	0.1	0.05	0.01	0.005
		Cyclohexane	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.28E-05	1.40E-04	8.45E-02	5.22E-01	3.75E-01	3.85E-01	9.39E-02	2.92E-01	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.29E-01	2.30E-01	3.75E-01	3.85E-01	9.40E-02	2.90E-01	0.111	1.11	**3**	0.8	0.3	0.1
		Fluoranthene	5.91E-05	8.30E-05	7.63E-01	2.35E+00	3.75E-01	3.85E-01	9.47E-02	3.02E-01	2	20	0.2	0.05	0.02	0.005
		Fluorene	2.48E-05	5.00E-05	4.35E-02	1.60E-01	3.75E-01	3.85E-01	9.38E-02	2.90E-01	1.11	11.1	0.3	0.1	0.03	0.01
		Hexachlorobenzene	2.50E-03	2.50E-03	2.32E-02	2.30E-01	3.75E-01	3.85E-01	9.39E-02	2.90E-01	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	9.40E-02	2.90E-01	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	4.95E-05	1.30E-04	2.58E-01	1.36E+00	3.75E-01	3.85E-01	9.41E-02	2.96E-01	2	20	0.1	0.05	0.01	0.005
		Isophorone	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	9.40E-02	2.90E-01	--	--	--	--	--	--
		Naphthalene	2.67E-05	5.00E-05	3.40E-02	1.67E-01	3.75E-01	3.85E-01	9.38E-02	2.90E-01	2.86	28.6	0.1	0.03	0.01	0.003
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	9.40E-02	2.90E-01	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	2.39E-01	5.50E-01	1.08E+00	3.85E+00	2.70E-01	2.89E+00	--	--	--	--	--	--
		Phenanthrene	4.63E-05	5.00E-05	3.88E-01	1.30E+00	3.75E-01	3.85E-01	9.42E-02	2.96E-01	1.11	11.1	0.3	0.1	0.03	0.01
		Phenol	2.50E-03	2.50E-03	1.38E-01	2.30E-01	3.75E-01	3.85E-01	9.41E-02	2.90E-01	--	--	--	--	--	--
		Pyrene	5.76E-05	8.70E-05	7.35E-01	2.22E+00	3.75E-01	3.85E-01	9.47E-02	3.01E-01	2	20	0.2	0.05	0.02	0.005

US EPA ARCHIVE DOCUMENT

TABLE 7-20a
CALCULATED HAZARD QUOTIENTS FOR SMALL PISCIVOROUS BIRDS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water (sw)		Sediment (dw)		Fish (ww)									
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	1.56E-06	2.80E-06	2.48E-03	1.24E-02	1.75E-02	1.86E-02	4.38E-03	1.40E-02	0.0028	0.028	**5**	**2**	0.5	0.2
		4,4'-DDE	1.82E-06	2.80E-06	1.95E-03	1.06E-02	5.42E-02	6.02E-02	1.36E-02	4.52E-02	0.0028	0.028	**16**	**5**	**2**	0.5
			1.56E-06	2.80E-06	6.86E-04	2.70E-03	3.14E-04	3.20E-04	7.94E-05	2.56E-04	0.0028	0.028	0.09	0.03	0.01	0.003
		alpha-Chlordane	9.83E-07	1.40E-06	8.51E-04	2.98E-03	1.54E-02	1.64E-02	3.85E-03	1.23E-02	0.211	2.11	0.06	0.02	0.01	0.002
		Dieldrin	2.05E-06	2.80E-06	2.28E-03	6.29E-03	3.11E-02	3.39E-02	7.78E-03	2.55E-02	0.077	0.37	0.3	0.1	0.07	0.02
		Endosulfan Sulfate	1.56E-06	2.80E-06	5.38E-04	1.30E-02	4.98E-03	5.51E-03	1.25E-03	4.21E-03	0.31	3.1	0.01	0.004	0.001	0.0004
		Endrin	1.56E-06	2.80E-06	3.91E-04	4.60E-04	3.14E-04	3.20E-04	7.91E-05	2.43E-04	0.01	0.1	0.02	0.01	0.002	0.001
	4,4'-DDT	Endrin Aldehyde	1.56E-06	2.80E-06	7.04E-04	2.70E-03	3.14E-04	3.20E-04	7.95E-05	2.56E-04	0.0232	0.232	0.01	0.003	0.001	0.0003
		Endrin Ketone	1.56E-06	2.80E-06	9.19E-04	2.00E-02	3.14E-04	3.20E-04	7.97E-05	3.53E-04	0.0232	0.232	0.02	0.003	0.002	0.0003
		Gamma-BHC	9.83E-07	1.40E-06	2.75E-04	4.20E-04	5.23E-04	9.08E-04	1.31E-04	6.84E-04	--	--	--	--	--	--
		Gamma-Chlordane	9.83E-07	1.40E-06	1.58E-03	4.16E-03	9.96E-03	1.08E-02	2.49E-03	8.12E-03	0.211	2.11	0.04	0.01	0.004	0.001
		Heptachlor Epoxide	9.83E-07	1.40E-06	2.75E-04	4.20E-04	3.14E-04	3.20E-04	7.89E-05	2.43E-04	0.211	2.11	0.001	0.0004	0.0001	0.00004
		Toxaphene	9.83E-05	1.40E-04	3.04E-02	5.00E-02	3.14E-02	3.20E-02	7.89E-03	2.43E-02	0.0531	0.531	0.5	0.1	0.05	0.01
	PCBs	Total PCBs	3.13E-05	5.50E-05	1.19E-01	9.18E-01	1.49E+00	1.65E+00	3.73E-01	1.24E+00	--	--	--	--	--	--
	Metals	Aluminum	1.33E-01	3.60E-01	4.35E+03	8.96E+03	7.33E+00	9.85E+00	7.28E+00	5.78E+01	109.7	1097	0.5	0.07	0.05	0.01
		Antimony	8.25E-04	1.50E-03	4.10E-01	5.97E-01	1.58E-02	1.70E-02	4.51E-03	1.64E-02	--	--	--	--	--	--
		Arsenic	1.76E-03	2.29E-03	3.99E+00	6.45E+00	8.68E-02	9.69E-02	2.68E-02	1.09E-01	1.85	3.88	0.06	0.01	0.03	0.01
			4.64E-02	1.00E-01	3.81E+01	6.72E+01	1.68E+00	1.90E+00	4.70E-01	1.82E+00	20.8	41.7	0.09	0.02	0.04	0.01
		Beryllium	1.16E-04	1.50E-04	3.51E-01	5.42E-01	6.29E-03	7.00E-03	2.02E-03	8.32E-03	--	--	--	--	--	--
		Cadmium	2.86E-04	8.20E-04	1.43E+00	7.22E+00	5.28E-02	5.83E-02	1.50E-02	8.45E-02	1.45	3.05	0.06	0.01	0.03	0.005
		Chromium	2.57E-03	5.00E-03	2.48E+01	6.70E+01	8.48E-01	1.81E+00	2.43E-01	1.74E+00	1	5	**2**	0.2	0.3	0.05
		Cobalt	1.75E-03	2.50E-02	4.43E+00	6.82E+00	6.25E-02	6.59E-02	2.13E-02	9.19E-02	--	--	--	--	--	--
		Copper	9.79E-03	1.25E-02	3.87E+01	1.13E+02	5.99E-01	6.49E-01	1.99E-01	1.12E+00	22.3	31.5	0.05	0.01	0.04	0.01
	Barium	Cyanide	2.09E-03	2.40E-03	1.96E-01	3.30E-01	--	--	--	--	--	--	--	--	--	--
		Iron	5.43E-01	8.40E-01	8.56E+03	1.28E+04	1.51E+02	1.61E+02	4.85E+01	1.93E+02	--	--	--	--	--	--
		Lead	3.16E-03	1.10E-02	4.12E+01	2.03E+02	1.21E-01	1.49E-01	8.19E-02	1.26E+00	0.0114	0.114	**110**	**7**	**11**	0.7
		Manganese	9.40E-02	1.26E-01	1.47E+02	2.07E+02	1.03E+01	1.16E+01	2.76E+00	9.89E+00	77.6	776	0.1	0.04	0.01	0.004
		Mercury	4.36E-05	7.50E-05	9.36E-02	2.60E-01	2.87E-02	3.09E-02	7.29E-03	2.46E-02	0.0064	0.064	**4**	**1**	0.4	0.1
		Nickel	3.21E-03	4.10E-03	1.21E+01	2.57E+01	7.84E-01	1.02E+00	2.11E-01	9.10E-01	25.1	45.3	0.04	0.01	0.02	0.005
		Selenium	8.78E-04	3.70E-03	5.14E-01	1.04E+00	6.43E-01	6.86E-01	1.61E-01	5.21E-01	--	--	--	--	--	--
		Silver	2.20E-04	1.00E-03	1.30E+00	2.43E+00	6.29E-03	7.00E-03	3.21E-03	1.91E-02	9.36	19.2	0.002	0.0003	0.001	0.0002
		Thallium	5.57E-04	2.00E-03	1.84E-01	2.46E-01	3.16E-03	3.45E-03	1.05E-03	4.30E-03	--	--	--	--	--	--
		Vanadium	2.91E-03	2.50E-02	9.64E+00	1.54E+01	5.62E-02	6.31E-02	2.63E-02	1.38E-01	11.4	22.8	0.01	0.002	0.01	0.001
		Zinc	1.34E-02	2.08E-02	1.04E+02	3.12E+02	4.00E+01	4.32E+01	1.01E+01	3.42E+01	14.5	131	**2**	0.7	0.3	0.08

Notes:

-- = Fish tissue data and/or TRV not available or benchmark not reported. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = Central Tendency Exposure
RME = reasonable maximum exposure

HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = Body Weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-20b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS BIRDS - BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
iver - Site	VOCs	Acetone	2.68E-03	1.20E-02	1.28E-02	5.71E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	3.23E-03	2.26E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.57E-04	3.40E-04	3.26E-03	7.00E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	2.92E-03	1.40E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.39E-01	6.10E-01	3.75E-01	3.80E-01	9.41E-02	2.89E-01	--	--	--	--	--	--	--	--	--	--
		2-Methylphenol	2.50E-03	2.50E-03	8.61E-02	6.10E-01	3.75E-01	3.80E-01	9.40E-02	2.89E-01	0.96	9.6	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		4-Methylphenol	2.50E-03	2.50E-03	1.46E-01	6.10E-01	3.75E-01	3.80E-01	9.41E-02	2.89E-01	0.96	9.6	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Acenaphthene	4.23E-05	5.00E-05	3.70E-02	1.87E-01	3.75E-01	3.80E-01	9.38E-02	2.86E-01	1.11	11.1	0.3	0.08	0.03	0.01	<1	<1	<1	<1
		Acenaphthylene	4.44E-05	5.00E-05	4.29E-02	1.95E-01	3.75E-01	3.80E-01	9.38E-02	2.86E-01	1.11	11.1	0.3	0.08	0.03	0.01	<1	<1	<1	<1
		Anthracene	4.54E-05	5.00E-05	1.27E-01	7.58E-01	3.75E-01	3.80E-01	9.39E-02	2.89E-01	1.11	11.1	0.3	0.08	0.03	0.01	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.59E-01	1.89E-01	2.47E+00	4.10E+00	6.18E-01	3.08E+00	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	4.66E-05	5.00E-05	3.34E-01	1.75E+00	3.75E-01	3.80E-01	9.42E-02	2.95E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	4.72E-05	5.00E-05	3.46E-01	1.78E+00	3.75E-01	3.80E-01	9.42E-02	2.95E-01	10	20	0.03	0.01	0.01	0.005	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.18E-05	1.40E-04	3.93E-01	1.86E+00	3.75E-01	3.80E-01	9.42E-02	2.95E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Benzo(g,h,i)perylene	4.74E-05	5.00E-05	1.66E-01	8.98E-01	3.75E-01	3.80E-01	9.40E-02	2.90E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Benzo(k)fluoranthene	4.51E-05	5.00E-05	1.90E-01	1.21E+00	3.75E-01	3.80E-01	9.40E-02	2.92E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Carbazole	--	--	1.79E-01	2.45E-01	3.75E-01	3.80E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	4.94E-05	7.20E-05	4.11E-01	1.50E+00	3.75E-01	3.80E-01	9.43E-02	2.93E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	3.15E-03	1.40E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.27E-05	5.00E-05	5.62E-02	2.98E-01	3.75E-01	3.80E-01	9.38E-02	2.87E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.88E-01	1.10E+01	3.75E-01	3.80E-01	9.41E-02	3.47E-01	0.111	1.11	**3**	0.8	0.3	0.08	<1	<1	<1	<1
		Fluoranthene	5.44E-05	1.20E-04	6.32E-01	3.44E+00	3.75E-01	3.80E-01	9.45E-02	3.04E-01	2	20	0.2	0.05	0.02	0.005	<1	<1	<1	<1
		Fluorene	4.28E-05	5.00E-05	4.24E-02	2.62E-01	3.75E-01	3.80E-01	9.38E-02	2.86E-01	1.11	11.1	0.3	0.08	0.03	0.01	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	4.65E-05	5.00E-05	1.62E-01	9.04E-01	3.75E-01	3.80E-01	9.40E-02	2.90E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Naphthalene	4.26E-05	5.00E-05	2.96E-02	1.89E-01	3.75E-01	3.80E-01	9.38E-02	2.86E-01	2.86	28.6	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		Phenanthrene	5.11E-05	1.10E-04	3.64E-01	2.34E+00	3.75E-01	3.80E-01	9.42E-02	2.98E-01	1.11	11.1	0.3	0.08	0.03	0.01	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.57E-01	6.10E-01	3.75E-01	3.80E-01	9.41E-02	2.89E-01	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.45E-05	1.70E-04	6.95E-01	2.61E+00	3.75E-01	3.80E-01	9.46E-02	3.00E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
	Pesticides	4,4'-DDD	2.36E-06	4.70E-06	1.26E-03	3.79E-03	1.20E-02	1.30E-02	3.00E-03	9.77E-03	0.0028	0.028	**3**	**1**	0.3	0.1	<1	<1	<1	<1
		4,4'-DDE	2.39E-06	2.80E-06	8.70E-04	2.78E-03	4.07E-02	4.80E-02	1.02E-02	3.60E-02	0.0028	0.028	**13**	**4**	**1**	0.4	<1	<1	<1	<1
		alpha-Chlordane	1.22E-06	1.40E-06	3.53E-04	1.81E-03	1.02E-02	1.20E-02	2.55E-03	9.01E-03	0.211	2.11	0.04	0.01	0.004	0.001	<1	<1	<1	<1
		Dieldrin	2.46E-06	2.80E-06	1.39E-03	4.01E-03	1.83E-02	1.90E-02	4.58E-03	1.43E-02	0.077	0.37	0.2	0.1	0.04	0.01	<1	<1	<1	<1
		Endosulfan Sulfate	2.29E-06	2.80E-06	4.96E-04	4.30E-03	2.73E-03	2.90E-03	6.83E-04	2.20E-03	0.31	3.1	0.01	0.002	0.001	0.0002	<1	<1	<1	<1
		Endrin Ketone	2.30E-06	2.80E-06	5.61E-04	1.20E-02	3.15E-04	3.20E-04	7.96E-05	3.08E-04	0.0232	0.232	0.01	0.003	0.001	0.0003	<1	<1	<1	<1
		Gamma-Chlordane	1.22E-06	1.40E-06	5.48E-04	2.08E-03	5.90E-03	7.10E-03	1.48E-03	5.34E-03	0.211	2.11	0.03	0.01	0.003	0.001	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-20b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS BIRDS - BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	PCBs	Total PCBs	4.59E-05	5.50E-05	5.84E-02	4.88E-01	8.92E-01	9.70E-01	2.23E-01	7.30E-01	--	--	--	--	--	--	--	--	--	--
	Metals	Aluminum	8.07E-02	1.51E-01	3.52E+03	4.36E+03	9.32E+00	2.30E+01	6.73E+00	4.18E+01	109.7	1097	0.4	0.06	0.04	0.01	<1	<1	<1	<1
		Arsenic	1.72E-03	1.95E-03	5.89E+00	4.73E+01	1.49E-01	2.40E-01	4.47E-02	4.46E-01	1.85	3.88	0.2	0.02	0.1	0.01	<1	<1	<1	<1
			4.12E-02	3.35E-02	2.72E+01	4.58E+01	2.05E+00	2.40E+00	5.49E-01	2.06E+00	20.8	41.7	0.1	0.03	0.05	0.01	<1	<1	<1	<1
		Beryllium	1.41E-04	1.50E-04	2.91E-01	2.97E-01	6.16E-03	6.50E-03	1.91E-03	6.57E-03	--	--	--	--	--	--	--	--	--	--
		Cadmium	2.20E-04	3.69E-04	7.41E-01	3.28E+00	6.12E-02	7.70E-02	1.62E-02	7.63E-02	1.45	3.05	0.05	0.01	0.03	0.01	<1	<1	<1	<1
		Chromium	6.90E-04	1.49E-03	1.80E+01	5.73E+01	1.08E+00	1.40E+00	2.93E-01	1.37E+00	1	5	**1**	0.3	0.3	0.06	<1	<1	<1	<1
		Cobalt	4.07E-04	6.85E-04	3.67E+00	4.02E+00	7.84E-02	9.50E-02	2.42E-02	9.40E-02	--	--	--	--	--	--	--	--	--	--
	Barium	Copper	5.21E-03	1.25E-02	2.12E+01	4.26E+01	7.56E-01	9.60E-01	2.16E-01	9.62E-01	22.3	31.5	0.04	0.01	0.03	0.01	<1	<1	<1	<1
		Iron	5.93E-01	8.92E-01	8.06E+03	1.12E+04	1.98E+02	2.20E+02	5.96E+01	2.28E+02	--	--	--	--	--	--	--	--	--	--
		Lead	1.69E-03	3.69E-03	2.25E+01	5.10E+01	2.13E-01	4.30E-01	8.15E-02	6.10E-01	0.0114	0.114	**53**	**7**	**5**	0.7	<1	<1	<1	<1
		Manganese	1.41E-01	3.10E-01	1.29E+02	2.05E+02	1.52E+01	2.40E+01	3.97E+00	1.92E+01	77.6	776	0.2	0.05	0.02	0.01	<1	<1	<1	<1
		Mercury	7.00E-05	4.60E-04	5.78E-02	1.65E-01	2.67E-02	3.30E-02	6.75E-03	2.58E-02	0.0064	0.064	**4**	**1**	0.4	0.1	<1	<1	<1	<1
		Nickel	2.23E-03	3.33E-03	6.53E+00	1.02E+01	9.79E-01	1.10E+00	2.53E-01	8.83E-01	25.1	45.3	0.04	0.01	0.02	0.01	<1	<1	<1	<1
		Selenium	1.20E-03	1.50E-03	6.86E-01	3.91E+00	5.74E-01	6.30E-01	1.44E-01	4.95E-01	--	--	--	--	--	--	--	--	--	--
		Silver	4.96E-04	1.00E-03	1.65E+00	4.10E+00	6.16E-03	6.50E-03	3.63E-03	2.81E-02	9.36	19.2	0.003	0.0004	0.001	0.0002	<1	<1	<1	<1
		Thallium	1.28E-03	2.00E-03	2.16E-01	2.47E-01	3.12E-03	3.20E-03	1.12E-03	4.12E-03	--	--	--	--	--	--	--	--	--	--
		Vanadium	7.86E-04	1.04E-03	7.19E+00	9.89E+00	6.07E-02	1.20E-01	2.42E-02	1.46E-01	11.4	22.8	0.01	0.002	0.01	0.001	<1	<1	<1	<1
		Zinc	1.15E-02	2.17E-02	6.38E+01	1.04E+02	3.62E+01	4.10E+01	9.13E+00	3.13E+01	14.5	131	**2**	0.6	0.2	0.07	<1	<1	<1	<1

Notes:

-- = Fish tissue data and/or TRV not available or benchmark not reported. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = Central Tendency Exposure
RME = reasonable maximum exposure
RR = residual risk
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-20c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS BIRDS - POND A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond A	VOCs	2-Butanone	2.50E-03	2.50E-03	3.46E-02	2.66E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2.50E-03	2.50E-03	6.86E-02	5.32E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	5.47E-03	6.56E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.69E-04	4.40E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	5.99E-03	3.80E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	5.50E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.72E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.71E-01	3.30E-01	3.72E-01	3.80E-01	9.34E-02	2.87E-01	--	--	--	--	--	--	--	--	--	--
		2-Methylphenol	2.50E-03	2.50E-03	1.50E-01	3.30E-01	3.72E-01	3.80E-01	9.33E-02	2.87E-01	0.96	9.6	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.90E-01	3.30E-01	3.72E-01	3.80E-01	9.34E-02	2.87E-01	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.90E-01	3.30E-01	3.72E-01	3.80E-01	9.34E-02	2.87E-01	1	10	0.3	0.1	0.03	0.01	<1	<1	<1	<1
Acetone		4-Methylphenol	2.50E-03	2.50E-03	1.72E-01	3.30E-01	3.72E-01	3.80E-01	9.34E-02	2.87E-01	0.96	9.6	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		4-Nitroaniline	1.00E-02	1.00E-02	4.07E-01	8.50E-01	3.72E-01	3.80E-01	9.41E-02	2.91E-01	0.75	7.5	0.4	0.1	0.04	0.01	<1	<1	<1	<1
		Acenaphthene	5.00E-05	5.00E-05	7.35E-02	1.11E-01	3.72E-01	3.80E-01	9.31E-02	2.86E-01	1.11	11.1	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Acenaphthylene	5.00E-05	5.00E-05	1.17E-01	2.91E-01	3.72E-01	3.80E-01	9.31E-02	2.87E-01	1.11	11.1	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.75E-01	3.30E-01	3.72E-01	3.80E-01	9.34E-02	2.87E-01	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.00E-05	5.00E-05	1.93E-01	5.55E-01	3.72E-01	3.80E-01	9.32E-02	2.88E-01	1.11	11.1	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	2.44E-01	5.51E-01	6.29E+00	7.24E+00	1.57E+00	5.43E+00	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.54E-05	1.40E-04	5.72E-01	1.60E+00	3.72E-01	3.80E-01	9.37E-02	2.94E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.91E-05	1.20E-04	6.45E-01	1.84E+00	3.72E-01	3.80E-01	9.38E-02	2.95E-01	10	20	0.03	0.01	0.01	0.005	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.00E-05	5.00E-05	6.91E-01	2.30E+00	3.72E-01	3.80E-01	9.39E-02	2.98E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.00E-05	5.00E-05	3.22E-01	9.38E-01	3.72E-01	3.80E-01	9.34E-02	2.90E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	3.36E-01	1.00E+00	3.72E-01	3.80E-01	9.34E-02	2.91E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Carbazole	--	--	1.55E-01	1.98E-01	3.72E-01	3.80E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.50E-05	1.30E-04	6.41E-01	1.90E+00	3.72E-01	3.80E-01	9.38E-02	2.96E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	1.25E-01	3.30E-01	3.72E-01	3.80E-01	9.32E-02	2.87E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.64E-01	3.30E-01	3.72E-01	3.80E-01	9.33E-02	2.87E-01	0.111	1.11	**3**	0.8	0.3	0.1	<1	<1	<1	<1
		Fluoranthene	5.80E-05	2.20E-04	1.03E+00	3.14E+00	3.72E-01	3.80E-01	9.43E-02	3.03E-01	2	20	0.2	0.05	0.02	0.005	<1	<1	<1	<1
		Fluorene	5.00E-05	5.00E-05	9.92E-02	1.84E-01	3.72E-01	3.80E-01	9.31E-02	2.86E-01	1.11	11.1	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	1.15E-01	3.30E-01	3.72E-01	3.80E-01	9.33E-02	2.87E-01	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.90E-01	3.30E-01	3.72E-01	3.80E-01	9.34E-02	2.87E-01	--	--	--	--	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	5.00E-05	5.00E-05	3.40E-01	1.41E+00	3.72E-01	3.80E-01	9.34E-02	2.93E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Isophorone	2.50E-03	2.50E-03	1.90E-01	3.30E-01	3.72E-01	3.80E-01	9.34E-02	2.87E-01	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.00E-05	5.00E-05	8.30E-02	1.87E-01	3.72E-01	3.80E-01	9.31E-02	2.86E-01	2.86	28.6	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.90E-01	3.30E-01	3.72E-01	3.80E-01	9.34E-02	2.87E-01	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	6.16E-01	1.50E+00	3.80E+00	3.80E+00	9.51E-01	2.86E+00	--	--	--	--	--	--	--	--	--	--
		Phenanthrene	6.21E-05	2.00E-04	4.76E-01	1.51E+00	3.72E-01	3.80E-01	9.36E-02	2.94E-01	1.11	11.1	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.81E-01	3.30E-01	3.72E-01	3.80E-01	9.34E-02	2.87E-01	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.77E-05	2.10E-04	9.27E-01	2.58E+00	3.72E-01	3.80E-01	9.42E-02	3.00E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-20c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS BIRDS - POND A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.50E-06	2.50E-06	3.03E-03	9.86E-03	5.83E-03	6.66E-03	1.46E-03	5.05E-03	0.0028	0.028	**2**	0.5	0.2	0.1	<1	<1	<1	<1
		4,4'-DDE	2.50E-06	2.50E-06	4.46E-03	1.64E-02	1.13E-02	1.27E-02	2.83E-03	9.62E-03	0.0028	0.028	**3**	**1**	0.3	0.1	<1	<1	<1	<1
			2.50E-06	2.50E-06	7.38E-04	4.05E-03	3.14E-04	3.20E-04	7.96E-05	2.63E-04	0.0028	0.028	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		alpha-Chlordane	1.25E-06	1.25E-06	2.37E-03	2.15E-02	2.73E-03	3.20E-03	6.86E-04	2.52E-03	0.211	2.11	0.01	0.003	0.001	0.0003	<1	<1	<1	<1
		Dieldrin	2.50E-06	2.50E-06	1.45E-03	2.10E-02	1.31E-02	1.48E-02	3.28E-03	1.12E-02	0.077	0.37	0.1	0.04	0.03	0.01	<1	<1	<1	<1
		Endosulfan Sulfate	2.50E-06	2.50E-06	1.02E-03	1.00E-02	1.62E-03	2.05E-03	4.06E-04	1.59E-03	0.31	3.1	0.01	0.001	0.001	0.0001	<1	<1	<1	<1
		Endrin	2.50E-06	2.50E-06	5.18E-04	8.60E-03	3.14E-04	3.20E-04	7.93E-05	2.89E-04	0.01	0.1	0.03	0.01	0.003	0.001	<1	<1	<1	<1
	4,4'-DDT	Endrin Aldehyde	2.50E-06	2.50E-06	7.45E-04	5.80E-03	3.14E-04	3.20E-04	7.96E-05	2.73E-04	0.0232	0.232	0.01	0.003	0.001	0.0003	<1	<1	<1	<1
		Endrin Ketone	2.50E-06	2.50E-06	4.96E-04	2.10E-03	3.14E-04	3.20E-04	7.93E-05	2.52E-04	0.0232	0.232	0.01	0.003	0.001	0.0003	<1	<1	<1	<1
		Gamma-BHC	1.25E-06	1.25E-06	2.29E-04	3.35E-04	3.14E-04	3.20E-04	7.89E-05	2.42E-04	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.25E-06	1.25E-06	9.27E-04	3.50E-02	1.37E-03	1.85E-03	3.44E-04	1.58E-03	0.211	2.11	0.01	0.002	0.001	0.0002	<1	<1	<1	<1
		Heptachlor Epoxide	1.25E-06	1.25E-06	3.46E-04	2.70E-02	3.14E-04	3.20E-04	7.90E-05	3.92E-04	0.211	2.11	0.002	0.0004	0.0002	0.00004	<1	<1	<1	<1
		Toxaphene	1.25E-04	1.25E-04	2.37E-02	4.20E-02	3.14E-02	3.20E-02	7.89E-03	2.43E-02	0.0531	0.531	0.5	0.1	0.05	0.01	<1	<1	<1	<1
	PCBs	Total PCBs	5.00E-05	5.00E-05	2.38E-01	6.00E-01	3.58E-01	3.80E-01	8.98E-02	2.88E-01	--	--	--	--	--	--	--	--	--	--
	Metals	Aluminum	7.41E-02	1.93E-01	5.75E+03	1.02E+04	3.49E+00	4.39E+00	8.06E+00	6.07E+01	109.7	1097	0.6	0.1	0.1	0.01	<1	<1	<1	<1
		Arsenic	2.02E-03	2.27E-03	6.82E+00	1.68E+01	6.70E-02	1.26E-01	2.54E-02	1.89E-01	1.85	3.88	0.1	0.01	0.05	0.01	<1	<1	<1	<1
			3.42E-02	1.00E-01	5.26E+01	1.24E+02	1.12E+00	1.31E+00	3.48E-01	1.70E+00	20.8	41.7	0.1	0.02	0.04	0.01	<1	<1	<1	<1
		Beryllium	1.50E-04	1.50E-04	4.82E-01	9.26E-01	6.68E-03	7.00E-03	2.28E-03	1.05E-02	--	--	--	--	--	--	--	--	--	--
		Cadmium	1.55E-04	2.20E-03	3.42E+00	1.82E+01	2.52E-02	2.91E-02	1.06E-02	1.25E-01	1.45	3.05	0.1	0.01	0.04	0.003	<1	<1	<1	<1
		Chromium	3.49E-04	4.80E-03	5.74E+01	1.48E+02	8.02E-01	1.28E+00	2.72E-01	1.79E+00	1	5	**2**	0.3	0.4	0.1	<1	<1	<1	<1
		Cobalt	1.85E-03	2.50E-02	7.75E+00	1.60E+01	5.38E-02	6.24E-02	2.32E-02	1.41E-01	--	--	--	--	--	--	--	--	--	--
	Barium	Copper	3.93E-03	1.25E-02	6.33E+01	1.83E+02	3.24E-01	3.65E-01	1.60E-01	1.31E+00	22.3	31.5	0.1	0.01	0.04	0.01	<1	<1	<1	<1
		Cyanide	1.82E-03	3.20E-03	5.09E-01	2.31E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Iron	1.51E+00	4.18E+00	1.23E+04	2.17E+04	1.74E+02	1.97E+02	5.90E+01	2.71E+02	--	--	--	--	--	--	--	--	--	--
		Lead	1.79E-03	1.55E-02	6.75E+01	1.76E+02	1.42E-01	1.83E-01	1.20E-01	1.13E+00	0.0114	0.114	**99**	**11**	**10**	**1**	<1	**3**	<1	<1
		Manganese	3.63E-01	3.97E-01	2.01E+02	4.88E+02	1.23E+01	1.42E+01	3.35E+00	1.35E+01	77.6	776	0.2	0.04	0.02	0.004	<1	<1	<1	<1
		Mercury	6.87E-05	7.50E-05	2.63E-01	6.29E-01	1.66E-02	1.82E-02	4.48E-03	1.72E-02	0.0064	0.064	**3**	0.7	0.3	0.1	<1	<1	<1	<1
		Nickel	3.88E-03	2.00E-02	1.48E+01	4.14E+01	7.05E-01	9.02E-01	1.95E-01	9.13E-01	25.1	45.3	0.04	0.01	0.02	0.004	<1	<1	<1	<1
		Selenium	1.50E-03	1.50E-03	1.31E+00	2.58E+00	2.80E-01	3.14E-01	7.17E-02	2.50E-01	--	--	--	--	--	--	--	--	--	--
		Silver	8.19E-04	5.00E-03	3.43E+00	1.12E+01	6.68E-03	7.00E-03	6.00E-03	6.91E-02	9.36	19.2	0.01	0.001	0.004	0.0003	<1	<1	<1	<1
		Zinc	1.45E-02	1.55E-01	2.01E+02	6.92E+02	1.73E+01	2.00E+01	4.58E+00	1.89E+01	14.5	131	**1**	0.3	0.1	0.03	<1	<1	<1	<1

Notes:

-- = Fish tissue data and/or TRV not available or benchmark not reported. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = Central Tendency Exposure
RME = reasonable maximum exposure
RR = residual risk
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-20d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS BIRDS - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Statistics (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
ond F	VOCs	Acetone	2.50E-03	2.50E-03	1.09E-01	6.90E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	3.67E-03	7.00E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	9.29E-02	2.80E-01	--	--	--	--	--	--	--	--	--	--
		2-Methylphenol	2.50E-03	2.50E-03	1.47E-01	2.95E-01	3.70E-01	3.70E-01	9.28E-02	2.80E-01	0.96	9.6	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	9.29E-02	2.80E-01	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	9.29E-02	2.80E-01	1	10	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		4-Methylphenol	2.50E-03	2.50E-03	1.40E-01	2.55E-01	3.70E-01	3.70E-01	9.28E-02	2.79E-01	0.96	9.6	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		4-Nitroaniline	1.00E-02	1.00E-02	4.06E-01	7.50E-01	3.70E-01	3.70E-01	9.36E-02	2.83E-01	0.75	7.5	0.4	0.1	0.04	0.01	<1	<1	<1	<1
		Acenaphthene	5.00E-05	5.00E-05	7.54E-02	9.60E-02	2.79E-01	3.70E-01	6.98E-02	2.78E-01	1.11	11.1	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Acenaphthylene	5.00E-05	5.00E-05	1.11E-01	3.00E-01	3.70E-01	3.70E-01	9.26E-02	2.79E-01	1.11	11.1	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	9.29E-02	2.80E-01	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.00E-05	5.00E-05	3.02E-01	4.70E-01	3.70E-01	3.70E-01	9.29E-02	2.80E-01	1.11	11.1	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.04E-01	2.10E-01	3.62E+00	7.80E+00	9.05E-01	5.85E+00	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.00E-05	5.00E-05	8.77E-01	1.40E+00	3.70E-01	3.70E-01	9.36E-02	2.85E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	6.79E-05	1.70E-04	9.00E-01	1.80E+00	3.70E-01	3.70E-01	9.36E-02	2.88E-01	10	20	0.03	0.01	0.01	0.005	<1	<1	<1	<1
		Benzo(b)fluoranthene	6.69E-05	1.60E-04	1.16E+00	2.60E+00	3.70E-01	3.70E-01	9.40E-02	2.92E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.00E-05	5.00E-05	4.57E-01	9.60E-01	3.70E-01	3.70E-01	9.31E-02	2.83E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	6.72E-01	1.10E+00	3.70E-01	3.70E-01	9.33E-02	2.84E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Carbazole	--	--	1.28E-01	2.95E-01	3.70E-01	3.70E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	6.47E-05	1.40E-04	1.04E+00	2.10E+00	3.70E-01	3.70E-01	9.38E-02	2.89E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	1.97E-01	3.50E-01	3.70E-01	3.70E-01	9.27E-02	2.79E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.01E-01	3.90E-01	3.70E-01	3.70E-01	9.29E-02	2.80E-01	0.111	1.11	**3**	0.8	0.3	0.1	<1	<1	<1	<1
		Fluoranthene	6.89E-05	1.80E-04	2.20E+00	4.00E+00	3.70E-01	3.70E-01	9.53E-02	3.00E-01	2	20	0.2	0.05	0.02	0.005	<1	<1	<1	<1
		Fluorene	5.00E-05	5.00E-05	1.12E-01	1.50E-01	3.70E-01	3.70E-01	9.26E-02	2.78E-01	1.11	11.1	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	1.06E-01	2.95E-01	3.70E-01	3.70E-01	9.28E-02	2.80E-01	--	--	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	9.29E-02	2.80E-01	--	--	--	--	--	--	--	--	--	--
		Indeno(1,2,3-cd)pyrene	5.00E-05	5.00E-05	5.07E-01	1.10E+00	3.70E-01	3.70E-01	9.31E-02	2.84E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1
		Isophorone	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	9.29E-02	2.80E-01	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.34E-05	6.50E-05	1.77E-01	2.55E-01	3.70E-01	3.70E-01	9.27E-02	2.79E-01	2.86	28.6	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	9.29E-02	2.80E-01	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	6.20E-01	7.50E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Phenanthrene	8.07E-05	1.70E-04	1.07E+00	1.70E+00	2.85E-01	3.70E-01	7.26E-02	2.87E-01	1.11	11.1	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.87E-01	2.95E-01	3.70E-01	3.70E-01	9.29E-02	2.80E-01	--	--	--	--	--	--	--	--	--	--
		Pyrene	7.48E-05	2.50E-04	1.67E+00	2.70E+00	3.70E-01	3.70E-01	9.46E-02	2.93E-01	2	20	0.1	0.05	0.01	0.005	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-20d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS BIRDS - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Statistics (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.50E-06	2.50E-06	4.54E-03	8.20E-03	1.30E-02	1.40E-02	3.26E-03	1.05E-02	0.0028	0.028	**4**	**1**	0.4	0.1	<1	<1	<1	<1
		4,4'-DDE	2.50E-06	2.50E-06	2.63E-02	3.70E-02	2.34E-02	2.90E-02	5.88E-03	2.20E-02	0.0028	0.028	**8**	**2**	0.8	0.2	<1	<1	<1	<1
			2.50E-06	2.50E-06	8.68E-04	4.80E-03	3.20E-04	3.20E-04	8.12E-05	2.67E-04	0.0028	0.028	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		alpha-Chlordane	1.25E-06	1.25E-06	5.29E-04	4.30E-03	6.17E-03	8.40E-03	1.54E-03	6.32E-03	0.211	2.11	0.03	0.01	0.003	0.001	<1	<1	<1	<1
		Dieldrin	2.50E-06	2.50E-06	1.67E-02	3.60E-02	2.51E-02	3.00E-02	6.30E-03	2.27E-02	0.077	0.37	0.3	0.1	0.1	0.02	<1	<1	<1	<1
		Endosulfan Sulfate	2.50E-06	2.50E-06	1.75E-03	5.10E-03	3.28E-03	5.10E-03	8.22E-04	3.85E-03	0.31	3.1	0.01	0.003	0.001	0.0003	<1	<1	<1	<1
		Endrin Aldehyde	2.50E-06	2.50E-06	1.62E-03	9.50E-03	3.20E-04	3.20E-04	8.22E-05	2.94E-04	0.0232	0.232	0.01	0.004	0.001	0.0004	<1	<1	<1	<1
	4,4'-DDT	Endrin Ketone	2.50E-06	2.50E-06	3.69E-04	4.40E-04	3.20E-04	3.20E-04	8.06E-05	2.43E-04	0.0232	0.232	0.01	0.003	0.001	0.0003	<1	<1	<1	<1
		Gamma-BHC	1.25E-06	1.25E-06	2.63E-04	3.10E-04	3.20E-04	3.20E-04	8.04E-05	2.42E-04	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.25E-06	1.25E-06	6.69E-04	3.70E-03	3.31E-03	6.10E-03	8.28E-04	4.60E-03	0.211	2.11	0.02	0.004	0.002	0.0004	<1	<1	<1	<1
		Toxaphene	1.25E-04	1.25E-04	2.75E-02	3.85E-02	3.20E-02	3.20E-02	8.04E-03	2.42E-02	0.0531	0.531	0.5	0.2	0.05	0.02	<1	<1	<1	<1
	PCBs	Total PCBs	5.00E-05	5.00E-05	1.45E-01	6.00E-01	7.50E-01	9.60E-01	1.88E-01	7.23E-01	--	--	--	--	--	--	--	--	--	--
	Metals	Aluminum	1.23E-01	9.95E-01	5.39E+03	1.11E+04	5.51E+00	1.10E+01	8.12E+00	7.09E+01	109.7	1097	0.6	0.1	0.06	0.01	<1	<1	<1	<1
		Arsenic	1.71E-03	2.41E-03	6.56E+00	1.73E+01	9.68E-02	1.20E-01	3.25E-02	1.88E-01	1.85	3.88	0.1	0.02	0.05	0.01	<1	<1	<1	<1
			4.03E-02	1.00E-01	5.88E+01	2.02E+02	1.23E+00	1.40E+00	3.83E-01	2.20E+00	20.8	41.7	0.1	0.02	0.05	0.01	<1	<1	<1	<1
		Beryllium	1.50E-04	1.50E-04	5.48E-01	8.50E-01	6.50E-03	6.50E-03	2.32E-03	9.68E-03	--	--	--	--	--	--	--	--	--	--
		Cadmium	1.57E-04	6.00E-04	4.96E+00	1.48E+01	5.02E-02	1.20E-01	1.88E-02	1.73E-01	1.45	3.05	0.1	0.01	0.06	0.01	<1	<1	<1	<1
		Chromium	2.22E-03	1.00E-02	5.53E+01	1.49E+02	8.27E-01	1.00E+00	2.76E-01	1.59E+00	1	5	**2**	0.3	0.3	0.1	<1	<1	<1	<1
		Cobalt	3.33E-04	1.15E-03	6.98E+00	8.50E+00	7.33E-02	8.30E-02	2.71E-02	1.10E-01	--	--	--	--	--	--	--	--	--	--
	Barium	Copper	5.48E-03	1.25E-02	7.77E+01	2.34E+02	5.51E-01	7.30E-01	2.35E-01	1.87E+00	22.3	31.5	0.08	0.01	0.06	0.01	<1	<1	<1	<1
		Cyanide	1.61E-03	2.00E-03	2.77E-01	3.60E-01	--	--	--	--	-	--	--	--	--	--	--	--	--	--
		Iron	2.11E+00	4.91E+00	1.07E+04	2.45E+04	2.06E+02	2.20E+02	6.50E+01	3.04E+02	--	--	--	--	--	--	--	--	--	--
		Lead	3.29E-03	1.96E-02	8.30E+01	2.07E+02	1.40E-01	3.30E-01	1.39E-01	1.42E+00	0.0114	0.114	**124**	**12**	**12**	**1**	**14**	**5**	**1**	<1
		Manganese	2.24E-01	1.01E+00	2.14E+02	6.72E+02	1.29E+01	1.80E+01	3.50E+00	1.74E+01	77.6	776	0.2	0.05	0.02	0.005	<1	<1	<1	<1
		Mercury	6.74E-05	7.00E-05	2.02E-01	6.10E-01	5.05E-02	6.10E-02	1.29E-02	4.92E-02	0.0064	0.064	**8**	**2**	0.8	0.2	**4**	<1	<1	<1
		Nickel	3.60E-03	2.00E-02	1.71E+01	3.77E+01	8.83E-01	1.00E+00	2.42E-01	9.65E-01	25.1	45.3	0.04	0.01	0.02	0.01	<1	<1	<1	<1
		Selenium	1.50E-03	1.50E-03	9.74E-01	3.60E+00	4.94E-01	5.60E-01	1.25E-01	4.40E-01	--	--	--	--	--	--	--	--	--	--
		Silver	8.91E-04	2.10E-03	3.30E+00	1.46E+01	6.50E-03	6.50E-03	5.80E-03	8.73E-02	9.36	19.2	0.01	0.001	0.005	0.0003	<1	<1	<1	<1
		Thallium	1.61E-03	2.00E-03	2.40E-01	3.45E-01	3.25E-03	3.25E-03	1.20E-03	4.71E-03	--	--	--	--	--	--	--	--	--	--
		Vanadium	7.71E-04	3.20E-03	1.20E+01	2.71E+01	6.89E-02	1.20E-01	3.23E-02	2.43E-01	11.4	22.8	0.02	0.003	0.01	0.001	<1	<1	<1	<1
		Zinc	1.47E-02	4.64E-02	1.89E+02	4.77E+02	2.14E+01	2.70E+01	5.59E+00	2.29E+01	14.5	131	**2**	0.4	0.2	0.04	<1	<1	<1	<1

otes:
-- = Fish tissue data and/or TRV not available or benchmark not reported. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = Central Tendency Exposure
RME = reasonable maximum exposure
RR = residual risk
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

Table 7-20e: Weight-of-Evidence Integration for small piscivorous birds
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:
Maintain stable and healthy populations of small piscivorous birds
Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small piscivorous birds foraging in selected aquatic habitats at the site?

Measurement Endpoint
7.A: use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to no effect and effect avian TRVs.

Weight-of-Evidence Integration

Blackstone River

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm			**7.A**		

Pond A

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm			**7.A**		

Pond F

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm			**7.A**		

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Table 7-21 was removed from the May 2009 Revised BERA

US EPA ARCHIVE DOCUMENT

TABLE 7-22a
CALCULATED HAZARD QUOTIENTS FOR LARGE OMNIVOROUS MAMMALS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/Kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water		Soil (dw)		Food (ww)										
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE
River - Upstream	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.18E-05	3.74E-05	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.07E-04	3.24E-04	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.07E-04	3.24E-04	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.07E-04	3.24E-04	25	50	0.00001	0.000004	0.00001	0.000002
		Acetone	2.97E-03	4.95E-03	5.57E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	1.28E-04	6.39E-04	10	50	0.0001	0.00001	0.00001	0.000003
		Carbon Disulfide	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.18E-05	3.74E-05	--	--	--	--	--	--
		Chloromethane	2.76E-04	3.70E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.29E-05	5.27E-05	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.18E-05	3.74E-05	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.18E-05	3.74E-05	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.18E-05	3.74E-05	--	--	--	--	--	--
		Methylene chloride	3.13E-04	4.20E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.45E-05	5.91E-05	5.85	50	0.00001	0.000002	0.000001	0.0000003
		Styrene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	--	--	--	--	--	--	--	--	--	--	--
		Tetrachloroethene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.18E-05	3.74E-05	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.18E-05	3.74E-05	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.79E-01	2.40E-01	--	--	--	--	--	--	--	--	--	--	--
		2-Methylnapthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		2-Methylphenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.27E+00	4.66E-01	5.45E-01	2.58E-02	9.06E-02	--	--	--	--	--	--
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.73E+00	9.69E-01	1.13E+00	5.34E-02	1.88E-01	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.81E-02	9.86E-03	1.15E-02	6.99E-04	2.49E-03	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	3.07E-01	6.30E-02	7.38E-02	3.62E-03	1.28E-02	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	5.15E-01	6.00E-01	5.24E-01	2.70E-01	3.14E-01	1.54E-02	5.38E-02	--	--	--	--	--	--
		Acenaphthene	2.39E-05	5.00E-05	2.69E-01	8.80E-01	--	--	--	--	--	5	10	--	--	--	--
		Acenaphthylene	2.92E-05	5.00E-05	2.81E-01	7.30E-01	3.66E+00	1.03E+00	2.67E+00	5.67E-02	4.42E-01	5	10	0.09	0.01	0.04	0.006
		Acetophenone	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.37E+00	4.86E-01	5.69E-01	2.69E-02	9.44E-02	--	--	--	--	--	--
		Anthracene	3.19E-05	5.00E-05	1.26E+00	4.00E+00	3.87E-01	4.88E-01	1.55E+00	2.71E-02	2.60E-01	5	10	0.05	0.005	0.03	0.003
		Benzaldehyde	2.50E-03	2.50E-03	1.72E-01	2.00E-01	5.70E-01	9.81E-02	1.14E-01	5.54E-03	1.94E-02	--	--	--	--	--	--
		Benzo[a]anthracene	4.11E-05	5.00E-05	2.91E+00	9.30E+00	2.54E-01	7.40E-01	2.37E+00	4.14E-02	4.01E-01	--	--	--	--	--	--
		Benzo(a)pyrene	5.14E-05	6.70E-05	2.82E+00	7.50E+00	2.13E-01	6.00E-01	1.60E+00	3.37E-02	2.72E-01	1	10	0.27	0.03	0.03	0.003
		Benzo(b)fluoranthene	5.05E-05	8.60E-05	3.04E+00	7.80E+00	4.16E-01	1.26E+00	3.24E+00	7.03E-02	5.44E-01	1	2	0.5	0.07	0.3	0.04
		Benzo(g,h,i)perylene	5.24E-05	1.30E-04	1.71E+00	4.40E+00	4.70E-01	8.04E-01	2.07E+00	4.47E-02	3.46E-01	1	2	0.3	0.04	0.2	0.02
		Benzo(k)fluoranthene	4.21E-05	6.90E-05	1.28E+00	3.40E+00	4.16E-01	5.32E-01	1.41E+00	2.96E-02	2.37E-01	--	--	--	--	--	--
		Bis(2-ethylhexyl)phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.29E+02	2.65E+01	3.11E+01	1.46E+00	5.13E+00	18.3	183	0.3	0.08	0.03	0.008
		Butyl benzyl phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.60E-01	5.33E-02	6.24E-02	3.09E-03	1.09E-02	--	--	--	--	--	--
		Carbazole	--	--	2.88E-01	5.50E-01	2.71E+00	7.79E-01	1.49E+00	--	--	--	--	--	--	--	--
		Chrysene	4.82E-05	7.40E-05	3.07E+00	8.90E+00	3.66E-01	1.12E+00	3.26E+00	6.26E-02	5.48E-01	1	2	0.5	0.1	0.3	0.03
		Cyclohexane	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	1.18E-05	3.74E-05	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.28E-05	1.40E-04	4.59E-01	9.40E-01	3.70E-01	1.70E-01	3.47E-01	9.45E-03	5.84E-02	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.69E-01	4.40E-01	9.14E-01	1.55E-01	4.02E-01	8.65E-03	6.72E-02	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.83E+01	3.74E+00	4.38E+00	2.06E-01	7.24E-01	7500	15000	0.0001	0.00003	0.00005	0.00001
		Fluoranthene	5.91E-05	8.30E-05	4.63E+00	1.50E+01	4.86E-01	2.25E+00	7.30E+00	1.25E-01	1.22E+00	1	2	**1**	0.1	0.6	0.06
		Fluorene	2.48E-05	5.00E-05	3.30E-01	1.20E+00	--	--	--	--	--	5	10	--	--	--	--
		Hexachlorobenzene	2.50E-03	2.50E-03	2.05E-01	2.40E-01	--	--	--	--	--	1.6	3.2	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.03E-01	2.11E-02	2.47E-02	1.32E-03	4.66E-03	0.2	0.4	0.02	0.007	0.01	0.003
		Indeno(1,2,3-cd)pyrene	4.95E-05	1.30E-04	1.25E+00	2.60E+00	4.58E-01	5.72E-01	1.19E+00	3.18E-02	1.99E-01	1	--	0.2	0.03	--	--
		Isophorone	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.51E-01	3.09E-02	3.62E-02	1.86E-03	6.55E-03	--	--	--	--	--	--
		Naphthalene	2.67E-05	5.00E-05	1.83E-01	2.80E-01	7.04E-01	1.29E-01	1.97E-01	7.13E-03	3.28E-02	5	10	0.01	0.001	0.003	0.001
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.40E-01	9.03E-02	1.06E-01	5.12E-03	1.80E-02	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	5.15E-01	6.00E-01	4.10E+01	2.11E+01	2.46E+01	1.16E+00	4.06E+00	0.24	2.4	**17**	**5**	**2**	0.5
		Phenanthrene	4.63E-05	5.00E-05	3.98E+00	1.40E+01	2.75E-01	1.10E+00	3.85E+00	6.12E-02	6.51E-01	5	10	0.1	0.01	0.07	0.006
		Phenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.76E-05	8.70E-05	4.79E+00	1.90E+01	2.80E-01	1.34E+00	5.32E+00	7.49E-02	8.99E-01	1	2	0.9	0.07	0.4	0.04

US EPA ARCHIVE DOCUMENT

TABLE 7-22a
CALCULATED HAZARD QUOTIENTS FOR LARGE OMNIVOROUS MAMMALS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/Kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water		Soil (dw)		Food (ww)										
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	1.56E-06	2.80E-06	3.38E-03	8.10E-03	5.11E-01	1.73E-03	4.14E-03	9.59E-05	6.92E-04	0.8	4	0.001	0.0001	0.0002	0.00002
		4,4'-DDE	1.82E-06	2.80E-06	5.27E-03	5.90E-03	1.90E+00	1.00E-02	1.12E-02	5.53E-04	1.86E-03	0.8	4	0.002	0.001	0.0005	0.0001
		4,4'-DDT	1.56E-06	2.80E-06	4.26E-03	9.80E-03	1.34E+00	5.70E-03	1.31E-02	3.15E-04	2.18E-03	0.8	4	0.003	0.0004	0.001	0.0001
		alpha-Chlordane	9.83E-07	1.40E-06	1.06E-03	1.25E-03	2.85E+00	3.02E-03	3.56E-03	1.66E-04	5.89E-04	--	--	--	--	--	--
		Dieldrin	2.05E-06	2.80E-06	1.42E-02	3.30E-02	1.56E+00	2.21E-02	5.14E-02	1.22E-03	8.52E-03	0.02	0.2	0.4	0.06	0.04	0.006
		Endosulfan I	9.83E-07	1.40E-06	1.06E-03	1.25E-03	7.98E-01	8.46E-04	9.98E-04	4.68E-05	1.66E-04	0.15	0.3	0.001	0.0003	0.001	0.0002
		Endosulfan II	1.56E-06	2.80E-06	2.07E-03	2.45E-03	7.98E-01	1.65E-03	1.96E-03	9.14E-05	3.26E-04	--	--	--	--	--	--
		Endosulfan Sulfate	1.56E-06	2.80E-06	1.85E-03	1.85E-03	7.98E-01	1.48E-03	1.48E-03	8.17E-05	2.46E-04	--	--	--	--	--	--
		Endrin	1.56E-06	2.80E-06	2.07E-03	2.45E-03	5.76E-01	1.19E-03	1.41E-03	6.62E-05	2.36E-04	0.092	0.92	0.003	0.001	0.0003	0.0001
		Endrin Aldehyde	1.56E-06	2.80E-06	2.95E-03	7.10E-03	5.76E-01	1.70E-03	4.09E-03	9.42E-05	6.83E-04	--	--	--	--	--	--
		Endrin Ketone	1.56E-06	2.80E-06	2.07E-03	2.45E-03	5.76E-01	1.19E-03	1.41E-03	6.62E-05	2.36E-04	--	--	--	--	--	--
		Gamma-BHC	9.83E-07	1.40E-06	1.06E-03	1.25E-03	1.62E+00	1.71E-03	2.02E-03	9.45E-05	3.35E-04	--	--	--	--	--	--
		Gamma-Chlordane	9.83E-07	1.40E-06	9.75E-04	1.00E-03	2.85E+00	2.78E-03	2.85E-03	1.53E-04	4.71E-04	--	--	--	--	--	--
		Heptachlor Epoxide	9.83E-07	1.40E-06	1.06E-03	1.25E-03	1.74E+00	1.85E-03	2.18E-03	1.02E-04	3.61E-04	--	--	--	--	--	--
		Methoxychlor	4.56E-06	1.40E-05	1.83E-02	3.40E-02	2.13E-01	3.90E-03	7.25E-03	2.19E-04	1.24E-03	4	8	0.0003	0.0001	0.0002	0.00003
		Toxaphene	9.83E-05	1.40E-04	1.06E-01	1.25E-01	7.43E-02	7.88E-03	9.29E-03	4.64E-04	1.69E-03	8	16	0.0002	0.0001	0.0001	0.00003
	Metals	Aluminum	1.33E-01	3.60E-01	4.64E+03	6.35E+03	1.54E-01	7.14E+02	9.77E+02	4.04E+01	1.68E+02	1.93	19.3	**87**	**21**	**9**	**2**
		Antimony	8.25E-04	1.50E-03	9.52E-01	1.15E+00	1.54E-01	1.46E-01	1.77E-01	8.33E-03	3.07E-02	0.125	0.66	0.2	0.07	0.05	0.01
		Arsenic	1.76E-03	2.29E-03	5.66E+00	9.50E+00	3.86E-02	2.19E-01	3.67E-01	1.35E-02	7.14E-02	0.126	1.26	0.6	0.1	0.06	0.01
		Barium	4.64E-02	1.00E-01	2.93E+01	4.96E+01	1.46E-02	4.27E-01	7.22E-01	3.27E-02	1.87E-01	0.51	19.8	0.4	0.06	0.009	0.002
		Beryllium	1.16E-04	1.50E-04	3.87E-01	5.00E-01	--	--	--	--	--	0.66	1.32	--	--	--	--
		Cadmium	2.86E-04	8.20E-04	1.14E+00	1.90E+00	1.32E+00	1.51E+00	2.52E+00	8.34E-02	4.18E-01	1	2.52	0.4	0.08	0.2	0.03
		Chromium	2.57E-03	5.00E-03	4.98E+01	8.96E+01	4.90E-02	2.44E+00	4.39E+00	1.46E-01	8.24E-01	3.28	13.14	0.3	0.04	0.06	0.01
		Cobalt	1.75E-03	2.50E-02	5.48E+00	6.00E+00	1.95E-02	1.07E-01	1.17E-01	7.31E-03	2.92E-02	--	--	--	--	--	--
		Copper	9.79E-03	1.25E-02	4.70E+01	7.51E+01	8.24E-02	3.87E+00	6.19E+00	2.25E-01	1.11E+00	11.7	15.14	0.09	0.02	0.07	0.01
		Cyanide	2.09E-03	2.40E-03	1.21E-01	3.15E-01	1.54E-01	1.86E-02	4.85E-02	1.14E-03	8.65E-03	24	48	0.0004	0.00005	0.0002	0.00002
		Iron	5.43E-01	8.40E-01	8.33E+03	1.18E+04	1.54E-01	1.28E+03	1.82E+03	7.26E+01	3.13E+02	--	--	--	--	--	--
		Lead	3.16E-03	1.10E-02	9.28E+01	1.61E+02	1.29E-01	1.19E+01	2.07E+01	6.80E-01	3.60E+00	8	80	0.4	0.08	0.04	0.008
		Manganese	9.40E-02	1.26E-01	1.10E+02	1.36E+02	7.13E-02	7.84E+00	9.69E+00	4.62E-01	1.77E+00	88	284	0.02	0.005	0.006	0.002
		Mercury	4.36E-05	7.50E-05	3.09E-01	7.00E-01	3.12E-01	9.64E-02	2.18E-01	5.38E-03	3.68E-02	0.015	0.025	**2**	0.4	**1**	0.2
		Nickel	3.21E-03	4.10E-03	4.36E+00	4.70E+00	1.69E-01	7.39E-01	7.96E-01	4.18E-02	1.37E-01	40	80	0.003	0.001	0.002	0.001
		Selenium	8.78E-04	3.70E-03	2.18E-01	2.35E-01	1.48E-01	3.24E-02	3.49E-02	1.87E-03	6.49E-03	--	--	--	--	--	--
		Silver	2.20E-04	1.00E-03	5.03E+00	7.30E+00	3.27E-01	1.65E+00	2.39E+00	9.18E-02	4.02E-01	N/A	3.75	--	--	0.1	0.02
		Thallium	5.57E-04	2.00E-03	2.18E-01	2.35E-01	1.54E-01	3.35E-02	3.62E-02	1.92E-03	6.48E-03	0.0074	0.074	0.9	0.3	0.09	0.03
		Vanadium	2.91E-03	2.50E-02	1.38E+01	2.12E+01	6.72E-03	9.27E-02	1.42E-01	8.62E-03	5.02E-02	0.21	2.1	0.2	0.04	0.02	0.004
		Zinc	1.34E-02	2.08E-02	4.04E+01	5.17E+01	1.37E+01	5.53E+02	7.07E+02	3.04E+01	1.17E+02	160	320	0.7	0.2	0.4	0.1

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

DRAFT
BERA
JUNE 2007
REVISED NOVEMBER 2007
REVISED SEPTEMBER 2008
REVISED MAY 2009

TABLE 7-22b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR LARGE OMNIVOROUS MAMMALS - ALL ON-SITE TERRESTRIAL HABITATS COMBINED

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/Kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
All Locations	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	4.41E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.17E-05	7.53E-04	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	4.72E-03	4.29E-03	0.00E+00	0.00E+00	0.00E+00	1.07E-04	3.24E-04	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	4.41E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.07E-04	1.04E-03	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	4.42E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.07E-04	1.04E-03	25	50	0.00004	0.000004	0.00002	0.000002	<1	<1	<1	<1
		Acetone	2.60E-03	1.20E-02	1.10E-02	2.87E-02	0.00E+00	0.00E+00	0.00E+00	1.13E-04	1.56E-03	10	50	0.0002	0.00001	0.00003	0.000002	<1	<1	<1	<1
		Carbon Disulfide	2.50E-04	2.50E-04	4.41E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.17E-05	7.53E-04	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.72E-04	3.97E-04	4.42E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.26E-05	7.71E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	4.42E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.17E-05	7.53E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	4.42E-03	6.50E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	4.56E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.17E-05	7.53E-04	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	4.43E-03	9.38E-02	0.00E+00	0.00E+00	0.00E+00	1.17E-05	1.36E-04	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	2.92E-04	7.00E-04	5.56E-03	3.60E-01	0.00E+00	0.00E+00	0.00E+00	1.38E-05	4.88E-04	5.85	50	0.0001	0.000002	0.00001	0.0000003	<1	<1	<1	<1
		Styrene	2.50E-04	2.50E-04	4.88E-03	6.50E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Tetrachloroethene	2.50E-04	2.50E-04	4.49E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.17E-05	7.53E-04	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	4.42E-03	6.50E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.34E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.17E-05	7.53E-04	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.60E-01	8.84E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		2-Methylnaphthalene	4.68E-05	5.00E-05	1.14E-01	1.29E-01	3.54E-01	4.03E-02	4.56E-02	2.25E-03	7.68E-03	5	10	0.002	0.0004	0.001	0.0002	<1	<1	<1	<1
		2-Methylphenol	2.50E-03	2.50E-03	1.82E-01	4.15E-01	2.27E+00	4.14E-01	9.43E-01	2.29E-02	1.56E-01	--	--	--	--	--	--	--	--	--	--
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.82E-01	4.15E-01	4.73E+00	8.60E-01	1.96E+00	4.75E-02	3.24E-01	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.00E-01	2.66E-01	4.81E-02	9.62E-03	1.28E-02	6.84E-04	2.72E-03	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.79E-01	4.15E-01	3.07E-01	5.50E-02	1.28E-01	3.18E-03	2.18E-02	--	--	--	--	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	3.93E-01	1.05E+00	5.24E-01	2.06E-01	5.50E-01	1.18E-02	9.32E-02	--	--	--	--	--	--	--	--	--	--
		Acenaphthene	4.69E-05	5.00E-05	1.27E-01	1.91E-01	--	--	--	--	--	5	10	--	--	--	--	--	--	--	--
		Acenaphthylene	4.78E-05	5.00E-05	1.55E-01	2.39E-01	3.66E+00	5.68E-01	8.76E-01	3.13E-02	1.45E-01	5	10	0.03	0.006	0.01	0.003	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.78E-01	9.19E-02	2.37E+00	4.22E-01	2.18E-01	2.33E-02	3.63E-02	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.01E-05	1.90E-04	2.60E-01	4.67E-01	3.87E-01	1.01E-01	1.81E-01	5.60E-03	3.04E-02	5	10	0.006	0.001	0.003	0.001	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.79E-01	3.97E-01	5.70E-01	1.02E-01	2.26E-01	5.77E-03	3.81E-02	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.19E-05	2.00E-04	7.38E-01	1.73E+00	2.54E-01	1.88E-01	4.40E-01	1.05E-02	7.46E-02	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.36E-05	1.22E-04	7.30E-01	1.67E+00	2.13E-01	1.55E-01	3.55E-01	8.73E-03	6.05E-02	1	10	0.06	0.009	0.006	0.001	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.62E-05	1.18E-04	1.05E+00	2.69E+00	4.16E-01	4.37E-01	1.12E+00	2.43E-02	1.88E-01	1	2	0.2	0.02	0.09	0.01	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.13E-05	2.30E-04	5.20E-01	1.15E+00	4.70E-01	2.45E-01	5.41E-01	1.36E-02	9.06E-02	1	2	0.09	0.01	0.05	0.007	<1	<1	<1	<1
		Benzo(k)fluoranthene	4.98E-05	2.60E-04	3.88E-01	8.51E-01	4.16E-01	1.61E-01	3.54E-01	8.98E-03	5.94E-02	--	--	--	--	--	--	--	--	--	--
		Bis(2-ethylhexyl)phthalate	2.46E-03	2.50E-03	5.73E-01	2.55E+01	1.29E+02	7.42E+01	3.30E+03	4.08E+00	5.45E+02	18.3	183	**30**	0.2	**3**	0.02	--	<1	--	<1
		Butyl benzyl phthalate	2.50E-03	2.50E-03	1.36E-01	1.40E-01	2.60E-01	3.54E-02	3.64E-02	2.09E-03	6.48E-03	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.65E-01	2.44E-01	2.71E+00	4.46E-01	6.60E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.53E-05	8.80E-05	7.98E-01	1.90E+00	3.66E-01	2.92E-01	6.96E-01	1.63E-02	1.17E-01	1	2	0.1	0.02	0.06	0.008	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	4.37E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	1.17E-05	7.53E-04	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.70E-05	5.00E-05	1.85E-01	2.79E-01	3.70E-01	6.84E-02	1.03E-01	3.81E-03	1.73E-02	--	--	--	--	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.34E-01	1.47E-01	9.14E-01	1.23E-01	1.34E-01	6.88E-03	2.27E-02	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.40E-01	8.13E-01	1.83E+01	4.38E+00	1.49E+01	2.41E-01	2.45E+00	7500	15000	0.0003	0.00003	0.0002	0.00002	<1	<1	<1	<1
		Fluoranthene	6.02E-05	1.17E-04	1.20E+00	2.62E+00	4.86E-01	5.84E-01	1.27E+00	3.24E-02	2.13E-01	1	2	0.2	0.03	0.1	0.02	<1	<1	<1	<1
		Fluorene	4.71E-05	5.00E-05	1.31E-01	2.04E-01	--	--	--	--	--	5	10	--	--	--	--	--	--	--	--
		Hexachlorobenzene	2.50E-03	2.50E-03	1.82E-01	4.15E-01	--	--	--	--	--	1.6	3.2	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.82E-01	4.15E-01	1.03E-01	1.87E-02	4.27E-02	1.18E-03	7.83E-03	0.2	0.4	0.04	0.006	0.02	0.003	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	5.02E-05	1.90E-04	4.82E-01	1.05E+00	4.58E-01	2.21E-01	4.80E-01	1.23E-02	8.05E-02	1	--	0.08	0.01	--	--	<1	<1	--	--
		Isophorone	2.50E-03	2.50E-03	1.80E-01	4.15E-01	1.51E-01	2.71E-02	6.25E-02	1.64E-03	1.11E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	4.90E-05	1.90E-04	1.18E-01	1.75E-01	7.04E-01	8.31E-02	1.23E-01	4.60E-03	2.05E-02	5	10	0.004	0.001	0.002	0.0005	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.48E-03	2.50E-03	1.86E-01	1.80E+00	4.40E-01	8.19E-02	7.93E-01	4.66E-03	1.33E-01	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	4.82E-01	1.05E+00	4.10E+01	1.98E+01	4.30E+01	1.09E+00	7.10E+00	0.24	2.4	**30**	**5**	**3**	0.5	**29**	**4**	**3**	<1
		Phenanthrene	6.12E-05	7.44E-05	7.64E-01	2.74E+00	2.75E-01	2.10E-01	7.54E-01	1.18E-02	1.27E-01	5	10	0.03	0.002	0.01	0.001	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.74E-01	4.15E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	6.38E-05	1.30E-04	1.33E+00	4.32E+00	2.80E-01	3.72E-01	1.21E+00	2.08E-02	2.04E-01	1	2	0.2	0.02	0.1	0.01	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-22b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR LARGE OMNIVOROUS MAMMALS - ALL ON-SITE TERRESTRIAL HABITATS COMBINED

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/Kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	3.05E-06	2.50E-05	3.86E-03	7.94E-03	5.11E-01	1.97E-03	4.06E-03	1.10E-04	6.81E-04	0.8	4	0.001	0.0001	0.0002	0.00003	<1	<1	<1	<1
		4,4'-DDE	2.68E-06	1.50E-05	5.36E-03	1.17E-02	1.90E+00	1.02E-02	2.23E-02	5.63E-04	3.69E-03	0.8	4	0.005	0.001	0.001	0.0001	<1	<1	<1	<1
		4,4'-DDT	2.52E-06	9.20E-06	5.03E-03	1.24E-02	1.34E+00	6.74E-03	1.66E-02	3.72E-04	2.75E-03	0.8	4	0.003	0.0005	0.001	0.0001	<1	<1	<1	<1
		alpha-Chlordane	1.26E-06	3.30E-06	3.02E-03	6.19E-03	2.85E+00	8.60E-03	1.76E-02	4.74E-04	2.92E-03	--	--	--	--	--	--	--	--	--	--
		Dieldrin	1.25E-06	2.78E-06	2.51E-02	1.71E-01	1.56E+00	3.91E-02	2.66E-01	2.16E-03	4.41E-02	0.02	0.2	**2**	0.1	0.2	0.01	**2**	<1	<1	<1
		Endosulfan I	1.25E-06	1.40E-06	1.00E-03	4.60E-03	7.98E-01	7.98E-04	3.67E-03	4.42E-05	6.11E-04	0.15	0.3	0.004	0.0003	0.002	0.0001	<1	<1	<1	<1
		Endosulfan II	2.48E-06	2.80E-06	2.19E-03	3.53E-03	7.98E-01	1.75E-03	2.82E-03	9.68E-05	4.69E-04	--	--	--	--	--	--	--	--	--	--
		Endosulfan Sulfate	2.58E-06	1.30E-05	3.33E-03	4.11E-03	7.98E-01	2.66E-03	3.28E-03	1.47E-04	5.47E-04	--	--	--	--	--	--	--	--	--	--
		Endrin	2.48E-06	2.80E-06	1.87E-03	9.00E-03	5.76E-01	1.08E-03	5.18E-03	5.98E-05	8.66E-04	0.092	0.92	0.009	0.001	0.001	0.0001	<1	<1	<1	<1
		Endrin Aldehyde	2.44E-06	2.80E-06	2.51E-03	7.92E-03	5.76E-01	1.45E-03	4.56E-03	8.02E-05	7.62E-04	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.47E-06	6.00E-06	1.98E-03	1.40E-02	5.76E-01	1.14E-03	8.06E-03	6.33E-05	1.35E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-BHC	1.26E-06	4.30E-06	9.67E-04	4.60E-03	1.62E+00	1.56E-03	7.43E-03	8.62E-05	1.23E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.32E-06	9.40E-06	2.81E-03	5.88E-03	2.85E+00	8.00E-03	1.67E-02	4.41E-04	2.77E-03	--	--	--	--	--	--	--	--	--	--
		Heptachlor Epoxide	1.31E-06	5.10E-06	1.10E-03	1.30E-02	1.74E+00	1.92E-03	2.27E-02	1.06E-04	3.76E-03	--	--	--	--	--	--	--	--	--	--
		Methoxychlor	1.23E-05	1.40E-05	8.46E-03	5.62E-03	2.13E-01	1.81E-03	1.20E-03	1.02E-04	2.06E-04	4	8	0.00005	0.00003	0.00003	0.00001	<1	<1	<1	<1
		Toxaphene	1.24E-04	1.40E-04	9.68E-02	4.60E-01	7.43E-02	7.20E-03	3.42E-02	4.25E-04	6.17E-03	8	16	0.001	0.0001	0.0004	0.00003	<1	<1	<1	<1
	Metals	Aluminum	1.31E-01	2.01E+00	2.04E+03	7.59E+03	1.54E-01	3.14E+02	1.17E+03	1.78E+01	2.01E+02	1.93	19.3	**104**	**9**	**10**	0.9	**90**	**8**	**9**	<1
		Antimony	1.41E-03	1.50E-03	2.00E+00	5.88E+00	1.54E-01	3.08E-01	9.05E-01	1.75E-02	1.56E-01	0.125	0.66	**1**	0.1	0.2	0.03	**1**	<1	<1	<1
		Arsenic	1.57E-03	3.15E-03	8.33E+00	1.16E+01	3.86E-02	3.22E-01	4.48E-01	1.98E-02	8.72E-02	0.126	1.26	0.7	0.2	0.07	0.02	<1	<1	<1	<1
		Barium	4.77E-02	6.90E-02	7.01E+01	1.28E+02	1.46E-02	1.02E+00	1.86E+00	7.54E-02	4.58E-01	0.51	19.8	0.9	0.1	0.02	0.004	<1	<1	<1	<1
		Beryllium	1.53E-04	1.60E-03	4.62E-01	7.28E-01	--	--	--	--	--	0.66	1.32	--	--	--	--	--	--	--	--
		Cadmium	2.06E-04	1.33E-03	2.61E+00	7.08E+00	1.32E+00	3.46E+00	9.38E+00	1.91E-01	1.56E+00	1	2.52	**2**	0.2	0.6	0.08	**2**	<1	<1	<1
		Chromium	8.98E-04	2.42E-02	7.09E+01	1.33E+02	4.90E-02	3.47E+00	6.51E+00	2.08E-01	1.22E+00	3.28	13.14	0.4	0.06	0.09	0.02	<1	<1	<1	<1
		Cobalt	7.46E-04	1.24E-03	5.10E+00	5.42E+00	1.95E-02	9.96E-02	1.06E-01	6.76E-03	2.36E-02	--	--	--	--	--	--	--	--	--	--
		Copper	4.67E-03	4.28E-01	9.63E+01	1.95E+02	8.24E-02	7.94E+00	1.61E+01	4.60E-01	2.92E+00	11.7	15.14	0.2	0.04	0.2	0.03	<1	<1	<1	<1
		Cyanide	2.22E-03	1.46E-02	4.80E-01	1.03E+00	1.54E-01	7.38E-02	1.58E-01	4.27E-03	2.91E-02	24	48	0.001	0.0002	0.001	0.0001	<1	<1	<1	<1
		Iron	1.17E+00	6.77E+00	2.04E+03	2.07E+04	1.54E-01	3.14E+02	3.18E+03	1.78E+01	5.49E+02	--	--	--	--	--	--	--	--	--	--
		Lead	2.38E-03	3.26E-02	1.28E+02	3.13E+02	1.29E-01	1.65E+01	4.03E+01	9.37E-01	7.00E+00	8	80	0.9	0.1	0.09	0.01	<1	<1	<1	<1
		Manganese	1.71E-01	3.62E-01	2.72E+02	5.56E+02	7.13E-02	1.94E+01	3.96E+01	1.14E+00	7.20E+00	88	284	0.08	0.01	0.03	0.004	<1	<1	<1	<1
		Mercury	6.93E-05	4.60E-04	2.71E-01	4.89E-01	3.12E-01	8.46E-02	1.53E-01	4.72E-03	2.58E-02	0.015	0.025	**2**	0.3	**1**	0.2	1	<1	0	<1
		Nickel	3.52E-03	4.71E-03	1.53E+01	2.52E+01	1.69E-01	2.59E+00	4.27E+00	1.47E-01	7.33E-01	40	80	0.02	0.004	0.009	0.002	<1	<1	<1	<1
		Selenium	1.37E-03	1.50E-03	3.68E-01	5.38E-01	1.48E-01	5.46E-02	7.99E-02	3.15E-03	1.40E-02	--	--	--	--	--	--	--	--	--	--
		Silver	6.45E-04	1.52E-02	1.43E+00	3.03E+00	3.27E-01	4.68E-01	9.91E-01	2.61E-02	1.69E-01	N/A	3.75	--	--	0.05	0.007	--	--	<1	<1
		Thallium	1.53E-03	2.00E-03	4.67E-01	7.23E-01	1.54E-01	7.18E-02	1.11E-01	4.13E-03	1.94E-02	0.0074	0.074	**3**	0.6	0.3	0.06	**2**	<1	<1	<1
		Vanadium	9.41E-04	4.04E-03	1.71E+01	2.10E+01	6.72E-03	1.15E-01	1.41E-01	1.06E-02	4.71E-02	0.21	2.1	0.224	0.05	0.02	0.005	<1	<1	<1	<1
		Zinc	1.49E-02	6.25E-02	1.29E+02	2.60E+02	1.37E+01	1.76E+03	3.56E+03	9.71E+01	5.87E+02	160	320	**4**	0.6	**2**	0.3	**4**	<1	**2**	<1

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

Table 7-22c: Weight-of-Evidence Integration for large omnivorous mammals
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:

Maintain stable and healthy population of large omnivorous mammals

Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large omnivorous mammals foraging in the terrestrial habitats at the site?

Measurement Endpoint
8.A: use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.

Weight-of-Evidence Integration

All terrestrial habitats combined[a]	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm			**8.A**		

[a] The terrestrial habitats consist of J.M. Mills Landfill, Unnamed Island, Nunes Parcel, Quinville Well Field, Wetlands A through D, and Pratt Dam

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

DRAFT
BERA
JUNE 2007
REVISED NOVEMBER 2007
REVISED SEPTEMBER 2008
REVISED MAY 2009

TABLE 7-23a
CALCULATED HAZARD QUOTIENTS FOR SMALL OMNIVOROUS MAMMALS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water (sw)		Soil (dw)		Food (ww)										
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE
River-Upstream	VOCs	Chloromethane	2.76E-04	3.70E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	3.59E-05	1.46E-04	--	--	--	--	--	--
		Cyclohexane	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	3.30E-05	1.07E-04	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	3.30E-05	1.07E-04	--	--	--	--	--	--
		Methyl acetate	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	3.30E-05	1.07E-04	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	4.83E-03	5.00E-03	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	3.30E-05	1.07E-04	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.79E-01	2.40E-01	--	--	--	--	--	--	--	--	--	--	--
		2-Methylnaphthalene	2.35E-05	5.00E-05	1.11E-01	2.70E-01	3.54E-01	3.93E-02	9.55E-02	1.10E-02	8.15E-02	5	10	0.02	0.002	0.008	0.001
		2-Methylphenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.27E+00	4.66E-01	5.45E-01	1.30E-01	4.60E-01	--	--	--	--	--	--
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.73E+00	9.69E-01	1.13E+00	2.69E-01	9.55E-01	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.81E-02	9.86E-03	1.15E-02	3.23E-03	1.17E-02	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	3.07E-01	6.30E-02	7.38E-02	1.80E-02	6.40E-02	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	5.15E-01	6.00E-01	5.24E-01	2.70E-01	3.14E-01	7.65E-02	2.70E-01	--	--	--	--	--	--
		Acenaphthene	2.39E-05	5.00E-05	2.69E-01	8.80E-01	--	--	--	--	--	5	10	--	--	--	--
		Acenaphthylene	2.92E-05	5.00E-05	2.81E-01	7.30E-01	3.66E+00	1.03E+00	2.67E+00	2.86E-01	2.25E+00	5	10	0.5	0.1	0.2	0.03
		Acetophenone	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.37E+00	4.86E-01	5.69E-01	1.35E-01	4.80E-01	--	--	--	--	--	--
		Anthracene	3.19E-05	5.00E-05	1.26E+00	4.00E+00	3.87E-01	4.88E-01	1.55E+00	1.37E-01	1.32E+00	5	10	0.3	0.03	0.1	0.01
		Benzaldehyde	2.50E-03	2.50E-03	1.72E-01	2.00E-01	5.70E-01	9.81E-02	1.14E-01	2.77E-02	9.76E-02	--	--	--	--	--	--
		Benzo[a]anthracene	4.11E-05	5.00E-05	2.91E+00	9.30E+00	2.54E-01	7.40E-01	2.37E+00	2.09E-01	2.03E+00	--	--	--	--	--	--
		Benzo(a)pyrene	5.14E-05	6.70E-05	2.82E+00	7.50E+00	2.13E-01	6.00E-01	1.60E+00	1.70E-01	1.38E+00	1	10	**1**	0.2	0.1	0.02
		Benzo(b)fluoranthene	5.05E-05	8.60E-05	3.04E+00	7.80E+00	4.16E-01	1.26E+00	3.24E+00	3.54E-01	2.76E+00	1	2	**3**	0.4	**1**	0.2
		Benzo(g,h,i)perylene	5.24E-05	1.30E-04	1.71E+00	4.40E+00	4.70E-01	8.04E-01	2.07E+00	2.25E-01	1.76E+00	1	2	**2**	0.2	0.9	0.1
		Benzo(k)fluoranthene	4.21E-05	6.90E-05	1.28E+00	3.40E+00	4.16E-01	5.32E-01	1.41E+00	1.49E-01	1.20E+00	--	--	--	--	--	--
		Bis(2-ethylhexyl)phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.29E+02	2.65E+01	3.11E+01	7.36E+00	2.61E+01	18.3	183	**1**	0.4	0.1	0.04
		Butyl benzyl phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	2.60E-01	5.33E-02	6.24E-02	1.53E-02	5.44E-02	--	--	--	--	--	--
		Carbazole	--	--	2.88E-01	5.50E-01	2.71E+00	7.79E-01	1.49E+00	--	--	--	--	--	--	--	--
		Chrysene	4.82E-05	7.40E-05	3.07E+00	8.90E+00	3.66E-01	1.12E+00	3.26E+00	3.15E-01	2.78E+00	1	2	**3**	0.3	**1**	0.16
		Cyclohexane	2.50E-04	2.50E-04	4.83E-03	5.00E-03	0.00E+00	0.00E+00	0.00E+00	3.30E-05	1.07E-04	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.28E-05	1.40E-04	4.59E-01	9.40E-01	3.70E-01	1.70E-01	3.47E-01	4.76E-02	2.96E-01	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.69E-01	4.40E-01	9.14E-01	1.55E-01	4.02E-01	4.33E-02	3.41E-01	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.83E+01	3.74E+00	4.38E+00	1.04E+00	3.68E+00	7500	15000	0.0005	0.0001	0.0002	0.0001
		Fluoranthene	5.91E-05	8.30E-05	4.63E+00	1.50E+01	4.86E-01	2.25E+00	7.30E+00	6.30E-01	6.20E+00	1	2	**6**	0.6	**3**	0.3
		Fluorene	2.48E-05	5.00E-05	3.30E-01	1.20E+00	--	--	--	--	--	5	10	--	--	--	--
		Hexachlorobenzene	2.50E-03	2.50E-03	2.05E-01	2.40E-01	--	--	--	--	--	1.6	3.2	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.03E-01	2.11E-02	2.47E-02	6.35E-03	2.27E-02	0.2	0.4	0.1	0.03	0.06	0.02
		Indeno(1,2,3-cd)pyrene	4.95E-05	1.30E-04	1.25E+00	2.60E+00	4.58E-01	5.72E-01	1.19E+00	1.60E-01	1.01E+00	1	--	**1**	0.2	--	--
		Isophorone	2.50E-03	2.50E-03	2.05E-01	2.40E-01	1.51E-01	3.09E-02	3.62E-02	9.07E-03	3.24E-02	--	--	--	--	--	--
		Naphthalene	2.67E-05	5.00E-05	1.83E-01	2.80E-01	7.04E-01	1.29E-01	1.97E-01	3.59E-02	1.67E-01	5	10	0.03	0.01	0.02	0.004
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	2.05E-01	2.40E-01	4.40E-01	9.03E-02	1.06E-01	2.56E-02	9.08E-02	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	5.15E-01	6.00E-01	4.10E+01	2.11E+01	2.46E+01	5.86E+00	2.07E+01	0.24	2.4	**86**	**24**	**9**	**2**
		Phenanthrene	4.63E-05	5.00E-05	3.98E+00	1.40E+01	2.75E-01	1.10E+00	3.85E+00	3.08E-01	3.30E+00	5	10	0.7	0.1	0.33	0.03
		Phenol	2.50E-03	2.50E-03	2.05E-01	2.40E-01	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.76E-05	8.70E-05	4.79E+00	1.90E+01	2.80E-01	1.34E+00	5.32E+00	3.77E-01	4.56E+00	1	2	**5**	0.4	**2**	0.2

US EPA ARCHIVE DOCUMENT

TABLE 7-23a
CALCULATED HAZARD QUOTIENTS FOR SMALL OMNIVOROUS MAMMALS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water (sw)		Soil (dw)		Food (ww)										
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	1.56E-06	2.80E-06	3.38E-03	8.10E-03	5.11E-01	1.73E-03	4.14E-03	4.83E-04	3.52E-03	0.8	4	0.004	0.001	0.001	0.0001
		4,4'-DDE	1.82E-06	2.80E-06	5.27E-03	5.90E-03	1.90E+00	1.00E-02	1.12E-02	2.79E-03	9.47E-03	0.8	4	0.01	0.003	0.002	0.001
			1.56E-06	2.80E-06	4.26E-03	9.80E-03	1.34E+00	5.70E-03	1.31E-02	1.59E-03	1.11E-02	0.8	4	0.01	0.002	0.003	0.0004
		alpha-Chlordane	9.83E-07	1.40E-06	1.06E-03	1.25E-03	2.85E+00	3.02E-03	3.56E-03	8.39E-04	3.00E-03	--	--	--	--	--	--
		Dieldrin	2.05E-06	2.80E-06	1.42E-02	3.30E-02	1.56E+00	2.21E-02	5.14E-02	6.15E-03	4.33E-02	0.02	0.2	**2**	0.3	0.2	0.03
		Endosulfan I	9.83E-07	1.40E-06	1.06E-03	1.25E-03	7.98E-01	8.46E-04	9.98E-04	2.36E-04	8.45E-04	0.15	0.3	0.01	0.002	0.003	0.001
		Endosulfan II	1.56E-06	2.80E-06	2.07E-03	2.45E-03	7.98E-01	1.65E-03	1.96E-03	4.61E-04	1.66E-03	--	--	--	--	--	--
	4,4'-DDT	Endosulfan Sulfate	1.56E-06	2.80E-06	1.85E-03	1.85E-03	7.98E-01	1.48E-03	1.48E-03	4.12E-04	1.25E-03	--	--	--	--	--	--
		Endrin	1.56E-06	2.80E-06	2.07E-03	2.45E-03	5.76E-01	1.19E-03	1.41E-03	3.33E-04	1.20E-03	0.092	0.92	0.01	0.004	0.001	0.0004
		Endrin Aldehyde	1.56E-06	2.80E-06	2.95E-03	7.10E-03	5.76E-01	1.70E-03	4.09E-03	4.75E-04	3.47E-03	--	--	--	--	--	--
		Endrin Ketone	1.56E-06	2.80E-06	2.07E-03	2.45E-03	5.76E-01	1.19E-03	1.41E-03	3.33E-04	1.20E-03	--	--	--	--	--	--
		Gamma-BHC	9.83E-07	1.40E-06	1.06E-03	1.25E-03	1.62E+00	1.71E-03	2.02E-03	4.77E-04	1.70E-03	--	--	--	--	--	--
		Gamma-Chlordane	9.83E-07	1.40E-06	9.75E-04	1.00E-03	2.85E+00	2.78E-03	2.85E-03	7.72E-04	2.40E-03	--	--	--	--	--	--
		Heptachlor Epoxide	9.83E-07	1.40E-06	1.06E-03	1.25E-03	1.74E+00	1.85E-03	2.18E-03	5.14E-04	1.84E-03	--	--	--	--	--	--
		Methoxychlor	4.56E-06	1.40E-05	1.83E-02	3.40E-02	2.13E-01	3.90E-03	7.25E-03	1.10E-03	6.26E-03	4	8	0.002	0.0003	0.0008	0.0001
		Toxaphene	9.83E-05	1.40E-04	1.06E-01	1.25E-01	7.43E-02	7.88E-03	9.29E-03	2.31E-03	8.46E-03	8	16	0.0011	0.0003	0.0005	0.0001
	Metals	Aluminum	1.33E-01	3.60E-01	4.64E+03	6.35E+03	1.54E-01	7.14E+02	9.77E+02	2.03E+02	8.51E+02	1.93	19.3	**441**	**105**	**44**	**11**
		Antimony	8.25E-04	1.50E-03	9.52E-01	1.15E+00	1.54E-01	1.46E-01	1.77E-01	4.17E-02	1.55E-01	0.125	0.66	**1**	0.3	0.2	0.1
		Arsenic	1.76E-03	2.29E-03	5.66E+00	9.50E+00	3.86E-02	2.19E-01	3.67E-01	6.69E-02	3.55E-01	0.126	1.26	**3**	0.5	0.3	0.1
			4.64E-02	1.00E-01	2.93E+01	4.96E+01	1.46E-02	4.27E-01	7.22E-01	1.55E-01	8.80E-01	0.51	19.8	**2**	0.3	0.04	0.01
		Beryllium	1.16E-04	1.50E-04	3.87E-01	5.00E-01	--	--	--	--	--	0.66	1.32	--	--	--	--
		Cadmium	2.86E-04	8.20E-04	1.14E+00	1.90E+00	1.32E+00	1.51E+00	2.52E+00	4.20E-01	2.12E+00	1	2.52	**2**	0.4	0.8	0.2
		Chromium	2.57E-03	5.00E-03	4.98E+01	8.96E+01	4.90E-02	2.44E+00	4.39E+00	7.30E-01	4.12E+00	3.28	13.14	**1**	0.2	0.3	0.1
		Cobalt	1.75E-03	2.50E-02	5.48E+00	6.00E+00	1.95E-02	1.07E-01	1.17E-01	3.57E-02	1.36E-01	--	--	--	--	--	--
	Barium	Copper	9.79E-03	1.25E-02	4.70E+01	7.51E+01	8.24E-02	3.87E+00	6.19E+00	1.13E+00	5.57E+00	11.7	15.14	0.5	0.1	0.4	0.1
		Cyanide	2.09E-03	2.40E-03	1.21E-01	3.15E-01	1.54E-01	1.86E-02	4.85E-02	5.53E-03	4.30E-02	24	48	0.002	0.0002	0.0009	0.0001
		Iron	5.43E-01	8.40E-01	8.33E+03	1.18E+04	1.54E-01	1.28E+03	1.82E+03	3.65E+02	1.58E+03	--	--	--	--	--	--
		Lead	3.16E-03	1.10E-02	9.28E+01	1.61E+02	1.29E-01	1.19E+01	2.07E+01	3.41E+00	1.82E+01	8	80	**2**	0.4	0.2	0.04
		Manganese	9.40E-02	1.26E-01	1.10E+02	1.36E+02	7.13E-02	7.84E+00	9.69E+00	2.30E+00	8.84E+00	88	284	0.1	0.03	0.03	0.01
		Mercury	4.36E-05	7.50E-05	3.09E-01	7.00E-01	3.12E-01	9.64E-02	2.18E-01	2.71E-02	1.87E-01	0.015	0.025	**12**	**2**	**7**	**1**
		Nickel	3.21E-03	4.10E-03	4.36E+00	4.70E+00	1.69E-01	7.39E-01	7.96E-01	2.10E-01	6.93E-01	40	80	0.02	0.01	0.01	0.003
		Selenium	8.78E-04	3.70E-03	2.18E-01	2.35E-01	1.48E-01	3.24E-02	3.49E-02	9.31E-03	3.17E-02	--	--	--	--	--	--
		Silver	2.20E-04	1.00E-03	5.03E+00	7.30E+00	3.27E-01	1.65E+00	2.39E+00	4.62E-01	2.04E+00	N/A	3.75	--	--	0.5	0.1
		Thallium	5.57E-04	2.00E-03	2.18E-01	2.35E-01	1.54E-01	3.35E-02	3.62E-02	9.60E-03	3.22E-02	0.0074	0.074	**4**	**1**	0.4	0.1
		Vanadium	2.91E-03	2.50E-02	1.38E+01	2.12E+01	6.72E-03	9.27E-02	1.42E-01	4.08E-02	2.30E-01	0.21	2.1	**1**	0.2	0.1	0.02
		Zinc	1.34E-02	2.08E-02	4.04E+01	5.17E+01	1.37E+01	5.53E+02	7.07E+02	1.53E+02	5.94E+02	160	320	**4**	0.96	**2**	0.5

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

DRAFT
BERA
JUNE 2007
REVISED NOVEMBER 2007
REVISED SEPTEMBER 2008
REVISED MAY 2009

TABLE 7-23b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - J.M. MILLS LANDFILL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
ndfill	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	3.38E-05	1.28E-04	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	5.93E-03	1.40E-02	0.00E+00	0.00E+00	0.00E+00	2.85E-04	8.93E-04	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	2.85E-04	8.71E-04	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	2.85E-04	8.71E-04	25	50	0.00003	0.00001	0.00002	0.00001	<1	<1	<1	<1
		Acetone	2.50E-03	2.50E-03	1.49E-02	1.70E-01	0.00E+00	0.00E+00	0.00E+00	2.95E-04	1.65E-03	10	50	0.0002	0.00003	0.00003	0.00001	<1	<1	<1	<1
		Carbon Disulfide	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	3.38E-05	1.28E-04	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.61E-04	3.40E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	3.51E-05	1.58E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	3.38E-05	1.28E-04	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	3.38E-05	1.28E-04	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	3.38E-05	1.28E-04	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	3.08E-04	7.00E-04	5.67E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	4.04E-05	2.77E-04	5.85	50	0.00005	0.00001	0.00001	0.000001	<1	<1	<1	<1
		Tetrachloroethene	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	3.38E-05	1.28E-04	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	3.38E-05	1.28E-04	--	--	--	--	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	3.38E-05	1.28E-04	2.1	2.6	0.00006	0.00002	0.00005	0.00001	<1	<1	<1	<1
	SVOCs	2-Methylnaphthalene	5.00E-05	5.00E-05	1.14E-01	1.49E-01	3.54E-01	4.03E-02	5.27E-02	1.13E-02	4.50E-02	5	10	0.009	0.002	0.005	0.001	<1	<1	<1	<1
		2-Methylphenol	2.50E-03	2.50E-03	2.23E-01	4.15E-01	2.27E+00	5.07E-01	9.43E-01	1.41E-01	7.95E-01	--	--	--	--	--	--	--	--	--	--
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	2.23E-01	4.15E-01	4.73E+00	1.05E+00	1.96E+00	2.93E-01	1.65E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.47E-01	1.20E+00	4.81E-02	1.19E-02	5.77E-02	3.84E-03	5.51E-02	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	2.23E-01	4.15E-01	3.07E-01	6.86E-02	1.28E-01	1.95E-02	1.10E-01	--	--	--	--	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	4.88E-01	1.05E+00	5.24E-01	2.56E-01	5.50E-01	7.26E-02	4.71E-01	--	--	--	--	--	--	--	--	--	--
		Acenaphthylene	5.00E-05	5.00E-05	1.44E-01	2.25E-01	3.66E+00	5.28E-01	8.24E-01	1.47E-01	6.94E-01	5	10	0.1	0.03	0.07	0.01	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	2.23E-01	4.15E-01	2.37E+00	5.28E-01	9.83E-01	1.47E-01	8.29E-01	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.76E-05	1.80E-04	3.46E-01	9.54E-01	3.87E-01	1.34E-01	3.69E-01	3.76E-02	3.15E-01	5	10	0.06	0.01	0.03	0.004	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.45E-01	8.90E-02	5.70E-01	8.27E-02	5.08E-02	2.34E-02	4.39E-02	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.83E-05	2.00E-04	1.04E+00	2.08E+00	2.54E-01	2.65E-01	5.29E-01	7.45E-02	4.55E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	6.19E-05	3.40E-04	8.59E-01	1.88E+00	2.13E-01	1.83E-01	4.00E-01	5.16E-02	3.45E-01	1	10	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Benzo(b)fluoranthene	6.23E-05	3.60E-04	1.47E+00	2.45E+00	4.16E-01	6.12E-01	1.02E+00	1.71E-01	8.68E-01	1	2	0.9	0.2	0.4	0.1	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.92E-05	2.30E-04	5.64E-01	1.19E+00	4.70E-01	2.65E-01	5.60E-01	7.42E-02	4.76E-01	1	2	0.5	0.1	0.2	0.04	<1	<1	<1	<1
		Benzo(k)fluoranthene	6.01E-05	2.60E-04	5.36E-01	8.27E-01	4.16E-01	2.23E-01	3.44E-01	6.25E-02	2.93E-01	--	--	--	--	--	--	--	--	--	--
		bis(2-Ethylhexyl)phthalate	2.50E-03	2.50E-03	6.59E-01	1.97E+00	1.29E+02	8.53E+01	2.55E+02	2.37E+01	2.14E+02	18.3	183	**12**	**1**	**1**	0.1	**10**	<1	**1**	<1
		Butyl benzyl phthalate	2.50E-03	2.50E-03	1.28E-01	5.56E-01	2.60E-01	3.33E-02	1.45E-01	9.65E-03	1.25E-01	--	--	--	--	--	--	--	--	--	--
		Carbazole		--	1.74E-01	2.84E-01	2.71E+00	4.71E-01	7.68E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	6.10E-05	3.00E-04	1.13E+00	2.34E+00	3.66E-01	4.14E-01	8.57E-01	1.16E-01	7.32E-01	1	2	0.7	0.1	0.4	0.1	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	5.60E-03	9.50E-03	0.00E+00	0.00E+00	0.00E+00	3.38E-05	1.28E-04	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	2.36E-01	3.26E-01	3.70E-01	8.72E-02	1.20E-01	2.45E-02	1.03E-01	--	--	--	--	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.41E-01	1.62E-01	9.14E-01	1.29E-01	1.48E-01	3.62E-02	1.26E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.33E-01	1.30E+00	1.83E+01	4.26E+00	2.37E+01	1.18E+00	2.00E+01	7500	15000	0.003	0.0002	0.001	0.0001	<1	<1	<1	<1
		Fluoranthene	6.28E-05	3.90E-04	1.84E+00	3.60E+00	4.86E-01	8.95E-01	1.75E+00	2.50E-01	1.49E+00	1	2	**1**	0.3	0.7	0.1	<1	<1	<1	<1
		Hexachlorobutadiene	2.50E-03	2.50E-03	2.23E-01	4.15E-01	1.03E-01	2.29E-02	4.27E-02	6.88E-03	3.87E-02	0.2	0.4	0.2	0.0	0.1	0.02	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	5.80E-05	1.90E-04	6.54E-01	1.14E+00	4.58E-01	2.99E-01	5.22E-01	8.38E-02	4.44E-01	1	--	0.4	0.1	--	--	<1	<1	--	--
		Isophorone	2.50E-03	2.50E-03	2.23E-01	4.15E-01	1.51E-01	3.36E-02	6.25E-02	9.84E-03	5.53E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.00E-05	5.00E-05	9.18E-02	1.07E-01	7.04E-01	6.46E-02	7.53E-02	1.80E-02	6.38E-02	5	10	0.013	0.004	0.006	0.002	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	2.23E-01	4.15E-01	4.40E-01	9.82E-02	1.83E-01	2.78E-02	1.56E-01	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	5.60E-01	1.05E+00	4.10E+01	2.30E+01	4.30E+01	6.37E+00	3.62E+01	0.24	2.4	**151**	**27**	**15**	**3**	**65**	**2**	**6**	<1
		Phenanthrene	5.83E-05	2.00E-04	1.17E+00	3.01E+00	2.75E-01	3.22E-01	8.28E-01	9.06E-02	7.10E-01	5	10	0.1	0.02	0.07	0.01	<1	<1	<1	<1
		Pyrene	6.33E-05	4.20E-04	1.84E+00	3.98E+00	2.80E-01	5.15E-01	1.11E+00	1.45E-01	9.55E-01	1	2	0.96	0.1	0.5	0.07	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

DRAFT
BERA
JUNE 2007
REVISED NOVEMBER 2007
REVISED SEPTEMBER 2008
REVISED MAY 2009

TABLE 7-23b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - J.M. MILLS LANDFILL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	3.60E-06	2.50E-05	2.94E-03	1.90E-02	5.11E-01	1.50E-03	9.71E-03	4.20E-04	8.26E-03	0.8	4	0.01	0.001	0.002	0.0001	<1	<1	<1	<1
		4,4'-DDE	3.17E-06	1.50E-05	5.07E-03	1.37E-02	1.90E+00	9.66E-03	2.61E-02	2.69E-03	2.20E-02	0.8	4	0.03	0.003	0.01	0.001	<1	<1	<1	<1
			2.60E-06	2.80E-06	3.60E-03	2.50E-02	1.34E+00	4.82E-03	3.35E-02	1.34E-03	2.82E-02	0.8	4	0.04	0.002	0.01	0.0003	<1	<1	<1	<1
		alpha-Chlordane	1.30E-06	1.40E-06	3.24E-03	5.28E-03	2.85E+00	9.23E-03	1.50E-02	2.56E-03	1.27E-02	--	--	--	--	--	--	--	--	--	--
		Dieldrin	3.14E-06	1.40E-05	1.26E-02	2.20E-02	1.56E+00	1.96E-02	3.43E-02	5.46E-03	2.89E-02	0.02	0.2	**1**	0.3	0.1	0.03	<1	<1	<1	<1
		Endosulfan I	1.30E-06	1.40E-06	1.16E-03	4.35E-03	7.98E-01	9.26E-04	3.47E-03	2.58E-04	2.94E-03	0.15	0.3	0.02	0.002	0.01	0.001	<1	<1	<1	<1
		Endosulfan II	2.60E-06	2.80E-06	2.04E-03	2.90E-03	7.98E-01	1.63E-03	2.31E-03	4.54E-04	1.96E-03	--	--	--	--	--	--	--	--	--	--
	4,4'-DDT	Endosulfan Sulfate	3.24E-06	1.10E-05	6.73E-03	1.10E-02	7.98E-01	5.37E-03	8.78E-03	1.50E-03	7.43E-03	--	--	--	--	--	--	--	--	--	--
		Endrin	2.60E-06	2.80E-06	2.04E-03	2.90E-03	5.76E-01	1.18E-03	1.67E-03	3.29E-04	1.42E-03	0.092	0.92	0.02	0.004	0.002	0.0004	<1	<1	<1	<1
		Endrin Aldehyde	2.60E-06	2.80E-06	3.78E-03	5.80E-02	5.76E-01	2.18E-03	3.34E-02	6.09E-04	2.83E-02	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.60E-06	2.80E-06	2.08E-03	2.90E-03	5.76E-01	1.20E-03	1.67E-03	3.35E-04	1.42E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-BHC	1.30E-06	1.40E-06	1.04E-03	1.50E-03	1.62E+00	1.68E-03	2.42E-03	4.68E-04	2.04E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.30E-06	1.40E-06	3.68E-03	7.40E-03	2.85E+00	1.05E-02	2.11E-02	2.91E-03	1.77E-02	--	--	--	--	--	--	--	--	--	--
		Heptachlor Epoxide	1.46E-06	3.70E-06	1.05E-03	1.50E-03	1.74E+00	1.83E-03	2.62E-03	5.09E-04	2.21E-03	--	--	--	--	--	--	--	--	--	--
		Methoxychlor	1.30E-05	1.40E-05	1.05E-02	1.50E-02	2.13E-01	2.24E-03	3.20E-03	6.34E-04	2.77E-03	4	8	0.0007	0.0002	0.0003	0.0001	<1	<1	<1	<1
		Toxaphene	1.30E-04	1.40E-04	1.05E-01	1.50E-01	7.43E-02	7.80E-03	1.11E-02	2.29E-03	1.01E-02	8	16	0.001	0.0003	0.0006	0.0001	<1	<1	<1	<1
	Metals	Aluminum	1.12E-01	2.55E+01	7.36E+03	9.17E+03	1.54E-01	1.13E+03	1.41E+03	3.22E+02	1.24E+03	1.93	19.3	**641**	**167**	**64**	**17**	**200**	**62**	**20**	**6**
		Antimony	1.50E-03	1.50E-03	5.10E+00	1.05E+01	1.54E-01	7.85E-01	1.62E+00	2.23E-01	1.41E+00	0.125	0.66	**11**	**2**	**2**	0.3	**10**	**1**	**2**	<1
		Arsenic	2.36E-03	1.12E-02	1.19E+01	1.53E+01	3.86E-02	4.60E-01	5.91E-01	1.41E-01	5.74E-01	0.126	1.26	**5**	**1**	0.5	0.1	**2**	<1	<1	<1
			6.32E-02	5.98E-01	1.17E+02	1.68E+02	1.46E-02	1.70E+00	2.45E+00	6.04E-01	3.06E+00	0.51	19.8	**6**	**1**	0.2	0.03	**4**	<1	<1	<1
		Cadmium	4.69E-04	2.43E-02	6.77E+00	1.15E+01	1.32E+00	8.97E+00	1.52E+01	2.50E+00	1.29E+01	1	2.52	**13**	**2**	**5**	0.99	**11**	**2**	**4**	<1
		Chromium	1.62E-03	3.26E-01	8.02E+01	1.30E+02	4.90E-02	3.93E+00	6.36E+00	1.18E+00	6.08E+00	3.28	13.14	**2**	0.4	0.5	0.1	<1	<1	<1	<1
		Copper	1.02E-02	4.28E-01	1.40E+02	2.08E+02	8.24E-02	1.15E+01	1.71E+01	3.35E+00	1.55E+01	11.7	15.14	**1**	0.3	**1**	0.2	<1	<1	<1	<1
		Cyanide	2.37E-03	1.06E-02	7.30E-01	1.27E+00	1.54E-01	1.12E-01	1.95E-01	3.22E-02	1.74E-01	24	48	0.007	0.001	0.004	0.001	<1	<1	<1	<1
		Iron	9.26E-01	6.84E+01	1.85E+04	2.45E+04	1.54E-01	2.85E+03	3.77E+03	8.10E+02	3.31E+03	--	--	--	--	--	--	--	--	--	--
	Barium	Lead	3.05E-03	4.13E-01	1.65E+02	2.34E+02	1.29E-01	2.12E+01	3.01E+01	6.07E+00	2.66E+01	8	80	**3**	0.8	0.3	0.1	**1**	<1	<1	<1
		Manganese	1.30E-01	7.55E-01	4.57E+02	6.92E+02	7.13E-02	3.26E+01	4.93E+01	9.54E+00	4.50E+01	88	284	1	0.1	0.2	0.03	<1	<1	<1	<1
		Mercury	1.02E-04	4.60E-04	3.41E-01	5.13E-01	3.12E-01	1.06E-01	1.60E-01	2.99E-02	1.37E-01	0.015	0.025	**9**	**2**	**5**	**1**	<1	<1	<1	<1
		Nickel	3.94E-03	3.78E-02	2.54E+01	3.48E+01	1.69E-01	4.30E+00	5.90E+00	1.22E+00	5.13E+00	40	80	0.1	0.03	0.06	0.02	<1	<1	<1	<1
		Silver	7.92E-04	1.52E-02	2.73E+00	4.71E+00	3.27E-01	8.93E-01	1.54E+00	2.51E-01	1.32E+00	N/A	3.75	--	--	0.4	0.1	--	--	<1	<1
		Thallium	1.76E-03	2.00E-03	5.25E-01	1.50E+00	1.54E-01	8.08E-02	2.31E-01	2.32E-02	2.02E-01	0.0074	0.074	**27**	**3**	**3**	0.3	**23**	**2**	**2**	<1
		Vanadium	1.12E-03	7.38E-02	1.99E+01	2.59E+01	6.72E-03	1.34E-01	1.74E-01	5.84E-02	2.96E-01	0.21	2.1	**1**	0.3	0.1	0.03	<1	<1	<1	<1
		Zinc	2.16E-02	7.51E-01	2.52E+02	4.42E+02	1.37E+01	3.45E+03	6.05E+03	9.57E+02	5.08E+03	160	320	**32**	**6**	**16**	**3**	**28**	**5**	**14**	**3**

otes:
- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RR = residual risk
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-23c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - UNNAMED ISLAND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
and	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	4.86E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.31E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	5.55E-03	4.40E-02	0.00E+00	0.00E+00	0.00E+00	2.85E-04	1.04E-03	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	2.84E-04	8.59E-04	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	2.84E-04	8.59E-04	25	50	0.00003	0.00001	0.00002	0.00001	<1	<1	<1	<1
		Acetone	2.63E-03	5.50E-03	9.26E-03	2.70E-02	0.00E+00	0.00E+00	0.00E+00	3.03E-04	1.95E-03	10	50	0.0002	0.00003	0.00004	0.00001	<1	<1	<1	<1
		Carbon Disulfide	2.50E-04	2.50E-04	4.89E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.31E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.55E-04	4.40E-04	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.37E-05	1.79E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.31E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	4.94E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.31E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.31E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	2.89E-04	7.00E-04	5.91E-03	1.25E-02	0.00E+00	0.00E+00	0.00E+00	3.85E-05	2.91E-04	5.85	50	0.00005	0.00001	0.00001	0.000001	<1	<1	<1	<1
		Tetrachloroethene	2.50E-04	2.50E-04	5.03E-03	2.50E-02	0.00E+00	0.00E+00	0.00E+00	3.32E-05	2.03E-04	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.93E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.31E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	5.13E-03	1.50E-02	0.00E+00	0.00E+00	0.00E+00	3.33E-05	1.55E-04	2.1	2.6	0.00007	0.00002	0.00006	0.00001	<1	<1	<1	<1
	SVOCs	2-Methylnaphthalene	5.00E-05	5.00E-05	1.61E-01	1.73E-01	3.54E-01	5.69E-02	6.12E-02	1.60E-02	5.23E-02	5	10	0.01	0.003	0.005	0.002	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.92E-01	2.55E-01	4.73E+00	9.08E-01	1.21E+00	2.52E-01	1.01E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.92E-01	2.55E-01	4.81E-02	9.23E-03	1.23E-02	3.05E-03	1.24E-02	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.82E-01	2.55E-01	3.07E-01	5.60E-02	7.84E-02	1.60E-02	6.79E-02	--	--	--	--	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	4.86E-01	6.50E-01	5.24E-01	2.55E-01	3.41E-01	7.23E-02	2.93E-01	--	--	--	--	--	--	--	--	--	--
		Acenaphthene	5.00E-05	5.00E-05	1.78E-01	2.90E-01	--	--	--	--	--	5	10	--	--	--	--	--	--	--	--
		Acenaphthylene	5.00E-05	5.00E-05	1.12E-01	1.27E-01	3.66E+00	4.10E-01	4.65E-01	1.14E-01	3.92E-01	5	10	0.08	0.02	0.04	0.01	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.90E-01	8.60E-01	2.37E+00	4.50E-01	2.04E+00	1.25E-01	1.72E+00	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.00E-05	5.00E-05	1.94E-01	3.78E-01	3.87E-01	7.51E-02	1.46E-01	2.11E-02	1.25E-01	5	10	0.02	0.004	0.01	0.002	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.49E-01	1.63E-01	5.70E-01	8.50E-02	9.30E-02	2.40E-02	7.97E-02	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.68E-05	1.40E-04	5.98E-01	1.39E+00	2.54E-01	1.52E-01	3.54E-01	4.29E-02	3.04E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	6.01E-05	1.50E-04	6.02E-01	1.29E+00	2.13E-01	1.28E-01	2.75E-01	3.62E-02	2.37E-01	1	10	0.2	0.04	0.02	0.004	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.57E-05	2.50E-04	8.01E-01	2.11E+00	4.16E-01	3.33E-01	8.78E-01	9.33E-02	7.48E-01	1	2	0.7	0.09	0.4	0.05	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.27E-05	1.10E-04	4.15E-01	9.34E-01	4.70E-01	1.95E-01	4.39E-01	5.46E-02	3.74E-01	1	2	0.4	0.05	0.2	0.03	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	2.95E-01	6.98E-01	4.16E-01	1.23E-01	2.90E-01	3.44E-02	2.47E-01	--	--	--	--	--	--	--	--	--	--
		bis(2-Ethylhexyl)phthalate	2.37E-03	2.50E-03	1.03E+00	3.94E+01	1.29E+02	1.33E+02	5.10E+03	3.70E+01	4.28E+03	18.3	183	**234**	**2**	**23**	0.2	**233**	**2**	**23**	<1
		Butyl benzyl phthalate	2.50E-03	2.50E-03	1.65E-01	1.74E-01	2.60E-01	4.29E-02	4.53E-02	1.24E-02	3.97E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.53E-01	2.41E-01	2.71E+00	4.14E-01	6.52E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.76E-05	1.60E-04	6.46E-01	2.01E+00	3.66E-01	2.37E-01	7.36E-01	6.64E-02	6.28E-01	1	2	0.6	0.1	0.3	0.03	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	4.73E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.29E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	1.60E-01	2.52E-01	3.70E-01	5.91E-02	9.31E-02	1.66E-02	7.95E-02	--	--	--	--	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.68E-01	2.37E-01	9.14E-01	1.54E-01	2.17E-01	4.31E-02	1.84E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	3.73E-01	3.11E+00	1.83E+01	6.81E+00	5.68E+01	1.89E+00	4.77E+01	7500	15000	0.01	0.0003	0.003	0.0001	<1	<1	<1	<1
		Fluoranthene	6.10E-05	2.20E-04	8.91E-01	2.30E+00	4.86E-01	4.33E-01	1.12E+00	1.21E-01	9.51E-01	1	2	0.95	0.1	0.5	0.06	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	1.92E-01	2.55E-01	--	--	--	--	--	1.6	3.2	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.92E-01	2.55E-01	1.03E-01	1.98E-02	2.62E-02	5.97E-03	2.41E-02	0.2	0.4	0.1	0.03	0.06	0.01	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	5.27E-05	1.10E-04	3.35E-01	7.71E-01	4.58E-01	1.53E-01	3.53E-01	4.29E-02	3.00E-01	1	--	0.3	0.04	--	--	<1	<1	--	--
		Isophorone	2.50E-03	2.50E-03	1.92E-01	2.55E-01	1.51E-01	2.89E-02	3.84E-02	8.51E-03	3.43E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.47E-05	1.90E-04	1.56E-01	2.50E-01	7.04E-01	1.10E-01	1.76E-01	3.06E-02	1.49E-01	5	10	0.03	0.01	0.01	0.003	<1	<1	<1	<1
		Phenanthrene	7.30E-05	1.58E-04	5.93E-01	2.35E+00	2.75E-01	1.63E-01	6.47E-01	4.59E-02	5.55E-01	5	10	0.1	0.01	0.06	0.005	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.65E-01	2.55E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	6.99E-05	3.80E-04	1.23E+00	3.59E+00	2.80E-01	3.44E-01	1.01E+00	9.69E-02	8.62E-01	1	2	0.9	0.1	0.4	0.05	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-23c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - UNNAMED ISLAND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.78E-06	1.20E-05	3.21E-03	9.28E-03	5.11E-01	1.64E-03	4.74E-03	4.59E-04	4.03E-03	0.8	4	0.01	0.001	0.001	0.0001	<1	<1	<1	<1
		4,4'-DDE	2.50E-06	2.50E-06	4.02E-03	1.35E-02	1.90E+00	7.66E-03	2.57E-02	2.13E-03	2.17E-02	0.8	4	0.03	0.003	0.01	0.0005	<1	<1	<1	<1
			2.73E-06	9.20E-06	3.21E-03	6.67E-03	1.34E+00	4.30E-03	8.93E-03	1.20E-03	7.54E-03	0.8	4	0.01	0.001	0.002	0.0003	<1	<1	<1	<1
		alpha-Chlordane	1.33E-06	3.30E-06	1.60E-03	3.55E-03	2.85E+00	4.56E-03	1.01E-02	1.27E-03	8.51E-03	--	--	--	--	--	--	--	--	--	--
		Dieldrin	2.50E-06	2.50E-06	2.79E-02	2.95E-01	1.56E+00	4.34E-02	4.59E-01	1.21E-02	3.87E-01	0.02	0.2	**19**	0.6	**2**	0.1	**17**	<1	**2**	<1
		Endosulfan II	2.50E-06	2.50E-06	2.03E-03	6.10E-03	7.98E-01	1.62E-03	4.87E-03	4.52E-04	4.12E-03	--	--	--	--	--	--	--	--	--	--
		Endosulfan Sulfate	2.50E-06	2.50E-06	3.39E-03	4.86E-03	7.98E-01	2.71E-03	3.88E-03	7.55E-04	3.28E-03	--	--	--	--	--	--	--	--	--	--
	4,4'-DDT	Endrin	2.50E-06	2.50E-06	1.93E-03	2.60E-03	5.76E-01	1.11E-03	1.50E-03	3.11E-04	1.27E-03	0.092	0.92	0.01	0.003	0.001	0.0003	<1	<1	<1	<1
		Endrin Aldehyde	2.50E-06	2.50E-06	2.75E-03	7.62E-03	5.76E-01	1.58E-03	4.39E-03	4.43E-04	3.72E-03	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.50E-06	2.50E-06	2.11E-03	1.40E-02	5.76E-01	1.22E-03	8.06E-03	3.40E-04	6.84E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-BHC	1.36E-06	4.30E-06	9.97E-04	1.35E-03	1.62E+00	1.61E-03	2.18E-03	4.48E-04	1.84E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.64E-06	9.40E-06	1.51E-03	1.80E-02	2.85E+00	4.30E-03	5.13E-02	1.20E-03	4.32E-02	--	--	--	--	--	--	--	--	--	--
		Heptachlor Epoxide	1.37E-06	5.10E-06	1.11E-03	1.30E-02	1.74E+00	1.94E-03	2.27E-02	5.39E-04	1.91E-02	--	--	--	--	--	--	--	--	--	--
		Methoxychlor	1.25E-05	1.25E-05	1.08E-02	2.80E-02	2.13E-01	2.30E-03	5.97E-03	6.52E-04	5.16E-03	4	8	0.001	0.0002	0.001	0.0001	<1	<1	<1	<1
		Toxaphene	1.25E-04	1.25E-04	9.97E-02	1.35E-01	7.43E-02	7.41E-03	1.00E-02	2.18E-03	9.12E-03	8	16	0.001	0.0003	0.001	0.0001	<1	<1	<1	<1
	Metals	Aluminum	1.02E-01	3.26E+00	5.34E+03	6.00E+03	1.54E-01	8.22E+02	9.23E+02	2.34E+02	8.05E+02	1.93	19.3	**417**	**121**	**42**	**12**	<1	**16**	<1	**2**
		Antimony	1.50E-03	1.50E-03	3.31E+00	1.57E+01	1.54E-01	5.09E-01	2.42E+00	1.45E-01	2.11E+00	0.125	0.66	**17**	**1**	**3**	0.2	**16**	<1	**3**	<1
		Arsenic	1.77E-03	3.20E-03	6.46E+00	1.11E+01	3.86E-02	2.50E-01	4.29E-01	7.64E-02	4.15E-01	0.126	1.26	**3**	0.6	0.3	0.1	<1	<1	<1	<1
			4.91E-02	2.75E-01	5.10E+01	1.67E+02	1.46E-02	7.43E-01	2.43E+00	2.66E-01	2.94E+00	0.51	19.8	**6**	0.5	0.1	0.01	**4**	<1	<1	<1
		Cadmium	2.30E-04	1.42E-03	2.00E+00	4.61E+00	1.32E+00	2.65E+00	6.11E+00	7.37E-01	5.15E+00	1	2.52	**5**	0.7	**2**	0.3	**3**	<1	**1**	<1
		Chromium	7.64E-04	1.35E-02	7.18E+01	1.53E+02	4.90E-02	3.52E+00	7.49E+00	1.05E+00	7.04E+00	3.28	13.14	**2**	0.3	1	0.1	<1	<1	<1	<1
		Copper	5.71E-03	7.03E-02	8.98E+01	3.33E+02	8.24E-02	7.40E+00	2.74E+01	2.15E+00	2.47E+01	11.7	15.14	**2**	0.2	**2**	0.1	**2**	<1	**1**	<1
		Cyanide	1.91E-03	4.80E-03	3.94E-01	9.33E-01	1.54E-01	6.06E-02	1.44E-01	1.75E-02	1.27E-01	24	48	0.005	0.001	0.003	0.0004	<1	<1	<1	<1
		Iron	2.59E+00	1.04E+01	1.20E+04	2.45E+04	1.54E-01	1.85E+03	3.77E+03	5.25E+02	3.29E+03	--	--	--	--	--	--	--	--	--	--
		Lead	3.11E-03	2.20E-02	1.20E+02	1.36E+03	1.29E-01	1.54E+01	1.75E+02	4.41E+00	1.54E+02	8	80	**19**	0.6	**2**	0.1	**17**	<1	**2**	<1
		Manganese	4.30E-01	5.79E-01	1.72E+02	2.89E+02	7.13E-02	1.23E+01	2.06E+01	3.63E+00	1.89E+01	88	284	0.2	0.04	0.1	0.01	<1	<1	<1	<1
		Mercury	6.84E-05	7.50E-05	2.56E-01	5.45E-01	3.12E-01	7.99E-02	1.70E-01	2.24E-02	1.45E-01	0.015	0.025	**10**	**1**	**6**	0.9	<1	<1	<1	<1
		Silver	9.58E-04	5.00E-03	2.09E+00	4.59E+00	3.27E-01	6.84E-01	1.50E+00	1.92E-01	1.29E+00	N/A	3.75	--	--	0.3	0.1	--	--	<1	<1
		Thallium	1.68E-03	2.00E-03	3.65E-01	1.20E+00	1.54E-01	5.62E-02	1.85E-01	1.62E-02	1.62E-01	0.0074	0.074	**22**	**2**	**2**	0.2	**17**	<1	**2**	<1
		Vanadium	6.37E-04	2.54E-03	1.35E+01	1.66E+01	6.72E-03	9.07E-02	1.12E-01	3.96E-02	1.75E-01	0.21	2.1	0.8	0.2	0.08	0.02	<1	<1	<1	<1
		Zinc	2.18E-02	7.96E-02	1.05E+02	1.07E+03	1.37E+01	1.44E+03	1.46E+04	3.99E+02	1.23E+04	160	320	**77**	**2**	**38**	**1**	**73**	**2**	**37**	<1

otes:
- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RR = residual risk
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-23d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - NUNES PARCEL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
nes	VOCs	2-Butanone	2.50E-03	2.50E-03	5.80E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	2.85E-04	3.97E-03	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	5.28E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	2.84E-04	3.97E-03	--	--	--	--	--	--	--	--	--	--
		Acetone	3.04E-03	1.20E-02	1.28E-02	6.50E-01	0.00E+00	0.00E+00	0.00E+00	3.53E-04	7.10E-03	10	50	0.0007	0.00004	0.0001	0.00001	<1	<1	<1	<1
		Methyl Acetate	2.50E-04	2.50E-04	5.75E-03	1.10E+00	0.00E+00	0.00E+00	0.00E+00	3.40E-05	5.40E-03	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	3.04E-04	4.35E-04	6.19E-03	3.60E-01	0.00E+00	0.00E+00	0.00E+00	4.05E-05	1.89E-03	5.85	50	0.0003	0.00001	0.00004	0.000001	<1	<1	<1	<1
		Tetrachloroethene	2.50E-04	2.50E-04	5.56E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	3.38E-05	3.23E-03	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.86E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	3.31E-05	3.23E-03	--	--	--	--	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	5.86E-03	6.50E-01	0.00E+00	0.00E+00	0.00E+00	3.41E-05	3.23E-03	2.1	2.6	0.002	0.00002	0.001	0.00001	<1	<1	<1	<1
	SVOCs	2-Methylnaphthalene	3.27E-05	5.00E-05	9.74E-02	1.10E-01	3.54E-01	3.45E-02	3.89E-02	9.67E-03	3.32E-02	5	10	0.007	0.002	0.003	0.001	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.74E-01	2.70E-01	4.73E+00	8.22E-01	1.28E+00	2.29E-01	1.07E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.33E-01	2.40E+00	4.81E-02	1.12E-02	1.15E-01	3.64E-03	1.09E-01	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.74E-01	2.70E-01	3.07E-01	5.35E-02	8.30E-02	1.53E-02	7.19E-02	--	--	--	--	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	3.81E-01	7.00E-01	5.24E-01	2.00E-01	3.67E-01	5.69E-02	3.15E-01	--	--	--	--	--	--	--	--	--	--
		Acenaphthene	3.29E-05	5.00E-05	1.53E-01	3.44E-01	--	--	--	--	--	5	10	--	--	--	--	--	--	--	--
		Acenaphthylene	3.72E-05	5.00E-05	2.22E-01	3.51E-01	3.66E+00	8.13E-01	1.29E+00	2.26E-01	1.08E+00	5	10	0.2	0.05	0.1	0.02	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.74E-01	2.70E-01	2.37E+00	4.12E-01	6.40E-01	1.15E-01	5.39E-01	--	--	--	--	--	--	--	--	--	--
		Anthracene	3.92E-05	5.00E-05	3.72E-01	7.41E-01	3.87E-01	1.44E-01	2.87E-01	4.04E-02	2.45E-01	5	10	0.05	0.01	0.02	0.004	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.09E-01	7.86E-02	5.70E-01	6.22E-02	4.48E-02	1.76E-02	3.89E-02	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	4.57E-05	1.20E-04	1.15E+00	2.49E+00	2.54E-01	2.93E-01	6.33E-01	8.24E-02	5.44E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	4.34E-05	5.00E-05	1.22E+00	2.58E+00	2.13E-01	2.60E-01	5.49E-01	7.33E-02	4.74E-01	1	10	0.5	0.1	0.05	0.01	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.59E-05	1.80E-04	1.74E+00	3.11E+00	4.16E-01	7.24E-01	1.29E+00	2.03E-01	1.10E+00	1	2	**1**	0.2	1	0.1	<1	<1	<1	<1
		Benzo(g,h,i)perylene	4.68E-05	1.00E-04	9.03E-01	1.55E+00	4.70E-01	4.25E-01	7.29E-01	1.19E-01	6.20E-01	1	2	0.6	0.1	0.3	0.1	<1	<1	<1	<1
		Benzo(k)fluoranthene	4.14E-05	1.00E-04	5.71E-01	1.56E+00	4.16E-01	2.38E-01	6.49E-01	6.65E-02	5.53E-01	--	--	--	--	--	--	--	--	--	--
		bis(2-Ethylhexyl)phthalate	2.50E-03	2.50E-03	6.81E-01	2.50E+00	1.29E+02	8.81E+01	3.24E+02	2.45E+01	2.72E+02	18.3	183	**15**	**1**	**1**	0.1	**13**	1	**1**	<1
		Butyl benzyl phthalate	2.50E-03	2.50E-03	1.27E-01	1.78E-01	2.60E-01	3.30E-02	4.63E-02	9.58E-03	4.06E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	2.08E-01	4.57E-01	2.71E+00	5.63E-01	1.24E+00	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.41E-05	1.50E-04	1.37E+00	2.82E+00	3.66E-01	5.02E-01	1.03E+00	1.41E-01	8.82E-01	1	2	0.9	0.1	0.4	0.1	<1	<1	<1	<1
		Dibenz[a,h]anthracene	3.37E-05	5.00E-05	2.85E-01	4.81E-01	3.70E-01	1.05E-01	1.78E-01	2.95E-02	1.52E-01	--	--	--	--	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.16E-01	2.17E-01	9.14E-01	1.06E-01	1.98E-01	2.98E-02	1.69E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.64E-01	2.70E-01	1.83E+01	3.00E+00	4.93E+00	8.32E-01	4.15E+00	7500	15000	0.0006	0.0001	0.0003	0.0001	<1	<1	<1	<1
		Fluoranthene	6.63E-05	2.40E-04	2.04E+00	5.27E+00	4.86E-01	9.92E-01	2.56E+00	2.78E-01	2.18E+00	1	2	**2**	0.3	**1**	0.1	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	1.74E-01	2.70E-01	--	--	--	--	--	1.6	3.2	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.74E-01	2.70E-01	1.03E-01	1.79E-02	2.78E-02	5.43E-03	2.55E-02	0.2	0.4	0.1	0.03	0.06	0.01	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	4.18E-05	5.00E-05	8.16E-01	1.43E+00	4.58E-01	3.73E-01	6.54E-01	1.04E-01	5.57E-01	1	--	1	0.1	--	--	<1	<1	--	--
		Isophorone	2.50E-03	2.50E-03	1.66E-01	2.35E-01	1.51E-01	2.50E-02	3.54E-02	7.40E-03	3.17E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	3.72E-05	1.40E-04	1.21E-01	2.03E-01	7.04E-01	8.52E-02	1.43E-01	2.38E-02	1.21E-01	5	10	0.02	0.005	0.01	0.002	<1	<1	<1	<1
		Phenanthrene	5.95E-05	1.40E-04	1.25E+00	6.79E+00	2.75E-01	3.44E-01	1.87E+00	9.68E-02	1.60E+00	5	10	0.3	0.02	0.2	0.01	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.74E-01	2.70E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	6.98E-05	2.20E-04	2.10E+00	5.40E+00	2.80E-01	5.88E-01	1.51E+00	1.65E-01	1.30E+00	1	2	**1**	0.2	0.6	0.1	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-23d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - NUNES PARCEL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.07E-06	5.20E-06	6.75E-03	1.17E-02	5.11E-01	3.45E-03	5.98E-03	9.65E-04	5.08E-03	0.8	4	0.01	0.001	0.001	0.0002	<1	<1	<1	<1
		4,4'-DDE	2.12E-06	2.80E-06	6.44E-03	1.02E-02	1.90E+00	1.23E-02	1.94E-02	3.41E-03	1.64E-02	0.8	4	0.02	0.004	0.004	0.0009	<1	<1	<1	<1
			2.16E-06	2.80E-06	5.26E-03	8.70E-02	1.34E+00	7.04E-03	1.16E-01	1.96E-03	9.83E-02	0.8	4	0.1	0.002	0.02	0.0005	<1	<1	<1	<1
		alpha-Chlordane	1.11E-06	1.40E-06	7.35E-03	1.24E-02	2.85E+00	2.09E-02	3.53E-02	5.82E-03	2.97E-02	--	--	--	--	--	--	--	--	--	--
		Dieldrin	2.63E-06	1.20E-05	2.21E-02	1.34E-01	1.56E+00	3.44E-02	2.09E-01	9.57E-03	1.76E-01	0.02	0.2	**9**	0.5	0.9	0.05	**7**	<1	<1	<1
		Endosulfan I	1.11E-06	1.40E-06	1.05E-03	1.40E-03	7.98E-01	8.38E-04	1.12E-03	2.34E-04	9.46E-04	0.15	0.3	0.01	0.002	0.003	0.001	<1	<1	<1	<1
		Endosulfan II	1.93E-06	2.80E-06	2.19E-03	6.80E-03	7.98E-01	1.75E-03	5.43E-03	4.88E-04	4.59E-03	--	--	--	--	--	--	--	--	--	--
	4,4'-DDT	Endosulfan Sulfate	1.93E-06	2.80E-06	3.46E-03	9.50E-03	7.98E-01	2.76E-03	7.58E-03	7.70E-04	6.42E-03	--	--	--	--	--	--	--	--	--	--
		Endrin	1.93E-06	2.80E-06	2.04E-03	2.70E-03	5.76E-01	1.18E-03	1.56E-03	3.28E-04	1.32E-03	0.092	0.92	0.01	0.004	0.001	0.0004	<1	<1	<1	<1
		Endrin Aldehyde	1.93E-06	2.80E-06	2.46E-03	1.00E-02	5.76E-01	1.42E-03	5.76E-03	3.96E-04	4.89E-03	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.10E-06	6.00E-06	2.45E-03	1.00E-02	5.76E-01	1.41E-03	5.76E-03	3.94E-04	4.89E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-BHC	1.11E-06	1.40E-06	1.05E-03	1.40E-03	1.62E+00	1.70E-03	2.26E-03	4.72E-04	1.91E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.09E-06	1.40E-06	7.34E-03	1.10E-02	2.85E+00	2.09E-02	3.13E-02	5.81E-03	2.64E-02	--	--	--	--	--	--	--	--	--	--
		Heptachlor Epoxide	1.08E-06	1.40E-06	1.05E-03	1.40E-03	1.74E+00	1.83E-03	2.44E-03	5.09E-04	2.06E-03	--	--	--	--	--	--	--	--	--	--
		Methoxychlor	6.98E-06	1.40E-05	1.06E-02	1.40E-02	2.13E-01	2.26E-03	2.99E-03	6.40E-04	2.58E-03	4	8	0.0006	0.0002	0.0003	0.0001	<1	<1	<1	<1
		Toxaphene	1.11E-04	1.40E-04	1.05E-01	1.40E-01	7.43E-02	7.80E-03	1.04E-02	2.29E-03	9.47E-03	8	16	0.001	0.0003	0.0006	0.0001	<1	<1	<1	<1
	Metals	Aluminum	1.30E-01	2.40E-01	7.94E+03	1.06E+04	1.54E-01	1.22E+03	1.63E+03	3.47E+02	1.42E+03	1.93	19.3	**736**	**180**	**74**	**18**	**295**	**75**	**30**	**7**
		Antimony	1.05E-03	1.50E-03	1.88E+00	8.00E+00	1.54E-01	2.89E-01	1.23E+00	8.24E-02	1.07E+00	0.125	0.66	**9**	0.7	**2**	0.1	**7**	<1	**1**	<1
		Arsenic	2.31E-03	3.07E-03	1.15E+01	1.66E+01	3.86E-02	4.44E-01	6.41E-01	1.36E-01	6.20E-01	0.126	1.26	**5**	**1**	0.5	0.1	**2**	1	<1	<1
			4.62E-02	1.00E-01	1.17E+02	2.76E+02	1.46E-02	1.70E+00	4.02E+00	6.03E-01	4.74E+00	0.51	19.8	**9**	**1**	0.2	0.03	**8**	1	<1	<1
		Cadmium	3.28E-04	5.12E-04	3.47E+00	1.14E+01	1.32E+00	4.60E+00	1.51E+01	1.28E+00	1.27E+01	1	2.52	**13**	**1**	**5**	0.5	**11**	1	**4**	<1
		Chromium	1.08E-03	2.87E-03	8.34E+01	2.22E+02	4.90E-02	4.08E+00	1.09E+01	1.22E+00	1.02E+01	3.28	13.14	**3**	0.4	0.8	0.1	**2**	<1	<1	<1
		Cobalt	4.62E-04	9.21E-04	7.16E+00	1.15E+01	1.95E-02	1.40E-01	2.24E-01	4.65E-02	2.45E-01	--	--	--	--	--	--	--	--	--	--
		Copper	7.94E-03	1.25E-02	1.45E+02	3.35E+02	8.24E-02	1.19E+01	2.76E+01	3.47E+00	2.48E+01	11.7	15.14	**2**	0.30	**2**	0.23	**2**	<1	**1**	<1
		Cyanide	2.10E-03	5.00E-03	5.50E-01	2.03E+00	1.54E-01	8.46E-02	3.12E-01	2.43E-02	2.74E-01	24	48	0.01	0.001	0.01	0.001	<1	<1	<1	<1
	Barium	Iron	8.97E-01	7.92E+00	1.81E+04	2.46E+04	1.54E-01	2.78E+03	3.78E+03	7.92E+02	3.30E+03	--	--	--	--	--	--	--	--	--	--
		Lead	3.16E-03	5.98E-03	2.36E+02	8.28E+02	1.29E-01	3.04E+01	1.07E+02	8.68E+00	9.35E+01	8	80	**12**	**1**	**1**	0.1	**9**	1	1	<1
		Manganese	1.39E-01	4.42E-01	4.28E+02	9.52E+02	7.13E-02	3.05E+01	6.78E+01	8.93E+00	6.17E+01	88	284	0.7	0.1	0.2	0.03	<1	<1	<1	<1
		Mercury	5.10E-05	7.50E-05	3.47E-01	6.21E-01	3.12E-01	1.08E-01	1.94E-01	3.04E-02	1.66E-01	0.015	0.025	**11**	**2**	**7**	**1**	<1	<1	<1	<1
		Nickel	2.82E-03	3.63E-03	2.05E+01	3.43E+01	1.69E-01	3.47E+00	5.81E+00	9.86E-01	5.05E+00	40	80	0.13	0.02	0.06	0.01	<1	<1	<1	<1
		Selenium	1.03E-03	1.50E-03	4.71E-01	9.95E-01	1.48E-01	6.99E-02	1.48E-01	2.00E-02	1.29E-01	--	--	--	--	--	--	--	--	--	--
		Silver	3.17E-04	1.00E-03	1.08E+00	2.34E+00	3.27E-01	3.53E-01	7.66E-01	9.92E-02	6.55E-01	N/A	3.75	--	--	0.2	0.03	--	--	<1	<1
		Thallium	8.77E-04	2.00E-03	8.53E-01	1.91E+00	1.54E-01	1.31E-01	2.94E-01	3.74E-02	2.57E-01	0.0074	0.074	**35**	**5**	**3**	0.5	**30**	**4**	**3**	<1
		Vanadium	1.26E-03	2.20E-03	1.97E+01	2.80E+01	6.72E-03	1.32E-01	1.88E-01	5.79E-02	2.94E-01	0.21	2.1	**1**	0.3	0.1	0.03	<1	<1	<1	<1
		Zinc	1.23E-02	3.87E-02	2.16E+02	3.72E+02	1.37E+01	2.95E+03	5.09E+03	8.20E+02	4.28E+03	160	320	**27**	**5**	**13**	**3**	**23**	**4**	**12**	**2**

tes:
= BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
OC = volatile organic compound
VOC= semivolatile organic compound
CBs = polychlorinated biphenyls
CL = Upper Confidence Limit
soilAF = Biota-Soil Accumulation Factor
TE = central tendency exposure
R = residual risk

RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

DRAFT
BERA
JUNE 2007
REVISED NOVEMBER 2007
REVISED SEPTEMBER 2008
REVISED MAY 2009

TABLE 7-23e
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - QUINNVILLE WELL FIELD

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Well Field	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.04E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	2.42E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	2.81E-04	8.59E-04	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	2.81E-04	8.59E-04	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	2.81E-04	8.59E-04	25	50	0.00003	0.00001	0.00002	0.00001	<1	<1	<1	<1
		Acetone	3.70E-03	1.20E-02	1.13E-02	4.76E-02	0.00E+00	0.00E+00	0.00E+00	4.25E-04	4.19E-03	10	50	0.0004	0.00004	0.00008	0.00001	<1	<1	<1	<1
		Carbon Disulfide	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.04E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.68E-04	3.30E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.24E-05	1.43E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.04E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.04E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.04E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	2.98E-04	4.15E-04	4.03E-03	1.35E-02	0.00E+00	0.00E+00	0.00E+00	3.75E-05	2.02E-04	5.85	50	0.00003	0.00001	0.000004	0.000001	<1	<1	<1	<1
		Tetrachloroethene	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.04E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.04E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	4.21E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.24E-05	1.16E-04	2.1	2.6	0.00006	0.00002	0.00004	0.00001	<1	<1	<1	<1
	SVOCs	2-Methylnaphthalene	5.00E-05	5.00E-05	9.49E-02	2.25E-01	3.54E-01	3.36E-02	7.96E-02	9.42E-03	6.80E-02	5	10	0.01	0.002	0.007	0.001	<1	<1	<1	<1
		2-Methylphenol	2.50E-03	2.50E-03	1.39E-01	2.35E-01	2.27E+00	3.16E-01	5.34E-01	8.81E-02	4.51E-01	--	--	--	--	--	--	--	--	--	--
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.39E-01	2.35E-01	4.73E+00	6.57E-01	1.11E+00	1.83E-01	9.35E-01	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.39E-01	2.35E-01	4.81E-02	6.68E-03	1.13E-02	2.28E-03	1.15E-02	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.39E-01	2.35E-01	3.07E-01	4.27E-02	7.23E-02	1.23E-02	6.27E-02	--	--	--	--	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	2.14E-01	6.00E-01	5.24E-01	1.12E-01	3.14E-01	3.25E-02	2.70E-01	--	--	--	--	--	--	--	--	--	--
		Acenaphthene	5.00E-05	5.00E-05	5.55E-02	9.25E-02	--	--	--	--	--	5	10	--	--	--	--	--	--	--	--
		Acenaphthylene	5.00E-05	5.00E-05	1.34E-01	6.11E-01	3.66E+00	4.91E-01	2.24E+00	1.36E-01	1.88E+00	5	10	0.4	0.03	0.19	0.01	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.36E-01	2.35E-01	2.37E+00	3.22E-01	5.57E-01	8.98E-02	4.70E-01	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.00E-05	5.00E-05	1.57E-01	6.42E-01	3.87E-01	6.08E-02	2.49E-01	1.70E-02	2.12E-01	5	10	0.04	0.003	0.021	0.002	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	5.42E-01	2.13E+00	5.70E-01	3.09E-01	1.21E+00	8.66E-02	1.03E+00	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.00E-05	5.00E-05	5.42E-01	1.23E+00	2.54E-01	1.38E-01	3.13E-01	3.88E-02	2.69E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.00E-05	5.00E-05	5.61E-01	1.21E+00	2.13E-01	1.19E-01	2.57E-01	3.37E-02	2.22E-01	1	10	0.2	0.03	0.02	0.003	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.00E-05	5.00E-05	7.94E-01	1.76E+00	4.16E-01	3.30E-01	7.32E-01	9.25E-02	6.24E-01	1	2	0.6	0.1	0.3	0.05	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.00E-05	5.00E-05	4.32E-01	1.08E+00	4.70E-01	2.03E-01	5.08E-01	5.69E-02	4.32E-01	1	2	0.4	0.1	0.2	0.03	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	2.89E-01	6.65E-01	4.16E-01	1.20E-01	2.77E-01	3.37E-02	2.36E-01	--	--	--	--	--	--	--	--	--	--
		bis(2-Ethylhexyl)phthalate	2.50E-03	2.50E-03	2.18E-01	9.25E-01	1.29E+02	2.82E+01	1.20E+02	7.83E+00	1.01E+02	18.3	183	**5**	0.43	0.5	0.04	**4**	<1	<1	<1
		Butyl benzyl phthalate	2.50E-03	2.50E-03	1.25E-01	2.10E-01	2.60E-01	3.25E-02	5.46E-02	9.43E-03	4.77E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.19E-01	1.47E-01	2.71E+00	3.22E-01	3.98E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.00E-05	5.00E-05	5.57E-01	1.21E+00	3.66E-01	2.04E-01	4.43E-01	5.72E-02	3.78E-01	1	2	0.4	0.1	0.2	0.03	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	2.37E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.04E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	8.94E-02	1.83E-01	3.70E-01	3.30E-02	6.76E-02	9.27E-03	5.77E-02	--	--	--	--	--	--	--	--	--	--
		Dibenzofuran	2.50E-03	2.50E-03	1.27E-01	2.35E-01	9.14E-01	1.16E-01	2.15E-01	3.26E-02	1.82E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.33E-01	5.40E-01	1.83E+01	4.26E+00	9.86E+00	1.18E+00	8.29E+00	7500	15000	0.001	0.0002	0.0006	0.0001	<1	<1	<1	<1
		Fluoranthene	5.00E-05	5.00E-05	8.88E-01	2.39E+00	4.86E-01	4.32E-01	1.16E+00	1.21E-01	9.88E-01	1	2	0.99	0.1	0.5	0.06	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	1.39E-01	2.35E-01	--	--	--	--	--	1.6	3.2	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.39E-01	2.35E-01	1.03E-01	1.43E-02	2.42E-02	4.40E-03	2.23E-02	0.2	0.4	0.1	0.02	0.06	0.01	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	5.00E-05	5.00E-05	3.81E-01	1.02E+00	4.58E-01	1.74E-01	4.67E-01	4.88E-02	3.97E-01	1	--	0.4	0.05	--	--	<1	<1	--	--
		Isophorone	2.50E-03	2.50E-03	1.39E-01	2.35E-01	1.51E-01	2.09E-02	3.54E-02	6.24E-03	3.17E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.00E-05	5.00E-05	9.87E-02	5.44E-01	7.04E-01	6.95E-02	3.83E-01	1.94E-02	3.24E-01	5	10	0.06	0.004	0.03	0.002	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.39E-01	2.35E-01	4.40E-01	6.12E-02	1.04E-01	1.74E-02	8.89E-02	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	5.52E-01	8.50E-01	4.10E+01	2.26E+01	3.48E+01	6.28E+00	2.93E+01	0.24	2.4	**122**	**26**	**12**	**3**	**36**	**2**	**4**	<1
		Phenanthrene	5.00E-05	5.00E-05	5.03E-01	1.17E+00	2.75E-01	1.38E-01	3.22E-01	3.90E-02	2.76E-01	5	10	0.06	0.01	0.03	0.004	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.39E-01	2.35E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.00E-05	5.00E-05	1.02E+00	2.11E+00	2.80E-01	2.86E-01	5.91E-01	8.03E-02	5.06E-01	1	2	0.5	0.1	0.3	0.04	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-23e
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - QUINNVILLE WELL FIELD

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.65E-06	2.80E-06	3.78E-03	1.50E-02	5.11E-01	1.93E-03	7.66E-03	5.40E-04	6.51E-03	0.8	4	0.008	0.001	0.002	0.0001	<1	<1	<1	<1
		4,4'-DDE	2.65E-06	2.80E-06	8.36E-03	2.86E-02	1.90E+00	1.59E-02	5.45E-02	4.43E-03	4.59E-02	0.8	4	0.1	0.01	0.01	0.001	<1	<1	<1	<1
			2.65E-06	2.80E-06	1.26E-02	2.66E-02	1.34E+00	1.69E-02	3.56E-02	4.70E-03	3.00E-02	0.8	4	0.04	0.01	0.01	0.001	<1	<1	<1	<1
		alpha-Chlordane	1.32E-06	1.40E-06	3.55E-03	9.76E-03	2.85E+00	1.01E-02	2.78E-02	2.81E-03	2.34E-02	--	--	--	--	--	--	--	--	--	--
		Dieldrin	2.65E-06	2.80E-06	5.22E-02	4.52E-01	1.56E+00	8.13E-02	7.04E-01	2.26E-02	5.93E-01	0.02	0.2	**30**	**1**	**3**	0.1	**28**	1	**3**	<1
		Endosulfan I	1.32E-06	1.40E-06	7.65E-04	4.20E-03	7.98E-01	6.11E-04	3.35E-03	1.70E-04	2.84E-03	0.15	0.3	0.02	0.001	0.01	0.001	<1	<1	<1	<1
		Endosulfan II	2.65E-06	2.80E-06	2.41E-03	7.46E-03	7.98E-01	1.92E-03	5.95E-03	5.37E-04	5.04E-03	--	--	--	--	--	--	--	--	--	--
	4,4'-DDT	Endosulfan Sulfate	2.65E-06	2.80E-06	3.03E-03	3.39E-03	7.98E-01	2.42E-03	2.71E-03	6.75E-04	2.29E-03	--	--	--	--	--	--	--	--	--	--
		Endrin	2.65E-06	2.80E-06	1.35E-03	5.50E-03	5.76E-01	7.78E-04	3.17E-03	2.18E-04	2.69E-03	0.092	0.92	0.03	0.002	0.003	0.0002	<1	<1	<1	<1
		Endrin Aldehyde	2.65E-06	2.80E-06	1.72E-03	2.10E-02	5.76E-01	9.91E-04	1.21E-02	2.77E-04	1.03E-02	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.65E-06	2.80E-06	1.52E-03	6.50E-03	5.76E-01	8.76E-04	3.74E-03	2.45E-04	3.18E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-BHC	1.32E-06	1.40E-06	7.13E-04	1.20E-03	1.62E+00	1.15E-03	1.94E-03	3.21E-04	1.64E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.32E-06	1.40E-06	2.89E-03	8.10E-03	2.85E+00	8.23E-03	2.31E-02	2.29E-03	1.94E-02	--	--	--	--	--	--	--	--	--	--
		Heptachlor Epoxide	1.72E-06	2.90E-06	1.12E-03	6.50E-03	1.74E+00	1.95E-03	1.13E-02	5.43E-04	9.55E-03	--	--	--	--	--	--	--	--	--	--
		Methoxychlor	1.32E-05	1.40E-05	3.50E-03	1.20E-02	2.13E-01	7.47E-04	2.56E-03	2.12E-04	2.21E-03	4	8	0.0006	0.0001	0.0003	0.00003	<1	<1	<1	<1
		Toxaphene	1.32E-04	1.40E-04	7.13E-02	1.20E-01	7.43E-02	5.30E-03	8.92E-03	1.56E-03	8.12E-03	8	16	0.001	0.0002	0.0005	0.0001	<1	<1	<1	<1
	Metals	Aluminum	8.00E-02	1.00E-01	6.44E+03	7.74E+03	1.54E-01	9.91E+02	1.19E+03	2.82E+02	1.04E+03	1.93	19.3	**538**	**146**	**54**	**15**	**97**	**41**	**10**	**4**
		Antimony	1.50E-03	1.50E-03	1.13E+00	1.12E+00	1.54E-01	1.74E-01	1.72E-01	4.96E-02	1.51E-01	0.125	0.66	**1**	0.4	0.2	0.1	<1	<1	<1	<1
		Arsenic	2.19E-03	4.04E-03	7.12E+00	1.18E+01	3.86E-02	2.75E-01	4.56E-01	8.42E-02	4.41E-01	0.126	1.26	**4**	0.7	0.4	0.1	<1	<1	<1	<1
			6.18E-02	1.00E-01	4.71E+01	7.34E+01	1.46E-02	6.86E-01	1.07E+00	2.47E-01	1.29E+00	0.51	19.8	**3**	0.5	0.1	0.01	<1	<1	<1	<1
		Cadmium	2.20E-04	3.10E-04	1.62E+00	3.84E+00	1.32E+00	2.15E+00	5.09E+00	5.97E-01	4.29E+00	1	2.52	**4**	0.6	**2**	0.2	**2**	<1	<1	<1
		Chromium	5.06E-04	1.00E-03	7.40E+01	2.23E+02	4.90E-02	3.62E+00	1.09E+01	1.08E+00	1.03E+01	3.28	13.14	**3**	0.3	0.8	0.1	**2**	<1	<1	<1
		Copper	8.23E-03	1.25E-02	7.62E+01	1.34E+02	8.24E-02	6.28E+00	1.10E+01	1.82E+00	9.93E+00	11.7	15.14	0.8	0.2	0.7	0.1	<1	<1	<1	<1
		Cyanide	2.43E-03	5.00E-03	3.68E-01	8.53E-01	1.54E-01	5.66E-02	1.31E-01	1.64E-02	1.16E-01	24	48	0.005	0.001	0.002	0.0003	<1	<1	<1	<1
	Barium	Iron	5.38E-01	1.25E+00	1.21E+04	1.59E+04	1.54E-01	1.86E+03	2.45E+03	5.30E+02	2.13E+03	--	--	--	--	--	--	--	--	--	--
		Lead	2.01E-03	3.40E-03	9.62E+01	2.07E+02	1.29E-01	1.24E+01	2.66E+01	3.54E+00	2.34E+01	8	80	**3**	0.4	0.3	0.04	<1	<1	<1	<1
		Manganese	1.52E-01	6.22E-01	2.11E+02	4.68E+02	7.13E-02	1.50E+01	3.33E+01	4.41E+00	3.05E+01	88	284	0.3	0.1	0.1	0.02	<1	<1	<1	<1
		Mercury	7.12E-05	7.50E-05	2.74E-01	7.87E-01	3.12E-01	8.55E-02	2.46E-01	2.40E-02	2.10E-01	0.015	0.025	**14**	**2**	**8**	0.96	**2**	<1	<1	<1
		Silver	4.05E-04	1.00E-03	1.30E+00	6.28E+00	3.27E-01	4.25E-01	2.05E+00	1.19E-01	1.76E+00	N/A	3.75	--	--	0.5	0.03	--	--	<1	<1
		Vanadium	1.67E-03	2.50E-02	1.85E+01	2.53E+01	6.72E-03	1.24E-01	1.70E-01	5.44E-02	2.73E-01	0.21	2.1	**1**	0.3	0.1	0.03	<1	<1	<1	<1
		Zinc	6.22E-03	1.00E-02	7.46E+01	1.19E+02	1.37E+01	1.02E+03	1.63E+03	2.83E+02	1.37E+03	160	320	**9**	**2**	**4**	0.9	**5**	<1	**2**	<1

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic comopound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RR = residual risk
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-23f
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - WETLANDS A THROUGH D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Wetlands A-D	VOCs	Acetone	2.50E-03	2.50E-03	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	2.84E-04	8.59E-04	10	50	0.0001	0.00003	0.00002	0.00001	<1	<1	<1	<1
		Chloromethane	3.17E-04	4.61E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	4.03E-05	1.86E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.28E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	4.66E-03	7.00E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Cyclohexane	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.28E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.28E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Methyl acetate	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.28E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	4.66E-03	7.00E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	4.66E-03	7.00E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.28E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		2-Methylphenol	2.50E-03	2.50E-03	1.88E-01	2.00E-01	2.27E+00	4.27E-01	4.54E-01	1.19E-01	3.84E-01	--	--	--	--	--	--	--	--	--	--
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.88E-01	2.00E-01	4.73E+00	8.89E-01	9.45E-01	2.47E-01	7.96E-01	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.88E-01	2.00E-01	4.81E-02	9.04E-03	9.62E-03	2.99E-03	9.87E-03	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.88E-01	2.00E-01	3.07E-01	5.78E-02	6.15E-02	1.65E-02	5.34E-02	--	--	--	--	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	4.71E-01	5.00E-01	5.24E-01	2.47E-01	2.62E-01	7.01E-02	2.26E-01	--	--	--	--	--	--	--	--	--	--
		Acenaphthene	5.00E-05	5.00E-05	1.88E-01	2.00E-01	--	--	--	--	--	5	10	--	--	--	--	--	--	--	--
		Acenaphthylene	5.00E-05	5.00E-05	1.88E-01	2.00E-01	3.66E+00	6.89E-01	7.33E-01	1.91E-01	6.17E-01	5	10	0.1	0.04	0.06	0.02	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.88E-01	2.00E-01	2.37E+00	4.45E-01	4.74E-01	1.24E-01	4.00E-01	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.41E-05	1.90E-04	1.88E-01	2.00E-01	3.87E-01	7.28E-02	7.74E-02	2.04E-02	6.61E-02	5	10	0.01	0.004	0.007	0.002	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.88E-01	2.00E-01	5.70E-01	1.07E-01	1.14E-01	3.02E-02	9.76E-02	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.00E-05	5.00E-05	9.40E-02	1.70E-01	2.54E-01	2.39E-02	4.32E-02	6.74E-03	3.72E-02	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.00E-05	5.00E-05	9.96E-02	1.70E-01	2.13E-01	2.12E-02	3.62E-02	5.99E-03	3.12E-02	1	10	0.03	0.01	0.003	0.001	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.21E-05	1.00E-04	7.71E-02	1.30E-01	4.16E-01	3.21E-02	5.41E-02	8.99E-03	4.61E-02	1	2	0.05	0.01	0.02	0.004	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.00E-05	5.00E-05	7.60E-02	1.70E-01	4.70E-01	3.58E-02	8.00E-02	1.00E-02	6.80E-02	1	2	0.1	0.01	0.03	0.01	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	1.00E-01	1.90E-01	4.16E-01	4.16E-02	7.90E-02	1.17E-02	6.73E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.88E-01	2.00E-01	2.71E+00	5.09E-01	5.41E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.24E-05	1.10E-04	7.78E-02	1.60E-01	3.66E-01	2.85E-02	5.86E-02	8.00E-03	5.01E-02	1	2	0.05	0.01	0.03	0.004	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	4.66E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.28E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	1.88E-01	2.00E-01	3.70E-01	6.95E-02	7.39E-02	1.95E-02	6.31E-02	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.88E-01	2.00E-01	1.83E+01	3.43E+00	3.65E+00	9.53E-01	3.07E+00	7500	15000	0.0004	0.0001	0.0002	0.0001	<1	<1	<1	<1
		Fluoranthene	5.65E-05	2.00E-04	1.13E-01	2.30E-01	4.86E-01	5.50E-02	1.12E-01	1.54E-02	9.52E-02	1	2	0.1	0.02	0.05	0.01	<1	<1	<1	<1
		Fluorene	5.00E-05	5.00E-05	1.88E-01	2.00E-01	--	--	--	--	--	5	10	--	--	--	--	--	--	--	--
		Hexachlorobenzene	2.50E-03	2.50E-03	1.88E-01	2.00E-01	--	--	--	--	--	1.6	3.2	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.88E-01	2.00E-01	1.03E-01	1.93E-02	2.06E-02	5.85E-03	1.91E-02	0.2	0.4	0.1	0.03	0.05	0.01	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	5.00E-05	5.00E-05	9.96E-02	1.90E-01	4.58E-01	4.56E-02	8.69E-02	1.28E-02	7.40E-02	1	--	0.07	0.01	--	--	<1	<1	--	--
		Isophorone	2.50E-03	2.50E-03	1.88E-01	2.00E-01	1.51E-01	2.83E-02	3.01E-02	8.34E-03	2.71E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.00E-05	5.00E-05	1.88E-01	2.00E-01	7.04E-01	1.32E-01	1.41E-01	3.69E-02	1.19E-01	5	10	0.02	0.01	0.01	0.004	<1	<1	<1	<1
		Phenanthrene	5.51E-05	1.20E-04	1.09E-01	1.90E-01	2.75E-01	3.00E-02	5.23E-02	8.45E-03	4.49E-02	5	10	0.01	0.002	0.004	0.001	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.88E-01	2.00E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.78E-05	2.10E-04	1.13E-01	1.90E-01	2.80E-01	3.16E-02	5.32E-02	8.91E-03	4.57E-02	1	2	0.05	0.01	0.02	0.004	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-23f
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - WETLANDS A THROUGH D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.50E-06	2.50E-06	1.86E-03	1.95E-03	5.11E-01	9.50E-04	9.96E-04	2.66E-04	8.47E-04	0.8	4	0.001	0.0003	0.0002	0.0001	<1	<1	<1	<1
		4,4'-DDE	2.50E-06	2.50E-06	1.86E-03	1.95E-03	1.90E+00	3.54E-03	3.71E-03	9.85E-04	3.13E-03	0.8	4	0.004	0.001	0.001	0.0002	<1	<1	<1	<1
		4,4'-DDT	2.50E-06	2.50E-06	1.86E-03	1.95E-03	1.34E+00	2.49E-03	2.61E-03	6.93E-04	2.20E-03	0.8	4	0.003	0.001	0.001	0.0002	<1	<1	<1	<1
		alpha-Chlordane	1.25E-06	1.25E-06	9.59E-04	1.00E-03	2.85E+00	2.73E-03	2.85E-03	7.59E-04	2.40E-03	--	--	--	--	--	--	--	--	--	--
		Endosulfan Sulfate	2.77E-06	1.30E-05	1.86E-03	1.95E-03	7.98E-01	1.48E-03	1.56E-03	4.14E-04	1.32E-03	--	--	--	--	--	--	--	--	--	--
		Endrin Aldehyde	2.50E-06	2.50E-06	1.86E-03	1.95E-03	5.76E-01	1.07E-03	1.12E-03	3.00E-04	9.54E-04	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.50E-06	2.50E-06	1.86E-03	1.95E-03	5.76E-01	1.07E-03	1.12E-03	3.00E-04	9.54E-04	--	--	--	--	--	--	--	--	--	--
		Gamma-BHC	1.25E-06	1.25E-06	9.59E-04	1.00E-03	1.62E+00	1.55E-03	1.62E-03	4.31E-04	1.36E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.25E-06	1.25E-06	9.59E-04	1.00E-03	2.85E+00	2.73E-03	2.85E-03	7.59E-04	2.40E-03	--	--	--	--	--	--	--	--	--	--
		Toxaphene	1.25E-04	1.25E-04	9.59E-02	1.00E-01	7.43E-02	7.13E-03	7.43E-03	2.09E-03	6.77E-03	8	16	0.001	0.0003	0.0004	0.0001	<1	<1	<1	<1
	Metals	Aluminum	2.22E-01	9.52E-01	5.02E+03	7.57E+03	1.54E-01	7.72E+02	1.16E+03	2.20E+02	1.02E+03	1.93	19.3	**526**	**114**	**53**	**11**	**85**	**9**	**8**	<1
		Antimony	1.46E-03	1.50E-03	3.74E-01	5.50E-01	1.54E-01	5.75E-02	8.46E-02	1.65E-02	7.42E-02	0.125	0.66	0.6	0.1	0.1	0.03	<1	<1	<1	<1
		Arsenic	9.23E-04	1.61E-03	3.68E+00	7.20E+00	3.86E-02	1.42E-01	2.78E-01	4.35E-02	2.69E-01	0.126	1.26	**2**	0.3	0.2	0.03	<1	<1	<1	<1
		Barium	4.89E-02	1.00E-01	2.21E+01	3.46E+01	1.46E-02	3.22E-01	5.04E-01	1.18E-01	6.24E-01	0.51	19.8	**1**	0.2	0.03	0.01	<1	<1	<1	<1
		Beryllium	1.46E-04	1.50E-04	5.60E-01	8.40E-01	--	--	--	--	--	0.66	1.32	--	--	--	--	--	--	--	--
		Cadmium	1.23E-04	1.20E-03	4.82E-01	5.50E-01	1.32E+00	6.39E-01	7.29E-01	1.78E-01	6.15E-01	1	2.52	0.6	0.2	0.2	0.1	<1	<1	<1	<1
		Chromium	6.90E-04	1.71E-03	1.14E+01	1.89E+01	4.90E-02	5.58E-01	9.25E-01	1.67E-01	8.69E-01	3.28	13.14	0.3	0.1	0.1	0.01	<1	<1	<1	<1
		Cobalt	7.52E-04	1.91E-03	4.82E+00	5.50E+00	1.95E-02	9.41E-02	1.07E-01	3.13E-02	1.17E-01	--	--	--	--	--	--	--	--	--	--
		Copper	2.31E-03	1.25E-02	1.11E+01	1.74E+01	8.24E-02	9.15E-01	1.43E+00	2.66E-01	1.29E+00	11.7	15.14	0.1	0.02	0.09	0.02	<1	<1	<1	<1
		Cyanide	3.05E-03	1.79E-01	2.40E-01	2.70E-01	1.54E-01	3.69E-02	4.15E-02	1.08E-02	9.53E-02	24	48	0.004	0.0005	0.002	0.0002	<1	<1	<1	<1
		Iron	8.84E-01	1.62E+00	7.87E+03	9.47E+03	1.54E-01	1.21E+03	1.46E+03	3.44E+02	1.27E+03	--	--	--	--	--	--	--	--	--	--
		Lead	1.83E-03	3.28E-03	1.52E+01	2.39E+01	1.29E-01	1.96E+00	3.08E+00	5.59E-01	2.70E+00	8	80	0.3	0.1	0.03	0.01	<1	<1	<1	<1
		Manganese	8.13E-02	3.22E-01	1.02E+02	1.17E+02	7.13E-02	7.27E+00	8.34E+00	2.13E+00	7.68E+00	88	284	0.1	0.02	0.03	0.01	<1	<1	<1	<1
		Mercury	6.94E-05	7.50E-05	4.58E-02	8.10E-02	3.12E-01	1.43E-02	2.53E-02	4.02E-03	2.16E-02	0.015	0.025	**1**	0.3	0.9	0.2	<1	<1	<1	<1
		Nickel	5.41E-03	2.00E-02	4.56E+00	8.20E+00	1.69E-01	7.73E-01	1.39E+00	2.20E-01	1.21E+00	40	80	0.03	0.01	0.02	0.003	<1	<1	<1	<1
		Selenium	1.50E-03	1.50E-03	--	--	1.48E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Silver	5.11E-04	2.80E-03	2.21E-01	3.70E-01	3.27E-01	7.23E-02	1.21E-01	2.04E-02	1.04E-01	N/A	3.75	--	--	0.03	0.01	--	--	<1	<1
		Thallium	1.75E-03	2.00E-03	5.70E-01	9.80E-01	1.54E-01	8.77E-02	1.51E-01	2.51E-02	1.32E-01	0.0074	0.074	**18**	**3**	**2**	0.3	**13**	**2**	**1**	<1
		Vanadium	1.35E-03	2.31E-03	1.12E+01	1.63E+01	6.72E-03	7.53E-02	1.10E-01	3.30E-02	1.72E-01	0.21	2.1	0.8	0.2	0.1	0.02	<1	<1	<1	<1
		Zinc	1.16E-02	9.84E-02	3.30E+01	4.09E+01	1.37E+01	4.51E+02	5.60E+02	1.25E+02	4.70E+02	160	320	**3**	0.8	**1**	0.4	<1	<1	<1	<1

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RR = residual risk

RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

DRAFT
BERA
JUNE 2007
REVISED NOVEMBER 2007
REVISED SEPTEMBER 2008
REVISED MAY 2009

TABLE 7-23g
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - PRATT DAM

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pratt Dam	VOCs	1,1-Dichloroethene	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	3.35E-05	1.26E-04	--	--	--	--	--	--	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	2.84E-04	8.69E-04	--	--	--	--	--	--	--	--	--	--
		2-Hexanone	2.50E-03	2.50E-03	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	2.84E-04	8.69E-04	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	2.84E-04	8.69E-04	25	50	0.00003	0.00001	0.00002	0.00001	<1	<1	<1	<1
		Acetone	2.76E-03	1.20E-02	1.09E-02	3.10E-02	0.00E+00	0.00E+00	0.00E+00	3.19E-04	4.11E-03	10	50	0.0004	0.00003	0.00008	0.00001	<1	<1	<1	<1
		Carbon Disulfide	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	3.35E-05	1.26E-04	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.54E-04	3.30E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	3.39E-05	1.52E-04	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	3.35E-05	1.26E-04	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	3.35E-05	1.26E-04	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	4.40E-03	7.00E-03	0.00E+00	0.00E+00	0.00E+00	3.26E-05	1.16E-04	--	--	--	--	--	--	--	--	--	--
		Methylene chloride	2.67E-04	4.15E-04	6.61E-03	1.45E-02	0.00E+00	0.00E+00	0.00E+00	3.68E-05	2.07E-04	5.85	50	0.00004	0.00001	0.000004	0.000001	<1	<1	<1	<1
		Tetrachloroethene	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	3.35E-05	1.26E-04	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	3.35E-05	1.26E-04	--	--	--	--	--	--	--	--	--	--
		Xylene (Total)	2.50E-04	2.50E-04	5.28E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	3.35E-05	1.26E-04	2.1	2.6	0.00006	0.00002	0.00005	0.00001	<1	<1	<1	<1
	SVOCs	4-Bromophenyl-phenylether	2.50E-03	2.50E-03	2.09E-01	2.55E-01	4.73E+00	9.88E-01	1.21E+00	2.75E-01	1.01E+00	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	2.42E-01	3.59E-01	4.81E-02	1.16E-02	1.73E-02	3.77E-03	1.71E-02	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	2.09E-01	2.55E-01	3.07E-01	6.43E-02	7.84E-02	1.83E-02	6.79E-02	--	--	--	--	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	5.31E-01	6.50E-01	5.24E-01	2.78E-01	3.41E-01	7.89E-02	2.93E-01	--	--	--	--	--	--	--	--	--	--
		Acenaphthene	5.00E-05	5.00E-05	1.31E-01	1.45E-01	--	--	--	--	--	5	10	--	--	--	--	--	--	--	--
		Acenaphthylene	5.00E-05	5.00E-05	2.66E-01	3.24E-01	3.66E+00	9.75E-01	1.19E+00	2.71E-01	9.99E-01	5	10	0.2	0.1	0.1	0.03	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.73E-01	2.55E-01	2.37E+00	4.10E-01	6.04E-01	1.14E-01	5.10E-01	--	--	--	--	--	--	--	--	--	--
		Benzaldehyde	2.50E-03	2.50E-03	1.20E-01	2.55E-01	5.70E-01	6.84E-02	1.45E-01	1.94E-02	1.24E-01	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.00E-05	5.00E-05	1.77E+00	2.09E+00	2.54E-01	4.50E-01	5.32E-01	1.27E-01	4.57E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.40E-05	1.70E-04	1.73E+00	2.05E+00	2.13E-01	3.68E-01	4.36E-01	1.04E-01	3.76E-01	1	10	0.4	0.1	0.04	0.01	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.73E-05	1.60E-04	2.24E+00	2.81E+00	4.16E-01	9.32E-01	1.17E+00	2.61E-01	9.96E-01	1	2	0.996	0.3	0.5	0.1	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.00E-05	5.00E-05	1.17E+00	1.42E+00	4.70E-01	5.50E-01	6.68E-01	1.54E-01	5.68E-01	1	2	0.6	0.2	0.3	0.1	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	8.43E-01	1.02E+00	4.16E-01	3.51E-01	4.24E-01	9.82E-02	3.61E-01	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.33E-05	1.40E-04	1.98E+00	2.33E+00	3.66E-01	7.25E-01	8.54E-01	2.03E-01	7.28E-01	1	2	0.7	0.2	0.4	0.1	<1	<1	<1	<1
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	3.48E-01	4.12E-01	3.70E-01	1.29E-01	1.52E-01	3.61E-02	1.30E-01	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.09E-01	2.55E-01	1.83E+01	3.82E+00	4.66E+00	1.06E+00	3.91E+00	7500	15000	0.001	0.0001	0.0003	0.0001	<1	<1	<1	<1
		Fluoranthene	5.72E-05	1.80E-04	2.96E+00	3.68E+00	4.86E-01	1.44E+00	1.79E+00	4.03E-01	1.52E+00	1	2	**2**	0.4	0.8	0.2	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	2.09E-01	2.55E-01	--	--	--	--	--	1.6	3.2	--	--	--	--	--	--	--	--
		Hexachlorobutadiene	2.50E-03	2.50E-03	2.09E-01	2.55E-01	1.03E-01	2.15E-02	2.62E-02	6.47E-03	2.41E-02	0.2	0.4	0.1	0.03	0.06	0.02	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	5.00E-05	5.00E-05	1.02E+00	1.23E+00	4.58E-01	4.67E-01	5.63E-01	1.31E-01	4.79E-01	1	--	0.5	0.1	--	--	<1	<1	--	--
		Isophorone	2.50E-03	2.50E-03	2.09E-01	2.55E-01	1.51E-01	3.15E-02	3.84E-02	9.24E-03	3.43E-02	--	--	--	--	--	--	--	--	--	--
		Phenanthrene	5.92E-05	1.70E-04	1.90E+00	2.19E+00	2.75E-01	5.23E-01	6.03E-01	1.47E-01	5.17E-01	5	10	0.1	0.03	0.05	0.01	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	2.09E-01	2.55E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.97E-05	2.50E-04	2.54E+00	3.09E+00	2.80E-01	7.11E-01	8.65E-01	2.00E-01	7.42E-01	1	2	0.7	0.2	0.4	0.1	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-23g
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL OMNIVOROUS MAMMALS - PRATT DAM

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)							Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Soil (dw)		Food (ww)														
			CTE	RME	CTE	RME	BSoilAF (ww/dw)	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDT	2.57E-06	2.80E-06	5.01E-03	1.10E-02	1.34E+00	6.71E-03	1.47E-02	1.87E-03	1.24E-02	0.8	4	0.02	0.002	0.003	0.0005	<1	<1	<1	<1
		alpha-Chlordane	1.29E-06	1.40E-06	6.68E-03	9.75E-03	2.85E+00	1.90E-02	2.78E-02	5.29E-03	2.34E-02	--	--	--	--	--	--	--	--	--	--
		Endosulfan Sulfate	2.57E-06	2.80E-06	3.91E-03	9.00E-03	7.98E-01	3.12E-03	7.18E-03	8.70E-04	6.08E-03	--	--	--	--	--	--	--	--	--	--
		Endrin Aldehyde	2.57E-06	2.80E-06	4.10E-03	4.10E-03	5.76E-01	2.36E-03	2.36E-03	6.60E-04	2.00E-03	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.57E-06	2.80E-06	9.00E-03	9.00E-03	5.76E-01	5.18E-03	5.18E-03	1.45E-03	4.40E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-BHC	1.29E-06	1.40E-06	1.31E-03	4.60E-03	1.62E+00	2.12E-03	7.43E-03	5.89E-04	6.27E-03	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.29E-06	1.40E-06	5.55E-03	5.70E-03	2.85E+00	1.58E-02	1.62E-02	4.39E-03	1.37E-02	--	--	--	--	--	--	--	--	--	--
		Heptachlor Epoxide	1.28E-06	1.40E-06	1.31E-03	4.60E-03	1.74E+00	2.28E-03	8.02E-03	6.36E-04	6.76E-03	--	--	--	--	--	--	--	--	--	--
		Toxaphene	1.29E-04	1.40E-04	1.31E-01	4.60E-01	7.43E-02	9.74E-03	3.42E-02	2.86E-03	3.10E-02	8	16	0.004	0.0004	0.002	0.0002	<1	<1	<1	<1
	Metals	Barium	4.86E-02	4.63E-02	9.98E+01	1.26E+02	1.46E-02	1.45E+00	1.83E+00	5.15E-01	2.17E+00	0.51	19.8	**4**	**1**	0.1	0.03	**3**	<1	<1	<1
		Cadmium	1.47E-04	6.70E-04	3.92E+00	6.94E+00	1.32E+00	5.19E+00	9.19E+00	1.45E+00	7.76E+00	1	2.52	**8**	**1**	**3**	0.6	**6**	**1**	**2**	<1
		Copper	4.74E-03	1.25E-02	1.35E+02	1.82E+02	8.24E-02	1.11E+01	1.50E+01	3.23E+00	1.35E+01	11.7	15.14	**1**	0.3	0.9	0.2	<1	<1	<1	<1
		Iron	1.05E+00	1.78E+00	1.61E+04	1.94E+04	1.54E-01	2.48E+03	2.98E+03	7.05E+02	2.60E+03	--	--	--	--	--	--	--	--	--	--
		Lead	1.90E-03	6.48E-03	1.53E+02	2.06E+02	1.29E-01	1.97E+01	2.65E+01	5.63E+00	2.33E+01	8	80	**3**	0.7	0.3	0.1	<1	<1	<1	<1
		Manganese	2.14E-01	4.27E-01	4.42E+02	6.67E+02	7.13E-02	3.15E+01	4.75E+01	9.23E+00	4.33E+01	88	284	0.5	0.1	0.2	0.03	<1	<1	<1	<1
		Silver	6.67E-04	2.10E-03	1.01E+00	1.31E+00	3.27E-01	3.30E-01	4.29E-01	9.29E-02	3.67E-01	N/A	3.75	--	--	0.1	0.02	--	--	<1	<1

Notes:

-- = BSoilAF and/or TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
BsoilAF = Biota-Soil Accumulation Factor
CTE = central tendency exposure
RR = residual risk
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

Table 7-23h: Weight-of-Evidence Integration for small omnivorous mammals
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:
Maintain stable and healthy populations of small omnivorous mammals
Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small omnivorous mammals foraging in the terrestrial habitats at the site?

Measurement Endpoint
9.A: use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.

Weight-of-Evidence Integration

J.M. Mills Landfill

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low		**9.A**			
Undeterminate					
No Harm					

Unnamed Island

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**9.A**			

Nunes Parcel

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low		**9.A**			
Undeterminate					
No Harm					

Quinville Well Field

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low		**9.A**			
Undeterminate					
No Harm					

US EPA ARCHIVE DOCUMENT

Table 7-23h: Weight-of-Evidence Integration for small omnivorous mammals
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Wetland A through D	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**9.A**			

Pratt Dam	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm		**9.A**			

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

TABLE 7-24a
CALCULATED HAZARD QUOTIENTS FOR LARGE PISCIVOROUS MAMMALS - BLACKSTONE RIVER (UPSTREAM AND POND P-6 COMBINED)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ			Effect HQ
			Surface Water (sw)		Sediment (dw)		Fish (ww)									
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE
River-Upstream and Pond P-6	VOCs	2-Butanone	2.50E-03	2.50E-03	9.03E-03	2.69E-02	--	--	--	--	--	--	--	--	--	--
			2.97E-03	4.95E-03	2.22E-02	9.24E-02	--	--	--	--	10	50	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	3.06E-03	4.99E-03	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.76E-04	3.70E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	2.48E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	2.66E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.21E-01	2.30E-01	3.70E-01	3.75E-01	1.03E-02	3.19E-02	--	--	--	--	--	--
		2-Methylnaphthalene	2.35E-05	5.00E-05	2.63E-02	1.75E-01	2.56E-01	3.75E-01	7.00E-03	3.15E-02	5	10	0.01	0.001	0.003	0.001
		2-Methylphenol	2.50E-03	2.50E-03	5.34E-02	2.30E-01	3.70E-01	3.75E-01	1.02E-02	3.19E-02	--	--	--	--	--	--
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.70E-01	3.75E-01	1.03E-02	3.19E-02	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.70E-01	3.75E-01	1.03E-02	3.19E-02	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.24E-01	2.30E-01	3.70E-01	3.75E-01	1.03E-02	3.19E-02	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	1.94E-01	5.50E-01	3.70E-01	3.75E-01	1.06E-02	3.38E-02	--	--	--	--	--	--
		Acenaphthene	2.39E-05	5.00E-05	3.05E-02	1.09E-01	2.40E-01	2.30E-01	6.56E-03	1.93E-02	5	10	0.004	0.001	0.002	0.001
Acetone		Acenaphthylene	2.92E-05	5.00E-05	7.86E-02	3.63E-01	2.28E-01	2.07E-01	6.27E-03	1.81E-02	5	10	0.004	0.001	0.002	0.001
		Acetophenone	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.56E-01	3.75E-01	9.88E-03	3.19E-02	--	--	--	--	--	--
		Anthracene	3.19E-05	5.00E-05	1.35E-01	4.67E-01	2.54E-01	3.75E-01	7.01E-03	3.23E-02	5	10	0.01	0.001	0.003	0.001
		Benzaldehyde	2.50E-03	2.50E-03	1.63E-01	2.08E-01	1.18E+00	2.57E+00	3.24E-02	2.13E-01	--	--	--	--	--	--
		Benzo[a]anthracene	4.11E-05	5.00E-05	4.17E-01	1.36E+00	2.54E-01	3.75E-01	7.19E-03	3.49E-02	--	--	--	--	--	--
		Benzo(a)pyrene	5.14E-05	6.70E-05	4.69E-01	1.33E+00	2.55E-01	3.75E-01	7.26E-03	3.48E-02	1	10	0.03	0.01	0.003	0.001
		Benzo(b)fluoranthene	5.05E-05	8.60E-05	5.53E-01	1.48E+00	2.50E-01	3.75E-01	7.17E-03	3.53E-02	1	2	0.04	0.01	0.02	0.004
		Benzo(g,h,i)perylene	5.24E-05	1.30E-04	2.79E-01	1.47E+00	2.54E-01	3.75E-01	7.11E-03	3.52E-02	1	2	0.04	0.01	0.02	0.004
		Benzo(k)fluoranthene	4.21E-05	6.90E-05	3.00E-01	1.72E+00	2.50E-01	3.75E-01	7.01E-03	3.59E-02	--	--	--	--	--	--
		Carbazole	--	--	1.72E-01	2.51E-01	3.70E-01	3.75E-01	--	--	--	--	--	--	--	--
		Chrysene	4.82E-05	7.40E-05	4.78E-01	1.46E+00	2.45E-01	2.23E-01	6.99E-03	2.27E-02	1	2	0.02	0.01	0.01	0.003
		Cyclohexane	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.28E-05	1.40E-04	8.45E-02	5.22E-01	2.45E-01	2.29E-01	6.74E-03	2.04E-02	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.29E-01	2.30E-01	3.70E-01	3.75E-01	1.03E-02	3.19E-02	7500	15000	0.000004	0.000001	0.000002	0.000001
		Fluoranthene	5.91E-05	8.30E-05	7.63E-01	2.35E+00	2.76E-01	3.75E-01	8.02E-03	3.78E-02	1	2	0.04	0.01	0.02	0.004
		Fluorene	2.48E-05	5.00E-05	4.35E-02	1.60E-01	2.54E-01	3.75E-01	6.95E-03	3.14E-02	5	10	0.01	0.001	0.003	0.001
		Hexachlorobenzene	2.50E-03	2.50E-03	2.32E-02	2.30E-01	2.50E-01	3.75E-01	6.93E-03	3.19E-02	1.6	3.2	0.02	0.004	0.01	0.002
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.70E-01	3.75E-01	1.03E-02	3.19E-02	0.2	0.4	0.2	0.1	0.1	0.03
		Indeno(1,2,3-cd)pyrene	4.95E-05	1.30E-04	2.58E-01	1.36E+00	2.55E-01	3.75E-01	7.12E-03	3.49E-02	1	--	0.03	0.01	--	--
		Isophorone	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.39E-01	3.58E-01	9.42E-03	3.05E-02	--	--	--	--	--	--
		Phenanthrene	4.63E-05	5.00E-05	3.88E-01	1.30E+00	2.44E-01	2.36E-01	6.90E-03	2.33E-02	5	10	0.005	0.001	0.002	0.001
		Naphthalene	2.67E-05	5.00E-05	3.40E-02	1.68E-01	2.43E-01	2.28E-01	6.65E-03	1.93E-02	5	10	0.004	0.001	0.002	0.001
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.70E-01	3.75E-01	1.03E-02	3.19E-02	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	2.39E-01	5.50E-01	9.30E-01	9.50E-01	2.56E-02	8.03E-02	0.24	2.4	0.3	0.1	0.03	0.01
		Phenol	2.50E-03	2.50E-03	1.38E-01	2.30E-01	3.70E-01	3.75E-01	1.03E-02	3.19E-02	--	--	--	--	--	--
		Pyrene	5.76E-05	8.70E-05	7.35E-01	2.22E+00	2.49E-01	3.75E-01	7.26E-03	3.74E-02	1	2	0.04	0.01	0.02	0.004

US EPA ARCHIVE DOCUMENT

TABLE 7-24a
CALCULATED HAZARD QUOTIENTS FOR LARGE PISCIVOROUS MAMMALS - BLACKSTONE RIVER (UPSTREAM AND POND P-6 COMBINED)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ			Effect HQ
			Surface Water (sw)		Sediment (dw)		Fish (ww)									
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	1.56E-06	2.80E-06	2.48E-03	1.24E-02	1.32E-02	2.46E-02	3.62E-04	2.07E-03	0.8	4	0.003	0.0005	0.0005	0.0001
		4,4'-DDE	1.82E-06	2.80E-06	1.95E-03	1.06E-02	4.15E-02	6.13E-02	1.13E-03	5.09E-03	0.8	4	0.01	0.001	0.001	0.0003
			1.56E-06	2.80E-06	6.86E-04	2.70E-03	1.97E-03	8.57E-03	5.42E-05	7.15E-04	0.8	4	0.0009	0.0001	0.0002	0.00001
		alpha-Chlordane	9.83E-07	1.40E-06	8.51E-04	2.95E-03	7.69E-03	2.21E-02	2.10E-04	1.83E-03	--	--	--	--	--	--
		Dieldrin	2.05E-06	2.80E-06	2.28E-03	6.29E-03	3.32E-02	3.88E-02	9.07E-04	3.22E-03	0.02	0.2	0.2	0.05	0.02	0.005
		Endosulfan Sulfate	1.56E-06	2.80E-06	5.38E-04	1.30E-02	4.34E-03	7.57E-03	1.19E-04	6.63E-04	--	--	--	--	--	--
		Endrin	1.56E-06	2.80E-06	3.91E-04	4.60E-04	3.12E-04	3.20E-04	8.82E-06	2.81E-05	0.092	0.92	0.0003	0.0001	0.00003	0.00001
		Endrin Aldehyde	1.56E-06	2.80E-06	7.04E-04	2.70E-03	3.23E-04	3.80E-04	9.32E-06	3.95E-05	--	--	--	--	--	--
	4,4'-DDT	Endrin Ketone	1.56E-06	2.80E-06	9.19E-04	2.00E-02	3.12E-04	3.20E-04	9.16E-06	8.49E-05	--	--	--	--	--	--
		Gamma-BHC	9.83E-07	1.40E-06	2.75E-04	4.20E-04	7.77E-04	9.10E-04	2.14E-05	7.65E-05	--	--	--	--	--	--
		Gamma-Chlordane	9.83E-07	1.40E-06	1.58E-03	4.09E-03	7.48E-03	9.81E-03	2.05E-04	8.21E-04	--	--	--	--	--	--
		Heptachlor Epoxide	9.83E-07	1.40E-06	2.75E-04	4.20E-04	1.14E-03	3.74E-03	3.13E-05	3.10E-04	--	--	--	--	--	--
		Toxaphene	9.83E-05	1.40E-04	3.04E-02	5.00E-02	3.12E-02	3.20E-02	8.74E-04	2.80E-03	8	16	0.0004	0.0001	0.0002	0.0001
	PCBs	Total PCBs	3.13E-05	5.50E-05	1.19E-01	9.18E-01	9.40E-01	1.83E+00	2.57E-02	1.54E-01	--	--	--	--	--	--
	Metals	Aluminum	1.33E-01	3.60E-01	4.35E+03	8.96E+03	6.09E+00	1.11E+01	2.96E+00	2.70E+01	1.93	19.3	**14**	**2**	**1**	0.2
		Antimony	8.25E-04	1.50E-03	4.10E-01	6.00E-01	1.70E-02	1.70E-02	7.60E-04	3.33E-03	0.125	0.66	0.03	0.01	0.01	0.001
		Arsenic	1.76E-03	2.29E-03	3.99E+00	6.45E+00	7.42E-02	9.83E-02	4.65E-03	2.71E-02	0.126	1.26	0.2	0.04	0.02	0.004
			4.64E-02	1.00E-01	3.81E+01	6.72E+01	7.28E-01	8.92E-01	4.61E-02	2.81E-01	0.51	19.8	0.6	0.1	0.01	0.002
		Beryllium	1.16E-04	1.50E-04	3.51E-01	5.42E-01	7.00E-03	7.00E-03	4.20E-04	2.17E-03	0.66	1.32	0.003	0.001	0.002	0.0003
		Cadmium	2.86E-04	8.20E-04	1.43E+00	7.22E+00	9.82E-02	1.48E-01	3.61E-03	3.33E-02	1	2.52	0.03	0.004	0.01	0.001
		Chromium	2.57E-03	5.00E-03	2.48E+01	6.70E+01	1.71E+00	2.52E+00	6.26E-02	4.03E-01	3.28	13.14	0.1	0.02	0.03	0.005
		Cobalt	1.75E-03	2.50E-02	4.43E+00	6.82E+00	5.33E-02	5.83E-02	4.36E-03	2.77E-02	--	--	--	--	--	--
		Copper	9.79E-03	1.25E-02	3.87E+01	1.13E+02	6.40E-01	7.73E-01	4.26E-02	3.94E-01	11.7	15.14	0.03	0.004	0.03	0.003
	Barium	Cyanide	2.09E-03	2.40E-03	1.96E-01	3.30E-01	--	--	--	--	24	48	--	--	--	--
		Iron	5.43E-01	8.40E-01	8.56E+03	1.28E+04	1.19E+02	1.38E+02	8.75E+00	4.87E+01	--	--	--	--	--	--
		Lead	3.16E-03	1.10E-02	4.12E+01	2.03E+02	7.13E-02	2.75E-01	2.85E-02	6.14E-01	8	80	0.1	0.004	0.01	0.0004
		Manganese	9.40E-02	1.26E-01	1.47E+02	2.07E+02	6.55E+00	1.43E+01	2.77E-01	1.80E+00	88	284	0.02	0.003	0.01	0.001
		Mercury	4.36E-05	7.50E-05	9.36E-02	2.64E-01	7.47E-02	1.67E-01	2.10E-03	1.46E-02	0.015	0.025	0.97	0.1	0.6	0.1
		Nickel	3.21E-03	4.10E-03	1.21E+01	2.57E+01	1.28E+00	1.63E+00	4.28E-02	2.10E-01	40	80	0.01	0.001	0.003	0.001
		Selenium	8.78E-04	3.70E-03	5.14E-01	1.05E+00	5.31E-01	5.76E-01	1.48E-02	5.10E-02	--	--	--	--	--	--
		Silver	2.20E-04	1.00E-03	1.30E+00	2.43E+00	7.76E-03	1.30E-02	1.05E-03	8.26E-03	N/A	3.75	--	--	0.002	0.0003
		Thallium	5.57E-04	2.00E-03	1.84E-01	2.46E-01	3.59E-03	4.60E-03	2.38E-04	1.34E-03	0.0074	0.074	0.2	0.03	0.02	0.003
		Vanadium	2.91E-03	2.50E-02	9.64E+00	1.54E+01	6.97E-02	1.19E-01	8.19E-03	5.76E-02	0.21	2.1	0.3	0.04	0.03	0.004
		Zinc	1.34E-02	2.08E-02	1.04E+02	3.12E+02	1.47E+01	1.77E+01	4.68E-01	2.37E+00	160	320	0.01	0.003	0.01	0.001

Notes:

-- = LOAEL toxicity reference values not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = Central Tendency Exposure
RME = reasonable maximum exposure
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-24b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR LARGE PISCIVOROUS MAMMALS - BLACKSTONE RIVER, POND A, AND POND F COMBINED

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
River-Site and Pools A and F	VOCs	2-Butanone	2.50E-03	2.50E-03	1.19E-02	6.02E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2.61E-03	1.20E-02	2.47E-02	1.75E-01	--	--	--	--	10	50	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	3.75E-03	3.69E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.60E-04	4.40E-04	3.98E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	3.99E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	3.98E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	3.91E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	3.74E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	3.92E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	3.98E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	3.81E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.52E-01	6.60E-01	3.72E-01	3.85E-01	1.03E-02	3.40E-02	--	--	--	--	--	--	--	--	--	--
		2-Methylnaphthalene	4.48E-05	5.00E-05	3.64E-02	1.11E-01	3.00E-01	2.37E-01	8.20E-03	1.99E-02	5	10	0.004	0.002	0.002	0.001	<1	<1	<1	<1
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.65E-01	3.30E-01	3.72E-01	3.85E-01	1.03E-02	3.30E-02	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.65E-01	3.30E-01	3.72E-01	3.85E-01	1.03E-02	3.30E-02	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.52E-01	6.60E-01	3.72E-01	3.85E-01	1.03E-02	3.40E-02	--	--	--	--	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	3.41E-01	8.50E-01	3.72E-01	3.85E-01	1.08E-02	3.54E-02	--	--	--	--	--	--	--	--	--	--
		Acenaphthene	4.49E-05	5.00E-05	4.75E-02	2.04E-01	3.33E-01	3.85E-01	9.11E-03	3.24E-02	5	10	0.006	0.002	0.003	0.001	<1	<1	<1	<1
		Acenaphthylene	4.63E-05	5.00E-05	6.14E-02	2.15E-01	3.72E-01	3.85E-01	1.02E-02	3.24E-02	5	10	0.006	0.002	0.003	0.001	<1	<1	<1	<1
Acetone		Acetophenone	2.50E-03	2.50E-03	1.62E-01	6.60E-01	3.72E-01	3.85E-01	1.03E-02	3.40E-02	--	--	--	--	--	--	--	--	--	--
		Anthracene	4.70E-05	5.00E-05	1.55E-01	6.38E-01	3.29E-01	3.85E-01	9.07E-03	3.36E-02	5	10	0.007	0.002	0.003	0.001	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.69E-01	2.38E-01	4.26E+00	9.52E+00	1.16E-01	7.86E-01	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	4.91E-05	1.40E-04	4.24E-01	1.57E+00	3.29E-01	3.85E-01	9.24E-03	3.64E-02	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.19E-05	1.70E-04	4.49E-01	1.68E+00	3.29E-01	3.85E-01	9.26E-03	3.67E-02	1	10	0.04	0.01	0.004	0.001	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.27E-05	1.60E-04	5.09E-01	1.89E+00	3.41E-01	3.85E-01	9.63E-03	3.73E-02	1	2	0.04	0.01	0.02	0.005	<1	<1	<1	<1
		Benzo(g,h,i)perylene	4.83E-05	5.00E-05	2.19E-01	8.48E-01	3.27E-01	3.85E-01	9.06E-03	3.42E-02	1	2	0.03	0.01	0.02	0.005	<1	<1	<1	<1
		Benzo(k)fluoranthene	4.68E-05	5.00E-05	2.52E-01	1.07E+00	3.20E-01	3.85E-01	8.89E-03	3.49E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.66E-01	2.13E-01	3.72E-01	3.85E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.22E-05	1.40E-04	5.08E-01	1.77E+00	3.29E-01	3.85E-01	9.30E-03	3.69E-02	1	2	0.04	0.01	0.02	0.005	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	3.89E-03	4.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.52E-05	5.00E-05	7.88E-02	2.90E-01	3.11E-01	2.08E-01	8.53E-03	1.80E-02	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.83E-01	4.76E-01	3.72E-01	3.85E-01	1.04E-02	3.35E-02	7500	15000	0.000004	0.000001	0.000002	0.000001	<1	<1	<1	<1
		Fluoranthene	5.67E-05	1.02E-04	8.18E-01	3.16E+00	3.20E-01	3.85E-01	9.25E-03	4.10E-02	1	2	0.04	0.01	0.02	0.005	<1	<1	<1	<1
		Fluorene	4.53E-05	5.00E-05	5.84E-02	2.18E-01	3.03E-01	2.11E-01	8.30E-03	1.80E-02	5	10	0.004	0.002	0.002	0.001	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	7.91E-02	3.30E-01	3.72E-01	3.85E-01	1.03E-02	3.30E-02	1.6	3.2	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.65E-01	3.30E-01	3.72E-01	3.85E-01	1.03E-02	3.30E-02	0.2	0.4	0.2	0.05	0.08	0.03	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	4.77E-05	5.00E-05	2.21E-01	8.75E-01	3.20E-01	3.85E-01	8.87E-03	3.43E-02	1	--	0.03	0.01	--	--	<1	<1	--	--
		Isophorone	2.50E-03	2.50E-03	1.65E-01	3.30E-01	3.69E-01	4.10E-01	1.03E-02	3.51E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	4.54E-05	6.50E-05	4.66E-02	1.61E-01	2.91E-01	2.09E-01	7.97E-03	1.77E-02	5	10	0.004	0.002	0.002	0.001	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.63E-01	6.60E-01	3.72E-01	3.85E-01	1.03E-02	3.40E-02	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	4.06E-01	3.00E+00	3.65E+00	3.65E+00	9.99E-02	3.10E-01	0.24	2.4	**1**	0.4	0.1	0.04	<1	<1	<1	<1
		Phenanthrene	5.63E-05	6.72E-05	4.37E-01	1.93E+00	2.56E-01	2.11E-01	7.26E-03	2.30E-02	5	10	0.005	0.001	0.002	0.001	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.66E-01	1.06E-01	3.72E-01	3.85E-01	1.04E-02	3.24E-02	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.71E-05	1.06E-04	8.21E-01	2.86E+00	3.43E-01	3.85E-01	9.88E-03	4.01E-02	1	2	0.04	0.01	0.02	0.005	<1	<1	<1	<1
	Pesticides	4,4'-DDD	2.41E-06	4.70E-06	1.70E-03	4.65E-03	1.68E-02	2.06E-02	4.59E-04	1.71E-03	0.8	4	0.002	0.001	0.0004	0.0001	<1	<1	<1	<1
		4,4'-DDE	2.43E-06	2.80E-06	1.61E-03	8.64E-03	3.57E-02	4.39E-02	9.74E-04	3.65E-03	0.8	4	0.005	0.001	0.0009	0.0002	<1	<1	<1	<1
			2.44E-06	2.80E-06	5.99E-04	1.63E-03	8.15E-04	4.02E-03	2.27E-05	3.37E-04	0.8	4	0.0004	0.00003	0.0001	0.00001	<1	<1	<1	<1
		alpha-Chlordane	1.23E-06	1.40E-06	5.77E-04	5.74E-03	8.94E-03	1.16E-02	2.44E-04	9.74E-04	--	--	--	--	--	--	--	--	--	--
		Dieldrin	2.47E-06	2.80E-06	1.69E-03	6.92E-03	2.41E-02	3.04E-02	6.58E-04	2.53E-03	0.02	0.2	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		Endosulfan Sulfate	2.37E-06	2.80E-06	6.53E-04	2.11E-03	3.71E-03	4.74E-03	1.02E-04	3.98E-04	--	--	--	--	--	--	--	--	--	--
		Endrin	2.37E-06	2.80E-06	4.35E-04	8.60E-03	3.13E-04	3.20E-04	8.91E-06	5.18E-05	0.092	0.92	0.0006	0.0001	0.0001	0.00001	<1	<1	<1	<1
		Endrin Aldehyde	2.37E-06	2.80E-06	6.31E-04	2.26E-03	3.13E-04	3.20E-04	9.03E-06	3.33E-05	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.37E-06	2.80E-06	5.33E-04	1.95E-03	3.13E-04	3.20E-04	8.97E-06	3.24E-05	--	--	--	--	--	--	--	--	--	--
	4,4'-DDT	Gamma-BHC	1.23E-06	1.40E-06	2.40E-04	4.50E-04	4.59E-04	9.92E-04	1.27E-05	8.33E-05	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.23E-06	1.40E-06	6.58E-04	4.51E-03	6.12E-03	7.64E-03	1.67E-04	6.44E-04	--	--	--	--	--	--	--	--	--	--
		Heptachlor Epoxide	1.29E-06	3.70E-06	2.66E-04	2.70E-02	4.76E-04	8.11E-04	1.32E-05	1.46E-04	--	--	--	--	--	--	--	--	--	--
		Toxaphene	1.23E-04	1.40E-04	2.51E-02	5.50E-02	3.13E-02	3.20E-02	8.74E-04	2.82E-03	8	16	0.0004	0.0001	0.0002	0.0001	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-24b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR LARGE PISCIVOROUS MAMMALS - BLACKSTONE RIVER, POND A, AND POND F COMBINED

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water (sw)		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	PCBs	Total PCBs	4.73E-05	5.50E-05	8.85E-02	3.51E-01	1.13E+00	1.42E+00	3.09E-02	1.18E-01	--	--	--	--	--	--	--	--	--	--
	Metals	Aluminum	8.25E-02	1.76E-01	4.17E+03	7.23E+03	4.76E+00	1.07E+01	2.80E+00	2.19E+01	1.93	19.3	**11**	**1**	**1**	0.1	<1	<1	<1	<1
		Antimony	1.37E-03	1.50E-03	4.64E-01	9.64E-01	1.64E-02	1.80E-02	8.00E-04	4.47E-03	0.125	0.66	0.04	0.01	0.01	0.001	<1	<1	<1	<1
		Arsenic	1.79E-03	1.97E-03	6.18E+00	2.19E+01	6.61E-02	8.77E-02	5.83E-03	7.10E-02	0.126	1.26	0.6	0.05	0.06	0.005	<1	<1	<1	<1
			3.92E-02	3.24E-02	3.50E+01	6.65E+01	7.94E-01	1.15E+00	4.57E-02	2.92E-01	0.51	19.8	0.6	0.1	0.01	0.002	<1	<1	<1	<1
		Beryllium	1.44E-04	1.50E-04	3.54E-01	4.51E-01	6.57E-03	7.00E-03	4.12E-04	1.91E-03	0.66	1.32	0.003	0.001	0.001	0.0003	<1	<1	<1	<1
		Cadmium	1.94E-04	4.38E-04	1.34E+00	7.65E+00	6.16E-02	8.33E-02	2.55E-03	2.92E-02	1	2.52	0.03	0.003	0.01	0.001	<1	<1	<1	<1
		Chromium	6.53E-04	1.84E-03	2.73E+01	1.44E+02	1.17E+00	1.99E+00	4.94E-02	5.84E-01	3.28	13.14	0.2	0.02	0.04	0.004	<1	<1	<1	<1
		Cobalt	5.87E-04	6.40E-04	4.76E+00	5.51E+00	6.50E-02	7.29E-02	4.85E-03	2.21E-02	--	--	--	--	--	--	--	--	--	--
		Copper	4.87E-03	1.25E-02	3.22E+01	1.14E+02	5.85E-01	6.51E-01	3.68E-02	3.88E-01	11.7	15.14	0.03	0.003	0.03	0.002	<1	<1	<1	<1
		Cyanide	1.89E-03	5.00E-03	2.62E-01	7.17E-01	--	--	--	--	24	48	--	--	--	--	--	--	--	--
	Barium	Iron	8.59E-01	2.03E+00	9.25E+03	1.66E+04	1.52E+02	1.73E+02	1.01E+01	6.28E+01	--	--	--	--	--	--	--	--	--	--
		Lead	1.84E-03	4.50E-03	3.42E+01	1.04E+02	8.47E-02	1.31E-01	2.43E-02	3.13E-01	8	80	0.04	0.0030	0.004	0.0003	<1	<1	<1	<1
		Manganese	1.89E-01	3.81E-01	1.52E+02	2.59E+02	7.38E+00	1.74E+01	3.06E-01	2.24E+00	88	284	0.03	0.003	0.008	0.001	<1	<1	<1	<1
		Mercury	6.94E-05	4.60E-04	9.73E-02	3.87E-01	5.38E-02	6.67E-02	1.53E-03	6.68E-03	0.015	0.025	0.4	0.1	0.3	0.06	<1	<1	<1	<1
		Nickel	2.70E-03	2.86E-03	8.91E+00	1.74E+01	1.08E+00	1.48E+00	3.53E-02	1.73E-01	40	80	0.004	0.001	0.002	0.0004	<1	<1	<1	<1
		Selenium	1.29E-03	1.50E-03	8.40E-01	3.19E+00	4.63E-01	4.91E-01	1.32E-02	5.00E-02	--	--	--	--	--	--	--	--	--	--
		Silver	5.99E-04	5.00E-03	2.15E+00	6.45E+00	6.97E-03	1.40E-02	1.59E-03	2.05E-02	N/A	3.75	--	--	0.01	0.0004	--	--	<1	<1
		Thallium	1.41E-03	2.00E-03	2.24E-01	2.42E-01	3.52E-03	5.90E-03	2.97E-04	1.43E-03	0.0074	0.074	0.2	0.04	0.02	0.004	<1	<1	<1	<1
		Vanadium	6.84E-04	1.04E-03	8.78E+00	1.35E+01	5.90E-02	7.18E-02	7.26E-03	4.52E-02	0.21	2.1	0.2	0.03	0.02	0.003	<1	<1	<1	<1
		Zinc	1.25E-02	2.99E-02	9.60E+01	5.01E+02	1.65E+01	1.93E+01	5.12E-01	3.05E+00	160	320	0.02	0.003	0.01	0.002	<1	<1	<1	<1

Notes:

-- = LOAEL toxicity reference values not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = central tendency exposure
RME = reasonable maximum exposure
RR = residual risk
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

Table 7-24c: Weight-of-Evidence Integration for large piscivorous mammals
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:
Maintain stable and healthy populations of large piscivorous mammals
Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of populations of large piscivorous mammals foraging in selected aquatic habitats at the site?

Measurement Endpoint
10.A: use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to no effect and effect mammalian TRVs.

Weight-of-Evidence Integration

Blackstone R. & Ponds A & F combined	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm			**10.A**		

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

TABLE 7-25a
CALCULATED HAZARD QUOTIENTS FOR SMALL PISCIVOROUS MAMMALS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water		Sediment (dw)		Fish (ww)									
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE
River-Upstream	VOCs	Acetone	2.97E-03	4.95E-03	2.22E-02	9.24E-02	--	--	--	--	10	50	--	--	--	--
		2-Butanone	2.50E-03	2.50E-03	9.03E-03	2.69E-02	--	--	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	2.75E-03	7.50E-03	--	--	--	--	25	50	--	--	--	--
		Acetone	2.97E-03	4.95E-03	2.22E-02	9.24E-02	--	--	--	--	10	50	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	3.06E-03	5.05E-03	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.76E-04	3.70E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	2.48E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
			2.50E-04	2.50E-04	2.66E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
Styrene	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.21E-01	2.30E-01	3.75E-01	3.85E-01	2.99E-02	9.46E-02	--	--	--	--	--	--
		2-Methylnaphthalene	2.35E-05	5.00E-05	2.63E-02	1.77E-01	3.75E-01	3.85E-01	2.96E-02	9.39E-02	5	10	0.02	0.01	0.01	0.003
		2-Methylphenol	2.50E-03	2.50E-03	5.34E-02	2.30E-01	3.75E-01	3.85E-01	2.97E-02	9.46E-02	--	--	--	--	--	--
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	2.99E-02	9.46E-02	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	2.99E-02	9.46E-02	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.24E-01	2.30E-01	3.75E-01	3.85E-01	2.99E-02	9.46E-02	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	1.94E-01	5.50E-01	3.75E-01	3.85E-01	3.03E-02	9.82E-02	--	--	--	--	--	--
		Acenaphthene	2.39E-05	5.00E-05	3.05E-02	1.09E-01	3.75E-01	3.85E-01	2.96E-02	9.33E-02	5	10	0.02	0.01	0.01	0.003
		Acenaphthylene	2.92E-05	5.00E-05	7.86E-02	3.63E-01	3.75E-01	3.85E-01	2.97E-02	9.55E-02	5	10	0.02	0.01	0.01	0.003
		Acetophenone	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	2.99E-02	9.46E-02	--	--	--	--	--	--
		Anthracene	3.19E-05	5.00E-05	1.35E-01	4.67E-01	3.75E-01	3.85E-01	2.98E-02	9.64E-02	5	10	0.02	0.01	0.01	0.003
		Benzaldehyde	2.50E-03	2.50E-03	1.63E-01	2.24E-01	1.99E+00	3.28E+00	1.57E-01	7.89E-01	--	--	--	--	--	--
		Benzo[a]anthracene	4.11E-05	5.00E-05	4.17E-01	1.36E+00	3.75E-01	3.85E-01	3.03E-02	1.04E-01	--	--	--	--	--	--
		Benzo(a)pyrene	5.14E-05	6.70E-05	4.69E-01	1.33E+00	3.75E-01	3.85E-01	3.04E-02	1.04E-01	1	10	0.1	0.03	0.01	0.003
		Benzo(b)fluoranthene	5.05E-05	8.60E-05	5.53E-01	1.48E+00	3.75E-01	3.85E-01	3.06E-02	1.05E-01	1	2	0.1	0.03	0.1	0.02
		Benzo(g,h,i)perylene	5.24E-05	1.30E-04	2.79E-01	1.47E+00	3.75E-01	3.85E-01	3.00E-02	1.05E-01	1	2	0.1	0.03	0.1	0.02
		Benzo(k)fluoranthene	4.21E-05	6.90E-05	3.00E-01	1.72E+00	3.75E-01	3.85E-01	3.01E-02	1.07E-01	--	--	--	--	--	--
		Carbazole	--	--	1.72E-01	2.54E-01	3.75E-01	3.85E-01	--	--	--	--	--	--	--	--
		Chrysene	4.82E-05	7.40E-05	4.78E-01	1.46E+00	3.75E-01	3.85E-01	3.04E-02	1.05E-01	1	2	0.1	0.03	0.1	0.02
		Cyclohexane	2.50E-04	2.50E-04	2.75E-03	7.50E-03	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.28E-05	1.40E-04	8.45E-02	5.22E-01	3.75E-01	3.85E-01	2.97E-02	9.68E-02	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.29E-01	2.30E-01	3.75E-01	3.85E-01	2.99E-02	9.46E-02	7500	15000	0.00001	0.000004	0.00001	0.000002
		Fluoranthene	5.91E-05	8.30E-05	7.63E-01	2.35E+00	3.75E-01	3.85E-01	3.09E-02	1.12E-01	1	2	0.1	0.03	0.1	0.02
		Fluorene	2.48E-05	5.00E-05	4.35E-02	1.60E-01	3.75E-01	3.85E-01	2.96E-02	9.38E-02	5	10	0.02	0.01	0.01	0.003
		Hexachlorobenzene	2.50E-03	2.50E-03	2.32E-02	2.30E-01	3.75E-01	3.85E-01	2.97E-02	9.46E-02	1.6	3.2	0.1	0.02	0.03	0.01
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	2.99E-02	9.46E-02	0.2	0.4	0.5	0.1	0.2	0.1
		Indeno(1,2,3-cd)pyrene	4.95E-05	1.30E-04	2.58E-01	1.36E+00	3.75E-01	3.85E-01	3.00E-02	1.04E-01	1	--	0.1	0.03	--	--
		Isophorone	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	2.99E-02	9.46E-02	--	--	--	--	--	--
		Naphthalene	2.67E-05	5.00E-05	3.40E-02	1.67E-01	3.75E-01	3.85E-01	2.96E-02	9.38E-02	5	10	0.02	0.01	0.01	0.003
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.20E-01	2.30E-01	3.75E-01	3.85E-01	2.99E-02	9.46E-02	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	2.39E-01	5.50E-01	1.08E+00	3.85E+00	8.56E-02	9.29E-01	0.24	2.4	**4**	0.4	0.4	0.04
		Phenanthrene	4.63E-05	5.00E-05	3.88E-01	1.30E+00	3.75E-01	3.85E-01	3.03E-02	1.03E-01	5	10	0.02	0.01	0.01	0.003
		Phenol	2.50E-03	2.50E-03	1.38E-01	2.30E-01	3.75E-01	3.85E-01	2.99E-02	9.46E-02	--	--	--	--	--	--
		Pyrene	5.76E-05	8.70E-05	7.35E-01	2.22E+00	3.75E-01	3.85E-01	3.09E-02	1.11E-01	1	2	0.1	0.03	0.1	0.02

US EPA ARCHIVE DOCUMENT

TABLE 7-25a
CALCULATED HAZARD QUOTIENTS FOR SMALL PISCIVOROUS MAMMALS - BLACKSTONE RIVER (UPSTREAM)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ	
			Surface Water		Sediment (dw)		Fish (ww)									
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	1.56E-06	2.80E-06	2.48E-03	1.24E-02	1.75E-02	1.86E-02	1.38E-03	4.57E-03	0.8	4	0.01	0.002	0.001	0.0003
		4,4'-DDE	1.82E-06	2.80E-06	1.95E-03	1.06E-02	5.42E-02	6.02E-02	4.27E-03	1.45E-02	0.8	4	0.02	0.01	0.004	0.001
			1.56E-06	2.80E-06	6.86E-04	2.70E-03	3.14E-04	3.20E-04	2.61E-05	1.00E-04	0.8	4	0.0001	0.00003	0.00002	0.00001
		alpha-Chlordane	9.83E-07	1.40E-06	8.51E-04	2.98E-03	1.54E-02	1.64E-02	1.21E-03	3.96E-03	--	--	--	--	--	--
		Dieldrin	2.05E-06	2.80E-06	2.28E-03	6.29E-03	3.11E-02	3.39E-02	2.45E-03	8.19E-03	0.02	0.2	0.4	0.1	0.04	0.01
		Endosulfan Sulfate	1.56E-06	2.80E-06	5.38E-04	1.30E-02	4.98E-03	5.51E-03	3.93E-04	1.43E-03	--	--	--	--	--	--
		Endrin	1.56E-06	2.80E-06	3.91E-04	4.60E-04	3.14E-04	3.20E-04	2.55E-05	8.10E-05	0.092	0.92	0.001	0.0003	0.0001	0.00003
		Endrin Aldehyde	1.56E-06	2.80E-06	7.04E-04	2.70E-03	3.14E-04	3.20E-04	2.61E-05	1.00E-04	--	--	--	--	--	--
	4,4'-DDT	Endrin Ketone	1.56E-06	2.80E-06	9.19E-04	2.00E-02	3.14E-04	3.20E-04	2.65E-05	2.46E-04	--	--	--	--	--	--
		Gamma-BHC	9.83E-07	1.40E-06	2.75E-04	4.20E-04	5.23E-04	9.08E-04	4.17E-05	2.22E-04	--	--	--	--	--	--
		Gamma-Chlordane	9.83E-07	1.40E-06	1.58E-03	4.16E-03	9.96E-03	1.08E-02	7.87E-04	2.63E-03	--	--	--	--	--	--
		Heptachlor Epoxide	9.83E-07	1.40E-06	2.75E-04	4.20E-04	3.14E-04	3.20E-04	2.53E-05	8.05E-05	--	--	--	--	--	--
		Toxaphene	9.83E-05	1.40E-04	3.04E-02	5.00E-02	3.14E-02	3.20E-02	2.53E-03	8.12E-03	8	16	0.001	0.0003	0.001	0.0002
	PCBs	Total PCBs	3.13E-05	5.50E-05	1.19E-01	9.18E-01	1.49E+00	1.65E+00	1.18E-01	4.04E-01	--	--	--	--	--	--
	Metals	Aluminum	1.33E-01	3.60E-01	4.35E+03	8.96E+03	7.33E+00	9.85E+00	8.63E+00	7.82E+01	1.93	19.3	**41**	**4**	**4**	0.4
		Antimony	8.25E-04	1.50E-03	4.10E-01	5.97E-01	1.58E-02	1.70E-02	2.04E-03	9.31E-03	0.125	0.66	0.1	0.02	0.01	0.003
		Arsenic	1.76E-03	2.29E-03	3.99E+00	6.45E+00	8.68E-02	9.69E-02	1.43E-02	7.81E-02	0.126	1.26	0.6	0.1	0.1	0.01
			4.64E-02	1.00E-01	3.81E+01	6.72E+01	1.68E+00	1.90E+00	2.05E-01	1.04E+00	0.51	19.8	**2**	0.4	0.1	0.01
		Beryllium	1.16E-04	1.50E-04	3.51E-01	5.42E-01	6.29E-03	7.00E-03	1.15E-03	6.28E-03	0.66	1.32	0.01	0.002	0.005	0.001
		Cadmium	2.86E-04	8.20E-04	1.43E+00	7.22E+00	5.28E-02	5.83E-02	6.82E-03	7.52E-02	1	2.52	0.1	0.01	0.03	0.003
		Chromium	2.57E-03	5.00E-03	2.48E+01	6.70E+01	8.48E-01	1.81E+00	1.13E-01	1.00E+00	3.28	13.14	0.3	0.03	0.1	0.009
		Cobalt	1.75E-03	2.50E-02	4.43E+00	6.82E+00	6.25E-02	6.59E-02	1.32E-02	7.65E-02	--	--	--	--	--	--
		Copper	9.79E-03	1.25E-02	3.87E+01	1.13E+02	5.99E-01	6.49E-01	1.19E-01	1.11E+00	11.7	15.14	0.1	0.01	0.1	0.01
	Barium	Cyanide	2.09E-03	2.40E-03	1.96E-01	3.30E-01	--	--	--	--	24	48	--	--	--	--
		Iron	5.43E-01	8.40E-01	8.56E+03	1.28E+04	1.51E+02	1.61E+02	2.78E+01	1.47E+02	--	--	--	--	--	--
		Lead	3.16E-03	1.10E-02	4.12E+01	2.03E+02	1.21E-01	1.49E-01	8.59E-02	1.75E+00	8	80	0.2	0.01	0.02	0.001
		Manganese	9.40E-02	1.26E-01	1.47E+02	2.07E+02	1.03E+01	1.16E+01	1.09E+00	4.55E+00	88	284	0.1	0.01	0.02	0.004
		Mercury	4.36E-05	7.50E-05	9.36E-02	2.60E-01	2.87E-02	3.09E-02	2.44E-03	9.62E-03	0.015	0.025	0.6	0.2	0.4	0.1
		Nickel	3.21E-03	4.10E-03	1.21E+01	2.57E+01	7.84E-01	1.02E+00	8.43E-02	4.63E-01	40	80	0.01	0.002	0.01	0.001
		Selenium	8.78E-04	3.70E-03	5.14E-01	1.04E+00	6.43E-01	6.86E-01	5.16E-02	1.74E-01	--	--	--	--	--	--
		Silver	2.20E-04	1.00E-03	1.30E+00	2.43E+00	6.29E-03	7.00E-03	2.91E-03	2.24E-02	N/A	3.75	--	--	0.01	0.001
		Thallium	5.57E-04	2.00E-03	1.84E-01	2.46E-01	3.16E-03	3.45E-03	6.11E-04	3.15E-03	0.0074	0.074	0.4	0.1	0.04	0.01
		Vanadium	2.91E-03	2.50E-02	9.64E+00	1.54E+01	5.62E-02	6.31E-02	2.24E-02	1.48E-01	0.21	2.1	0.7	0.1	0.1	0.01
		Zinc	1.34E-02	2.08E-02	1.04E+02	3.12E+02	4.00E+01	4.32E+01	3.34E+00	1.30E+01	160	320	0.1	0.02	0.04	0.01

Notes:

-- = TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = central tendency exposure
RME = reasonable maximum exposure
RR = residual risk

HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-25b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS MAMMALS - BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
River-Site	VOCs	Acetone	2.68E-03	1.20E-02	1.28E-02	5.71E-02	--	--	--	--	10	50	--	--	--	--	--	--	--	--
		4-Methyl-2-pentanone	2.50E-03	2.50E-03	3.26E-03	7.00E-03	--	--	--	--	25	50	--	--	--	--	--	--	--	--
		Acetone	2.68E-03	1.20E-02	1.28E-02	5.71E-02	--	--	--	--	10	50	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	3.23E-03	2.26E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.57E-04	3.40E-04	3.26E-03	7.00E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	3.17E-03	1.40E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.39E-01	6.10E-01	3.75E-01	3.80E-01	2.99E-02	9.67E-02	--	--	--	--	--	--	--	--	--	--
		2-Methylphenol	2.50E-03	2.50E-03	8.61E-02	6.10E-01	3.75E-01	3.80E-01	2.98E-02	9.67E-02	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.46E-01	6.10E-01	3.75E-01	3.80E-01	2.99E-02	9.67E-02	--	--	--	--	--	--	--	--	--	--
		Acenaphthene	4.23E-05	5.00E-05	3.70E-02	1.87E-01	3.75E-01	3.80E-01	2.96E-02	9.28E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Acenaphthylene	4.44E-05	5.00E-05	4.29E-02	1.95E-01	3.75E-01	3.80E-01	2.96E-02	9.29E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Anthracene	4.54E-05	5.00E-05	1.27E-01	7.58E-01	3.75E-01	3.80E-01	2.98E-02	9.76E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.59E-01	1.89E-01	2.47E+00	4.10E+00	1.95E-01	9.86E-01	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	4.66E-05	5.00E-05	3.34E-01	1.75E+00	3.75E-01	3.80E-01	3.02E-02	1.06E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	4.72E-05	5.00E-05	3.46E-01	1.78E+00	3.75E-01	3.80E-01	3.02E-02	1.06E-01	1	10	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.18E-05	1.40E-04	3.93E-01	1.86E+00	3.75E-01	3.80E-01	3.03E-02	1.07E-01	1	2	0.1	0.03	0.1	0.02	<1	<1	<1	<1
		Benzo(g,h,i)perylene	4.74E-05	5.00E-05	1.66E-01	8.98E-01	3.75E-01	3.80E-01	2.98E-02	9.88E-02	1	2	0.1	0.03	0.05	0.01	<1	<1	<1	<1
		Benzo(k)fluoranthene	4.51E-05	5.00E-05	1.90E-01	1.21E+00	3.75E-01	3.80E-01	2.99E-02	1.01E-01	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.79E-01	2.45E-01	3.75E-01	3.80E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	4.94E-05	7.20E-05	4.11E-01	1.50E+00	3.75E-01	3.80E-01	3.03E-02	1.04E-01	1	2	0.1	0.03	0.1	0.02	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	3.15E-03	1.40E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	4.27E-05	5.00E-05	5.62E-02	2.98E-01	3.75E-01	3.80E-01	2.96E-02	9.37E-02	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.88E-01	1.10E+01	3.75E-01	3.80E-01	3.00E-02	1.85E-01	7500	15000	0.00002	0.000004	0.00001	0.000002	<1	<1	<1	<1
		Fluoranthene	5.44E-05	1.20E-04	6.32E-01	3.44E+00	3.75E-01	3.80E-01	3.07E-02	1.20E-01	1	2	0.1	0.03	0.1	0.02	<1	<1	<1	<1
		Fluorene	4.28E-05	5.00E-05	4.24E-02	2.62E-01	3.75E-01	3.80E-01	2.96E-02	9.34E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	4.65E-05	5.00E-05	1.62E-01	9.04E-01	3.75E-01	3.80E-01	2.98E-02	9.89E-02	1	--	0.1	0.03	--	--	<1	<1	--	--
		Naphthalene	4.26E-05	5.00E-05	2.96E-02	1.89E-01	3.75E-01	3.80E-01	2.96E-02	9.28E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Phenanthrene	5.11E-05	1.10E-04	3.64E-01	2.34E+00	3.75E-01	3.80E-01	3.02E-02	1.11E-01	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.57E-01	6.10E-01	3.75E-01	3.80E-01	2.99E-02	9.67E-02	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.45E-05	1.70E-04	6.95E-01	2.61E+00	3.75E-01	3.80E-01	3.08E-02	1.13E-01	1	2	0.1	0.03	0.1	0.02	<1	<1	<1	<1
	Pesticides	4,4'-DDD	2.36E-06	4.70E-06	1.26E-03	3.79E-03	1.20E-02	1.30E-02	9.47E-04	3.15E-03	0.8	4	0.004	0.001	0.001	0.0002	<1	<1	<1	<1
		4,4'-DDE	2.39E-06	2.80E-06	8.70E-04	2.78E-03	4.07E-02	4.80E-02	3.21E-03	1.15E-02	0.8	4	0.01	0.004	0.003	0.001	<1	<1	<1	<1
		alpha-Chlordane	1.22E-06	1.40E-06	3.53E-04	1.81E-03	1.02E-02	1.20E-02	8.04E-04	2.90E-03	--	--	--	--	--	--	--	--	--	--
		Dieldrin	2.46E-06	2.80E-06	1.39E-03	4.01E-03	1.83E-02	1.90E-02	1.44E-03	4.59E-03	0.02	0.2	0.2	0.1	0.02	0.01	<1	<1	<1	<1
		Endosulfan Sulfate	2.29E-06	2.80E-06	4.96E-04	4.30E-03	2.73E-03	2.90E-03	2.16E-04	7.33E-04	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.30E-06	2.80E-06	5.61E-04	1.20E-02	3.15E-04	3.20E-04	2.59E-05	1.79E-04	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.22E-06	1.40E-06	5.48E-04	2.08E-03	5.90E-03	7.10E-03	4.66E-04	1.72E-03	--	--	--	--	--	--	--	--	--	--

US EPA ARCHIVE DOCUMENT

TABLE 7-25b
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS MAMMALS - BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	PCBs	Total PCBs	4.59E-05	5.50E-05	5.84E-02	4.88E-01	8.92E-01	9.70E-01	7.04E-02	2.37E-01	--	--	--	--	--	--	--	--	--	--
	Metals	Aluminum	8.07E-02	1.51E-01	3.52E+03	4.36E+03	9.32E+00	2.30E+01	7.25E+00	4.24E+01	1.93	19.3	**22**	**4**	**2**	0.4	<1	<1	<1	<1
		Arsenic	1.72E-03	1.95E-03	5.89E+00	4.73E+01	1.49E-01	2.40E-01	2.27E-02	4.58E-01	0.126	1.26	**4**	0.2	0.4	0.02	**3**	<1	<1	<1
			4.12E-02	3.35E-02	2.72E+01	4.58E+01	2.05E+00	2.40E+00	2.13E-01	9.68E-01	0.51	19.8	**2**	0.4	0.05	0.01	<1	<1	<1	<1
		Beryllium	1.41E-04	1.50E-04	2.91E-01	2.97E-01	6.16E-03	6.50E-03	1.03E-03	4.09E-03	0.66	1.32	0.01	0.002	0.00	0.001	<1	<1	<1	<1
		Cadmium	2.20E-04	3.69E-04	7.41E-01	3.28E+00	6.12E-02	7.70E-02	6.20E-03	4.63E-02	1	2.52	0.05	0.01	0.02	0.002	<1	<1	<1	<1
		Chromium	6.90E-04	1.49E-03	1.80E+01	5.73E+01	1.08E+00	1.40E+00	1.18E-01	8.21E-01	3.28	13.14	0.3	0.04	0.1	0.01	<1	<1	<1	<1
		Cobalt	4.07E-04	6.85E-04	3.67E+00	4.02E+00	7.84E-02	9.50E-02	1.30E-02	5.69E-02	--	--	--	--	--	--	--	--	--	--
		Copper	5.21E-03	1.25E-02	2.12E+01	4.26E+01	7.56E-01	9.60E-01	9.90E-02	5.92E-01	11.7	15.14	0.1	0.01	0.04	0.01	<1	<1	<1	<1
		Iron	5.93E-01	8.92E-01	8.06E+03	1.12E+04	1.98E+02	2.20E+02	3.05E+01	1.48E+02	--	--	--	--	--	--	--	--	--	--
	Barium	Lead	1.69E-03	3.69E-03	2.25E+01	5.10E+01	2.13E-01	4.30E-01	5.85E-02	5.35E-01	8	80	0.1	0.01	0.01	0.001	<1	<1	<1	<1
		Manganese	1.41E-01	3.10E-01	1.29E+02	2.05E+02	1.52E+01	2.40E+01	1.44E+00	7.53E+00	88	284	0.1	0.02	0.03	0.01	<1	<1	<1	<1
		Mercury	7.00E-05	4.60E-04	5.78E-02	1.65E-01	2.67E-02	3.30E-02	2.21E-03	9.37E-03	0.015	0.025	0.6	0.1	0.4	0.1	<1	<1	<1	<1
		Nickel	2.23E-03	3.33E-03	6.53E+00	1.02E+01	9.79E-01	1.10E+00	8.93E-02	3.51E-01	40	80	0.01	0.002	0.004	0.001	<1	<1	<1	<1
		Selenium	1.20E-03	1.50E-03	6.86E-01	3.91E+00	5.74E-01	6.30E-01	4.65E-02	1.84E-01	--	--	--	--	--	--	--	--	--	--
		Silver	4.96E-04	1.00E-03	1.65E+00	4.10E+00	6.16E-03	6.50E-03	3.56E-03	3.64E-02	N/A	3.75	--	--	0.01	0.001	--	--	<1	<1
		Thallium	1.28E-03	2.00E-03	2.16E-01	2.47E-01	3.12E-03	3.20E-03	6.96E-04	3.09E-03	0.0074	0.074	0.4	0.1	0.04	0.01	<1	<1	<1	<1
		Vanadium	7.86E-04	1.04E-03	7.19E+00	9.89E+00	6.07E-02	1.20E-01	1.81E-02	1.13E-01	0.21	2.1	0.5	0.1	0.1	0.01	<1	<1	<1	<1
		Zinc	1.15E-02	2.17E-02	6.38E+01	1.04E+02	3.62E+01	4.10E+01	2.97E+00	1.07E+01	160	320	0.1	0.02	0.03	0.01	<1	<1	<1	<1

Notes:

-- = TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = central tendency exposure
RME = reasonable maximum exposure
RR = residual risk
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-25c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS MAMMALS - POND A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond-A	VOCs	Acetone	2.50E-03	2.50E-03	6.86E-02	5.32E-01	--	--	--	--	10	50	--	--	--	--	--	--	--	--
			2.50E-03	2.50E-03	3.46E-02	2.66E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Acetone	2.50E-03	2.50E-03	6.86E-02	5.32E-01	--	--	--	--	10	50	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	5.47E-03	6.56E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.69E-04	4.40E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	5.99E-03	3.80E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	5.50E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	4.72E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.71E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	--	--	--	--	--	--	--	--	--	--
		2-Methylphenol	2.50E-03	2.50E-03	1.50E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	--	--	--	--	--	--	--	--	--	--
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.90E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	--	--	--	--	--	--	--	--	--	--
2-Butanone		4-Chloroaniline	2.50E-03	2.50E-03	1.90E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.72E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	--	--	--	--	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	4.07E-01	8.50E-01	3.72E-01	3.80E-01	3.04E-02	9.96E-02	--	--	--	--	--	--	--	--	--	--
		Acenaphthene	5.00E-05	5.00E-05	7.35E-02	1.11E-01	3.72E-01	3.80E-01	2.94E-02	9.21E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Acenaphthylene	5.00E-05	5.00E-05	1.17E-01	2.91E-01	3.72E-01	3.80E-01	2.95E-02	9.37E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.75E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.00E-05	5.00E-05	1.93E-01	5.55E-01	3.72E-01	3.80E-01	2.97E-02	9.59E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	2.44E-01	5.51E-01	6.29E+00	7.24E+00	4.96E-01	1.74E+00	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.54E-05	1.40E-04	5.72E-01	1.60E+00	3.72E-01	3.80E-01	3.04E-02	1.05E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	5.91E-05	1.20E-04	6.45E-01	1.84E+00	3.72E-01	3.80E-01	3.05E-02	1.07E-01	1	10	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		Benzo(b)fluoranthene	5.00E-05	5.00E-05	6.91E-01	2.30E+00	3.72E-01	3.80E-01	3.06E-02	1.11E-01	1	2	0.1	0.03	0.06	0.02	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.00E-05	5.00E-05	3.22E-01	9.38E-01	3.72E-01	3.80E-01	2.99E-02	9.91E-02	1	2	0.1	0.03	0.05	0.01	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	3.36E-01	1.00E+00	3.72E-01	3.80E-01	2.99E-02	9.97E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.55E-01	1.98E-01	3.72E-01	3.80E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	5.50E-05	1.30E-04	6.41E-01	1.90E+00	3.72E-01	3.80E-01	3.05E-02	1.07E-01	1	2	0.1	0.03	0.1	0.02	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	5.82E-03	2.30E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	1.25E-01	3.30E-01	3.72E-01	3.80E-01	2.95E-02	9.40E-02	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	1.64E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	7500	15000	0.00001	0.000004	0.000006	0.000002	<1	<1	<1	<1
		Fluoranthene	5.80E-05	2.20E-04	1.03E+00	3.14E+00	3.72E-01	3.80E-01	3.12E-02	1.18E-01	1	2	0.1	0.03	0.1	0.02	<1	<1	<1	<1
		Fluorene	5.00E-05	5.00E-05	9.92E-02	1.84E-01	3.72E-01	3.80E-01	2.95E-02	9.28E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	1.15E-01	3.30E-01	3.72E-01	3.80E-01	2.96E-02	9.43E-02	1.6	3.2	0.1	0.02	0.03	0.01	<1	<1	<1	<1
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.90E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	0.2	0.4	0.5	0.1	0.2	0.1	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	5.00E-05	5.00E-05	3.40E-01	1.41E+00	3.72E-01	3.80E-01	2.99E-02	1.03E-01	1	--	0.1	0.03	--	--	<1	<1	--	--
		Isophorone	2.50E-03	2.50E-03	1.90E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.00E-05	5.00E-05	8.30E-02	1.87E-01	3.72E-01	3.80E-01	2.95E-02	9.28E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.90E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	6.16E-01	1.50E+00	3.80E+00	3.80E+00	3.00E-01	9.25E-01	0.24	2.4	**4**	**1**	0.4	0.1	<1	1	<1	<1
		Phenanthrene	6.21E-05	2.00E-04	4.76E-01	1.51E+00	3.72E-01	3.80E-01	3.02E-02	1.04E-01	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.81E-01	3.30E-01	3.72E-01	3.80E-01	2.97E-02	9.43E-02	--	--	--	--	--	--	--	--	--	--
		Pyrene	5.77E-05	2.10E-04	9.27E-01	2.58E+00	3.72E-01	3.80E-01	3.10E-02	1.13E-01	1	2	0.1	0.03	0.06	0.02	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-25c
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS MAMMALS - POND A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.50E-06	2.50E-06	3.03E-03	9.86E-03	5.83E-03	6.66E-03	4.65E-04	1.68E-03	0.8	4	0.002	0.001	0.0004	0.0001	<1	<1	<1	<1
		4,4'-DDE	2.50E-06	2.50E-06	4.46E-03	1.64E-02	1.13E-02	1.27E-02	8.98E-04	3.19E-03	0.8	4	0.004	0.001	0.001	0.0002	<1	<1	<1	<1
			2.50E-06	2.50E-06	7.38E-04	4.05E-03	3.14E-04	3.20E-04	2.62E-05	1.11E-04	0.8	4	0.0001	0.00003	0.00003	0.00001	<1	<1	<1	<1
		alpha-Chlordane	1.25E-06	1.25E-06	2.37E-03	2.15E-02	2.73E-03	3.20E-03	2.19E-04	9.50E-04	--	--	--	--	--	--	--	--	--	--
		Dieldrin	2.50E-06	2.50E-06	1.45E-03	2.10E-02	1.31E-02	1.48E-02	1.03E-03	3.73E-03	0.02	0.2	0.2	0.1	0.02	0.01	<1	<1	<1	<1
		Endosulfan Sulfate	2.50E-06	2.50E-06	1.02E-03	1.00E-02	1.62E-03	2.05E-03	1.30E-04	5.77E-04	--	--	--	--	--	--	--	--	--	--
		Endrin	2.50E-06	2.50E-06	5.18E-04	8.60E-03	3.14E-04	3.20E-04	2.58E-05	1.50E-04	0.092	0.92	0.002	0.0003	0.0002	0.00003	<1	<1	<1	<1
	4,4'-DDT	Endrin Aldehyde	2.50E-06	2.50E-06	7.45E-04	5.80E-03	3.14E-04	3.20E-04	2.62E-05	1.26E-04	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.50E-06	2.50E-06	4.96E-04	2.10E-03	3.14E-04	3.20E-04	2.57E-05	9.49E-05	--	--	--	--	--	--	--	--	--	--
		Gamma-BHC	1.25E-06	1.25E-06	2.29E-04	3.35E-04	3.14E-04	3.20E-04	2.52E-05	7.98E-05	--	--	--	--	--	--	--	--	--	--
		Gamma-Chlordane	1.25E-06	1.25E-06	9.27E-04	3.50E-02	1.37E-03	1.85E-03	1.10E-04	7.40E-04	--	--	--	--	--	--	--	--	--	--
		Heptachlor Epoxide	1.25E-06	1.25E-06	3.46E-04	2.70E-02	3.14E-04	3.20E-04	2.54E-05	3.05E-04	--	--	--	--	--	--	--	--	--	--
		Toxaphene	1.25E-04	1.25E-04	2.37E-02	4.20E-02	3.14E-02	3.20E-02	2.52E-03	8.05E-03	8	16	0.001	0.0003	0.0005	0.0002	<1	<1	<1	<1
	PCBs	Total PCBs	5.00E-05	5.00E-05	2.38E-01	6.00E-01	3.58E-01	3.80E-01	2.86E-02	9.63E-02	--	--	--	--	--	--	--	--	--	--
	Metals	Aluminum	7.41E-02	1.93E-01	5.75E+03	1.02E+04	3.49E+00	4.39E+00	1.09E+01	8.74E+01	1.93	19.3	**45**	**6**	**5**	0.6	**5**	**1**	<1	<1
		Arsenic	2.02E-03	2.27E-03	6.82E+00	1.68E+01	6.70E-02	1.26E-01	1.80E-02	1.73E-01	0.126	1.26	**1**	0.1	0.1	0.01	<1	<1	<1	<1
			3.42E-02	1.00E-01	5.26E+01	1.24E+02	1.12E+00	1.31E+00	1.87E-01	1.38E+00	0.51	19.8	**3**	0.4	0.07	0.01	<1	<1	<1	<1
		Beryllium	1.50E-04	1.50E-04	4.82E-01	9.26E-01	6.68E-03	7.00E-03	1.42E-03	9.53E-03	0.66	1.32	0.01	0.002	0.01	0.001	<1	<1	<1	<1
		Cadmium	1.55E-04	2.20E-03	3.42E+00	1.82E+01	2.52E-02	2.91E-02	8.32E-03	1.61E-01	1	2.52	0.2	0.01	0.06	0.003	<1	<1	<1	<1
		Chromium	3.49E-04	4.80E-03	5.74E+01	1.48E+02	8.02E-01	1.28E+00	1.69E-01	1.56E+00	3.28	13.14	0.5	0.1	0.1	0.01	<1	<1	<1	<1
		Cobalt	1.85E-03	2.50E-02	7.75E+00	1.60E+01	5.38E-02	6.24E-02	1.87E-02	1.53E-01	--	--	--	--	--	--	--	--	--	--
	Barium	Copper	3.93E-03	1.25E-02	6.33E+01	1.83E+02	3.24E-01	3.65E-01	1.43E-01	1.64E+00	11.7	15.14	0.1	0.01	0.1	0.01	<1	<1	<1	<1
		Cyanide	1.82E-03	3.20E-03	5.09E-01	2.31E+00	--	--	--	--	24	48	--	--	--	--	--	--	--	--
		Iron	1.51E+00	4.18E+00	1.23E+04	2.17E+04	1.74E+02	1.97E+02	3.65E+01	2.31E+02	--	--	--	--	--	--	--	--	--	--
		Lead	1.79E-03	1.55E-02	6.75E+01	1.76E+02	1.42E-01	1.83E-01	1.36E-01	1.53E+00	8	80	0.2	0.02	0.02	0.002	<1	<1	<1	<1
		Manganese	3.63E-01	3.97E-01	2.01E+02	4.88E+02	1.23E+01	1.42E+01	1.35E+00	7.58E+00	88	284	0.1	0.02	0.03	0.005	<1	<1	<1	<1
		Mercury	6.87E-05	7.50E-05	2.63E-01	6.29E-01	1.66E-02	1.82E-02	1.80E-03	9.70E-03	0.015	0.025	0.6	0.1	0.4	0.1	<1	<1	<1	<1
		Nickel	3.88E-03	2.00E-02	1.48E+01	4.14E+01	7.05E-01	9.02E-01	8.31E-02	5.69E-01	40	80	0.01	0.002	0.007	0.001	<1	<1	<1	<1
		Selenium	1.50E-03	1.50E-03	1.31E+00	2.58E+00	2.80E-01	3.14E-01	2.45E-02	9.74E-02	--	--	--	--	--	--	--	--	--	--
		Silver	8.19E-04	5.00E-03	3.43E+00	1.12E+01	6.68E-03	7.00E-03	6.91E-03	9.70E-02	N/A	3.75	--	--	0.03	0.002	--	--	<1	<1
		Zinc	1.45E-02	1.55E-01	2.01E+02	6.92E+02	1.73E+01	2.00E+01	1.73E+00	1.07E+01	160	320	0.07	0.01	0.03	0.01	<1	<1	<1	<1

Notes:

-- = TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = central tendency exposure
RME = reasonable maximum exposure
RR = residual risk
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

US EPA ARCHIVE DOCUMENT

TABLE 7-25d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS MAMMALS - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
Pond-F	VOCs	Acetone	2.50E-03	2.50E-03	1.09E-01	6.90E-01	--	--	--	--	10	50	--	--	--	--	--	--	--	--
		Acetone	2.50E-03	2.50E-03	1.09E-01	6.90E-01	--	--	--	--	10	50	--	--	--	--	--	--	--	--
		Carbon Disulfide	2.50E-04	2.50E-04	3.67E-03	7.00E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Chloromethane	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,2-Dichloroethene	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		cis-1,3-Dichloropropene	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Isopropylbenzene	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Methyl Acetate	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Styrene	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		trans-1,3-Dichloropropene	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Trichlorofluoromethane	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	SVOCs	1,1'-Biphenyl	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	2.96E-02	9.16E-02	--	--	--	--	--	--	--	--	--	--
		2-Methylphenol	2.50E-03	2.50E-03	1.47E-01	2.95E-01	3.70E-01	3.70E-01	2.95E-02	9.16E-02	--	--	--	--	--	--	--	--	--	--
		4-Bromophenyl-phenylether	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	2.96E-02	9.16E-02	--	--	--	--	--	--	--	--	--	--
		4-Chloroaniline	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	2.96E-02	9.16E-02	--	--	--	--	--	--	--	--	--	--
		4-Methylphenol	2.50E-03	2.50E-03	1.40E-01	2.55E-01	3.70E-01	3.70E-01	2.95E-02	9.13E-02	--	--	--	--	--	--	--	--	--	--
		4-Nitroaniline	1.00E-02	1.00E-02	4.06E-01	7.50E-01	3.70E-01	3.70E-01	3.03E-02	9.63E-02	--	--	--	--	--	--	--	--	--	--
		Acenaphthene	5.00E-05	5.00E-05	7.54E-02	9.60E-02	2.79E-01	3.70E-01	2.21E-02	8.96E-02	5	10	0.02	0.004	0.01	0.002	<1	<1	<1	<1
		Acenaphthylene	5.00E-05	5.00E-05	1.11E-01	3.00E-01	3.70E-01	3.70E-01	2.93E-02	9.13E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Acetophenone	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	2.96E-02	9.16E-02	--	--	--	--	--	--	--	--	--	--
		Anthracene	5.00E-05	5.00E-05	3.02E-01	4.70E-01	3.70E-01	3.70E-01	2.97E-02	9.28E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Benzaldehyde	2.50E-03	2.50E-03	1.04E-01	2.10E-01	3.62E+00	7.80E+00	2.85E-01	1.87E+00	--	--	--	--	--	--	--	--	--	--
		Benzo[a]anthracene	5.00E-05	5.00E-05	8.77E-01	1.40E+00	3.70E-01	3.70E-01	3.08E-02	1.01E-01	--	--	--	--	--	--	--	--	--	--
		Benzo(a)pyrene	6.79E-05	1.70E-04	9.00E-01	1.80E+00	3.70E-01	3.70E-01	3.08E-02	1.04E-01	1	10	0.1	0.03	0.01	0.003	<1	<1	<1	<1
		Benzo(b)fluoranthene	6.69E-05	1.60E-04	1.16E+00	2.60E+00	3.70E-01	3.70E-01	3.13E-02	1.11E-01	1	2	0.1	0.03	0.06	0.02	<1	<1	<1	<1
		Benzo(g,h,i)perylene	5.00E-05	5.00E-05	4.57E-01	9.60E-01	3.70E-01	3.70E-01	3.00E-02	9.69E-02	1	2	0.1	0.03	0.05	0.01	<1	<1	<1	<1
		Benzo(k)fluoranthene	5.00E-05	5.00E-05	6.72E-01	1.10E+00	3.70E-01	3.70E-01	3.04E-02	9.81E-02	--	--	--	--	--	--	--	--	--	--
		Carbazole	--	--	1.28E-01	2.95E-01	3.70E-01	3.70E-01	--	--	--	--	--	--	--	--	--	--	--	--
		Chrysene	6.47E-05	1.40E-04	1.04E+00	2.10E+00	3.70E-01	3.70E-01	3.11E-02	1.07E-01	1	2	0.1	0.03	0.05	0.02	<1	<1	<1	<1
		Cyclohexane	2.50E-04	2.50E-04	5.24E-03	1.20E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Dibenz[a,h]anthracene	5.00E-05	5.00E-05	1.97E-01	3.50E-01	3.70E-01	3.70E-01	2.95E-02	9.18E-02	--	--	--	--	--	--	--	--	--	--
		Di-N-Octyl phthalate	2.50E-03	2.50E-03	2.01E-01	3.90E-01	3.70E-01	3.70E-01	2.96E-02	9.24E-02	7500	15000	0.00001	0.000004	0.000006	0.000002	<1	<1	<1	<1
		Fluoranthene	6.89E-05	1.80E-04	2.20E+00	4.00E+00	3.70E-01	3.70E-01	3.32E-02	1.23E-01	1	2	0.1	0.03	0.1	0.02	<1	<1	<1	<1
		Fluorene	5.00E-05	5.00E-05	1.12E-01	1.50E-01	3.70E-01	3.70E-01	2.93E-02	9.01E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		Hexachlorobenzene	2.50E-03	2.50E-03	1.06E-01	2.95E-01	3.70E-01	3.70E-01	2.94E-02	9.16E-02	1.6	3.2	0.1	0.02	0.03	0.01	<1	<1	<1	<1
		Hexachlorobutadiene	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	2.96E-02	9.16E-02	0.2	0.4	0.5	0.1	0.2	0.1	<1	<1	<1	<1
		Indeno(1,2,3-cd)pyrene	5.00E-05	5.00E-05	5.07E-01	1.10E+00	3.70E-01	3.70E-01	3.01E-02	9.81E-02	1	--	0.1	0.03	--	--	<1	<1	--	--
		Isophorone	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	2.96E-02	9.16E-02	--	--	--	--	--	--	--	--	--	--
		Naphthalene	5.34E-05	6.50E-05	1.77E-01	2.55E-01	3.70E-01	3.70E-01	2.95E-02	9.10E-02	5	10	0.02	0.01	0.01	0.003	<1	<1	<1	<1
		N-Nitrosodiphenylamine	2.50E-03	2.50E-03	1.92E-01	2.95E-01	3.70E-01	3.70E-01	2.96E-02	9.16E-02	--	--	--	--	--	--	--	--	--	--
		Pentachlorophenol	2.50E-03	2.50E-03	6.20E-01	7.50E-01	--	--	--	--	0.24	2.4	--	--	--	--	--	--	--	--
		Phenanthrene	8.07E-05	1.70E-04	1.07E+00	1.70E+00	2.85E-01	3.70E-01	2.44E-02	1.03E-01	5	10	0.02	0.005	0.01	0.002	<1	<1	<1	<1
		Phenol	2.50E-03	2.50E-03	1.87E-01	2.95E-01	3.70E-01	3.70E-01	2.96E-02	9.16E-02	--	--	--	--	--	--	--	--	--	--
		Pyrene	7.48E-05	2.50E-04	1.67E+00	2.70E+00	3.70E-01	3.70E-01	3.22E-02	1.12E-01	1	2	0.1	0.03	0.06	0.02	<1	<1	<1	<1

US EPA ARCHIVE DOCUMENT

TABLE 7-25d
CALCULATED HAZARD QUOTIENTS AND RESIDUAL RISKS FOR SMALL PISCIVOROUS MAMMALS - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Area	Chemical Group	COPEC	Exposure Point Concentrations (mg/L or mg/kg)						Exposure Rate (mg/kg BW/day)		NOAEL (mg/kg BW/day)	LOAEL (mg/kg BW/day)	No Effect HQ		Effect HQ		No Effect RR		Effect RR	
			Surface Water		Sediment (dw)		Fish (ww)													
			CTE	RME	CTE	RME	CTE	RME	CTE	RME			RME	CTE	RME	CTE	RME	CTE	RME	CTE
	Pesticides	4,4'-DDD	2.50E-06	2.50E-06	4.54E-03	8.20E-03	1.30E-02	1.40E-02	1.03E-03	3.43E-03	0.8	4	0.004	0.001	0.001	0.0003	<1	<1	<1	<1
		4,4'-DDE	2.50E-06	2.50E-06	2.63E-02	3.70E-02	2.34E-02	2.90E-02	1.89E-03	7.27E-03	0.8	4	0.01	0.002	0.002	0.0005	<1	<1	<1	<1
			2.50E-06	2.50E-06	8.68E-04	4.80E-03	3.20E-04	3.20E-04	2.69E-05	1.18E-04	0.8	4	0.0001	0.00003	0.00003	0.00001	<1	<1	<1	<1
		alpha-Chlordane	1.25E-06	1.25E-06	5.29E-04	4.30E-03	6.17E-03	8.40E-03	4.87E-04	2.05E-03	--	--	--	--	--	--	--	--	--	--
		Dieldrin	2.50E-06	2.50E-06	1.67E-02	3.60E-02	2.51E-02	3.00E-02	2.01E-03	7.50E-03	0.02	0.2	0.4	0.1	0.04	0.01	<1	<1	<1	<1
		Endosulfan Sulfate	2.50E-06	2.50E-06	1.75E-03	5.10E-03	3.28E-03	5.10E-03	2.62E-04	1.27E-03	--	--	--	--	--	--	--	--	--	--
		Endrin Aldehyde	2.50E-06	2.50E-06	1.62E-03	9.50E-03	3.20E-04	3.20E-04	2.83E-05	1.57E-04	--	--	--	--	--	--	--	--	--	--
		Endrin Ketone	2.50E-06	2.50E-06	3.69E-04	4.40E-04	3.20E-04	3.20E-04	2.60E-05	8.08E-05	--	--	--	--	--	--	--	--	--	--
		Gamma-BHC	1.25E-06	1.25E-06	2.63E-04	3.10E-04	3.20E-04	3.20E-04	2.57E-05	7.96E-05	--	--	--	--	--	--	--	--	--	--
	4,4'-DDT	Gamma-Chlordane	1.25E-06	1.25E-06	6.69E-04	3.70E-03	3.31E-03	6.10E-03	2.62E-04	1.50E-03	--	--	--	--	--	--	--	--	--	--
		Toxaphene	1.25E-04	1.25E-04	2.75E-02	3.85E-02	3.20E-02	3.20E-02	2.58E-03	8.02E-03	8	16	0.001	0.0003	0.001	0.0002	<1	<1	<1	<1
	PCBs	Total PCBs	5.00E-05	5.00E-05	1.45E-01	6.00E-01	7.50E-01	9.60E-01	5.93E-02	2.35E-01	--	--	--	--	--	--	--	--	--	--
	Metals	Aluminum	1.23E-01	9.95E-01	5.39E+03	1.11E+04	5.51E+00	1.10E+01	1.04E+01	9.67E+01	1.93	19.3	**50**	**5**	**5**	0.5	**10**	1	<1	<1
		Arsenic	1.71E-03	2.41E-03	6.56E+00	1.73E+01	9.68E-02	1.20E-01	1.98E-02	1.75E-01	0.126	1.26	**1**	0.2	0.1	0.02	1	<1	<1	<1
			4.03E-02	1.00E-01	5.88E+01	2.02E+02	1.23E+00	1.40E+00	2.07E-01	2.06E+00	0.51	19.8	**4**	0.4	0.1	0.01	**2**	<1	<1	<1
		Beryllium	1.50E-04	1.50E-04	5.48E-01	8.50E-01	6.50E-03	6.50E-03	1.53E-03	8.77E-03	0.66	1.32	0.01	0.002	0.01	0.001	<1	<1	<1	<1
		Cadmium	1.57E-04	6.00E-04	4.96E+00	1.48E+01	5.02E-02	1.20E-01	1.31E-02	1.54E-01	1	2.52	0.2	0.01	0.1	0.01	<1	<1	<1	<1
		Chromium	2.22E-03	1.00E-02	5.53E+01	1.49E+02	8.27E-01	1.00E+00	1.68E-01	1.50E+00	3.28	13.14	0.5	0.1	0.1	0.01	<1	<1	<1	<1
		Cobalt	3.33E-04	1.15E-03	6.98E+00	8.50E+00	7.33E-02	8.30E-02	1.87E-02	9.20E-02	--	--	--	--	--	--	--	--	--	--
		Copper	5.48E-03	1.25E-02	7.77E+01	2.34E+02	5.51E-01	7.30E-01	1.87E-01	2.16E+00	11.7	15.14	0.2	0.02	0.1	0.01	<1	<1	<1	<1
		Cyanide	1.61E-03	2.00E-03	2.77E-01	3.60E-01	--	--	--	--	24	48	--	--	--	--	--	--	--	--
	Barium	Iron	2.11E+00	4.91E+00	1.07E+04	2.45E+04	2.06E+02	2.20E+02	3.61E+01	2.61E+02	--	--	--	--	--	--	--	--	--	--
		Lead	3.29E-03	1.96E-02	8.30E+01	2.07E+02	1.40E-01	3.30E-01	1.65E-01	1.83E+00	8	80	0.2	0.02	0.02	0.002	<1	<1	<1	<1
		Manganese	2.24E-01	1.01E+00	2.14E+02	6.72E+02	1.29E+01	1.80E+01	1.42E+00	1.01E+01	88	284	0.1	0.02	0.04	0.01	<1	<1	<1	<1
		Mercury	6.74E-05	7.00E-05	2.02E-01	6.10E-01	5.05E-02	6.10E-02	4.35E-03	1.98E-02	0.015	0.025	**1**	0.3	0.8	0.2	<1	<1	<1	<1
		Nickel	3.60E-03	2.00E-02	1.71E+01	3.77E+01	8.83E-01	1.00E+00	1.01E-01	5.61E-01	40	80	0.01	0.003	0.01	0.001	<1	<1	<1	<1
		Selenium	1.50E-03	1.50E-03	9.74E-01	3.60E+00	4.94E-01	5.60E-01	4.08E-02	1.65E-01	--	--	--	--	--	--	--	--	--	--
		Silver	8.91E-04	2.10E-03	3.30E+00	1.46E+01	6.50E-03	6.50E-03	6.65E-03	1.25E-01	N/A	3.75	--	--	0.03	0.002	--	--	<1	<1
		Thallium	1.61E-03	2.00E-03	2.40E-01	3.45E-01	3.25E-03	3.25E-03	7.64E-04	3.94E-03	0.0074	0.074	0.5	0.1	0.1	0.01	<1	<1	<1	<1
		Vanadium	7.71E-04	3.20E-03	1.20E+01	2.71E+01	6.89E-02	1.20E-01	2.77E-02	2.58E-01	0.21	2.1	**1**	0.1	0.1	0.01	<1	<1	<1	<1
		Zinc	1.47E-02	4.64E-02	1.89E+02	4.77E+02	2.14E+01	2.70E+01	2.04E+00	1.05E+01	160	320	0.07	0.01	0.03	0.01	<1	<1	<1	<1

Notes:

-- = TRV not available. CTE/RME and associated HQs cannot be calculated.
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCBs = polychlorinated biphenyls
UCL = Upper Confidence Limit
CTE = central tendency exposure
RME = reasonable maximum exposure
RR = residual risk
HQ = hazard quotient
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
BW = body weight
dw = dry weight
ww = wet weight
LOAEL = lowest observable adverse effects level
NOAEL = no observable adverse effects level

Table 7-25e: Weight-of-Evidence Integration for small piscivorous mammals
Baseline Ecological Risk Assessment
Peterson Puritan Site - Operable Unit 2, Cumberland and Lincoln, Rhode Island

Assessment Endpoint:
Maintain stable and healthy populations of small piscivorous mammals
Are COPC levels sufficiently high to cause biologically-significant changes or impair the function of populations of small piscivorous mammals foraging in selected aquatic habitats at the site?

Measurement Endpoint
11.A: use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to no effect and effect mammalian TRVs.

Weight-of-Evidence Integration

Blackstone River

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm			**11.A**		

Pond A

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm			**11.A**		

Pond F

	WEIGHT				
HARM/MAGNITUDE	Low	Low - Medium	Medium	Medium - High	High
Yes/High					
Yes/Low					
Undeterminate					
No Harm			**11.A**		

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

TABLE 7-26a
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a moderate level of confidence, that adverse effects are unlikely to the benthic invertebrate community (***risk scenario 2***).	Sediment benchmarks are non-site specific & generic, but conservative, and were missing for some COPECs. Bioavailability (except for SEM) or cumulative risk from multiple COPECs are not considered.	No COPECs have effect CTE RRs > 1.0. Impairment is not expected. The evaluation uses 29 samples.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Severe toxicity is present for both test species in 1 (BR-006) of the 4 samples collected from the river for toxicity testing	The samples reflect only specific locations. Too few toxicity testing samples (n=4) for the entire EU. Survival is already reduced for 1 test species in 2 of 7 background samples. Sample handling changes the conditions found in the field. The samples come from select depositional areas in the river which maximizes contamination (= worst case) but may not represent non-depositional sections.	The observed toxicity in BR-006 cannot be readily linked to COPECs in the sample.
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Some impact is observed in 2 (BR-001 and BR-006) of the 4 samples collected for benthic community analysis.	Physical and chemical differences in habitat may affect structure and function of the community. Too few community samples (n=4) for the entire EU.The samples come from select depositional areas in the river which maximizes contamination (= worst case) but may not represent the non-depositional sections.	Benthic assemblage and habitat data vary between individual locations. The observed community responses do not appear to result from pollution-induced degradation.
	OVERALL RISK CONCLUSION		***Some adverse effects are possible to the benthic community in the Blackstone River, but are localized and do not appear strongly associated with site-derived COPECs.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	The fisheries data show a fish community which appears to respond to increased disturbance.	--	The data could not be used to determine if the disturbance reflects habitat differences with the upstream location or site-related chemical exposure. This measurement endpoint is not used to formulate the overall risk conclusion for fish.
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to the fish community (***risk scenario 5***).	Benchmarks are (a) non-species specific and generic, but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	No surface water COPECs have chronic CTE RRs > 1. Impairment is not expected. The evaluation uses 25 samples.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to the fish community (***risk scenario 5***).	CBRs are (a) non-species specific and generic, but conservative, (b) missing for many COPECs, and (c) do not consider cumulative risk.	No tissue COPECs have effect CTE RRs > 1. The only effect RME RRs at or above 1.0 are for Al (RR = 1) and Ba (RR = 1). Impairment is not expected.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to the fish community in the Blackstone River (near-site).***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to amphibians (***risk scenario 4 & 5***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	No surface water COPECs have chronic CTE RRs > 1. Impairment is not expected. The evaluation uses 25 samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to amphibians in the Blackstone River (near-site) .***		
Large Piscivorous Birds[b] (great blue heron)	6.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analaysis shows, with a high level of confidence, that adverse effects are unlikely to large piscivorous birds (***risk scenario 1***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect CTE RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to large piscivorous birds feeding at the Blackstone River (near-site), Pond A, and Pond F combined.***		

US EPA ARCHIVE DOCUMENT

TABLE 7-26a
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - BLACKSTONE RIVER (NEAR-SITE)

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Small Piscivorous Birds (belted kingfisher)	7.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are unlikely to small piscivorous birds (***risk scenario 1***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect CTE RRs > 1.0. Impairment is not expected. The evaluation uses 3 fish samples, 30 sediment samples, and 25 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to small piscivorous birds feeding at the Blackstone River (near-site).***		
Large Piscivorous Mammals[b] (river otter)	10.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are unlikely to large piscivorous mammals (***risk scenario 2***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to large piscivorous mammals feeding at the Blackstone River (near-site), Pond A, and Pond F combined.***		
Small Piscivorous Mammals (mink)	11.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are unlikely to small piscivorous mammals (***risk scenario 2***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Impairment is not expected. The evaluation uses 3 fish samples, 30 sediment samples, and 25 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to small piscivorous mammals feeding at the Blackstone River (near-site).***		

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; SEM = simultaneously extracted metals; TRV = toxicity reference value; WOE = weight-of-evidence.

[b] The conclusion for this receptor group is based on risk from exposure to COPECs in the Blackstone River, Pond A, and Pond F combined.

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water

Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-26b
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability (except for SEM) or cumulative risk from multiple COPECs not considered.	Acetone is the only COPEC with an effect CTE RR > 1 (CTE RR = 2). This RR exceedance is small and not expected to cause severe impairment. The evaluation uses 12 sediment samples.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	The 2 samples (PA-001 & PA-003) collected from Pond A had significantly lower survival in both test species, which cannot be readily linked to COPECs, except perhaps for Cd (see comments).	A sample reflects only one specific location. Too few toxicity testing samples (n=2) for the entire EU. Survival is already reduced for 1 test species in 2 of 7 background samples. Sample handling changes the conditions found in the field.	Cd in PA-003 (25 mg/kg) is 5X above the effect benchmark of 4.98 mg/kg. However, Cd in PA-001, which is just as toxic as PA-003, is only 12 mg/kg. Cd in the two background samples equal 9.9 mg/kg and 9.8 mg/kg, respectively.
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Sample PA-001 shows severe community impairment, whereas sample PA-003 shows some community impairment.	Too few community samples (n=2) for the entire EU. Physical and chemical differences in habitat may affect structure and function of the community.	Benthic assemblage and habitat data vary between individual locations. Low dissolved oxygen could be a potential source of impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic community in Pond A. The source of impairment is unclear but may be related to COPECs and/or habitat issues.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	The fisheries data from Pond A are inconclusive because comparable data from a reference pond are unavailable.	--	This measurement endpoint is not used to formulate the overall risk conclusion for fish.
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	Mn is the only detected surface water COPEC with a chronic CTE RR > 1 (RR = 3). This RR exceedance is small and not expected to cause severe impairment. The evaluation uses 10 surface water samples.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to the fish community (***risk scenario 4***).	CBRs are (a) non-species specific and generic but conservative, (b) missing for many COPECs, and (c) do not consider cumulative risk.	No tissue COPECs have effect RME or CTE RRs > 1. Impairment is not expected.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond A.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	Mn is the only detected surface water COPEC with a chronic CTE RR > 1 (RR = 3). This RR exceedance is small and not expected to cause severe impairment. The evaluation uses 10 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond A .***		
Large Piscivorous Birds[b] (great blue heron)	6.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are unlikely to large piscivorous birds (***risk scenario 1***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to large piscivorous birds feeding at the Blackstone River (near-site), Pond A, and Pond F combined.***		

US EPA ARCHIVE DOCUMENT

TABLE 7-26b
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND A

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Small Piscivorous Birds (belted kingfisher)	7.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a low level of confidence, that adverse effects are unlikely to small piscivorous birds (***risk scenario 3***)	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Pb is the only COPEC with a no effect RR > 1 (RME RR < 1 and CTE RR = 3). This RR exceedance was small and not expected to cause impairment. The evaluation uses 8 fish samples, 12 sediment samples, and 10 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to small piscivorous birds feeding at Pond A.***		
Large Piscivorous Mammals[b] (river otter)	10.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are unlikely to large piscivorous mammals (***risk scenario 1***)	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect or no effect RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to large piscivorous mammals feeding at Ponds A and F combined.***		
Small Piscivorous Mammals (mink)	11.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a low level of confidence, that adverse effects are unlikely to small piscivorous mammals (***risk scenario 3***)	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Al is the only COPEC with a no effect RR > 1 (RME RR = 5 and CTE RR = 1). This RR exceedance was small and not expected to cause impairment. The evaluation uses 8 fish samples, 12 sediment samples, and 10 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to small piscivorous mammals feeding at Pond A.***		

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[b] The conclusion for this receptor group is based on risk from exposure to COPECs in the Blackstone River, Pond A, and Pond F combined.

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water

Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-26c
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND B

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PUTITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs are not considered. Only 3 sediment samples are available for evaluation.	2-methylphenol, Cd and Ag are the only COPECs with an effect CTE RR $\geq$ 1 (1, 1, and 1, respectively). These RR exceedances are small and not expected to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Pond B	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Pond B	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic invertebrate community in Pond B.***		
Fish	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--
Amphibians	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond B	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water

Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-26d
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND C

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs are not considered. The exposures are "averages" for the entire EU. Only 2 sediment samples are available for evaluation.	2-methylphenol and Cd are the only two COPECs with an effect CTE RR $\geq$ 1 (1 and 1, respectively). These RR exceedances are small and not expected to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Pond C	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Pond C	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible in the benthic invertebrate community in Pond C.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond C.	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***). Pb is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only two surface water samples are available for evaluation.	Al, Ba, Cd, Cu, and Pb are the detected surface water COPECs with the highest chronic CTE RRs (21 , 40, 31, 15, and 62, respectively). These RR exceedances could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBR.	medium	Measurement endpoint 2.C was not evaluated in Pond C.	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond C.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***). Pb is the main risk driver	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only two surface water samples are available for evaluation.	Al, Ba, Cd, Cu, and Pb are the detected surface water COPECs with the highest chronic CTE RRs (21 , 40, 31, 15, and 62, respectively). These RR exceedances could cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond C.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond C	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond C	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond C	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond C	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE 7-26d
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND C

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-26e
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs are not considered. Only 4 sediment samples are available for evaluation.	Pyrene and Cd are the only two COPECs with an effect CTE RR $\geq$ 1 (1 and 1, respectively). These RR exceedances are small and not expected to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	The 1 sample (PD-002) collected for toxicity testing shows severe effects to both test species.	A sample reflects only one specific location. Too few sediment samples (n=1) for the entire EU. Survival is already reduced for 1 test species in 2 of 7 background samples. Sample handling changes the conditions found in the field.	PD-002 has the highest PAHs measured in the 7 pond samples, with total PAHs of 61.9 mg/kg vs. 20.2 mg/kg and 18 mg/kg in the 2 background samples. On the other hand, PD-002 has the lowest metal levels measured in these same seven samples.
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	The results for PD-002 are in the range of background conditions, excep for lower number of total organisms (67 vs. 91 to 92)	Too few community samples (n=1) for the entire EU. Physical and chemical differences in habitat may affect structure and function of the community.	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic community in Pond D. The source of impairment is unclear but may be related to COPECs and/or habitat issues.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond D	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***). Pb is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Al, Ba, Cd, and Pb are the detected surface water COPECs with the highest chronic CTE RRs (22 , 11, 22, and 77, respectively). These RR exceedances could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	Measurement endpoint 2.C was not evaluated in Pond D	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond D.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***). Pb is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Al, Ba, Cd, and Pb are the detected surface water COPECs with the highest chronic CTE RRs (22 , 11, 22, and 77, respectively). These RR exceedances could cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond D.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond D	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond D	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond D	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond D	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE 7-26e
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-26f
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND E

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***). Pb is the main risk driver.	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs are not considered. Only 2 sediment samples are available for evaluation.	The COPECs with effect CTE RRs $\geq$ 1 are acetone (10), carbon disulfide (2), Cd (2), Cr (2), Cu (3), Pb (11), and Zn (3). Several of these RR exceedances are large enough to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Pond E	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Pond E	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic invertebrate community in Pond E.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond E	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***). Ba is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Ba, Pb and Mn are the detected surface water COPECs with the highest chronic CTE RRs (55, 8, and 7, respectively). These RR exceedances could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	Measurement endpoint 2.C was not evaluated in Pond E	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond E.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenrio 6***). Ba is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Ba, Pb and Mn are the detected surface water COPECs with the highest chronic CTE RRs (55, 8, and 7, respectively). These RR exceedances could cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond E.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond E	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond E	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond E	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond E	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE 7-26f
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND E

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-26g
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability (except for SEM) or cumulative risk from multiple COPECs are not considered. The exposures are "averages" for the entire EU. Only 5 sediment samples are available for evaluation.	The only COPEC with an effect CTE RR $\geq$ 1 is acetone (2). This RR exceedance is small and not expected to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	The 1 sample (PF-004) collected from Pond F for toxicity testing did not result in a significant reduction in survival or growth.	A sample reflects only one specific location. Too few toxicity testing samples (n=1) for the entire EU. Survival is already reduced for 1 test species in 2 of 7 background samples. Sample handling changes the conditions found in the field.	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Benthic metric results for PF-004 are generally lower than the metric results from the background, indicating the potential for site-related impacts.	Physical and chemical differences in habitat may affect structure and function of the community. Too few community samples (n=1) for the entire EU.	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic community in Pond F. The source of impairment is unclear but may be related to COPECs and/or habitat issues.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	The fisheries data from Pond F are inconclusive because comparable data from a reference pond are missing.	--	This measurement endpoint could not be used to formulate the overall risk conclusion for fish due to a lack of usable reference data.
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 4 surface water samples are available for evaluation.	Mn and Ag are the only detected surface water COPECs with chronic CTE RRs > 1 (RR of 2 and 2, respectively). These small RR exceedances are not expected to cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	CBRs are (a) non-species specific and generic but conservative, (b) missing for many COPECs, and (c) do not consider cumulative risk.	Ba and Zn are the only detected COPECs with effect CTE RRs > 1 (RR of 1 and 1, respectively). These small RR exceedances are not expected to cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond F.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 4 syrface water samples are available for evaluation.	Mn and Ag are the only detected surface water COPECs with chronic CTE RRs > 1 (RR of 2 and 2, respectively). These small RR exceedances are not expected to cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the amphibians in Pond F.***		
Large Piscivorous Birds[b] (great blue heron)	6.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are unlikely to large piscivorous birds (***risk scenario 1***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse are unlikely to large piscivorous birds feeding at the Blackstone River (near-site), Pond A, and Pond F combined.***		

US EPA ARCHIVE DOCUMENT

TABLE 7-26g
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND F

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Small Piscivorous Birds (belted kingfisher)	7.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to large piscivorous birds (***risk scenario 5***).	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	Pb is the only COPEC with effect RRs > 1.0 (effect RME RR = 1 and effect CTE RR < 1). This RR exceedance is small and not expected to cause impairment. The evaluation uses 3 fish samples, 5 sediment samples, and 4 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse are possible but not expected to small piscivorous birds feeding at Pond F.***		
Large Piscivorous Mammals[b] (river otter)	10.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a high level of confidence, that adverse effects are unlikely to large piscivorous mammals feeding across Ponds A and F combined (***risk scenario 1***)	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect or no effect RRs > 1.0. Impairment is not expected. The evaluation uses 58 fish samples, 47 sediment samples, and 39 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to large piscivorous mammals feeding at Ponds A and F combined.***		
Small Piscivorous Mammals (mink)	11.A: Use food chain modeling to calculate daily doses from ingesting surface water, sediment, and fish, and compare these values to TRVs.	medium	The RR analysis shows, with a low level of confidence, that adverse effects are unlikely to small piscivorous mammals feeding in Pond E (***risk scenario 3***)	Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Some COPECs lack TRVs. COPECs assumed to be 100% bioavailable. Cumulative risk is not considered.	No COPECs have effect RRs > 1.0. Impairment is not expected. The evaluation uses 3 fish samples, 5 sediment samples, and 4 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to small piscivorous mammals feeding at Pond F.***		

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[b] The conclusion for this receptor group is based on risk from exposure to COPECs in the Blackstone River, Pond A, and Pond F combined.

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water

Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-26h
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND I

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs are not considered. Only 3 sediment samples are available for evaluation.	The COPECs with effect CTE RRs $\geq$ 1 are acetone (3), benzo[g,h,i]perylene (3), chrysene (1), fluoranthene (1), pyrene (1), Cd (2), and Cu (1). These RR exceedances are small but numerous and might results in impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	The one sample (BR-005) collected from Pond I for toxicity testing shows reduced growth in *C. dilutus.*	A sample reflects only one specific location. Too few toxicity testing samples (n=1) for the entire EU. Survival is already reduced for 1 test species in 2 of 7 background samples. Sample handling changes the conditions found in the field.	BR-005 has the highest PAHs and metal levels in the Blackstone R., but is less toxic than sample BR-006 which has COPEC levels no different from the other 3 near-site river samples tested for toxicity.
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	BR-005 had a lower diversity index and higher % tolerant organisms, but the total organisms, No. of taxa, % gatherer, and % burrower metrics compared to the background range.	Physical and chemical differences in habitat may affect structure and function of the community. Too few community samples (n=1) for the entire EU.	The observed impairment may be habitat-related (e.g., water temperature, grain size)
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic community in Pond I. The source of impairment is unclear but may be related to COPECs and/or habitat issues.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond I	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Pb is the detected surface water COPEC with the highest chronic CTE RR (RR = 10). This RR exceedance could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	Measurement endpoint 2.C was not evaluated in Pond I	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond I.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***). Pb is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 2 surface water samples are available for evaluation.	Pb is the detected surface water COPEC with the highest chronic CTE RR (RR = 10). This RR exceedance could cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond I.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond I	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond I	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond I	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond I	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE 7-26h
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND I

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE, OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-26i
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND N

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion"	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 6***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs not considered. Only 1 sediment sample is available for evaluation.	The COPECs with effect CTE RRs $\geq$ 1 are 4,4'-DDD (1), dieldrin (1), Cd (2), and Cr (1). These RR exceedances are small and not expected to cause severe impairment.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Pond N	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Pond N	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the benthic invertebrate community in Pond N.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond N	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***). Al is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 1 surface water sample is available for evaluation.	Al and Pb are the detected surface water COPECs with the highest chronic CTE RRs (22 and 12, respectively). These RR exceedances could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	Measurement endpoint 2.C was not evaluated in Pond N	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond N.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibiams (***risk scenario 6***). Al is the main risk driver.	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 1 surface water sample is available for evaluation.	Al and Pb are the detected surface water COPECs with the highest chronic CTE RRs (22 and 12, respectively). These RR exceedances could cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond N.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond N	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond N	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond N	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond N	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE 7-26i
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND N

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water

Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-26j
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND P

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion"	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a low level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 4***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability or cumulative risk from multiple COPECs not considered. Only 1 sediment sample is available for evaluation.	No COPECs have effect RRs > 1.0. Only 3 COPECs have no effect RRs $\geq$ 1. Impairment is not expected.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Pond P	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Pond P	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to the benthic invertebrate community in Pond P.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Pond P	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 1 surface water sample is available for evaluation.	4,4'-DDT, Mn, and Ag are the detected surface water COPECs with the highest chronic CTE RRs (8, 13, and 7, respectively). These RR exceedances could cause severe impairment.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect	medium	Measurement endpoint 2.C was not evaluated in Pond P	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible to the fish community in Pond P.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples. Only 1 surface water sample is available for evaluation.	4,4'-DDT, Mn, and Ag are the detected surface water COPECs with the highest chronic CTE RRs (8, 13, and 7, respectively). These RR exceedances could cause severe impairment.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to amphibians in Pond P.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Pond P	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Pond P	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Pond P	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Pond P	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE 7-26j
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - POND P

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-26k
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - WETLANDS A THROUGH D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[a]	Major Uncertainties	Comments
Benthic Invertebrates	1.A: Compare the COPEC levels in bulk sediment samples to conservative no effect and effect sediment benchmarks.	low	The RR analysis shows, with a moderate level of confidence, that adverse effects are possible to the benthic invertebrate community (***risk scenario 5***).	Sediment benchmarks are non-site specific & generic but conservative, and were missing for some COPECs. Bioavailability and cumulative risk from multiple COPECs are not considered.	No COPECs have effect CTE RRs > 1.0. The only COPEC with an effect RME RR $\geq$ 1 is carbon disulfide (1). Impairment is not expected. The evaluation uses 23 sediment samples.
	1.B: Measure survival and growth in *H. azteca* and *C. dilutus* exposed in the laboratory to bulk sediment samples.	medium	Measurement endpoint 1.B was not evaluated in Wetlands A through D	--	--
	1.C: Evaluate the structure and function of the benthic invertebrate community.	high	Measurement endpoint 1.C was not evaluated in Wetlands A through D	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to the benthic invertebrate community in Wetlands A through D.***		
Fish	2.A: Evaluate the structure and function of the fish community.	high	Measurement endpoint 2.A was not evaluated in Wetlands A through D	--	--
	2.B: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to the fish community (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	Toxaphene had the highest chronic CTE RR (134) but was not detected in any of the 17 surface water samples. None of the other COPECs had a chronic CTE RR > 1. Impairment is not expected. The evaluation uses 17 surface water samples.
	2.C: Compare COPEC levels measured in whole fish to no effect and effect CBRs.	medium	Measurement endpoint 2.C was not evaluated in Wetlands A through D	--	--
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to the fish community in Wetlands A through D.***		
Amphibians	3.A: Compare the COPEC levels in surface water samples to acute and chronic surface water benchmarks.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to amphibians (***risk scenario 6***).	Benchmarks are (a) non-species specific and generic but conservative, (b) missing for some COPECs, and (c) do not consider cumulative risk. The EPCs are conservative because they are based on unfiltered samples.	Toxaphene had a chronic CTE RR of 134 but was not detected in any of the 17 samples. None of the other COPECs had a chronic CTE RR > 1. Impairment is not expected. The evaluation uses 17 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are unlikely to amphibians in Wetlands A through D.***		
Large Piscivorous Birds (heron)	This receptor group was not evaluated for ecological risk in Wetlands A through D	--	--	--	--
Small Piscivorous Birds (kingfisher)	This receptor group was not evaluated for ecological risk in Wetlands A through D	--	--	--	--
Large Piscivorous Mammals (otter)	This receptor group was not evaluated for ecological risk in Wetlands A through D	--	--	--	--
Small Piscivorous Mammals (mink)	This receptor group was not evaluated for ecological risk in Wetlands A through D	--	--	--	--

CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; CBR = critical body residue; EU = exposure unit; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

US EPA ARCHIVE DOCUMENT

TABLE 7-26k
SUMMARY OF ECOLOGICAL RISK IN AQUATIC HABITATS - WETLANDS A THROUGH D

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHOSE ISLAND

[a]Interpretive Risk Matrix for sediment benchmarks, fish CBRs, and wildlife TRVs						
Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

[a]Interpretive Risk Matrix for surface water				
Risk Scenario	Chronic Toxicity		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE		
1,2 & 3	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
4 & 5	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQs)

US EPA ARCHIVE DOCUMENT

TABLE 7-27a
SUMMARY OF ECOLOGICAL RISK IN TERRESTRIAL HABITATS - J.M. MILLS LANDFILL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON PURITAN SITE IN TERRESTRIAL HABITATS - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[b]	Major Uncertainties	Comments
Large omnivorous birds[a] (American woodcock)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to large omnivorous birds feeding across all the near-site terrestrial EUs combined (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RR $\geq$ 1 are BEHP (5), Pb (17), and Zn (4). These RR exceedances could cause severe impairment. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to large omnivorous birds feeding across the terrestrial EUs combined.***		
Small omnivorous birds (American robin)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous birds feeding at the J.M. Mills Landfill (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs $\geq$ 1 are BEHP (7), Cd (1), Pb (41), and Zn (10). These RR exceedances could cause severe impairment. The evaluation uses 16 soil samples and 9 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous birds feeding at the J.M. Mills Landfill.***		
Large omnivorous mammals[a] (red fox)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to large omnivorous mammals feeding across all terrestrial EUs combined (***risk scenario 4***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs $\geq$ 1. The red fox is assumed to have a 100% worm diet. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to large omnivorous mammals feeding across the terrestrial EUs combined.***		
Small omnivorous mammals (short-tailed shrew)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous mammals feeding at the J.M. Mills Landfill (***risk scenario 6***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs $\geq$ 1 are Al (6) and Zn (3). Some impairment is possible. The evaluation uses 16 soil samples and 9 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous mammals feeding at the J.M. Mills Landfill.***		

BAF = bioaccumulation factor; BEHP = bis(2-ethylhexyl)phthalate; CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; EU = exposure unit; PCP = pentachlorophenol; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a] The conclusion for this receptor group is based on risk from exposure to COPECs from all the terrestrial EUs combined.

[b] **Interpretive Risk Matrix**

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

US EPA ARCHIVE DOCUMENT

TABLE 7-27b
SUMMARY OF ECOLOGICAL RISK IN TERRESTRIAL HABITATS - UNNAMED ISLAND

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON-PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[b]	Major Uncertainties	Comments
Large omnivorous birds[a] (American woodcock)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to large omnivorous birds feeding across all the near-site terrestrial EUs combined ***(risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RR ≥ 1 are BEHP (5), Pb (17), and Zn (4). These RR exceedances could cause severe impairment. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to large omnivorous birds feeding across the terrestrial EUs combined.***		
Small omnivorous birds (American robin)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous birds feeding at the Unnamed Island ***(risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs ≥ 1 are BEHP (14), di-n-octyl phthalate (1), Pb (15), and Zn (3). The RR exceedances could cause severe impairment. The evaluation uses 25 soil samples and 15 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous birds feeding at the Unnamed Island.***		
Large omnivorous mammals[a] (red fox)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to large omnivorous mammals feeding across all terrestrial EUs combined ***(risk scenario 4***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs ≥ 1. The red fox is assumed to have a 100% worm diet. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to large omnivorous mammals feeding across the terrestrial EUs combined.***		
Small omnivorous mammals (short-tailed shrew)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous mammals feeding at the Unnamed Island (***risk scenario 6***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The only COPEC with an effect CTE ≥ 1 is Al (2). Severe impairment is not expected from this small RR exceedance. The evaluation uses 25 soil samples and 15 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous mammals feeding at the Unnamed Island.***		

BAF = bioaccumulation factor; BEHP = bis(2-ethylhexyl)phthalate; CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; EU = exposure unit; PCP = pentachlorophenol; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a] The conclusion for this receptor group is based on risk from exposure to COPECs from all the terrestrial EUs combined.

[b]**Interpretive Risk Matrix**

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

US EPA ARCHIVE DOCUMENT

TABLE 7-27c
SUMMARY OF ECOLOGICAL RISK IN TERRESTRIAL HABITATS - NUNES PARCEL

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON-PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN, RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[b]	Major Uncertainties	Comments
Large omnivorous birds[a] (American woodcock)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR risk analysis shows, with a high level of confidence, that adverse effects are possible to large omnivorous birds feeding across all the near-site terrestrial EUs combined (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RR ≥ 1 are BEHP (5), Pb (17), and Zn (4). These RR exceedances could cause severe impairment. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to large omnivorous birds feeding across the terrestrial EUs combined.***		
Small omnivorous birds (American robin)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous birds feeding at the Nunes Parcel (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs ≥ are BEHP (8), Pb (81), and Zn (8). These RR exceedances could cause severe impairment. The evaluation uses 20 soil samples and 10 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous birds feeding at the Nunes Parcel.***		
Large omnivorous mammals[a] (red fox)		low-medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to large omnivorous mammals feeding across all terrestrial EUs combined (***risk scenario 4***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs ≥ 1. The red fox is assumed to have a 100% worm diet. The evaluation is based on 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to large omnivorous mammals feeding across the terrestrial EUs combined.***		
Small omnivorous mammals (short-tailed shrew)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous mammals feeding at the Nunes Parcel (***risk scenario 6***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs ≥ 1 are Al (7) and Zn (2). Severe impairment is not expected. The evaluation uses 20 soil samples and 10 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effecs are possible to small omnivorous mammals feeding at Nunes Parcel.***		

BAF = bioaccumulation factor; BEHP = bis(2-ethylhexyl)phthalate; CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; EU = exposure unit; PCP = pentachlorophenol; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a] The conclusion for this receptor group is based on risk from exposure to COPECs from all the terrestrial EUs combined.

[b] **Interpretive Risk Matrix**

Risk Scenario	No effect (NOAEL) RME	No effect (NOAEL) CTE	Effect (LOAEL) RME	Effect (LOAEL) CTE	Potential for Adverse Population-level Effects	Confidence Level
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

US EPA ARCHIVE DOCUMENT

TABLE 7-27d
SUMMARY OF ECOLOGICAL RISK IN TERRESTRIAL HABITATS - QUINNVILLE WELL FIELD

BASELINE ECOLOGICAL RISK ASSESSMENT
PETERSON-PURITAN SITE - OPERABLE UNIT 2, CUMBERLAND AND LINCOLN , RHODE ISLAND

Receptor Group	Measurement Endpoint	WOE	Residual Risk Conclusion[b]	Major Uncertainties	Comments
Large omnivorous birds[a] (American woodcock)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to large omnivorous birds feeding across all the near-site terrestrial EUs combined (***risk scenario 6***). Pb is the main risk driver.	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RR $\geq$ 1 are BEHP (5), Pb (17), and Zn (4). These RR exceedances could cause severe impairment. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to large omnivorous birds feeding across the terrestrial EUs combined.***		
Small omnivorous birds (American robin)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect avian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous birds feeding at the Quinville Well Field (***risk scenario 6***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The COPECs with effect CTE RRs $\geq$ 1 are Pb (2) and Zn (2). Severe impairment is not expected. The evaluation uses 19 soil samples and 4 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous birds feeding at the Quinville Well Field.***		
Large omnivorous mammals[a] (red fox)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a low level of confidence, that adverse effects are possible to large omnivorous mammals feeding across all terrestrial EUs combined (***risk scenario 4***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	No COPECs have effect CTE RRs $\geq$ 1. The red fox is assumed to have a 100% worm diet. The evaluation uses 93 soil samples and 65 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible but not expected to large omnivorous mammals feeding across the terrestrial EUs combined.***		
Small omnivorous mammals (short-tailed shrew)	Use soil analytical data to estimate the body residues of COPECs in terrestrial invertebrates; use food chain modeling to calculate daily doses from ingesting surface water, soil, and terrestrial invertebrates, and compare these values to no effect and effect mammalian TRVs.	low-medium	The RR analysis shows, with a high level of confidence, that adverse effects are possible to small omnivorous mammals feeding at the Quinville Well Field (***risk scenario 6***).	"Worst-case" diet (i.e, 100% eartworms). COPECs in worms derived from generic BAFs. COPECs in soil and worms assumed to be 100% bioavailable. Exposure parameters may not assess sensitive life stages. TRVs are conservative and not species specific. Cumulative risk is not considered.	The only COPEC with an effect CTE RR $\geq$ 1 is Al (4). Severe impairment is not expected. The evaluation uses 19 soil samples and 4 surface water samples.
	OVERALL RISK CONCLUSION		***Adverse effects are possible to small omnivorous mammals feeding at the Quinnville Well Field.***		

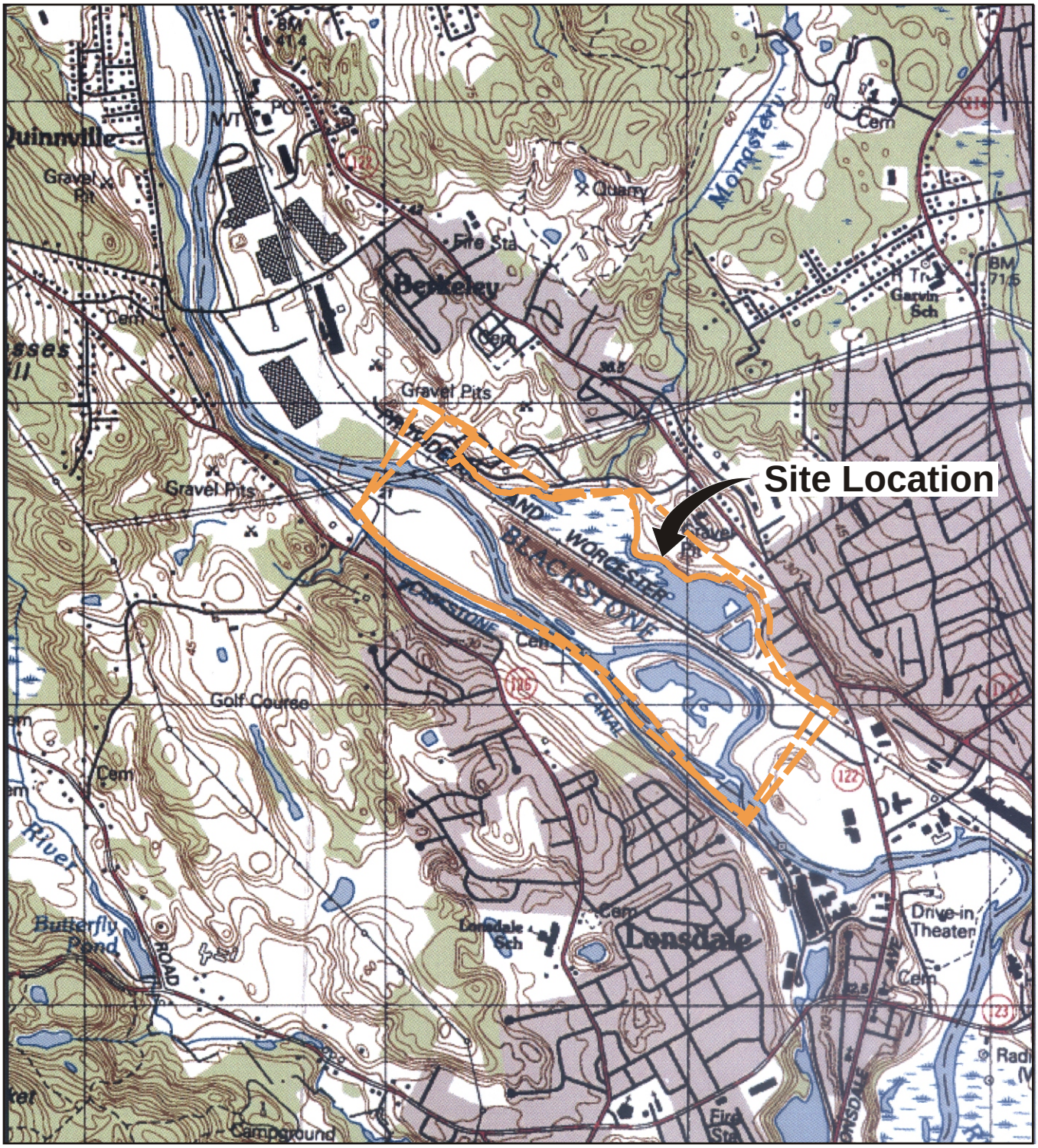
BAF = bioaccumulation factor; BEHP = bis(2-ethylhexyl)phthalate; CTE = central tendency exposure; COPEC = contaminant of potential ecological concern; EU = exposure unit; PCP = pentachlorophenol; RME = reasonable maximum exposure; RR = residual risk; TRV = toxicity reference value; WOE = weight-of-evidence.

[a] The conclusion for this receptor group is based on risk from exposure to COPECs from all the terrestrial EUs combined.

[b] **Interpretive Risk Matrix**

Risk Scenario	No effect (NOAEL)		Effect (LOAEL)		Potential for Adverse Population-level Effects	Confidence Level
	RME	CTE	RME	CTE		
1	RR ≤ 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	High
2	RR > 1	RR ≤ 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Moderate
3	RR > 1	RR > 1	RR ≤ 1	RR ≤ 1	Adverse effects are unlikely	Low
4	RR > 1	RR ≤ 1	RR > 1	RR ≤ 1	Adverse effects are possible	Low
5	RR > 1	RR > 1	RR > 1	RR ≤ 1	Adverse effects are possible	Moderate
6	RR > 1	RR > 1	RR > 1	RR > 1	Adverse effects are possible	High (increase with higher HQ)

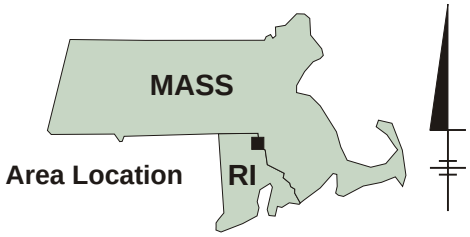
US EPA ARCHIVE DOCUMENT



REFERENCE: BASE MAP USGS 7.5 MIN. QUAD., ATTLEBORO, MASS.

0 0.25 0.5

Approximate Scale in Miles



PETERSON PURITAN SUPERFUND SITE - OU2
CUMBERLAND AND LINCOLN, RHODE ISLAND

REMEDIAL INVESTIGATION REPORT

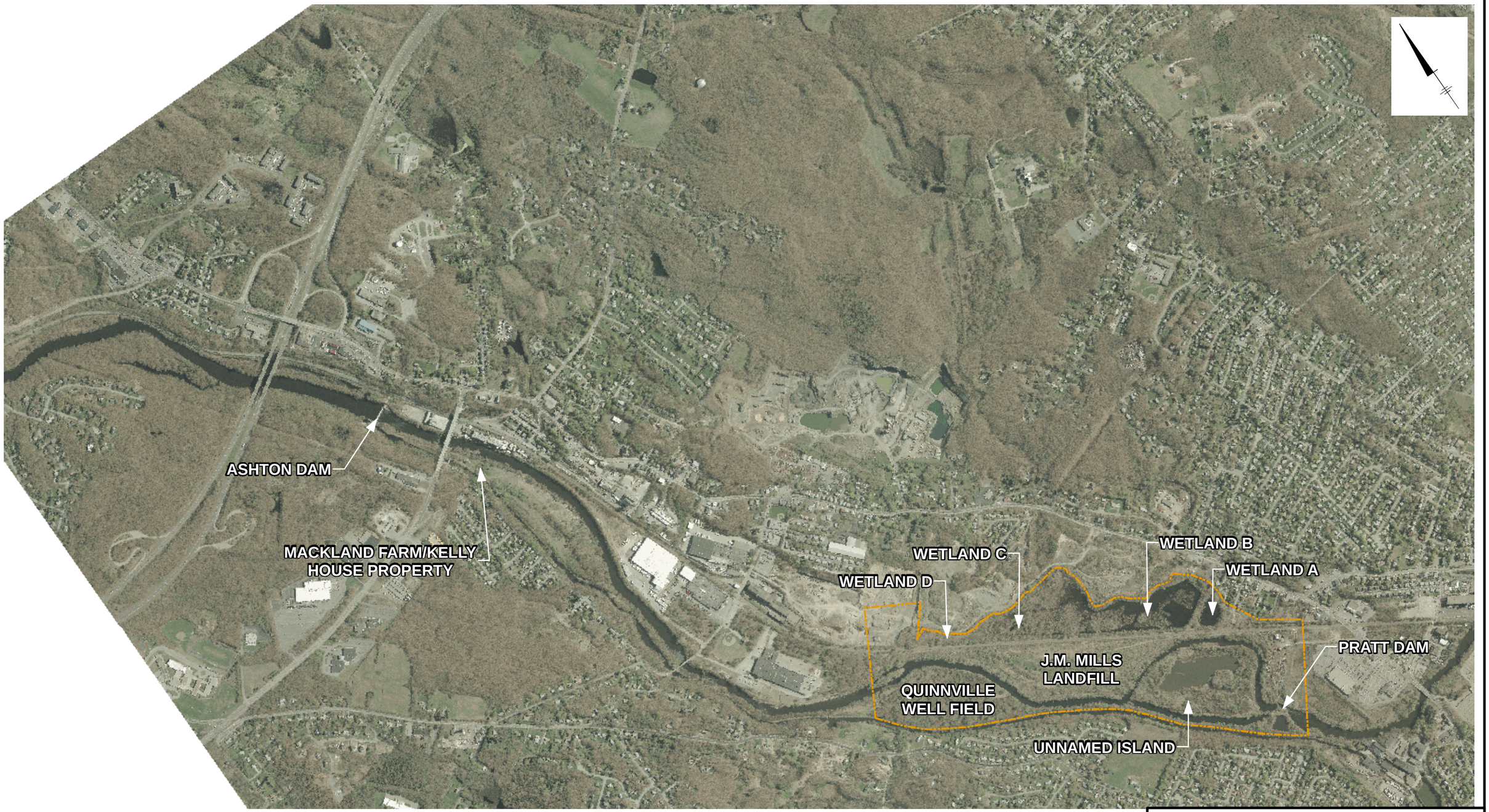
SITE LOCATION MAP

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 1-1

06/14/07 SYR-D85-DJH
37902006/37902n02.cdr

US EPA ARCHIVE DOCUMENT



NOTE:

1. 2002 AERIAL PHOTO OBTAINED FROM RHODE ISLAND GEOGRAPHIC INFORMATION SYSTEM: HTTP://WWW.EDC.URI.EDU/RIGIS/

LEGEND:

OU2 BOUNDARY

0 1,200 2,400 Feet

GRAPHIC SCALE

PETERSON PURITAN SUPERFUND SITE - OU2
CUMBERLAND AND LINCOLN, RHODE ISLAND
REMEDIAL INVESTIGATION REPORT

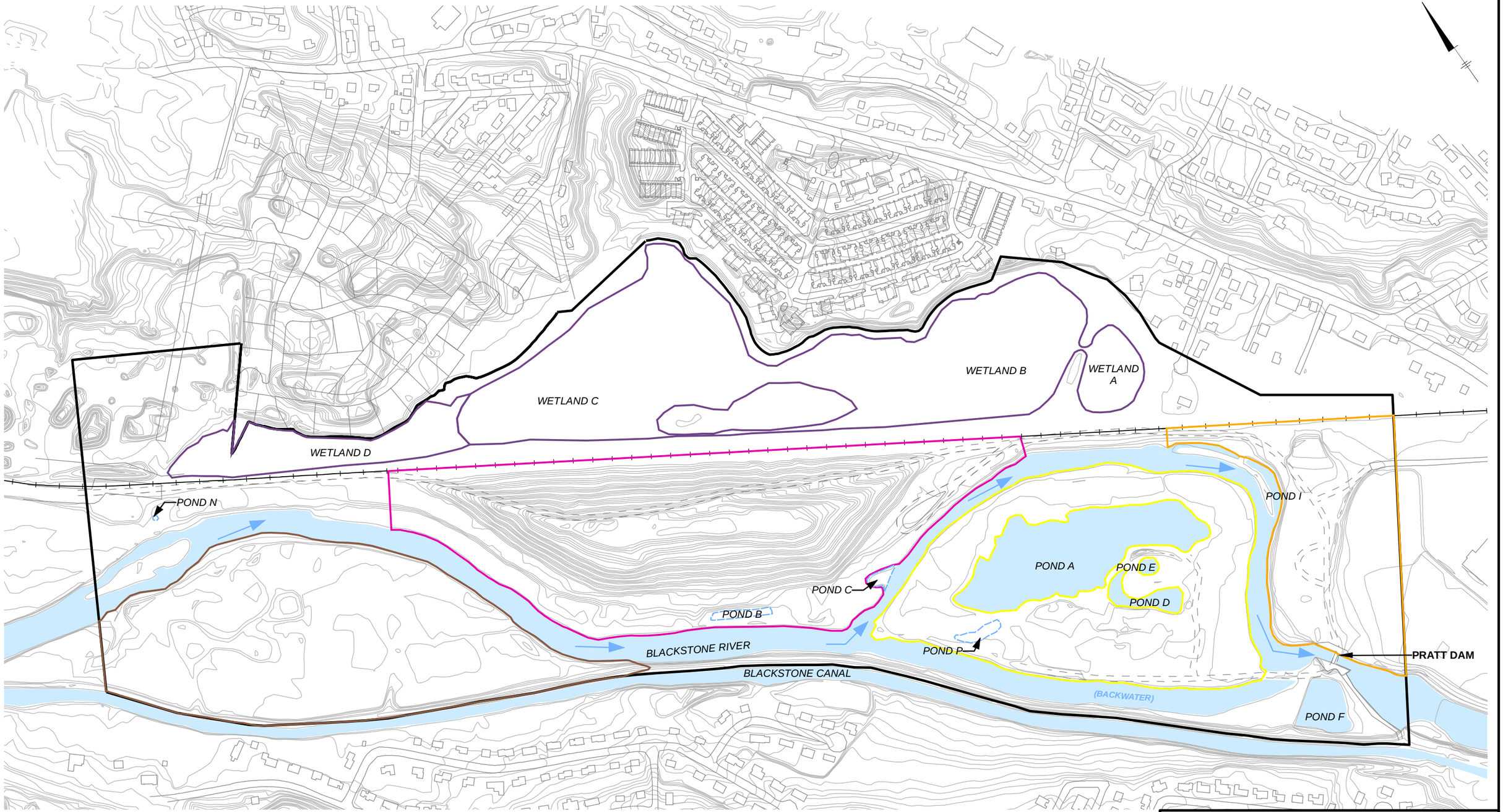
SITE LAYOUT

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 1-2

7/7/06 SYR-85 EAB
Peterson/Puritan (37902.012)
QQ:\Peterson_Puritan\Cumberland_RI\RemedialInvestigationReport\mxd\SiteLayout.mxd

US EPA ARCHIVE DOCUMENT



LEGEND:

- OU2 BOUNDARY
- RAILROAD
- HISTORICAL ACCESS ROAD
- DIRECTION OF SURFACE WATER FLOW
- WATER
- HISTORICAL POND
- J.M. MILLS LANDFILL
- UNNAMED ISLAND
- QUINNVILLE WELL FIELD
- WETLAND
- SOLID WASTE TRANSFER STATION (NFO NUNES DISPOSAL, INC.)

NOTE:

1. NFO - NOW OR FORMERLY OWNED BY

0 400 800 Feet

GRAPHIC SCALE

PETERSON PURITAN SUPERFUND SITE - OU2
CUMBERLAND AND LINCOLN, RHODE ISLAND

REMEDIAL INVESTIGATION REPORT

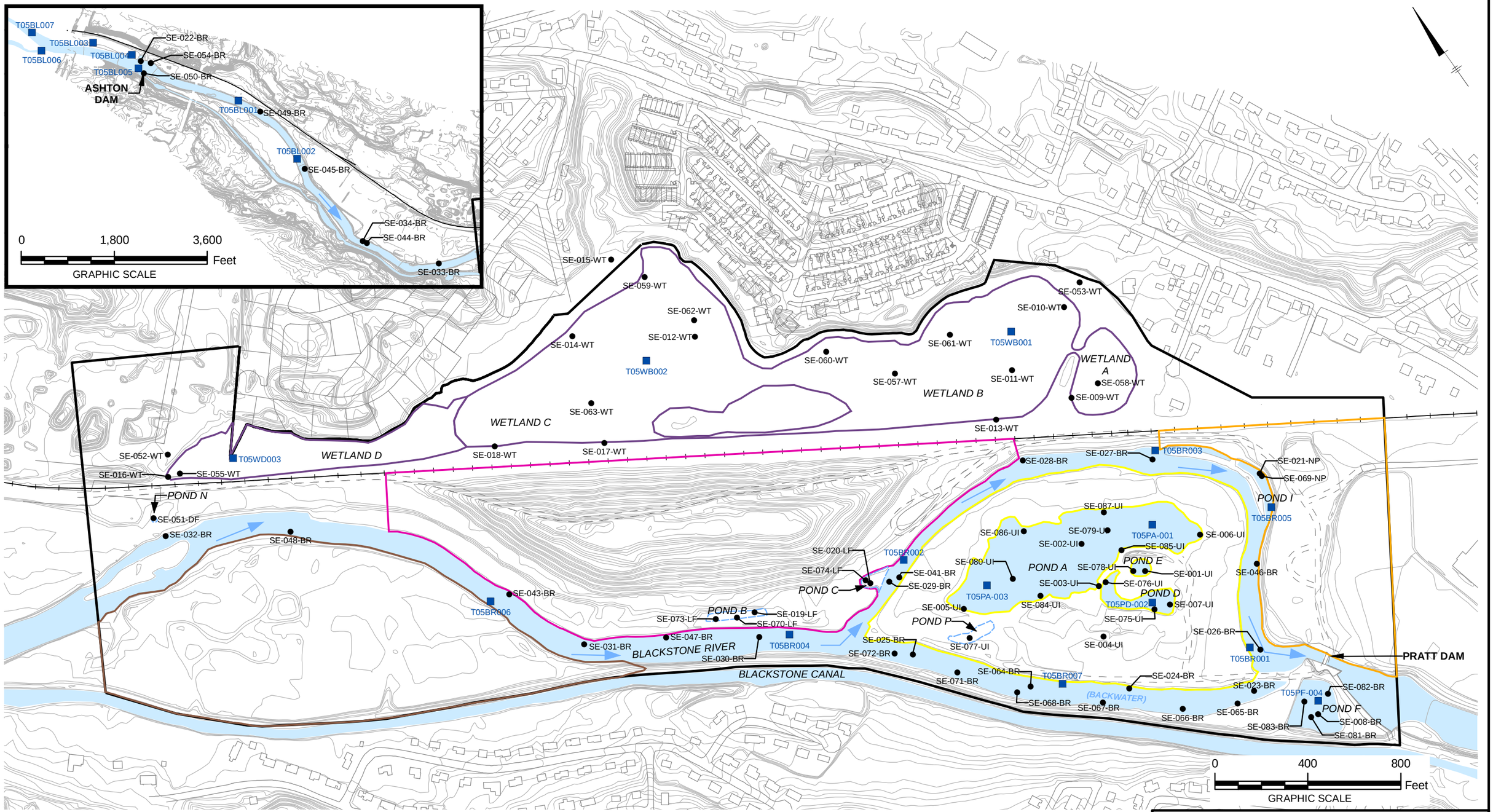
SUB AREA DEFINITION

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 1-3

6/13/06 SYR-85 EAB
Peterson Puritan
Q:\Peterson_Puritan\Cumberland_RI\RemedialInvestigationReport\mxd\SoilSampPhaseaandb-topobasemap.mxd

US EPA ARCHIVE DOCUMENT



LEGEND:

- SE-001-UI ● PHASE 1A SEDIMENT SAMPLE LOCATION
- T05BR004 ■ PHASE 1B SEDIMENT SAMPLE LOCATION
- OU2 BOUNDARY
- RAILROAD
- HISTORICAL ACCESS ROAD
- DIRECTION OF SURFACE WATER FLOW
- WATER
- HISTORICAL POND
- J.M. MILLS LANDFILL
- UNNAMED ISLAND
- QUINNVILLE WELL FIELD
- WETLAND
- SOLID WASTE TRANSFER STATION (NFO NUNES DISPOSAL, INC.)

NOTES:

1. SAMPLE LOCATIONS AND BASEMAPPING ARE IN THE COORDINATE SYSTEM: STATE PLANE RHODE ISLAND NAD 83 FEET. LOCATIONS RECORDED IN THE FIELD USING GPS.
2. NFO - NOW OR FORMERLY OWNED BY

PETERSON PURITAN SUPERFUND SITE - OU2
CUMBERLAND AND LINCOLN, RHODE ISLAND
REMEDIAL INVESTIGATION REPORT

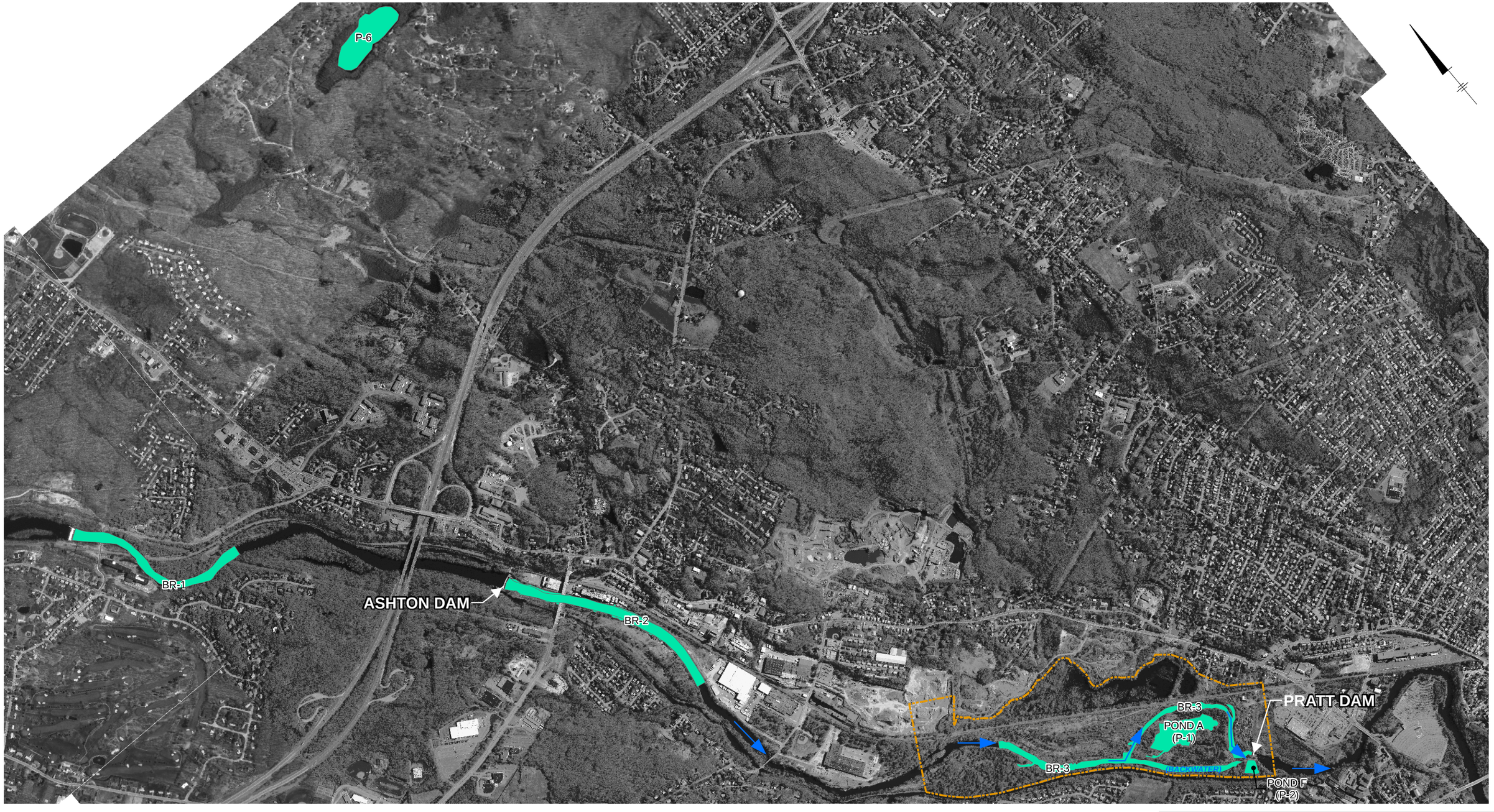
SEDIMENT SAMPLE LOCATIONS

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 2-4

6/14/07 SYR-85 EAB
Peterson Puritan
Q:\Peterson_Puritan\Cumberland_RI\RemedialInvestigationReport\mxd\SedSampPhase1aand1b-topobasemap.mxd

US EPA ARCHIVE DOCUMENT



NOTES:

1. 1997 AERIAL PHOTOGRAPH OBTAINED FROM THE UNIVERSITY OF RHODE ISLAND'S DIGITAL IMAGERY SERVER (HTTP://ORTHO.EDC.URI.EDU/). 2002 AERIAL PHOTO OBTAINED FROM RHODE ISLAND GEOGRAPHIC INFORMATION SYSTEM: HTTP://WWW.EDC.URI.EDU/RIGIS/

2. SAMPLE LOCATIONS NAMED USING THE FOLLOWING DESIGNATION:
   <WATER BODY>-<SAMPLE NUMBER>
   EX. BR-1 FISH SAMPLE LOCATION ONE (1) COLLECTION FROM THE BLACKSTONE RIVER (BR)

3. SAMPLE LOCATIONS RECORDED IN THE FIELD USING GPS.

LEGEND:

- FISH COMMUNITY SURVEY AND FISH TISSUE SAMPLE LOCATIONS
- OU2 BOUNDARY
- DIRECTION OF SURFACE WATER FLOW

0 1,500 3,000 Feet

GRAPHIC SCALE

PETERSON PURITAN SUPERFUND SITE - OU2
CUMBERLAND AND LINCOLN, RHODE ISLAND
REMEDIAL INVESTIGATION REPORT

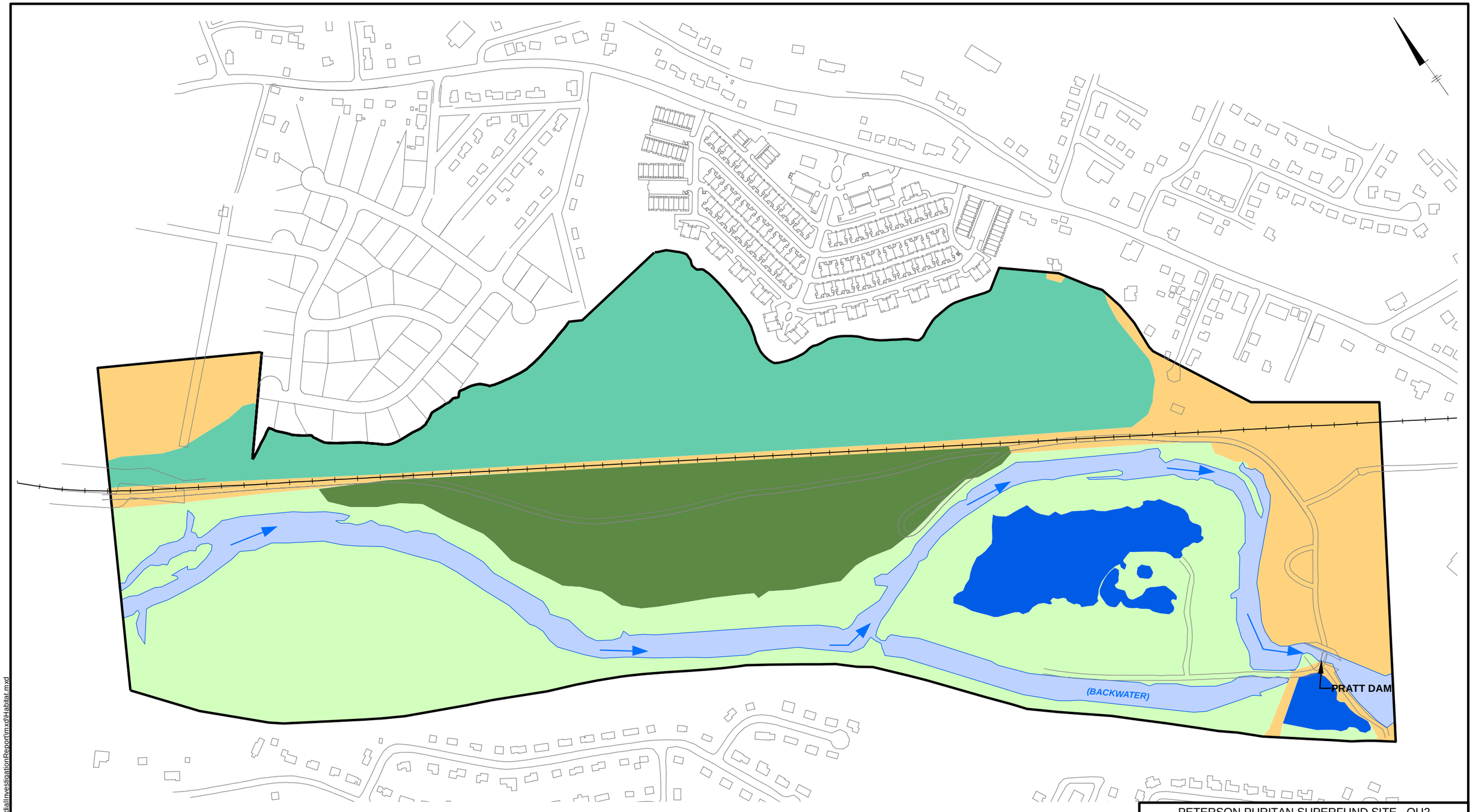
FISH COMMUNITY SURVEY AND FISH TISSUE SAMPLE LOCATIONS

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
2-7

6/14/07 SYR-85 EAB
PetersonPuritan
Q:\Peterson_Puritan\Cumberland_RI\RemedialInvestigationReport\mxd\FishTissueCommSampLocs.mxd

US EPA ARCHIVE DOCUMENT



NOTES:

1. NFO - NOW OR FORMERLY OWNED BY.
2. HABITAT DELINEATION PERFORMED AS PART OF THE HABITAT ASSESSMENT ACTIVITES BETWEEN JULY 11 AND 13, 2005.

LEGEND:

- BLACKSTONE RIVER
- DISTURBED/DEVELOPED AREA
- LANDFILL
- POND
- RIPARIAN
- WETLAND
- OU2 BOUNDARY
- DIRECTION OF SURFACE WATER FLOW

0 400 800 Feet

GRAPHIC SCALE

PETERSON PURITAN SUPERFUND SITE - OU2
CUMBERLAND AND LINCOLN, RHODE ISLAND

REMEDIAL INVESTIGATION REPORT

HABITAT CHARACTERIZATION AREAS

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 2-8

6/13/07 SYR-85 EAB
Peterson Puritan
O:\Peterson_Puritan\Cumberland_RI\RemedialInvestigationReport\mxd\Habitat.mxd

US EPA ARCHIVE DOCUMENT

FIGURE 7.9. General Exposure Pathways and Routes

