FINAL

RECORD OF DECISION
TO ADDRESS SURFACE WATER AND SEDIMENT
AT OPERABLE UNIT 51
ENVIRONMENTAL RESTORATION
PROGRAM SITE SS-63
LANGLEY AIR FORCE BASE, VIRGINIA

August 2008

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LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
ARAR	applicable or relevant and appropriate requirement
BLRA	baseline risk assessment
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act ("Superfund")
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSF	carcinogenic slope factor
CSM	conceptual site model
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
FDA	Food and Drug Administration
FS	Feasibility Study
HGL	HydroGeoLogic, Inc.
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IRP	Installation Restoration Program
LOAEL	lowest observed adverse effect level
LTA	Lighter-than-Air
LTM	long-term monitoring
LUC	land use control
MCPP	2-(2-methyl-4-chlorophenoxy)propionic acid
mg/kg	milligrams per kilogram
mg/kg-day	milligrams of chemical per kilogram of body weight per day
NASA	National Aeronautics and Space Administration
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

NOAEL	no observed adverse effect level
O&M	operation and maintenance
OU	Operable Unit
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCT	polychlorinated terphenyl
RAB	Restoration Advisory Board
RAO	remedial action objective
RBSL	risk-based screening level
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SI	site inspection
SVOC	semivolatile organic compound
TRV	toxicity reference value
UTL	upper tolerance limit
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound

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RECORD OF DECISION TO ADDRESS SURFACE WATER AND SEDIMENT AT OPERABLE UNIT 51 ENVIRONMENTAL RESTORATION PROGRAM SITE SS-63 LANGLEY AIR FORCE BASE, VIRGINIA AUGUST 2008

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Operable Unit 51 (OU51), Environmental Restoration Program (ERP) Site SS-63
Langley Air Force Base (AFB), Virginia
EPA ID No. VA2800005033

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the Selected Remedy for addressing surface water and sediment at OU51 (ERP Site SS-63) at Langley AFB in Hampton, Virginia. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the information contained in the Administrative Record file for the Site, and this ROD will become part of the Administrative Record.

The U.S. Air Force is the lead agency and provides funding for site clean-up activities at Langley AFB. The U.S. Air Force and U.S. Environmental Protection Agency (EPA) Region III have co-selected the remedy presented in this ROD. The Virginia Department of Environmental Quality (VDEQ) concurs with the Selected Remedy.

1.3 ASSESSMENT OF THE SITE

OU51 is one of the 24 ERP OUs identified under CERCLA at Langley AFB. ERP Site SS-63 encompasses surface water and sediment in the Back River system along the shoreline of Langley AFB. The Back River is a tidal estuary that discharges into the Chesapeake Bay. Previous investigations identified two areas of ERP Site SS-63 that showed elevated concentrations of chemicals in sediment. These investigations did not identify chemical constituents in surface water at concentrations that pose a threat to human health or the environment. The first area (approximately 2-acres) identified was the Lighter-than-Air (LTA) Cove, located along the Northwest Branch Back River. The Site is adjacent to the former trap and skeet ranges at OU34 (ERP Site LF-17), which has resulted in lead pellet deposition and contaminant impacts similar to those observed at ERP Site LF-17. Langley AFB determined that lead-contaminated sediment within the LTA Cove area would likely

require the same or similar treatment methods as the soils characterized with lead contamination at ERP Site LF-17. Accordingly, Langley AFB, in consultation with EPA and VDEQ, decided that remedial action in the ERP Site SS-63 LTA Cove would be conducted concurrent with remediation at ERP Site LF-17. Based on this administrative decision, the LTA Cove portion of ERP Site SS-63 is addressed in the ROD for OU34 (ERP Site LF-17) (HydroGeoLogic, Inc. [HGL], 2007a).

The second area requiring remediation is located along the Langley AFB shoreline of the Southwest Branch of the Back River. This area contains elevated concentrations of polychlorinated biphenyls (PCBs) and polychlorinated terphenyls (PCTs) that pose a potential threat to human health and the environment. The response action presented in this ROD for the Back River along the Langley AFB shoreline is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 DESCRIPTION OF THE SELECTED REMEDY

The Selected Remedy for ERP Site SS-63, excluding the LTA Cove portion, addresses the medium of concern (sediment in the Southwest Branch) and comprises the final remedial action for this Site. The major components of the Selected Remedy include the following:

- Construction of temporary dams to isolate and dewater the contaminated areas.
- Dry excavation of sediment using conventional earthmoving equipment (e.g., backhoe) and transfer to an on-shore staging area.
- Containment and treatment of decant water from the sediment on shore.
- Off-site disposal of contaminated sediment.

The active remedy (dry excavation with off-site disposal) was selected to address human health risks associated with the indirect exposure of potential receptors to the site-related contaminants of concern (COCs) in sediment at the Southwest Branch portion of ERP Site SS-63. Once the remedial action is complete, all site-related COCs in sediment would be removed to a concentration that would allow for unlimited use and unrestricted exposure at the Site under this CERCLA action. The use of the term unlimited use and unrestricted exposure in this ROD does not supersede the existing Virginia Department of Health condemnations or advisories pertaining to shellfishing, fishing, or recreation in the Back River and several of its tributaries including the Northwest Branch and Southwest Branch.

1.5 STATUTORY DETERMINATIONS

The Selected Remedy for ERP Site SS-63 is protective of human health and the environment and complies with federal and state regulations that are applicable or relevant and appropriate to the remedial action, are cost-effective, and utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. In addition, the Selected Remedy attains the mandates of CERCLA Section 121, and to the extent

practicable, the regulatory requirements of the NCP. The remedy for this OU does not satisfy the CERCLA statutory preference for treatment as a principal element for the remedy (40 Code of Federal Regulations [CFR] 300.430(a)(1)(iii)(A)). However, this element is not required because there are no principal threat wastes located at the site. Because the Selected Remedy will not result in site-related pollutants or contaminants remaining on-site above levels that would pose unacceptable risk to human health or the environment, a 5-year review will not be required for this remedial action.

1.6 DATA CERTIFICATION CHECKLIST

The following information is included in the ROD. Additional information can be found in the Administrative Record file for Langley AFB.

- Chemicals of potential concern (COPCs) and chemicals of potential ecological concern (COPECs) and their respective concentrations (Section 2.7 and associated tables).
- Baseline risk represented by the COPCs and COPECs (Section 2.7).
- Current and reasonably anticipated future land and resource use (Section 2.6).
- Potential land use that will be available at the Site as a result of the Selected Remedy (Section 2.12.1.4).
- Estimated capital costs, annual maintenance and performance costs, and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (Section 2.12.1.3; Table 2.19).
- Key factors that led to selecting the remedy and how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria (Section 2.12.1.1).
- Sediment cleanup goals established for COCs and the basis for those goals (Section 2.8).

1.7 AUTHORIZING SIGNATURES

Timothy A Byers — 18 AUG 08

TIMOTHY A. BYERS — Date
Brigadier General, USAF
Director of Installations and Mission Support (A7)

K. Hoke Sessoms for — 9/3/08

JAMES J. BURKE, Director — Date
Hazardous Site Cleanup Division
EPA Region III

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

Langley AFB is located near Hampton, Virginia, between the Northwest Branch and the Southwest Branch of the Back River, a tidal estuary of the Chesapeake Bay. The location of Langley AFB is shown on Figure 2.1. The site layout of ERP Site SS-63, which includes portions of the Back River and its tributaries, is shown on Figure 2.2. Langley AFB was listed jointly on the Superfund National Priorities List with the National Aeronautics and Space Administration (NASA) Langley Research Center in 1994 (EPA ID: VA2800005033). However, the CERCLA investigations for these two facilities are conducted separately. Langley AFB investigations and site cleanups are funded by the U.S. Air Force while the NASA Langley Research Center investigations and site cleanups are funded by NASA. The U.S. Air Force is the lead agency and provides funding for site clean-up activities at Langley AFB. The U.S. Air Force and U.S. EPA Region III have co-selected the remedy presented in this ROD. The VDEQ concurs with the Selected Remedy.

ERP Site SS-63 is composed of areas in the Back River system along the shoreline of Langley AFB. The Back River is a tidal estuary that discharges into the Chesapeake Bay, as shown in Figure 2.2. The peninsula containing Langley AFB divides the main channel of the river into the Northwest Branch and the Southwest Branch. Brick Kiln Creek and Tabbs Creek are the primary tributaries to the Northwest Branch. Newmarket Creek and Tides Mill Creek are the main tributaries to the Southwest Branch. Large areas along the shoreline of the Back River and its tributaries consist of wetlands, including the Plum Tree Island National Wildlife Refuge, which is located along the north bank of the main channel near the mouth of the river. Beds of submerged aquatic vegetation are present near the shores of the main channel. These areas of wetland and submerged aquatic vegetation provide important nursery and feeding habitat for a variety of species of fish and shellfish.

2.2 SUMMARY OF STUDIES AND INVESTIGATIONS

The following subsections provide summaries of the investigations that have been conducted to address surface water and sediment at ERP Site SS-63. There have been no CERCLA enforcement activities at Langley AFB.

2.2.1 Non-CERCLA Investigations

This section summarizes the non-CERCLA investigations that have been conducted for ERP Site SS-63.

2.2.1.1 Fish and Wildlife Report Summary for Langley AFB (U.S. Fish and Wildlife Service, 1993)

In 1993, a study was conducted by the U.S. Fish and Wildlife Service in response to a 1987 study that identified the presence of polynuclear aromatic hydrocarbons (PAHs) and PCTs in sediments near outfalls to the Back River. The goal of the 1993 study was to identify the area

within the Back River affected by contaminants, to assess the extent of contamination in the food chain, and to determine toxicity of sediments in areas with PCT concentrations. Sediment and biota samples were collected and analyzed for PCTs, PAHs, and metals. In addition, sediment samples were used in bioassays to assess toxicity. Areas of PCT, PAH, and metals (silver, chromium, zinc, copper, mercury, nickel, and lead) contamination were identified. The highest PCT concentrations in sediment were observed in samples collected from Tabbs Creek and from the vicinity of Outfall 4 (current Outfall 7) (Figure 2.3) in the Southwest Branch of the Back River. PCTs were detected in some of the biota samples. Based on the bioassay results, the study concluded that none of the sample locations could be considered critically contaminated (i.e., survival of organisms was depressed, but reproduction was still possible).

2.2.1.2 Water Quality Assessment of the Back River (CH2M Hill, 1997)

In 1997, a Draft Water Quality Assessment of the Back River was prepared in support of natural resources compliance programs at Langley AFB. This study included collection of 23 co-located surface water and sediment samples and biota samples (6 locations) throughout the estuary. Sediment, surface water, and biota samples were analyzed for semivolatile organic compounds (SVOCs), PCBs, PCTs, pesticides, and selected metals. The study concluded that PCTs and some metals were present at higher concentrations in the Northwest Branch and the Southwest Branch of the Back River as compared to the main channel.

2.2.2 Preliminary Assessment/Site Inspection Report (Radian, 1999)

In 1998, a Preliminary Assessment/Site Inspection (PA/SI) was conducted for the Back River to characterize better the concentrations of chemicals in river sediment and to assess the potential impact of these chemicals on ecological receptors. This study included collection and analysis of sediment samples, as well as modeling contributions from surface water discharge and groundwater discharge to contaminant loading in the Back River. The sediment data showed higher chemical concentrations in sediments of the Northwest Branch and the Southwest Branch of the Back River as compared to the main channel. The report included a screening-level ecological risk assessment (SLERA) and a qualitative human health risk assessment (HHRA). The results of these assessments indicated an additional assessment of ecological effects was warranted, and that a baseline ecological risk assessment (ERA) should be performed. The PA/SI recommended preparation of a remedial investigation/feasibility study (RI/FS) for the Back River.

2.2.3 Remedial Investigation Report (URS Corporation, 2003)

An RI was conducted in 2000 to further characterize potential contamination identified during previous investigations, conduct a baseline ERA and HHRA, and to evaluate potential impacts to the Back River from Langley AFB ERP sites situated along the shoreline (Figure 2.3). The RI included the following sampling: collection of 30 sediment samples for chemical analysis (metals, cyanide, pesticides, PCBs, PCTs, chlorinated herbicides, SVOCs, and volatile organic compounds [VOCs]); collection of 20 sediment samples for benthic invertebrate identification and enumeration; collection of 10 sediment samples for toxicity testing;

collection of 10 surface water samples for chemical analysis (metals, cyanide, pesticides, PCBs, PCTs, chlorinated herbicides, SVOCs, and VOCs); collection of biota (sport fish, killifish, bivalves, and crabs) samples for chemical analysis (metals, cyanide, pesticides, PCBs, PCTs, chlorinated herbicides, and SVOCs); and pathologic examination of fish from select locations.

Based on the RI data, two areas with elevated concentrations of chemicals were identified: LTA Cove and the shoreline of the Southwest Branch of the Back River. As previously mentioned, this ROD does not address sediment within the LTA Cove portion of ERP Site SS-63. The LTA Cove portion of ERP Site SS-63 is addressed in the ROD for ERP Site LF-17.

Along the Langley AFB shoreline of the Southwest Branch of the Back River, sediment samples collected from the vicinity of Outfall 4 (current Outfall 7 [Figure 2.3]) were characterized by elevated PCB/PCT concentrations. The PCBs/PCTs observed in sediment samples from the Southwest Branch of the Back River originated from a release in the 1980s at an electrical substation that was transported through the Langley AFB storm sewer system and discharged at Outfall 4 (current Outfall 7). The cause of the release was corrected by Langley AFB, and the impacted section of the storm sewer system was decontaminated in 1996.

As described in Section 2.7, the RI included a quantitative HHRA and ERA to evaluate potential threats from chemicals in the Back River sediment and surface water. For human health, there are no unacceptable risks associated with direct exposure to surface water or sediment. The only exposure pathway that posed an unacceptable risk was indirect exposure to chemicals in the sediment through consumption of fish, bivalves, and crabs (fish being the primary exposure route) that had accumulated sediment contaminants in their tissues. The contaminants that were associated with unacceptable health risks were PCBs and PCTs. The ERA concluded that chemicals in ERP Site SS-63 sediment and surface water were not adversely affecting ecological receptors. The RI recommended preparation of a FS to evaluate possible remedial alternatives to address the contaminated sediment.

2.2.4 2004 Back River Sediment Sampling (URS Corporation, 2004)

In July and August 2004, sediment samples were collected along the Southwest Branch to determine whether the PCB/PCT contamination detected in 2000 during the RI had migrated as a result of Hurricane Isabel (which struck Langley AFB in September 2003) and to refine the estimated cost for the potential remedial action. For this investigation, samples were collected from 118 locations in the Southwest Branch of the Back River and analyzed for PCBs and PCTs.

Generally, the 2004 samples were characterized by lower concentrations of PCBs/PCTs than observed during previous sampling efforts. Relatively high concentrations (i.e., greater than 1 milligram per kilogram [mg/kg]) of PCBs/PCTs were detected in the general vicinity of Outfall 4 (current Outfall 7) and Outfall 6. The highest concentration of total PCBs/PCTs (15.2 mg/kg) was detected adjacent to a jet fuel unloading facility north of Outfall 4 (Figure 2.3).

2.2.5 Feasibility Study (HydroGeoLogic, 2006)

Following completion of the RI, an FS was conducted to evaluate, screen, and develop remedial alternatives for ERP Site SS-63. During the FS, remedial objectives were identified and alternatives were developed to address risks to human health and the environment posed by the PCB/PCT contaminated sediment. The following alternatives were evaluated to address the contaminated sediment at the Southwest Branch:

- Alternative No. 1 – No action (Natural Recovery)
- Alternative No. 2 – Manage waste in place – Monitoring
- Alternative No. 3 – Mechanical dredging with off-site disposal
- Alternative No. 4 – Dry excavation with off-site disposal of impacted sediment
- Alternative No. 5 – Capping impacted sediment

A detailed and comparative analysis was performed on the remedial alternatives developed for ERP Site SS-63. Both analyses evaluated the alternatives with respect to the nine criteria outlined in Section 300.430 (e) of the NCP and CERCLA Section 121. In the detailed analysis, the acceptability and performance of each alternative against the criteria were evaluated individually (without consideration of other alternatives) so that relative strengths and weaknesses could be identified. The comparative analysis evaluated the performance of each remedial alternative relative to one another to identify its advantages and disadvantages. Alternative Nos. 1 and 2 were determined not to be protective of human health. Alternative Nos. 3, 4, and 5 were determined to be protective of human health and feasible.

2.2.6 Proposed Plan (HydroGeoLogic, 2007b)

Pursuant to CERCLA Section 117 (42 U.S.C. Section 9617) and the NCP at 40 CFR 300.430(f)(2), Langley AFB issued a Proposed Plan for ERP Site SS-63 in December 2007. The Proposed Plan identified the Preferred Alternative, Dry Excavation with Off-site Disposal, for addressing the PCB/PCT contaminated sediment at the Southwest Branch portion of ERP Site SS-63. The U.S. Air Force issued a public notice of availability, provided a public comment period, and held a public meeting as required by the NCP (see Section 2.3). No significant changes were made to the preferred remedial action alternative identified in the Proposed Plan as a result of the public meeting and comment period.

2.3 COMMUNITY PARTICIPATION

The U.S. Air Force and EPA provide information regarding the cleanup of Langley AFB to the public through the community relations program, which includes a Restoration Advisory Board (RAB), public meetings, the Administrative Record file for the Site, the information repository, and announcements published in local newspapers. The public participation activities were consistent with the requirements of CERCLA Sections 113(k)(2)(B)(i-v) and 117, 42 U.S.C. Sections 9613(k)(2)(B)(i-v) and 9617.

Langley AFB provided a public comment period from December 16, 2007 through January 15, 2008, for the Proposed Plan for ERP Site SS-63. To fulfill the public participation requirement under Section 117(a) of CERCLA, as amended by SARA, a Notice of Availability of the Proposed Plan and supporting documentation, the public comment period, and the public meeting was published in the *Daily Press* (Newport News) newspaper. The public meeting to present the Proposed Plan was held on January 8, 2008, at the Machen Elementary School, located in Hampton, Virginia.

The Proposed Plan and previous investigation reports for ERP Site SS-63 are available to the public in the Administrative Record maintained at:

Langley AFB
37 Sweeney Boulevard
Langley AFB, Virginia 23665
By Appointment
Mr. John Tice
(757) 764-1082

2.4 SCOPE AND ROLE OF THE RESPONSE ACTION

The U.S. Air Force has organized work to date at Langley AFB into 24 OUs. The current CERCLA status and schedule of remedial actions for each OU is detailed in the Management Action Plan, which can be found in the information repository maintained at Langley AFB.

This ROD documents the rationale for the Selected Remedy to address the contaminated sediment at Southwest Branch portion of ERP Site SS-63. The LTA Cove portion of ERP Site SS-63 is addressed in the ROD for ERP Site LF-17. Surface water at ERP Site SS-63 does not present a risk to human health and the environment; therefore, no action is required for this medium. The Selected Remedy for ERP Site SS-63 will be the final CERCLA action for sediment at the Site. The general remedial objective at ERP Site SS-63 is to prevent current and future indirect exposure to the COCs in sediment through excavation and disposal of the contaminated material. Once the remedial action is complete, all site-related COCs in sediment would be removed to levels that would no longer present an unacceptable risk to human health or the environment.

2.5 SITE CHARACTERISTICS

Because historical accounts indicate that potentially hazardous materials were released from the Langley AFB storm sewer system, investigations were conducted at ERP Site SS-63 to determine the nature and extent of any potential contamination. The results of these investigations are summarized in Section 2.2. For further information, all of the documents summarized in Section 2.2, and in the site characterization discussion below, can be found in the associated Information Repository and Administrative Record files at the location provided in Section 2.3.

2.5.1 Conceptual Site Model

The source of contamination at ERP Site SS-63 is the PCB and PCT contaminated sediment at the Southwest Branch. The conceptual site models (CSMs) for human health (Figure 2.4) and ecological receptors (Figure 2.5) show potential exposure pathways for ERP Site SS-63. The baseline risk assessment (BLRA) and ERA and the subsequent remedial action objectives (RAOs) for ERP Site SS-63 (see Section 2.8) were based on these CSMs.

2.5.2 Site Overview

ERP Site SS-63 is composed of areas in the Back River system along the shoreline of Langley AFB. Langley AFB is located on a peninsula between the Northwest Branch and Southwest Branch of the Back River, which is a tidal estuary of the Chesapeake Bay. Along the shoreline within Langley AFB, which borders the Southwest Branch, development generally extends to, or near to, the riverbank although a narrow buffer of grassland is present in some locations. Langley AFB operations along the Southwest Branch include airfield and support facilities, research and development facilities, testing facilities, fuel docking and storage facilities, office and storage buildings, military housing, and the Langley AFB Marina.

Surface water and sediment contamination along the Langley AFB shoreline has resulted primarily from activities that occurred on land. Contaminants may have been transported to the river by point source discharges (collection of runoff and discharge through creeks, ditches or pipelines) and non-point source discharges (runoff directly into the river from the land surface) to surface water. Numerous storm water outfalls drain the land area occupied by Langley AFB and are potential conduits for contamination to the river. Other potential sources of contamination not related to Langley AFB include the NASA Langley Research Center, several marinas located along the shores of the Back River, and other developed areas along the tributaries that drain into the watershed. An additional potential source of contamination is discharge of contaminated groundwater from Langley AFB to the river. However, surface water and groundwater modeling studies performed as part of the PA/SI have indicated that groundwater discharge is not likely to contribute significantly to contamination in the Back River, given that groundwater discharge appears to be between 41 and 7,450 times less contaminated than the surface water discharge.

2.5.3 Sampling Strategy

A variety of sediment and biota samples were collected and analyzed to characterize the nature and extent of contamination and potential risks to human health and the environment at ERP Site SS-63 as part of the RI conducted in 2000 (URS, 2003). The RI sample locations are shown in Figure 2.6. The sampling strategy included conducting the following tasks:

- Collection of sediment samples from 30 locations for chemical analysis (metals, cyanide, pesticides, PCBs, PCTs, chlorinated herbicides, SVOCs, and VOCs).
- Collection of sediment samples from 20 locations for identification and enumeration of benthic macroinvertebrates.

- Collection of sediment samples from 10 locations for a solid-phase sediment toxicity test using *Leptocheirus plumulosus* (benthic invertebrate) and an elutriate toxicity test using *Mysodopsis bahia* (mysid shrimp).
- Collection of surface water samples (total and dissolved) at 10 locations for chemical analysis (metals, cyanide, pesticides, PCBs, PCTs, chlorinated herbicides, SVOCs, and VOCs).
- Collection of biota samples (sport fish from 10 locations; killifish and bivalves from 12 locations; and crabs [crabmeat and soft tissue] from 6 locations) for chemical analysis (metals, cyanide, pesticides, PCBs, PCTs, chlorinated herbicides, SVOCs, and VOCs).
- Pathologic examination of fish from selected locations.

In July and August 2004, sediment samples were collected along the Southwest Branch to determine whether the PCB/PCT contamination detected in 2000 during the ERP Site SS-63 RI (URS, 2003) had migrated as a result of Hurricane Isabel (which struck Langley AFB in September 2003) and to refine the estimated cost for the potential remedial action. For this investigation, samples were collected from 118 locations in the Southwest Branch of the Back River and analyzed for PCBs and PCTs (URS, 2004). These sample locations are provided in Figures 2.7 and 2.8.

2.5.4 Nature of Contamination and Potential Routes of Migration

This section discusses the nature of contamination and the potential routes of migration based on the data collected during the ERP Site SS-63 RI and July/August 2004 sampling event. To focus discussion on significant analytical results, this section discusses the results for compounds present at concentrations greater than the matrix-specific background upper tolerance limits (UTLs) (Radian, 1997) and/or human health Risk-Based Screening Levels (RBSLs). This section does not discuss the nature of contamination associated with the LTA Cove portion of ERP Site SS-63 because it is addressed in the ROD for ERP Site LF-17.

2.5.4.1 Sediment

Samples collected adjacent to Outfall 4 (current Outfall 7) in the Southwest Branch contained maximum concentrations for many of the organics detected during the ERP Site SS-63 RI (i.e., PAHs, PCBs/PCTs, and pesticides), which also frequently exceeded evaluation criteria. Sediment sample locations around Outfall 4 (current Outfall 7) include SD-10, SD-11, SD-12, TOX-05, TOX-06, and TOX-07. Sediment sampling results are provided in Table 2.1. The next most contaminated location for organics was along the Southwest Branch between the marina and Tide Mill Creek (samples SD-14, SD-15, SD-16, SD-17, and SD-18). Samples collected from the Northwest Branch generally had lower frequency of detection and lower concentrations of organics than samples collected from the Southwest Branch.

Sediment samples collected in July/August 2004 generally had lower concentrations of PCBs/PCTs than those detected during the RI sampling effort. Relatively high concentrations

of PCBs/PCTs were again detected in the general vicinity of Outfall 4 (current Outfall 7). The highest concentration of total PCBs/PCTs (15.2 mg/kg) was detected adjacent to a jet fuel unloading facility north of Outfall 4. Samples from four locations along the Southwest Branch were also analyzed for an expanded list of 52 PCB/PCT congeners. It was noted that 9 out of 13 dioxin-like PCB congeners were detected in sediment from these locations. The sample results for total PCBs/PCTs are provided in Figures 2.7 and 2.8 and in Tables 2.2 and 2.3.

Aluminum, arsenic, chromium, and iron were the most prevalent inorganics exceeding human health criteria from sample locations along the Northwest Branch and Southwest Branch. The higher concentrations of aluminum and chromium were generally detected near Outfall 4 (current Outfall 7) at sample locations SD-10, SD-11, SD-12, TOX-05, TOX-06, and TOX-07. Arsenic concentrations were generally higher at sample locations SD-17 and TOX-09 located near Tide Mill Creek. Iron concentrations were generally higher at sample locations in the Southwest Branch than in the Northwest Branch.

2.5.4.2 Benthic Macroinvertebrate Community Structure

The results of benthic invertebrate identification and enumeration are provided in Table 2.4. Information from this effort did not provide indications of stress due to chemicals in the sediment. Samples from some locations had somewhat lower richness and diversity than others, but these differences were moderate and appeared to be more closely associated with the physical characteristics of the sediment at the sample locations than with the sediment chemistry. Community structure in sediment from some of the more contaminated locations appeared to be healthy based on the community structure analysis, and there was no apparent correlation between sediment chemistry and benthic community structure. These findings were consistent with the results of similar analyses performed as part of the PA/SI for the Back River and indicate that the concentrations of chemicals in the sediment are not high enough to cause disruption of the structure of the benthic macroinvertebrate community.

2.5.4.3 Sediment Toxicity Testing

Toxicity tests using sediment from the Back River and the benthic invertebrate *Leptocheirus plumulosus* did not provide any indication of sediment toxicity. Elutriate toxicity tests using *Mysodopsis bahia* (mysid shrimp) were performed using sediment from the same 10 locations. Results of the elutriate toxicity testing is provided in Table 2.5. One of the 10 samples had a survival rate that was statistically different (lower) than the rate observed in the laboratory control. This sample was not collected from a location where a release of chemicals is known to have occurred. For the endpoint of fecundity (reproductive potential), statistical analysis indicated that there were no differences between any of the Back River samples and the laboratory control. For the endpoint measuring growth, as determined by the weight of the mysid shrimp at the end of the test, statistical analysis indicated that growth of the shrimp was slightly repressed in several samples from the Southwest Branch of the Back River. The repressed growth indicated by these results did not correlate with sediment chemistry at these locations; therefore, a correlation analysis was not performed.

2.5.4.4 Surface Water

Surface water sampling results are provided on Table 2.6. All surface water samples generally had low concentrations of pesticides and inorganics. The results for one or more pesticides exceeded ambient water quality criteria in several samples, including sample SW-04, which was collected near Plum Tree Island National Wildlife Refuge and used as a qualitative reference location. The widespread detection of low levels of pesticides may be due to the normal application of pesticides by base and off-base sources to control mosquitoes and other pests. Several inorganics also exceeded the screening criteria, and SW-04 had the most frequent detection of inorganics that exceeded these criteria.

2.5.4.5 Sport Fish

Ten sport fish samples (i.e., croaker and spot) were collected from various locations in the Northwest Branch and Southwest Branch of the Back River. Results of analysis of these samples are provided in Table 2.7. All the samples contained pesticides and PCBs; PCTs were detected in one sample from the Northwest Branch and in five samples from the Southwest Branch. Sample BIO-05, located between ERP Site WP-02 and Outfall 4 (current Outfall 7), had the highest concentrations of PCBs and PCTs for all sport fish samples. Sample BIO-06, located near Outfall 4 (current Outfall 7), had the second highest PCB/PCT concentration. Arsenic was detected in all samples except for BIO-03, which was the reference location. While chemicals detected in some samples exceeded EPA Region 3 RBSLs (appropriate screening levels for this investigation), Food and Drug Administration (FDA) action levels were not exceeded in any sample.

Bioaccumulation of pesticides, PCBs, and PCTs is occurring in the sport fish. Because sport fish have a large territorial range extending well beyond the Back River, it is difficult to determine how much of the contamination is being contributed from sources other than the Back River and Langley AFB.

2.5.4.6 Crab Sampling

Results of analysis of crab meat and tissue are provided in Table 2.8. The most prevalent elevated chemical concentrations in crabs were from pesticides, PCBs, and arsenic. PCBs were detected in only three samples, which were meat only, while pesticides and arsenic were detected in all meat and total tissue samples. PCTs were not detected in any of the samples. As with the fish samples, the crab samples indicate bioaccumulation of pesticides and PCBs based on higher levels detected in tissue compared to the levels in sediment and surface water samples. However, it is difficult to determine the level of contamination in crabs contributed by sources in the Back River because crabs can have a territorial range extending beyond the Back River estuary.

2.5.4.7 Small Fish

Fundulus (i.e., killifish) were sampled due to their limited territory, and the results would reflect possible contamination from nearby sources. Analytical results for the killifish samples

are provided in Table 2.9. Based on analytical results, PCBs, pesticides, and several inorganics are bioaccumulating within the fish tissue. Analytical results show PCB levels in the fish exceeding EPA Region 3 Fish RBSLs in all samples. The highest concentration of PCBs was detected in sample BIO-9, located near Site LF-05. The second highest PCB concentration was detected in sample BIO-6, which is located near Outfall 4 (current Outfall 7). The pesticides 4,4′-DDD and 4,4′-DDE were detected in all samples at levels exceeding fish RBSLs except for sample location BIO-03, which is the reference location. Several other organics exceeded fish RBSLs in the samples as well. For inorganics, arsenic was detected in all samples with maximum concentration at BIO-03, the reference location. None of the detected concentrations exceeded the FDA action levels for any chemical.

When chemical concentrations in the fish tissue are compared with sediment and surface water samples from their respective locations, the concentrations of pesticides and PCBs are higher in the fish tissue in most cases. Arsenic levels in fish are near that of sediment and higher than surface water levels.

2.5.4.8 Bivalve

Samples from sessile (immobile) organisms, such as oysters and mussels, can reflect contamination levels that may be attributable to nearby sources. Results of analysis of bivalve samples are provided in Table 2.10. The bivalve samples collected from the Back River generally showed elevated levels of bioaccumulative chemicals, which include pesticides, PCBs, and arsenic. PCTs were detected at six locations in both branches of the river at approximately similar concentrations; the highest concentration was at BIO-06 near Outfall 4 (current Outfall 7). PAHs were detected at elevated levels from sample location BIO-04, which is located near a fuel dock that may be contributing to the elevated levels of PAHs.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land use in the Back River watershed (which includes ERP Site SS-63) is primarily a mixture of open space, woodlands, and residential and commercial development. The northern portion of the watershed, which drains into the Northwest Branch, is primarily woodlands, open space and residential. The southern portion of the watershed, which drains to the Southwest Branch, is developed with mostly residential and commercial land use. Portions of Langley AFB are highly developed and support industrial operations. Other portions of the drainage area are intensively developed for residential use. The Back River itself is routinely used for recreational fishing and recreational boating. A less frequent use is training by the Langley AFB Sea Rescue Team. The U.S. Air Force has no plan to change its use of the existing resource in the foreseeable future.

2.7 SITE RISKS

A HHRA and ERA were completed to identify and characterize the current and potential future risks associated with ERP Site SS-63 if no remediation is implemented. The risk assessments provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action.

A detailed discussion of potential risks is provided in the ERP Site SS-63 RI Report (URS, 2003). The RI included both an HHRA and an ERA. The HHRA identified the other worker (Sea Rescue Team trainer), other recreation person (jet ski user), child fisher, and adult fisher as individuals who may be exposed to chemicals in Back River surface water or sediment. A child or adult fisher may be exposed to chemicals in the surface water while catching sport fish, crabs, or bivalves from the Back River. The sport fish, crabs, or bivalves may accumulate in their tissues chemicals present in the surface water or sediment. By eating these tissues, the adult fisher and child fisher may be exposed to the chemicals. The other worker and other recreation person may be exposed to chemicals in the surface water through incidental ingestion of and dermal contact with the water. For all potential human receptors, no complete pathway for direct exposure to sediment was identified.

Exposure scenarios evaluated in the ERA focused on aquatic pathways. Site SS-63 consists of portions of the Northwest Branch and Southwest Branch of the Back River. The shoreline of these water bodies along Langley AFB is generally developed with heaviest shoreline development occurring along the Southwest Branch. Substrate characteristics vary by location, but the substrate tends to be predominantly composed of fine-grained material. Sediment migration patterns are complex and are driven by tidal fluctuations and large storm events which cause significant erosion along the shoreline. Large pieces of concrete rubble have been placed along many portions of the shoreline to prevent erosion during these storm events. The presence of this debris decreases the quality of the aquatic habitat along the shoreline in these areas. Aquatic receptors considered in the ERA include benthic invertebrates, fish (Atlantic croakers), fish-eating birds (belted kingfisher), and carnivorous mammals (mink). These receptors could be exposed to chemicals in the near-shore sediment through direct contact with, or incidental ingestion of, sediment or ingestion of organisms that have accumulated chemicals in their tissue.

If no further action is taken, there are potential unacceptable human health risks associated with the indirect exposure to chemicals in the sediment through consumption of fish, bivalves, and crabs (fish being the primary exposure route) that have accumulated sediment contaminants in their tissues. There are no unacceptable human health risks associated with direct exposure to surface water or sediment. In addition, the ERA concluded that chemicals in ERP Site SS-63 sediment and surface water were not adversely affecting ecological receptors.

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

2.7.1 Human Health Risk Summary

2.7.1.1 Chemicals of Potential Concern

The initial screening of the data resulted in identification of a number COPCs for surface water, fish tissue, crab tissue, and bivalve tissue. The COPCs and their associated exposure point concentrations (EPCs) used to estimate the risk are provided in Appendix A.2 and A.3,

respectively. Surface water and tissue COPCs included metals, PAHs, pesticides, PCBs and PCTs. Detailed information for the selection of COPCs at ERP Site SS-63 is provided in Section 6.0 of the RI and Section 4.1 of the Bivalve HHRA Addendum in Appendix L of the RI (URS, 2003).

2.7.1.2 Exposure Assessment

The human health exposure assessment identifies and evaluates the contaminant sources, release mechanisms, exposure pathways, exposure routes, and receptors. The elements of the exposure assessment for ERP Site SS-63 are identified in the CSM (Figure 2.4). A detailed discussion of the exposure assessment for all the scenarios considered in the HHRA is provided in Section 6.2 of the RI Report and Section 4.2 of the Bivalve HHRA Addendum in Appendix L of the RI (URS, 2003). Estimates of risk were developed for ERP Site SS-63, evaluating exposure to surface water and animal tissue for the adult fisher, child fisher, other worker, and other recreational person:

- **Fisher** – Child and adult fishers could be exposed to chemicals in surface water while landing fish and crabs. These receptors would also be consumers of fish, crabs, and bivalves from the Back River who may be affected by chemicals present in the animal tissue originating from surface water or sediment.
- **Other Worker** – Sea team rescue trainer (chronic exposure to adult only). This individual is an adult who trains members of the sea rescue team, which practices maneuvers in the Back River. This receptor would be exposed directly to chemicals in the surface water.
- **Other Recreational Person –** Jet ski user (chronic exposure to adolescents [teens] only). This person would ride a jet ski in the Back River and be exposed to surface water. The other recreational person would most likely use the river only during the summer months.

2.7.1.3 Toxicity Assessment

The toxicity assessment provides a numerical estimate of the relationship between the extent of exposure and possible severity of adverse effects, and consists of two steps: hazard identification and dose-response assessment. Most toxicity data used in the HHRA are the EPA toxicity values (noncarcinogenic reference doses [RfDs] and carcinogenic slope factors [CSFs]) published in the Integrated Risk Information System and the Health Effects Assessment Summary Tables databases, or from the EPA's Superfund Technical Support Center of the National Center for Environmental Assessment (NCEA). Toxicity data used in risk evaluations are provided in Appendix A.5 (non-cancer) and Appendix A.6 (cancer). A detailed discussion of the toxicity assessment is provided in Section 6.3 and in Appendix G of the RI Report and in Section 4.3 of the Bivalve HHRA Addendum in Appendix L of the RI (URS, 2003).

2.7.1.4 Risk Characterization

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated using the following equation:

$$\text{Risk} = \text{CDI} \times \text{CSF}$$

where:

Risk = a unitless probability (e.g., 2×10^{-6}) of an individual's developing cancer

CDI = chronic daily intake averaged over 70 years (milligrams per kilogram of body weight per day [mg/kg-day])

CSF = carcinogenic slope factor, expressed as $(\text{mg/kg-day})^{-1}$

These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that an individual experiencing the reasonable maximum exposure (RME) estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. EPA's generally acceptable risk range for site-related exposures is 1×10^{-6} to 1×10^{-4}.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (i.e., lifetime) with an RfD derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An $HQ < 1$ indicates that a receptor's dose of a single contaminant does not exceed the threshold dose, and that toxic non-carcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all COPCs that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An $HI < 1$ indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An $HI > 1$ indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

$$\text{Non-cancer HQ} = \text{CDI/RfD}$$

Detailed risk characterization results are provided in Section 6.4 and in Appendix G of the RI Report and in Section 4.4 of the Bivalve HHRA Addendum in Appendix L of the RI (URS, 2003). Risk characterization summaries for total and site-related human health risks are presented in Tables 2.11 through 2.16 and discussed below:

- **Other Worker** – The RME cancer risk estimate for exposure (ingestion) to surface water was 2×10^{-7} (for both total and site-related risk), which is less than the lower end of the target risk range (1×10^{-6} to 1×10^{-4}). The total non-

cancer HI was 0.002 (for both total and site-related risk), which is less than the acceptable level of 1.

- **Other Recreational Person –** The RME cancer risk estimate for exposure (ingestion) to surface water as 2×10^{-7} (for both total and site-related risk), which is less than the lower end of the target risk range (1×10^{-6} to 1×10^{-4}). The total non-cancer HI was 0.008 (for both total and site-related risk), which is less than the acceptable level of 1.

- **Adult Fisher** – RME risk estimates for exposure (dermal contact and ingestion) to surface water and animal tissue (fish and crabs) resulted in cancer risk estimates of 1×10^{-8} and 8×10^{-4}, respectively. The RME risk estimate for exposure (ingestion) to bivalve tissue resulted in a cancer risk estimate of 3×10^{-4}. The risks associated with the ingestion pathway exceeded the acceptable risk levels. The total HIs for consumption of fish/crab tissue and exposure to surface water were 5 and 0.0001, respectively. The total HI for the consumption of bivalves was 2. The HIs for consumption exceed the acceptable level of 1. Based on site-related chemicals (i.e., not including background contributions), the adult fisher cancer risk (2×10^{-4}) and non-cancer HI (2) exceeded target levels for consumption of fish and crabs. For consumption of bivalves, the adult fisher cancer risk (6×10^{-5}) and non-cancer HI (1) did not exceed target levels. On a target organ basis, the HIs for the immune system, eyes, and nails exceeded 1. The risks and hazards were due almost entirely to PCBs and PCTs. The primary exposure route was consumption of fish tissue.

- **Child Fisher** – RME risk estimates for exposure (dermal contact and ingestion) to surface water and animal tissue (fish and crabs) resulted in cancer risk estimates of 4×10^{-9} and 2×10^{-4}, respectively. The RME risk estimate for exposure (ingestion) to bivalve tissue resulted in a cancer risk estimate of 7×10^{-5}. The risks associated with the ingestion pathway (fish and crabs) exceeded the acceptable risk levels. The total HI for consumption of fish/crab tissue and exposure to surface water was 6 and 0.0002, respectively. The total HI for the consumption of bivalves was 3. The HIs for consumption exceed the acceptable level of 1. Based on site-related chemicals (i.e., not including background contributions), the child fisher cancer risk (5×10^{-5}) was within the target risk range (10^{-6} to 10^{-4}), but the non-cancer HI (3) exceeded target levels for consumption of fish and crabs. For consumption of bivalves, the child fisher cancer risk (2×10^{-5}) and non-cancer HI (1) did not exceed target levels. On a target organ basis, the HIs for the immune system, eyes, and nails exceeded 1. The hazards were due almost entirely to PCBs. The primary exposure route was consumption of fish tissue.

The risk estimates summarized above are also presented in tabular form in Appendices A.7 through A.10.

In summary, direct exposure to chemicals in the surface water resulted in acceptable risks. The only exposure pathway that resulted in unacceptable risk was indirect exposure to

chemicals in sediment via accumulation in fish, bivalve, and crab tissue (fish being the primary exposure route) and subsequent consumption by humans.

2.7.1.5 Uncertainty

The risk measures used in risk assessments are not fully probabilistic estimates of risk, but are conditional estimates given that a set of assumptions about exposure and toxicity are realized. Thus, it is important to specify the assumptions and uncertainties inherent in the risk assessment to place the risk estimates in proper perspective. A detailed discussion of the uncertainties associated with the risk assessment is included in Section 6.5 of the RI Report and Section 4.6 of the Bivalve HHRA Addendum in Appendix L of the RI (URS, 2003).

2.7.2 Ecological Risk Summary

2.7.2.1 Chemicals of Potential Ecological Concern

To determine the COPEC for ERP Site SS-63, an ERA was performed using sediment data from both the PA/SI (Radian, 1999) and the RI (URS, 2003) as well as surface water and biota data obtained during the RI. Conservative input values were used during the ERA to calculate HQ values for detected chemicals for each of the receptors considered. The HQs were developed for ecological receptors by dividing maximum and average exposure levels by the No Observed Adverse Effects Levels (NOAELs) and the Lowest Observed Adverse Effects Levels (LOAELs). If the average concentration of a given chemical resulted in a LOAEL HQ greater than 1, then the chemical was identified as a COPEC and evaluated in greater detail. Otherwise, it was determined that the chemical did not pose a threat. The resulting COPECs that were retained for further evaluation are presented in Appendix A.11.

2.7.2.2 Exposure and Ecological Effects Assessment

ERP Site SS-63 consists of areas of sediment along the shoreline of Langley AFB. The Back River supports a wide variety of aquatic organisms and provides important breeding and nursing habitat for many species. The assessment endpoints for SS-63 were chosen based on available habitat and include aquatic benthic invertebrates, estuarine fish, piscivorous birds, and carnivorous mammals. These ecological receptors would have a high level of exposure to sediment. Benthic invertebrates receive continual exposure to sediment, while other ecological receptors are exposed directly to sediment through incidental ingestion or are indirectly exposed through ingestion of prey that may have accumulated chemicals in their tissue through exposure to sediment. Table 2.17 presents the ecological exposure pathways of concern for ERP Site SS-63, including receptors, exposure routes, and assessment and measurement endpoints.

The ecological exposure assessment evaluated the potential exposure pathways associated with the Site and developed the following list of potential receptors: benthic invertebrates (bivalves), Atlantic croaker (fish), belted kingfisher (bird), and mink.

2.7.2.3 Ecological Risk Characterization

To characterize potential ecological risks, HQs were determined for the COPECs and receptors. HQs were calculated by comparing maximum and mean site concentrations to the associated NOAEL and LOAEL:

NOAEL/LOAEL HQ = (Mean or Maximum Total Daily Dose)/(NOAEL or LOAEL)

For each receptor, the ERA calculated a maximum NOAEL HQ, a mean NOAEL HQ, a maximum LOAEL HQ, and a mean LOAEL HQ for each COPEC. If one of these four HQ values was less than 1, then the risk assessment concluded that the chemical had minimal potential to pose a risk to that particular receptor. Because LOAEL HQs are less than NOAEL HQs, the LOAEL HQs dictated whether a chemical was identified as having the potential to pose a risk to a given receptor. If a chemical was identified as posing a potential risk, then the risk assessment considered additional lines of evidence in order to characterize the potential risk.

For benthic invertebrates exposed to sediment, the mean concentrations of two SVOCs (anthracene and dibenzo[a,h]anthracene), one PCT, one PCB, and six pesticides resulted in LOAEL HQs greater than 1. These analytical results, which indicated the potential for adverse effects to benthic invertebrates, were not supported by indicators of actual stress (community structure analysis) or direct measurement of stress (toxicity testing). At 20 locations, the structure of the benthic macroinvertebrate community was assessed through identification and enumeration of benthic organisms. This analysis indicated that differences in richness and diversity among the sample locations were related to the physical characteristics of the sediment, not the sediment chemistry. Sediment toxicity testing was performed with two different organisms: an amphipod (*Leptocheirus plumulosus*) and a mysid shrimp (*Mysidopsis bahia*). There was no evidence of decreased survival due to exposure of *Leptocheirus plumulosis* to the site sediment. The mysid shrimp were tested for fecundity and growth in addition to survival. No adverse effects on fecundity were observed. While one sample did showed reduced survival, it was collected from an area of no known release. Five samples exhibited decreased mysid shrimp growth. The repressed growth indicated by these results did not correlate with sediment chemistry at these locations; therefore, a correlation analysis was not performed. Based on these additional lines of evidence, it was determined that chemicals in the sediment near Langley AFB are not adversely affecting the benthic invertebrate community in the Back River.

For Atlantic Croakers exposed to surface water and sediment, concentrations of 13 metals, 16 SVOCs, 7 pesticides, and 7 PCBs/PCTs resulted in mean LOAEL HQs greater than 1.0. As with the benthic invertebrates, the Atlantic Croaker HQs were evaluated in light of other indicators of stress to the fish community. Tissue analysis of sport fish and small fish indicated that SVOCs were not accumulating in fish tissue. Samples of large fish from two locations characterized by high chemical concentrations in sediment and from one reference location (i.e., not contaminated), were examined for signs of stress. During examination, specific attention was given to the tissues and organs typically affected by the chemicals detected in the tissue of the fish samples. Results of these examinations indicated that the fish

appeared to be healthy and did not exhibit any signs of stress or abnormalities. These additional lines of evidence indicate that fish are not adversely affected by chemicals in the site sediment or surface water.

For fish-eating birds (belted kingfisher), the mean concentrations of phenol and 2-(2-methyl-4-chlorophenoxy) propionic acid (MCPP) detected in fish tissue resulted in LOAEL HQs greater than 1. MCPP, which had the highest HQ value at 131, was detected in only one of the three dietary components (killifish) for the kingfisher. In addition, MCPP was detected in only one of the 12 samples of killifish tissue analyzed.

For semi-aquatic carnivorous mammals (mink), only dibenzofuran had a mean LOAEL HQ greater than 1. Dibenzofuran was detected in only one of 41 sediment samples.

These low frequencies of detection indicate that the HQs for MCPP and dibenzofuran may be overstating the actual risk to ecological receptors. In addition, calculation of the HQ values assumes that the kingfisher and the mink forage exclusively along the shoreline of Langley AFB. In reality, the actual foraging area may include areas that are not associated with Langley AFB or ERP Site SS-63. Based on these factors, it was determined that there was minimal potential for adverse effects to fish-eating birds and semi-aquatic carnivorous mammals exposed to surface water and sediment.

Additional ecological risk analysis was performed as part of the FS. To assess the potential for adverse effects to small fish (e.g., killifish, mummichogs), fish tissue concentrations of PCBs and PCTs were compared to a toxicity reference value (TRV) developed from data provided by EPA Region 3 Biological Technical Advisory Group. PCTs were not detected in the small fish tissue samples collected during the RI, and the maximum PCB concentration was less than the TRV. Based on this analysis, it was concluded that current concentrations of PCBs and PCTs in the Back River sediments do not pose an unacceptable threat to small fish.

2.7.2.4 Uncertainty

The results of the ERA are influenced to some degree by variability and uncertainty, which need to be considered when interpreting results. Major sources of uncertainty include natural variability, and incomplete knowledge of site-specific biological processes and fate and transport mechanisms. A detailed discussion of the uncertainties associated with the ERA is included in Section 7.5 of the RI Report (URS, 2003).

2.8 REMEDIAL ACTION OBJECTIVES

It is the current judgment of the U.S. Air Force and EPA Region III, in consultation with VDEQ, that the Selected Remedy is warranted to protect public health, welfare, and the environment from actual or threatened releases of hazardous substances in sediment at ERP Site SS-63. Based on the anticipated future use for the area and the findings as documented in the RI and FS Reports, including the results of the HHRA and ERA, site-specific RAOs were developed to address the sediment contamination at ERP Site SS-63.

Based on the HHRA and ERA, there are no unacceptable risks associated with direct exposure to surface water or sediment. The only exposure pathway that posed an unacceptable risk was indirect exposure to chemicals in the sediment through consumption of fish, bivalves, and crabs (fish being the primary exposure route) that had accumulated sediment contaminants in their tissues. The way to decrease PCB and PCT concentrations in tissue is to decrease their concentrations in the sediment. Accordingly, RAOs were developed to reduce the levels of PCBs and PCTs observed in site sediment to levels that minimize bioaccumulation of those contaminants by fish, bivalves, and crabs, the consumption of which pose unacceptable risks to human health.

The ERP Site SS-63 RAOs include the following:

- Eliminate indirect exposure to sediment containing PCBs/PCTs at concentrations that pose an incremental cancer risk greater than $1x10^{-4}$.
- Eliminate indirect exposure to sediment containing PCBs/PCTs at concentrations that pose a target organ HI greater than 1.

To achieve the above RAOs, specific remedial goals were developed for PCBs and PCTs in sediment that would be protective of individuals consuming fish, bivalves, and crabs (fish being the primary exposure route) caught at the Site. Section 3.0 of the FS details how remedial goals were calculated. The sediment concentrations determined to be protective of the range of adult/child fisher exposure scenarios are summarized below.

- Recreational Freshwater Angler (fish consumption is 1/2 of total seafood ingested) = 1.7 mg/kg total PCBs/PCTs
- Recreational Freshwater Angler (fish consumption is 1/3 of total seafood ingested) = 2.8 mg/kg total PCBs/PCTs
- Recreational Marine Angler (fish consumption is 1/2 of total seafood ingested) = 2.6 mg/kg total PCBs/PCTs
- Recreational Marine Angler (fish consumption is 1/3 of total seafood ingested) = 4.0 mg/kg total PCBs/PCTs

The remedial goal selected was 1.7 mg/kg total PCBs/PCTs in sediment, the concentration protective of the most conservative exposure scenario.

2.9 DESCRIPTION OF ALTERNATIVES

2.9.1 Remedial Alternatives

Remedial alternatives to address sediment at ERP Site SS-63 are detailed in the FS. The alternatives evaluated are:

- Alternative No. 1 – No Action (Natural Recovery)
- Alternative No. 2 – Manage Waste in Place - Monitoring
- Alternative No. 3 – Mechanical Dredging with Off-Site Disposal
- Alternative No. 4 – Dry Excavation with Off-Site Disposal
- Alternative No. 5 – Capping

2.9.1.1 Alternative No. 1 – No Action (Natural Recovery)

The No Action alternative is included in accordance with the NCP to serve as a baseline for comparison with other alternatives. Under the No Action alternative, ERP Site SS-63 would be left as is. There is no cost for this alternative, and the timeframe is unlimited.

2.9.1.2 Alternative No. 2 - Manage Waste in Place - Monitoring

This is a risk management alternative that involves leaving the contaminated sediment in place and collecting additional information over time to evaluate whether natural processes may contain, destroy, or otherwise reduce bioavailability of the contaminants. For example, natural deposition of sediment may result in development of a "cap" over areas of elevated PCB/PCT concentrations, decreasing the levels to which aquatic organisms are exposed, and thus decreasing potential bioaccumulation.

A long-term monitoring (LTM) program would be included as part of this alternative, which addresses PCB/PCT concentrations in sediment and biota in portions of the Southwest Branch. Monitoring would include annual sampling of sediment, shellfish, and killifish for PCBs/PCTs. After 5 years of monitoring, an evaluation would be made regarding whether additional monitoring needs to be performed or if the monitoring program can be terminated (i.e., PCB/PCT concentrations in sediment below the remediation goal).

For this alternative, the estimated present worth cost is $353,000. It would take an estimated 3 months to implement this alternative.

2.9.1.3 Alternative No. 3 - Mechanical Dredging with Off-Site Disposal

This alternative involves mechanical dredging and off-site disposal of sediment from portions of the Southwest Branch characterized by total PCB/PCT sediment concentrations above the remedial goal. With the remedial goal of 1.7 mg/kg total PCBs/PCTs and an assumed dredging depth of 1 foot, it is estimated that this alternative will remove 1,693 cubic yards of sediment from the Southwest Branch of the Back River. The proposed remediation areas are shown in Figure 2.9.

The mechanical dredging would be accomplished using an environmental clamshell dry dredge. This dredging technology is desirable because it does not require large volumes of water to transport sediment from the river bottom to the land. In addition, it has been shown to have high contaminant removal efficiencies, low sediment resuspension, and low overall

cost when compared to other dredging techniques. The dry dredge uses a boom-mounted, sealed clamshell bucket to remove sediment from the river bottom. This procedure occurs at low speed, which minimizes sediment resuspension and water quality degradation. Although mechanical dredging will disrupt the benthic habitat, this technique's impact will be less severe than the habitat disruption caused by hydraulic dredging. Sediment resuspension will be contained by use of one or more silt curtains, which will be installed to isolate the work areas from the rest of the Back River during dredging activities. Although these silt curtains may not completely eliminate the release of suspended material to other parts of the river, they will significantly reduce the magnitude of such releases.

A resuspension monitoring program would be developed for dredging activities at the Site. A performance standard would be developed for local disturbance and downstream transport of PCBs/PCTs and other critical water quality parameters. Based on the characterization results, the water would be managed in accordance with the substantive requirements of the Clean Water Act and the Virginia Pollution Discharge Elimination System Permit regulation. This approach would ensure compliance with water quality standards and provide a means of notifying the public in the event of a release.

The sediment removed by the sealed clamshell would be deposited into an on-board hopper or barge for transfer to an on-shore staging area. The only water removed during the dredging process is water naturally present in the sediment's pore spaces. Water that separates from the sediment would be containerized on shore and managed in accordance with the substantive requirements of the Clean Water Act and the Virginia Pollutant Discharge Elimination System Permit regulation.

Dredged and dewatered sediment would be characterized and disposed of in accordance with the Virginia Solid Waste Management regulations. The Southwest Branch dredged areas would not be backfilled. Natural processes would in time fill in the excavation areas.

If this alternative is implemented, the primary source of PCBs/PCTs in the sediment would be removed. The dredging alternative includes construction and operational monitoring during implementation operations. Monitoring requirements would include water quality monitoring at the dredge site, monitoring of dredging residuals, monitoring of decant treatment effluent, and potential evaluation of air quality during dredging, transport and disposal. The effectiveness of containment structures used during dredge operations would be evaluated by assessing suspended solids both inside and outside of the structure.

During implementation of this alternative, there would be potential for fine particles to be suspended and released from the dredging areas; therefore, LTM of post-dredging conditions would be conducted to ensure that the areas are not re-contaminated by disturbance of any residuals that may remain above cleanup levels. Monitoring would include annual sampling of sediment, shellfish, and killifish for PCBs/PCTs. Sample locations would be strategically located to provide data that are representative of conditions within the remediation areas. After 5 years of monitoring, an evaluation would be made regarding whether additional monitoring is required or if the monitoring program can be terminated.

For this alternative, the estimated present worth cost is $952,000. Operation and maintenance (O&M) costs associated with this alternative are $206,000 and remedial action costs are $746,000. It would take an estimated 6 months to implement this alternative.

2.9.1.4 Alternative No. 4 – Dry Excavation with Off-Site Disposal

This alternative involves dry excavation and disposal of sediment from portions of the Southwest Branch characterized as containing total PCB/PCT sediment concentrations above the remedial goal. With the remedial goal of 1.7 mg/kg total PCBs/PCTs, and an assumed dredging depth of 1 foot, it is estimated that this alternative would remove 1,693 cubic yards of sediment from the Southwest Branch of the Back River. The remediation areas are shown in Figure 2.9.

Dry excavation of the sediment would begin after the contaminated areas are isolated and dewatered (prior to dewatering, authorization from the VDEQ Tidewater Regional Office would be required). To accomplish this, temporary coffer dams would be constructed around the areas identified for remedial action. It is estimated that approximately 1,900 feet of dam would be required. The dams would be constructed with a minimum of 2 feet of freeboard to account for tidal fluctuations and storm events. Prior to installation of the coffer dams, pre-confirmation sediment samples would be collected and analyzed for PCBs/PCTs. These data would be used to confirm the lateral and vertical extent of the contamination above the remedial goal (1.7 mg/kg total PCBs/PCTs) and to assist in the placement of the dams.

After removal of standing water within the isolated areas, the sediment would be excavated using conventional earthmoving equipment (e.g., backhoe). The sediment would be deposited into a mobile hopper and transferred via conveyor belt to an on-shore staging area. The only water removed during the excavation process is water naturally present in the sediment's pore spaces. Water that separates from the sediment would be containerized on shore and managed in accordance with the substantive requirements of the Clean Water Act and the Virginia Pollutant Discharge Elimination System Permit regulation.

Excavated and dewatered sediment would be characterized and disposed of off-site in accordance with the Virginia Solid Waste Management regulations. The Southwest Branch dredged areas would not be backfilled. Natural processes would in time fill in the excavation areas.

If this alternative is implemented, PCBs/PCTs in Southwest Branch sediment above the remedial goal would be removed. Therefore, LTM of the post-excavation conditions would not be required because dry excavation of contaminated sediment is more complete and there are no contaminant losses through resuspension.

For this alternative, the estimated present worth capital cost is $821,000. There are no O&M costs. It would take an estimated 6 months to implement this alternative.

2.9.1.5 Alternative No. 5- Capping

This alternative involves installing a submerged cover system that creates a barrier to contaminant migration from the underlying sediments to the water column and to bioturbation. Capping would be performed across areas characterized by total PCB/PCT sediment concentrations greater than 1.7 mg/kg (Figure 2.9.). It is estimated that 45,700 square feet of sediment in the Southwest Branch would require capping.

Typical cap materials include soil, sand, gravel, cobbles, clay, geotextile fabrics, and combinations of these materials. Typical cap construction consists of a geotextile fabric overlying the contaminated sediment. A layer of sand, gravel, or similar material overlies the fabric. A second tier of geotextile fabric separates the sand or gravel from an overlying armor material, such as stone or cobble. The constructed thickness of a typical submerged cap is approximately two to three feet. If chosen as a final remedy, methods for cap construction and isolation of resuspended/displaced sediments would be designed and implemented consistent with current technology and standards such that secondary releases are minimized during and following construction.

Bathymetric survey maps and field observations indicate that the depth of the river bottom in near-shore portions of the Southwest Branch ranges from 0.5 feet (at the shore) to 4-5 feet (approximately 100 feet offshore). The shallow nature of the river in this area will restrict the vertical extent (i.e., thickness) of the submerged cap and would require that cap construction occur from the land. It is assumed that an installed cap must maintain some portion of the water column above it to encourage aquatic and benthic communities to reestablish themselves in the capped portion of the river. In order to facilitate this goal, the submerged cap in the Southwest Branch would consist of a geotextile fabric overlying the PCB/PCT-contaminated sediments. The geotextile fabric would be covered with 6 to 12 inches of cobble or quarried riprap stone to weigh down the fabric and armor the cap against storm events. Once in place, the geotextile portion of the cap would prevent sediment contaminated with PCBs/PCTs from reentering the water column and would prevent direct exposure of benthic organisms to the contaminated sediment. These measures would minimize the potential for accumulation of PCBs/PCTs in the tissues of bivalves, crabs, and receptors farther up the food chain (sport fish).

Land use controls (LUCs) would be implemented in the form of access restrictions to protect the cap integrity. A monitoring program would be implemented to annually inspect the submerged cap and verify its integrity. Monitoring would consist of physical inspection of the cap materials, in-place thickness, and sediment resuspension to verify that the stone armor material is remaining intact. Any detected damage would be promptly corrected to ensure continued protection. Additional LTM of cap integrity would include evaluation of recolonization, chemical and physical isolation, and possibly periodic integrity inspections following severe weather events. Cap maintenance needs would be evaluated based on periodic inspections.

In addition to the cap inspections, sediment and biota samples would be collected as part of the LTM program. Monitoring would include annual sampling of sediment, shellfish, and killifish

for PCBs/PCTs. After 5 years of monitoring, an evaluation would be made regarding whether to continue or to terminate the monitoring program.

For this alternative, the estimated present worth cost is $1,183,000. O&M costs associated with this alternative are $264,000 and remedial action costs are $919,000. It would take an estimated 6 months to implement this alternative.

2.9.2 Common Elements and Distinguishing Features

Neither Alternative No. 1 nor Alternative No. 2 includes an engineered action to prevent exposure. However, unlike Alternative No. 1, Alternative No. 2 provides monitoring to evaluate whether conditions are changing or remaining constant. Over time, natural processes may contain, destroy, or otherwise reduce bioavailability of the contaminants.

Alternative Nos. 3 and 4 involve the physical removal and off-site disposal of the contaminated sediment. Alternative No. 4 relies on dry excavation of the sediment, while Alternative No. 3 uses dredging. During dredging, there is potential for fine particles to be suspended and released from the dredging area to the rest of the Back River. For this reason, LTM of dredged sites is required. With the dry excavation, there is no potential for the fine particles to be suspended and migrate away from the Site during remedial activities. Therefore, LTM is not required for dry excavated areas. In summary, Alternative No. 3 would require LTM, while Alternative No. 4 would not.

Alternative No. 5 is the only remedial alternative to use a cap to minimize exposure of ecological receptors to the PCB and PCT contamination. Because the integrity of the cover could degrade with time, LTM is required for this alternative.

Alternative Nos. 3, 4, and 5 have similar implementation times, estimated to be approximately 6 months.

2.9.3 Expected Outcomes of Each Alternative

The U.S. Air Force currently has no planned alternate use for ERP Site SS-63 regardless of whether the contaminants are contained or removed. If Alternative No. 2 was implemented, no reduction in exposure to humans would result. If Alternative Nos. 3 and 4 were implemented, exposure would be controlled through off-site disposal of impacted sediment. If Alternative No. 5 were implemented, exposure would be controlled through containment; however, LUCs (e.g., monitoring of cap) would be required in the absence of additional action.

2.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

Nine criteria are used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. A comparative analysis of the alternatives against the nine evaluation criteria is discussed below and presented in Table 2.18.

2.10.1 Threshold Criteria

2.10.1.1 Overall Protection of Human Health and the Environment

Alternative No. 3 (Mechanical Dredging and Off-Site Disposal) and Alternative No. 4 (Dry Excavation with Off-Site Disposal) are the most protective of human health. Both alternatives effectively eliminate the primary source of PCBs/PCTs in the sediment in the Southwest Branch. Alternative No. 5 (Capping) protects human health by establishing a physical barrier to PCB/PCT contaminant bioaccumulation. Under Alternative No. 5, the sources of PCBs/PCTs are not removed, but are covered to minimize bioaccumulation by aquatic organisms.

Alternative No. 2 (Manage Waste in Place – Monitoring) is less protective than Alternative Nos. 3, 4, and 5 because it neither removes the source of PCBs/PCTs nor eliminates the exposure pathway. However, Alternative No. 2 manages the potential risk to human receptors from fish consumption by assessing reduction of PCB/PCT bioavailability through natural processes. Although this alternative provides no reduction of volume, mobility, or toxicity of the contaminants, it would allow an evaluation to be made of whether PCBs/PCTs are moving up the food chain to higher trophic levels.

Alternative No. 1 (No Action) is not protective of human health or the environment and does not manage the potential risk for bioaccumulation. Alternative No. 1 is not considered further.

2.10.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative Nos. 2, 3, 4, and 5 would comply with Applicable or Relevant and Appropriate Requirements (ARARs). During implementation of Alternative Nos. 3, 4, and 5, control measures would be implemented to minimize the potential for short-term water quality degradation attributable to resuspension of affected sediments. Wetland and floodplain issues would be considered and mitigated, as needed, in accordance with the conditions of the Clean Water Act 404 permit and Clean Water Act 401 certification programs. The Virginia Board of Game and Inland Fisheries and the National Fish and Wildlife Service would be consulted, as needed, to ensure that impacts to listed and protected species are minimized.

2.10.2 Primary Balancing Criteria

2.10.2.1 Long-Term Effectiveness and Performance

Alternative Nos. 3 and 4 would effectively and permanently eliminate the potential for bioaccumulation by eliminating sediment with PCBs/PCTs above cleanup goals. Alternative No. 4 would ensure the most complete removal of contaminated sediments and no contaminant losses through re-suspension; therefore, no LTM of post-excavation conditions would be required, while Alternative No. 3 would require LTM of sediment to ensure that the area is not re-contaminated by re-suspension of any residuals that may remain above cleanup levels.

Alternative No. 5 would prevent contaminant bioaccumulation by providing a physical barrier between the contamination and the aquatic organisms. However, Alternative 5 provides less long-term effectiveness than Alternative Nos. 3 and 4 because sediment containing PCB/PCT remains in place. A physical monitoring program would need to be implemented to inspect the submerged cap and verify its integrity. Any detected damage would need to be corrected promptly to ensure continued protection.

Alternative No. 2 would not address bioaccumulation in a direct or permanent manner but would allow the extent of bioaccumulation to be monitored. Alternative No. 2 would not be as effective as Alternative Nos. 3, 4, and 5.

2.10.2.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative Nos. 3 and 4 provide the greatest reduction in mobility, toxicity, and volume of PCBs/PCTs in sediment at the site through removal. Alternative No. 5 would reduce the mobility of contaminated sediments in the Southwest Branch. However, this alternative would not reduce contaminant toxicity or volume and would therefore rank lower than Alternative Nos. 3 and 4 with respect to these criteria.

Alternative No. 2 would not provide any reduction in contaminant toxicity, mobility, or volume.

2.10.2.3 Short-Term Effectiveness

Alternative No. 2 could be implemented immediately and would not result in any risk to the local community or the environment. A very low potential exists for exposure of workers involved in annual sediment and biota sampling events. This exposure potential is very limited and could be controlled by using approved methods for sample collection and analysis including implementation of a health and safety plan and use of appropriate personal protective equipment.

Alternative Nos. 3, 4, and 5 could be completed within a reasonable period of time. For these alternatives, any potential short-term risk to workers involved in implementation can be minimized if workers utilize appropriate personal protective equipment and adhere to health and safety protocols. There would be some degree of disruption to the local community, as transportation of materials would require additional heavy vehicle traffic, and portions of Back River would be temporarily closed to boating and fishing. The aquatic habitat in the areas being remediated would be affected during implementation; however, the effects are expected to be temporary.

2.10.2.4 Implementability

Alternative No. 2 could be readily implemented because the only action required would be annual monitoring at a limited number of locations.

Alternative Nos. 3 and 4 could be implemented using readily available equipment and contractors; however, shallow water may increase the difficulty of execution of clamshell dredging in Alternative No. 3.

Alternative No. 5 could be implemented using readily available equipment and contractors; however, shallow water would restrict the vertical extent (i.e., thickness) of the submerged cap in Alternative No. 5, requiring that cap construction occur from the land. Implementation of the access restrictions associated with Alternative No. 5 may be difficult because the restricted area is not under the control of Langley AFB.

All of the active remedial alternatives would require staging of personnel and equipment in portions of Langley AFB along the Back River shoreline. The technologies to be used to perform the action are well proven and could be successfully implemented with relative ease.

2.10.2.5 Cost

The estimated cost of Alternative No. 2 is $353,000. Of the remaining alternatives, which entail active remedial actions, Alternative No. 4 is the least expensive option on an estimated present-worth basis ($821,000). Alternative No. 3 is the next estimated least costly option ($952,000), and Alternative No. 5 is estimated as the most expensive option ($1,183,000) on a present-worth basis.

2.10.3 Modifying Criteria

2.10.3.1 State Acceptance

State involvement has been solicited throughout the CERCLA process and remedy selection. The VDEQ as the designated state support agency in Virginia has reviewed this ROD and concurs with the Selected Remedy.

2.10.3.2 Community Acceptance

A public meeting was held on January 8, 2008, to present the Proposed Plan for ERP Site SS-63 and answer any questions on the Proposed Plan and on the documents in the information repository. There were no questions or concerns raised at the meeting. No written comments, concerns, or questions were received by the U.S. Air Force, the EPA, or the Commonwealth of Virginia during the public comment period for the Proposed Plan from December 16, 2007 through January 15, 2008.

2.11 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that USEPA will use treatment to address the principal threats posed by a site whenever practicable. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Historic data for Site ERP Site SS-63 indicated that the site received point and non-point source discharges from LAFB, but no principle threat wastes were identified during

previous investigations. Once the remedial action is complete, all site-related COCs in sediment would be removed to a concentration that would allow for unlimited use and unrestricted exposure at the Site under this CERCLA action. The use of the term unlimited use and unrestricted exposure in this ROD does not supersede the existing Virginia Department of Health condemnations or advisories pertaining to shellfishing, fishing, or recreation in the Back River and several of its tributaries including the Northwest Branch and Southwest Branch.

2.12 SELECTED REMEDY

This section presents the basis for the selection of the remedy, a description of the remedy, and the expected outcome of the remedy.

2.12.1 Selected Remedy

The Selected Remedy for the ERP Site SS-63 LTA Cove is dry excavation with off-site disposal. This remedy was identified as Alternative No. 4 in the FS (HGL, 2006).

2.12.1.1 Summary of the Rationale for the Selected Remedy

Based on the evaluation of the balancing criteria, the Selected Remedy for closure of ERP Site SS-63 is Alternative No. 4 - Dry Excavation with Off-Site Disposal. This remedy was selected over the other alternatives because it provides the best balance in order to achieve protection of human health and the environment and compliance with ARARs. The Selected Remedy provides a long-term effective and permanent solution for protection of human health and the environment at a reasonable cost. Implementation of the Selected Remedy will meet the RAOs listed in Section 2.8 of this ROD.

Based on current information, the U.S. Air Force, EPA, and VDEQ believe the Selected Remedy for ERP Site SS-63 is protective of human health and the environment, complies with ARARs, is a permanent, cost-effective remedy, and provides the best balance with respect to the nine evaluation criteria.

2.12.1.2 Description of the Selected Remedy

The Selected Remedy addresses the medium of concern (sediment in the Southwest Branch) and comprises the final CERCLA remedial action for the Site. ERP Site SS-63 surface water poses no risk to human health or the environment; therefore, no action is required. The U.S. Air Force is responsible for and shall implement, operate, maintain, monitor, review, and enforce the Selected Remedy in accordance with CERCLA and the NCP to ensure protection of human health and the environment for the duration of the remedy. Once the remedial action is complete, all site-related COCs in sediment would be removed to levels that would no longer present an unacceptable risk to human health or the environment.

2.12.1.2.1 Remedy Objectives

The objectives of the remedy are as follows:

- Eliminate indirect exposure to sediment containing PCBs/PCTs at concentrations that pose an incremental cancer risk greater than $1x10^{-4}$.
- Eliminate indirect exposure to sediment containing PCBs/PCTs at concentrations that pose a target organ HI greater than 1.

2.12.1.2.2 Remedy Implementation

Dry excavation of the sediment would begin after the contaminated areas shown on Figure 2.9 are isolated and dewatered (prior to dewatering, authorization from the VDEQ Tidewater Regional Office would be required). To accomplish this, temporary dams would be constructed around the areas identified for remedial action. It is estimated that approximately 1,900 feet of dam would be required. The dams would be constructed with a minimum of 2 feet of freeboard to account for tidal fluctuations and storm events. Based on a remedial goal of 1.7 mg/kg total PCBs/PCTs, the amount of sediment that would require removal is estimated to be 1,693 cubic yards.

After removal of standing water within the isolated areas, the sediment would be excavated using conventional earthmoving equipment (e.g., backhoe). The sediment would be deposited into a mobile hopper and transferred via conveyor belt to an on-shore staging area. The only water removed during the excavation process is water naturally present in the sediment's pore spaces. Water that separates from the sediment would be managed in accordance with the substantive requirements of the Clean Water Act and the Virginia Pollutant Discharge Elimination System Permit regulation. The decant water would be containerized on shore and, at a minimum, sampled for PCBs/PCTs, dissolved oxygen, pH, temperature, and total suspended solids. Based on the characterization results, the water would be treated as necessary and discharged back into the river.

Excavated and dewatered sediment would be characterized and disposed of off-site in accordance with the Virginia Solid Waste Management regulations. The Southwest Branch dredged areas would not be backfilled. Natural processes would in time fill in the excavation areas.

No LTM would be required subsequent to the removal action. The use of dry excavation would ensure that the remediated areas would not become re-contaminated due to suspension and deposition of contaminated particles. Once removal is complete, sediments remaining at the Site would no longer be contaminated at levels that pose an unacceptable risk to human health. Because the source of risk will have been eliminated by the removal action, LUCs under this ROD would not be required, although any existing Virginia Department of Health condemnations or advisories pertaining to shellfishing, fishing, or recreation in the Back River and several of its tributaries including the Northwest Branch and Southwest Branch would remain in effect.

2.12.1.3 Summary of the Estimated Selected Remedy Costs

The information in the attached cost estimates are based on the best available information regarding the anticipated scope of the Selected Remedy. Changes in the cost estimate may occur as a result of new information and data collected during development of the remedial design of the Selected Remedy. Major changes will be documented in the form of a memorandum in the Administrative Record file. This is an order of magnitude engineering cost estimate that is expected to be within +50 percent to -30 percent of the actual project costs.

The total present-worth costs are $821,000 for the Selected Remedy. The estimated costs for the Selected Remedy are detailed in Table 2.19. It would take an estimated 6 months to implement the Selected Remedy.

2.12.1.4 Expected Outcomes of the Selected Remedy

The Selected Remedy will meet the RAOs and site related contamination would be reduced to levels that would no longer present an unacceptable risk to human health or the environment. Because the source of risk will have been eliminated by the removal action, LTM and LUCs would not be required, although any existing Virginia Department of Health condemnations or advisories pertaining to shellfishing, fishing, or recreation in the Back River and several of its tributaries including the Northwest Branch and Southwest Branch would remain in effect. Attainment of RAOs at ERP Site SS-63 is expected to require 6 months.

2.13 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, the Selected Remedy must be protective of human health and the environment, comply with ARARs, be cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The following discussion summarizes the statutory requirements that are met by the Selected Remedy for sediment in the ERP Site SS-63 Southwest Branch.

2.13.1 Protection of Human Health and the Environment

The Selected Remedy is protective of human health and the environment by preventing exposure through removal and off-site disposal of PCB/PCT contaminated sediment. The Selected Remedy does not pose unacceptable short-term risk.

2.13.2 Compliance with Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria

The Selected Remedy will meet the Federal and State ARARs presented herein. There are no ARARs that the remedy will not meet. Federal and state ARARs are summarized by classification (chemical-specific, location-specific, and action-specific) in Appendix B.

2.13.3 Cost-Effectiveness

The Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness (40 CFR Section 300.430(f)(1)(ii)(D))." This determination was accomplished by evaluating the overall effectiveness of the alternatives that satisfied the threshold criteria. Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to represent a reasonable value for the money to be spent. The estimated present-worth cost of the Selected Remedy is $821,000. The Selected Remedy is cost-effective because it provides protection of human health and the environment in the shortest timeframe and at the lowest cost of those remedies that satisfy ARARs and RAOs.

2.13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The U.S. Air Force and EPA determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at ERP Site SS-63. VDEQ concurred with this determination. No principal threat wastes have been identified at the Site, and treatment of the contaminated sediment is not practicable in a cost-effective manner because of the large volume of waste. Since long-term effectiveness and permanence are achieved in the shortest timeframe with the Selected Remedy, the U.S. Air Force, EPA, and VDEQ determined that the Selected Remedy provides the best balance of tradeoffs in terms of the balancing criteria, while also considering the statutory preference.

2.13.5 Preference for Treatment as a Principle Element

The statutory preference for remedies that employ treatment as a principal element will not be satisfied at ERP Site SS-63. However, no principal threat wastes have been identified at ERP Site SS-63; therefore, the requirement for treatment as a principal element of the remedy is not applicable.

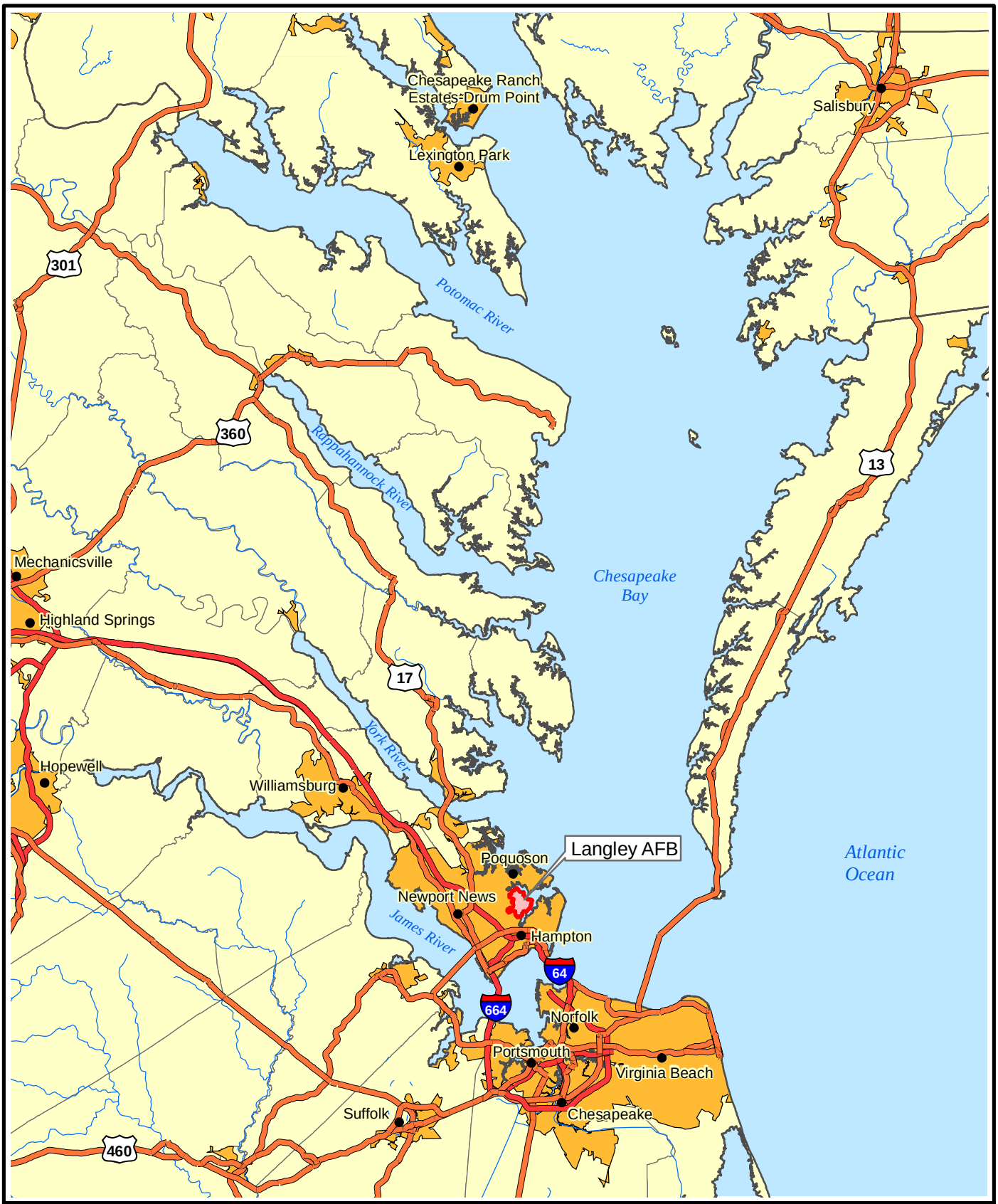
2.13.6 Five Year Review Requirements

Because the Selected Remedy will not result in site-related pollutants or contaminants remaining on-site above levels that would present an unacceptable risk to human health or the environment, a 5-year review will not be required for this remedial action.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for Operable Unit 51, ERP Site SS-63, at Langley AFB, Virginia, was released for public comment in December 2007. The Proposed Plan identified dry excavation with off-site disposal of sediment as the Preferred Alternative for remediation. No comments were received during the public comment period.

FIGURES



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HydroGeoLogic, Inc.
GIS Database, 2006

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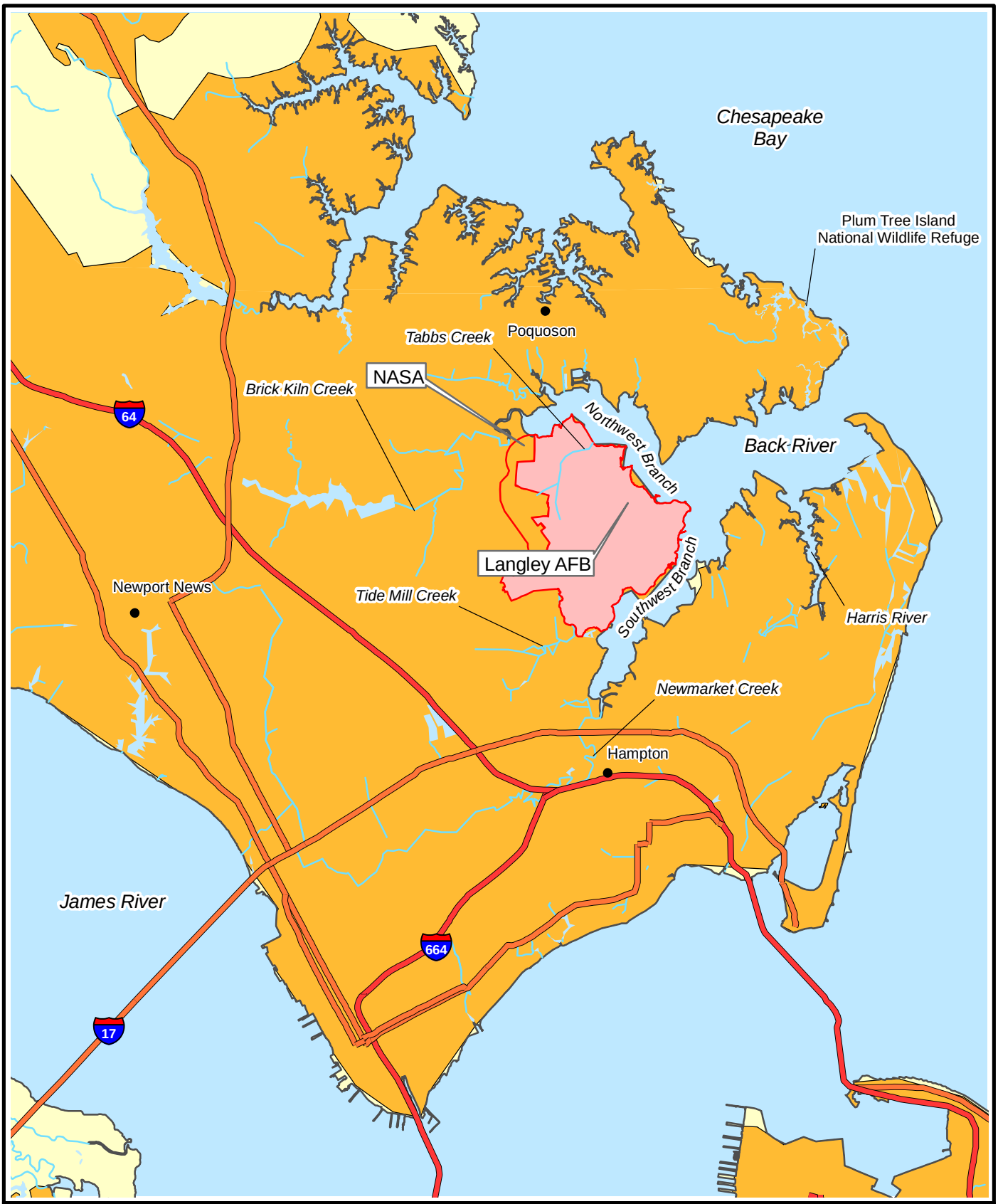
Figure 2.1
Location Map
Langley AFB



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GIS Database, 2006

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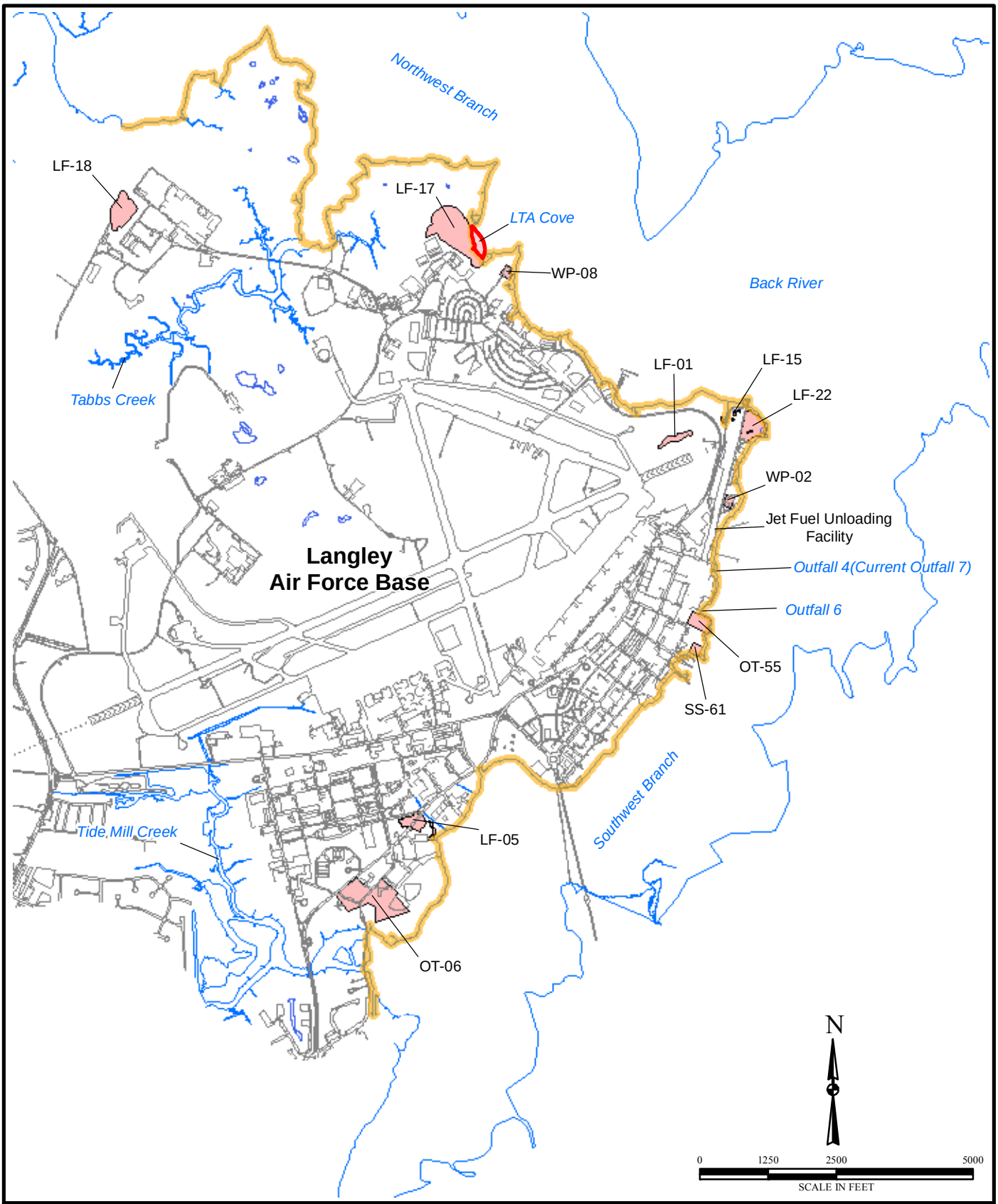
Figure 2.2
Back River and Tributaries



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Langley AFB Shoreline

ERP Site

Note: ERP Site SS-63 encompasses sediment adjacent to Langley AFB shoreline

Figure 2.3
Back River at Langley Air Force Base

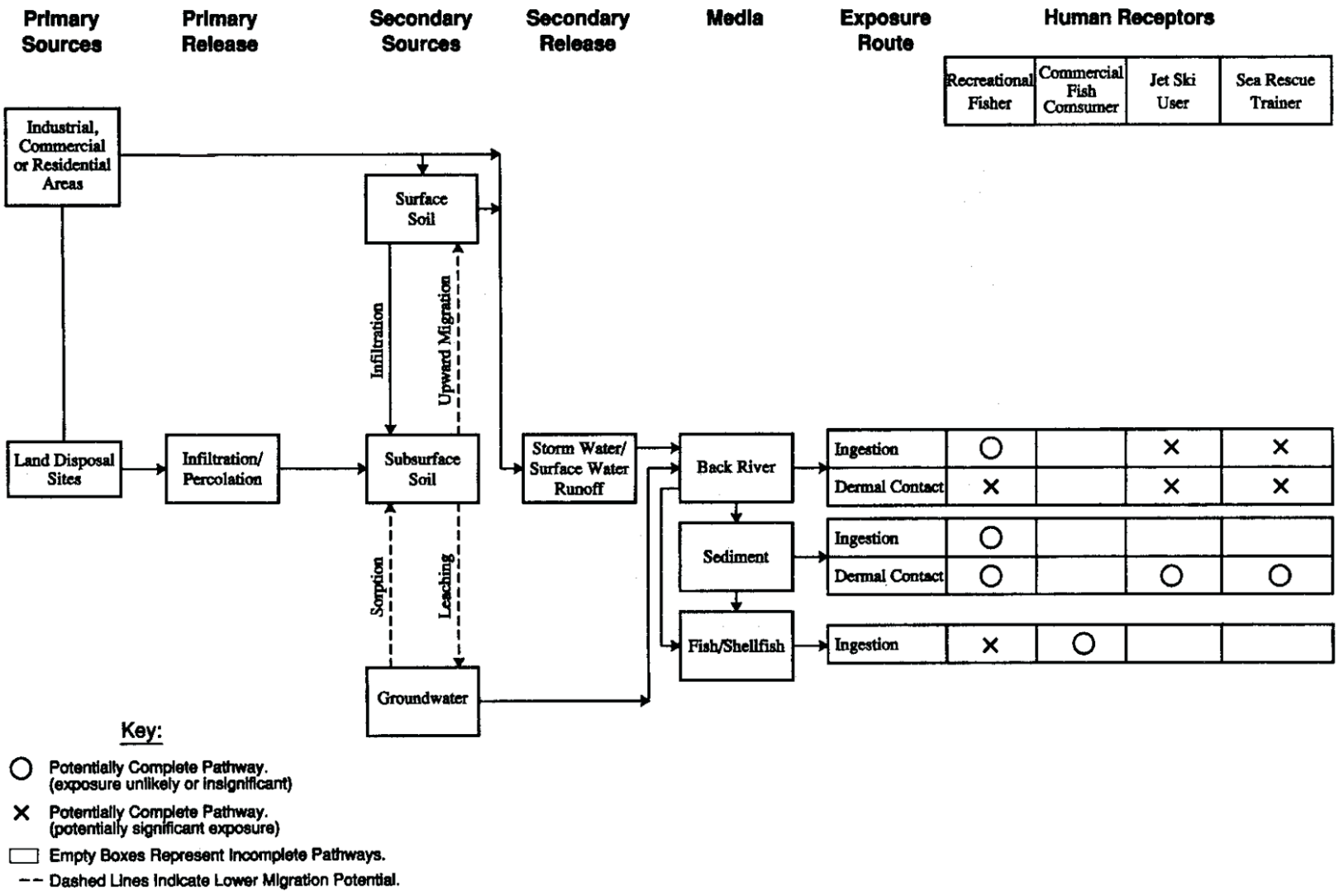

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Figure 2.4
ERP Site SS-63 Human Health Conceptual Site Model

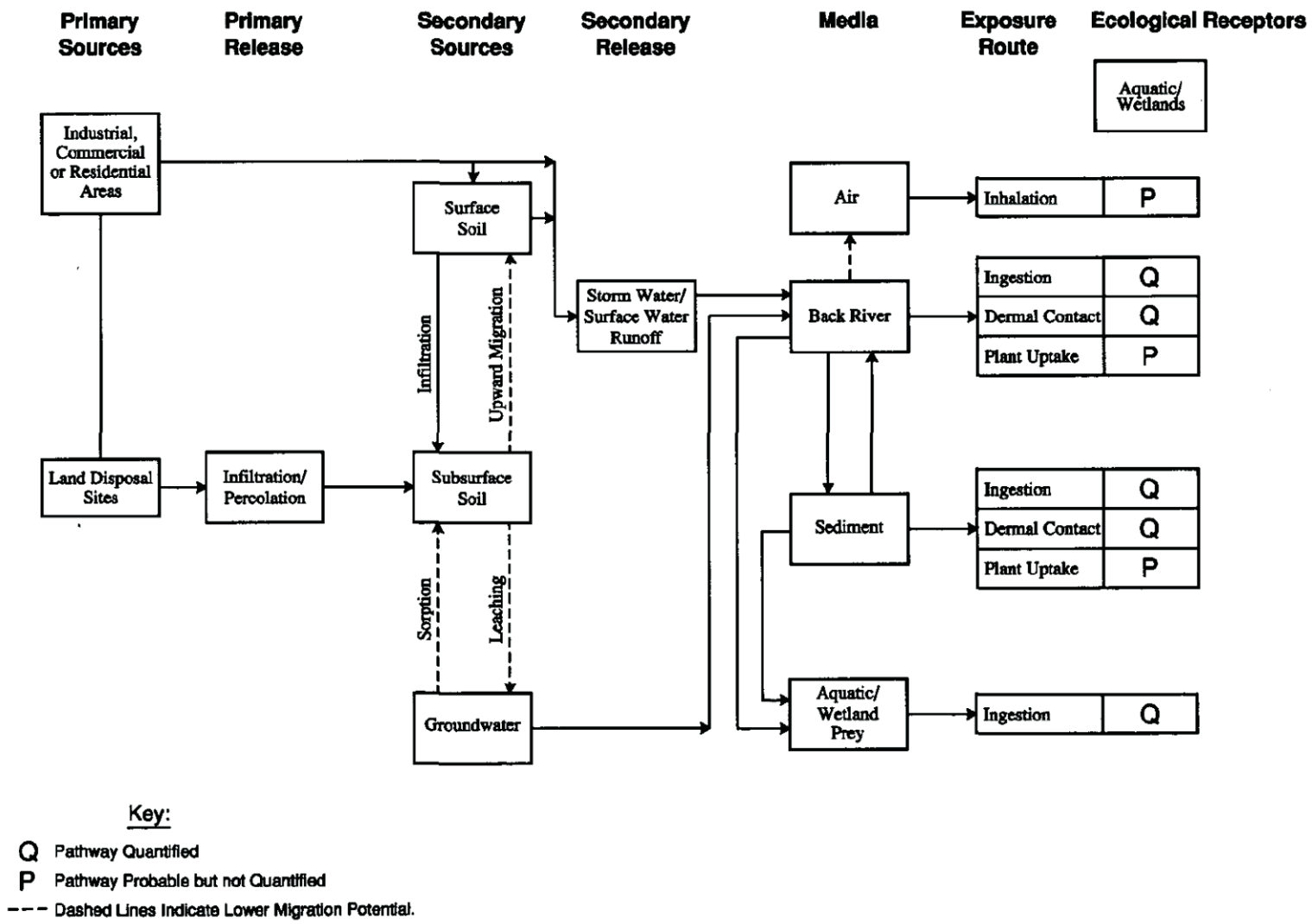

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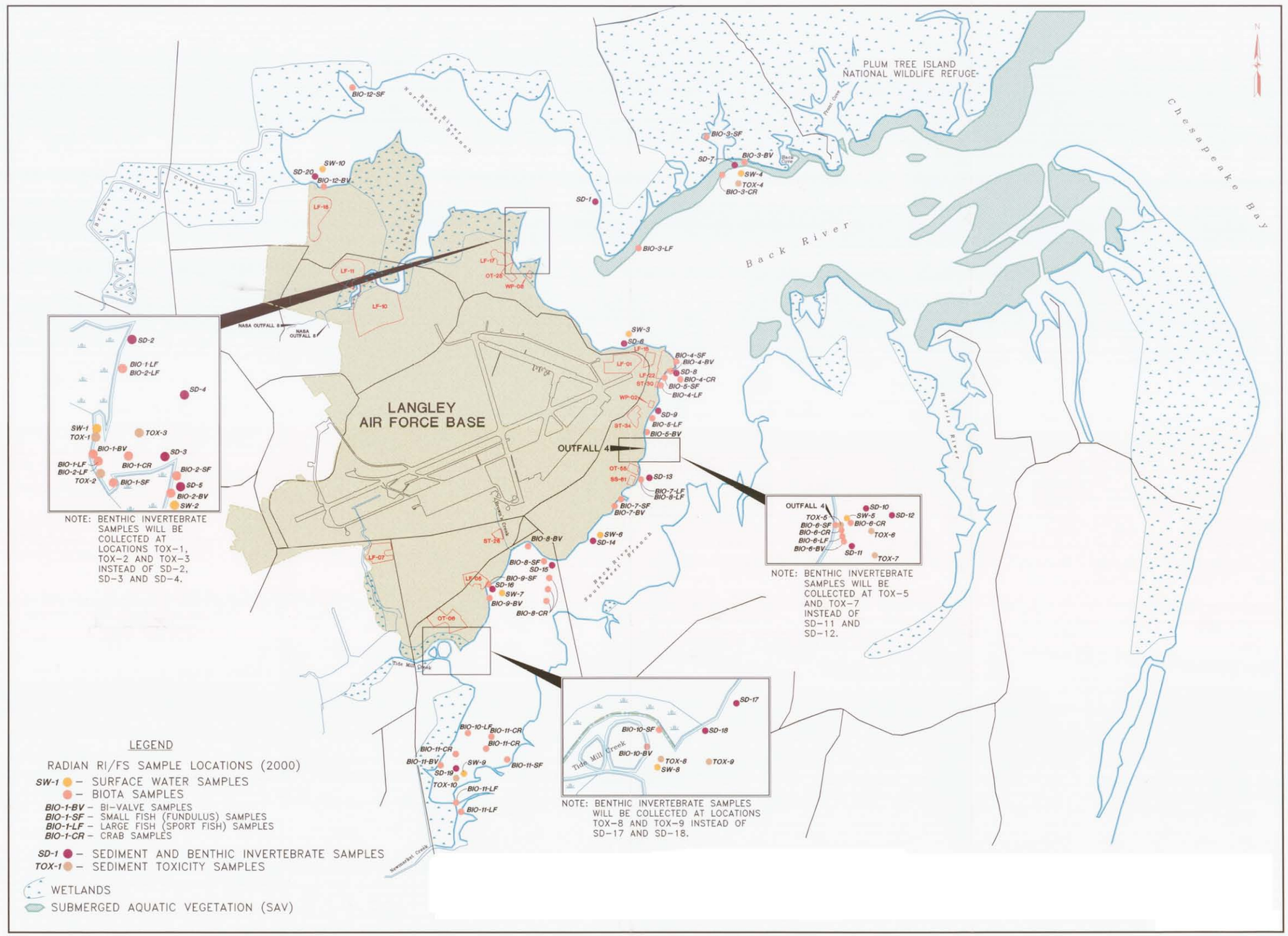
Figure 2.5
ERP Site SS-63 Ecological Conceptual Site Model

Figure 2.6
SS-63 RI Sample Locations



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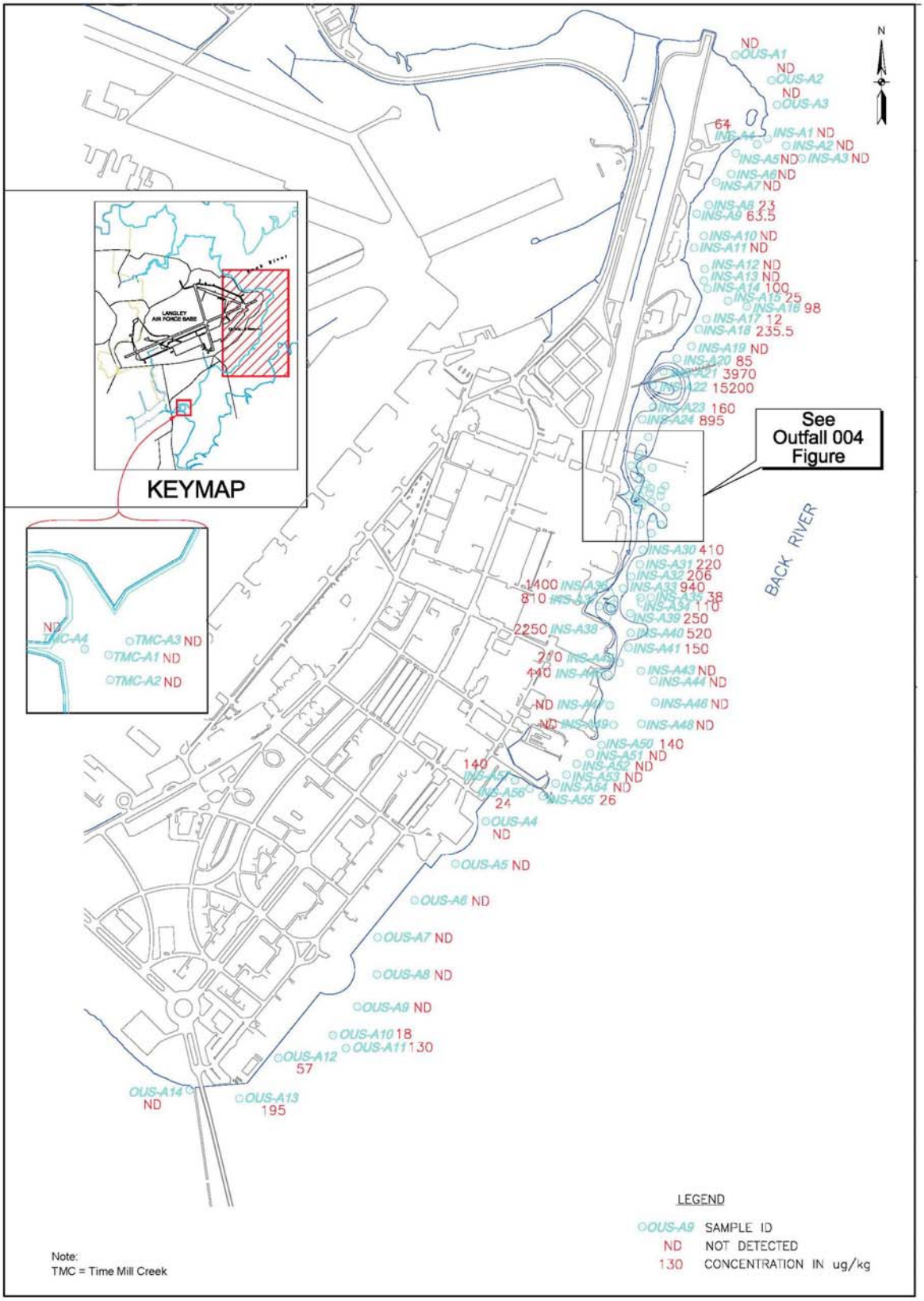

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Source: URS 2004

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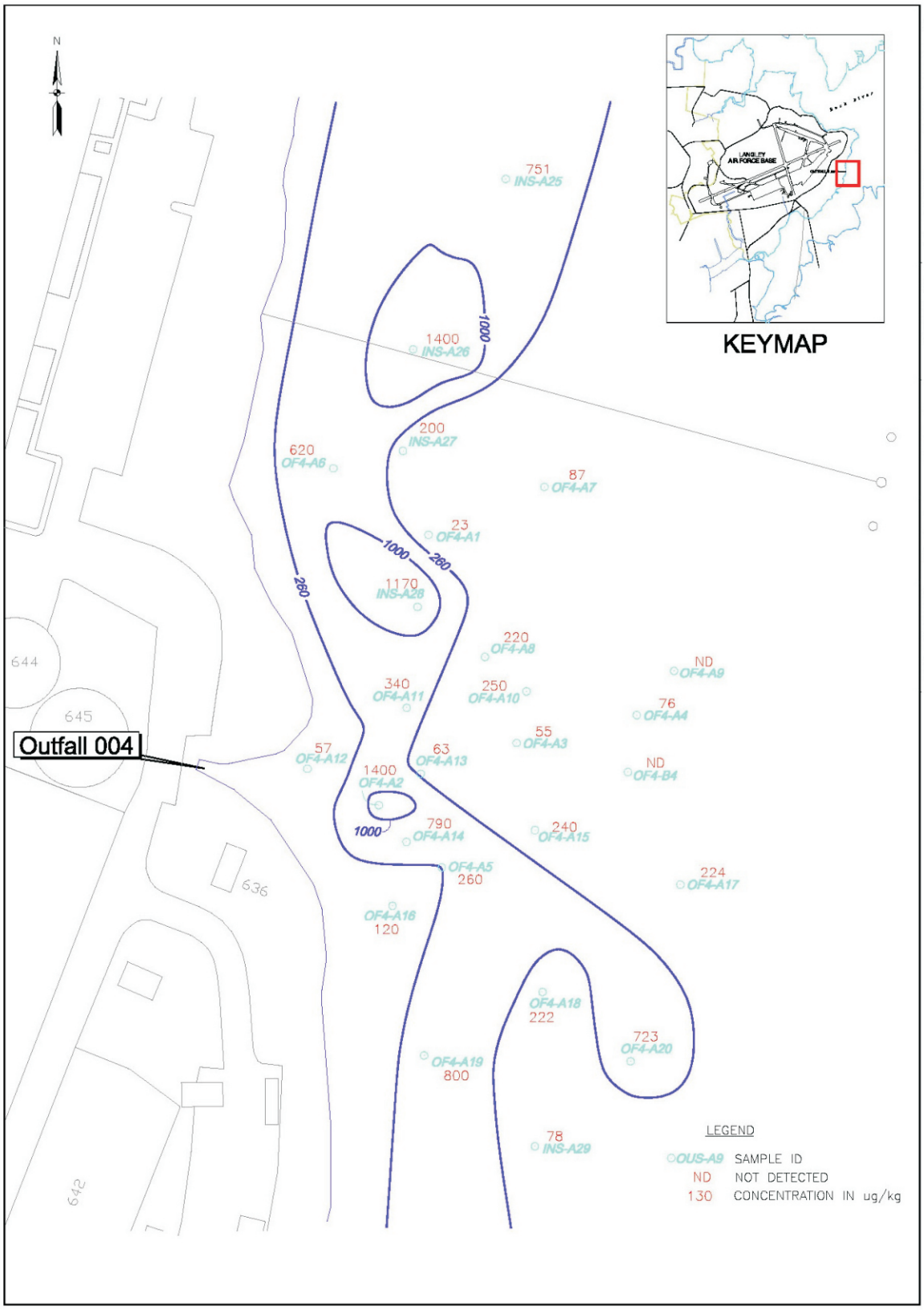
Figure 2.7
July/August 2004
Sediment Sampling Locations



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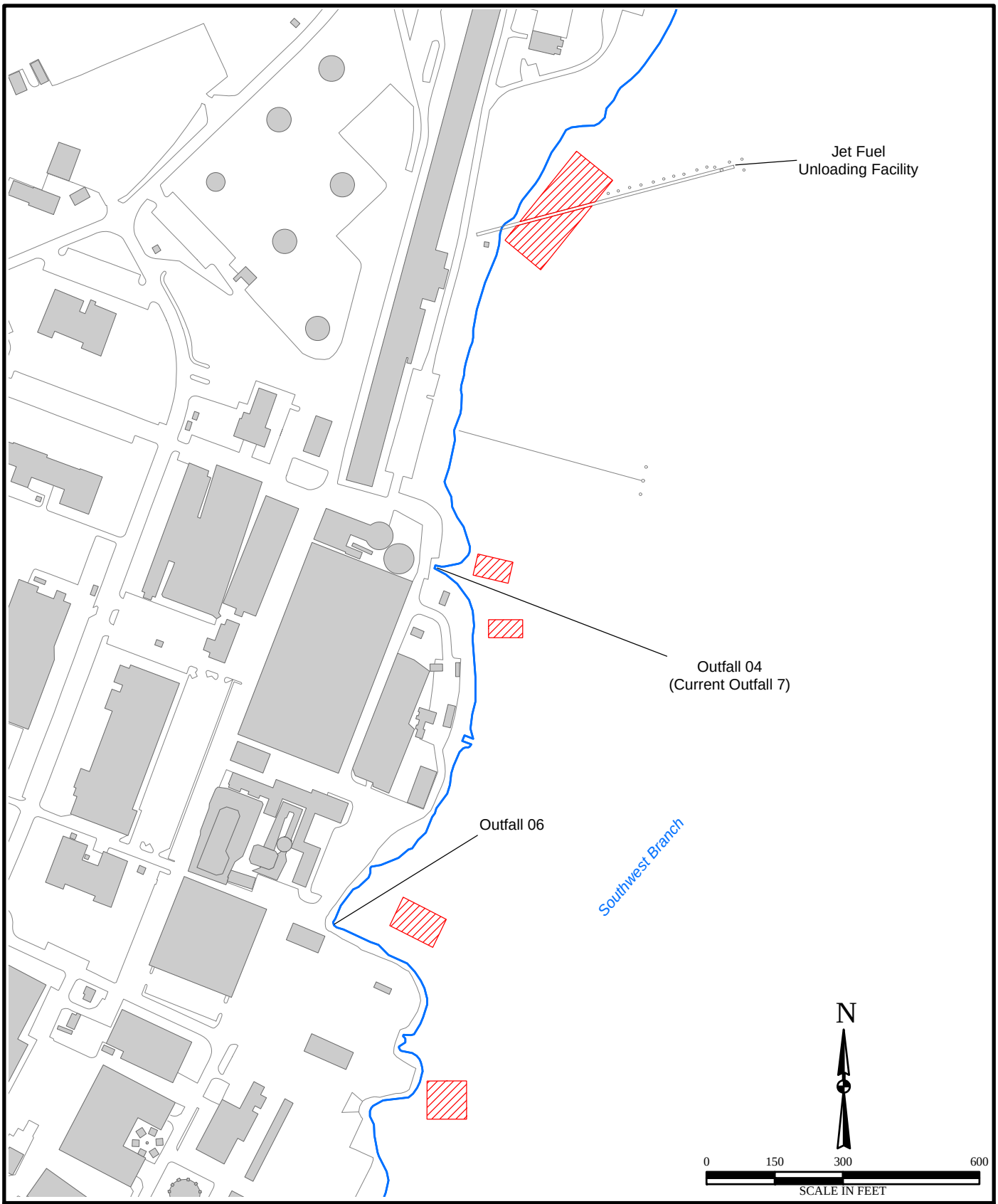
SCALE IN FEET

Figure 2.8
July/August 2004
Sediment Sampling Locations
Outfall 4 Area



Map Source:
AFCEE, HGL GIS Database

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/SS-63_ROD/Prop_Area_RA.mxd

Legend

- Proposed Remedial Action Area
- Building

Figure 2.9
Areas Proposed for Remedial Action

TABLES

Table 2.1. Results of Analyses for Sediment Sampling at Site SS-63, Langley AFB, Virginia

Parameter	EPA Region III Res. Soil RBSLs	Ecological Criteria	Ecological Criteria Reference	SD-01	SD-01 Duplicate	SD-02	SD-03	SD-04	SD-05	SD-06	SD-07	SD-08	SD-09	SD-10	SD-10 Duplicate	SD-11	SD-12	SD-13	SD-14	SD-15	SD-16	SD-17	SD-18	SD-19	SD-20
Moisture (%)	-	-	-	24.8	24.4	28.1	28.0	37.9	24.7	21.8	25.8	22.2	24.3	43.4	46.3	57.1	59.0	60.5	39.9	49.3	27.2	55.4	56.3	52.4	63.8
TOC (mg/kg)	-	-	-	4550	4830	21400	11200	7200	37300		3420	3960	5700	14700	15200	18000	17900	8880	9750	16600	13700	16400	16700	17100	25200
Total Cyanide (mg/kg)	160	-	-		0.193 J					0.528															
VOCs (ug/kg)																									
Acetone	780000	-	-	20.6	30.7	18.0	20.0	61.2	13.7 J			8.85	8.48	135	159	1030	140	49.5	445 J	22.7	125	119			240
2-Butanone (MEK)	4700000	-	-	3.51	5.76		4.06	10.7						16.3 J	6.35 J	20.8	25.8		3.42	6.59	23.0	18.8	5.67		55.8
Carbon disulfide	780000	-	-	4.35 J	10.2 J	17.5 J	13.8 J	33.6 J	7.12 J			8.28 J	8.12 J			31.6	23.2	80.2 J		15.1	32.6	36.3	19.1	22.7	43.3
Methylene chloride	85000	-	-																						
Toluene	1600000	-	-																						
SVOCs (mg/kg)																									
Acenaphthene	470	0.5	NOAA ER-M Marine										0.200		0.120 J				0.0251		0.0324				
Acenaphthylene	470	0.64	NOAA ER-M Marine																		0.0390				
Anthracene	2300	1.1	NOAA ER-M Marine										0.396		0.397 J				0.0599	0.0454	0.129				
Benz(a)anthracene	0.87	1.6	NOAA ER-M Marine					0.0370					0.713	0.351 J	0.828 J	0.382			0.235	0.277	0.498	0.0956	0.0816		
Benz(a)pyrene	0.087	1.6	NOAA ER-M Marine					0.0355					**0.643**	**0.381 J**	**0.819 J**				**0.264**	**0.382**	**0.651**	**0.131**	**0.116**		
Benzo(b)fluoranthene	0.87	1.8	NOAA AET Marine					0.0353					0.563	0.336	0.746	0.364			0.232	0.331	0.659	0.138	0.138		
Benzo(g,h,i)perylene	230	0.3	NOAA UET Fresh										**0.344**						0.155	0.268	**0.570**	0.0951	0.0930		
Benzo(k)fluoranthene	8.7	0.0272	NOAA Lowest TEL Fresh					**0.0372**					**0.587**	**0.391**	**0.677**	**0.545**			**0.236**	**0.360**	**0.711**	**0.135**	**0.115**		
Butylbenzylphthalate	1600	0.063	NOAA AET Marine																0.0503		0.0584				
Carbazole	32	0.4	Relative Risk ER-L Marine										0.181		0.183 J				0.0298	0.0374	0.106				
4-Chloro-3-methylphenol	160	-	-																						
Chrysene	87	2.8	NOAA ER-M Marine				0.0154	0.0423					0.726	0.401 J	0.858 J	0.446			0.261	0.367	0.631	0.141	0.117		
Dibenzo(a,h)anthracene	0.087	1.6	NOAA ER-M Marine																						
Dibenzofuran	31	0.11	NOAA AET Marine																		0.0214				
Di-n-butylphthalate	780	0.058	NOAA AET Marine																						
bis(2-Ethylhexyl)phthalate	46	0.18216	NOAA TEL Marine																		**0.221**	**1.25**			
Fluoranthene	310	5.1	NOAA ER-M Marine				0.0278	0.0810					1.70	0.703 J	1.88 J	0.718			0.472	0.524	0.982	0.208	0.190		
Fluorene	310	0.54	NOAA ER-M Marine										0.233								0.0342				
Indeno(1,2,3-cd)pyrene	0.87	0.01732	NOAA Lowest TEL Fresh										**0.327**		**0.464 J**				**0.151**	**0.240**	**0.521**	**0.0868**	**0.0859**		
2-Methylnaphthalene	160	0.67	NOAA ER-M Marine																0.0157		0.0329				
Naphthalene	160	2.1	NOAA ER-M Marine										0.191								0.0383				
Phenanthrene	230	1.5	NOAA ER-M Marine					0.0463					1.37	0.292 J	1.40 J	0.310			0.251	0.197	0.481	0.0607	0.0536		
Pyrene	230	2.6	NOAA ER-M Marine				0.0247	0.0650					1.14	0.583 J	1.39 J	0.625			0.403	0.465	0.874	0.194	0.178		
Chlorinated Pesticides & PCBs (ug/kg)																									
Aldrin	38	9.5	NOAA AET Marine											6.21	**10.5**	9.10	**12.9**								
alpha-BHC	100	100	NOAA UET Fresh												9.01										
beta-BHC	350	100	NOAA UET Fresh																		17.7				
gamma-BHC	490	100	NOAA UET Fresh																						
alpha-Chlordane	1800	6	NOAA ER-M Marine																		3.08				
gamma-Chlordane	1800	6	NOAA ER-M Marine										**46.1**					**12.6**	4.99					1.96	0.583
4,4'-DDD	2700	20	NOAA ER-M Marine											19.4	**29.0**	**39.3**	**21.6**	13.0		9.67	9.92	10.6	10.8		5.56
4,4'-DDE	1900	27	NOAA ER-M Marine				4.01	3.52				2.30	24.8	12.7	10.0	21.1	17.3	9.83	5.01			7.52	8.71	7.43	8.08
4,4'-DDT	1900	7	NOAA ER-M Marine				3.69							**82.9 J**		**37.0**				4.64	4.07		5.91		
Dieldrin	40	8	NOAA ER-M Marine														6.91							1.81	1.99
Endosulfan I	47000	-	-																						
Endosulfan II	47000	-	-												12.1 J	14.8									
Endosulfan sulfate	47000	-	-			0.618						2.41	37.7	12.4	7.56	13.2	7.38	10.0	6.35					2.01	1.60
Endrin	2300	0.02	Relative Risk ER-L Marine																						
Endrin aldehyde[1]	2300	0.02	Relative Risk ER-L Marine										**31.6**	**12.5**	**7.52**	**27.8**		**4.76**	**3.74**						
Endrin ketone[1]	2300	0.02	Relative Risk ER-L Marine	**0.214 J**										**16.3 J**	**45.3 J**	**49.0**									
Heptachlor	140	0.3	NOAA AET Marine																						
Heptachlor epoxide	70	0.6	NOAA TEL Fresh																						
Methoxychlor	39000	-	-																						
PCB-1254	320	180	NOAA ER-M Marine						15.1			27.2	**1210**					146	146						
PCB-1260	320	180	NOAA ER-M Marine																						
Chlorinated Herbicides (ug/kg)																									
Dichloroprop	63000	-	-																						
MCPA	3900	-	-																						
2,4-D	78000	-	-																						
2,4,5-T	78000	-	-																						
Metals (mg/kg)																									
Aluminum	7800	-	-	2560	2610	3840	4130	**9620**	2760 J	1800	1320	2380	3660	6000 J	**9880 J**	**11900**	**16400**	**19400**	5870	**9210**	3620	**13600**	**13900**	**14000**	**17200**
Antimony	3.1	2	Relative Risk ER-L Marine												0.405 J										
Arsenic	0.43	70	NOAA ER-M Marine	**1.72**	**1.54**	**2.16**	**2.39**	**4.69**	**1.83**	**1.43**	**0.920**	**2.10**	**2.12**	**3.42 J**	**5.99 J**	**7.59**	**8.78**	**9.66**	**5.79**	**6.13**	**4.34**	**10.5**	**10.7**	**8.01**	**8.65**
Barium	550	48	NOAA AET Marine	8.53	7.84	12.1	9.08	20.5	5.65	4.39	3.42	11.2	9.09	19.6 J	29.1 J	34.0	36.7	43.6	12.8	19.6	9.91	27.1	28.1	25.7	31.6
Beryllium	16	-	-	0.118	0.101	0.139	0.152	0.374	0.130	0.116		0.131	0.158	0.296 J	0.464 J	0.562	0.727	0.821	0.340	0.513	0.261	0.805	0.805	0.776	0.773
Cadmium	3.9	9.6	NOAA ER-M Marine											0.0798 J	0.140 J	0.240			0.0861				0.139		
Calcium	-	-	-	342	301.0	548	643	1170	605	352	148	476	529	895 J	1490 J	1470	2090	2560	1220	2050	26500	1640	1700	1360	1690
Chromium	23	370	NOAA ER-M Marine	6.24	5.99	11.5	12.4	**28.3**	9.27 J	6.54	2.83	8.41	9.91	22.8 J	**35.3 J**	**42.9**	**42.3**	**44.9**	15.9	**23.5**	11.9	**34.6**	**34.1**	**28.8**	**48.3**
Cobalt	160	10	NOAA AET Marine	1.12	0.784	1.25	1.43	3.08	1.28	1.07	0.322	1.03	1.47	2.41 J	3.85 J	4.81	5.97	6.73	3.59	4.50	2.25	6.96	6.96	7.02	5.01
Copper	310	270	NOAA ER-M Marine	2.47	2.31	4.48	5.18	10.7	2.88	2.04	1.47	3.91	4.66	20.1	21.5	21.9	21.8	24.5	10.3	12.8	6.29	17.6	17.8	13.8	27.7
Iron	2300	-	-	**3820**	**3530**	**5050**	**5400**	**12700**	**4400 J**	**3170**	1300	**4790**	**5000**	**8480 J**	**13600 J**	**16600**	**21600**	**25100**	**10900**	**14400**	**8460**	**22400**	**22400**	**18400**	**20700**
Mercury	0.78	0.71	NOAA ER-M Marine	0.0174	0.0154	0.0218	0.0309	0.0429	0.0139	0.0116	0.0100	0.0160	0.0304	0.2170	0.190	0.233	0.148	0.0952	0.0489	0.0742	0.0381	0.0743	0.0859	0.0868	0.107
Lead		218	NOAA ER-M Marine	4.76	4.50	9.51	17.0	18.3	5.83	3.93	3.37	8.21	10.0	26.9 J	39.2 J	51.7	38.5	39.0	17.6	24.2	13.4	35.5	34.9	29.8	28.9
Magnesium	-	-	-	706	719	1120	1200	2790	951	730	376	853	1120	1950 J	3080 J	3620	4950	5730	2770	3010	1660	4300	4270	3700	4970
Manganese	160	260	NOAA AET Marine	24.0	22.7	30.9	26.4	74.3	23.5	15.5	6.68	26.1	29.4	48.5 J	76.3 J	119	139	**163**	91.3	94.2	57.7	118	116	94.5	107
Nickel	160	51.6	NOAA ER-M Marine	2.00	1.91	3.14	3.53	8.23	2.71	1.85	0.969	2.24	3.17	6.15 J	10.3 J	13.2	15.3	17.0	6.13	9.03	4.07	13.9	14.0	12.8	13.7
Potassium	-	-	-	382	393	655	712	1670	535	431	212	572	652	1160 J	1970 J	2210	3080	3380	1110	1730	606	2580	2570	2590	3480
Selenium	39	-	-			0.458	0.374		0.432				0.360		0.584 J	0.728	0.642	0.625		0.635			0.572		
Silver	39	3.7	NOAA ER-M Marine											0.246 J	0.478 J	1.30	0.619		0.295	0.276	0.151	0.474	0.519	0.161	0.534
Sodium	-	-	-	1710	1980	2350	2300	4420	2000	1740	1520	1730	1990	3280 J	5020 J	5790	8650	8810	3600	5450	2150	6730	6850	5450	9420
Thallium	0.55	-	-														0.531								
Vanadium	55	57	NOAA AET Marine	6.78	6.63	9.48	10.3	22.8	7.37 J	5.51	3.21	8.78	9.33	17.2 J	27.9 J	34.0	41.0	46.8	16.6	24.1	14.2	36.2	35.6	32.6	40.3
Zinc	2300	410.0	NOAA ER-M Marine	15.2	14.1	22.8	27.6	56.9	22.5	14.6	8.74	18.9	25.0	53.9 J	81.9 J	94.4	112	125	56.8	79.3	40.2	120	116	102	88.8
PCTs (ug/kg)																									
Aroclor 5432	140	180	NOAA ER-M Marine											**1400**	**2200**	**3500**	**500**								64.0
Aroclor 6040	140	180	NOAA ER-M Marine											120	**320**	**270**	**150**	90.0							
Aroclor 6062	140	180	NOAA ER-M Marine	110 J								**760**	120						86.0	62.0					
Aroclor 6070	140	180	NOAA ER-M Marine																						
Acid Volatile Sulfides (um/g)	NV	-	-	3.40	2.40	2.10	4.00	10.2	1.60	0.890	3.10	1.00	2.50	5.70	7.40	8.80	17.9	32.1	2.90	12.6	7.40	20.1	18.7	15.3	21.9

- Screening criteria unavailable
Blank cell - Analyte was not detected in any of the samples from the indicated investigation.
B - Concentration similar to low-level concentrations found in associated blanks.
J - Estimated value.
[1] Endrin used as surrogate

Indicates result exceeds Human Health Criteria
Indicates result exceeds Ecological Health Criteria
Indicates result exceeds Ecological and Human Health Criteria

Table 2.1. Results of Analyses for Sediment Sampling at Site SS-63, Langley AFB, Virginia

Parameter	EPA Region III Res. Soil RBSLs	Ecological Criteria	Ecological Criteria Reference	TOX-01	TOX-02	TOX-03	TOX-04	TOX-05	TOX-05 Duplicate	TOX-06	TOX-07	TOX-08	TOX-09	TOX-10	R-1	R-2	R-3	R-4	R-5	R-5 Duplicate	R-6	R-7	R-8	R-9	R-10	R-11
Moisture (%)	-	-	-	28.1	48.0	28.3	24.3	26.4	25.7	51.9	55.6	60.9	61.6	57.6												
TOC (mg/kg)	-	-	-	7670	8220	8460	2910	11100	13300	16700	17600	8370	8170	7780												
Total Cyanide (mg/kg)	160	-	-									0.349														
VOCs (ug/kg)																										
Acetone	780000	-	-	8.03	67.2	15.0	223	21.2 B	96.2 J	143	407	109	86.2	80.3												
2-Butanone (MEK)	4700000	-	-		5.45		8.35	7.05 J	21.1 J	18.2	91.5	14.2	7.59	7.29							3.13					
Carbon disulfide	780000	-	-	4.87	12.9	14.2	7.39	16.2	31.6	24.7	50.6	10.8	19.7	37.6					2.35J	3.55 J	2.89	3.40			3.29	4.15
Methylene chloride	85000	-	-	1.14		1.64	1.52	1.54	1.77		3.67	2.23	2.33	1.95	4.35	4.76		2.09	3.49	4.21	5.23				9.52	10.2
Toluene	1600000	-	-						1.18 J																	
SVOCs (mg/kg)																										
Acenaphthene	470	0.5	NOAA ER-M Marine						**1.45 J**										0.371J							
Acenaphthylene	470	0.64	NOAA ER-M Marine																							
Anthracene	2300	1.1	NOAA ER-M Marine						**7.99 J**										1.02J		0.585	0.427				
Benz(a)anthracene	0.87	1.6	NOAA ER-M Marine						**25.7 J**	0.374	0.404								**3.78J**	**2.06 J**	**3.39**	**1.80**	0.218	0.294	0.747	
Benz(a)pyrene	0.087	1.6	NOAA ER-M Marine						**27.4 J**	**0.448**	**0.464**								**3.85**	**2.55**	**4.42**	**2.11**		**0.333**	**1.12**	
Benzo(b)fluoranthene	0.87	1.8	NOAA AET Marine						**19.9 J**	0.382	0.474							0.246 J	**3.43J**	**2.26 J**	**3.95**	**2.20**	0.491	0.623	**1.28**	
Benzo(g,h,i)perylene	230	0.3	NOAA UET Fresh						**15.9 J**										**2.35J**	**1.73 J**	**2.78**	**1.33**			**0.848**	
Benzo(k)fluoranthene	8.7	0.0272	NOAA Lowest TEL Fresh						**23.8 J**	**0.400**	**0.425**							**0.246 J**	**3.44**	**2.57**	**3.65**	**1.58**	**0.491**	**0.623**	**1.01**	
Butylbenzylphthalate	1600	0.063	NOAA AET Marine																							
Carbazole	32	0.4	Relative Risk ER-L Marine																							
4-Chloro-3-methylphenol	160	-	-																0.681							
Chrysene	87	2.8	NOAA ER-M Marine						**27.4 J**	0.471	0.581								**4.96 J**	2.70 J	**4.32**	2.44	0.324	0.335	1.26	
Dibenzo(a,h)anthracene	0.087	1.6	NOAA ER-M Marine																**1.03**							
Dibenzofuran	31	0.11	NOAA AET Marine																**0.208**							
Di-n-butylphthalate	780	0.058	NOAA AET Marine																							
bis(2-Ethylhexyl)phthalate	46	0.18216	NOAA TEL Marine																**3.35**		**2.84**				**0.485**	
Fluoranthene	310	5.1	NOAA ER-M Marine						**63.0 J**	0.800	0.894								**8.69 J**	4.90 J	**5.99**	3.78	0.620	0.518	1.93	
Fluorene	310	0.54	NOAA ER-M Marine																0.481							
Indeno(1,2,3-cd)pyrene	0.87	0.01732	NOAA Lowest TEL Fresh						**14.5 J**										**2.37**	**1.73**	**2.73**	**1.30**			**0.829**	
2-Methylnaphthalene	160	0.67	NOAA ER-M Marine																							
Naphthalene	160	2.1	NOAA ER-M Marine																							
Phenanthrene	230	1.5	NOAA ER-M Marine						**24.2 J**		0.357								**4.73 J**	**1.73 J**	**1.73**	**1.73**	0.281		0.601	
Pyrene	230	2.6	NOAA ER-M Marine						**48.8 J**	0.686	0.767						0.0916	0.123	**7.13 J**	**3.99 J**	**5.24**	**3.42**	0.468	0.450	1.67	0.214
Chlorinated Pesticides & PCBs (ug/kg)																										
Aldrin	38	9.5	NOAA AET Marine							6.79														3.49 J		
alpha-BHC	100	100	NOAA UET Fresh							9.21																
beta-BHC	350	100	NOAA UET Fresh																							
gamma-BHC	490	100	NOAA UET Fresh																							
alpha-Chlordane	1800	6	NOAA ER-M Marine					**6.00**	4.33					1.59												5.43
gamma-Chlordane	1800	6	NOAA ER-M Marine							**15.7**									**66.9 J**	**27.3 J**	**284**	**33.6**		**15**	1.58	1.48
4,4'-DDD	2700	20	NOAA ER-M Marine		9.07	7.00		**37.0**	**28.4**	**63.7**	**29.8**	11.9	12.1	10.0	2.43				**117**	**122**	**141**	**56.0**		5.56	9.63	4.6
4,4'-DDE	1900	27	NOAA ER-M Marine	3.99	9.55	4.70		26.5	18.1	23.1	13.4	8.12	8.07	6.41	1.25				**52.8 J**	**33.8 J**					9.86	5.44
4,4'-DDT	1900	7	NOAA ER-M Marine		6.11	**12.9**					**155**				2.25					**11.0 J**	**159 J**	**56.3**	**54.2**	**10.2 J**	6.56	
Dieldrin	40	8	NOAA ER-M Marine	1.16					6.64 J		7.70															
Endosulfan I	47000	-	-		3.48																					
Endosulfan II	47000	-	-						6.24 J	31.9	7.33															
Endosulfan sulfate	47000	-	-		3.53			15.0	11.4	23.0	8.24	3.75	3.86													
Endrin	2300	0.02	Relative Risk ER-L Marine																		**564 J**			**6.11 J**	**5.83**	
Endrin aldehyde[1]	2300	0.02	Relative Risk ER-L Marine					**11.9**	**7.50**	**73.4**	**10.4**								**8.02 J**		**204 J**			**11.1 J**		
Endrin ketone[1]	2300	0.02	Relative Risk ER-L Marine					**20.3**	**11.1**	**118**	**18.4**								**18.4J**						**6.40**	
Heptachlor	140	0.3	NOAA AET Marine																	**1.68 J**						
Heptachlor epoxide	70	0.6	NOAA TEL Fresh						**2.64 J**	**3.50**	**3.20**					**0.722**										
Methoxychlor	39000	-	-																		418 J			24.9 J		
PCB-1254	320	180	NOAA ER-M Marine																		**4180**			**736**		
PCB-1260	320	180	NOAA ER-M Marine		108																					
Chlorinated Herbicides (ug/kg)																										
Dichloroprop	63000	-	-																							
MCPA	3900	-	-	**13000**		**10100**				**16300**		**14500**	**13700**													
2,4-D	78000	-	-																		12.9					17.9
2,4,5-T	78000	-	-					2.52 J							3.51				3.58 J		4.27			5.72	6.88	6.94
Metals (mg/kg)																										
Aluminum	7800	-	-	3150	**10700 K**	6580	1790	3910	3990	**10900**	**11300**	**13900**	**14700**	**13700**	3000	1540	1670	4890	2440	2930	3310	**15,100**	**14800 H**	**14,700**	**17,300**	**22,000**
Antimony	3.1	2	Relative Risk ER-L Marine	0.314	0.416 J		0.247	**2.14 J**			0.620	0.438			0.170				0.268 J	1.20 J	0.295	0.341			0.335	
Arsenic	0.43	70	NOAA ER-M Marine	**1.87**	**6.47**	**3.47**	**0.830**	**3.30**	**3.39**	**6.52**	**6.41**	**10.0**	**10.4**	**9.49**	**1.85**	**0.744**	**1.49**	**4.74**	**3.87**	**2.54**	**3.50**	**8.11**	**7.77**	**8.94**	**10.2**	**12.1**
Barium	550	48	NOAA AET Marine	9.25	31.3	14.3	6.58	18.6	19.2	34.8	30.1	26.2	27.7	25.6	6.82	4.75	5.12	9.64	33.2	30.5	39.7	**51.0**	30.9	30.2	37.7	41.5
Beryllium	16	-	-	0.128	0.466	0.287	0.0664	0.205	0.200	0.508	0.522	0.825	0.826	0.867	0.195	0.316	0.105	0.321		0.251	0.218	0.727	0.736	0.810	0.842	1.42
Cadmium	3.9	9.6	NOAA ER-M Marine		0.226			0.107	0.156						0.179	0.105			0.898	0.880	0.967	0.238	0.142	0.210	1.38	1.46
Calcium	-	-	-	447	1230	787	212	1220	1460	1930	2320	1590	1680	1500	411	219	1000	833	14,300	10,300	1390	2850	1470	1900	1730	2080
Chromium	23	370	NOAA ER-M Marine	9.28	**33.1**	19.4	3.84	**71.9**	**61.0**	**63.3**	**36.4**	**34.4**	**35.5**	**31.5**	12.0	4.43	5.28	14.8	**28.3 J**	**50.8 J**	**54.6**	**42.2**	**32.9**	**44.0**	**39.7**	**48.2**
Cobalt	160	10	NOAA AET Marine	0.978	3.36	2.20	0.389	2.05	2.10	4.46	4.28	6.85	6.96	7.94	0.953	0.716	0.833	2.00	1.73	1.68	1.98	5.76	5.47	6.07	6.54	9.84
Copper	310	270	NOAA ER-M Marine	4.73	23.4	7.72	2.78	19.2	14.8	26.7	22.8	17.3	18.1	14.8	3.80	1.55	1.52	4.68	38.6 J	81.1 J	59.9	27.0	21.6	19.4	21.4	25.0
Iron	2300	-	-	**3920**	**13900**	**8180**	1740	**6840**	**6490**	**16100**	**16500**	**22900**	**23600**	**21900**	**3740**	1830	**2600**	**9800**	**5120**	**5950**	**5870**	**18,400**	**18,000**	**19,900**	**23,600**	**29,200**
Mercury	0.78	0.71	NOAA ER-M Marine	0.0199	0.0957	0.0672	0.0122	0.207	0.236	0.269	0.149	0.101	0.136	0.0683	0.0169	0.0126		0.0459	0.128 J	0.217 J	0.120 J	0.161	0.121	0.106	0.0830	0.123
Lead		218	NOAA ER-M Marine	45.3	164 L	15.7	4.87	32.2	25.0	46.1	32.2	33.8	34.3	35.3	6.51	3.66	3.74	7.61	54.9 J	186 J	147	75.7	31.8	84.0	42.7	47.3
Magnesium	-	-	-	937	3120	1840	561	2340	2370	3930	4250	4420	4570	4070	805	467	654	1530	1940	2260	1960	5230	4060	4180	4430	5790
Manganese	160	260	NOAA AET Marine	24.0	81.0	54.7	9.72	63.0	60.8	109	108	121	131	109	22.1	13.2	16.4	39.2	60.1	58.1	50.1	125	111	116	122	158
Nickel	160	51.6	NOAA ER-M Marine	2.71	9.46	5.49	1.37	5.44	5.21	11.9	10.9	13.7	14.3	14.5	2.37	1.23	1.40	4.03	3.69	3.80	4.45	13.5	12.2	12.8	15.7	19.5
Potassium	-	-	-	541	1860	1200	298	727	737	2120	2240	2480	2490	2230	541	305	354	1150	492	570	568	2260	2200	2200	2860	3790
Selenium	39	-	-	0.355		0.335																				
Silver	39	3.7	NOAA ER-M Marine	0.275	1.34	0.302				0.482	0.421	0.454	0.440		0.267			0.0430	0.718 J	0.293 J	0.349	0.419	0.558	0.479	0.460	0.621
Sodium	-	-	-	2620	5800	3750	2120	2580	2210	6390	7720	7180	7520	5210	1750	1460	1560	1910	2360	2110	2370	6040	5660	5360	6390	8460
Thallium	0.55	-	-		**0.572**	0.352																				
Vanadium	55	57	NOAA AET Marine	8.03	26.6	16.0	4.17	14.5	13.8	31.9	29.5	35.1	37.0	34.0	7.83	4.25	5.52	19.3	10.2	11.50	12.6	39.7	36.1	36.0	43.9	53.1
Zinc	2300	410.0	NOAA ER-M Marine	21.0	84.4	37.8	11.9	65.9	68.1	115	101	120	123	121	18.4	9.95	10.8	30.0	73.4	68.3	96.8	134	96.5	108	124	157
PCTs (ug/kg)																										
Aroclor 5432	140	180	NOAA ER-M Marine					**490**	**840**	**1800**	**1300**								**6100 J**	**2200 J**		**7200 J**				**2800 J**
Aroclor 6040	140	180	NOAA ER-M Marine		100				100 J	**380**																
Aroclor 6062	140	180	NOAA ER-M Marine																							
Aroclor 6070	140	180	NOAA ER-M Marine					89 J			**150**															
Acid Volatile Sulfides (um/g)	NV	-	-	2.00	11.1	4.80	1.17	6.60	7.40	19.0	13.4	8.80	9.30	9.80												

- Screening criteria unavailable
Blank cell - Analyte was not detected in any of the samples from the indicated investigation.
B - Concentration similar to low-level concentrations found in associated blanks.
J - Estimated value.
[1] Endrin used as surrogate

Indicates result exceeds Human Health Criteria
Indicates result exceeds Ecological Health Criteria
Indicates result exceeds Ecological and Human Health Criteria

Table 2.2. Summary of PCB/PCT Arochlors, Back River, Langley Air Force Base, Virginia

Sample ID Number	PCB/PCT Arochlors (µg/kg)																								
	PCB 1016	Q	PCB 1221	Q	PCB 1232	Q	PCB 1242	Q	PCB 1248	Q	PCB 1254	Q	PCB 1260	Q	PCT 5432	Q	PCT 5460	Q	PCT 6040	Q	PCT 6062	Q	PCT 6070	Q	Total
INS-A1-01	44	U	44	U	44	U	44	U	44	U	44	U	44	U	88	U	88	U	88	U	88	U	88	U	0
INS-A2-01	44	U	44	U	44	U	44	U	44	U	44	U	44	U	87	U	87	U	87	U	87	U	87	U	0
INS-A3-01	58	U	58	U	58	U	58	U	58	U	58	U	58	U	120	U	120	U	120	U	120	U	120	U	0
INS-A4-01	46	U	46	U	46	U	46	U	46	U	**64**		46	U	92	U	92	U	92	U	92	U	92	U	64
INS-A5-01	59	U	59	U	59	U	59	U	59	U	59	U	59	U	120	U	120	U	120	U	120	U	120	U	0
INS-A6-01	53	U	53	U	53	U	53	U	53	U	53	U	53	U	110	U	110	U	110	U	110	U	110	U	0
INS-A7-01	260	U	260	U	260	U	260	U	260	U	260	U	260	U	510	U	510	U	510	U	510	U	510	U	0
INS-A8-01	47	U	47	U	47	U	47	U	47	U	**23**	**J**	47	U	94	U	94	U	94	U	94	U	94	U	23
INS-A9-01	44	U	44	U	44	U	44	U	44	U	**25**	**J**	44	U	88	U	88	U	88	U	88	U	88	U	25
INS-A9-31	45	U	45	U	45	U	45	U	45	U	**79**		45	U	90	U	**23**	**JP**	90	U	90	U	90	U	102
INS-A10-01	49	U	49	U	49	U	49	U	49	U	49	U	49	U	98	U	98	U	98	U	98	U	98	U	0
INS-A11-01	46	U	46	U	46	U	46	U	46	U	46	U	46	U	91	U	91	U	91	U	91	U	91	U	0
INS-A12-01	54	U	54	U	54	U	54	U	54	U	54	U	54	U	110	U	110	U	110	U	110	U	110	U	0
INS-A13-01	45	U	45	U	45	U	45	U	45	U	45	U	45	U	89	U	89	U	89	U	89	U	89	U	0
INS-A14-01	55	U	55	U	55	U	55	U	55	U	**100**		55	U	110	U	110	U	110	U	110	U	110	U	100
INS-A15-01	49	U	49	U	49	U	49	U	49	U	49	U	**25**	**J**	98	U	98	U	98	U	98	U	98	U	25
INS-A16-01	63	U	63	U	63	U	63	U	63	U	**98**		63	U	130	U	130	U	130	U	130	U	130	U	98
INS-A17-01	44	U	44	U	44	U	44	U	44	U	**12**	**J**	44	U	88	U	88	U	88	U	88	U	88	U	12
INS-A18-01	47	U	47	U	47	U	47	U	47	U	**340**		47	U	93	U	**45**	**J**	93	U	93	U	93	U	385
INS-A18-31	47	U	47	U	47	U	47	U	47	U	**86**		47	U	93	U	93	U	93	U	93	U	93	U	86
INS-A19-01	96	U	96	U	96	U	96	U	96	U	96	U	96	U	190	U	190	U	190	U	190	U	190	U	0
INS-A20-01	72	U	72	U	72	U	72	U	72	U	72	U	**85**	*****	150	U	150	U	150	U	150	U	150	U	85
INS-A21-01	2200	U	2200	U	2200	U	2200	U	2200	U	**3600**		2200	U	4400	U	**370**	**J**	4400	U	4400	U	4400	U	3970
INS-A21-51	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	0
INS-A22-01	2300	U	2300	U	2300	U	2300	U	2300	U	**14000**		2300	U	4700	U	**1200**	**J**	4700	U	4700	U	4700	U	15200
INS-A23-01	61	U	61	U	61	U	61	U	61	U	**160**		61	U	120	U	120	U	120	U	120	U	120	U	160
INS-A24-01	110	U	110	U	110	U	110	U	110	U	**790**		110	U	210	U	**79**	**J**	210	U	210	U	210	U	869
INS-A24-31	260	U	260	U	260	U	260	U	260	U	**850**		260	U	520	U	**71**	**J**	520	U	520	U	520	U	921
INS-A25-01	95	U	95	U	95	U	95	U	95	U	**700**		95	U	190	U	**51**	**J**	190	U	190	U	190	U	751

Table 2.2. Summary of PCB/PCT Arochlors, Back River, Langley Air Force Base, Virginia

Sample ID Number	PCB/PCT Arochlors (µg/kg)																								
	PCB 1016	Q	PCB 1221	Q	PCB 1232	Q	PCB 1242	Q	PCB 1248	Q	PCB 1254	Q	PCB 1260	Q	PCT 5432	Q	PCT 5460	Q	PCT 6040	Q	PCT 6062	Q	PCT 6070	Q	Total
INS-A26-01	450	U	450	U	450	U	450	U	450	U	**1300**		450	U	890	U	**100**	**J**	890	U	890	U	890	U	1400
INS-A27-01	45	U	45	U	45	U	45	U	45	U	**200**		45	U	89	U	89	U	89	U	89	U	89	U	200
INS-A28-01	100	U	100	U	100	U	100	U	100	U	**710**	**P**	100	U	200	U	**460**		200	U	200	U	200	U	1170
INS-A29-01	44	U	44	U	44	U	44	U	44	U	**78**		44	U	88	U	88	U	88	U	88	U	88	U	78
INS-A30-01	43	U	43	U	43	U	43	U	43	U	43	U	43	U	**410**		87	U	87	U	87	U	87	U	410
INS-A31-01	43	U	43	U	43	U	43	U	43	U	43	U	43	U	**220**		87	U	87	U	87	U	87	U	220
INS-A32-01	45	U	45	U	45	U	45	U	45	U	**96**		45	U	90	U	**110**		90	U	90	U	90	U	206
INS-A33-01	50	U	50	U	50	U	50	U	50	U	50	U	50	U	**940**		99	U	99	U	99	U	99	U	940
INS-A34-01	71	U	71	U	71	U	71	U	71	U	**110**	***P**	71	U	140	U	140	U	140	U	140	U	140	U	110
INS-A35-01	82	U	82	U	82	U	82	U	82	U	82	U	**38**	**JP**	160	U	160	U	160	U	160	U	160	U	38
INS-A36-01	61	U	61	U	61	U	61	U	61	U	61	U	61	U	**1400**		120	U	120	U	120	U	120	U	1400
INS-A37-01	42	U	42	U	42	U	42	U	42	U	**100**		42	U	**710**		84	U	84	U	84	U	84	U	810
INS-A37-31	41	U	41	U	41	U	41	U	41	U	**110**		41	U	**490**		83	U	83	U	83	U	83	U	600
INS-A38-01	60	U	60	U	60	U	60	U	60	U	**250**	**P**	60	U	**2000**		120	U	120	U	120	U	120	U	2250
INS-A39-01	66	U	66	U	66	U	66	U	66	U	**50**	**J**	66	U	**200**	**P**	130	U	130	U	130	U	130	U	250
INS-A40-01	78	U	78	U	78	U	78	U	78	U	**90**		78	U	**430**	**P**	160	U	160	U	160	U	160	U	520
INS-A41-01	76	U	76	U	76	U	76	U	76	U	**150**	**P**	76	U	150	U	150	U	150	U	150	U	150	U	150
INS-A42-01	43	U	43	U	43	U	43	U	43	U	43	U	**210**	**P**	85	U	85	U	85	U	85	U	85	U	210
INS-A43-01	88	U	88	U	88	U	88	U	88	U	88	U	88	U	180	U	180	U	180	U	180	U	180	U	0
INS-A44-01	86	U	86	U	86	U	86	U	86	U	86	U	86	U	170	U	170	U	170	U	170	U	170	U	0
INS-A45-01	69	U	69	U	69	U	69	U	69	U	**140**	**P**	69	U	**300**	**P**	140	U	140	U	140	U	140	U	440
INS-A46-01	88	U	88	U	88	U	88	U	88	U	**95**		88	U	180	U	180	U	180	U	180	U	180	U	95
INS-A46-51	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	0
INS-A47-01	46	U	46	U	46	U	46	U	46	U	**69**	**P**	46	U	91	U	91	U	91	U	91	U	91	U	69
INS-A48-01	80	U	80	U	80	U	80	U	80	U	80	U	80	U	160	U	160	U	160	U	160	U	160	U	0
INS-A48-31	82	U	82	U	82	U	82	U	82	U	82	U	82	U	160	U	160	U	160	U	160	U	160	U	0
INS-A49-01	85	U	85	U	85	U	85	U	85	U	85	U	85	U	170	U	170	U	170	U	170	U	170	U	0
INS-A50-01	79	U	79	U	79	U	79	U	79	U	**140**		79	U	160	U	160	U	160	U	160	U	160	U	140
INS-A51-01	86	U	86	U	86	U	86	U	86	U	86	U	86	U	170	U	170	U	170	U	170	U	170	U	0

Table 2.2. Summary of PCB/PCT Arochlors, Back River, Langley Air Force Base, Virginia

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Sample ID Number	PCB/PCT Arochlors (µg/kg)																								
	PCB 1016	Q	PCB 1221	Q	PCB 1232	Q	PCB 1242	Q	PCB 1248	Q	PCB 1254	Q	PCB 1260	Q	PCT 5432	Q	PCT 5460	Q	PCT 6040	Q	PCT 6062	Q	PCT 6070	Q	Total
INS-A52-01	78	U	78	U	78	U	78	U	78	U	78	U	78	U	160	U	160	U	160	U	160	U	160	U	0
INS-A52-31	76	U	76	U	76	U	76	U	76	U	76	U	76	U	150	U	150	U	150	U	150	U	150	U	0
INS-A53-01	81	U	81	U	81	U	81	U	81	U	81	U	81	U	160	U	160	U	160	U	160	U	160	U	0
INS-A54-01	69	U	69	U	69	U	69	U	69	U	69	U	69	U	140	U	140	U	140	U	140	U	140	U	0
INS-A55-01	46	U	46	U	46	U	46	U	46	U	**26**	**J**	46	U	92	U	92	U	92	U	92	U	92	U	26
INS-A56-01	56	U	56	U	56	U	56	U	56	U	56	U	**24**	**J***	110	U	110	U	110	U	110	U	110	U	24
INS-A57-01	59	U	59	U	59	U	59	U	59	U	59	U	59	U	120	U	**140**	**P**	120	U	120	U	120	U	140
INS-B1-01	46	U	46	U	46	U	46	U	46	U	46	U	46	U	92	U	92	U	92	U	92	U	92	U	0
INS-B14-01	44	U	44	U	44	U	44	U	44	U	44	U	44	U	89	U	89	U	89	U	89	U	89	U	0
INS-B33-01	58	U	58	U	58	U	58	U	58	U	58	U	58	U	120	U	120	U	120	U	120	U	120	U	0
INS-B42-01	78	U	78	U	78	U	78	U	78	U	78	U	78	U	160	U	160	U	160	U	160	U	160	U	0
INS-C1-01	48	U	48	U	48	U	48	U	48	U	48	U	48	U	97	U	97	U	97	U	97	U	97	U	0
INS-C14-01	46	U	46	U	46	U	46	U	46	U	46	U	46	U	91	U	91	U	91	U	91	U	91	U	0
INS-C33-01	61	U	61	U	61	U	61	U	61	U	61	U	61	U	120	U	120	U	120	U	120	U	120	U	0
INS-C42-01	74	U	74	U	74	U	74	U	74	U	74	U	74	U	150	U	150	U	150	U	150	U	150	U	0
OF4-A1-01	45	U	45	U	45	U	45	U	45	U	**23**	**J**	45	U	90	U	90	U	90	U	90	U	90	U	23
OF4-A2-01	200	U	200	U	200	U	200	U	**1400**	**P**	200	U	200	U	410	U	410	U	410	U	410	U	410	U	1400
OF4-A3-01	55	U	55	U	55	U	55	U	55	U	250	U	**55**		110	U	110	U	110	U	110	U	110	U	55
OF4-A4-01	76	U	76	U	76	U	610	U	76	U	**76**		76	U	150	U	150	U	150	U	150	U	150	U	76
OF4-A5-01	46	U	46	U	46	U	46	U	46	U	**260**		46	U	92	U	92	U	92	U	92	U	92	U	260
OF4-A6-01	59	U	59	U	59	U	59	U	59	U	**520**		59	U	120	U	**100**	**J**	120	U	120	U	120	U	620
OF4-A7-01	51	U	51	U	51	U	51	U	51	U	**70**	**P**	51	U	100	U	**17**	**J**	100	U	100	U	100	U	87
OF4-A8-01	52	U	52	U	52	U	52	U	52	U	**220**	**P**	52	U	100	U	100	U	100	U	100	U	100	U	220
OF4-A9-01	62	U	62	U	62	U	62	U	62	U	62	U	62	U	130	U	130	U	130	U	130	U	130	U	0
OF4-A10-01	58	U	58	U	58	U	58	U	58	U	**110**	**P**	58	U	120	U	**140**		120	U	120	U	120	U	250
OF4-A10-51	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	0
OF4-A11-01	48	U	48	U	48	U	48	U	48	U	48	U	**110**	*	96	U	**230**		96	U	96	U	96	U	340
OF4-A12-01	57	U	57	U	57	U	57	U	57	U	**57**		150	U	110	U	110	U	110	U	110	U	110	U	57
OF4-A13-01	63	U	63	U	63	U	**63**		63	U	320	U	63	U	130	U	130	U	130	U	130	U	130	U	63

Table 2.2. Summary of PCB/PCT Arochlors, Back River, Langley Air Force Base, Virginia

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Sample ID Number	PCB/PCT Arochlors (µg/kg)																								
	PCB 1016	Q	PCB 1221	Q	PCB 1232	Q	PCB 1242	Q	PCB 1248	Q	PCB 1254	Q	PCB 1260	Q	PCT 5432	Q	PCT 5460	Q	PCT 6040	Q	PCT 6062	Q	PCT 6070	Q	Total
OF4-A14-01	**420**	***P**	92	U	92	U	92	U	92	U	**470**		92	U	180	U	180	U	180	U	180	U	180	U	890
OF4-A14-31	44	U	44	U	44	U	44	U	44	U	**330**		44	U	88	U	**360**		88	U	88	U	88	U	690
OF4-A15-01	39	U	39	U	39	U	39	U	39	U	**120**		39	U	78	U	**120**		78	U	78	U	78	U	240
OF4-A16-01	42	U	42	U	42	U	42	U	42	U	**120**		42	U	84	U	84	U	84	U	84	U	84	U	120
OF4-A17-01	65	U	65	U	65	U	65	U	65	U	**34**	**JP**	65	U	130	U	**190**	**P**	130	U	130	U	130	U	224
OF4-A18-01	57	U	57	U	57	U	57	U	57	U	**160**	**P**	57	U	110	U	**62**	**J**	110	U	110	U	110	U	222
OF4-A19-01	60	U	60	U	60	U	60	U	60	U	**210**	**P**	60	U	**590**	**P**	120	U	120	U	120	U	120	U	800
OF4-A20-01	330	U	330	U	330	U	330	U	330	U	**1100**	**P**	330	U	660	U	**270**	**J**	660	U	660	U	660	U	1370
OF4-A20-31	66	U	66	U	66	U	66	U	66	U	**76**	*****	66	U	130	U	130	U	130	U	130	U	130	U	76
OF4-B1-01	45	U	45	U	45	U	45	U	45	U	45	U	45	U	90	U	90	U	90	U	90	U	90	U	0
OF4-B2-01	240	U	240	U	240	U	240	U	240	U	240	U	**400**		480	U	**130**	**J***	480	U	480	U	480	U	530
OF4-B3-01	49	U	49	U	49	U	49	U	49	U	**32**	**JP**	49	U	98	U	98	U	98	U	98	U	98	U	32
OF4-B4-01	66	U	66	U	66	U	66	U	66	U	66	U	66	U	130	U	130	U	130	U	130	U	130	U	0
OF4-B5-01	45	U	45	U	45	U	45	U	45	U	45	U	45	U	91	U	91	U	91	U	91	U	91	U	0
OF4-C1-01	45	U	45	U	45	U	45	U	45	U	45	U	45	U	91	U	91	U	91	U	91	U	91	U	0
OF4-C2-01	46	U	46	U	46	U	46	U	46	U	46	U	**18**	**J**	91	U	**11**	**J***	91	U	91	U	91	U	29
OF4-C3-01	48	U	48	U	48	U	48	U	48	U	48	U	48	U	96	U	96	U	96	U	96	U	96	U	0
OF4-C4-01	62	U	62	U	62	U	62	U	62	U	62	U	62	U	130	U	130	U	130	U	130	U	130	U	0
OF4-C5-01	44	U	44	U	44	U	44	U	44	U	44	U	44	U	89	U	89	U	89	U	89	U	89	U	0
OF4-D5-01	44	U	44	U	44	U	44	U	44	U	44	U	44	U	87	U	87	U	87	U	87	U	87	U	0
OUS-A1-01	43	U	43	U	43	U	43	U	43	U	43	U	43	U	86	U	86	U	86	U	86	U	86	U	0
OUS-A1-01-2	33	U	33	U	33	U	33	U	33	U	33	U	33	U	67	U	67	U	67	U	67	U	67	U	0
OUS-A2-01	42	U	42	U	42	U	42	U	42	U	42	U	42	U	85	U	85	U	85	U	85	U	85	U	0
OUS-A2-51	1	U	1	U	1	U	1	U	1	U	1	U	1	U	2	U	2	U	2	U	2	U	2	U	0
OUS-A3-01	210	U	210	U	210	U	210	U	210	U	210	U	210	U	420	U	420	U	420	U	420	U	420	U	0
OUS-A3-31	210	U	210	U	210	U	210	U	210	U	210	U	210	U	420	U	420	U	420	U	420	U	420	U	0
OUS-A4-01	47	U	47	U	47	U	47	U	47	U	47	U	47	U	94	U	94	U	94	U	94	U	94	U	0
OUS-A5-01	63	U	63	U	63	U	63	U	63	U	63	U	63	U	130	U	130	U	130	U	130	U	130	U	0
OUS-A5-31	63	U	63	U	63	U	63	U	63	U	63	U	63	U	130	U	130	U	130	U	130	U	130	U	0

Table 2.2. Summary of PCB/PCT Arochlors, Back River, Langley Air Force Base, Virginia

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Sample ID Number	PCB/PCT Arochlors (µg/kg)																								
	PCB 1016	Q	PCB 1221	Q	PCB 1232	Q	PCB 1242	Q	PCB 1248	Q	PCB 1254	Q	PCB 1260	Q	PCT 5432	Q	PCT 5460	Q	PCT 6040	Q	PCT 6062	Q	PCT 6070	Q	Total
OUS-A6-01	60	U	60	U	60	U	60	U	60	U	60	U	60	U	120	U	120	U	120	U	120	U	120	U	0
OUS-A7-01	60	U	60	U	60	U	60	U	60	U	60	U	60	U	120	U	120	U	120	U	120	U	120	U	0
OUS-A8-01	57	U	57	U	57	U	57	U	57	U	57	U	57	U	110	U	110	U	110	U	110	U	110	U	0
OUS-A9-01	46	U	46	U	46	U	46	U	46	U	46	U	46	U	91	U	91	U	91	U	91	U	91	U	0
OUS-A10-01	55	U	55	U	55	U	55	U	55	U	55	U	**18**	**J**	110	U	110	U	110	U	110	U	110	U	18
OUS-A11-01	72	U	72	U	72	U	72	U	72	U	**130**	**P**	72	U	140	U	140	U	140	U	140	U	140	U	130
OUS-A12-01	52	U	52	U	52	U	52	U	52	U	**57**		52	U	100	U	100	U	100	U	100	U	100	U	57
OUS-A12-51	1	U	1	U	1	U	1	U	1	U	1	U	1	U	2	U	2	U	2	U	2	U	2	U	0
OUS-A13-01	46	U	46	U	46	U	46	U	46	U	**160**		46	U	92	U	**110**		92	U	92	U	92	U	270
OUS-A13-31	46	U	46	U	46	U	46	U	46	U	**120**		46	U	92	U	92	U	92	U	92	U	92	U	120
OUS-A14-01	47	U	47	U	47	U	47	U	47	U	47	U	47	U	94	U	94	U	94	U	94	U	94	U	0
OUS-B9-01	42	U	42	U	42	U	42	U	42	U	42	U	42	U	84	U	84	U	84	U	84	U	84	U	0
OUS-C9-01	43	U	43	U	43	U	43	U	43	U	43	U	43	U	86	U	86	U	86	U	86	U	86	U	0
TMC-A1-01	62	U	62	U	62	U	62	U	62	U	62	U	62	U	130	U	130	U	130	U	130	U	130	U	0
TMC-A2-01	66	U	66	U	66	U	66	U	66	U	66	U	66	U	130	U	130	U	130	U	130	U	130	U	0
TMC-A3-01	68	U	68	U	68	U	68	U	68	U	68	U	68	U	140	U	140	U	140	U	140	U	140	U	0
TMC-A3-31	70	U	70	U	70	U	70	U	70	U	70	U	70	U	140	U	140	U	140	U	140	U	140	U	0
TMC-A4-01	69	U	69	U	69	U	69	U	69	U	69	U	69	U	140	U	140	U	140	U	140	U	140	U	0
TMC-A4-51	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	0
TMC-B1-01	53	U	53	U	53	U	53	U	53	U	53	U	53	U	110	U	110	U	110	U	110	U	110	U	0
TMC-C1-01	64	U	64	U	64	U	64	U	64	U	64	U	64	U	130	U	130	U	130	U	130	U	130	U	0

Qualifier Definitions:
U – Indicates that the compound was analyzed for but not detected.
J – Indicates that the value is less than the reporting limit but greater than the Method Detection Limit (MDL).
P – Indicates that there is greater than 25% difference for detected Arochlor results between the two GC columns.
* – Indicates that the duplicate analysis was not within control limits.

Table 2.3. PCB Congener Analysis for Two Sample Locations, Back River, Langley Air Force Base, Virginia

Congener Number	PCB Species Name	Inner Shoreline ID Number and Concentration (µg/kg)		Outfall 004 ID Number and Concentration (µg/kg)		
		INS-A10-01	INS-A47-01	OF4-A2-01	OF4-A3-01	OF4-A3-31
1	2-Chlorobiphenyl	ND	ND	ND	ND	ND
3	4-Chlorobiphenyl	ND	ND	ND	ND	ND
5	2,3-Dichlorobiphenyl	ND	ND	B	ND	ND
7	2,4'-Dichlorobiphenyl	ND	ND	1.2 J,COL	2.4	1.6 J
15	4,4'-Dichlorobiphenyl	ND	ND	ND	ND	ND
18	2,2',5-Trichlorobiphenyl	ND	ND	4.3	5.2	3.1
28	2,4,4'-Trichlorobiphenyl	ND	2.8 J	5.4 J	5.0 J	3.3 J
29	2,4',5-Trichlorobiphenyl	ND	2.1 J	4.5 J	4.2 J	2.6 J
37	3,4',4'-Trichlorobiphenyl	ND	ND	ND	1.5 J,COL	ND
43	2,2',3,5'-Tetrachlorobiphenyl	ND	4.5	8.3	12	7.1
48	2,2',4,5'-Tetrachlorobiphenyl	0.27 J	3.5	6.5	7.3	4.5
52	2,2',5,5'-Tetrachlorobiphenyl	0.47 J	9.1	13	27	15
60	2,3',4,4'-Tetrachlorobiphenyl	0.17 J,COL	3.3 COL	7.6 COL	6.7 COL	4.0 COL
61	2,3',4',5'-Tetrachlorobiphenyl	ND	7.2	12	20	11
74	2,4,4',5'-Tetrachlorobiphenyl	ND	1.9	4.5	4.5	2.6
77	3,3',4,4'-Tetrachlorobiphenyl	ND	ND	ND	ND	ND
81	3,4,4',5-Tetrachlorobiphenyl	ND	ND	ND	ND	ND
87	2,2',3,4,5'-Pentachlorobiphenyl	0.31 J,COL	8.2 COL	7.3 COL	22 COL	13 COL
86	2,2',3,4,5-Pentachlorobiphenyl	ND	ND	ND	ND	ND
99	2,2',4,4',5-Pentachlorobiphenyl	0.50 J	8.0	8.1	19.0	10
101	2,2',4,5,5'-Pentachlorobiphenyl	1.0	14 COL	37	43	25
105	2,3,3',4,4'-Pentachlorobiphenyl	0.27 J	6.4	6.2	17	9.6
108	2,3,3',4',5-Pentachlorobiphenyl	0.86 J	20	18 COL	50	29
114	2,3,4,4',5-Pentachlorobiphenyl	ND	0.53 J,COL	1.8 J,COL	1.2 J,COL	0.71 J,COL
115	2,3,4,4',6-Pentachlorobiphenyl	ND	0.19 J,COL	ND	1.0 J,COL	0.52 J,COL
118	2,3',4,4',5-Pentachlorobiphenyl	0.70 J,COL	16	14	41	22
119	2,3',4,4',6-Pentachlorobiphenyl	ND	ND	ND	0.82 J	0.52 J,COL

Table 2.3. PCB Congener Analysis for Two Sample Locations, Back River, Langley Air Force Base, Virginia

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Congener Number	PCB Species Name	Inner Shoreline ID Number and Concentration (µg/kg)		Outfall 004 ID Number and Concentration (µg/kg)		
		INS-A10-01	INS-A47-01	OF4-A2-01	OF4-A3-01	OF4-A3-31
118	2,3',4,4',5'-Pentachlorobiphenyl	ND	ND I	1.3 J	ND	ND
126	3,3',4,4',5'-Pentachlorobiphenyl	ND	ND	ND	ND	ND
128	2,2',3,3',4,4'-Hexachlorobiphenyl	0.22 J	4.1	3.2	11	5.9
137	2,2',3,4,4',5'-Hexachlorobiphenyl	0.81 J	17	14	41	24
138	2,2',3,4,5,5'-Hexachlorobiphenyl	ND	3.1	2.8	8.2	4.7
149	2,2',3,4',5',6-Hexachlorobiphenyl	0.75 J	12 COL	9.5	29	17
151	2,2',3,5,5',6-Hexachlorobiphenyl	ND	2.6	2.3	6.5	3.7
153	2,2',4,4',5,5'-Hexachlorobiphenyl	0.89 J	14	11	33	19
156	2,3,3',4,4',5-Hexachlorobiphenyl	ND	1.9	1.6 J	5.1	2.9
157	2,3,3',4,4',5'-Hexachlorobiphenyl	ND	ND	ND	1.4 J, COL	0.84 J,COL
158	2,3,3',4,4',6-Hexachlorobiphenyl	ND	3.2	2.6	8.1	4.6
167	2,3',4,4',5,5'-Hexachlorobiphenyl	ND	1.1	0.81 J,COL	2.3	1.3 J
168	2,3',4,4',5',6-Hexachlorobiphenyl	ND	ND	ND	ND	ND
169	3,3',4,4',5,5'-Hexachlorobiphenyl	ND	ND	ND	ND	ND
170	2,2',3,3',4,4',5-Heptachlorobiphenyl	ND	4.1	3.4	8.7	5.2
174	2,2',3,3',4,5',6'-Heptachlorobiphenyl	ND	1.6 COL	1.5 J	3.3	2.2
180	2,2',3,4,4',5,5'-Heptachlorobiphenyl	ND	5.1	6.3	14	8.2
183	2,2',3,4,4',5',6-Heptachlorobiphenyl	ND	1.6	1.9	4.0	2.5
184	2,2',3,4,4',6,6'-Heptachlorobiphenyl	ND	ND	ND	ND	ND
185	2,2',3,4',5,5',6-Heptachlorobiphenyl	0.20 J	3.0	3.4	6.8	4.5
189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ND	ND	ND	0.44 J,COL	ND
194	2,2',3,3',4,4',5,5'-Octachlorobiphenyl	ND	ND G	2.0	3.9	2.7
195	2,2',3,3',4,4',5,6-Octachlorobiphenyl	ND	0.38 J,COL	0.71 J	1.1 J,COL	0.71 J,COL
201	2,2',3,3',4,5',6,6'-Octachlorobiphenyl	ND	ND	ND	ND	ND
203	2,2',3,3',4,5,5',6'-Octachlorobiphenyl	ND	ND G	3.0	7.3	ND G
202	2,2',3,3',5,5',6,6'-Octachlorobiphenyl	ND	3.3	ND	8.6	4.2

Table 2.3. PCB Congener Analysis for Two Sample Locations, Back River, Langley Air Force Base, Virginia

Congener Number	Congeners of Polychlorinated Biphenyls	Inner Shoreline ID Number and Concentration (µg/kg)		Outfall 004 ID Number and Concentration (µg/kg)		
		INS-A10-01	INS-A47-01	OF4-A2-01	OF4-A3-01	OF4-A3-31
205	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	ND	0.82 J,B	2.1	2.3	1.6 J
207	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl	ND	ND	ND	ND	ND
208	2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	ND	1.2	1.1 J,COL	0.68 J	ND

J - Estimated result. Result is less than reporting limit.
COL - More than 40% reported between primary and confirmation column results. Lower of the two results is reported.
I - Matrix interference.
G - Elevated reporting limit. The reporting limit is elevated due to matrix interference.
B - Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Table 2.4. Results of Back River Benthic Macroinvertebrate Sampling at Site SS-63, Langley AFB, Virginia

(Page 1 of 2)

	SD-01	SD-02	SD-03	SD-04	SD-05	SD-06	SD-07	SD-08	SD-09	SD-10
Depth	4.00	4.50	5.00	6.00	6.00	5.00	3.00	3.50	4.00	4.50
Temperature (^{o}C)	NA	27.40	26.30	26.20	27.00	24.60	23.90	NA	NA	24.30
Salinity (%)	NA	1.58	1.62	1.61	1.62	1.58	1.96	NA	NA	1.86
Conductivity (ms/cm)	NA	25.70	26.30	26.10	26.20	26.80	31.20	NA	NA	29.60
pH	NA	8.10	8.17	8.15	8.23	8.10	8.11	NA	NA	8.14
Total Taxa	19.00	6.00	15.00	15.00	17.00	24.00	28.00	25.00	21.00	21.00
Mean Number of individuals	132.70	13.70	38.70	23.30	50.30	92.00	164.00	85.30	50.70	50.00
Shannon-Weiner Diversity	1.60	1.19	2.05	2.23	2.10	1.79	2.01	1.68	2.44	2.45
Simpson's Dominance Index	0.30	0.42	0.18	0.16	0.18	0.31	0.22	0.40	0.13	0.12
Species Richness	3.01	1.35	2.95	3.30	3.19	4.09	4.36	4.33	3.98	3.99
Species Evenness	0.54	0.66	0.76	0.82	0.74	0.56	0.60	0.52	0.80	0.81
Ash Free Dry Weight (AFDW) (grams)	0.018	0.001	0.013	0.025	0.013	0.013	0.021	0.013	0.026	0.067
Number of Intolerant (Sensitive) Species	2	1	2	1	2	2	2	2	2	2

Table 2.4. Results of Back River Benthic Macroinvertebrate Sampling at Site SS-63, Langley AFB, Virginia

	SD-11	SD-12	SD-13	SD-14	SD-15	SD-16	SD-17	SD-18	SD-19	SD-20
Depth	5.00	7.00	5.00	4.00	4.00	3.00	3.50	3.00	2.00	2.50
Temperature (^{o}C)	23.70	23.90	NA	25.40	24.80	25.30	25.50	25.10	27.10	24.40
Dissolved Oxygen (DO) (mg/L)	7.76	7.72	NA	6.55	5.47	6.09	6.27	5.79	7.39	8.26
Salinity (%)	1.83	1.82	NA	1.60	1.43	1.49	1.39	1.37	1.01	1.01
Conductivity (ms/cm)	29.50	29.30	NA	26.10	23.20	25.00	22.90	22.50	17.10	17.10
pH	8.07	8.07	NA	7.87	7.74	7.86	7.78	7.74	7.86	6.52
Total Taxa	20.00	13.00	15.00	17.00	17.00	21.00	18.00	14.00	10.00	14.00
Mean Number of individuals	31.30	10.30	13.00	74.50	25.00	81.70	151.70	133.70	105.00	76.70
Shannon-Weiner Diversity	2.40	2.15	2.43	2.23	2.64	2.28	1.28	0.95	1.31	0.98
Simpson's Dominance Index	0.14	0.17	0.12	0.15	0.08	0.15	0.46	0.62	0.42	0.63
Species Richness	4.18	3.49	3.82	3.20	3.71	3.64	2.78	2.17	1.56	2.39
Species Evenness	0.80	0.84	0.90	0.79	0.93	0.75	0.44	0.36	0.57	0.37
Ash Free Dry Weight (AFDW) (grams)	0.018	0.010	0.014	0.019	0.022	0.064	0.076	0.041	0.049	0.029
Number of Intolerant (Sensitive) Species	1	1	1	3	3	3	3	3	3	3

NA – Not Available
^{o}C – degrees Celsius
mg/L – milligrams per liter
% - percent
ms/cm – millisiemens per centimeter

Table 2.5. Results of Mysid Shrimp Toxicity Data with Statistical Comparison at SS-63, Langley AFB, Virginia

Sample Location	Mean % Survival (SD)	Mean % Female with Eggs (SD)	Mean Mysid Dry Weight (mg) per Mysid (SD)
Lab Control	98(7)	83(36)	0.211(0.026)
TOX-01	95(9)	84(35)	0.233(0.037)
TOX-02	95(9)	81(35)	0.192(0.035)
TOX-03	98(7)	93(14)	0.174(0.022)
TOX-04	88(10)[c]	83(22)	0.187(0.022)
TOX-05	93(15)	92(15)	0.188(0.034)
TOX-06	94(10)	93(19)	0.152(0.039)[a]
TOX-07	100(0)	87(14)	0.150(0.032)[a]
TOX-08	85(14)[a,c]	89(16)	0.137(0.029)[a,b]
TOX-09	98(7)	80(19)	0.144(0.051)[a,b]
TOX-10	100(0)	94(18)	0.144(0.028)[a,b]

Notes:
[a] Statistically different compared to the lab control data.
[b] Statistically different compared to the TOX-04 (background control) data.
[c] Statistically different compared to the TOX-10 (upstream control) data.
% - percent
mg - milligrams

Table 2.6. Results of Analyses for Surface Water Sampling at Site SS-63, Langley AFB, Virginia

Parameter	EPA Region III Surface Water RBSLs[5]	Ambient Water Quality Criteria	AWQC Reference	SW-01 Total	SW-01 Dissolved	SW-02 Total	SW-02 Dissolved	SW-03 Total	SW-03 Dissolved	SW-04 Total	SW-04 Dissolved	SW-05 Total	SW-05 Dissolved	SW-06 Total	SW-06 Dissolved
Temperature (°C)	NA	NA	NA	25.60	25.60	24.90	24.90	24.30	24.30	24.00	24.00	24.60	24.60	25.60	25.60
Salinity (%)	NA	NA	NA	1.58	1.58	1.62	1.62	1.61	1.61	1.63	1.63	1.58	1.58	1.51	1.51
Conductivity (ms/cm)	NA	NA	NA	25.70	25.70	26.30	26.30	27.00	27.00	26.40	26.40	25.90	25.90	24.60	24.60
pH	NA	NA	NA	8.22	8.22	8.22	8.22	8.06	8.06	8.01	8.01	7.99	7.99	7.95	7.95
Total Cyanide (mg/L)	0.73	0.001	NOAA Marine												
VOCs (ug/L)															
Acetone	610	-	-								1.72			1.86	1.82
Carbon disulfide	1000	-	-										0.0533		
Chloromethane	21	-	-												
Toluene	750	5000	NOAA Marine		0.514		0.815		0.650		0.203		0.108		0.129
m&p-Xylenes	12000	-	-												
SVOCs (ug/L)															
4-Chloro-3-methylphenol	120	-	-										6.26		
Di-n-butylphthalate	3700	3.4	NOAA Marine										1.20		
bis(2-Ethylhexyl)phthalate	48	59	Virginia Water Quality Standard				2.67				**121**				
Chlorinated Pesticides & PCBs (ug/L)															
Aldrin	0.039	0.0014	Virginia Water Quality Standard												
beta-BHC[1]	0.37	0.34[1]	NOAA Marine		0.00447		0.00536			0.00521					0.0141
delta-BHC[1]	0.37[1]	0.34[1]	NOAA Marine		0.0165	0.0170		0.0147		0.00890				0.0161	0.00794
gamma-BHC[1]	0.52	0.34[1]	NOAA Marine	0.0179	0.00829					0.00627	0.0187	0.00450			
alpha-Chlordane	1.9	0.002	NOAA Marine												
4,4'-DDD	2.8	0.0084	Virginia Water Quality Standard				**0.0107**		**0.0108**	**0.0147**	**0.0132**				**0.0119**
4,4'-DDE	2	0.0059	Virginia Water Quality Standard											**0.00786**	
Endosulfan I[2]	220	0.00435	NOAA Marine												
Endosulfan II[2]	220	0.00435	NOAA Marine		0.00387										0.00413
Endrin	11	0.00115	NOAA Marine		**0.0103**		**0.0109**		**0.0105**		**0.00974**				**0.0112**
Endrin ketone[3]	11	0.00115	NOAA Marine	**0.00205**	**0.00223**		**0.00188**								
Heptachlor	0.15	0.0018	NOAA Marine												
Heptachlor epoxide	0.074	0.0018	NOAA Marine		**0.00472**	**0.00463**	**0.00538**		**0.00458**		**0.00407**				**0.00511**
Chlorinated Herbicides (ug/L)															
Dicamba	1100	-	-												
Dichloroprop	290	-	-		0.127				0.0556		0.146				
2,4,5-T	370	-	-							0.0337	0.0180				
MCPA	18	-	-							**63.7**					
Metals (mg/L)															
Aluminum	37	0.087	NOAA Fresh	**0.701**		**0.743**		**0.777**		**1.19**		**0.246**		**1.48**	
Antimony	0.015	0.5	NOAA Marine	0.00452		0.00681				0.0108		0.00501			
Arsenic[4]	0.00045	0.036[4]	NOAA Marine											**0.00374**	
Barium	2.6	-	-	0.0272	0.0256	0.0269	0.0253	0.0279	0.0248	0.0542	0.0241	0.0261		0.0306	0.0552
Beryllium	0.073	0.0053	NOAA Fresh												
Cadmium	0.018	0.0093	NOAA Marine												
Calcium	-	-	-	207	209	205	207	193	195	409	192	210	0.0633	189	369
Chromium	0.11	0.05	NOAA Marine	0.00139		0.00139		0.000980	0.00109	0.00660		0.00106		0.00365	
Cobalt	0.73	-	-												
Copper	1.5	0.0031	NOAA Marine												
Iron	11	1	NOAA Fresh	0.620	0.0863	0.624		0.713		**1.09**		0.402		**1.33**	0.200
Mercury	0.011	0.00094	NOAA Marine												
Lead		0.0081	NOAA Marine												
Magnesium	-	-	-	698	687	691	712	707 J	695 J	718 J	675 J	668 J	0.0818	641 J	649 J
Manganese	0.73	-	-	0.0238		0.0197		0.0214		0.0554	0.0145	0.0256		0.0547	0.0439
Nickel	0.73	0.0082	NOAA Marine												
Potassium	-	-	-	219 J	215	217	220	205 J	203 J	215 J	208 J	203 J		187 J	188 J
Selenium	0.18	0.071	NOAA Marine	0.0130	0.0144	0.0136	0.0161	0.0135	0.0183	0.0333	0.0159	0.0156		0.0126	0.0277
Silver	0.18	0.00095	NOAA Marine												
Sodium	-	-	-	5590	5500	5550	5630	5720 J	5630 J	5920 J	5710 J	5630 J	0.556	5300 J	5340 J
Thallium	0.0026	2.13	NOAA Marine						**0.00323**	**0.00686**					
Vanadium	0.26	-	-											0.00216	
Zinc	11	0.081	NOAA Marine												

NA - Not applicable
- Screening criteria unavailable
Blank cell - Analyte was not detected in any of the samples from the indicated investigation.
B - Concentration similar to low-level concentrations found in associated blanks.
J - Estimated value.
[1] BHC used as surrogate
[2] Endosulfan used as surrogate
[3] Endrin used as surrogate
[4] Total Arsenic used as surrogate
[5] Surface water RBSLs were determined by multiplying tap water RBSLs by 10

Indicates result exceeds Human Health Criteria
Indicates result exceeds Ecological Health Criteria
Indicates result exceeds Ecological and Human Health Criteria

Table 2.6. Results of Analyses for Surface Water Sampling at Site SS-63, Langley AFB, Virginia

Parameter	EPA Region III Surface Water RBSLs[5]	Ambient Water Quality Criteria	AWQC Reference	SW-07 Total	SW-07 Total-Dup	SW-07 Dissolved	SW-07 Dissolved-Dup	SW-08 Total	SW-08 Dissolved	SW-09 Total	SW-09 Dissolved	SW-10 Total	SW-10 Dissolved
Temperature (°C)	NA	NA	NA	24.70	24.70	24.70	24.70	26.60	26.60	27.10	27.10	24.40	24.40
Salinity (%)	NA	NA	NA	1.48	1.48	1.48	1.48	1.27	1.27	1.01	1.01	1.01	1.01
Conductivity (ms/cm)	NA	NA	NA	24.40	24.40	24.40	24.40	21.10	21.10	17.10	17.10	17.10	17.10
pH	NA	NA	NA	7.86	7.86	7.86	7.86	7.86	7.86	7.86	7.86	6.52	6.52
Total Cyanide (mg/L)	0.73	0.001	NOAA Marine										
VOCs (ug/L)													
Acetone	610	-	-	1.13	1.58				2.47	2.17	2.28		
Carbon disulfide	1000	-	-										
Chloromethane	21	-	-			0.291	0.320						
Toluene	750	5000	NOAA Marine				0.0942		0.132	0.0916	0.168		2.06
m&p-Xylenes	12000	-	-								0.142		
SVOCs (ug/L)													
4-Chloro-3-methylphenol	120	-	-										
Di-n-butylphthalate	3700	3.4	NOAA Marine										
bis(2-Ethylhexyl)phthalate	48	59	Virginia Water Quality Standard										
Chlorinated Pesticides & PCBs (ug/L)													
Aldrin	0.039	0.0014	Virginia Water Quality Standard	**0.00965**		**0.0127**	**0.0120**						
beta-BHC[1]	0.37	0.34[1]	NOAA Marine		0.00776 J								
delta-BHC[1]	0.37[1]	0.34[1]	NOAA Marine		0.00387 J	0.0102	0.0109	0.00447			0.0178	0.0134	
gamma-BHC[1]	0.52	0.34[1]	NOAA Marine		0.00463 J	0.00450	0.00382	0.00510		0.0121	0.0151	0.0111	
alpha-Chlordane	1.9	0.002	NOAA Marine									0.00135	
4,4'-DDD	2.8	0.0084	Virginia Water Quality Standard									**0.0144**	**0.0129**
4,4'-DDE	2	0.0059	Virginia Water Quality Standard						0.00482				
Endosulfan I[2]	220	0.00435	NOAA Marine										
Endosulfan II[2]	220	0.00435	NOAA Marine									**0.00455**	
Endrin	11	0.00115	NOAA Marine									**0.0119**	**0.0106**
Endrin ketone[3]	11	0.00115	NOAA Marine										**0.00190**
Heptachlor	0.15	0.0018	NOAA Marine			**0.0195 J**			**0.0208**		**0.0227**		
Heptachlor epoxide	0.074	0.0018	NOAA Marine										**0.00405**
Chlorinated Herbicides (ug/L)													
Dicamba	1100	-	-								0.0361		
Dichloroprop	290	-	-										
2,4,5-T	370	-	-										
MCPA	18	-	-										
Metals (mg/L)													
Aluminum	37	0.087	NOAA Fresh	**0.464**	**0.719**			**1.12**		**0.454**		**0.672**	
Antimony	0.015	0.5	NOAA Marine		0.00953 J	0.00845	0.00884		0.00719				
Arsenic[4]	0.00045	0.036[4]	NOAA Marine		**0.00276 J**	**0.00269 J**			**0.00490**				
Barium	2.6	-	-	0.0299	0.0302	0.0291	0.0298	0.0340	0.0322	0.0334	0.0326	0.0296	0.0289
Beryllium	0.073	0.0053	NOAA Fresh										
Cadmium	0.018	0.0093	NOAA Marine										
Calcium	-	-	-	183	193	196	184	172	176	131	138	155	181
Chromium	0.11	0.05	NOAA Marine		0.00384	0.00178	0.00144		0.00242	0.00252		0.00160	
Cobalt	0.73	-	-										
Copper	1.5	0.0031	NOAA Marine										
Iron	11	1	NOAA Fresh	0.672	0.953			**1.10**	0.0821	0.746		0.633	
Mercury	0.011	0.00094	NOAA Marine					0.000106		0.0000750			
Lead		0.0081	NOAA Marine										
Magnesium	-	-	-	588 J	613 J	602 J	592 J	542 J	543 J	421	437 J	467	572
Manganese	0.73	-	-	0.0676	0.0671	0.0308	0.0326	0.0964	0.0600	0.102	0.0528	0.0736	0.0385
Nickel	0.73	0.0082	NOAA Marine		0.00231 J					0.00227			
Potassium	-	-	-	168 J	180 J	176 J	172 J	156 J	154 J	111 J	120 J	243	171
Selenium	0.18	0.071	NOAA Marine	0.0155	0.0137	0.00965	0.0174	0.0109	0.0105	0.00994	0.00933	0.0113	0.0126
Silver	0.18	0.00095	NOAA Marine										
Sodium	-	-	-	4830 J	5110 J	5010 J	4900 J	4520 J	4500 J	3330	3600 J	3770	4560
Thallium	0.0026	2.13	NOAA Marine						**0.00325**				
Vanadium	0.26	-	-										
Zinc	11	0.081	NOAA Marine		0.0110								

NA - Not applicable
- Screening criteria unavailable
Blank cell - Analyte was not detected in any of the samples from the indicated investigation.
B - Concentration similar to low-level concentrations found in associated blanks.
J - Estimated value.
[1] BHC used as surrogate
[2] Endosulfan used as surrogate
[3] Endrin used as surrogate
[4] Total Arsenic used as surrogate
[5] Surface water RBSLs were determined by multiplying tap water RBSLs by 10

Indicates result exceeds Human Health Criteria
Indicates result exceeds Ecological Health Criteria
Indicates result exceeds Ecological and Human Health Criteria

Table 2.7. Results of Analyses for Sport Fish (Large Fish) Sampling at Site SS-63, Langley AFB, Virginia

Parameter	FDA Action Levels	FDA Reference	EPA RBSLs for Fish	BIO-01	BIO-02	BIO-03	BIO-04	BIO-05	BIO-06	BIO-07	BIO-08	BIO-10	BIO-11
Lipids (%)	-		-	3.31	3.12	6.01	3.24	3.91	5.42	3.39	4.73	5.75	7.06
Total Cyanide (mg/kg)	-	-	2.7										
SVOCs (mg/kg)													
Chlorinated Pesticides & PCBs (ug/kg)													
alpha-BHC	-	-	0.5	0.137	0.188	0.0744	0.212	0.223	0.104	0.134	0.132		
delta-BHC	-	-	1.8	0.178	0.212								
gamma-BHC	-	-	2.4	0.196		0.126				0.0813			
4,4'-DDD	-	-	13	2.03	2.23			**28.4**	6.41		6.58	5.04	6.42
4,4'-DDE	5000	Fish	9.3	**13.5**	**11.0**	4.00	6.42	**37.9**	**22.7**	4.54	**15.3**	**29.2**	**30.7**
Heptachlor	300	Fish	0.7										
PCB-1248	2000	Fish	1.6					**104**	**19.2**		**23.7**	**16.7**	**26.2**
PCB-1254	2000	Fish	1.6	**47.9**	**48.8**	**37.2**	**42.0**	**308**	**142**	**31.1**	**97.3**	**68.9**	**72.5**
PCB-1260	2000	Fish	1.6	**22.8**	**11.5**	**34.3**	**17.3**	**97.2**	**58.7**	**11.2**	**42.1**	**39.8**	**55.8**
Chlorinated Herbicides (ug/kg)													
Metals (mg/kg)													
Aluminum	-	-	140										
Arsenic	76	Crustacea	0.0021	**1.50**	**1.81**		**0.840**	**1.28**	**1.04**	**2.56**	**2.10**	**0.742**	**1.03**
Barium	-	-	9.5										
Beryllium	-	-	0.27										
Cadmium	3	Crustacea	0.14										
Calcium	-	-	-	1320		276				168			848
Chromium	12	Crustacea	200										
Cobalt	-	-	2.7										
Copper	-	-	5.4	0.228	0.439	0.315	0.395	0.332	0.427	0.335	0.316	0.451	0.419
Iron	-	-	41										
Mercury	1	Fish	0.014	**0.0593**	**0.0512**	**0.0486**	**0.0692**	**0.0521**	**0.0238**	**0.0598 J**	**0.0395**	**0.0504**	**0.0530**
Lead	1.5	Crustacea	0.000014										
Magnesium	-		-	317	288	300	304	348	358	349	360	315	282
Manganese	-		19										
Nickel	70	Crustacea	2.7										
Potassium	-	-	-	3511	3440	3489	3952	3863	3711	3650	3840	3525	3292
Selenium	-	-	0.68	0.638	**1.05**	**1.14**	**0.914**	**0.758**	**0.854**	**0.789**	**0.868**	0.636	0.670
Silver	-	-	0.68										
Sodium	-	-	-	296	317	335	403	633	622	717	707	472	263
Thallium	-	-	0.0095										
Vanadium	-	-	0.95										
Zinc	-	-	41.0	5.77	4.78	5.78	5.36	5.31	5.13	5.45	5.65	5.72	5.13
PCTs (mg/kg)													
Aroclor 5432	2000[3]	Fish	0.0007	**0.0226**				**0.379**	**0.155**		**0.158**	**0.0318**	**0.0586**
Moisture (%)	-	-	-	77.2	75.6	71.4	75.3	76.3	73.3	76.1	73.7	73.5	72.1

Blank cell - Analyte was not detected in any of the samples from the indicated investigation.
B - Concentration similar to low-level concentrations found in associated blanks.
J - Estimated value.
Yellow indicates result exceeds RBSL

Table 2.8. Results of Analyses for Blue Crab Sampling at Site SS-63, Langley AFB, Virginia

Parameter	FDA Action Levels	FDA Reference	EPA RBSLs for Fish	BIO-01 Meat	BIO-01 Total Tissue	BIO-03 Meat	BIO-03 Total Tissue	BIO-04 Meat	BIO-04 Total Tissue	BIO-04 Total Tissue-Dup	BIO-06 Meat	BIO-06 Total Tissue	BIO-08 Meat	BIO-08 Total Tissue	BIO-11 Meat	BIO-11 Total Tissue
Lipids (%)	-	-	-	0.647	1.47	0.998	1.25	0.93	2.34	2.11	0.599	1.45	0.655	2.84	0.624	3.18
Total Cyanide (mg/kg)																
SVOCs (mg/kg)																
Acenaphthene																
Anthracene																
Benz(a)anthracene																
Benz(a)pyrene																
Benzo(b)fluoranthene																
Benzo(g,h,i)perylene																
Benzo(k)fluoranthene																
4-Methylphenol	-	-	0.68		0.0754				0.130	0.144		0.166		0.0902		
bis(2-Ethylhexyl)phthalate	-	-	0.23	0.120					0.0792 J							0.198
Phenol	-	-	81		0.113	0.126		0.120	0.164	0.152	0.133	0.0680		0.216		0.108
Chlorinated Pesticides & PCBs (ug/kg)																
alpha-BHC	-	-	0.5													
delta-BHC	-	-	1.8											1.08		
gamma-BHC Lindane	-	-	2.4													
gamma-Chlordane	300	Fish	9											0.200		0.222
Dieldrin	300	Fish	0.2		**1.08**				**2.16**	**2.05**				**3.53**		**4.62**
4,4'-DDD	-	-	13	3.39	2.73		2.25		2.88	2.67	0.513	1.81				
4,4'-DDE	5000	Fish	9.3	**11.1**	**10.4**		6.30	4.05	**15.8**	**16.6**		**13.3**	1.27	**25.5**	2.24	**34.3**
Endosulfan I	-	-	810													
Endosulfan sulfate	-	-	810				0.165		0.180 J			0.196		0.431		
Endrin	-	-	41						1.67	1.89				2.94		2.38
Heptachlor	300	Fish	0.7		0.156		0.195	0.0757	0.0864 J	0.164 J		0.166		0.549		0.29
Heptachlor epoxide	300	Fish	0.35		**1.43**		**1.23**	**0.792**	**1.80**	**1.74**		**1.07**		**1.92**		**2.90**
PCB-1254	2000	Fish	1.6	**23.1**		**78.8**									**8.48**	
Chlorinated Herbicides (ug/kg)																
MCPP	-	-	140			**24500**										
2,4,5-T	-	-	1400		20.8	28.0	19.5			25.0 J						39.6
2,4,5-TP	-	-	1100				4.95		3.60 J	8.82 J						
Metals (mg/kg)																
Aluminum	-	-	140	15.3	42.8	6.51	29.7	7.25	13.2	13.4	6.19	39.6	8.12	17.5	6.53	25.2
Antimony	-	-	0.054													
Arsenic	76	Crustacea	0.0021	**3.05**	**1.86**	**4.18**	**2.88**	**3.38**	**2.74**	**2.95**	**3.08**	**2.33**	**1.75**	**2.06**	**1.07**	**0.924**
Barium	-	-	9.5	0.477	0.780	0.333	1.47	0.405	0.594	0.636	0.308	0.740	0.336	1.45	0.288	0.634
Beryllium	-	-	0.27													
Cadmium	3	Crustacea	0.14													
Calcium	-	-	-	2233	3237	1414	6060	1989	2502	2255	985	4621	1506	4704	806	1346
Chromium	12	Crustacea	200		1.16										0.304 B	
Cobalt	-	-	2.7													
Copper	-	-	5.4	**6.62**	**14.7**	**7.75**	**10.1**	**8.62**	**9.34**	**9.94**	**8.05**	**7.85**	**6.09**	**9.49**	**8.54**	**7.85**
Iron	-	-	41	14.20	**61.8**	12.1	**49.7**	13.1	34.4	**57.4**	11.1	**59.9**	11.4	30.2	10.2	**47.4**
Mercury	1	Fish	0.014													
Lead	1.5	Crustacea	0.000014													
Magnesium	-	-	-	547	449	352	642	454	391	420	352	797	444	633	365	305
Manganese	-	-	19	1.45	3.13	1.47	7.55	1.58	2.81	3.18	1.09	4.15	1.10	3.57	0.848	2.14
Nickel	70	Crustacea	2.7	0.431	0.351	0.263		0.370	0.342	0.431	0.496	0.347	0.425	0.274	**5.25**	0.792
Potassium	-	-	-	2002	2028	2730	1461	2464	2088	2276	2839	1555	2443	2215	2544	1175
Selenium	-	-	0.68	0.524	0.559	0.508		0.616	0.594	0.574	**0.684**		0.620		0.464	
Silver	-	-	0.68	**0.785**	0.637	0.333	**0.825**	0.458	0.522	0.595	0.445	0.468	0.425	0.451	0.288	0.330
Sodium	-	-	-	3419	6279	2363	2970	3643	2952	3198	3061	4017	3133	3606	2656	2310
Thallium	-	-	0.0095													
Vanadium	-	-	0.95		0.208		0.210					0.196				
Zinc	-	-	41.0	37.1	25.2	33.8	29.6	**41.9**	25.7	26.4	31.5	26.9	38.2	37.6	**41.4**	33.1
PCTs (mg/kg)																
Moisture (%)	-	-	-	84.6	87.0	82.5	85.0	82.4	82.0	79.5	82.9	84.9	82.3	80.4	84.0	86.8

Blank cell - Analyte was not detected in any of the samples from the indicated investigation.
B - Concentration similar to low-level concentrations found in associated blanks.
J - Estimated value.
Yellow indicates result exceeds RBSL

Table 2.9. Results of Analyses for *Fundulus* (Small Fish) Sampling at Site SS-63, Langley AFB, Virginia

Parameter	FDA Action Levels	FDA Reference	EPA RBSLs for Fish	BIO-01	BIO-01 Duplicate	BIO-02	BIO-03	BIO-04 M/M	BIO-05	BIO-06	BIO-06 Duplicate	BIO-07	BIO-08	BIO-09	BIO-10	BIO-11	BIO-12
Lipids (%)	**-**	**-**	**-**	1.52	1.52	1.17	1.76	2.08	1.25	2.27	2.65	1.54	2.44	1.62	1.57	2.41	1.98
Total Cyanide (mg/kg)			2.7														
SVOCs (mg/kg)																	
bis(2-Ethylhexyl)phthalate	-	-	0.23														
Phenol	-	-	81	0.901 J	0.750 J				0.114					0.128	0.0907	0.377	
Chlorinated Pesticides & PCBs (ug/kg)																	
alpha-BHC	-	-	0.5	**0.664**	**0.605**		0.116		0.155	0.0747 J	0.320 J	0.234	0.277	0.339	0.145	0.256	**0.667**
beta-BHC	-	-	1.8	1.49	1.26	0.0941				1.12 J	0.290 J	0.675	0.958	0.726	0.179	0.286	0.0815
delta-BHC	-	-	1.8	**2.37 J**	1.57 J							0.229					
gamma-BHC	-	-	2.4	0.0758 J								0.166	0.227				0.245
4,4'-DDD	-	-	13	**23.5**	**23.5**	8.05	4.18	**21.9**	1.97	9.46	8.32	1.98	3.28	7.94	2.74	2.21	3.95
4,4'-DDE	5000	Fish	9.3	**41.7**	**41.9**	**16.7**	7.66	**38.8**	**10.0**	**33.6**	**31.8**	**12.5**	**30.2**	**42.8**	**17.2**	**19.1**	**32.1**
Heptachlor	300	Fish	0.7														
PCB-1248	2000	Fish	1.6			**3.34**					**9.07 J**						
PCB-1254	2000	Fish	1.6	**27.3**	**24.2**	**18.4**	**22.0**	**36.0**	**16.4**	**55.3**	**50.4**	**48.2**	**83.2**	**106**	**20.1**	**26.1**	**76.6**
PCB-1260	2000	Fish	1.6	**62.3**	**63.4**	**11.9**	**5.57**	**27.5**	**8.96**	**82.7**	**76.1**	**17.4**	**40.3**	**174**	**12.3**	**16.1**	**27.2**
Chlorinated Herbicides (ug/kg)**																	
Dicamba	-	-	4100										7.81				
MCPP	-	-	140	**37920 J**													
2,4,5-T	-	-	1400				4.41					6.27	7.06				
Metals (mg/kg)																	
Aluminum	-	-	140	57.4	51.8		31.6			54.5 J	85.2 J	44.8	31.5	120	**164**	90.9	
Antimony	-	-	0.054														
Arsenic	76	Crustacea	0.0021	**1.28**	**1.38**	**0.690**	**2.18**	**1.59**	**0.941**	**1.42**	**1.51**	**0.747**	**0.605**	**0.944**	**0.931**	**0.879**	**0.766**
Barium	-	-	9.5	1.68	1.72	1.11	2.95	2.66	1.52	1.79	2.44	0.868	1.97	1.43	1.54	1.18	1.31
Beryllium	-	-	0.27														
Cadmium	3	Crustacea	0.14														
Calcium	-	-	-	20074	19820	9823	27608	11850	15568	16907	20513	8435	20614	22603	16415	15186	13486
Chromium	12	Crustacea	200														
Cobalt	-	-	2.7														
Copper	-	-	5.4	3.65	2.78	0.627	1.95	2.17	1.32	2.12	2.55	0.988	1.41	1.77	3.63	1.08	1.06
Iron	-	-	41	**65.4**	**59.8**	21.5		19.8	19.1	**59.3 J**	**98.5 J**			**127.00**	**156.00**	**93.60**	
Mercury	1	Fish	0.014	0.00972 J	**0.0242 J**	**0.0142**	0.00998	**0.0277**	0.0130	**0.0324**	**0.0353**	**0.0169**	0.00983	**0.0215**	**0.0294**	**0.0143**	0.00963
Lead	1.5	Crustacea	0.000014	**1.19**	**1.06**												
Magnesium	-	-	-	692	687	443	793	471	598	588	663	465	673	714	635	582	605
Manganese	-	-	19	10.5	9.70	1.99	12.9	4.55	2.89	4.81	6.40	4.82	5.67	14.1	15.1	11.8	2.49
Nickel	70	Crustacea	2.7														
Potassium	-	-	-	2678	2759	2884	2668	3095	2688	2938	2873	2772	2671	2807	2842	2811	2841
Selenium	-	-	0.68	**1.02**	0.0944	**0.961**	**0.789**	**0.901**	**0.851**	**0.996**	**1.08**	0.651	**0.706**	**1.11**	**0.858**	**0.954**	0.667
Silver	-	-	0.68	0.147	0.140			0.116			0.0832 J			0.0702	0.0735		
Sodium	-	-	-	1716	1815	1739	1993	1580	1933	1863	1882	1622	1704	1895	1573	1581	1502
Thallium	-	-	0.0095														
Vanadium	-	-	0.95	0.284	0.290		0.255			0.209	0.328		0.219	0.532	0.564	0.452	
Zinc	-	-	41.0	**43.6**	**44.0**	19.0	**48.0**	31.9	30.9	32.4	38.3	25.1	**42.8**	**44.8**	40.4	34.4	**46.4**
PCTs (mg/kg)																	
Moisture (%)	**-**	**-**	**-**	76.3	75.8	79.1	76.8	76.9	77.6	75.1	74.8	75.9	74.8	75.8	75.5	74.9	75.3

Blank cell - Analyte was not detected in any of the samples from the indicated investigation.
B - Concentration similar to low-level concentrations found in associated blanks.
J - Estimated value.
Yellow indicates results exceed RBSL

Table 2.10. Results of Analyses for Bivalves at Site SS-63, Langley AFB, Virginia

Parameter	FDA Action Levels	FDA Reference	EPA RBSLs for Fish	BIO-01 Oyster	BIO-02 Mussel	BIO-03 Mussel	BIO-04 Mussel	BIO-05 Mussel	BIO-06 Mussel	BIO-07 Mussel	BIO-08 Mussel	BIO-08 Mussel-Dup	BIO-09 Mussel	BIO-09 Mussel-Dup	BIO-10 Mussel	BIO-11 Mussel	BIO-12 Mussel
Lipids (%)	-	-	-	0.712	0.608	0.600	0.602	0.320	0.106	0.490	1.06	0.882	0.264	0.220	0.300	0.924	0.450
Total Cyanide (mg/kg)	-	-	2.7	ND	1.34	1.20	1.50	1.91	1.53	1.33	0.931	1.07	ND	0.880	2.08	0.816	1.09
SVOCs (mg/kg)																	
Benz(a)anthracene	-	-	0.0043		ND		**0.0366**			ND							ND
Benz(a)pyrene	-	-	0.00043				**0.0437**										
Benzo(b)fluoranthene	-	-	0.0043				**0.0484**										
Benzo(g,h,i)perylene	-	-	4.1	0.0596					0.0525								
Chrysene	-	-	0.43				0.0389										
2,6-Dinitrotoluene	-	-	0.14					0.0496	0.0742						0.0516		
bis(2-Ethylhexyl)phthalate	-	-	0.23														
2-Methylphenol	-	-	6.8			0.0518	0.0472				0.0893	0.0725				0.0650	
Phenanthrene	-	-	4.1					0.0336									
Pyrene	-	-	4.1				0.0590										
Chlorinated Pesticides & PCBs (ug/kg)																	
Aldrin	300	Fish	0.19	**0.303**							0.134 J	0.0706 J				0.131	
alpha-BHC	-	-	0.5	0.160		0.353	**0.555**		0.212	0.154	0.470 J	0.304 J	0.264 J	0.380 J		**0.747**	
beta-BHC	-	-	1.8			**2.18**										**2.08**	
delta-BHC	-	-	1.8	0.703													
4,4'-DDD	-	-	13				9.20									6.47	
4,4'-DDE	5000	Fish	9.3	7.74		0.713	1.77	0.536	0.954	0.525	3.65	3.23	1.67	2.26		5.01	
4,4'-DDT	5000	Fish	9.3				3.07	2.72	1.59								
Endosulfan I	-	-	810			0.735							0.255 J				
Endosulfan sulfate	-	-	810										0.207 J				
Endrin aldehyde	-	-	41		0.555	0.420			0.901	1.05					0.660 J		0.503
Endrin ketone	-	-	41							0.315					0.282		
Heptachlor	300	Fish	0.7														
Heptachlor epoxide	300	Fish	0.35	**0.427**			**0.472**							0.0935 J			
PCB-1254	2000	Fish	1.6	**35.6**	**9.88**		**11.8**	**23.2**	**7.42**	**7.70**	**24.0**	**32.3**			**9.00**	**16.2**	**24.0**
PCB-1260	2000	Fish	1.6					**4.72**				**5.78 J**					
Chlorinated Herbicides (ug/kg)																	
Dicamba	-	-	4100	2.82							9.41	10.0		ND		12.6	
2,4-DB	1000	Fish	1100	24.9		180	168				144 J	78.4 J	8.14 J			98.6	
2,4,5-T	-	-	1400		21.3			22.4	21.2	23.1					22.2 J		23.3
2,4,5-TP	-	-	1100	1.50		13.7						8.13 J	3.52 J			6.47	
Metals (mg/kg)																	
Aluminum	-	-	140	48.1	12.3	15.2	**142**	35.7	18.5	32.6	**160 J**	63.9 J			15.7		18.1
Antimony	-	-	0.054														
Arsenic	86	Bivalves	0.0021	**1.43**	**0.844**	**0.915**	**1.13**	**0.744**	**0.694**	**0.665**	**1.03**	**0.715**					**0.818**
Barium	-	-	9.5	0.312		0.225	1.46				0.768	0.343	0.216	0.369		0.262	
Beryllium	-	-	0.27														
Cadmium	4		0.14	**0.427**		0.128	**0.153**	0.120	0.111	0.0980	**0.144**	0.127	0.136	0.121		0.100	
Calcium	-	-	-	3587	1345 J	551	926	920 J	294 J	334 J	1776 J	528 J	308	339	247 J	257	243 J
Chromium	13	Bivalves	200	6.84		0.180	1.50	1.52		1.13	0.682	0.529	0.383	0.385		0.216	
Cobalt	-	-	2.7														
Copper	-	-	5.4	**18.5**	1.73 L	1.16	2.08				1.75	1.31	0.937	0.864		1.27	
Iron	-	-	41	**109**	24.5	**42.8**	**297**	**71.6**	38.1 J	**44.0**	**265 J**	**100 J**	**44.0**	**41.6**	29.3	35.7	31.5
Mercury[1]	1	Fish	0.014			0.00645	**0.0142**		**0.0201**		0.00922	0.0127				0.00624	
Lead[2]	1.7	Bivalves	0.000014	**2.23**													
Magnesium	-	-	-	521	401	554	627	410	346	370	757	507	360	364	287	291	324
Manganese	-	-	19	3.99	3.53	0.968	6.21	3.61	2.45	**33.2**	13.5 J	5.24 J	1.75	1.99	2.56	2.07	4.80
Nickel	80	Bivalves	2.7	0.498	0.274		0.283	0.288		0.959	0.346	0.196				0.216	0.225
Potassium	-	-	-	908	590	679	768	662	368	516	676	635	369	358	382	665	628
Selenium	-	-	0.68	0.472	0.593		**0.779**	0.480	0.620	0.630		0.529 J				**0.693**	
Silver	-	-	0.68	**1.14**	0.122	0.165	**1.24**	0.280	0.101	0.175	0.547	0.490	0.616 J	0.281 J	0.102	0.193	0.203
Sodium	-	-	-	3186	2956	4088	3788	2968	2655	2737	3197	3048	2477	2431	2058	1825	2513
Thallium	-	-	0.0095														
Vanadium	-	-	0.95	0.240			**1.09**				0.365	0.284					
Zinc	-	-	41.0	**457**	6.00 L	7.03	9.45	6.50 L		5.61 L	8.48	7.90		4.52		6.78	5.00 L
PCTs (mg/kg)																	
Aroclor 5432	2000[3]	Fish	0.0007	**0.0294**	ND	ND	**0.0224**	ND	**0.0403**	ND	**0.0278**	**0.0225**	ND	ND	ND	**0.0223**	**0.0248**
Moisture (%)	-	-	-	91.1	92.4	92.5	88.2	92.0	94.7	93.0	90.4	90.2	95.6	94.5	94.0	92.3	92.5

Blank cell - Analyte was not detected in any of the samples from the indicated investigation.
B - Concentration similar to low-level concentrations found in associated blanks.
J - Estimated value.
L - Potentially biased low.
[1] Methylmercury used as RBSL surrogate
[2] Tetraethyllead used as RBSL surrogate
Yellow indicates result exceeds RBSL
Green indicates result exceeds FDA Action Level and RBSL

Table 2.11. Human Health Total Risk Summary for Site SS-63, Langley AFB, Virginia

Medium of Concern	Child Fisher	Adult Fisher	Other Recreational Person[1]	Other Worker[2]
Receptor Hazard Index				
Surface Water	0.00022	0.0001	0.008	0.002
Animal Tissue (crabs & fish)	6 (0.98)	5 (0.80)	NA	NA
Total	6 (0.98)	5 (0.80)	0.008	0.002
Receptor Cancer Risk				
Surface Water	4E-09	1E-08	2E-07	2E-07
Animal Tissue (crabs & fish)	2E-04 (1E-05)	8E-04 (3E-05)	NA	NA
Total	2E-04 (1E-05)	8E-04 (3E-05)	2E-07	2E-07
Receptor Hazard Index				
Animal Tissue (bivalve)	3	2	NA	NA
Receptor Cancer Risk				
Animal Tissue (bivalve)	7E-05	3E-04	NA	NA

NA = Not applicable; pathway not evaluated.
Values in parentheses indicate central tendency value.

[1] JetSkier
[2] Sea Rescue Trainer

Table 2.12. Total Risk Characterization Summary for Site SS-63: Cancer Risks, Langley AFB, Virginia

Scenario	Receptor Age	Estimated Total Cancer Risk		COPC and Pathway Risk ≥ 1E-06	Primary Site Specific Uncertainties
		Reasonable Maximum	Central Tendency		
Current/Future Scenarios					
Fisher (chronic) (Fish & Crabs)	Child	2E-04	1E-05	1. Ingestion of arsenic, Aroclor 5432, PCB-1254, PCB-1248, and PCB-1260 in fish tissue. 2. Ingestion of arsenic in crab tissue	High uncertainty associated with source, speciation and toxicity of arsenic and with source of PCBs/PCTs in seafood.
Fisher (chronic) (Fish & Crabs)	Adult	8E-04	3E-05	1. Ingestion of arsenic, arclor 5432, PCB-1254, PCB-1248, PCB-1260 in fish tissue. 2. Ingestion of arsenic and PCB-1254 in crab tissue	High uncertainty associated with source, speciation and toxicity of arsenic and with source of PCBs/PCTs in seafood.
Other Recreational Person	Adolescent	2E-07	NA	NA	NA
Other Worker	Adult	2E-07	NA	NA	NA
Fisher (chronic) (Bivalves)	Child	7E-05	4E-06	1. Ingestion of arsenic, Aroclor 5432, PCB-1254, and benzo(a)pyrene in bivalve tissue.	High uncertainty associated with source, speciation and toxicity of arsenic and with source of PCBs/PCTs and PAHs in seafood.
Fisher (chronic) (Bivalves)	Adult	3E-04	1E-05	1. Ingestion of arsenic, Aroclor 5432, PCB-1254, and benzo(a)pyrene, benzo(a)anthracene, and benzo(b)fluoranthene in bivalve tissue.	High uncertainty associated with source, speciation and toxicity of arsenic and with source of PCBs/PCTs and PAHs in seafood.

Table 2.13. Total Risk Characterization Summary for Site SS-63: Non-Cancer Hazards, Langley AFB, Virginia

Scenario	Receptor Age	Estimated Total Hazard Index		COPC and Pathway HI ≥ 1	Target Organ HIs ≥ 1	Primary Site-Specific Uncertainties
		Reasonable Maximum	Central Tendency			
Current/Future Scenarios						
Fisher (chronic) (Fish & Crabs)	Child	6	0.98	1. Ingestion of arsenic and PCB-1254 in fish tissue 2. Ingestion of arsenic in crab tissue	Skin/Vascular (arsenic) (HI =3) Eye/Immune System (PCB-1254) (HI = 2)	High uncertainty associated with source, speciation and toxicity of arsenic and with source of PCBs/PCTs in seafood.
Fisher (chronic) (Fish & Crabs)	Adult	5	0.80	3. Ingestion of arsenic and PCB-1254 in fish tissue 4. Ingestion of arsenic in crab tissue	Skin/vascular (arsenic) (HI =3) Immune system/ Eye (PCB-1254) (HI = 2)	High uncertainty associated with source, speciation and toxicity of arsenic and with source of PCBs/PCTs in seafood.
Other Recreational Person[3]	Adolescent	0.008	NA	NA	NA	NA
Other Worker[4]	Adult	0.002	NA	NA	NA	NA
Fisher (chronic) (Bivalves)	Child	3	0.4	1. Ingestion of arsenic in bivalve tissue	Skin/Vascular (arsenic) (HI =1.24)	High uncertainty associated with source, speciation and toxicity of arsenic
Fisher (chronic) (Bivalves)	Adult	2	0.3	1. Ingestion of arsenic in bivalve tissue	Skin/Vascular (arsenic) (HI =1.12)	High uncertainty associated with source, speciation and toxicity of arsenic

NA = Not Applicable
RfD = Reference Dose

Table 2.14. Human Health Site Risk Summary for Site SS-63, Langley AFB, Virginia

Medium of Concern	Child Fisher	Adult Fisher	Other Recreational Person[5]	Other Worker[6]
Receptor Hazard Index				
Surface Water	0.0002	0.0001	0.008	0.002
Animal Tissue(crabs & fish)	2.6 (0.3)	2.3 (0.2)	NA	NA
Total	2.6 (0.3)	2.3 (0.2)	0.008	0.002
Receptor Cancer Risk				
Surface Water	4E-09	1E-08	2E-07	2E-07
Animal Tissue(crabs & fish)	5E-05	2E-04 (4E-06)	NA	NA
Total	5E-05	2E-04 (4E-06)	2E-07	2E-07
Receptor Hazard Index				
Animal Tissue (bivalve)	1	1	NA	NA
Receptor Cancer Risk				
Animal Tissue (bivalve)	2E-05	6E-05	NA	NA

NA = Not applicable; pathway not evaluated.
Values in parentheses indicate central tendency value.

[5] Jet Skier
[6] Sea Rescue Trainer

Table 2-15. Site Risk Summary for Site SS-63, Langley AFB, Virginia

Scenario	Receptor Age	Estimated Total Cancer Risk		COPC and Pathway Risk ≥ 1E-06	Primary Site Specific Uncertainties
		Reasonable Maximum	Central Tendency		
Current/Future Scenarios					
Fisher (chronic) (Fish & Crabs)	Child	5E-05	NA	1. Ingestion of Aroclor 5432, PCB-1254, PCB-1248, PCB-1260 in fish tissue.	High uncertainty associated with the source of PCBs/PCTs
Fisher (chronic) (Fish & Crabs)	Adult	2E-04	4E-06	2. Ingestion of Aroclor 5432, PCB-1254, PCB-1248, PCB-1260 in fish tissue. 3. Ingestion of PCB-1254 in crab tissue.	High uncertainty associated with the source of PCBs/PCTs.
Other Recreational Person	Adolescent	2E-07	NA	NA	NA
Other Worker	Adult	2E-07	NA	NA	NA
Fisher (chronic) (Bivalves)	Child	2E-05	NA	NA	NA
Fisher (chronic) (Bivalves)	Adult	6E-05	NA	NA	NA

Table 2-16. Site Risk Characterization Summary for Site SS-63: Non-Cancer Hazards, Langley AFB, Virginia

Scenario	Receptor Age	Estimated Total Hazard Index		COPC and Pathway HI ≥ 1	Target Organ HIs ≥ 1	Primary Site-Specific Uncertainties
		Reasonable Maximum	Central Tendency			
Current/Future Scenarios						
Fisher (chronic) (Fish & Crabs)	Child	2.6	0.3	1. Ingestion of PCB-1254 in fish tissue.	Immune System/Eye/Nails (PCB-1254) (HI = 2)	High uncertainty associated with source of PCBs/PCTs.
Fisher (chronic) (Fish & Crabs)	Adult	2.3	0.2	2. Ingestion of PCB-1254 in fish tissue.	Immune system/Eye/Nails (PCB-1254) (HI = 2)	High uncertainty associated with source of PCBs/PCTs.
Other Recreational Person[7]	Adolescent	0.008	NA	NA	NA	NA
Other Worker[8]	Adult	0.002	NA	NA	NA	NA
Fisher (chronic) (Bivalves)	Child	1	NA	NA	NA	NA
Fisher (chronic) (Bivalves)	Adult	1	NA	NA	NA	NA

NA = Not Applicable
RfD = Reference Dose

[7] Jet Skier
[8] Sea Rescue Trainer

Table 2.17
Ecological Exposure Pathways of Concern
ERP Site SS-63

Exposure Medium	Receptor	Exposure Route	Assessment Endpoints	Measurement Endpoints
Sediment	Benthic and Epibenthic Invertebrates	• Direct contact	• Protect benthic and epibenthic invertebrate communities to maintain species diversity, biomass, and nutrient cycling • Provide a food source for higher-level consumers • Minimize bioaccumulation to protect higher trophic level receptors	• Toxicity testing • Enumeration of benthic macroinvertebrates in sediment samples • Comparison of maximum and mean chemical concentrations to NOAELs and LOAELs obtained from the Langley AFB Toxicity Study • Comparison of maximum and mean chemical concentrations to NOAELs and LOAELs from the literature • Collection of bivalves and crabs for chemical analysis of their tissues
Sediment and Surface Water	Fish (Atlantic croaker)	• Direct contact • Ingestion	• Protect fish communities to maintain species diversity • Ensure that contaminant ingestion does not negatively affect growth or survival • Minimize bioaccumulation to protect higher-level consumers	• Collection of killifish and sport fish samples for tissue analysis • Comparison of killifish tissue concentrations to toxicity values obtained from the literature • Calculation of chemical intake by sport fish through use of a food chain model. Chemical concentration in food (benthic invertebrates, bivalves, and killifish) determined from sediment and tissue data. Maximum and mean chemical intakes were compared to NOAELs and LOAELs obtained from the literature • Examination of killifish and sport fish samples for evidence of stress or disease
Sediment and Surface Water	Piscivorous Birds (belted kingfisher)	• Ingestion	• Ensure that ingestion of contaminants in water or prey (fish, shellfish) does not negatively impact growth, survival, or reproduction	• Calculation of chemical intake through use of a food chain model. Chemical concentration in food obtained from tissue data. Maximum and mean chemical intakes were compared to NOAELs and LOAELs obtained from the literature.
Sediment and Surface Water	Semi-aquatic Carnivorous Mammals (mink)	• Ingestion	• Ensure that ingestion of contaminants in water or prey (fish, invertebrates) does not negatively impact growth, survival, or reproduction	• Calculation of chemical intake through use of a food chain model. Chemical concentration in food obtained from tissue and sediment data. Maximum and mean chemical intakes were compared to NOAELs and LOAELs obtained from the literature.

Table 2.18
Comparison of Sediment Remedial Action Alternatives
ERP Site SS-63 LTA Cove
Langley AFB, Virginia

Remedial Alternative	Evaluation Criteria								
	Threshold		*Balancing*					*Modifying*	
	1. Overall Protection of Human Health and the Environment	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Total Alternative Cost	8. State Acceptance	9. Community Acceptance
1: No Action	○	●	○	○	●	●	$ -	NA	NA
2: Manage waste in place – Monitoring	◒	●	○	○	●	●	$ 353,000	NA	NA
3: Mechanical dredging with off-site disposal	●	●	●	○	◒	◒	$ 952,000	NA	NA
4: Dry excavation with off-site disposal	●	●	●	○	◒	●	$ 821,000	Accepted	Accepted
5: Capping	●	●	●	○	◒	●	$ 1,183,000	NA	NA

Ranking Key: ● Fully Satisfies Criteria ◒ Partially Satisfies Criteria ○ Does Not Satisfies Criteria

NA: Not applicable

Table 2.19. Cost Estimate Summary for ERP Site SS-63
Dry Excavation with Offsite Disposal
Langley AFB, Virginia

Description	Unit	Quantity	Unit Cost	Cost
REMEDIAL ACTIVITIES				
Site Preparation				
Mobilization	Lump Sum	1	$15,000.00	$15,000
Develop Work Plans	Lump Sum	1	$50,000.00	$50,000
Setup Temporary Facilities	Lump Sum	1	$10,000.00	$10,000
Surveying	Lump Sum	1	$3,000.00	$3,000
Dredging Activities				
Pre-Confirmation Sampling	Each	104	$110.00	$11,440
Installation of Coffer Dams	Linear Feet	1,940	$71.00	$137,740
Excavation of Sediment	Cubic Yard	1,693	$20.60	$34,876
Dewatering Sediment	Cubic Yard	1,693	$15.00	$25,395
Sediment Characterization (TCLP)	Each	8	$1,000.00	$8,465
Transportation and Disposal				
PCB/PCT Contaminated Sediment (non-hazardous)	Ton	3,047	$60.00	$182,844
Site Restoration				
Cleanup and Demobilization	Lump Sum	1	$10,000.00	$10,000
Site Closeout				
Final Report	Lump Sum	1	$50,000.00	$50,000
Subtotal				$538,760
Additional Costs				
Engineering/Design		12% of Subtotal		$64,651
Project Management		10% of Subtotal		$53,876
Construction Management		8% of Subtotal		$43,101
Residual Wastes Management		2% of Subtotal		$10,775
Contingencies		20% of Subtotal		$110,214
Total Costs For Dry Excavation with Offsite Disposal				$821,377

Notes:

1. Sources for cost information include vendor-specific data and Means Environmental Remediation Cost Data (2005).
2. A conversion factor of 1.8 was used to convert cubic yard to tons.
3. Unit costs include all labor, equipment, and materials unless otherwise noted in the table.
4. Analysis of decant water included in residual waste management costs.
5. Assumed one characterization sample would be collected per every 200 cubic yards excavated.
6. Assumed PCB/PCT contaminated sediment would be classified as non-hazardous.

3.0 RESPONSIVENESS SUMMARY

The public participation requirements set out in the NCP at 40 CFR 300.435(c)(2)(ii) have been met for ERP Site SS-63. No questions or comments were received in the public meeting for the Proposed Plan held on January 8, 2008. No oral or written comments were received during the public comment period that extended from December 16, 2007 through January 15, 2008.

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4.0 REFERENCES

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APPENDIX A

RISK TABLES

(Source: URS, 2003)

Appendix A.1

RAGS Part D Table 1's
Selection of Exposure Pathways

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SS-63, LANGLEY AFB

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Surface Water	Surface Water	Surface Water from Back River	Fisher	Child	Ingestion	On-site	None	The physical configuration of the slope embankment of the Back River prevents the fisher from coming into contact with surface water such that ingestion would be unlikely or insignificant.
						Dermal Absorption	On-site	Quant	Receptor may come into contact with surface water by handling fish/crabs or by rinsing off hands.
					Adult	Ingestion	On-site	None	The physical configuration of the slope embankment of the Back River prevents the fisher from coming into contact with surface water such that ingestion would be unlikely or insignificant.
						Dermal Absorption	On-site	Quant	Receptor may come into contact with surface water by handling fish/crabs or by rinsing off hands.
				Other (1)	Adult	Ingestion	Off-Site	None	Receptor is not likely to ingest surface water from the Back River at an off-site location.
						Dermal Absorption	Off-Site	None	Receptor is not likely to come into contact with surface water from the Back River at an off-site location.
				Other Recreational Person (2)	Adolescents (teens)	Ingestion	On-site	Quant	Receptor incidentally ingests surface water while jet skiing.
						Dermal Absorption	On-site	Quant	Receptor comes into contact with surface water while jet skiing.
				Other Worker (3)	Adult	Ingestion	On-site	Quant	Receptor incidentally ingests surface water during training exercises in the Back River.
						Dermal Absorption	On-site	Quant	Receptor comes into contact with surface water during training exercises in the Back River.
	Sediment	Sediment	Sediment from Back River	Fisher	Child	Ingestion	On-site	None	The physical configuration of the slope embankment of the Back River prevents the fisher from coming into contact with the sediment of the Back River.
						Dermal Absorption	On-site	None	The physical configuration of the slope embankment of the Back River prevents the fisher from coming into contact with the sediment of the Back River.
					Adult	Ingestion	On site	None	The physical configuration of the slope embankment of the Back River prevents the fisher from coming into contact with the sediment of the Back River.
						Dermal Absorption	On-site	None	The physical configuration of the slope embankment of the Back River prevents the fisher from coming into contact with the sediment of the Back River.
				Other (1)	Adult	Ingestion	Off-Site	None	Receptor is not likely to ingest sediment from the Back River at an off-site location.
						Dermal Absorption	Off-Site	None	Receptor is not likely to come into contact with sediment from the Back River at an off-site location.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SS-63, LANGLEY AFB

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future (continued)	Sediment (continued)	Sediment (continued)	Sediment from Back River (continued)	Other Recreational Person (2)	Adolescents (teens)	Ingestion	On-site	None	The physical configuration of the slope embankment of the Back River prevents the jet skier from coming into contact with sediment such that ingestion would be unlikely or insignificant. Jet skier is most likely to enter water via jet ski.
						Dermal Absorption	On-site	None	The physical configuration of the slope embankment of the Back River prevents the jet skier from coming into contact with sediment such that contact would be unlikely or insignificant. Jet skier is most likely to enter water via jet ski.
				Other Worker (3)	Adult	Ingestion	On-site	None	Receptor would enter Back River via watercraft or helicopter and would not likely ingest sediment from the Back River.
						Dermal Absorption	On-site	None	Receptor would enter Back River via watercraft or helicopter and would not likely come into contact with sediment from the Back River.
	Animal Tissue	Animal Tissue	Fish from Back River	Fisher	Child	Ingestion	On-site	Quant	Receptor is likely to consume fish from the Back River.
					Adult	Ingestion	On-site	Quant	Receptor is likely to consume fish from the Back River.
				Other (1)	Adult	Ingestion	Off-Site	None	Receptor may consume fish from the Back River, but would most likely be mixed with other fish from other locations and consumption would be insignificant.
				Other Recreational Person (2)	Adolescents (teens)	Ingestion	On-site	None	Receptor is not likely to fish from the Back River.
				Other Worker (3)	Adult	Ingestion	On-site	None	Receptor is not likely to fish from the Back River.
	Animal Tissue	Animal Tissue	Crabs from Back River	Fisher	Child	Ingestion	On-site	Quant	Receptor is likely to consume crabs from the Back River.
					Adult	Ingestion	On-site	Quant	Receptor is likely to consume crabs from the Back River.
				Other (1)	Adult	Ingestion	Off-Site	None	Receptor may consume crabs from the Back River, but would most likely be mixed with other crabs from other locations and consumption would be insignificant.
				Other Recreational Person (2)	Adolescents (teens)	Ingestion	On-site	None	Receptor is not likely to crab from the Back River.
				Other Worker (3)	Adult	Ingestion	On-site	None	Receptor is not likely to crab from the Back River.

(1) Commercial Fish Consumer

(2) Jet Skier

(3) Sea Rescue Trainer

Appendix A.2

RAGS Part D Table 2's
Occurrence, Distribution, and Selection of COPCs
Selection of Exposure Pathways

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
ERP Site SS-63 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water-total (9)
Exposure Medium: Surface Water
Exposure Point: Surface Water

CAS Number	Chemical	(1) Minimum Concentration	Minimum (2) Qualifier	(1) Maximum Concentration	Maximum (2) Qualifier	Units	Location of Maximum Concentration	Detection (3) Frequency	Range of (4) Detection Limits	Concentration (5) Used for Screening	(6) Background Value	(7) Screening Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	(8) Rationale for Contaminant Deletion or Selection
	INORGANICS															
7429-90-5	Aluminum	0.246		1.48		mg/l	SS63-SW06	8/8	0.0142	1.48	N/A	37.0 N	0.087	NOAA Fresh	No	b
7440-36-0	Antimony	0.00452		0.00953	J	mg/l	SS63-SW07	4/8	0.00443	0.00953	N/A	0.0150 N	4.3	SW VA WQC	No	b
7440-38-2	Arsenic	0.00276	J	0.00374		mg/l	SS63-SW06	2/8	0.00238	0.00374	N/A	0.00045 C	0.036	NOAA Marine	Yes	e
7440-39-3	Barium	0.0261		0.0340		mg/l	SS63-SW08	8/8	0.0000800	0.0340	N/A	2.60 N	N/A	N/A	No	b
7440-70-2	Calcium	155		210		mg/l	SS63-SW05	8/8	0.0510	210	N/A	400	N/A	N/A	No	c
7440-47-3	Chromium	0.000980		0.00384		mg/l	SS63-SW07	7/8	0.000910	0.00384	N/A	0.110 N	0.05	NOAA Marine	No	b
7439-89-6	Iron	0.402		1.33		mg/l	SS63-SW06	8/8	0.0145	1.33	N/A	11 N	1	NOAA Fresh	No	b
7439-95-4	Magnesium	467		707	J	mg/l	SS63-SW03	8/8	0.0804	707	N/A	158	N/A	N/A	Yes	f
7439-96-5	Manganese	0.0197		0.0964		mg/l	SS63-SW08	8/8	0.000200	0.0964	N/A	0.73 N	N/A	N/A	No	b
7439-97-6	Mercury	0.000106		0.000106		mg/l	SS63-SW08	1/8	0.0000600	0.000106	N/A	0.011 N	0.000053	SW VA WQC	No	b
7440-02-0	Nickel	0.00231	J	0.00231	J	mg/l	SS63-SW07	1/8	0.00202	0.00231	N/A	0.730 N	4.6	SW VA WQC	No	b
7440-09-7	Potassium	156	J	243		mg/l	SS63-SW10	8/8	0.137 - 2.74	243	N/A	1000	N/A	N/A	No	c
7782-49-2	Selenium	0.0109		0.0156		mg/l	SS63-SW05	8/8	0.00260	0.0156	N/A	0.180 N	11	SW VA WQC	No	b
7440-23-5	Sodium	3770		5720	J	mg/l	SS63-SW03	8/8	2.80	5720	N/A	250	N/A	N/A	Yes	f
7440-62-2	Vanadium	0.00216		0.00216		mg/l	SS63-SW06	1/8	0.000410	0.00216	N/A	0.260 N	N/A	N/A	No	b
7440-66-6	Zinc	0.0110		0.0110		mg/l	SS63-SW07	1/8	0.00365	0.0110	N/A	11.0 N	0.081	NOAA Marine	No	b
	ORGANICS															
72-54-8	4,4'-DDD	0.0000144		0.0000144		mg/l	SS63-SW10	1/8	0.000000864 - 0.00000191	0.0000144	N/A	0.0028 C	0.0000084	SW VA WQC	No	b
72-55-9	4,4'-DDE	0.00000786		0.00000786		mg/l	SS63-SW06	1/8	0.00000108 - 0.00000233	0.00000786	N/A	0.002 C	0.0000059	SW VA WQC	No	b
67-64-1	Acetone	0.00136		0.00186		mg/l	SS63-SW06	2/8	0.000286 - 0.000499	0.00186	N/A	0.610 N	N/A	N/A	No	b
309-00-2	Aldrin	0.00000985		0.0000213		mg/l	SS63-SW01	6/8	0.000000749 - 0.00000144	0.0000213	N/A	0.000039 C	0.0000014	SW VA WQC	No	b
959-98-8	Endosulfan I	0.00000248		0.00000514		mg/l	SS63-SW06	5/8	0.000000572 - 0.00000126	0.00000514	N/A	0.220 N	0.24	SW VA WQC	No	b
33213-65-9	Endosulfan II	0.00000455		0.00000455		mg/l	SS63-SW10	1/8	0.000000743 - 0.00000157	0.00000455	N/A	0.220 N	0.24	SW VA WQC	No	b
72-20-8	Endrin	0.0000119		0.0000119		mg/l	SS63-SW10	1/8	0.00000175 - 0.00000636	0.0000119	N/A	0.011 N	0.00081	SW VA WQC	No	b
53494-70-5	Endrin Ketone	0.00000205		0.00000205		mg/l	SS63-SW01	1/8	0.00000157 - 0.00000302	0.00000205	N/A	0.011 N	N/A	N/A	No	b
76-44-8	Heptachlor	0.00000175		0.00000784		mg/l	SS63-SW10	3/8	0.000000661 - 0.00000304	0.00000784	N/A	0.00015 C	0.0000021	SW VA WQC	No	b
1024-57-3	Heptachlor epoxide	0.00000463		0.00000463		mg/l	SS63-SW02	1/8	0.000000639 - 0.00000633	0.00000463	N/A	0.000074 C	0.0000018	NOAA Marine	No	b
5103-71-9	alpha-Chlordane	0.00000135		0.00000135		mg/l	SS63-SW10	1/8	0.000000623 - 0.00000120	0.00000135	N/A	0.0019 C	0.0000059	SW VA WQC	No	b
319-85-7	beta-BHC	0.00000776	J	0.00000776	J	mg/l	SS63-SW07	1/8	0.000000585 - 0.00000500	0.00000776	N/A	0.00037 C	N/A	N/A	No	b
319-86-8	delta-BHC	0.00000387	J	0.0000170		mg/l	SS63-SW02	6/8	0.000000371 - 0.00000133	0.0000170	N/A	0.00037 C	N/A	N/A	No	b
58-89-9	gamma-BHC(Lindane)	0.00000450		0.0000179		mg/l	SS63-SW01	5/8	0.000000410 - 0.000000881	0.0000179	N/A	0.00052 C	0.025	SW VA WQC	No	b

(1) Minimum/maximum detected concentration.

(2) If minimum/maximum detected concentration comes from average of normal and field duplicate samples, then both qualifiers are presented. In a such case, the format is <normal qualifer>/<field duplicate qualifier>.

(3) Detection Frequency is defined as the number of samples that are detected and are not B-flagged over the total number of samples.

(4) Range of Detection Limits includes limits associated with any dilution factor. See the analytical results section for more details of detection limits and dilution factors, per sample.

(5) Maximum concentration is used for screening.

(6) N/A - Refer to supporting information for background discussion. Background values, derived from statistical analysis, are upper tolerance limits (UTLs).

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
ERP Site SS-63 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water-total (9)
Exposure Medium: Surface Water
Exposure Point: Surface Water

CAS Number	Chemical	Minimum Concentration (1)	Minimum (2) Qualifier	Maximum Concentration (1)	Maximum (2) Qualifier	Units	Location of Maximum Concentration	Detection (3) Frequency	Range of (4) Detection Limits	Concentration (5) Used for Screening	Background Value (6)	Screening Toxicity Value (7)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (8)

(7) Risk-Based Concentration Table, U.S. EPA Region III. October 2000. (Cancer benchmark value = 1E-06, HQ = 0.1). Surface water RBSLs were determined by multiplying the tap water RBSL x 10.

(8) Rationale for Contaminant Deletion or Selection:

a. No measurable results on site.

b. Maximum detected result is less than the RBSL.

c. Maximum detected concentration is less than Essential Nutrient intake rate.

d. Mean site concentration is not significantly greater than mean background concentration (alpha = 0.20) and maximum detected result is less than background UTL.

e. Maximum detected result exceeds screening toxicity value.

f. Maximum detected concentration exceeds Essential Nutrient intake rate.

(9) The surface water sample results are for unfiltered samples only.

Definitions: N/A = Not applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Federal Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
ERP Site SS-63 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Fish from Back River

CAS Number	Chemical	Minimum Concentration (1)	Minimum (2) Qualifier	Maximum Concentration (1)	Maximum (2) Qualifier	Units	Location of Maximum Concentration	Detection (3) Frequency	Range of (4) Detection Limits	Concentration (5) Used for Screening	Background Value (6)	Screening Toxicity Value (7)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (8)
	INORGANICS																
7440-38-2	Arsenic	0.742		2.56		mg/kg	SS63-BIO07	8/8	0.398 - 0.427	2.56	N/A	0.00210	C	N/A		Yes	e
7440-70-2	Calcium	188		1320		mg/kg	SS63-BIO01	2/2	1.98 - 1.98	1320	N/A	NA		N/A		Yes	e
7440-50-8	Copper	0.228		0.451		mg/kg	SS63-BIO10	8/8	0.108 - 0.111	0.451	N/A	5.40	N	N/A		No	b
7439-95-4	Magnesium	288		380		mg/kg	SS63-BIO08	8/8	3.18 - 3.31	380	N/A	NA		N/A		Yes	e
7439-97-6	Mercury	0.0238		0.0892		mg/kg	SS63-BIO04	8/8	00810 - 0.0085	0.0892	N/A	0.014	N	N/A		Yes	e
7440-09-7	Potassium	3440		3950		mg/kg	SS63-BIO04	8/8	24.0 - 24.9	3950	N/A	NA		N/A		Yes	e
7782-49-2	Selenium	0.636		1.05		mg/kg	SS63-BIO02	8/8	0.390 - 0.420	1.05	N/A	0.680	N	N/A		Yes	e
7440-23-5	Sodium	298		717		mg/kg	SS63-BIO07	8/8	27.0 - 27.9	717	N/A	NA		N/A		Yes	e
7440-66-6	Zinc	4.78		5.77		mg/kg	SS63-BIO01	8/8	0.265 - 0.269	5.77	N/A	41.0	N	N/A		No	b
	ORGANICS																
72-54-8	4,4'-DDD	0.00203		0.0284		mg/kg	SS63-BIO05	8/8	000129 - 0.0013	0.0284	N/A	0.0130	C	N/A		Yes	e
72-55-9	4,4'-DDE	0.00454		0.0379		mg/kg	SS63-BIO05	8/8	000129 - 0.0011	0.0379	N/A	0.00930	C	N/A		Yes	e
	Aroclor 5432	0.0228		0.379		*mg/kg*	SS63-BIO05	5/8	0.0199 - 0.0403	0.379	N/A	0.0007	C	N/A		Yes	e
12672-29-6	PCB-1248	0.0167		0.104		mg/kg	SS63-BIO05	4/8	00318 - 0.0066	0.104	N/A	0.00160	C	N/A		Yes	e
11097-69-1	PCB-1254	0.0311		0.308		mg/kg	SS63-BIO05	8/8	00318 - 0.0066	0.308	N/A	0.00160	C	N/A		Yes	e
11096-82-5	PCB-1260	0.0112		0.0972		mg/kg	SS63-BIO05	8/8	00318 - 0.0066	0.0972	N/A	0.00160	C	N/A		Yes	e
319-84-6	alpha-BHC	0.000104		0.000223		mg/kg	SS63-BIO05	7/8	000658 - 0.0000	0.000223	N/A	0.000500	C	N/A		No	b
319-86-8	delta-BHC	0.000178		0.000212		mg/kg	SS63-BIO02	2/8	000658 - 0.0000	0.000212	N/A	0.0018	C	N/A		No	b
58-89-9	gamma-BHC(Lindane)	0.0000813		0.000196		mg/kg	SS63-BIO01	2/8	000659 - 0.0003	0.000196	N/A	0.00240	C	N/A		No	b

(1) Minimum/maximum detected concentration.

(2) If minimum/maximum detected concentration comes from average of normal and field duplicate samples, then both qualifiers are presented. In a such case, the format is <normal qualifer>/<field duplicate qualifier>.

(3) Detection Frequency is defined as the number of samples that are detected and are not B-flagged over the total number of samples.

(4) Range of Detection Limits includes limits associated with any dilution factor. See the analytical results section for more details of detection limits and dilution factors, per sample

(5) Maximum concentration is used for screening.

(6) N/A - Refer to supporting information for background discussion. Background values, derived from statistical analyses, are upper tolerance limits (UTLs).

(7) Risk-Based Concentration Table, U.S. EPA Region III. October 2000. (Cancer benchmark value = 1E-06, HQ = 0.1).

(8) Rationale for Contaminant Deletion or Selection:

a. No measurable results on site.

b. Maximum detected result is less than the RBSL

c. Maximum detected result is less than the Essential Nutrient intake value

d. Mean site concentration is not significantly greater than mean background concentration (alpha = 0.20) and maximum detected result is less than background UTL.

e. Maximum detected result exceeds screening toxicity value.

Definitions. N/A = Not applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Federal Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level

TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
ERP Site SS-63 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Fish from Back River

CAS Number	Chemical	Minimum Concentration (1)	Minimum (2) Qualifier	Maximum Concentration (1)	Maximum (2) Qualifier	Units	Location of Maximum Concentration	Detection (3) Frequency	Range of (4) Detection Limits	Concentration (5) Used for Screening	Background Value (6)	Screening Toxicity Value (7)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (8)

J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

TABLE 2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
ERP Site SS-83 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Crabs from Back River

CAS Number	Chemical	Minimum Concentration (1)	Minimum (2) Qualifier	Maximum Concentration (1)	Maximum (2) Qualifier	Units	Location of Maximum Concentration	Detection (3) Frequency	Range of (4) Detection Limits	Concentration (5) Used for Screening	Background Value (6)	Screening Toxicity Value (7)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (8)
	INORGANICS															
7429-90-5	Aluminum	6.19		15.3		mg/kg	SS83-BIO01	4/4	3.75 - 3.85	15.3	N/A	NA	N/A		Yes	e
7440-38-2	Arsenic	1.75		3.38		mg/kg	SS83-BIO04	4/4	0.400 - 0.422	3.38	N/A	NA	N/A		Yes	e
7440-39-3	Barium	0.308		0.477		mg/kg	SS83-BIO01	4/4	0.0478 - 0.0498	0.477	N/A	NA	N/A		Yes	e
7440-70-2	Calcium	985		2230		mg/kg	SS83-BIO01	4/4	1.93 - 1.99	2230	N/A	NA	N/A		Yes	e
7440-50-8	Copper	6.09		8.62		mg/kg	SS83-BIO04	4/4	0.106 - 0.109	8.62	N/A	NA	N/A		Yes	e
7439-89-6	Iron	11.1		14.2		mg/kg	SS83-BIO01	4/4	1.93 - 1.99	14.2	N/A	NA	N/A		Yes	e
7439-95-4	Magnesium	352		547		mg/kg	SS83-BIO01	4/4	3.17 - 3.27	547	N/A	NA	N/A		Yes	e
7439-96-5	Manganese	1.09		1.58		mg/kg	SS83-BIO04	4/4	0.0283 - 0.0299	1.58	N/A	NA	N/A		Yes	e
7440-02-0	Nickel	0.370		0.496		mg/kg	SS83-BIO06	4/4	0.188 - 0.200	0.496	N/A	NA	N/A		Yes	e
7440-09-7	Potassium	2000		2840		mg/kg	SS83-BIO06	4/4	24.1 - 24.8	2840	N/A	NA	N/A		Yes	e
7782-49-2	Selenium	0.524		0.684		mg/kg	SS83-BIO06	4/4	0.389 - 0.410	0.684	N/A	NA	N/A		Yes	e
7440-22-4	Silver	0.425		0.785		mg/kg	SS83-BIO01	4/4	0.0561 - 0.0598	0.785	N/A	NA	N/A		Yes	e
7440-23-5	Sodium	3080		3640		mg/kg	SS83-BIO04	4/4	26.9 - 27.8	3640	N/A	NA	N/A		Yes	e
7440-66-6	Zinc	31.5		41.9		mg/kg	SS83-BIO04	4/4	0.266 - 0.282	41.9	N/A	NA	N/A		Yes	e
	ORGANICS															
72-54-8	4,4'-DDD	0.000513		0.00339		mg/kg	SS83-BIO01	2/4	00129 - 0.0003	0.00339	N/A	NA	N/A		Yes	e
72-55-9	4,4'-DDE	0.00127		0.0111		mg/kg	SS83-BIO01	3/4	00129 - 0.0003	0.0111	N/A	NA	N/A		Yes	e
76-44-8	Heptachlor	0.0000757		0.0000757		mg/kg	SS83-BIO04	1/3	00687 - 0.0000	0.0000757	N/A	NA	N/A		Yes	e
1024-57-3	Heptachlor epoxide	0.000792		0.000792		mg/kg	SS83-BIO04	1/2	000689 - 0.0001	0.000792	N/A	NA	N/A		Yes	e
11097-69-1	PCB-1254	0.0231		0.0231		mg/kg	SS83-BIO01	1/4	00325 - 0.0026	0.0231	N/A	NA	N/A		Yes	e
108-95-2	Phenol	0.120		0.133		mg/kg	SS83-BIO06	2/4	0.0687 - 0.0678	0.133	N/A	NA	N/A		Yes	e
117-81-7	bis(2-Ethylhexyl)phthalate	0.120		0.120		mg/kg	SS83-BIO01	1/4	0.0687 - 0.0678	0.120	N/A	NA	N/A		Yes	e

(1) Minimum/maximum detected concentration.

(2) If minimum/maximum detected concentration comes from average of normal and field duplicate samples, then both qualifiers are presented. In a such case, the format is <normal qualifier>/<field duplicate qualifier>.

(3) Detection Frequency is defined as the number of samples that are detected and are not B-flagged over the total number of samples.

(4) Range of Detection Limits includes limits associated with any dilution factor. See the analytical results section for more details of detection limits and dilution factors, per sample.

(5) Maximum concentration is used for screening.

(6) N/A - Refer to supporting information for background discussion. Background values, derived from statistical analysis, are upper tolerance limits (UTLs).

(7) Risk-Based Concentration Table, U.S. EPA Region III, October 2000. (Cancer benchmark value = 1E-06, HQ = 0.1).

(8) Rationale for Contaminant Deletion or Selection:

a. No measurable results on site.

b. Maximum detected result is less than the RBSL.

c. Maximum detected result is less than the Essential Nutrient intake value.

d. Mean site concentration is not significantly greater than mean background concentration (alpha = 0.20) and maximum detected result is less than background UTL.

e. Maximum detected result exceeds screening toxicity value.

Definitions: N/A = Not applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern

TABLE 2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
ERP Site SS-63 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Crabs from Back River

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier (2)	Maximum Concentration (1)	Maximum Qualifier (2)	Units	Location of Maximum Concentration	Detection Frequency (3)	Range of Detection Limits (4)	Concentration Used for Screening (5)	Background Value (6)	Screening Toxicity Value (7)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (8)

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Federal Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Back River, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Fish-shellfish tissue
Exposure Medium: Fish-shellfish tissue

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection (2) Frequency	Range of (3) Detection Limits	Concentration (4) Used for Screening	Background (5) Value	Screening Toxicity Value (6) (NC)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or (7) Deletion
Back River Shellfish		**Inorganics**													
	7429-90-5	Aluminum	12.3	142	mg/kg	SS63-BIO04	9/10	3.72 - 3.90	142	NA	140 N	NA	NA	Y	ASL
	7440-38-2	Arsenic	0.665	1.43	mg/kg	SS63-BIO01	8/10	0.368 - 0.418	1.43	NA	0.00210 C	NA	NA	Y	ASL
	7440-39-3	Barium	0.292	1.46	mg/kg	SS63-BIO04	4/4	0.0484 - 0.0496	1.46	NA	9.50 N	NA	NA	N	BSL
	7440-43-9	Cadmium	0.0280	0.427	mg/kg	SS63-BIO01	7/10	0.0840 - 0.0912	0.427	NA	0.740 N	NA	NA	Y	ASL
	7440-70-2	Calcium	243 J	3590	mg/kg	SS63-BIO01	10/10	1.90 - 2.00	3590	NA	NA	NA	NA	N	EN
	7440-47-3	Chromium (Total)	0.384	6.84	mg/kg	SS63-BIO01	6/6	0.153 - 0.160	6.84	NA	200 N	NA	NA	N	BSL
	7440-50-8	Copper	0.900	18.5	mg/kg	SS63-BIO01	5/5	0.166 - 0.189	18.5	NA	5.40 N	NA	NA	Y	ASL
	57-12-5	Cyanide	0.880 J	2.08	mg/kg	SS63-BIO10	9/10	0.177 - 0.184	2.08	NA	2.70 N	NA	NA	N	BSL
	7439-89-6	Iron	24.5	297	mg/kg	SS63-BIO04	10/10	1.90 - 2.00	297	NA	41.0 N	NA	NA	Y	ASL
	7439-92-1	Lead	2.23	2.23	mg/kg	SS63-BIO01	1/10	0.800 - 0.980	2.23	NA	NA	NA	NA	Y	ASL
	7439-95-4	Magnesium	287	632	mg/kg	SS63-BIO08	10/10	3.14 - 3.30	632	NA	NA	NA	NA	N	EN
	7439-96-5	Manganese	1.87	33.2	mg/kg	SS63-BIO07	10/10	0.0299 - 0.0304	33.2	NA	19.0 N	NA	NA	Y	ASL
	7439-97-6	Mercury	0.0115	0.0201	mg/kg	SS63-BIO05	3/10	0.00600 - 0.00649	0.0201	NA	0.0140 N	NA	NA	Y	ASL
	7440-02-0	Nickel	0.225	0.959	mg/kg	SS63-BIO07	7/10	0.194 - 0.201	0.959	NA	2.70 N	NA	NA	N	BSL
	7440-09-7	Potassium	363	908	mg/kg	SS63-BIO01	10/10	23.8 - 25.0	908	NA	NA	NA	NA	N	EN
	7782-49-2	Selenium	0.472	0.779	mg/kg	SS63-BIO04	7/10	0.392 - 0.410	0.779	NA	0.680 N	NA	NA	Y	ASL
	7440-22-4	Silver	0.101	1.24	mg/kg	SS63-BIO04	10/10	0.0676 - 0.0811	1.24	NA	0.680 N	NA	NA	Y	ASL
	7440-23-5	Sodium	2060	3790	mg/kg	SS63-BIO04	10/10	26.7 - 28.0	3790	NA	NA	NA	NA	N	EN
	7440-62-2	Vanadium	0.240	1.09	mg/kg	SS63-BIO04	3/10	0.180 - 0.192	1.09	NA	0.960 N	NA	NA	Y	ASL
	7440-66-6	Zinc	4.52	457	mg/kg	SS63-BIO01	8/8	0.270 - 0.281	457	NA	41.0 N	NA	NA	Y	ASL
		Organics													
	93-76-5	2,4,5-T	0.0212	0.0233	mg/kg	SS63-BIO12	6/9	0.00398 - 0.00802	0.0233	NA	1.40 N	NA	NA	N	BSL
	93-72-1	2,4,5-TP (Silvex)	0.00150	0.00813 J	mg/kg	SS63-BIO08	3/10	0.000329 - 0.00661	0.00813	NA	1.10 N	NA	NA	N	BSL
	94-82-6	2,4-DB	0.00814 J	0.168	mg/kg	SS63-BIO04	4/10	0.00329 - 0.0661	0.168	NA	1.10 N	NA	NA	N	BSL
	606-20-2	2,6-Dinitrotoluene	0.0495	0.0742	mg/kg	SS63-BIO05	3/10	0.0027 - 0.0033	0.0742	NA	0.140 N	NA	NA	N	BSL
	95-48-7	2-Methylphenol	0.0472	0.0809	mg/kg	SS63-BIO08	2/10	0.0027 - 0.0330	0.0809	NA	6.80 N	NA	NA	N	BSL
	72-54-8	4,4'-DDD	0.00920	0.00920	mg/kg	SS63-BIO04	1/10	0.000128 - 0.00003	0.00920	NA	0.0130 C	NA	NA	N	BSL
	72-55-9	4,4'-DDE	0.000625	0.00774	mg/kg	SS63-BIO01	7/10	0.000128 - 0.000134	0.00774	NA	0.00930 C	NA	NA	N	BSL
	50-29-3	4,4'-DDT	0.00159	0.00307	mg/kg	SS63-BIO04	3/10	0.000128 - 0.000134	0.00307	NA	0.00930 C	NA	NA	N	BSL
	309-00-2	Aldrin	0.000102 JPJ	0.000303	mg/kg	SS63-BIO01	2/10	0.0000660 - 0.000498	0.000303	NA	0.000190 C	NA	NA	Y	ASL
	11096-82-5	Aroclor 1260	0.0224	0.0403	mg/kg	SS63-BIO05	6/10	0.0196 - 0.0200	0.0403	NA	0.000700 C	NA	NA	Y	ASL
	56-55-3	Benz(a)anthracene	0.0366	0.0366	mg/kg	SS63-BIO04	1/10	0.0027 - 0.0333	0.0366	NA	0.004 C	NA	NA	Y	ASL
	50-32-8	Benz(a)pyrene	0.0437	0.0437	mg/kg	SS63-BIO04	1/10	0.0027 - 0.0333	0.0437	NA	0.0004 C	NA	NA	Y	ASL
	205-99-2	Benzo(b)fluoranthene	0.0484	0.0484	mg/kg	SS63-BIO04	1/10	0.0027 - 0.0333	0.0484	NA	0.004 C	NA	NA	Y	ASL
	191-24-2	Benzo(g,h,i)perylene	0.0525	0.0595	mg/kg	SS63-BIO01	2/10	0.0027 - 0.0333	0.0595	NA	4.10 N	NA	NA	N	BSL
	218-01-9	Chrysene	0.0389	0.0389	mg/kg	SS63-BIO04	1/10	0.0027 - 0.0333	0.0389	NA	0.430 C	NA	NA	N	BSL
	1918-00-9	Dicamba	0.00282	0.00970	mg/kg	SS63-BIO08	2/10	0.000757 - 0.0153	0.00970	NA	4.10 N	NA	NA	N	BSL
	959-98-8	Endosulfan I	0.000255 J	0.000255 J	mg/kg	SS63-BIO09	1/10	0.0000660 - 0.00398	0.000255	NA	0.810 N	NA	NA	N	BSL
	1031-07-8	Endosulfan Sulfate	0.000207 J	0.000207 J	mg/kg	SS63-BIO09	1/10	0.000128 - 0.000673	0.000207	NA	0.810 N	NA	NA	N	BSL
	7421-93-4	Endrin Aldehyde	0.000603	0.00105	mg/kg	SS63-BIO07	5/10	0.000128 - 0.00104	0.00105	NA	0.0410 N	NA	NA	N	BSL
	53494-70-5	Endrin Ketone	0.000282	0.000315	mg/kg	SS63-BIO07	2/10	0.000128 - 0.000134	0.000315	NA	0.0410 N	NA	NA	N	BSL
	1024-57-3	Heptachlor epoxide	0.0000935 J	0.000472	mg/kg	SS63-BIO04	3/10	0.0000660 - 0.000800	0.000472	NA	0.000350 C	NA	NA	Y	ASL
	11097-69-1	PCB-1254	0.00742	0.0356	mg/kg	SS63-BIO01	9/10	0.00327 - 0.00330	0.0356	NA	0.00160 C	NA	NA	Y	ASL
	11096-82-5	PCB-1260	0.00472	0.00578 J	mg/kg	SS63-BIO08	2/10	0.00327 - 0.00330	0.00578	NA	0.00160 C	NA	NA	Y	ASL
	85-01-8	Phenanthrene	0.0336	0.0336	mg/kg	SS63-BIO05	1/10	0.0027 - 0.0333	0.0336	NA	4.10 N	NA	NA	N	BSL
	129-00-0	Pyrene	0.0590	0.0590	mg/kg	SS63-BIO04	1/10	0.0027 - 0.0333	0.0590	NA	4.10 N	NA	NA	N	BSL
	319-84-6	alpha-BHC	0.000154	0.000555	mg/kg	SS63-BIO04	5/10	0.0000660 - 0.0000700	0.000555	NA	0.000500 C	NA	NA	Y	ASL
	319-85-7	beta-BHC	0.000394	0.000484	mg/kg	SS63-BIO09	2/8	0.0000660 - 0.0000700	0.000484	NA	0.00180 C	NA	NA	N	BSL
	319-86-8	delta-BHC	0.000703	0.000703	mg/kg	SS63-BIO01	1/10	0.0000660 - 0.0000700	0.000703	NA	0.000500 C	NA	NA	Y	ASL

(1) Minimum/maximum detected concentration. If minimum/maximum detected concentration comes from average of normal and field duplicate samples then both qualifiers are presented. In a such case, the format is <normal qualifier>/<field duplicate qualifier>.

(2) Detection Frequency is defined as the number of samples that are detected and are not R flagged over the total number of samples.

(3) Range of Detection Limits includes limits associated with any dilution factor. See the analytical results section for more details of detection limits and dilution factors per sample.

(4) Maximum concentration is used for screening.

(5) No background values have been derived for Fish Shellfish Tissue.

(6) All compounds were screened against the Risk Based Concentration (RBC) Table, U.S. EPA Region III, October 2002 for fish (cancer benchmark = 1E-06, HQ = 0.1).

(7) Rationale Codes.

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Back River, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Fish shellfish tissue
Exposure Medium: Fish shellfish tissue

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection (2) Frequency	Range of (3) Detection Limits	Concentration (4) Used for Screening	Background (5) Value	Screening Toxicity Value (6) (NC)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or (7) Deletion

Selection Reason: Above Screening Level (ASL)
Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (EN)

Definitions: NA = Not applicable
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

Appendix A.3

RAGS Part D Table 3's
Medium-Specific Exposure Point Concentration Summary

TABLE 3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
ERP Site SS-63 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water

Chemical of Potential Concern (a)	Units	Arithmetic Mean	95% UCL of Normal Data (b)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value (c)	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value (c)	Medium EPC Statistic	Medium EPC Rationale
INORGANICS												
Arsenic	mg/L	0.00171	0.00237	0.00374		mg/L	0.00237	95% UCL-N	W-Test (4)	0.00171	Mean-N	W-Test (4)
Magnesium	mg/L	627	684	707	J	mg/L	684	95% UCL-N	W-Test (3)	627	Mean-N	W-Test (3)
Mercury	mg/L	0.0000427	0.0000682	0.000106		mg/L	0.0000682	95% UCL-N	W-Test (4)	0.0000427	Mean-N	W-Test (4)
Sodium	mg/L	5130	5590	5720	J	mg/L	5590	95% UCL-N	W-Test (3)	5130	Mean-N	W-Test (3)
ORGANICS												
4,4'-DDD	mg/L	2.42E-06	0.00000567	0.0000144		mg/L	0.00000567	95% UCL-N	W-Test (4)	0.00000242	Mean-N	W-Test (4)
4,4'-DDE	mg/L	1.66E-06	0.00000335	0.00000786		mg/L	0.00000335	95% UCL-N	W-Test (4)	0.00000166	Mean-N	W-Test (4)
Aldrin	mg/L	0.0000129	0.0000186	0.0000213		mg/L	0.0000186	95% UCL-N	W-Test (3)	0.0000129	Mean-N	W-Test (3)
Heptachlor	mg/L	2.82E-06	0.00000489	0.00000784		mg/L	0.00000489	95% UCL-N	W-Test (4)	0.00000282	Mean-N	W-Test (4)
Heptachlor epoxide	mg/L	1.94E-06	0.00000309	0.00000463		mg/L	0.00000309	95% UCL-N	W-Test (4)	0.00000194	Mean-N	W-Test (4)

* Surface soil EPCs will be used for the following exposure points: 1) surface soil at WP-02, and 2) ambient air above WP-02 (vapors and partculates). Surface soil EPCs will be used to model ambient air route EPCs.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

For non-detects, 1/2 sample-specific method detection limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Normal Data (Mean-N); Mean of Log-transformed Data (Mean-T).

T - Total data set only.

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.

(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(3) Shapiro-Wilk W Test indicates data are normally distributed.

(4) Shapiro-Wilk W Test indicates data are neither log-normally distributed or normally distributed. Therefore, normal distribution equations used as default.

(a) All chemicals are in the site and total data sets unless otherwise footnoted with the letter "T".

(b) 95% UCL of Normal Data defined as the 95% UCL associated with the data's distribution.

(c) See Statistics Section of the report for more information on the calculation of the 95% UCL and the mean.

TABLE 3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
ERP Site S-63 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Fish from Back River

Chemical of Potential Concern (a)	Units	Arithmetic Mean	95% UCL of Normal Data (b)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value (c)	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value (c)	Medium EPC Statistic	Medium EPC Rationale
INORGANICS												
Arsenic	mg/kg	1.48	1.9	2.56		mg/kg	1.9	95% UCL-N	W-Test (3)	1.48	Mean-N	W-Test (3)
Calcium	mg/kg	744	4380	1320		mg/kg	1320	Max	W-Test (2)	744	Mean-N	W-Test (3)
Magnesium	mg/kg	330	348	360		mg/kg	348	95% UCL-N	W-Test (3)	330	Mean-N	W-Test (3)
Mercury	mg/kg	0.0506	0.0599	0.0692		mg/kg	0.0599	95% UCL-N	W-Test (3)	0.0506	Mean-N	W-Test (3)
Potassium	mg/kg	3690	3820	3950		mg/kg	3820	95% UCL-N	W-Test (3)	3690	Mean-N	W-Test (3)
Selenium	mg/kg	0.813	0.906	1.05		mg/kg	0.906	95% UCL-N	W-Test (3)	0.813	Mean-N	W-Test (3)
Sodium	mg/kg	521	636	717		mg/kg	636	95% UCL-N	W-Test (3)	521	Mean-N	W-Test (3)
ORGANICS												
4,4'-DDD	mg/kg	0.00635	5.32	0.0284		mg/kg	0.0284	Max	W-Test (2)	0.0109	Mean-T	W-Test (1)
4,4'-DDE	mg/kg	0.0176	0.0254	0.0379		mg/kg	0.0254	95% UCL-N	W-Test (3)	0.0176	Mean-N	W-Test (3)
Aroclor 5432	mg/kg	0.097	1.45	0.379		mg/kg	0.379	Max	W-Test (2)	0.0941	Mean-T	W-Test (1)
PCB-1248	mg/kg	0.0213	0.0446	0.104		mg/kg	0.0446	95% UCL-N	W-Test (4)	0.0213	Mean-N	W-Test (4)
PCB-1254	mg/kg	0.0982	0.219	0.308		mg/kg	0.219	95% UCL-T	W-Test (1)	0.0941	Mean-T	W-Test (1)
PCB-1260	mg/kg	0.0376	0.0572	0.0972		mg/kg	0.0572	95% UCL-N	W-Test (3)	0.0376	Mean-N	W-Test (3)

* Surface soil EPCs will be used for the following exposure points: 1) surface soil at WP-02, and 2) ambient air above WP-02 (vapors and particulates). Surface soil EPCs will be used to model ambient air route EPCs.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

For non-detects, 1/2 sample-specific method detection limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Normal Data (Mean-N); Mean of Log-transformed Data (Mean-T).

T - Total data set only.

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.

(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(3) Shapiro-Wilk W Test indicates data are normally distributed.

(4) Shapiro-Wilk W Test indicates data are neither log-normally distributed or normally distributed. Therefore, normal distribution equations used as default.

(a) All chemicals are in the site and total data sets unless otherwise footnoted with the letter "T".

(b) 95% UCL of Normal Data defined as the 95% UCL associated with the data's distribution.

TABLE 3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
ERP Site S-63 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Fish from Back River

Chemical of Potential Concern (a)	Units	Arithmetic Mean	95% UCL of Normal Data (b)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value (c)	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value (c)	Medium EPC Statistic	Medium EPC Rationale

(c) See Statistics Section of the report for more information on the calculation of the 95% UCL and the mean.

TABLE 3.3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
ERP Site SS-63 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Crabs from Back River

Chemical of Potential Concern (a)	Units	Arithmetic Mean	95% UCL of Normal Data (b)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value (c)	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value (c)	Medium EPC Statistic	Medium EPC Rationale
INORGANICS												
Aluminum	mg/kg	9.21	14.1	15.3		mg/kg	14.1	95% UCL-N	W-Test (3)	9.21	Mean-N	W-Test (3)
Arsenic	mg/kg	2.81	3.66	3.38		mg/kg	3.38	Max	W-Test (2)	2.81	Mean-N	W-Test (3)
Barium	mg/kg	0.382	0.471	0.477		mg/kg	0.471	95% UCL-N	W-Test (3)	0.382	Mean-N	W-Test (3)
Calcium	mg/kg	1680	2330	2230		mg/kg	2230	Max	W-Test (2)	1680	Mean-N	W-Test (3)
Copper	mg/kg	7.35	8.75	8.62		mg/kg	8.62	Max	W-Test (2)	7.35	Mean-N	W-Test (3)
Iron	mg/kg	12.4	14.1	14.2		mg/kg	14.1	95% UCL-N	W-Test (3)	12.4	Mean-N	W-Test (3)
Magnesium	mg/kg	449	543	547		mg/kg	543	95% UCL-N	W-Test (3)	449	Mean-N	W-Test (3)
Manganese	mg/kg	1.31	1.6	1.58		mg/kg	1.58	Max	W-Test (2)	1.31	Mean-N	W-Test (3)
Nickel	mg/kg	0.43	0.491	0.496		mg/kg	0.491	95% UCL-N	W-Test (3)	0.43	Mean-N	W-Test (3)
Potassium	mg/kg	2440	2840	2840		mg/kg	2840	Max	W-Test (2)	2440	Mean-N	W-Test (3)
Selenium	mg/kg	0.611	0.689	0.684		mg/kg	0.684	Max	W-Test (2)	0.611	Mean-N	W-Test (3)
Silver	mg/kg	0.528	0.73	0.785		mg/kg	0.73	95% UCL-N	W-Test (4)	0.528	Mean-N	W-Test (4)
Sodium	mg/kg	3310	3630	3640		mg/kg	3630	95% UCL-N	W-Test (3)	3310	Mean-N	W-Test (3)
Zinc	mg/kg	37.2	42.3	41.9		mg/kg	41.9	Max	W-Test (2)	37.2	Mean-N	W-Test (3)
ORGANICS												
4,4'-DDD	mg/kg	0.00101	0.00289	0.00339		mg/kg	0.00289	95% UCL-N	W-Test (4)	0.00101	Mean-N	W-Test (4)
4,4'-DDE	mg/kg	0.00412	0.00993	0.0111		mg/kg	0.00993	95% UCL-N	W-Test (3)	0.00412	Mean-N	W-Test (3)
Heptachlor	mg/kg	0.0000476	0.0000887	0.0000757		mg/kg	0.0000757	Max	W-Test (2)	0.0000476	Mean-N	W-Test (4)
Heptachlor epoxide	mg/kg	0.000642	0.00159	0.000792		mg/kg	0.000792	Max	W-Test (2)	0.000642	Mean-N	W-Test (3)
PCB-1254	mg/kg	0.00702	0.0196	0.0231		mg/kg	0.0196	95% UCL-N	W-Test (4)	0.00702	Mean-N	W-Test (4)
Phenol	mg/kg	0.0801	0.144	0.133		mg/kg	0.133	Max	W-Test (2)	0.0801	Mean-N	W-Test (3)
bis(2-Ethylhexyl)phthalate	mg/kg	0.0551	0.106	0.12		mg/kg	0.106	95% UCL-N	W-Test (4)	0.0551	Mean-N	W-Test (4)

* Surface soil EPCs will be used for the following exposure points: 1) surface soil at WP-02, and 2) ambient air above WP-02 (vapors and partculates). Surface soil EPCs will be used to model ambient air route EPCs.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

For non-detects, 1/2 sample-specific method detection limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

TABLE 3.3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
ERP Site SS-63 (Back River), Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Crabs from Back River

Chemical of Potential Concern (a)	Units	Arithmetic Mean	95% UCL of Normal Data (b)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value (c)	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value (c)	Medium EPC Statistic	Medium EPC Rationale

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Normal Data (Mean-N); Mean of Log-transformed Data (Mean-T).
T - Total data set only.
(1) Shapiro-Wilk W Test indicates data are log-normally distributed.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.
(3) Shapiro-Wilk W Test indicates data are normally distributed.
(4) Shapiro-Wilk W Test indicates data are neither log-normally distributed or normally distributed. Therefore, normal distribution equations used as default.
(a) All chemicals are in the site and total data sets unless otherwise footnoted with the letter "T".
(b) 95% UCL of Normal Data defined as the 95% UCL associated with the data's distribution.
(c) See Statistics Section of the report for more information on the calculation of the 95% UCL and the mean.

TABLE 3.1 RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
Back River, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Fish-shellfish tissue
Exposure Medium: Fish-shellfish tissue

Exposure Point	Chemical of Potential Concern (a)	Units	Arithmetic Mean	95% UCL (Distribution) (b)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value (b)	Units	Statistic	Rationale
Back River Shellfish	**Inorganics**								
	Aluminum	mg/kg	43.6	228 (T)	142	142	mg/kg	Max	W-Test (2)
	Arsenic	mg/kg	0.761	0.977 (N)	1.43	0.977	mg/kg	95% UCL-N	W-Test (3)
	Cadmium	mg/kg	0.131	0.240 (T)	0.427	0.240	mg/kg	95% UCL-T	W-Test (1)
	Chromium (Total)	mg/kg	2.00	10.7 (T)	6.84	6.84	mg/kg	Max	W-Test (2)
	Copper	mg/kg	4.95	133 (T)	18.5	18.5	mg/kg	Max	W-Test (2)
	Iron	mg/kg	87.1	188 (T)	297	188	mg/kg	95% UCL-T	W-Test (1)
	Lead	mg/kg	0.654	0.974 (N)	2.23	0.974	mg/kg	95% UCL-N	W-Test (4)
	Manganese	mg/kg	7.16	14.3 (T)	33.2	14.3	mg/kg	95% UCL-T	W-Test (1)
	Mercury	mg/kg	0.00669	0.0103 (N)	0.0201	0.0103	mg/kg	95% UCL-N	W-Test (4)
	Selenium	mg/kg	0.470	0.589 (N)	0.779	0.589	mg/kg	95% UCL-N	W-Test (3)
	Silver	mg/kg	0.433	1.13 (T)	1.24	1.13	mg/kg	95% UCL-T	W-Test (1)
	Vanadium	mg/kg	0.230	0.411 (N)	1.09	0.411	mg/kg	95% UCL-N	W-Test (4)
	Zinc	mg/kg	62.7	169 (N)	457	169	mg/kg	95% UCL-N	W-Test (4)
	Organics								
	Aldrin	mg/kg	0.000154	0.000203 (N)	0.000303	0.000203	mg/kg	95% UCL-N	W-Test (3)
	Aroclor 5432	mg/kg	0.0192	0.0255 (N)	0.0403	0.0255	mg/kg	95% UCL-N	W-Test (4)
	Benzo(a)anthracene	mg/kg	0.0165	0.0222 (N)	0.0366	0.0222	mg/kg	95% UCL-N	W-Test (4)
	Benzo(a)pyrene	mg/kg	0.0192	0.0242 (N)	0.0437	0.0242	mg/kg	95% UCL-N	W-Test (4)
	Benzo(b)fluoranthene	mg/kg	0.0197	0.0256 (N)	0.0484	0.0256	mg/kg	95% UCL-N	W-Test (4)
	Heptachlor epoxide	mg/kg	0.000224	0.000317 (N)	0.000472	0.000317	mg/kg	95% UCL-N	W-Test (3)
	PCB 1254	mg/kg	0.0158	0.0222 (N)	0.0356	0.0222	mg/kg	95% UCL-N	W-Test (3)
	PCB 1260	mg/kg	0.00237	0.00326 (N)	0.00578 J	0.00326	mg/kg	95% UCL-N	W-Test (4)
	alpha-BHC	mg/kg	0.000192	0.000296 (N)	0.000555	0.000296	mg/kg	95% UCL-N	W-Test (3)
	delta-BHC	mg/kg	0.000101	0.000224 (N)	0.000703	0.000224	mg/kg	95% UCL-N	W-Test (4)

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T)
For non-detects, 1/2 sample-specific method detection limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.
W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.
(1) Shapiro-Wilk W Test indicates data are log-normally distributed.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.
(3) Shapiro-Wilk W Test indicates data are normally distributed.
(4) Shapiro-Wilk W Test indicates data are neither log-normally distributed or normally distributed. Therefore, normal distribution equations used as default.

(a) All chemicals are in the site and total data sets unless otherwise footnoted with the letter "T".
(b) See Statistics Section of the report for more information on the calculation of the 95% UCL.

Definitions: J= Estimated Value
N=Normal UCL
T=Lognormal UCL

Appendix A.4

RAGS Part D Table 4's
Values Used for Daily Intake Calculations

TABLE 4.1

Daily Intake Equations for the Fisher (Child): Dermal Absorption of Surface Water

ERP Site SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name (2)
Dermal Absorption	CDI-W	Chronic Daily Intake, Surface Water	mg/kg-day	calculated	--	--	--	CDI-W (Inorganics) = $\frac{CW\text{-}M \times CF3 \times SA \times PC \times ET\text{-}D \times EF \times ED \times CF2}{BW \times AT}$
	CW-M	Chemical Concentration in Surface Water	mg/l	csv	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	410	EPA, 1997	--	--	CDI-W (Organics 1) = $\frac{CW\text{-}M \times CF3 \times SA \times (2 \times PC \times \sqrt{(6 \times tau \times ET\text{-}D/pi)}) \times EF \times ED \times CF2}{BW \times AT}$
	EF	Exposure Frequency	days/year	40	(1)	27	EPA, 1993	
	ED	Exposure Duration	years	7	(1)	2.1	(1)	
	BW	Body Weight	kg	20.2	EPA, 1997	--	--	
	ET-D	Exposure Time - Dermal	hr/event	0.25	(1)	--	--	
	PC	Permeability Coefficient	cm/hour	csv	--	--	--	CDI-W (Organics 2) = $\frac{CW\text{-}M \times CF3 \times SA \times PC \times [(ET\text{-}D/1 + B) + 2 \times tau \times (1 + (3 \times B)/(1+B))] \times EF \times ED \times CF2}{BW \times AT}$
	tau	tau	hour	csv	--	--	--	
	B	Cleek and Bunge (1992) parameter	unitless	csv	EPA, 1992	--	--	
	t*	steady state time factor	hour	csv	EPA, 1992	--	--	
	CF3	Conversion Factor 3	event/day	1	--	--	--	
	CF2	Conversion Factor 2	l/cm^3	0.001	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	2,555	ED x 365 days/yr	767	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

(2) For organics, if ET-D < t*, then equation (Organics 1) is used. If ET-D > t*, then equation (Organics 2) is used.

csv = chemical-specific value

TABLE 4.2

Daily Intake Equations for the Fisher (Adult): Dermal Absorption of Surface Water

ERP Site SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name (2)
Dermal Absorption	CDI-W	Chronic Daily Intake, Surface Water	mg/kg-day	calculated	--	--	--	CDI-W (Inorganics) = $\frac{CW\text{-}M \times CF3 \times SA \times PC \times ET\text{-}D \times EF \times ED \times CF2}{BW \times AT}$
	CW-M	Chemical Concentration in Surface Water	mg/l	csv	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	793	EPA, 1997	--	--	
	EF	Exposure Frequency	days/year	40	EPA, 1991	27	EPA, 1993	CDI-W (Organics 1) = $\frac{CW\text{-}M \times CF3 \times SA \times (2 \times PC \times \sqrt{(6 \times tau \times ET\text{-}D/pi)}) \times EF \times ED \times CF2}{BW \times AT}$
	ED	Exposure Duration	years	30	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	ET-D	Exposure Time - Dermal	hr/event	0.25	(1)	--	--	
	PC	Permeability Coefficient	cm/hour	csv	--	--	--	CDI-W (Organics 2) = $\frac{CW\text{-}M \times CF3 \times SA \times PC \times [(ET\text{-}D/1 + B) + 2 \times tau \times (1 + (3 \times B)/1+B)] \times EF \times ED \times CF2}{BW \times AT}$
	tau	tau	hour	csv	--	--	--	
	B	Cleek and Bunge (1992) parameter	unitless	csv	EPA, 1992	--	--	
	l*	steady state time factor	hour	csv	EPA, 1992	--	--	
	CF3	Conversion Factor 3	event/day	1	--	--	--	
	CF2	Conversion Factor 2	l/cm^3	0.001	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	ED x 365 days/yr	3,285	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

(2) For organics, if ET-D < l*, then equation (Organics 1) is used. If ET-D > l*, then equation (Organics 2) is used.

csv = chemical-specific value

TABLE 4.3

Daily Intake Equations for the Other Recreational Person [Adolescents (teens)]: Ingestion/Dermal Absorption of Surface Water

ERP Site SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Other Recreational Person[3]
Receptor Age: Adolescents (teens)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name (2)
Ingestion	CDI-W	Chronic Daily Intake, Surface Water	mg/kg-day	calculated	--	--	--	$CDI\text{-}W = \frac{CW\text{-}M \times IR\text{-}W \times EF \times ED \times FI\text{-}W}{BW \times AT}$
	CW-M	Chemical Concentration in Surface Water	mg/l	csv	--	--	--	
	IR-W	Ingestion Rate of Water	liters/day	0.2	EPA, 1989	--	--	
	FI-W	Fraction of Exposure, Surface Water	unitless	1	(1)	--	--	
	EF	Exposure Frequency	days/year	20	(1)	14	(1)	
	ED	Exposure Duration	years	6	(1)	1.8	(1)	
	BW	Body Weight	kg	57	EPA, 1997	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	ED x 365 days/yr	657	ED x 365 days/yr	
Dermal Absorption	CDI-W	Chronic Daily Intake, Surface Water	mg/kg-day	calculated	--	--	--	$CDI\text{-}W\ (Inorganics) = \frac{CW\text{-}M \times CF3 \times SA \times PC \times ET\text{-}D \times EF \times ED \times CF2}{BW \times AT}$
	CW-M	Chemical Concentration in Surface Water	mg/l	csv	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	15,800	EPA, 1997	--	--	
	EF	Exposure Frequency	days/year	20	(1)	14	(1)	$CDI\text{-}W\ (Organics\ 1) = \frac{CW\text{-}M \times CF3 \times SA \times (2 \times PC \times \sqrt{(6 \times tau \times ET\text{-}D/\pi)} \times EF \times ED \times CF2}{BW \times AT}$
	ED	Exposure Duration	years	6	EPA, 1991	1.8	(1)	
	BW	Body Weight	kg	57	EPA, 1997	--	--	
	ET-D	Exposure Time - Dermal	hr/event	4	(1)	--	--	
	PC	Permeability Coefficient	cm/hour	csv	--	--	--	$CDI\text{-}W\ (Organics\ 2) = \frac{CW\text{-}M \times CF3 \times SA \times PC \times [(ET\text{-}D/1 + B) + 2 \times tau \times (1 + (3 \times B)/1+B)] \times EF \times ED \times CF2}{BW \times AT}$
	tau	tau	hour	csv	--	--	--	
	B	Cleek and Bunge (1992) parameter	unitless	csv	EPA, 1992	--	--	
	t*	steady state time factor	hour	csv	EPA, 1992	--	--	
	CF3	Conversion Factor 3	event/day	1	--	--	--	
	CF2	Conversion Factor 2	l/cm^3	0.001	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	ED x 365 days/yr	657	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

(2) For organics, if ET-D < t*, then equation (Organics 1) is used. If ET-D > t*, then equation (Organics 2) is used.

(3) Jet Skier

csv = chemical-specific value

TABLE 4 4

Daily Intake Equations for the Other Worker (Adult): Ingestion/Dermal Absorption of Surface Water

ERP Site SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Other Worker[4]
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name (3)
Ingestion	CDI-W	Chronic Daily Intake, Surface Water	mg/kg-day	calculated	--	--	--	CDI-W = $\frac{CW\text{-}M \times IR\text{-}W \times EF \times ED \times FI\text{-}W}{BW \times AT}$
	CW-M	Chemical Concentration in Surface Water	mg/l	csv	--	--	--	
	IR-W	Ingestion Rate of Water	liters/day	0.2	EPA, 1989	--	--	
	FI-W	Fraction of Exposure, Surface Water	unitless	1	(1)	--	--	
	EF	Exposure Frequency	days/year	5	(1)	4	(1)	
	ED	Exposure Duration	years	25	EPA, 1991	7.5	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	ED x 365 days/yr	2,738	ED x 365 days/yr	
Dermal Absorption	CDI-W	Chronic Daily Intake, Surface Water	mg/kg-day	calculated	--	--	--	CDI-W (Inorganics) = $\frac{CW\text{-}M \times CF3 \times SA \times PC \times ET\text{-}D \times EF \times ED \times CF2}{BW \times AT}$
	CW-M	Chemical Concentration in Surface Water	mg/l	csv	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	20,000	EPA, 1997	--	--	
	EF	Exposure Frequency	days/year	5	(1)	4	(1)	CDI-W (Organics 1) = $\frac{CW\text{-}M \times CF3 \times SA \times (2 \times PC \times \sqrt{(6 \times tau \times ET\text{-}D/pi)}) \times EF \times ED \times CF2}{BW \times AT}$
	ED	Exposure Duration	years	25	EPA, 1991	7.5	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	ET-D	Exposure Time - Dermal	hr/event	4	(1)	--	--	
	PC	Permeability Coefficient	cm/hour	csv	--	--	--	CDI-W (Organics 2) = $\frac{CW\text{-}M \times CF3 \times SA \times PC \times [(ET\text{-}D/1 + B) + 2 \times tau \times (1 + (3 \times B)/(1+B))] \times EF \times ED \times CF2}{BW \times AT}$
	tau	tau	hour	csv	--	--	--	
	B	Cleek and Bunge (1992) parameter	unitless	csv	EPA, 1992	--	--	
	t*	steady state time factor	hour	csv	EPA, 1992	--	--	
	CF3	Conversion Factor 3	event/day	1	--	--	--	
	CF2	Conversion Factor 2	l/cm^3	1.0.E-03	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	ED x 365 days/yr	2,738	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

(2) Combined child/adult cancer risk for these routes will be addressed by adding cancer risk of the child and adult together.

(3) For organics, if ET-D < t*, then equation (Organics 1) is used. If ET-D > t*, then equation (Organics 2) is used.

(4) Sea Rescue Trainer

csv = chemical-specific value

TABLE 4.5

Daily Intake Equations for the Fisher (Child): Ingestion of Fish from Back River

ERP Site SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Fish from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CDI-F	Chronic Daily Intake, Fish	mg/kg-day	calculated	--	--	--	$CDI\text{-}F = \frac{CF \times IR_C\text{-}F \times EF \times ED \times FI\text{-}F}{BW \times AT}$
	CF	Chemical Concentration in Fish	mg/kg	csv	--	--	--	
	IR_C-F	Ingestion Rate, Fish for Child	kg/day	0.008	EPA, 1997	0.003	EPA, 1997	
	FI-F	Fraction of Exposure, Fish	unitless	0.5	(1)	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	7	(1)	2.1	(1)	
	BW	Body Weight	kg	20.2	EPA, 1997	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	2,555	ED x 365 days/yr	767	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

csv = chemical-specific value

TABLE 4.6

Daily Intake Equations for the Fisher (Adult): Ingestion of Fish from Back River

ERP Site SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Fish from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CDI-F	Chronic Daily Intake, Fish	mg/kg-day	calculated	--	--	--	$CDI\text{-}F = \frac{CF \times IR_A\text{-}F \times EF \times ED \times FI\text{-}F}{BW \times AT}$
	CF	Chemical Concentration in Fish	mg/kg	csv	--	--	--	
	IR_A-F	Ingestion Rate, Fish for Adult	kg/day	0.025	EPA, 1997	0.008	EPA, 1997	
	FI-F	Fraction of Exposure, Fish	unitless	0.5	(1)	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	30	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	ED x 365 days/yr	3,285	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

csv = chemical-specific value

TABLE 4.7

Daily Intake Equations for the Fisher (Child): Ingestion of Crabs from Back River

ERP Site SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Crabs from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CDI-F	Chronic Daily Intake, Crabs	mg/kg-day	calculated	--	--	--	$CDI\text{-}F = \frac{CF \times IR_C\text{-}C \times EF \times ED \times FI\text{-}C}{BW \times AT}$
	CF	Chemical Concentration in Crabs	mg/kg	csv	--	--	--	
	IR_C-C	Ingestion Rate, Crabs for Child	kg/day	0.008	EPA, 1997	0.003	EPA, 1997	
	FI-C	Fraction of Exposure, Crabs	unitless	0.5	(1)	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	7	(1)	2.1	(1)	
	BW	Body Weight	kg	20.2	EPA, 1997	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	2,555	ED x 365 days/yr	767	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

csv = chemical-specific value

TABLE 4.8

Daily Intake Equations for the Fisher (Adult): Ingestion of Crabs from Back River

ERP Site SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Crabs from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CDI-F	Chronic Daily Intake, Crabs	mg/kg-day	calculated	--	--	--	$CDI\text{-}F = \frac{CF \times IR_A\text{-}C \times EF \times ED \times FI\text{-}C}{BW \times AT}$
	CF	Chemical Concentration in Crabs	mg/kg	csv	--	--	--	
	IR_A-C	Ingestion Rate, Crabs for Adult	kg/day	0.025	EPA, 1997	0.008	EPA, 1997	
	FI-C	Fraction of Exposure, Crabs	unitless	0.5	(1)	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	30	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	ED x 365 days/yr	3,285	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

csv = chemical-specific value

TABLE 4.1

Daily Intake Equations for the Fisher (Child): Ingestion of Bivalves from Back River

ERP Site SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Bivalves from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CDI-BV	Chronic Daily Intake, Bivalves	mg/kg-day	calculated	--	--	--	$CDI\text{-}BV = \frac{CF \times IR_C\text{-}C \times EF \times ED \times FI\text{-}C}{BW \times AT}$
	CF	Chemical Concentration in Bivalves	mg/kg	csv	--	--	--	
	IR_C-BV	Ingestion Rate, Bivalves for Child	kg/day	0.008	EPA, 1997	0.003	EPA, 1997	
	FI-BV	Fraction of Exposure, Bivalves	unitless	1	(1)	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	7	(1)	2.1	(1)	
	BW	Body Weight	kg	20.2	EPA, 1997	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	2,555	ED x 365 days/yr	767	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

csv = chemical-specific value

TABLE 4.2

Daily Intake Equations for the Fisher (Adult): Ingestion of Bivalves from Back River

ERP Site SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Bivalves from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CDI-BV	Chronic Daily Intake, Bivalves	mg/kg-day	calculated	--	--	--	$CDI\text{-}BV = \frac{CF \times IR_A\text{-}C \times EF \times ED \times FI\text{-}C}{BW \times AT}$
	CF	Chemical Concentration in Bivalves	mg/kg	csv	--	--	--	
	IR_A-BV	Ingestion Rate, Bivalves for Adult	kg/day	0.025	EPA, 1997	0.008	EPA, 1997	
	FI-BV	Fraction of Exposure, Bivalves	unitless	1	(1)	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	30	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	ED x 365 days/yr	3,285	ED x 365 days/yr	

(1) *Professional Judgement (see Appendix F1)*

csv = chemical-specific value

Appendix A.5

RAGS Part D Table 5's
Non-Cancer Toxicity Data

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

ERP Site SS-63, Langley Air Force Base

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (MM/DD/YY)
4,4'-DDD	Chronic	N/A	N/A	70%	N/A	N/A	N/A	N/A	N/A	N/A
4,4'-DDE	Chronic	N/A	N/A	70%	N/A	N/A	N/A	N/A	N/A	N/A
Aldrin	Chronic	3.0E-05	mg/kg-day	90%	2.7E-05	mg/kg-day	liver	1000	IRIS	03/21/01
Aluminum	Chronic	1.0E+00	mg/kg-day	27%	2.7E-01	mg/kg-day	Dev. NS	100	NCEA	09/26/96
Aroclor 5432	Chronic	N/A	N/A	90%	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	3.0E-04	mg/kg-day	95%	2.9E-04	mg/kg-day	skin/vascular	3	IRIS	03/21/01
Barium	Chronic	7.0E-02	mg/kg-day	100%	7.0E-02	mg/kg-day	kidney	3	IRIS	03/21/01
bis (2-Ethylhexyl) phthalate	Chronic	2.0E-02	mg/kg-day	55%	1.1E-02	mg/kg-day	liver	1000	IRIS	03/21/01
Calcium	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	Chronic	4.0E-02	mg/kg-day	60%	2.4E-02	mg/kg-day	GI tract	N/A	NCEA	04/29/97
Heptachlor	Chronic	5.0E-04	mg/kg-day	90%	4.5E-04	mg/kg-day	liver	300	IRIS	03/21/01
Heptachlor epoxide	Chronic	1.3E-05	mg/kg-day	90%	1.2E-05	mg/kg-day	liver	1000	IRIS	03/21/01
Iron	Chronic	3.0E-01	mg/kg-day	100%	3.0E-01	mg/kg-day	blood/liver/GI tract	1	NCEA	01/05/99
Magnesium	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese (food)	Chronic	1.4E-01	mg/kg-day	N/A	N/A	N/A	CNS	1	IRIS	03/21/01
Manganese (non-food)	Chronic	2.0E-02	mg/kg-day	5%	1.0E-03	mg/kg-day	CNS	1	IRIS	03/21/01
Mercury	Chronic	3.0E-04	mg/kg-day	100%	3.0E-04	mg/kg-day	Immune system	1000	IRIS	03/21/01
Methylmercury	Chronic	1.0E-04	mg/kg-day	90%	9.0E-05	mg/kg-day	Dev. NS	10	IRIS	03/21/01
Nickel	Chronic	2.0E-02	mg/kg-day	0.4%	8.6E-05	mg/kg-day	heart/liver	300	IRIS	03/21/01
PCB-1248	Chronic	N/A	N/A	100%	N/A	N/A	N/A	N/A	N/A	N/A
PCB-1254	Chronic	2.0E-05	mg/kg-day	100%	2.0E-05	mg/kg-day	Immune system/eye/nails	300	IRIS	03/21/01
PCB-1260	Chronic	N/A	N/A	100%	N/A	N/A	N/A	N/A	N/A	N/A
Phenol	Chronic	6.0E-01	mg/kg-day	90%	5.4E-01	mg/kg-day	fetus	100	IRIS	03/21/01
Potassium	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	Chronic	5.0E-03	mg/kg-day	44%	2.2E-03	mg/kg-day	Liver/hair/nails/skin/CNS	3	IRIS	03/21/01
Silver	Chronic	5.0E-03	mg/kg-day	N/A	5.0E-03	mg/kg-day	skin	3	IRIS	03/21/01
Sodium	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	Chronic	3.0E-01	mg/kg-day	25%	7.5E-02	mg/kg-day	blood	3	IRIS	03/21/01

N/A = Not Available

(1) Refer to RAGS, Part A

(2) Adjusted Dermal $RfD_{chemical}$ = Oral Chronic RfDchemical x GI Absorption $Factor_{chemical}$

(3) The date IRIS was searched.

The date of HEAST.

The date of the article provided by NCEA.

The date of the RBC Region III Tables

TABLE 5.1

NON-CANCER TOXICITY DATA – ORAL/DERMAL

ERP Site SS-63, Langley Air Force Base

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (MM/DD/YY)

Note: Endosulfan was used as a surrogate for endosulfan I and endosulfan sulfate.

Endrin was used as a surrogate for endrin aldehyde, and endrin ketone.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

ERP Site SS-63, Langley Air Force Base

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (MM/DD/YY)
Aldrin	Chronic	3.0E-05	mg/kg-day	90%	2.7E-05	mg/kg-day	liver	1000	IRIS	03/21/01
Aluminum	Chronic	1.0E+00	mg/kg-day	27%	2.7E-01	mg/kg-day	Dev. NS	100	NCEA	08/26/96
Aroclor 5432	Chronic	N/A	N/A	90%	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	3.0E-04	mg/kg-day	95%	2.9E-04	mg/kg-day	skin/vascular	3	IRIS	03/21/01
Benzo(a)anthracene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(b) fluoranthene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
alpha-BHC	Chronic	N/A	N/A	97.4%	N/A	N/A	N/A	N/A	N/A	N/A
delta-BHC	Chronic	N/A	N/A	90%	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	Chronic	1.0E-03	mg/kg-day	2.5%	2.5E-05	mg/kg-day	kidney	10	IRIS	03/21/01
Chromium	Chronic	1.5E+00	mg/kg-day	1%	1.5E-02	mg/kg-day	GI tract/fetus/bone marrow/spleen/liver	1000	IRIS	03/21/01
Copper	Chronic	4.0E-02	mg/kg-day	60%	2.4E-02	mg/kg-day	GI tract	N/A	NCEA	04/29/97
Heptachlor epoxide	Chronic	1.3E-05	mg/kg-day	90%	1.2E-05	mg/kg-day	liver	1000	IRIS	03/21/01
Iron	Chronic	3.0E-01	mg/kg-day	100%	3.0E-01	mg/kg-day	blood/liver/GI tract	1	NCEA	01/05/98
Manganese (food)	Chronic	1.4E-01	mg/kg-day	N/A	N/A	N/A	CNS	1	IRIS	03/21/01
Methylmercury	Chronic	1.0E-04	mg/kg-day	90%	9.0E-05	mg/kg-day	Dev. NS	10	IRIS	03/21/01
PCB-1254	Chronic	2.0E-05	mg/kg-day	100%	2.0E-05	mg/kg-day	Immune system/eye/nails	300	IRIS	03/21/01
PCB-1260	Chronic	N/A	N/A	100%	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	Chronic	5.0E-03	mg/kg-day	44%	2.2E-03	mg/kg-day	Liver/hair/nails/skin/CNS	3	IRIS	03/21/01
Silver	Chronic	5.0E-03	mg/kg-day	N/A	5.0E-03	mg/kg-day	skin	3	IRIS	03/21/01
Vanadium	Chronic	7.0E-03	mg/kg-day	2%	1.4E-04	mg/kg-day	GI tract/CNS/kidney/bone marrow/liver	100	HEAST	04/29/97
Zinc	Chronic	3.0E-01	mg/kg-day	25%	7.5E-02	mg/kg-day	blood	3	IRIS	03/21/01

N/A = Not Available

(1) Refer to RAGS, Part A

(2) Adjusted Dermal $RfD_{chemical}$ = Oral Chronic RfDchemical x GI Absorption $Factor_{chemical}$

(3) The date IRIS was searched.

The date of HEAST

The date of the article provided by NCEA.

The date of the Region III RBC Tables.

Note: Endosulfan was used as a surrogate for endosulfan I and endosulfan sulfate.

Endrin was used as a surrogate for endrin aldehyde, and endrin ketone.

Appendix A.6

RAGS Part D Table 6's
Cancer Toxicity Data

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

ERP Site SS-63, Langley Air Force Base

Chemical of Potential Concern	Oral Cancer Slope Factor	Units	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
4,4'-DDD	2.4E-01	(mg/kg-day)$^{-1}$	70%	3.4E-01	(mg/kg-day)$^{-1}$	B2	IRIS	03/21/01
4,4'-DDE	3.4E-01	(mg/kg-day)$^{-1}$	70%	4.9E-01	(mg/kg-day)$^{-1}$	B2	IRIS	03/21/01
Aldrin	1.7E+01	(mg/kg-day)$^{-1}$	90%	1.9E+01	(mg/kg-day)$^{-1}$	B2	IRIS	03/21/01
Aluminum	N/A	(mg/kg-day)$^{-1}$	27%	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Aroclor 5432	4.5E+00	(mg/kg-day)$^{-1}$	90%	5.0E+00	(mg/kg-day)$^{-1}$	B2	IRIS	03/21/01
Arsenic	1.5E+00	(mg/kg-day)$^{-1}$	95%	1.6E+00	(mg/kg-day)$^{-1}$	A	IRIS	03/21/01
Barium	N/A	(mg/kg-day)$^{-1}$	100%	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
bis (2-Ethylhexyl) phthalate	1.4E-02	(mg/kg-day)$^{-1}$	55%	2.5E-02	(mg/kg-day)$^{-1}$	B2	IRIS	03/21/01
Calcium	N/A	(mg/kg-day)$^{-1}$	5%	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Copper	N/A	(mg/kg-day)$^{-1}$	60%	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Heptachlor	4.5E+00	(mg/kg-day)$^{-1}$	90.0%	5.0E+00	N/A	B2	IRIS	03/21/01
Heptachlor epoxide	9.1E+00	(mg/kg-day)$^{-1}$	90%	1.0E+01	N/A	B2	IRIS	03/21/01
Iron	N/A	(mg/kg-day)$^{-1}$	100%	N/A	N/A	N/A	N/A	N/A
Magnesium	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A	N/A	N/A	N/A
Manganese (food)	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Manganese (non-food)	N/A	(mg/kg-day)$^{-1}$	5%	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Mercury	N/A	N/A	100%	N/A	N/A	N/A	N/A	N/A
Methylmercury	N/A	N/A	90%	N/A	N/A	N/A	N/A	N/A
Nickel	N/A	N/A	0%	N/A	N/A	N/A	N/A	N/A
PCB-1248	2.0E+00	(mg/kg-day)$^{-1}$	100%	2.0E+00	N/A	B2	IRIS	03/21/01
PCB-1254	2.0E+00	(mg/kg-day)$^{-1}$	100%	2.0E+00	(mg/kg-day)$^{-1}$	B2	IRIS	01/01/01
PCB-1260	2.0E+00	(mg/kg-day)$^{-1}$	100%	2.0E+00	N/A	B2	IRIS	03/21/01
Phenol	N/A	(mg/kg-day)$^{-1}$	90%	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Potassium	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Selenium	N/A	(mg/kg-day)$^{-1}$	44%	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Silver	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Sodium	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Zinc	N/A	(mg/kg-day)$^{-1}$	25%	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

EPA Group:

A - Human carcinogen

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

ERP Site SS-63, Langley Air Force Base

Chemical of Potential Concern	Oral Cancer Slope Factor	Units	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)

N/A= Not Available

(1) Adjusted SF_d = Sf_o / GI Absorption Factor

(2) The date IRIS was searched.

The date of HEAST.

The date of article provided by NCEA.

Note: For PCTs and PCB-1248,

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

ERP Site SS-63, Langley Air Force Base

Chemical of Potential Concern	Oral Cancer Slope Factor	Units	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
Aldrin	1.7E+01	$(mg/kg\text{-}day)^{-1}$	90%	1.9E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	03/21/01
Aluminum	N/A	N/A	27%	N/A	N/A	N/A	N/A	N/A
Aroclor 5432	4.5E+00	$(mg/kg\text{-}day)^{-1}$	90%	5.0E+00	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	03/21/01
Arsenic	1.5E+00	$(mg/kg\text{-}day)^{-1}$	95%	1.6E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	03/21/01
Benzo(a)anthracene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A	B2	NCEA, IRIS	07/01/93, 3/21/01
Benzo(a)pyrene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A	B2	IRIS	03/21/01
Benzo(b)fluoranthene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A	B2	NCEA, IRIS	07/01/93, 03/21/01
alpha-BHC	6.3E+00	$(mg/kg\text{-}day)^{-1}$	97.4%	6.5E+00	(mg/kg-day) -1	B2	IRIS	03/21/01
delta-BHC	1.8E+00	$(mg/kg\text{-}day)^{-1}$	90%	2.0E+00	(mg/kg-day) -1	D	IRIS	03/21/01
Cadmium	N/A	N/A	2.5%	N/A	N/A	N/A	N/A	N/A
Chromium	N/A	N/A	1%	N/A	N/A	D	N/A	N/A
Copper	N/A	N/A	60%	N/A	N/A	N/A	N/A	N/A
Heptachlor epoxide	9.1E+00	$(mg/kg\text{-}day)^{-1}$	90%	1.0E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	03/21/01
Iron	N/A	$(mg/kg\text{-}day)^{-1}$	100%	N/A	N/A	N/A	N/A	N/A
Manganese (food)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Methylmercury	N/A	N/A	90%	N/A	N/A	N/A	N/A	N/A
PCB-1254	2.0E+00	$(mg/kg\text{-}day)^{-1}$	100%	2.0E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	03/21/01
PCB-1260	2.0E+00	$(mg/kg\text{-}day)^{-1}$	100%	2.0E+00	N/A	B2	IRIS	03/21/01
Selenium	N/A	N/A	44%	N/A	N/A	N/A	N/A	N/A
Silver	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	2%	N/A	N/A	N/A	N/A	N/A
Zinc	N/A	N/A	25%	N/A	N/A	N/A	N/A	N/A

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

N/A= Not Available

(1) Adjusted SF_d = St_o / GI Absorption Factor

(2) The date IRIS was searched.

The date of HEAST.

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

ERP Site SS-63, Langley Air Force Base

Chemical of Potential Concern	Oral Cancer Slope Factor	Units	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)

The date of article provided by NCEA.

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

Appendix A.7

RAGS Part D Table 7's
Calculation of Non-Cancer Hazards
Resonable Maximum Exposure

TABLE 7.1.RME
RME CALCULATION OF NON-CANCER HAZARDS: DERMAL ABSORPTION
OF SURFACE WATER FROM BACK RIVER FOR THE CHILD FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal Absorption	**INORGANICS**												
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	1.3E-09	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.000005
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	3.8E-04	mg/kg-day	--	--	N/A	N/A	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	3.8E-11	mg/kg-day	9.0E-05	mg/kg-day	N/A	N/A	0.0000004
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	3.1E-03	mg/kg-day	--	--	N/A	N/A	--
	ORGANICS												
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	1.4E-08	mg/kg-day	--	--	N/A	N/A	--
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	6.8E-09	mg/kg-day	--	--	N/A	N/A	--
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	3.5E-10	mg/kg-day	2.7E-05	mg/kg-day	N/A	N/A	0.00001
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	6.8E-10	mg/kg-day	4.5E-04	mg/kg-day	N/A	N/A	0.00000
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	2.4E-09	mg/kg-day	1.2E-05	mg/kg-day	N/A	N/A	0.0002
	(Total)												0.0002
												Total Hazard Index Across All Exposure Routes/Pathways	0.0002

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 7.2.RME
RME CALCULATION OF NON-CANCER HAZARDS: DERMAL ABSORPTION
OF SURFACE WATER FROM BACK RIVER FOR THE ADULT FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal Absorption	**INORGANICS**												
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	7.4E-10	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.000003
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	2.1E-04	mg/kg-day	--	--	N/A	N/A	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	2.1E-11	mg/kg-day	9.0E-05	mg/kg-day	N/A	N/A	0.0000002
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	1.7E-03	mg/kg-day	--	--	N/A	N/A	--
	ORGANICS												
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	7.6E-09	mg/kg-day	--	--	N/A	N/A	--
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	3.8E-09	mg/kg-day	--	--	N/A	N/A	--
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	2.0E-10	mg/kg-day	2.7E-05	mg/kg-day	N/A	N/A	0.000007
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	3.8E-10	mg/kg-day	4.5E-04	mg/kg-day	N/A	N/A	0.000001
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	1.3E-09	mg/kg-day	1.2E-05	mg/kg-day	N/A	N/A	0.0001
	(Total)												0.0001
												Total Hazard Index Across All Exposure Routes/Pathways	0.0001

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation

TABLE 7.3.RME
RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION
OF SURFACE WATER FROM BACK RIVER FOR THE OTHER RECREATIONAL PERSON [ADOLESCENTS (TEENS)]
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Other Recreational Person[2]
Receptor Age: Adolescents (teens)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	INORGANICS												
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	4.6E-07	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.002
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	1.3E-01	mg/kg-day	--	--	N/A	N/A	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	1.3E-08	mg/kg-day	1.0E-04	mg/kg-day	N/A	N/A	0.0001
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	1.1E+00	mg/kg-day	--	--	N/A	N/A	--
	ORGANICS												
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	1.1E-09	mg/kg-day	--	--	N/A	N/A	--
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	6.4E-10	mg/kg-day	--	--	N/A	N/A	--
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	3.6E-09	mg/kg-day	3.0E-05	mg/kg-day	N/A	N/A	0.0001
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	9.4E-10	mg/kg-day	5.0E-04	mg/kg-day	N/A	N/A	0.000002
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	5.9E-10	mg/kg-day	1.3E-05	mg/kg-day	N/A	N/A	0.00005
	(Total)												0.002
Dermal Absorption	INORGANICS												
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	1.4E-07	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.0005
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	4.2E-02	mg/kg-day	--	--	N/A	N/A	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	4.1E-09	mg/kg-day	9.0E-05	mg/kg-day	N/A	N/A	0.00005
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	3.4E-01	mg/kg-day	--	--	N/A	N/A	--
	ORGANICS												
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	3.7E-07	mg/kg-day	--	--	N/A	N/A	--
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	1.9E-07	mg/kg-day	--	--	N/A	N/A	--
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	9.7E-09	mg/kg-day	2.7E-05	mg/kg-day	N/A	N/A	0.0004
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	1.9E-08	mg/kg-day	4.5E-04	mg/kg-day	N/A	N/A	0.0000
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	6.5E-08	mg/kg-day	1.2E-05	mg/kg-day	N/A	N/A	0.006
	(Total)												0.006
												Total Hazard Index Across All Exposure Routes/Pathways	0.008

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Jet Skier

TABLE 7.4 RME
RME CALCULATION OF NON-CANCER HAZARDS. INGESTION/DERMAL ABSORPTION
OF SURFACE WATER FROM BACK RIVER FOR OTHER WORKER (ADULT)
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Other Worker[2]
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	INORGANICS												
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	9.3E-08	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.0003
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	2.7E-02	mg/kg-day	--	--	N/A	N/A	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	2.7E-09	mg/kg-day	1.0E-04	mg/kg-day	N/A	N/A	0.00003
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	2.2E-01	mg/kg-day	--	--	N/A	N/A	--
	ORGANICS												
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	2.2E-10	mg/kg-day	--	--	N/A	N/A	--
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	1.3E-10	mg/kg-day	--	--	N/A	N/A	--
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	7.3E-10	mg/kg-day	3.0E-05	mg/kg-day	N/A	N/A	0.00002
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	1.9E-10	mg/kg-day	5.0E-04	mg/kg-day	N/A	N/A	0.0000004
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	1.2E-10	mg/kg-day	1.3E-05	mg/kg-day	N/A	N/A	0.000009
	(Total)												0.0004
Dermal Absorption	INORGANICS												
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	3.7E-08	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.0001
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	1.1E-02	mg/kg-day	--	--	N/A	N/A	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	1.1E-09	mg/kg-day	9.0E-05	mg/kg-day	N/A	N/A	0.00001
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	8.8E-02	mg/kg-day	--	--	N/A	N/A	--
	ORGANICS												
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	9.6E-08	mg/kg-day	--	--	N/A	N/A	--
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	4.6E-08	mg/kg-day	--	--	N/A	N/A	--
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	2.5E-09	mg/kg-day	2.7E-05	mg/kg-day	N/A	N/A	0.00009
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	4.8E-09	mg/kg-day	4.5E-04	mg/kg-day	N/A	N/A	0.0000
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	1.7E-08	mg/kg-day	1.2E-05	mg/kg-day	N/A	N/A	0.001
	(Total)												0.002
												Total Hazard Index Across All Exposure Routes/Pathways	0.002

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Sea Rescue Trainer

TABLE 7.5.RME
RME CALCULATION OF NON-CANCER HAZARDS: INGESTION
OF FISH FROM BACK RIVER FOR THE CHILD FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Fish from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Arsenic	1.9E+00	mg/kg	1.9E+00	mg/kg	M	3.6E-04	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	1
	Calcium	1.3E+03	mg/kg	1.3E+03	mg/kg	M	2.5E-01	mg/kg-day	--	--	N/A	N/A	--
	Magnesium	3.5E+02	mg/kg	3.5E+02	mg/kg	M	6.6E-02	mg/kg-day	--	--	N/A	N/A	--
	Methylmercury	6.0E-02	mg/kg	6.0E-02	mg/kg	M	1.1E-05	mg/kg-day	1.0E-04	mg/kg-day	N/A	N/A	0.1
	Potassium	3.8E+03	mg/kg	3.8E+03	mg/kg	M	7.3E-01	mg/kg-day	--	--	N/A	N/A	--
	Selenium	9.1E-01	mg/kg	9.1E-01	mg/kg	M	1.7E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	0.03
	Sodium	6.4E+02	mg/kg	6.4E+02	mg/kg	M	1.2E-01	mg/kg-day	--	--	N/A	N/A	--
	ORGANICS												
	4,4'-DDD	2.8E-02	mg/kg	2.8E-02	mg/kg	M	5.4E-06	mg/kg-day	--	--	N/A	N/A	--
	4,4'-DDE	2.5E-02	mg/kg	2.5E-02	mg/kg	M	4.8E-06	mg/kg-day	--	--	N/A	N/A	--
	Aroclor 5432	3.8E-01	mg/kg	3.8E-01	mg/kg	M	7.2E-05	mg/kg-day	--	--	N/A	N/A	--
	PCB-1248	4.5E-02	mg/kg	4.5E-02	mg/kg	M	8.5E-06	mg/kg-day	--	--			
	PCB-1254	2.2E-01	mg/kg	2.2E-01	mg/kg	M	4.2E-05	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	2
	PCB-1260	5.7E-02	mg/kg	5.7E-02	mg/kg	M	1.1E-05	mg/kg-day	--	--	N/A	N/A	--
	(Total)												3.4
												Total Hazard Index Across All Exposure Routes/Pathways	3.4

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 7.6.RME
RME CALCULATION OF NON-CANCER HAZARDS: INGESTION
OF FISH FROM BACK RIVER FOR THE ADULT FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Fish from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Arsenic	1.9E+00	mg/kg	1.9E+00	mg/kg	M	3.3E-04	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	1
	Calcium	1.3E+03	mg/kg	1.3E+03	mg/kg	M	2.3E-01	mg/kg-day	--	--	N/A	N/A	--
	Magnesium	3.5E+02	mg/kg	3.5E+02	mg/kg	M	6.0E-02	mg/kg-day	--	--	N/A	N/A	--
	Methylmercury	6.0E-02	mg/kg	6.0E-02	mg/kg	M	1.0E-05	mg/kg-day	1.0E-04	mg/kg-day	N/A	N/A	0.1
	Potassium	3.8E+03	mg/kg	3.8E+03	mg/kg	M	6.5E-01	mg/kg-day	--	--	N/A	N/A	--
	Selenium	9.1E-01	mg/kg	9.1E-01	mg/kg	M	1.6E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	0.03
	Sodium	6.4E+02	mg/kg	6.4E+02	mg/kg	M	1.1E-01	mg/kg-day	--	--	N/A	N/A	--
	ORGANICS												
	4,4'-DDD	2.8E-02	mg/kg	2.8E-02	mg/kg	M	4.9E-06	mg/kg-day	--	--	N/A	N/A	--
	4,4'-DDE	2.5E-02	mg/kg	2.5E-02	mg/kg	M	4.3E-06	mg/kg-day	--	--	N/A	N/A	--
	Aroclor 5432	3.8E-01	mg/kg	3.8E-01	mg/kg	M	6.5E-05	mg/kg-day	--	--	N/A	N/A	--
	PCB-1248	4.5E-02	mg/kg	4.5E-02	mg/kg	M	7.6E-06	mg/kg-day	--	--	N/A	N/A	--
	PCB-1254	2.2E-01	mg/kg	2.2E-01	mg/kg	M	3.8E-05	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	2
	PCB-1260	5.7E-02	mg/kg	5.7E-02	mg/kg	M	9.8E-06	mg/kg-day	--	--	N/A	N/A	--
	(Total)												3.1
												Total Hazard Index Across All Exposure Routes/Pathways	3.1

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 7.7.RME
RME CALCULATION OF NON-CANCER HAZARDS: INGESTION
OF CRABS FROM BACK RIVER FOR THE CHILD FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Crabs from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.4E+01	mg/kg	1.4E+01	mg/kg	M	2.7E-03	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.003
	Arsenic	3.4E+00	mg/kg	3.4E+00	mg/kg	M	6.4E-04	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	2
	Barium	4.7E-01	mg/kg	4.7E-01	mg/kg	M	8.9E-05	mg/kg-day	7.0E-02	mg/kg-day	N/A	N/A	0.001
	Calcium	2.2E+03	mg/kg	2.2E+03	mg/kg	M	4.2E-01	mg/kg-day	--	--	N/A	N/A	--
	Copper	8.6E+00	mg/kg	8.6E+00	mg/kg	M	1.6E-03	mg/kg-day	4.0E-02	mg/kg-day	N/A	N/A	0.04
	Iron	1.4E+01	mg/kg	1.4E+01	mg/kg	M	2.7E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.009
	Magnesium	5.4E+02	mg/kg	5.4E+02	mg/kg	M	1.0E-01	mg/kg-day	--	--	N/A	N/A	--
	Manganese (food)	1.6E+00	mg/kg	1.6E+00	mg/kg	M	3.0E-04	mg/kg-day	1.4E-01	mg/kg-day	N/A	N/A	0.002
	Nickel	4.9E-01	mg/kg	4.9E-01	mg/kg	M	9.3E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.005
	Potassium	2.8E+03	mg/kg	2.8E+03	mg/kg	M	5.4E-01	mg/kg-day	--	--	N/A	N/A	--
	Selenium	6.8E-01	mg/kg	6.8E-01	mg/kg	M	1.3E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	0.03
	Silver	7.3E-01	mg/kg	7.3E-01	mg/kg	M	1.4E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	0.03
	Sodium	3.6E+03	mg/kg	3.6E+03	mg/kg	M	6.9E-01	mg/kg-day	--	--	N/A	N/A	--
	Zinc	4.2E+01	mg/kg	4.2E+01	mg/kg	M	8.0E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.03
	ORGANICS												
	4,4'-DDD	2.9E-03	mg/kg	2.9E-03	mg/kg	M	5.5E-07	mg/kg-day	--	--	N/A	N/A	--
	4,4'-DDE	9.9E-03	mg/kg	9.9E-03	mg/kg	M	1.9E-06	mg/kg-day	--	--	N/A	N/A	--
	Heptachlor	7.6E-05	mg/kg	7.6E-05	mg/kg	M	1.4E-08	mg/kg-day	5.0E-04	mg/kg-day	N/A	N/A	0.00003
	Heptachlor epoxide	7.9E-04	mg/kg	7.9E-04	mg/kg	M	1.5E-07	mg/kg-day	1.3E-05	mg/kg-day	N/A	N/A	0.01
	PCB-1254	2.0E-02	mg/kg	2.0E-02	mg/kg	M	3.7E-06	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	0.2
	Phenol	1.3E-01	mg/kg	1.3E-01	mg/kg	M	2.5E-05	mg/kg-day	6.0E-01	mg/kg-day	N/A	N/A	0.00004
	bis (2-Ethylhexyl) phthalate	1.1E-01	mg/kg	1.1E-01	mg/kg	M	2.0E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.001
	(Total)												2.5
										Total Hazard Index Across All Exposure Routes/Pathways			2.5

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 7.8.RME
RME CALCULATION OF NON-CANCER HAZARDS: INGESTION
OF CRABS FROM BACK RIVER FOR THE ADULT FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Crabs from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.4E+01	mg/kg	1.4E+01	mg/kg	M	2.4E-03	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.002
	Arsenic	3.4E+00	mg/kg	3.4E+00	mg/kg	M	5.8E-04	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	2
	Barium	4.7E-01	mg/kg	4.7E-01	mg/kg	M	8.1E-05	mg/kg-day	7.0E-02	mg/kg-day	N/A	N/A	0.001
	Calcium	2.2E+03	mg/kg	2.2E+03	mg/kg	M	3.8E-01	mg/kg-day	--	--	N/A	N/A	--
	Copper	8.6E+00	mg/kg	8.6E+00	mg/kg	M	1.5E-03	mg/kg-day	4.0E-02	mg/kg-day	N/A	N/A	0.04
	Iron	1.4E+01	mg/kg	1.4E+01	mg/kg	M	2.4E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.01
	Magnesium	5.4E+02	mg/kg	5.4E+02	mg/kg	M	9.3E-02	mg/kg-day	--	--	N/A	N/A	--
	Manganese (food)	1.6E+00	mg/kg	1.6E+00	mg/kg	M	2.7E-04	mg/kg-day	1.4E-01	mg/kg-day	N/A	N/A	0.002
	Nickel	4.9E-01	mg/kg	4.9E-01	mg/kg	M	8.4E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.004
	Potassium	2.8E+03	mg/kg	2.8E+03	mg/kg	M	4.9E-01	mg/kg-day	--	--	N/A	N/A	--
	Selenium	6.8E-01	mg/kg	6.8E-01	mg/kg	M	1.2E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	0.02
	Silver	7.3E-01	mg/kg	7.3E-01	mg/kg	M	1.3E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	0.03
	Sodium	3.6E+03	mg/kg	3.6E+03	mg/kg	M	6.2E-01	mg/kg-day	--	--	N/A	N/A	--
	Zinc	4.2E+01	mg/kg	4.2E+01	mg/kg	M	7.2E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.02
	ORGANICS												
	4,4'-DDD	2.9E-03	mg/kg	2.9E-03	mg/kg	M	4.9E-07	mg/kg-day	--	--	N/A	N/A	--
	4,4'-DDE	9.9E-03	mg/kg	9.9E-03	mg/kg	M	1.7E-06	mg/kg-day	--	--	N/A	N/A	--
	Heptachlor	7.6E-05	mg/kg	7.6E-05	mg/kg	M	1.3E-08	mg/kg-day	5.0E-04	mg/kg-day	N/A	N/A	0.00003
	Heptachlor epoxide	7.9E-04	mg/kg	7.9E-04	mg/kg	M	1.4E-07	mg/kg-day	1.3E-05	mg/kg-day	N/A	N/A	0.01
	PCB-1254	2.0E-02	mg/kg	2.0E-02	mg/kg	M	3.4E-06	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	0.2
	Phenol	1.3E-01	mg/kg	1.3E-01	mg/kg	M	2.3E-05	mg/kg-day	6.0E-01	mg/kg-day	N/A	N/A	0.00004
	bis (2-Ethylhexyl) phthalate	1.1E-01	mg/kg	1.1E-01	mg/kg	M	1.8E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.0009
	(Total)												2.2
												Total Hazard Index Across All Exposure Routes/Pathways	2.2

(1) *Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.*

TABLE 7.1.RME
RME CALCULATION OF NON-CANCER HAZARDS: INGESTION
OF BIVALVES FROM BACK RIVER FOR THE CHILD FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Bivalves from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	142	mg/kg	142	mg/kg	M	5.4E-02	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.05
	Arsenic	0.977	mg/kg	0.977	mg/kg	M	3.7E-04	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	1.24
	Cadmium	0.24	mg/kg	0.24	mg/kg	M	9.1E-05	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.09
	Chromium (Total)	6.84	mg/kg	6.84	mg/kg	M	2.6E-03	mg/kg-day	1.5E+00	mg/kg-day	N/A	N/A	0.0017
	Copper	18.5	mg/kg	18.5	mg/kg	M	7.0E-03	mg/kg-day	4.0E-02	mg/kg-day	N/A	N/A	0.18
	Iron	188	mg/kg	188	mg/kg	M	7.1E-02	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.24
	Manganese	14.3	mg/kg	14.3	mg/kg	M	5.4E-03	mg/kg-day	1.4E-01	mg/kg-day	N/A	N/A	0.04
	Mercury	0.0103	mg/kg	0.0103	mg/kg	M	3.9E-06	mg/kg-day	1.0E-04	mg/kg-day	N/A	N/A	0.04
	Selenium	0.589	mg/kg	0.589	mg/kg	M	2.2E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	0.04
	Silver	1.13	mg/kg	1.13	mg/kg	M	4.3E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	0.09
	Vanadium	0.411	mg/kg	0.411	mg/kg	M	1.6E-04	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.02
	Zinc	169	mg/kg	169	mg/kg	M	6.4E-02	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.21
	ORGANICS												
	Aldrin	0.000203	mg/kg	0.000203	mg/kg	M	7.7E-08	mg/kg-day	3.0E-05	mg/kg-day	N/A	N/A	0.0026
	Aroclor 5432	0.0255	mg/kg	0.0255	mg/kg	M	9.7E-06	mg/kg-day	--	--	N/A	N/A	--
	Benzo(a)anthracene	0.0222	mg/kg	0.0222	mg/kg	M	8.4E-06	mg/kg-day	--	--	N/A	N/A	--
	Benzo(a)pyrene	0.0242	mg/kg	0.0242	mg/kg	M	9.2E-06	mg/kg-day	--	--	N/A	N/A	--
	Benzo(b)fluoranthene	0.0256	mg/kg	0.0256	mg/kg	M	9.7E-06	mg/kg-day	--	--	N/A	N/A	--
	Heptachlor epoxide	0.000317	mg/kg	0.000317	mg/kg	M	1.2E-07	mg/kg-day	1.3E-05	mg/kg-day	N/A	N/A	0.01
	PCB 1254	0.0222	mg/kg	0.0222	mg/kg	M	8.4E-06	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	0.42
	PCB 1260	0.00326	mg/kg	0.00326	mg/kg	M	1.2E-06	mg/kg-day	--	--	N/A	N/A	--
	alpha-BHC	0.000296	mg/kg	0.000296	mg/kg	M	1.1E-07	mg/kg-day	--	--	N/A	N/A	--
	delta-BHC	0.000224	mg/kg	0.000224	mg/kg	M	8.5E-08	mg/kg-day	--	--	N/A	N/A	--
	(Total)												2.7
												Total Hazard Index Across All Exposure Routes/Pathways	2.7

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 7.2.RME
RME CALCULATION OF NON-CANCER HAZARDS: INGESTION
OF BIVALVES FROM BACK RIVER FOR THE ADULT FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Animal Tissue
Exposure Medium: Animal Tissue
Exposure Point: Bivalves from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	142	mg/kg	142	mg/kg	M	4.9E-02	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.05
	Arsenic	0.977	mg/kg	0.977	mg/kg	M	3.3E-04	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	1.12
	Cadmium	0.24	mg/kg	0.24	mg/kg	M	8.2E-05	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.08
	Chromium (Total)	6.84	mg/kg	6.84	mg/kg	M	2.3E-03	mg/kg-day	1.5E+00	mg/kg-day	N/A	N/A	0.0016
	Copper	18.5	mg/kg	18.5	mg/kg	M	6.3E-03	mg/kg-day	4.0E-02	mg/kg-day	N/A	N/A	0.16
	Iron	188	mg/kg	188	mg/kg	M	6.4E-02	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.21
	Manganese	14.3	mg/kg	14.3	mg/kg	M	4.9E-03	mg/kg-day	1.4E-01	mg/kg-day	N/A	N/A	0.03
	Mercury	0.0103	mg/kg	0.0103	mg/kg	M	3.5E-06	mg/kg-day	1.0E-04	mg/kg-day	N/A	N/A	0.04
	Selenium	0.589	mg/kg	0.589	mg/kg	M	2.0E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	0.04
	Silver	1.13	mg/kg	1.13	mg/kg	M	3.9E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	0.08
	Vanadium	0.411	mg/kg	0.411	mg/kg	M	1.4E-04	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.02
	Zinc	169	mg/kg	169	mg/kg	M	5.8E-02	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.19
	ORGANICS												
	Aldrin	0.000203	mg/kg	0.000203	mg/kg	M	7.0E-08	mg/kg-day	[illegible]E-05	mg/kg-day	N/A	N/A	0.0023
	Aroclor 5432	0.0255	mg/kg	0.0255	mg/kg	M	8.7E-06	mg/kg-day	--	--	N/A	N/A	--
	Benzo(a)anthracene	0.0222	mg/kg	0.0222	mg/kg	M	7.6E-06	mg/kg-day	--	--	N/A	N/A	--
	Benzo(a)pyrene	0.0242	mg/kg	0.0242	mg/kg	M	8.3E-06	mg/kg-day	--	--	N/A	N/A	--
	Benzo(b)fluoranthene	0.0256	mg/kg	0.0256	mg/kg	M	8.8E-06	mg/kg-day	--	--	N/A	N/A	--
	Heptachlor epoxide	0.000317	mg/kg	0.000317	mg/kg	M	1.1E-07	mg/kg-day	1.3E-05	mg/kg-day	N/A	N/A	0.01
	PCB 1254	0.0222	mg/kg	0.0222	mg/kg	M	7.6E-06	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	0.38
	PCB 1260	0.00326	mg/kg	0.00326	mg/kg	M	1.1E-06	mg/kg-day	--	--	N/A	N/A	--
	alpha-BHC	0.000296	mg/kg	0.000296	mg/kg	M	1.0E-07	mg/kg-day	--	--	N/A	N/A	--
	delta-BHC	0.000224	mg/kg	0.000224	mg/kg	M	7.7E-08	mg/kg-day	--	--	N/A	N/A	--
	(Total)												2.4
												Total Hazard Index Across All Exposure Routes/Pathways	2.4

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Appendix A.8

RAGS Part D Table 8's
Calculation of Cancer Risks
Resonable Maximum

TABLE 8.1.RME
RME CALCULATION OF CANCER RISKS: DERMAL ABSORPTION
OF SURFACE WATER FROM BACK RIVER FOR THE CHILD FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	**INORGANICS**										
Absorption	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	1.3E-10	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	2.1E-10
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	3.8E-05	mg/kg-day	--	--	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	3.8E-12	mg/kg-day	--	--	--
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	3.1E-04	mg/kg-day	--	--	--
	ORGANICS										
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	1.4E-09	mg/kg-day	3.4E-01	mg/kg-day $^{-1}$	4.7E-10
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	6.8E-10	mg/kg-day	4.9E-01	mg/kg-day $^{-1}$	3.3E-10
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	3.5E-11	mg/kg-day	1.9E+01	mg/kg-day $^{-1}$	6.7E-10
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	6.8E-11	mg/kg-day	5.0E+00	mg/kg-day $^{-1}$	3.4E-10
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	2.4E-10	mg/kg-day	1.0E+01	mg/kg-day $^{-1}$	2.4E-09
	(Total)										4E-09
										Total Risk Across All Exposure Routes/Pathways	4E-09

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 8.2.RME
RME CALCULATION OF CANCER RISKS: DERMAL ABSORPTION
OF SURFACE WATER FROM BACK RIVER FOR THE ADULT FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: *Surface Water*
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal Absorption	**INORGANICS**										
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	3.2E-10	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	5.0E-10
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	9.1E-05	mg/kg-day	--	--	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	9.1E-12	mg/kg-day	--	--	--
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	7.4E-04	mg/kg-day	--	--	--
	ORGANICS										
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	3.3E-09	mg/kg-day	3.4E-01	mg/kg-day $^{-1}$	1.1E-09
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	1.6E-09	mg/kg-day	4.9E-01	mg/kg-day $^{-1}$	7.9E-10
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	8.5E-11	mg/kg-day	1.9E+01	mg/kg-day $^{-1}$	1.6E-09
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	1.6E-10	mg/kg-day	5.0E+00	mg/kg-day $^{-1}$	8.2E-10
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	5.7E-10	mg/kg-day	1.0E+01	mg/kg-day $^{-1}$	5.7E-09
	(Total)										1E-08
										Total Risk Across All Exposure Routes/Pathways	1E-08

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 8.3.RME

RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION

OF SURFACE WATER FROM BACK RIVER FOR THE OTHER RECREATIONAL PERSON [ADOLESCENTS (TEENS)]

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Other Recreational Person[2]
Receptor Age: Adolescents (teens)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	**INORGANICS**										
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	3.9E-08	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	5.9E-08
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	1.1E-02	mg/kg-day	--	--	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	1.1E-09	mg/kg-day	--	--	--
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	9.2E-02	mg/kg-day	--	--	--
	ORGANICS										
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	9.3E-11	mg/kg-day	2.4E-01	mg/kg-day $^{-1}$	2.2E-11
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	5.5E-11	mg/kg-day	3.4E-01	mg/kg-day $^{-1}$	1.9E-11
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	3.1E-10	mg/kg-day	1.7E+01	mg/kg-day $^{-1}$	5.2E-09
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	8.1E-11	mg/kg-day	4.5E+00	mg/kg-day $^{-1}$	3.6E-10
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	5.1E-11	mg/kg-day	9.1E+00	mg/kg-day $^{-1}$	4.6E-10
	(Total)										6.5E-08
Dermal Absorption	**INORGANICS**										
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	1.2E-08	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	1.9E-08
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	3.6E-03	mg/kg-day	--	--	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	3.6E-10	mg/kg-day	--	--	--
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	2.9E-02	mg/kg-day	--	--	--
	ORGANICS										
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	3.2E-08	mg/kg-day	3.4E-01	mg/kg-day $^{-1}$	1.1E-08
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	1.6E-08	mg/kg-day	4.9E-01	mg/kg-day $^{-1}$	7.7E-09
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	8.3E-10	mg/kg-day	1.9E+01	mg/kg-day $^{-1}$	1.6E-08
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	1.6E-09	mg/kg-day	5.0E+00	mg/kg-day $^{-1}$	8.0E-09
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	5.6E-09	mg/kg-day	1.0E+01	mg/kg-day $^{-1}$	5.6E-08
	(Total)										1E-07
										Total Risk Across All Exposure Routes/Pathways	2E-07

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

(2) Jet Skier

TABLE 8.4.RME
RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SURFACE WATER FROM BACK RIVER FOR OTHER WORKER (ADULT)
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water from Back River
Receptor Population: Other Worker[2]
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	**INORGANICS**										
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	3.3E-08	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	5.0E-08
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	9.6E-03	mg/kg-day	--	--	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	9.5E-10	mg/kg-day	--	--	--
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	7.8E-02	mg/kg-day	--	--	--
	ORGANICS										
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	7.9E-11	mg/kg-day	2.4E-01	mg/kg-day $^{-1}$	1.9E-11
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	4.7E-11	mg/kg-day	3.4E-01	mg/kg-day $^{-1}$	1.6E-11
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	2.6E-10	mg/kg-day	1.7E+01	mg/kg-day $^{-1}$	4.4E-09
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	6.8E-11	mg/kg-day	4.5E+00	mg/kg-day $^{-1}$	3.1E-10
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	4.3E-11	mg/kg-day	9.1E+00	mg/kg-day $^{-1}$	3.9E-10
	(Total)										5.5E-08
Dermal Absorption	**INORGANICS**										
	Arsenic	2.4E-03	mg/l	2.4E-03	mg/l	M	1.3E-08	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	2.1E-08
	Magnesium	6.8E+02	mg/l	6.8E+02	mg/l	M	3.8E-03	mg/kg-day	--	--	--
	Methylmercury	6.8E-05	mg/l	6.8E-05	mg/l	M	3.8E-10	mg/kg-day	--	--	--
	Sodium	5.6E+03	mg/l	5.6E+03	mg/l	M	3.1E-02	mg/kg-day	--	--	--
	ORGANICS										
	4,4'-DDD	5.7E-06	mg/l	5.7E-06	mg/l	M	3.4E-08	mg/kg-day	3.4E-01	mg/kg-day $^{-1}$	1.2E-08
	4,4'-DDE	3.4E-06	mg/l	3.4E-06	mg/l	M	1.7E-08	mg/kg-day	4.9E-01	mg/kg-day $^{-1}$	8.3E-09
	Aldrin	1.9E-05	mg/l	1.9E-05	mg/l	M	8.9E-10	mg/kg-day	1.9E+01	mg/kg-day $^{-1}$	1.7E-08
	Heptachlor	4.9E-06	mg/l	4.9E-06	mg/l	M	1.7E-09	mg/kg-day	5.0E+00	mg/kg-day $^{-1}$	8.6E-09
	Heptachlor epoxide	3.1E-06	mg/l	3.1E-06	mg/l	M	6.0E-09	mg/kg-day	1.0E+01	mg/kg-day $^{-1}$	6.0E-08
	(Total)										1E-07
										Total Risk Across All Exposure Routes/Pathways	2E-07

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
(2) Sea Rescue Trainer

TABLE 8.5.RME
RME CALCULATION OF CANCER RISKS: INGESTION
OF FISH FROM BACK RIVER FOR THE CHILD FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Animal Tissue
Exposure Point: Fish from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	**INORGANICS**										
	Arsenic	1.9E+00	mg/kg	1.9E+00	mg/kg	M	3.6E-05	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	5.4E-05
	Calcium	1.3E+03	mg/kg	1.3E+03	mg/kg	M	2.5E-02	mg/kg-day	--	--	--
	Magnesium	3.5E+02	mg/kg	3.5E+02	mg/kg	M	6.6E-03	mg/kg-day	--	--	--
	Methylmercury	6.0E-02	mg/kg	6.0E-02	mg/kg	M	1.1E-06	mg/kg-day	--	--	--
	Potassium	3.8E+03	mg/kg	3.8E+03	mg/kg	M	7.3E-02	mg/kg-day	--	--	--
	Selenium	9.1E-01	mg/kg	9.1E-01	mg/kg	M	1.7E-05	mg/kg-day	--	--	--
	Sodium	6.4E+02	mg/kg	6.4E+02	mg/kg	M	1.2E-02	mg/kg-day	--	--	--
	ORGANICS										
	4,4'-DDD	2.8E-02	mg/kg	2.8E-02	mg/kg	M	5.4E-07	mg/kg-day	2.4E-01	mg/kg-day $^{-1}$	1.3E-07
	4,4'-DDE	2.5E-02	mg/kg	2.5E-02	mg/kg	M	4.8E-07	mg/kg-day	3.4E-01	mg/kg-day $^{-1}$	1.6E-07
	Aroclor 5432	3.8E-01	mg/kg	3.8E-01	mg/kg	M	7.2E-06	mg/kg-day	4.5E+00	mg/kg-day $^{-1}$	3.2E-05
	PCB-1248	4.5E-02	mg/kg	4.5E-02	mg/kg	M	8.5E-07	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	1.7E-06
	PCB-1254	2.2E-01	mg/kg	2.2E-01	mg/kg	M	4.2E-06	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	8.3E-06
	PCB-1260	5.7E-02	mg/kg	5.7E-02	mg/kg	M	1.1E-06	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	2.2E-06
	(Total)										1E-04
										Total Risk Across All Exposure Routes/Pathways	1E-04

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 8.6.RME
RME CALCULATION OF CANCER RISKS: INGESTION
OF FISH FROM BACK RIVER FOR THE ADULT FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Animal Tissue
Exposure Point: Fish from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	**INORGANICS**										
	Arsenic	1.9E+00	mg/kg	1.9E+00	mg/kg	M	1.4E-04	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	2.1E-04
	Calcium	1.3E+03	mg/kg	1.3E+03	mg/kg	M	9.7E-02	mg/kg-day	--	--	--
	Magnesium	3.5E+02	mg/kg	3.5E+02	mg/kg	M	2.6E-02	mg/kg-day	--	--	--
	Methylmercury	6.0E-02	mg/kg	6.0E-02	mg/kg	M	4.4E-06	mg/kg-day	--	--	--
	Potassium	3.8E+03	mg/kg	3.8E+03	mg/kg	M	2.8E-01	mg/kg-day	--	--	--
	Selenium	9.1E-01	mg/kg	9.1E-01	mg/kg	M	6.6E-05	mg/kg-day	--	--	--
	Sodium	6.4E+02	mg/kg	6.4E+02	mg/kg	M	4.7E-02	mg/kg-day	--	--	--
	ORGANICS										
	4,4'-DDD	2.8E-02	mg/kg	2.8E-02	mg/kg	M	2.1E-06	mg/kg-day	2.4E-01	mg/kg-day $^{-1}$	5.0E-07
	4,4'-DDE	2.5E-02	mg/kg	2.5E-02	mg/kg	M	1.9E-06	mg/kg-day	3.4E-01	mg/kg-day $^{-1}$	6.3E-07
	Aroclor 5432	3.8E-01	mg/kg	3.8E-01	mg/kg	M	2.8E-05	mg/kg-day	4.5E+00	mg/kg-day $^{-1}$	1.3E-04
	PCB-1248	4.5E-02	mg/kg	4.5E-02	mg/kg	M	3.3E-06	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	6.5E-06
	PCB-1254	2.2E-01	mg/kg	2.2E-01	mg/kg	M	1.6E-05	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	3.2E-05
	PCB-1260	5.7E-02	mg/kg	5.7E-02	mg/kg	M	4.2E-06	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	8.4E-06
	(Total)										4E-04
										Total Risk Across All Exposure Routes/Pathways	4E-04

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 8.7.RME
RME CALCULATION OF CANCER RISKS: INGESTION
OF CRABS FROM BACK RIVER FOR THE CHILD FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Animal Tissue
Exposure Point: Crabs from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	**INORGANICS**										
	Aluminum	1.4E+01	mg/kg	1.4E+01	mg/kg	M	2.7E-04	mg/kg-day	--	--	--
	Arsenic	3.4E+00	mg/kg	3.4E+00	mg/kg	M	6.4E-05	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	9.6E-05
	Barium	4.7E-01	mg/kg	4.7E-01	mg/kg	M	8.9E-06	mg/kg-day	--	--	--
	Calcium	2.2E+03	mg/kg	2.2E+03	mg/kg	M	4.2E-02	mg/kg-day	--	--	--
	Copper	8.6E+00	mg/kg	8.6E+00	mg/kg	M	1.6E-04	mg/kg-day	--	--	--
	Iron	1.4E+01	mg/kg	1.4E+01	mg/kg	M	2.7E-04	mg/kg-day	--	--	--
	Magnesium	5.4E+02	mg/kg	5.4E+02	mg/kg	M	1.0E-02	mg/kg-day	--	--	--
	Manganese (food)	1.6E+00	mg/kg	1.6E+00	mg/kg	M	3.0E-05	mg/kg-day	--	--	--
	Nickel	4.9E-01	mg/kg	4.9E-01	mg/kg	M	9.3E-06	mg/kg-day	--	--	--
	Potassium	2.8E+03	mg/kg	2.8E+03	mg/kg	M	5.4E-02	mg/kg-day	--	--	--
	Selenium	6.8E-01	mg/kg	6.8E-01	mg/kg	M	1.3E-05	mg/kg-day	--	--	--
	Silver	7.3E-01	mg/kg	7.3E-01	mg/kg	M	1.4E-05	mg/kg-day	--	--	--
	Sodium	3.6E+03	mg/kg	3.6E+03	mg/kg	M	6.9E-02	mg/kg-day	--	--	--
	Zinc	4.2E+01	mg/kg	4.2E+01	mg/kg	M	8.0E-04	mg/kg-day	--	--	--
	ORGANICS										
	4,4'-DDD	2.9E-03	mg/kg	2.9E-03	mg/kg	M	5.5E-08	mg/kg-day	2.4E-01	mg/kg-day $^{-1}$	1.3E-08
	4,4'-DDE	9.9E-03	mg/kg	9.9E-03	mg/kg	M	1.9E-07	mg/kg-day	3.4E-01	mg/kg-day $^{-1}$	6.4E-08
	Heptachlor	7.6E-05	mg/kg	7.6E-05	mg/kg	M	1.4E-09	mg/kg-day	4.5E+00	mg/kg-day $^{-1}$	6.5E-09
	Heptachlor epoxide	7.9E-04	mg/kg	7.9E-04	mg/kg	M	1.5E-08	mg/kg-day	9.1E+00	mg/kg-day $^{-1}$	1.4E-07
	PCB-1254	2.0E-02	mg/kg	2.0E-02	mg/kg	M	3.7E-07	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	7.4E-07
	Phenol	1.3E-01	mg/kg	1.3E-01	mg/kg	M	2.5E-06	mg/kg-day	--	--	--
	bis (2-Ethylhexyl) phthalate	1.1E-01	mg/kg	1.1E-01	mg/kg	M	2.0E-06	mg/kg-day	1.4E-02	mg/kg-day $^{-1}$	2.8E-08
	(Total)										1E-04
										Total Risk Across All Exposure Routes/Pathways	1E-04

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 8.8.RME
RME CALCULATION OF CANCER RISKS: INGESTION
OF CRABS FROM BACK RIVER FOR THE ADULT FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Animal Tissue
Exposure Point: Crabs from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	**INORGANICS**										
	Aluminum	1.4E+01	mg/kg	1.4E+01	mg/kg	M	1.0E-03	mg/kg-day	--	--	--
	Arsenic	3.4E+00	mg/kg	3.4E+00	mg/kg	M	2.5E-04	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	3.7E-04
	Barium	4.7E-01	mg/kg	4.7E-01	mg/kg	M	3.5E-05	mg/kg-day	--	--	--
	Calcium	2.2E+03	mg/kg	2.2E+03	mg/kg	M	1.6E-01	mg/kg-day	--	--	--
	Copper	8.6E+00	mg/kg	8.6E+00	mg/kg	M	6.3E-04	mg/kg-day	--	--	--
	Iron	1.4E+01	mg/kg	1.4E+01	mg/kg	M	1.0E-03	mg/kg-day	--	--	--
	Magnesium	5.4E+02	mg/kg	5.4E+02	mg/kg	M	4.0E-02	mg/kg-day	--	--	--
	Manganese (food)	1.6E+00	mg/kg	1.6E+00	mg/kg	M	1.2E-04	mg/kg-day	--	--	--
	Nickel	4.9E-01	mg/kg	4.9E-01	mg/kg	M	3.6E-05	mg/kg-day	--	--	--
	Potassium	2.8E+03	mg/kg	2.8E+03	mg/kg	M	2.1E-01	mg/kg-day	--	--	--
	Selenium	6.8E-01	mg/kg	6.8E-01	mg/kg	M	5.0E-05	mg/kg-day	--	--	--
	Silver	7.3E-01	mg/kg	7.3E-01	mg/kg	M	5.4E-05	mg/kg-day	--	--	--
	Sodium	3.6E+03	mg/kg	3.6E+03	mg/kg	M	2.7E-01	mg/kg-day	--	--	--
	Zinc	4.2E+01	mg/kg	4.2E+01	mg/kg	M	3.1E-03	mg/kg-day	--	--	--
	ORGANICS										
	4,4'-DDD	2.9E-03	mg/kg	2.9E-03	mg/kg	M	2.1E-07	mg/kg-day	2.4E-01	mg/kg-day $^{-1}$	5.1E-08
	4,4'-DDE	9.9E-03	mg/kg	9.9E-03	mg/kg	M	7.3E-07	mg/kg-day	3.4E-01	mg/kg-day $^{-1}$	2.5E-07
	Heptachlor	7.6E-05	mg/kg	7.6E-05	mg/kg	M	5.6E-09	mg/kg-day	4.5E+00	mg/kg-day $^{-1}$	2.5E-08
	Heptachlor epoxide	7.9E-04	mg/kg	7.9E-04	mg/kg	M	5.8E-08	mg/kg-day	9.1E+00	mg/kg-day $^{-1}$	5.3E-07
	PCB-1254	2.0E-02	mg/kg	2.0E-02	mg/kg	M	1.4E-06	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	2.9E-06
	Phenol	1.3E-01	mg/kg	1.3E-01	mg/kg	M	9.8E-06	mg/kg-day	--	--	--
	bis (2-Ethylhexyl) phthalate	1.1E-01	mg/kg	1.1E-01	mg/kg	M	7.8E-06	mg/kg-day	1.4E-02	mg/kg-day $^{-1}$	1.1E-07
	(Total)										4E-04
										Total Risk Across All Exposure Routes/Pathways	4E-04

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 8.1.RME
RME CALCULATION OF CANCER RISKS: INGESTION
OF BIVALVES FROM BACK RIVER FOR THE CHILD FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Animal Tissue
Exposure Point: Bivalves from Back River
Receptor Population: Fisher
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	**INORGANICS**										
	Aluminum	142	mg/kg	142	mg/kg	M	5.4E-03	mg/kg-day	--	--	--
	Arsenic	0.977	mg/kg	0.977	mg/kg	M	3.7E-05	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	5.6E-05
	Cadmium	0.24	mg/kg	0.24	mg/kg	M	9.1E-06	mg/kg-day	--	--	--
	Chromium (Total)	6.84	mg/kg	6.84	mg/kg	M	2.6E-04	mg/kg-day	--	--	--
	Copper	18.5	mg/kg	18.5	mg/kg	M	7.0E-04	mg/kg-day	--	--	--
	Iron	188	mg/kg	188	mg/kg	M	7.1E-03	mg/kg-day	--	--	--
	Manganese	14.3	mg/kg	14.3	mg/kg	M	5.4E-04	mg/kg-day	--	--	--
	Mercury	0.0103	mg/kg	0.0103	mg/kg	M	3.9E-07	mg/kg-day	--	--	--
	Selenium	0.589	mg/kg	0.589	mg/kg	M	2.2E-05	mg/kg-day	--	--	--
	Silver	1.13	mg/kg	1.13	mg/kg	M	4.3E-05	mg/kg-day	--	--	--
	Vanadium	0.411	mg/kg	0.411	mg/kg	M	1.6E-05	mg/kg-day	--	--	--
	Zinc	169	mg/kg	169	mg/kg	M	6.4E-03	mg/kg-day	--	--	--
	ORGANICS										
	Aldrin	0.000203	mg/kg	0.000203	mg/kg	M	7.7E-09	mg/kg-day	1.7E+01	mg/kg-day $^{-1}$	1.3E-07
	Aroclor 5432	0.0255	mg/kg	0.0255	mg/kg	M	9.7E-07	mg/kg-day	4.5E+00	mg/kg-day $^{-1}$	4.4E-06
	Benzo(a)anthracene	0.0222	mg/kg	0.0222	mg/kg	M	8.4E-07	mg/kg-day	7.3E-01	mg/kg-day $^{-1}$	6.2E-07
	Benzo(a)pyrene	0.0242	mg/kg	0.0242	mg/kg	M	9.2E-07	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	6.7E-06
	Benzo(b)fluoranthene	0.0256	mg/kg	0.0256	mg/kg	M	9.7E-07	mg/kg-day	7.3E-01	mg/kg-day $^{-1}$	7.1E-07
	Heptachlor epoxide	0.000317	mg/kg	0.000317	mg/kg	M	1.2E-08	mg/kg-day	9.1E+00	mg/kg-day $^{-1}$	1.1E-07
	PCB 1254	0.0222	mg/kg	0.0222	mg/kg	M	8.4E-07	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	1.7E-06
	PCB 1260	0.00326	mg/kg	0.00326	mg/kg	M	1.2E-07	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	2.5E-07
	alpha-BHC	0.000296	mg/kg	0.000296	mg/kg	M	1.1E-08	mg/kg-day	6.3E+00	mg/kg-day $^{-1}$	7.1E-08
	delta-BHC	0.000224	mg/kg	0.000224	mg/kg	M	8.5E-09	mg/kg-day	1.8E+00	mg/kg-day $^{-1}$	1.5E-08
	(Total)										7.0E-05
										Total Risk Across All Exposure Routes/Pathways	7.0E-05

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 8.2.RME
RME CALCULATION OF CANCER RISKS: INGESTION
OF BIVALVES FROM BACK RIVER FOR THE ADULT FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Animal Tissue
Exposure Point: Bivalves from Back River
Receptor Population: Fisher
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	**INORGANICS**										
	Aluminum	142	mg/kg	142	mg/kg	M	2.1E-02	mg/kg-day	--	--	--
	Arsenic	0.977	mg/kg	0.977	mg/kg	M	1.4E-04	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	2.2E-04
	Cadmium	0.24	mg/kg	0.24	mg/kg	M	3.5E-05	mg/kg-day	--	--	--
	Chromium (Total)	6.84	mg/kg	6.84	mg/kg	M	1.0E-03	mg/kg-day	--	--	--
	Copper	18.5	mg/kg	18.5	mg/kg	M	2.7E-03	mg/kg-day	--	--	--
	Iron	188	mg/kg	188	mg/kg	M	2.8E-02	mg/kg-day	--	--	--
	Manganese	14.3	mg/kg	14.3	mg/kg	M	2.1E-03	mg/kg-day	--	--	--
	Mercury	0.0103	mg/kg	0.0103	mg/kg	M	1.5E-06	mg/kg-day	--	--	--
	Selenium	0.589	mg/kg	0.589	mg/kg	M	8.6E-05	mg/kg-day	--	--	--
	Silver	1.13	mg/kg	1.13	mg/kg	M	1.7E-04	mg/kg-day	--	--	--
	Vanadium	0.411	mg/kg	0.411	mg/kg	M	6.0E-05	mg/kg-day	--	--	--
	Zinc	169	mg/kg	169	mg/kg	M	2.5E-02	mg/kg-day	--	--	--
	ORGANICS										
	Aldrin	0.000203	mg/kg	0.000203	mg/kg	M	3.0E-08	mg/kg-day	1.7E+01	mg/kg-day $^{-1}$	5.1E-07
	Aroclor 5432	0.0255	mg/kg	0.0255	mg/kg	M	3.7E-06	mg/kg-day	4.5E+00	mg/kg-day $^{-1}$	1.7E-05
	Benzo(a)anthracene	0.0222	mg/kg	0.0222	mg/kg	M	3.3E-06	mg/kg-day	7.3E-01	mg/kg-day $^{-1}$	2.4E-06
	Benzo(a)pyrene	0.0242	mg/kg	0.0242	mg/kg	M	3.6E-06	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	2.6E-05
	Benzo(b)fluoranthene	0.0256	mg/kg	0.0256	mg/kg	M	3.8E-06	mg/kg-day	7.3E-01	mg/kg-day $^{-1}$	2.7E-06
	Heptachlor epoxide	0.000317	mg/kg	0.000317	mg/kg	M	4.7E-08	mg/kg-day	9.1E+00	mg/kg-day $^{-1}$	4.2E-07
	PCB 1254	0.0222	mg/kg	0.0222	mg/kg	M	3.3E-06	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	6.5E-06
	PCB 1260	0.00326	mg/kg	0.00326	mg/kg	M	4.8E-07	mg/kg-day	2.0E+00	mg/kg-day $^{-1}$	9.6E-07
	alpha-BHC	0.000296	mg/kg	0.000296	mg/kg	M	4.3E-08	mg/kg-day	6.3E+00	mg/kg-day $^{-1}$	2.7E-07
	delta-BHC	0.000224	mg/kg	0.000224	mg/kg	M	3.3E-08	mg/kg-day	1.8E+00	mg/kg-day $^{-1}$	5.9E-08
	(Total)										2.7E-04
										Total Risk Across All Exposure Routes/Pathways	2.7E-04

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Appendix A.9

RAGS Part D Table 9's
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure

TABLE 9.1.RME

RME SUMMARY OF SITE CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	**INORGANICS**					**INORGANICS**					
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	--	--	0.0000004	0.0000004
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					**ORGANICS**					
			4,4'-DDD	--	--	4.7E-10	5E-10	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	--	--	3.3E-10	3E-10	4,4'-DDE	--	--	--	--	--
			Aldrin	--	--	6.7E-10	7E-10	Aldrin	liver	--	--	0.0000131	0.0000131
			Heptachlor	--	--	3.4E-10	3E-10	Heptachlor	liver	--	--	0.0000015	0.0000015
			Heptachlor epoxide	--	--	2.4E-09	2E-09	Heptachlor epoxide	liver	--	--	0.000203	0.000203
			(Total)	--	--	4E-09	4E-09	(Total)		--	--	0.00022	0.00022
Animal Tissue	Animal Tissue	Fish from Back River	**INORGANICS**					**INORGANICS**					
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.11	--	--	0.11
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.03	--	--	0.03
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					**ORGANICS**					
			4,4'-DDD	1.3E-07	--	--	1E-07	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	1.6E-07	--	--	2E-07	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	3.2E-05	--	--	3E-05	Aroclor 5432	--	--	--	--	--
			PCB-1248	1.7E-06	--	--	2E-06	PCB-1248	--	--	--	--	--
			PCB-1254	8.3E-06	--	--	8E-06	PCB-1254	Immune system/eye/nails	2	--	--	2
			PCB-1260	2.2E-06	--	--	2E-06	PCB-1260	--	--	--	--	--
			(Total)	4E-05	--	--	4E-05	(Total)		2.2	--	--	2.2
		Crabs from Back River	**INORGANICS**					**INORGANICS**					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.003	--	--	0.003
			Barium	--	--	--	--	Barium	kidney	0.001	--	--	0.001
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Copper	--	--	--	--	Copper	GI tract	0.04	--	--	0.04
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.009	--	--	0.009
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Manganese (food)	--	--	--	--	Manganese (food)	CNS	0.002	--	--	0.002
			Nickel	--	--	--	--	Nickel	heart/liver	0.00	--	--	0.00
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.03	--	--	0.03
			Silver	--	--	--	--	Silver	skin	0.03	--	--	0.03

TABLE 9.1.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Manganese (food)	--	--	--	--	Manganese (food)	CNS	0.002	--	--	0.002
			Nickel	--	--	--	--	Nickel	heart/liver	0.005	--	--	0.005
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.03	--	--	0.03
			Silver	--	--	--	--	Silver	skin	0.03	--	--	0.03
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			Zinc	--	--	--	--	Zinc	blood	0.03	--	--	0.03
			ORGANICS					ORGANICS					
			4,4'-DDD	1E-08	--	--	1E-08	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	6E-08	--	--	6E-08	4,4'-DDE	--	--	--	--	--
			Heptachlor	6E-09	--	--	6E-09	Heptachlor	liver	0.00003	--	--	0.00003
			Heptachlor epoxide	1E-07	--	--	1E-07	Heptachlor epoxide	liver	0.01	--	--	0.01
			PCB-1254	7E-07	--	--	7E-07	PCB-1254	Immune system/eye/nails	0.2	--	--	0.2
			Phenol	--	--	--	--	Phenol	fetus	0.00004	--	--	0.00004
			bis (2-Ethylhexyl) phthalate	3E-08	--	--	3E-08	bis (2-Ethylhexyl) phthalate	liver	0.001	--	--	0.001
			(Total)	1E-04	--	--	1E-04	(Total)		2.5	--	--	2.5

Total Risk Across Surface Water	4E-09
Total Risk Across Animal Tissue	2E-04
Total Risk Across All Media and All Exposure Routes	2E-04

Total Hazard Index Across Surface Water	0.00022
Total Hazard Index Across Animal Tissue	6
Total Hazard Index Across All Media and All Exposure Routes	6

Total blood HI =	0.04
Total CNS HI =	0.063
Total Dev. NS HI =	0.118
Total eye HI =	2
Total fetus HI =	0.00004
Total GI tract HI =	0.05
Total hair HI =	0.06
Total heart HI =	0.005
Total immune system HI =	2
Total kidney HI =	0.001
Total liver HI =	0.09
Total nails HI =	2
Total skin HI =	3.4
Total vascular HI =	3.3

TABLE 9.2.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	INORGANICS					INORGANICS					
			Arsenic	--	--	5.0E-10	5E-10	Arsenic	skin/vascular	--	--	0.000003	0.000003
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	--	--	0.0000002	0.0000002
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	--	--	1.1E-09	1E-09	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	--	--	7.9E-10	8E-10	4,4'-DDE	--	--	--	--	--
			Aldrin	--	--	1.6E-09	2E-09	Aldrin	liver	--	--	0.000007	0.000007
			Heptachlor	--	--	8.2E-10	8E-10	Heptachlor	liver	--	--	0.000001	0.000001
			Heptachlor epoxide	--	--	5.7E-09	6E-09	Heptachlor epoxide	liver	--	--	0.0001	0.0001
			(Total)	--	--	1E-08	1E-08	(Total)		--	--	0.0001	0.0001
Animal Tissue	Animal Tissue	Fish from Back River	INORGANICS					INORGANICS					
			Arsenic	2.1E-04	--	--	2E-04	Arsenic	skin/vascular	1	--	--	1
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.1	--	--	0.1
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.03	--	--	0.03
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	5.0E-07	--	--	5E-07	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	6.3E-07	--	--	6E-07	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	1.3E-04	--	--	1E-04	Aroclor 5432	--	--	--	--	--
			PCB-1248	6.5E-06	--	--	7E-06	PCB-1248	--	--	--	--	--
			PCB-1254	3.2E-05	--	--	3E-05	PCB-1254	Immune system/eye/nails	2	--	--	2
			PCB-1260	8.4E-06	--	--	8E-06	PCB-1260	--	--	--	--	--
			(Total)	4E-04	--	--	4E-04	(Total)		3.1	--	--	3.1
		Crabs from Back River	INORGANICS					INORGANICS					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.002	--	--	0.002
			Arsenic	4E-04	--	--	4E-04	Arsenic	skin/vascular	2	--	--	2
			Barium	--	--	--	--	Barium	kidney	0.001	--	--	0.001
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Copper	--	--	--	--	Copper	GI tract	0.037	--	--	0.04
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.008	--	--	0.008

TABLE 9.2 RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Manganese (food)	--	--	--	--	Manganese (food)	CNS	0.002	--	--	0.002
			Nickel	--	--	--	--	Nickel	heart/liver	0.004	--	--	0.004
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.023	--	--	0.02
			Silver	--	--	--	--	Silver	skin	0.025	--	--	0.03
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			Zinc	--	--	--	--	Zinc	blood	0.024	--	--	0.02
			ORGANICS					ORGANICS					
			4,4'-DDD	5E-08	--	--	5E-08	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	2E-07	--	--	2E-07	4,4'-DDE	--	--	--	--	--
			Heptachlor	2E-08	--	--	2E-08	Heptachlor	liver	0.00003	--	--	0.00003
			Heptachlor epoxide	5E-07	--	--	5E-07	*Heptachlor epoxide*	*liver*	*0.010*	--	--	*0.01*
			PCB-1254	3E-06	--	--	3E-06	PCB-1254	Immune system/eye/nails	0.168	--	--	0.2
			Phenol	--	--	--	--	Phenol	fetus	0.00004	--	--	0.00004
			bis (2-Ethylhexyl) phthalate	1E-07	--	--	1E-07	bis (2-Ethylhexyl) phthalate	liver	0.0009	--	--	0.0009
			(Total)	4E-04	--	--	4E-04	(Total)		2.2	--	--	2.2

Total Risk Across Surface Water	1E-08	Total Hazard Index Across Surface Water	0.000124
Total Risk Across Animal Tissue	8E-04	Total Hazard Index Across Animal Tissue	5
Total Risk Across All Media and All Exposure Routes	8E-04	Total Hazard Index Across All Media and All Exposure Routes	5

Total blood HI =	0.03
Total CNS HI =	0.056
Total Dev. NS HI =	0.105
Total eye HI =	2
Total fetus HI =	0.00004
Total GI tract HI =	0.04
Total hair HI =	0.054
Total heart HI =	0.004
Total immune system HI =	2
Total kidney HI =	0.001
Total liver HI =	0.08
Total nails HI =	2
Total skin HI =	3
Total vascular HI =	3

TABLE 9.3.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: OTHER RECREATIONAL PERSON [ADOLESCENTS (TEENS)]

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Other Recreational Person'
Receptor Age: Adolescents (teens)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	INORGANICS					INORGANICS					
			Arsenic	5.9E-08	--	1.9E-08	8E-08	Arsenic	skin/vascular	0.0015	--	0.0005	0.002
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.00013	--	0.000046	0.0002
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	2.2E-11	--	1.1E-08	1E-08	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	1.9E-11	--	7.7E-09	8E-09	4,4'-DDE	--	--	--	--	--
			Aldrin	5.2E-09	--	1.6E-08	2E-08	Aldrin	liver	0.00012	--	0.00036	0.0005
			Heptachlor	3.6E-10	--	8.0E-09	8E-09	Heptachlor	liver	0.0000019	--	0.00004	0.0000
			Heptachlor epoxide	4.6E-10	--	5.6E-08	6E-08	Heptachlor epoxide	liver	0.00005	--	0.006	0.006
			(Total)	6E-08	--	1E-07	2E-07	(Total)		0.002	--	0.006	0.008
						Total Risk Across Surface Water	2E-07					Total Hazard Index Across Surface Water	0.008

Total Risk Across All Media and All Exposure Routes: 2E-07

Total Hazard Index Across All Media and All Exposure Routes: 0.008

(1) Jet Skier

Total Dev. NS HI = 0.0002
Total liver HI = 0.006
Total skin HI = 0.002
Total vascular HI = 0.002

TABLE 9.4.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: OTHER WORKER (ADULT)

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Other Worker'
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	INORGANICS					INORGANICS					
			Arsenic	5.0E-08	--	2.1E-08	7E-08	Arsenic	skin/vascular	0.0003	--	0.0001	0.0004
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.000027	--	0.000012	0.00004
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	1.9E-11	--	1.2E-08	1E-08	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	1.6E-11	--	8.3E-09	8E-09	4,4'-DDE	--	--	--	--	--
			Aldrin	4.4E-09	--	1.7E-08	2E-08	Aldrin	liver	0.00002	--	0.00009	0.0001
			Heptachlor	3.1E-10	--	8.6E-09	9E-09	Heptachlor	liver	0.0000004	--	0.00001	0.00001
			Heptachlor epoxide	3.9E-10	--	6.0E-08	6E-08	Heptachlor epoxide	liver	0.000009	--	0.0014	0.001
			(Total)	5E-08	--	1E-07	2E-07	(Total)		0.0004	--	0.0017	0.002
						Total Risk Across Surface Water	2E-07					Total Hazard Index Across Surface Water	0.002

Total Risk Across All Media and All Exposure Routes: 2E-07

Total Hazard Index Across All Media and All Exposure Routes: 0.002

(1) Sea Rescue Trainer

Total Dev. NS HI = 0.00004
Total liver HI = 0.002
Total skin HI = 0.0004
Total vascular HI = 0.0004

TABLE 9.1.CT

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	**INORGANICS**					**INORGANICS**					
			Arsenic	--	--	3.0E-11	3E-11	Arsenic	skin/vascular	--	--	0.000002	0.000002
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	--	--	0.00000018	0.00000018
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					**ORGANICS**					
			4,4'-DDD	--	--	4.0E-11	4E-11	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	--	--	3.3E-11	3E-11	4,4'-DDE	--	--	--	--	--
			Aldrin	--	--	9.4E-11	9E-11	Aldrin	liver	--	--	0.0000061	0.0000061
			Heptachlor	--	--	4.0E-11	4E-11	Heptachlor	liver	--	--	0.0000006	0.0000006
			Heptachlor epoxide	--	--	3.0E-10	3E-10	Heptachlor epoxide	liver	--	--	0.000086	0.000086
			(Total)	--	--	5E-10	5E-10	(Total)		--	--	0.000095	0.000095
Animal Tissue	Animal Tissue	Fish from Back River	**INORGANICS**					**INORGANICS**					
			Arsenic	3.2E-06	--	--	3E-06	Arsenic	skin/vascular	0.23	--	--	0.2
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.024	--	--	0.024
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.008	--	--	0.008
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					**ORGANICS**					
			4,4'-DDD	3.7E-09	--	--	4E-09	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	8.5E-09	--	--	9E-09	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	6.0E-07	--	--	6E-07	Aroclor 5432	--	--	--	--	--
			PCB-1248	6.1E-08	--	--	6E-08	PCB-1248	--	--	--	--	--
			PCB-1254	2.7E-07	--	--	3E-07	PCB-1254	Immune system/eye/nails	0.2	--	--	0.2
			PCB-1260	1.1E-07	--	--	1E-07	PCB-1260	--	--	--	--	--
			(Total)	4E-06	--	--	4E-06	(Total)		0.5	--	--	0.5
		Crabs from Back River	**INORGANICS**					**INORGANICS**					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.0004	--	--	0.0004
			Arsenic	6E-06	--	--	6E-06	Arsenic	skin/vascular	0.45	--	--	0.4
			Barium	--	--	--	--	Barium	kidney	0.0003	--	--	0.0003
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Copper	--	--	--	--	Copper	GI tract	0.009	--	--	0.009
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.002	--	--	0.002
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Manganese (food)	--	--	--	--	Manganese (food)	CNS	0.0004	--	--	0.0004
			Nickel	--	--	--	--	Nickel	heart/liver	0.001	--	--	0.001

TABLE 9.1.CT

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.006	--	--	0.006
			Silver	--	--	--	--	Silver	skin	0.005	--	--	0.005
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			Zinc	--	--	--	--	Zinc	blood	0.006	--	--	0.006
			ORGANICS					**ORGANICS**					
			4,4'-DDD	3E-10	--	--	3E-10	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	2E-09	--	--	2E-09	4,4'-DDE	--	--	--	--	--
			Heptachlor	3E-10	--	--	3E-10	Heptachlor	liver	0.000005	--	--	0.000005
			Heptachlor epoxide	8E-09	--	--	8E-09	Heptachlor epoxide	liver	0.002	--	--	0.002
			PCB-1254	2E-08	--	--	2E-08	PCB-1254	immune system/eye/nails	0.02	--	--	0.02
			Phenol	--	--	--	--	Phenol	fetus	0.000006	--	--	0.000006
			bis (2-Ethylhexyl) phthalate	1E-09	--	--	1E-09	bis (2-Ethylhexyl) phthalate	liver	0.0001	--	--	0.0001
			(Total)	6E-06	--	--	6E-06	(Total)		0.5	--	--	0.5
						Total Risk Across Surface Water	5E-10					Total Hazard Index Across Surface Water	0.000095
						Total Risk Across Animal Tissue	1E-05					Total Hazard Index Across Animal Tissue	0.98
						Total Risk Across All Media and All Exposure Routes	1E-05					Total Hazard Index Across All Media and All Exposure Routes	0.98

Total blood HI =	0.008
Total CNS HI =	0.0140
Total Dev. NS HI =	0.0245
Total eye HI =	0.2
Total fetus HI =	0.000006
Total GI tract HI =	0.01
Total hair HI =	0.014
Total heart HI =	0.001
Total immune system HI =	0.2
Total kidney HI =	0.0003
Total liver HI =	0.019
Total nails HI =	0.25
Total skin HI =	0.7
Total vascular HI =	0.7

TABLE 9.2 CT

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	INORGANICS					INORGANICS					
			Arsenic	--	--	7.3E-11	7E-11	Arsenic	skin/vascular	--	--	0.000001	0.000001
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	--	--	0.00000010	0.00000010
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	--	--	9.7E-11	1E-10	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	--	--	7.9E-11	8E-11	4,4'-DDE	--	--	--	--	--
			Aldrin	--	--	2.2E-10	2E-10	Aldrin	liver	--	--	0.0000034	0.0000034
			Heptachlor	--	--	9.5E-11	1E-10	Heptachlor	liver	--	--	0.0000003	0.0000003
			Heptachlor epoxide	--	--	7.3E-10	7E-10	Heptachlor epoxide	liver	--	--	0.000046	0.000046
			(Total)	--	--	1E-09	1E-09	(Total)		--	--	0.000053	0.000053
Animal Tissue	Animal Tissue	Fish from Back River	INORGANICS					INORGANICS					
			Arsenic	1.0E-05	--	--	1E-05	Arsenic	skin/vascular	0.2	--	--	0.2
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.019	--	--	0.019
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.006	--	--	0.006
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	1.2E-08	--	--	1E-08	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	2.8E-08	--	--	3E-08	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	2.0E-06	--	--	2E-06	Aroclor 5432	--	--	--	--	--
			PCB-1248	2.0E-07	--	--	2E-07	PCB-1248	--	--	--	--	--
			PCB-1254	8.9E-07	--	--	9E-07	PCB-1254	Immune system/eye/nails	0.2	--	--	0.2
			PCB-1260	3.5E-07	--	--	4E-07	PCB-1260	--	--	--	--	--
			(Total)	1E-05	--	--	1E-05	(Total)		0.4	--	--	0.4
		Crabs from Back River	INORGANICS					INORGANICS					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.0003	--	--	0.0003
			Arsenic	2E-05	--	--	2E-05	Arsenic	skin/vascular	0.3	--	--	0.3
			Barium	--	--	--	--	Barium	kidney	0.0002	--	--	0.0002
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Copper	--	--	--	--	Copper	GI tract	0.007	--	--	0.007
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.002	--	--	0.002
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Manganese (food)	--	--	--	--	Manganese (food)	CNS	0.0003	--	--	0.0003
			Nickel	--	--	--	--	Nickel	heart/liver	0.0008	--	--	0.0008

TABLE 9.2.CT

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.004	--	--	0.004
			Silver	--	--	--	--	Silver	skin	0.004	--	--	0.004
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			Zinc	--	--	--	--	Zinc	blood	0.005	--	--	0.005
			ORGANICS					ORGANICS					
			4,4'-DDD	1E-09	--	--	1E-09	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	7E-09	--	--	7E-09	4,4'-DDE	--	--	--	--	--
			Heptachlor	1E-09	--	--	1E-09	Heptachlor	liver	0.000003	--	--	0.000003
			Heptachlor epoxide	3E-08	--	--	3E-08	Heptachlor epoxide	liver	0.002	--	--	0.002
			PCB-1254	7E-08	--	--	7E-08	PCB-1254	Immune system/eye/nails	0.013	--	--	0.01
			Phenol	--	--	--	--	Phenol	fetus	0.000005	--	--	0.000005
			bis (2-Ethylhexyl) phthalate	4E-09	--	--	4E-09	bis (2-Ethylhexyl) phthalate	liver	0.0001	--	--	0.0001
			(Total)	2E-05	--	--	2E-05	(Total)		0.4	--	--	0.4
						Total Risk Across Surface Water	1E-09					Total Hazard Index Across Surface Water	0.000053
						Total Risk Across Animal Tissue	3E-05					Total Hazard Index Across Animal Tissue	0.8
						Total Risk Across All Media and All Exposure Routes	3E-05					Total Hazard Index Across All Media and All Exposure Routes	0.8

Total blood HI =	0.006
Total CNS HI =	0.0108
Total Dev NS HI =	0.0189
Total eye HI =	0.2
Total fetus HI =	0.000005
Total GI tract HI =	0.008
Total hair HI =	0.01
Total heart HI =	0.0008
Total immune system HI =	0.2
Total kidney HI =	0.0002
Total liver HI =	0.015
Total nails HI =	0.20
Total skin HI =	0.5
Total vascular HI =	0.5

TABLE 9.1.RME

RME SUMMARY OF SITE CANCER RISKS AND NON-CANCER HAZARDS FOR COPC©HILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	INORGANICS					INORGANICS					
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	--	--	0.0000004	0.0000004
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	--	--	4.7E-10	5E-10	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	--	--	3.3E-10	3E-10	4,4'-DDE	--	--	--	--	--
			Aldrin	--	--	6.7E-10	7E-10	Aldrin	liver	--	--	0.0000131	0.0000131
			Heptachlor	--	--	3.4E-10	3E-10	Heptachlor	liver	--	--	0.0000015	0.0000015
			Heptachlor epoxide	--	--	2.4E-09	2E-09	Heptachlor epoxide	liver	--	--	0.000203	0.000203
			(Total)	--	--	4E-09	4E-09	(Total)		--	--	0.00022	0.00022
Animal Tissue	Animal Tissue	Fish from Back River	INORGANICS					INORGANICS					
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.11	--	--	0.11
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.03	--	--	0.03
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	1.3E-07	--	--	1E-07	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	1.6E-07	--	--	2E-07	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	3.2E-05	--	--	3E-05	Aroclor 5432	--	--	--	--	--
			PCB-1248	1.7E-06	--	--	2E-06	PCB-1248	--	--	--	--	--
			PCB-1254	8.3E-06	--	--	8E-06	PCB-1254	Immune system/eye/nails	2	--	--	2
			PCB-1260	2.2E-06	--	--	2E-06	PCB-1260	--	--	--	--	--
			(Total)	4E-05	--	--	4E-05	(Total)		2.2	--	--	2.2
		Crabs from Back River	INORGANICS					INORGANICS					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.003	--	--	0.003
			Barium	--	--	--	--	Barium	kidney	0.001	--	--	0.001
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Copper	--	--	--	--	Copper	GI tract	0.04	--	--	0.04
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.009	--	--	0.009
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Manganese (food)	--	--	--	--	Manganese (food)	CNS	0.002	--	--	0.002
			Nickel	--	--	--	--	Nickel	heart/liver	0.00	--	--	0.00
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.03	--	--	0.03
			Silver	--	--	--	--	Silver	skin	0.03	--	--	0.03

TABLE 9.1.RME

RME SUMMARY OF SITE CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			Zinc	--	--	--	--	Zinc	blood	0.03	--	--	0.03
			ORGANICS					ORGANICS					
			4,4'-DDD	1E-08	--	--	1E-08	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	6E-08	--	--	6E-08	4,4'-DDE	--	--	--	--	--
			Heptachlor	6E-09	--	--	6E-09	Heptachlor	liver	0.00003	--	--	0.00003
			Heptachlor epoxide	1E-07	--	--	1E-07	Heptachlor epoxide	liver	0.01	--	--	0.01
			PCB-1254	7E-07	--	--	7E-07	PCB-1254	immune system/eye/nails	0.2	--	--	0.2
			Phenol	--	--	--	--	Phenol	fetus	0.00004	--	--	0.00004
			bis (2-Ethylhexyl) phthalate	3E-08	--	--	3E-08	bis (2-Ethylhexyl) phthalate	liver	0.001	--	--	0.001
			(Total)	1E-06	--	--	1E-06	(Total)		0.3	--	--	0.3

Total Risk Across Surface Water	4E-09	Total Hazard Index Across Surface Water	0.00022
Total Risk Across Animal Tissue	5E-05	Total Hazard Index Across Animal Tissue	2.6
Total Risk Across All Media and All Exposure Routes	5E-05	Total Hazard Index Across All Media and All Exposure Routes	2.6

Total blood HI =	0.04
Total CNS HI =	0.063
Total Dev. NS HI =	0.116
Total eye HI =	2.3
Total fetus HI =	0.00004
Total GI tract HI =	0.05
Total hair HI =	0.06
Total heart HI =	0.005
Total immune system HI =	2.3
Total kidney HI =	0.001
Total liver HI =	0.09
Total nails HI =	2.3
Total skin HI =	0
Total vascular HI =	0

Estimated risk from ingestion of fish and crabs does not include the contribution of arsenic in tissue. Based on statistical analysis of sediment data, it was determined that arsenic in fish and crab tissue is not related to site activities (see Section 4).

TABLE 9.2.RME

RME SUMMARY OF SITE CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	**INORGANICS**					**INORGANICS**					
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	--	--	0.00000024	0.00000024
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					**ORGANICS**					
			4,4'-DDD	--	--	1.1E-09	1E-09	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	--	--	7.9E-10	8E-10	4,4'-DDE	--	--	--	--	--
			Aldrin	--	--	1.6E-09	2E-09	Aldrin	liver	--	--	0.0000073	0.0000073
			Heptachlor	--	--	8.2E-10	8E-10	Heptachlor	liver	--	--	0.0000008	0.0000008
			Heptachlor epoxide	--	--	5.7E-09	6E-09	Heptachlor epoxide	liver	--	--	0.000113	0.000113
			(Total)	--	--	1E-08	1E-08	(Total)		--	--	0.000122	0.0001
Animal Tissue	Animal Tissue	Fish from Back River	**INORGANICS**					**INORGANICS**					
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.10	--	--	0.10
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.03	--	--	0.03
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					**ORGANICS**					
			4,4'-DDD	5.0E-07	--	--	5E-07	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	6.3E-07	--	--	6E-07	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	1.3E-04	--	--	1E-04	Aroclor 5432	--	--	--	--	--
			PCB-1248	6.5E-06	--	--	7E-06	PCB-1248	--	--	--	--	--
			PCB-1254	3.2E-05	--	--	3E-05	PCB-1254	Immune system/eye/nails	2	--	--	2
			PCB-1260	8.4E-06	--	--	8E-06	PCB-1260	--	--	--	--	--
			(Total)	2E-04	--	--	2E-04	(Total)		2.0	--	--	2.0
		Crabs from Back River	**INORGANICS**					**INORGANICS**					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.002	--	--	0.002
			Barium	--	--	--	--	Barium	kidney	0.001	--	--	0.001
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Copper	--	--	--	--	Copper	GI tract	0.037	--	--	0.04
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.008	--	--	0.008
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Manganese (food)	--	--	--	--	Manganese (food)	CNS	0.002	--	--	0.002
			Nickel	--	--	--	--	Nickel	heart/liver	0.004	--	--	0.004
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.023	--	--	0.02
			Silver	--	--	--	--	Silver	skin	0.025	--	--	0.03

TABLE 9.2.RME

RME SUMMARY OF SITE CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			Zinc	--	--	--	--	Zinc	blood	0.024	--	--	0.02
			ORGANICS					ORGANICS					
			4,4'-DDD	5E-08	--	--	5E-08	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	2E-07	--	--	2E-07	4,4'-DDE	--	--	--	--	--
			Heptachlor	2E-08	--	--	2E-08	Heptachlor	liver	0.00003	--	--	0.00003
			Heptachlor epoxide	5E-07	--	--	5E-07	Heptachlor epoxide	liver	0.010	--	--	0.01
			PCB-1254	3E-06	--	--	3E-06	PCB-1254	immune system/eye/nails	0.168	--	--	0.2
			Phenol	--	--	--	--	Phenol	fetus	0.00004	--	--	0.00004
			bis (2-Ethylhexyl) phthalate	1E-07	--	--	1E-07	bis (2-Ethylhexyl) phthalate	liver	0.0009	--	--	0.0009
			(Total)	4E-06	--	--	4E-06	(Total)		0.3	--	--	0.31
						Total Risk Across Surface Water	1E-08					Total Hazard Index Across Surface Water	0.000122
						Total Risk Across Animal Tissue	2E-04					Total Hazard Index Across Animal Tissue	2.31
						Total Risk Across All Media and All Exposure Routes	2E-04					Total Hazard Index Across All Media and All Exposure Routes	2.31

Total blood HI =	0.03
Total CNS HI =	0.056
Total Dev. NS HI =	0.105
Total eye HI =	2.0
Total fetus HI =	0.00004
Total GI tract HI =	0.04
Total hair HI =	0.05
Total heart HI =	0.004
Total immune system HI =	2.0
Total kidney HI =	0.001
Total liver HI =	0.08
Total nails HI =	2.1
Total skin HI =	0.08
Total vascular HI =	0

Estimated risk from ingestion of fish and crabs does not include the contribution of arsenic in tissue. Based on statistical analysis of sediment data, it was determined that arsenic in fish and crab tissue is not related to site activities (see Section 4).

TABLE 9.1.CT

RME SUMMARY OF SITE CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	INORGANICS					INORGANICS					
			Arsenic	--	--	3.0E-11	3E-11	Arsenic	skin/vascular	--	--	0.000002	0.000002
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	--	--	0.00000018	0.00000018
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	--	--	4.0E-11	4E-11	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	--	--	3.3E-11	3E-11	4,4'-DDE	--	--	--	--	--
			Aldrin	--	--	9.4E-11	9E-11	Aldrin	liver	--	--	0.0000061	0.0000061
			Heptachlor	--	--	4.0E-11	4E-11	Heptachlor	liver	--	--	0.0000006	0.0000006
			Heptachlor epoxide	--	--	3.0E-10	3E-10	Heptachlor epoxide	liver	--	--	0.000086	0.000086
			(Total)	--	--	5E-10	5E-10	(Total)		--	--	0.000095	0.000095
Animal Tissue	Animal Tissue	Fish from Back River	INORGANICS					INORGANICS					
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.024	--	--	0.024
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.008	--	--	0.008
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	3.7E-09	--	--	4E-09	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	8.5E-09	--	--	9E-09	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	6.0E-07	--	--	6E-07	Aroclor 5432	--	--	--	--	--
			PCB-1248	6.1E-08	--	--	6E-08	PCB-1248	--	--	--	--	--
			PCB-1254	2.7E-07	--	--	3E-07	PCB-1254	Immune system/eye/nails	0.2	--	--	0.2
			PCB-1260	1.1E-07	--	--	1E-07	PCB-1260	--	--	--	--	--
			(Total)	1E-06	--	--	1E-06	(Total)		0.3	--	--	0.3
		Crabs from Back River	INORGANICS					INORGANICS					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.0004	--	--	0.0004
			Barium	--	--	--	--	Barium	kidney	0.0003	--	--	0.0003
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Copper	--	--	--	--	Copper	GI tract	0.009	--	--	0.009
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.002	--	--	0.002
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Manganese (food)	--	--	--	--	Manganese (food)	CNS	0.0004	--	--	0.0004
			Nickel	--	--	--	--	Nickel	heart/liver	0.001	--	--	0.001
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.006	--	--	0.006

TABLE 9.1.CT

RME SUMMARY OF SITE CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs CHILD FISHER

SS-83, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Silver	--	--	--	--	Silver	skin	0.005	--	--	0.005
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			Zinc	--	--	--	--	Zinc	blood	0.006	--	--	0.006
			ORGANICS					ORGANICS					
			4,4'-DDD	3E-10	--	--	3E-10	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	2E-09	--	--	2E-09	4,4'-DDE	--	--	--	--	--
			Heptachlor	3E-10	--	--	3E-10	Heptachlor	liver	0.000005	--	--	0.000005
			Heptachlor epoxide	8E-09	--	--	8E-09	Heptachlor epoxide	liver	0.002	--	--	0.002
			PCB-1254	2E-08	--	--	2E-08	PCB-1254	immune system/eye/nails	0.02	--	--	0.02
			Phenol	--	--	--	--	Phenol	fetus	0.000006	--	--	0.000006
			bis (2-Ethylhexyl) phthalate	1E-09	--	--	1E-09	bis (2-Ethylhexyl) phthalate	liver	0.0001	--	--	0.0001
			(Total)	3E-08	--	--	3E-08	(Total)		0.0	--	--	0.0
						Total Risk Across Surface Water	5E-10					Total Hazard Index Across Surface Wate	0.000095
						Total Risk Across Animal Tissue	1E-06					Total Hazard Index Across Animal Tissu	0.30
						Total Risk Across All Media and All Exposure Routes	1E-06					Total Hazard Index Across All Media and All Exposure Routes	0.30

Total blood HI =	0.008
Total CNS HI =	0.0140
Total Dev. NS HI =	0.0245
Total eye HI =	0.2
Total fetus HI =	0.000006
Total GI tract HI =	0.01
Total hair HI =	0.014
Total heart HI =	0.001
Total immune system HI =	0.2
Total kidney HI =	0.0003
Total liver HI =	0.019
Total nails HI =	0.25
Total skin HI =	0.0
Total vascular HI =	0.0

TABLE 9.2.CT
CT SUMMARY OF SITE CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: ADULT FISHER
SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	INORGANICS					INORGANICS					
			Arsenic	--	--	7.3E-11	7E-11	Arsenic	skin/vascular	--	--	0.000001	0.000001
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	--	--	0.00000010	0.00000010
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	--	--	9.7E-11	1E-10	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	--	--	7.9E-11	6E-11	4,4'-DDE	--	--	--	--	--
			Aldrin	--	--	2.2E-10	2E-10	Aldrin	liver	--	--	0.0000034	0.0000034
			Heptachlor	--	--	9.5E-11	1E-10	Heptachlor	liver	--	--	0.0000003	0.0000003
			Heptachlor epoxide	--	--	7.3E-10	7E-10	Heptachlor epoxide	liver	--	--	0.000048	0.000048
			(Total)	--	--	1E-09	1E-09	(Total)		--	--	0.000053	0.000053
Animal Tissue	Animal Tissue	Fish from Back River	INORGANICS					INORGANICS					
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.019	--	--	0.019
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.008	--	--	0.008
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	1.2E-08	--	--	1E-08	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	2.8E-08	--	--	3E-08	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	2.0E-08	--	--	2E-08	Aroclor 5432	--	--	--	--	--
			PCB-1248	2.0E-07	--	--	2E-07	PCB-1248	--	--	--	--	--
			PCB-1254	8.9E-07	--	--	9E-07	PCB-1254	Immune system/eye/nails	0.2	--	--	0.2
			PCB-1260	3.5E-07	--	--	4E-07	PCB-1260	--	--	--	--	--
			(Total)	3E-06	--	--	3E-06	(Total)		0.2	--	--	0.2
		Crabs from Back River	INORGANICS					INORGANICS					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.0003	--	--	0.0003
			Barium	--	--	--	--	Barium	kidney	0.0002	--	--	0.0002
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Copper	--	--	--	--	Copper	GI tract	0.007	--	--	0.007
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.002	--	--	0.002
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Manganese (food)	--	--	--	--	Manganese (food)	CNS	0.0003	--	--	0.0003
			Nickel	--	--	--	--	Nickel	heart/liver	0.0008	--	--	0.0008
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.004	--	--	0.004

TABLE 9.2.CT

CT SUMMARY OF SITE CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Silver	--	--	--	--	Silver	skin	0.004	--	--	0.004
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			Zinc	--	--	--	--	Zinc	blood	0.005	--	--	0.005
			ORGANICS					ORGANICS					
			4,4'-DDD	1E-09	--	--	1E-09	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	7E-09	--	--	7E-09	4,4'-DDE	--	--	--	--	--
			Heptachlor	1E-09	--	--	1E-09	Heptachlor	liver	0.000003	--	--	0.000003
			Heptachlor epoxide	3E-08	--	--	3E-08	Heptachlor epoxide	liver	0.002	--	--	0.002
			PCB-1254	7E-08	--	--	7E-08	PCB-1254	immune system/eye/nails	0.013	--	--	0.01
			Phenol	--	--	--	--	Phenol	fetus	0.000005	--	--	0.000005
			bis (2-Ethylhexyl) phthalate	4E-09	--	--	4E-09	bis (2-Ethylhexyl) phthalate	liver	0.0001	--	--	0.0001
			(Total)	1E-07	--	--	1E-07	(Total)		0.0	--	--	0.0
						Total Risk Across Surface Water	1E-09					Total Hazard Index Across Surface Water	0.000053
						Total Risk Across Animal Tissue	4E-06					Total Hazard Index Across Animal Tissue	0.2
						Total Risk Across All Media and All Exposure Routes	4E-06					Total Hazard Index Across All Media and All Exposure Routes	0.2

Total blood HI =	0.006
Total CNS HI =	0.0108
Total Dev. NS HI =	0.0189
Total eye HI =	0.2
Total fetus HI =	0.000006
Total GI tract HI =	0.006
Total hair HI =	0.01
Total heart HI =	0.0008
Total immune system HI =	0.2
Total kidney HI =	0.0002
Total liver HI =	0.015
Total nails HI =	0.20
Total skin HI =	0.0
Total vascular HI =	0.0

Estimated risk from ingestion of fish and crabs does not include the contribution of arsenic in tissue. Based on statistical analysis of sediment data, it was determined that arsenic in fish and crab tissue is not related to site activities (see Section 4).

TABLE 9.1.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Animal Tissue	Animal Tissue	Bivalves from Back River	INORGANICS					INORGANICS					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.05	--	--	0.05
			Arsenic	5.6E-05	--	--	5.6E-05	Arsenic	skin/vascular	1.24	--	--	1.24
			Cadmium	--	--	--	--	Cadmium	kidney	0.09	--	--	0.09
			Chromium (Total)	--	--	--	--	Chromium (Total)	GI tract/fetus/bone marrow/spleen/liver	0.00	--	--	0.0017
			Copper	--	--	--	--	Copper	GI tract	0.18	--	--	0.18
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.24	--	--	0.24
			Manganese	--	--	--	--	Manganese	CNS	0.04	--	--	0.04
			Mercury	--	--	--	--	Mercury	Dev. NS	0.04	--	--	0.04
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.04	--	--	0.04
			Silver	--	--	--	--	Silver	skin	0.09	--	--	0.09
			Vanadium	--	--	--	--	Vanadium	GI tract/CNS/kidney/bone marrow/liver	0.02	--	--	0.02
			Zinc	--	--	--	--	Zinc	blood	0.21	--	--	0.21
			ORGANICS				--	ORGANICS					--
			Aldrin	1.3E-07	--	--	1.3E-07	Aldrin	liver	0.00	--	--	0.0026
			Aroclor 5432	4.4E-06	--	--	4.4E-06	Aroclor 5432	N/A	--	--	--	--
			Benzo(a)anthracene	6.2E-07	--	--	6.2E-07	Benzo(a)anthracene	N/A	--	--	--	--
			Benzo(a)pyrene	6.7E-06	--	--	6.7E-06	Benzo(a)pyrene	N/A	--	--	--	--
			Benzo(b)fluoranthene	7.1E-07	--	--	7.1E-07	Benzo(b)fluoranthene	N/A	--	--	--	--

TABLE 9.1.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Heptachlor epoxide	1.1E-07	--	--	1.1E-07	Heptachlor epoxide	liver	0.01	--	--	0.01
			PCB 1254	1.7E-06	--	--	1.7E-06	PCB 1254	Immune system/eye/nails	0.42	--	--	0.42
			PCB 1260	2.5E-07	--	--	2.5E-07	PCB 1260	N/A	--	--	--	--
			alpha-BHC	7.1E-08	--	--	7.1E-08	alpha-BHC	N/A	--	--	--	--
			delta-BHC	1.5E-08	--	--	1.5E-08	delta-BHC	N/A	--	--	--	--
			(Total)	7.0E-05	--	--	7.0E-05	(Total)		2.7	--	--	2.7

Total blood HI =	0.45
Total CNS HI =	0.11
Total Dev. NS HI =	0.093
Total eye HI =	0.42
Total fetus HI =	0.0017
Total GI tract HI =	0.44
Total hair HI =	0.045
Total immune system HI =	0.42
Total kidney HI =	0.11
Total liver HI =	0.32
Total nails HI =	0.47
Total skin HI =	1.4
Total vascular HI =	1.2
Total Bone Marrow =	0.024
Total Spleen HI =	0.0017

TABLE 9.2.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Animal Tissue	Animal Tissue	Bivalves from Back River	**INORGANICS**					**INORGANICS**					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.05	--	--	0.05
			Arsenic	2.2E-04	--	--	2.2E-04	Arsenic	skin/vascular	1.12	--	--	1.12
			Cadmium	--	--	--	--	Cadmium	kidney	0.08	--	--	0.08
			Chromium (Total)	--	--	--	--	Chromium (Total)	GI tract/fetus/bone marrow/spleen/liver	0.00	--	--	0.0016
			Copper	--	--	--	--	Copper	GI tract	0.16	--	--	0.16
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.21	--	--	0.21
			Manganese	--	--	--	--	Manganese	CNS	0.03	--	--	0.03
			Mercury	--	--	--	--	Mercury	Dev. NS	0.04	--	--	0.04
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.04	--	--	0.04
			Silver	--	--	--	--	Silver	skin	0.08	--	--	0.08
			Vanadium	--	--	--	--	Vanadium	GI tract/CNS/kidney/bone marrow/liver	0.02	--	--	0.02
			Zinc	--	--	--	--	Zinc	blood	0.19	--	--	0.19
			ORGANICS					**ORGANICS**					
			Aldrin	5.1E-07	--	--	5.1E-07	Aldrin	liver	0.00	--	--	0.0023
			Aroclor 5432	1.7E-05	--	--	1.7E-05	Aroclor 5432	N/A	--	--	--	--
			Benzo(a)anthracene	2.4E-06	--	--	2.4E-06	Benzo(a)anthracene	N/A	--	--	--	--
			Benzo(a)pyrene	2.6E-05	--	--	2.6E-05	Benzo(a)pyrene	N/A	--	--	--	--
			Benzo(b)fluoranthene	2.7E-06	--	--	2.7E-06	Benzo(b)fluoranthene	N/A	--	--	--	--

TABLE 9.2.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Heptachlor epoxide	4.2E-07	--	--	4.2E-07	Heptachlor epoxide	liver	0.01	--	--	0.01
			PCB 1254	6.5E-06	--	--	6.5E-06	PCB 1254	immune system/eye/nails	0.38	--	--	0.38
			PCB 1260	9.6E-07	--	--	9.6E-07	PCB 1260	N/A	--	--	--	--
			alpha-BHC	2.7E-07	--	--	2.7E-07	alpha-BHC	N/A	--	--	--	--
			delta-BHC	5.9E-08	--	--	5.9E-08	delta-BHC	N/A	--	--	--	--
			(Total)	2.7E-04	--	--	2.7E-04	(Total)		2.4	--	--	2.4

Total blood HI =	0.41
Total CNS HI =	0.10
Total Dev. NS HI =	0.084
Total eye HI =	0.38
Total fetus HI =	0.0016
Total GI tract HI =	0.39
Total hair HI =	0.040
Total immune system HI =	0.38
Total kidney HI =	0.10
Total liver HI =	0.29
Total nails HI =	0.42
Total skin HI =	1.2
Total vascular HI =	1.1
Total Bone Marrow =	0.022
Total Spleen HI =	0.0016

TABLE 9.1.CT

CT SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Animal Tissue	Animal Tissue	Bivalves from Back River	**INORGANICS**					**INORGANICS**					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.00	--	--	0.004
			Arsenic	3.3E-06	--	--	3.3E-06	Arsenic	skin/vascular	0.24	--	--	0.24
			Cadmium	--	--	--	--	Cadmium	kidney	0.01	--	--	0.01
			Chromium (Total)	--	--	--	--	Chromium (Total)	GI tract/fetus/bone marrow/spleen/liver	0.00	--	--	0.0001
			Copper	--	--	--	--	Copper	GI tract	0.01	--	--	0.01
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.03	--	--	0.03
			Manganese	--	--	--	--	Manganese	CNS	0.00	--	--	0.005
			Mercury	--	--	--	--	Mercury	Dev. NS	0.01	--	--	0.01
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.01	--	--	0.01
			Silver	--	--	--	--	Silver	skin	0.01	--	--	0.01
			Vanadium	--	--	--	--	Vanadium	GI tract/CNS/kidney/bone marrow/liver	0.00	--	--	0.003
			Zinc	--	--	--	--	Zinc	blood	0.02	--	--	0.02
			ORGANICS				--	**ORGANICS**					--
			Aldrin	7.5E-09	--	--	7.5E-09	Aldrin	liver	0.00	--	--	0.0005
			Aroclor 5432	2.5E-07	--	--	2.5E-07	Aroclor 5432	N/A	--	--	--	--
			Benzo(a)anthracene	3.9E-08	--	--	3.9E-08	Benzo(a)anthracene	N/A	--	--	--	--
			Benzo(a)pyrene	4.0E-07	--	--	4.0E-07	Benzo(a)pyrene	N/A	--	--	--	--
			Benzo(b)fluoranthene	4.1E-08	--	--	4.1E-08	Benzo(b)fluoranthene	N/A	--	--	--	--

TABLE 9.1.CT

CT SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Heptachlor epoxide	5.8E-09	--	--	5.8E-09	Heptachlor epoxide	liver	0.00	--	--	0.002
			PCB 1254	9.0E-08	--	--	9.0E-08	PCB 1254	immune system/eye/nails	0.08	--	--	0.08
			PCB 1260	1.4E-08	--	--	1.4E-08	PCB 1260	N/A	--	--	--	--
			alpha-BHC	3.5E-09	--	--	3.5E-09	alpha-BHC	N/A	--	--	--	--
			delta-BHC	5.2E-10	--	--	5.2E-10	delta-BHC	N/A	--	--	--	--
			(Total)	4.1E-06	--	--	4.1E-06	(Total)		0.4	--	--	0.4

Total blood HI =	0.05
Total CNS HI =	0.02
Total Dev. NS HI =	0.011
Total eye HI =	0.08
Total fetus HI =	0.0001
Total GI tract HI =	0.04
Total hair HI =	0.009
Total immune system HI =	0.08
Total kidney HI =	0.02
Total liver HI =	0.04
Total nails HI =	0.08
Total skin HI =	0.3
Total vascular HI =	0.2
Total Bone Marrow =	0.003
Total Spleen HI =	0.0001

TABLE 9.2.CT

CT SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Animal Tissue	Animal Tissue	Bivalves from Back River	**INORGANICS**					**INORGANICS**					
			Aluminum	--	--	--	--	Aluminum	Dev. NS	0.00	--	--	0.003
			Arsenic	1.1E-05	--	--	1.1E-05	Arsenic	skin/vascular	0.19	--	--	0.19
			Cadmium	--	--	--	--	Cadmium	kidney	0.01	--	--	0.01
			Chromium (Total)	--	--	--	--	Chromium (Total)	GI tract/fetus/bone marrow/spleen/liver	0.00	--	--	0.0001
			Copper	--	--	--	--	Copper	GI tract	0.01	--	--	0.01
			Iron	--	--	--	--	Iron	blood/liver/GI tract	0.02	--	--	0.02
			Manganese	--	--	--	--	Manganese	CNS	0.00	--	--	0.004
			Mercury	--	--	--	--	Mercury	Dev. NS	0.00	--	--	0.005
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.01	--	--	0.01
			Silver	--	--	--	--	Silver	skin	0.01	--	--	0.01
			Vanadium	--	--	--	--	Vanadium	GI tract/CNS/kidney/bone marrow/liver	0.00	--	--	0.002
			Zinc	--	--	--	--	Zinc	blood	0.02	--	--	0.02
			ORGANICS					**ORGANICS**					
			Aldrin	2.5E-08	--	--	2.5E-08	Aldrin	liver	0.00	--	--	0.0004
			Aroclor 5432	8.1E-07	--	--	8.1E-07	Aroclor 5432	N/A	--	--	--	--
			Benzo(a)anthracene	1.3E-07	--	--	1.3E-07	Benzo(a)anthracene	N/A	--	--	--	--
			Benzo(a)pyrene	1.3E-06	--	--	1.3E-06	Benzo(a)pyrene	N/A	--	--	--	--
			Benzo(b)fluoranthene	1.4E-07	--	--	1.4E-07	Benzo(b)fluoranthene	N/A	--	--	--	--

TABLE 9.2.CT

CT SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Heptachlor epoxide	1.9E-08	--	--	1.9E-08	Heptachlor epoxide	liver	0.00	--	--	0.001
			PCB 1254	3.0E-07	--	--	3.0E-07	PCB 1254	Immune system/eye/nails	0.06	--	--	0.06
			PCB 1260	4.5E-08	--	--	4.5E-08	PCB 1260	N/A	--	--	--	--
			alpha-BHC	1.1E-08	--	--	1.1E-08	alpha-BHC	N/A	--	--	--	--
			delta-BHC	1.7E-09	--	--	1.7E-09	delta-BHC	N/A	--	--	--	--
			(Total)	1.4E-05	--	--	1.4E-05	(Total)		0.3	--	--	0.3

Total blood HI =	0.04
Total CNS HI =	0.01
Total Dev. NS HI =	0.008
Total eye HI =	0.06
Total fetus HI =	0.0001
Total GI tract HI =	0.03
Total hair HI =	0.007
Total immune system HI =	0.06
Total kidney HI =	0.01
Total liver HI =	0.03
Total nails HI =	0.06
Total skin HI =	0.2
Total vascular HI =	0.2
Total Bone Marrow =	0.003
Total Spleen HI =	0.0001

Appendix A.10

RAGS Part D Table 10's
Risk Assessment Summary
Resonable Maximum Exposure

TABLE 10.1.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	--	--	--	--	--	--	--	--	--	--	--
			(Total)	--	--	--	--	(Total)	--	--	--	--	--
Animal Tissue	Animal Tissue	Fish from Back River	INORGANICS					INORGANICS					
			Arsenic	5.4E-05	--	--	5E-05	Arsenic	skin/vascular	1	--	--	1
			ORGANICS					ORGANICS					
			4,4'-DDD	1.3E-07	--	--	1E-07	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	1.6E-07	--	--	2E-07	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	3.2E-05	--	--	3E-05	Aroclor 5432	--	--	--	--	--
			PCB-1248	1.7E-06	--	--	2E-06	PCB-1248	--	--	--	--	--
			PCB-1254	8.3E-06	--	--	8E-06	PCB-1254	Immune system/eye/nails	2	--	--	2
			PCB-1260	2.2E-06	--	--	2E-06	PCB-1260	--	--	--	--	--
			(Total)	1E-04	--	--	1E-04	(Total)		3.3	--	--	3.3
		Crabs from Back River	INORGANICS					INORGANICS					
			Arsenic	1E-04	--	--	1E-04	Arsenic	skin/vascular	2.1	--	--	2.1
			(Total)	1E-04	--	--	1E-04	(Total)		2.1	--	--	2.1

Total Risk Across Surface Water	--	Total Hazard Index Across Surface Water	--
Total Risk Across Animal Tissue	2E-04	Total Hazard Index Across Animal Tissue	5
Total Risk Across All Media and All Exposure Routes	2E-04	Total Hazard Index Across All Media and All Exposure Routes	5

Total eye HI =	2
Total immune system HI =	2
Total nails HI =	2
Total skin HI =	3
Total vascular HI =	3

TABLE 10.2 RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	--	--	--	--	--	--	--	--	--	--	--
			(Total)	--	--	--	--	(Total)	--	--	--	--	--
Animal Tissue	Animal Tissue	Fish from Back River	INORGANICS					INORGANICS					
			Arsenic	2.1E-04	--	--	2E-04	Arsenic	skin/vascular	1	--	--	1
			ORGANICS					ORGANICS					
			Aroclor 5432	1.3E-04	--	--	1E-04	Aroclor 5432	--	--	--	--	--
			PCB-1254	3.2E-05	--	--	3E-05	PCB-1254	Immune system/eye/nails	2	--	--	2
			(Total)	4E-04	--	--	4E-04	(Total)		3.0	--	--	3.0
		Crabs from Back River	INORGANICS					INORGANICS					
			Arsenic	4E-04	--	--	4E-04	Arsenic	skin/vascular	2	--	--	2
			(Total)	4E-04	--	--	4E-04	(Total)		1.9	--	--	1.9

Total Risk Across Surface Water: --
Total Risk Across Animal Tissue: 7E-04

Total Hazard Index Across Surface Water: --
Total Hazard Index Across Animal Tissue: 5

Total Risk Across All Media and All Exposure Routes: 7E-04

Total Hazard Index Across All Media and All Exposure Routes: 5

Total eye HI = 2
Total immune system HI = 2
Total nails HI = 2
Total skin HI = 3
Total vascular HI = 3

TABLE 10.1.CT

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	--	--	--	--	--	--	--	--	--	--	--
			(Total)	--	--	--	--	(Total)	--	--	--	--	--
Animal Tissue	Animal Tissue	Fish from Back River	INORGANICS					INORGANICS					
			Arsenic	3.2E-06	--	--	3E-06	Arsenic	skin/vascular	0.2	--	--	0.2
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.024	--	--	0.024
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.008	--	--	0.008
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	3.7E-09	--	--	4E-09	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	8.5E-09	--	--	9E-09	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	6.0E-07	--	--	6E-07	Aroclor 5432	--	--	--	--	--
			PCB-1248	6.1E-08	--	--	6E-08	PCB-1248	--	--	--	--	--
			PCB-1254	2.7E-07	--	--	3E-07	PCB-1254	immune system/eye/nails	0.2	--	--	0.2
			PCB-1260	1.1E-07	--	--	1E-07	PCB-1260	--	--	--	--	--
			(Total)	4E-06	--	--	4E-06	(Total)		0.5	--	--	0.5
		Crabs from Back River	INORGANICS					INORGANICS					
			Arsenic	6E-06	--	--	6E-06	Arsenic	skin/vascular	0.4	--	--	0.4
			(Total)	6E-06	--	--	6E-06	(Total)		0.4	--	--	0.4

Total Risk Across Surface Water	--	Total Hazard Index Across Surface Water	--
Total Risk Across Animal Tissue	1E-05	Total Hazard Index Across Animal Tissue	0.9
Total Risk Across All Media and All Exposure Routes	1E-05	Total Hazard Index Across All Media and All Exposure Routes	0.9

Total eye HI =	0.2
Total hair HI =	0.008
Total immune system HI =	0.2
Total nails HI =	0.2
Total skin HI =	0.7
Total vascular HI =	0.7

TABLE 10 2 CT

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Surface Water from Back River	--	--	--	--	--	--	--	--	--	--	--
			(Total)	--	--	--	--	(Total)	--	--	--	--	--
Animal Tissue	Animal Tissue	Fish from Back River	INORGANICS					INORGANICS					
			Arsenic	1.0E-05	--	--	1E-05	Arsenic	skin/vascular	0.2	--	--	0.2
			Calcium	--	--	--	--	Calcium	--	--	--	--	--
			Magnesium	--	--	--	--	Magnesium	--	--	--	--	--
			Methylmercury	--	--	--	--	Methylmercury	Dev. NS	0.019	--	--	0.019
			Potassium	--	--	--	--	Potassium	--	--	--	--	--
			Selenium	--	--	--	--	Selenium	Liver/hair/nails/skin/CNS	0.006	--	--	0.006
			Sodium	--	--	--	--	Sodium	--	--	--	--	--
			ORGANICS					ORGANICS					
			4,4'-DDD	1.2E-08	--	--	1E-08	4,4'-DDD	--	--	--	--	--
			4,4'-DDE	2.8E-08	--	--	3E-08	4,4'-DDE	--	--	--	--	--
			Aroclor 5432	2.0E-06	--	--	2E-06	Aroclor 5432	--	--	--	--	--
			PCB-1248	2.0E-07	--	--	2E-07	PCB-1248	--	--	--	--	--
			PCB-1254	8.9E-07	--	--	9E-07	PCB-1254	Immune system/eye/nails	0.2	--	--	0.2
			PCB-1260	3.5E-07	--	--	4E-07	PCB-1260	--	--	--	--	--
			(Total)	1E-05	--	--	1E-05	(Total)		0.4	--	--	0.4
		Crabs from Back River	INORGANICS					INORGANICS					
			Arsenic	2E-05	--	--	2E-05	Arsenic	skin/vascular	0.3	--	--	0.3
			(Total)	2E-05	--	--	2E-05	(Total)		0.3	--	--	0.3

Total Risk Across Surface Water	--	Total Hazard Index Across Surface Water	--
Total Risk Across Animal Tissue	3E-05	Total Hazard Index Across Animal Tissue	0.7
Total Risk Across All Media and All Exposure Routes	3E-05	Total Hazard Index Across All Media and All Exposure Routes	0.7

Total eye HI =	0.2
Total hair HI =	0.006
Total immune system HI =	0.2
Total nails HI =	0.2
Total skin HI =	0.5
Total vascular HI =	0.5

TABLE 10.1.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: CHILD FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Animal Tissue	Animal Tissue	Bivalves from Back River	INORGANICS				
			ORGANICS				
			(Total)	0E+00	--	--	0E+00
			Total Risk Across All Exposure Routes/Pathways				0E+00

Chemical	Non-Carcinogenic Hazard Quotient				
	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
INORGANICS					
Arsenic	skin/vascular	1.2	--	--	1.2
ORGANICS					
(Total)		1.2	--	--	1.2
Total Hazard Index Across All Exposure Routes/Pathways					1.2

Total skin HI = 1.2
Total vascular HI = 1.2

TABLE 10.2.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: ADULT FISHER

SS-63, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Animal Tissue	Animal Tissue	Bivalves from Back River	INORGANICS					INORGANICS					
			Arsenic	2.2E-04	--	--	2.2E-04	Arsenic	skin/vascular	1.1	--	--	1.1
			ORGANICS					ORGANICS					
			Aroclor 5432	1.7E-05	--	--	1.7E-05						
			Benzo(a)pyrene	2.6E-05	--	--	2.6E-05						
			(Total)	2.6E-04	--	--	2.6E-04	(Total)		1.1	--	--	1.1
			Total Risk Across All Exposure Routes/Pathways				2.6E-04		Total Hazard Index Across All Exposure Routes/Pathways				1.1

Total skin HI = 1.1
Total vascular HI = 1.1

Appendix A.11

Ecological Risk Assessment Data

Table 7.1-1. Summary of SERA Results for Specific Receptors, Site SS-63

Benthic Invertebrates		Croaker		Kingfisher		Mink	
Parameter	SERA Results	Parameter	SERA Results	Parameter	SERA Results	Parameter	SERA Results
Inorganic Analytes							
Aluminum	*	Aluminum	*	Aluminum	*	Aluminum	*
Antimony	*	Antimony	*	Antimony	*	Antimony	*
Arsenic	*	Arsenic	*	Arsenic	1	Arsenic	*
Barium	1	Barium	*	Barium	1	Barium	*
Beryllium	*	Beryllium	*	Calcium	3	Beryllium	1
Cadmium	*	Cadmium	*	Chromium	1	Cadmium	1
Calcium	3	Calcium	3	Copper	1	Calcium	3
Chromium	*	Chromium	*	Iron	1	Chromium	*
Cobalt	*	Cobalt	*	Lead	1	Cobalt	1
Copper	1	Copper	*	Magnesium	*	Copper	1
Cyanide	*	Cyanide	1	Manganese	1	Cyanide	1
Iron	1	Iron	*	Mercury	*	Iron	1
Lead	*	Lead	*	Nickel	1	Lead	*
Magnesium	1	Magnesium	*	Potassium	3	Magnesium	*
Manganese	1	Manganese	*	Selenium	1	Manganese	1
Mercury	*	Mercury	*	Silver	1	Mercury	*
Nickel	*	Nickel	*	Sodium	3	Nickel	1
Potassium	3	Potassium	3	Vanadium	1	Potassium	3
Selenium	*	Selenium	*	Zinc	*	Selenium	*
Silver	*	Silver	*			Silver	1
Sodium	3	Sodium	3			Sodium	3
Thallium	1	Thallium	*			Thallium	*
Vanadium	1	Vanadium	*			Vanadium	*
Zinc	1	Zinc	*			Zinc	1
Volatile Organic Compounds							
Acetone	2	Acetone	1	Acetone	1	Acetone	1
2-Butanone (MEK)	2	2-Butanone (MEK)	1			2-Butanone (MEK)	1
Carbon disulfide	2	Carbon disulfide	1			Carbon disulfide	1
Methylene chloride	2	Methylene chloride	1			Methylene chloride	1
Toluene	2	Toluene	1			Toluene	1
Semi-volatile Organic Compounds							
2-Methylnaphthalene	2	2-Methylnaphthalene	*	Bis(2-ethylhexyl)phthalate	1	2-Methylnaphthalene	1
Acenaphthene	1	Acenaphthene	*	Phenol	*	Acenaphthene	*
Acenaphthylene	*	Acenaphthylene	*			Acenaphthylene	1
Anthracene	*	Anthracene	*			Anthracene	*
Benz(a)anthracene	*	Benz(a)anthracene	*			Benz(a)anthracene	*
Benzo(a)pyrene	*	Benzo(a)pyrene	*			Benzo(a)pyrene	*
Benzo(b)fluoranthene	*	Benzo(b)fluoranthene	*			Benzo(b)fluoranthene	*
Benzo(g,h,i)perylene	*	Benzo(g,h,i)perylene	*			Benzo(g,h,i)perylene	*
Benzo(k)fluoranthene	*	Benzo(k)fluoranthene	*			Benzo(k)fluoranthene	*
Butylbenzylphthalate	2	Butylbenzylphthalate	1			Butylbenzylphthalate	1
Bis(2-ethylhexyl)phthalate	*	Bis(2-ethylhexyl)phthalate	1			Bis(2-ethylhexyl)phthalate	1
Carbazole	2	Carbazole	*			Carbazole	1
Chrysene	*	Chrysene	*			Chrysene	*
Dibenz(a,h)anthracene	*	Dibenz(a,h)anthracene	*			Dibenz(a,h)anthracene	1

Table 7.1-1. Summary of SERA Results for Specific Receptors, Site SS-63

Benthic Invertebrates		Croaker		Kingfisher		Mink	
Parameter	SERA Results	Parameter	SERA Results	Parameter	SERA Results	Parameter	SERA Results
Dibenzofuran	2	**Dibenzofuran**	*			**Dibenzofuran**	*
Fluoranthene	*	**Fluoranthene**	*			Fluoranthene	1
Fluorene	*	**Fluorene**	*			Fluorene	1
Indeno(1,2,3-cd)pyrene	*	**Indeno(1,2,3-cd)pyrene**	*			Indeno(1,2,3-cd)pyrene	1
Naphthalene	2	**Naphthalene**	*			Naphthalene	1
Phenanthrene	*	**Phenanthrene**	*			**Phenanthrene**	*
Pyrene	*	**Pyrene**	*			Pyrene	1
		2,6-Dinitrotoluene	2			Phenol	1
		2-Methylphenol	*				
Pesticides & PCBs							
Aldrin	*	Aldrin	1	Aldrin	1	Aldrin	1
Arochlor 5432	*	**Arochlor 5432**	*	Dieldrin	1	Arochlor 5432	1
Arochlor 6040	*	**Arochlor 6040**	*	alpha-BHC	1	Arochlor 6040	1
Arochlor 6062	*	**Arochlor 6062**	*	beta-BHC	1	Arochlor 6062	1
Arochlor 6070	*	**Arochlor 6070**	*	gamma-BHC(Lindane)	1	Arochlor 6070	1
Dieldrin	1	Dicamba	1	alpha-Chlordane	1	Dieldrin	1
alpha-BHC	1	Dieldrin	1	gamma-Chlordane	1	alpha-BHC	1
beta-BHC	1	**alpha-BHC**	*	Endosulfan I	1	beta-BHC	1
gamma-BHC(Lindane)	1	**beta-BHC**	*	Endosulfan II	1	gamma-BHC(Lindane)	1
alpha-Chlordane	1	**gamma-BHC(Lindane)**	*	Endosulfan Sulfate	1	alpha-Chlordane	1
gamma-Chlordane	*	**alpha-Chlordane**	*	Endrin	1	gamma-Chlordane	1
Endosulfan I	*	**gamma-Chlordane**	*	Endrin Ketone	1	delta - BHC	1
Endosulfan II	*	**delta - BHC**	*	4,4'-DDD	1	Endosulfan I	1
Endosulfan Sulfate	*	Endosulfan I	1	4,4'-DDE	1	Endosulfan II	1
Endrin	*	Endosulfan II	1	Heptachlor	1	Endosulfan Sulfate	1
Endrin Ketone	*	Endosulfan Sulfate	1	Heptachlor epoxide	1	Endrin	1
Endrin Aldehyde	*	**Endrin**	*	PCB-1248	1	Endrin Ketone	1
4,4'-DDD	*	Endrin Ketone	1	PCB-1254	1	Endrin Aldehyde	1
4,4'-DDE	*	Endrin Aldehyde	1	PCB-1260	1	4,4'-DDD	1
4,4'-DDT	*	4,4'-DDD	1	2,4,5-T	1	4,4'-DDE	1
Heptachlor	*	4,4'-DDE	1	**MCPP**	*	4,4'-DDT	1
Heptachlor epoxide	*	4,4'-DDT	1	Dicamba	1	Heptachlor	1
MCPA	2	**Heptachlor**	*	delta - BHC	1	Heptachlor epoxide	1
Methoxychlor	*	**Heptachlor epoxide**	*	2,4,5 - TP	2	**MCPA**	*
PCB-1254	*	**MCPA**	*			**MCPP**	*
PCB-1260	1	**Methoxychlor**	*			Methoxychlor	1
2,4,5-T	1	**PCB - 1248**	*			PCB - 1248	1
2,4-D	2	**PCB-1254**	*			**PCB-1254**	*
		PCB-1260	*			PCB-1260	1
		2,4,5-T	1			2,4,5-T	1
		2,4,5-TP	1			2,4-D	1
		2,4-D	1			Dicamba	1
		2,4-DB	*				

* - Chemical will be evaluated in BERA (chemicals are in bold type)

1 - Hazard Quotient less than 1 - not evaluated in BERA

2 - No TRV available - not evaluated in BERA

Table 7.1-2. Baseline Assessment and Measurement Endpoints for the Evaluation of Aquatic Ecosystems, Site SS-63

Assessment Goal	Assessment Endpoint	Risk Questions	Measurement Endpoint
Protection of aquatic ecosystem structure and function	Protection of benthic and epibenthic invertebrate communities from toxic effects of contaminants in sediment to maintain species diversity, biomass, and nutrient cycling (trophic structure); to provide a food source for higher level consumers; and to insure that contaminant levels in benthic invertebrate tissue are low enough to minimize the risk of bioaccumulation and/or other negative toxic effects in higher trophic levels.	*Are levels of site contaminants in sediment sufficient to cause adverse alterations to the structure and/or function to the benthic community at either the population or community level?*	To determine whether concentrations of chemicals in sediment are toxic to benthic organisms, a 10-day toxicity evaluation was performed using the amphipod *Leptocheirus plumulosus*. The endpoint for this evaluation was survival. Test results were compared with those from a reference location. This test was used previously to determine toxicity of sediment during basewide toxicity testing at Langley AFB. Collocated sediment samples were analyzed for Target Analyte List (TAL) metals, Target Compound List (TCL) organics, PCTs, chlorinated herbicides, total organic carbon, particle size distribution, and percent moisture. Care was taken to collect sediment samples from depositional areas. To determine whether concentrations of chemicals in sediment which become resuspended and dissolved in the water column are toxic to organisms inhabiting the water column or upper portions of the benthic substrate and to determine whether contaminants are impacting the reproductive capability of these organisms, a 7-day toxicity evaluation was performed using mysid shrimp (*Mysidopsis bahia*). The endpoints for this evaluation were survival, growth and fecundity. Test results were compared with those from a reference location. To evaluate the effects of sediment resuspension on the water column and the subsequent impact on aquatic organisms, this test was performed using elutriate prepared by mixing sediment and water. This test provided insight into whether epibenthic organisms are being adversely affected by contaminants and addressed the potential effect of the frequent sediment resuspension, which occurs in the Back River. Collocated sediment samples were analyzed for TAL metals, TCL compounds, PCTs, chlorinated herbicides, total organic carbon, and particle size distribution.

Table 7.1-2. Baseline Assessment and Measurement Endpoints for the Evaluation of Aquatic Ecosystems, Site SS-63 (Continued)

Assessment Goal	Assessment Endpoint	Risk Questions	Measurement Endpoint
Protection of aquatic ecosystem structure and function.	Protection of benthic and epibenthic invertebrate communities from toxic effects of contaminants in sediment to maintain species diversity, biomass, and nutrient cycling (trophic structure); to provide a food source for higher level consumers; and to insure that contaminant levels in benthic invertebrate tissue are low enough to minimize the risk of bioaccumulation and/or other negative toxic effects in higher trophic levels.	*Are levels of site contaminants in sediment sufficient to cause adverse alterations to the structure and/or function to the benthic community at either the population or community level?*	To determine whether concentrations of chemicals in the sediment are causing adverse alterations to the structure of the benthic macroinvertebrate community, sediment samples were collected for identification and enumeration of benthic macroinvertebrates. Indices measuring the richness and diversity of species composition were used to assess community structure and for comparison with a reference location. Similar evaluation was performed at other near-shore locations at Langley during the PA/SI. Collocated sediment samples were analyzed for TAL metals, TCL compounds, PCTs, chlorinated herbicides, total organic carbon, particle size distribution, and percent moisture. To provide additional evidence concerning the potential for adverse effects to benthic organisms attributable to concentrations of chemicals in sediment collected from near-shore locations, these chemical data were used in the BERA in conjunction with TEVs to determine HQ values for COCs.
Protection of aquatic ecosystem structure and function.	Protecting fish communities from toxic effects of contaminants in surface water to maintain species diversity; also ensuring that ingestion of contaminants by fish not have a negative impact on growth or survival; additionally, ensuring that contaminant levels accumulated in fish tissue are low enough to minimize risk of accumulation and negative effects to higher trophic levels.	*Are levels of site contaminants in water and sediment sufficient to cause adverse alterations to the structure and reproductive capacity of the aquatic community?*	To provide information concerning the potential for adverse effects to the fish community attributable to concentrations of chemicals in the sediment and biota which are components of the fish diet, chemical data from sediment and biota samples collected from near-shore locations were used to estimate the dose of various chemicals to the fish. The diet of the selected indicator species, the Atlantic croaker, was assumed to consist of benthic invertebrates (assumed to have chemical concentrations equal to those detected in sediment), bivalves and killifish. The dose calculated for the croaker was then used in the BERA in conjunction with TEVs to determine HQ values for the COCs.

Table 7.1-2. Baseline Assessment and Measurement Endpoints for the Evaluation of Aquatic Ecosystems, Site SS-63 (Continued)

Assessment Goal	Assessment Endpoint	Risk Questions	Measurement Endpoint
Protection of aquatic ecosystem structure and function.	Protecting fish communities from toxic effects of contaminants in surface water to maintain species diversity; also ensuring that ingestion of contaminants by fish not have a negative impact on growth or survival; additionally, ensuring that contaminant levels accumulated in fish tissue are low enough to minimize risk of accumulation and negative effects to higher trophic levels.	*Are levels of site contaminants in water and sediment sufficient to cause adverse alterations to the structure and reproductive capacity of the aquatic community?*	To provide insight concerning whether chemicals contained in dietary components are accumulating in fish, samples of killifish were collected from near-shore locations adjacent to Langley AFB and analyzed for TAL metals, SVOCs, organochlorine pesticides, PCBs, PCTs, chlorinated herbicides, and cyanide. Samples of sport fish (predominantly croaker and spot) were also collected from near-shore locations adjacent to Langley and analyzed for the same list of chemicals. Because the sport fish were used for evaluation of potential adverse effects to human health, only the fillets were submitted for chemical analysis. Although analysis of the fillets excludes internal organs and other tissues in which chemicals may concentrate and may underestimate the concentrations of some chemicals in the fish, this was still considered to be useful information when used in conjunction with the killifish whole body data. The absence of specific chemicals or classes of chemicals in the fish tissue would provide an indication that these chemicals are being metabolized by the fish. To determine whether concentrations of chemicals in surface water and sediment are adversely affecting the aquatic community, samples of killifish were collected and analyzed for TAL metals, SVOCs, organochlorine pesticides, PCBs, PCTs, chlorinated herbicides, cyanide, percent lipids, percent solids, and percent water content. These data was compared to TEVs for survival or reproductive capacity from current scientific literature.

Table 7.1-2. Baseline Assessment and Measurement Endpoints for the Evaluation of Aquatic Ecosystems, Site SS-63 (Continued)

Assessment Goal	Assessment Endpoint	Risk Questions	Measurement Endpoint
Protection of aquatic ecosystem structure and function.	Protecting fish communities from toxic effects of contaminants in surface water to maintain species diversity; also ensuring that ingestion of contaminants by fish not have a negative impact on growth or survival; additionally, ensuring that contaminant levels accumulated in fish tissue are low enough to minimize risk of accumulation and negative effects to higher trophic levels.	*Are levels of site contaminants in water and sediment sufficient to cause adverse alterations to the structure and reproductive capacity of the aquatic community?*	To provide insight into the overall health of aquatic organisms and the potential for adverse effects from specific contaminants, samples of killifish and larger sport fish (such as spot or croaker) were carefully examined for any indication of stress or disease. At locations where elevated concentrations of specific contaminants are present such as lead concentrations in the vicinity of ERP Site LF-17 and PAH and PCB concentrations in the vicinity of Outfall 4 in the Southwest Branch, internal organs of fish were examined for contaminant-specific abnormalities. For lead, these include damage to the liver, kidney or gill. For PCBs and PAHs, these include damage to the liver or kidney. A similar evaluation was performed for fish obtained at a reference location. It is acknowledged that the fish collected during this effort cannot be closely associated with a discreet portion of shoreline because of their much larger home range, however, this effort still provides useful information concerning the health of fish whose range includes the contaminated areas as well as the overall health of the aquatic community.
Protection of aquatic ecosystem structure and function.	Protecting piscivorous birds to ensure that ingestion of contaminants in water or food organisms does not have negative impact on growth, survival, or reproduction.	*Are levels of site contaminants in surface water and fish sufficient to have adverse effects on the long-term health and reproductive capacity of aquatic feeding birds [belted kingfisher (Ceryle alcyon)] that utilize the site?*	^ food chain model was used to evaluate risk to aquatic feeding birds that utilize the site as a food source. The selected endpoint receptor species is the belted kingfisher (*Ceryle alcyon*). Fish were identified as the primary food source for the kingfisher with shellfish as a secondary source. A dietary dose was calculated based on ingestion of fish and shellfish. The concentration of COCs in the fish and in shellfish was obtained from direct measurement. The resulting total daily dose was compared to existing toxicity data through the calculation of a HQ.

Table 7.1-2. Baseline Assessment and Measurement Endpoints for the Evaluation of Aquatic Ecosystems, Site SS-63 (Continued)

Assessment Goal	Assessment Endpoint	Risk Questions	Measurement Endpoint
Protection of aquatic ecosystem structure and function.	Protecting semi-aquatic carnivorous mammals that feed on aquatic life to ensure that contaminants in water and in food organisms do not have a negative impact on growth, survival, or reproduction.	*Are levels of site contaminants in surface water and fish sufficient to have adverse effects on the long-term health and reproductive capacity of carnivorous semi-aquatic mammals [mink (Mustela vison)] that utilize the site?*	A food chain model was used to evaluate risk to carnivorous semi-aquatic mammals that utilize the site as a food source. The selected endpoint receptor species is the mink (*Mustela vison*). Fish and invertebrates were identified as the primary food source for the mink. A dietary dose was calculated based on ingestion of fish and invertebrates. The concentration of COCs in the fish was obtained from direct measurement. Concentrations of chemicals in invertebrates were assumed the same as those detected in sediment. The resulting total daily dose was compared to existing toxicity data through the calculation of a HQ.

* Measurement endpoint evaluated in the SERA.

Table 7.4-1

Summary of Baseline Assessment NOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
Inorganic Analytes				
Aluminum-max	**1.38E+00**	**8.28E+02**	6.75E-02	**2.94E+00**
Aluminum-mean	5.61E-01	**3.38E+02**	3.37E-02	**1.20E+00**
Antimony-max	**1.95E+00**	3.23E-02	1.65E-02	7.19E-03
Antimony-mean	2.85E-01	4.75E-03	7.51E-03	1.10E-03
Arsenic-max	**1.42E+00**	**3.80E+01**	NC	9.24E-01
Arsenic-mean	6.69E-01	**1.86E+01**	NC	4.52E-01
Barium-max	NC	**1.16E+03**	NC	1.52E-02
Barium-mean	NC	**5.26E+02**	NC	6.96E-03
Beryllium-max	**1.48E+00**	3.04E-01	NC	NC
Beryllium-mean	5.05E-01	1.04E-01	NC	NC
Cadmium-max	**1.72E+00**	**2.30E+00**	NC	NC
Cadmium-mean	2.34E-01	3.82E-01	NC	NC
Chromium-max	**3.02E+00**	**3.69E+01**	NC	8.34E-03
Chromium-mean	**1.32E+00**	**1.57E+01**	NC	3.65E-03
Cobalt-max	**1.56E+00**	**3.32E+01**	NC	NC
Cobalt-mean	5.89E-01	**1.25E+01**	NC	NC
Copper-max	NC	**8.56E+01**	NC	NC
Copper-mean	NC	**2.35E+01**	NC	NC
Cyanide-max	**1.04E+00**	NC	NC	NC
Cyanide-mean	2.51E-01	NC	NC	NC
Iron-max	NC	**4.22E+03**	NC	NC
Iron-mean	NC	**1.86E+03**	NC	NC
Lead-max	**7.81E+00**	**5.35E+03**	NC	6.37E-02
Lead-mean	**1.80E+00**	**1.24E+03**	NC	1.48E-02
Magnesium-max	NC	**1.04E+03**	**1.55E+00**	6.82E-01
Magnesium-mean	NC	**5.59E+02**	**1.28E+00**	4.47E-01
Manganese-max	NC	**9.80E+01**	NC	NC
Manganese-mean	NC	**4.32E+01**	NC	NC
Mercury-max	**1.17E+00**	**3.42E+03**	**2.07E+00**	3.77E-01
Mercury-mean	3.99E-01	**1.23E+03**	**1.18E+00**	1.39E-01

Table 7.4-1

Summary of Baseline Assessment NOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
Nickel-max	**2.57E+00**	**6.93E+02**	NC	NC
Nickel-mean	**1.11E+00**	**2.98E+02**	NC	NC
Selenium-max	**2.70E+00**	**7.83E+00**	NC	8.98E-02
Selenium-mean	**1.14E+00**	**4.81E+00**	NC	5.89E-02
Silver-max	**2.20E+00**	**9.27E+01**	NC	NC
Silver-mean	7.05E-01	**3.10E+01**	NC	NC
Thallium-max	NC	**1.84E+00**	NC	2.38E-01
Thallium-mean	NC	9.15E-01	NC	1.19E-01
Vanadium-max	NC	**8.22E+00**	NC	5.26E-02
Vanadium-mean	NC	**3.64E+00**	NC	2.34E-02
Zinc-max	NC	**4.44E+00**	3.12E-01	NC
Zinc-mean	NC	**1.21E+00**	2.43E-01	NC
Semivolatile Organic Compounds				
2-Methylnaphthalene-max	NC	**1.34E+01**	NC	NC
2-Methylnaphthalene-mean	NC	**1.34E+01**	NC	NC
Acenaphthene-max	NC	**2.24E+00**	NC	**1.79E+00**
Acenaphthene-mean	NC	1.90E-01	NC	1.52E-01
Acenaphthylene-max	**8.86E+00**	**4.93E+00**	NC	NC
Acenaphthylene-mean	**8.86E+00**	**4.93E+00**	NC	NC
Anthracene-max	**9.37E+03**	**8.80E+02**	NC	1.87E-01
Anthracene-mean	**4.31E+02**	**4.05E+01**	NC	8.62E-03
Benz(a)anthracene-max	**2.14E+01**	**9.44E+02**	NC	1.10E-01
Benz(a)anthracene-mean	9.25E-01	**4.13E+01**	NC	4.75E-03
Benzo(a)pyrene-max	**2.28E+01**	**3.36E+03**	NC	1.69E-01
Benzo(a)pyrene-mean	**1.03E+00**	**1.52E+02**	NC	7.58E-03
Benzo(b)fluoranthene-max	**9.95E+00**	**2.44E+03**	NC	3.83E-01
Benzo(b)fluoranthene-mean	5.10E-01	**1.27E+02**	NC	1.97E-02

Table 7.4-1

Summary of Baseline Assessment NOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
Benzo(g,h,i)perylene-max	**2.37E+01**	**1.95E+03**	NC	9.80E-02
Benzo(g,h,i)perylene-mean	**1.11E+00**	**9.30E+01**	NC	4.57E-03
Benzo(k)fluoranthene-max	**1.19E+01**	**2.91E+03**	NC	2.53E-01
Benzo(k)fluoranthene-mean	5.60E-01	**1.37E+02**	NC	1.19E-02
Bis(2-ethylhexyl)phthalate-max	**8.17E+00**	NC	NC	NC
Bis(2-ethylhexyl)phthalate-mean	**1.49E+00**	NC	NC	NC
Carbazole-max	NC	**1.94E+02**	NC	NC
Carbazole-mean	NC	**2.32E+01**	NC	NC
Chrysene-max	**1.30E+02**	**1.06E+01**	NC	4.27E-01
Chrysene-mean	**6.00E+00**	4.92E-01	NC	1.96E-02
Dibenz(a,h)anthracene-max	**2.40E+02**	**1.26E+02**	NC	NC
Dibenz(a,h)anthracene-mean	**2.27E+01**	**1.19E+01**	NC	NC
Dibenzofuran-max	NC	**6.17E+01**	NC	**2.14E+03**
Dibenzofuran-mean	NC	**1.67E+01**	NC	**5.80E+02**
Fluoranthene-max	**2.52E+01**	**1.16E+03**	NC	NC
Fluoranthene-mean	**1.02E+00**	**4.70E+01**	NC	NC
Fluorene-max	**4.81E+01**	**1.77E+02**	NC	NC
Fluorene-mean	**9.77E+00**	**3.59E+01**	NC	NC
Indeno(1,2,3-cd)pyrene-max	**2.27E+01**	**1.77E+03**	NC	NC
Indeno(1,2,3-cd)pyrene-mean	**1.09E+00**	**8.55E+01**	NC	NC
Naphthalene-max	NC	**7.79E+01**	NC	NC
Naphthalene-mean	NC	**3.32E+01**	NC	NC
Phenanthrene-max	**1.86E+01**	**5.60E+03**	NC	4.48E-01
Phenanthrene-mean	7.92E-01	**2.41E+02**	NC	1.90E-02

Table 7.4-1

Summary of Baseline Assessment NOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
Pyrene-max	**2.32E+01**	**1.20E+04**	NC	NC
Pyrene-mean	9.67E-01	**5.01E+02**	NC	NC
Phenol-max	NC	NC	**1.40E+02**	NC
Phenol-mean	NC	NC	**3.19E+01**	NC
2-Methylphenol-max	NC	**4.27E+00**	NC	NC
2-Methylphenol-mean	NC	**1.37E+00**	NC	NC
Pesticides & PCBs				
4,4'-DDD-max	**1.44E+01**	NC	NC	NC
4,4'-DDD-mean	**1.98E+00**	NC	NC	NC
4,4'-DDE-max	**5.48E+00**	NC	NC	NC
4,4'-DDE-mean	**1.10E+00**	NC	NC	NC
4,4'-DDT-max	**9.94E+01**	NC	NC	NC
4,4'-DDT-mean	**1.09E+01**	NC	NC	NC
Aldrin-max	**1.95E+00**	NC	NC	NC
Aldrin-mean	3.58E-01	NC	NC	NC
Arochlor 5432-max	**7.20E+02**	**2.65E+05**	NC	NC
Arochlor 5432-mean	**6.81E+01**	**2.55E+04**	NC	NC
Arochlor 6040-max	**3.80E+01**	**1.39E+04**	NC	NC
Arochlor 6040-mean	**6.12E+00**	**2.25E+03**	NC	NC
Arochlor 6062-max	**7.60E+01**	**2.79E+04**	NC	NC
Arochlor 6062-mean	**6.08E+00**	**2.23E+03**	NC	NC
Arochlor 6070-max	**1.50E+01**	**5.51E+03**	NC	NC
Arochlor 6070-mean	**3.88E+00**	**1.42E+03**	NC	NC
alpha-BHC-max	NC	**3.54E+03**	NC	NC
alpha-BHC-mean	NC	**8.17E+02**	NC	NC

Table 7.4-1

Summary of Baseline Assessment NOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
beta-BHC-max	NC	**5.92E+00**	NC	NC
beta-BHC-mean	NC	5.82E-01	NC	NC
delta-BHC-max	NC	3.93E-01	NC	NC
delta-BHC-mean	NC	6.45E-02	NC	NC
gamma-BHC(Lindane)-max	NC	**7.33E+02**	NC	NC
gamma-BHC(Lindane)-mean	NC	**6.13E+02**	NC	NC
alpha-Chlordane-max	NC	**8.30E+02**	NC	NC
alpha-Chlordane-mean	NC	**2.29E+02**	NC	NC
Endosulfan I-max	**6.00E+01**	NC	NC	NC
Endosulfan I-mean	**1.66E+01**	NC	NC	NC
Endosulfan II-max	**5.50E+02**	NC	NC	NC
Endosulfan II-mean	**4.91E+01**	NC	NC	NC
Endosulfan Sulfate-max	**6.50E+02**	NC	NC	NC
Endosulfan Sulfate-mean	**1.05E+02**	NC	NC	NC
Endrin-max	**4.34E+03**	6.04E-03	NC	NC
Endrin-mean	**1.43E+02**	1.99E-04	NC	NC
Endrin Ketone-max	**1.23E+03**	NC	NC	NC
Endrin Ketone-mean	**8.18E+01**	NC	NC	NC
Endrin Aldehyde-max	**1.02E+05**	NC	NC	NC
Endrin Aldehyde-mean	**5.95E+03**	NC	NC	NC
PCB-1248-max	NC	**2.56E+02**	NC	NC
PCB-1248-mean	NC	**7.23E+01**	NC	NC
PCB-1260-max	NC	**9.04E+03**	NC	NC
PCB-1260-mean	NC	**2.09E+03**	NC	NC
PCB-1254-max	**4.18E+02**	**1.57E+05**	NC	5.67E-01
PCB-1254-mean	**1.89E+01**	**8.75E+03**	NC	3.18E-02

Table 7.4-1

Summary of Baseline Assessment NOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
MCPA-max	NC	**4.99E+01**	NC	5.58E-01
MCPA-mean	NC	**7.65E+00**	NC	8.56E-02
MCPP-max	NC	NC	**2.75E+03**	**1.38E+00**
MCPP-mean	NC	NC	**1.31E+03**	6.61E-01
gamma-Chlordane-max	**2.84E+01**	**4.34E+04**	NC	NC
gamma-Chlordane-mean	**1.32E+00**	**2.02E+03**	NC	NC
Heptachlor-max	**6.00E+00**	**4.24E+02**	NC	NC
Heptachlor-mean	**2.84E+00**	**2.01E+02**	NC	NC
Heptachlor epoxide-max	**9.72E+00**	**9.40E+02**	NC	NC
Heptachlor epoxide-mean	**2.28E+00**	**2.42E+02**	NC	NC
Methoxychlor-max	**5.23E+04**	**8.52E+03**	NC	NC
Methoxychlor-mean	**2.00E+03**	**3.26E+02**	NC	NC
2,4-DB-max	NC	3.95E-01	NC	NC
2,4-DB-mean	NC	9.64E-02	NC	NC

For each COPEC, the top value was calculated using maximum media concentrations. The bottom value was calculated using mean media concentrations.
Bold values indicate the NOAEL-based hazard quotient is greater than or equal to one.

NC = Not Calculated, Chemical was eliminated during SERA

Table 7.4-2

Summary of Baseline Assessment LOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
Inorganic Analytes				
Aluminum-max	**1.00E+00**	**8.28E+01**	6.75E-03	2.94E-01
Aluminum-mean	4.08E-01	**3.38E+01**	3.37E-03	1.20E-01
Antimony-max	5.63E-03	3.23E-03	1.65E-03	7.19E-04
Antimony-mean	8.26E-04	4.75E-04	7.51E-04	1.10E-04
Arsenic-max	9.31E-02	**3.80E+00**	NC	9.24E-02
Arsenic-mean	4.38E-02	**1.86E+00**	NC	4.52E-02
Barium-max	NC	**1.16E+02**	NC	1.52E-03
Barium-mean	NC	**5.26E+01**	NC	6.96E-04
Beryllium-max	1.42E-01	3.04E-02	NC	NC
Beryllium-mean	4.85E-02	1.04E-02	NC	NC
Cadmium-max	1.62E-01	2.30E-01	NC	NC
Cadmium-mean	2.21E-02	3.82E-02	NC	NC
Chromium-max	3.50E-01	**3.69E+00**	NC	8.34E-04
Chromium-mean	1.53E-01	**1.57E+00**	NC	3.65E-04
Cobalt-max	1.64E-01	**3.32E+00**	NC	NC
Cobalt-mean	6.18E-02	**1.25E+00**	NC	NC
Copper-max	NC	**8.56E+00**	NC	NC
Copper-mean	NC	**2.35E+00**	NC	NC
Cyanide-max	5.87E-01	NC	NC	NC
Cyanide-mean	1.42E-01	NC	NC	NC
Iron-max	NC	**4.22E+02**	NC	NC
Iron-mean	NC	**1.86E+02**	NC	NC
Lead-max	**2.08E+00**	**5.35E+02**	NC	6.37E-03
Lead-mean	4.78E-01	**1.24E+02**	NC	1.48E-03
Magnesium-max	NC	**1.04E+02**	1.55E-01	6.82E-02
Magnesium-mean	NC	**5.59E+01**	1.28E-01	4.47E-02
Manganese-max	NC	**9.80E+00**	NC	NC
Manganese-mean	NC	**4.32E+00**	NC	NC
Mercury-max	1.35E-01	**3.42E+02**	2.07E-01	3.77E-02
Mercury-mean	4.59E-02	**1.23E+02**	1.18E-01	1.39E-02
Nickel-max	1.39E-01	**6.93E+01**	NC	NC
Nickel-mean	6.04E-02	**2.98E+01**	NC	NC

Table 7.4-2

Summary of Baseline Assessment LOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
Bis(2-ethylhexyl)phthalate-max	8.17E-01	NC	NC	NC
Bis(2-ethylhexyl)phthalate-mean	1.49E-01	NC	NC	NC
Carbazole-max	NC	**1.94E+01**	NC	NC
Carbazole-mean	NC	**2.32E+00**	NC	NC
Chrysene-max	**1.96E+01**	**1.06E+00**	NC	4.27E-02
Chrysene-mean	9.00E-01	4.92E-02	NC	1.96E-03
Dibenz(a,h)anthracene-max	**2.40E+01**	**1.26E+01**	NC	NC
Dibenz(a,h)anthracene-mean	**2.27E+00**	**1.19E+00**	NC	NC
Dibenzofuran-max	NC	**6.17E+00**	NC	**2.14E+02**
Dibenzofuran-mean	NC	**1.67E+00**	NC	**5.80E+01**
Fluoranthene-max	**2.10E+00**	**1.16E+02**	NC	NC
Fluoranthene-mean	8.50E-02	**4.70E+00**	NC	NC
Fluorene-max	**4.81E+00**	**1.77E+01**	NC	NC
Fluorene-mean	9.77E-01	**3.59E+00**	NC	NC
Indeno(1,2,3-cd)pyrene-max	**2.42E+00**	**1.77E+02**	NC	NC
Indeno(1,2,3-cd)pyrene-mean	1.17E-01	**8.55E+00**	NC	NC
Naphthalene-max	NC	**7.79E+00**	NC	NC
Naphthalene-mean	NC	**3.32E+00**	NC	NC
Phenanthrene-max	**2.42E+00**	**5.60E+02**	NC	4.48E-02
Phenanthrene-mean	1.03E-01	**2.41E+01**	NC	1.90E-03
Pyrene-max	**2.44E+00**	**1.20E+03**	NC	NC
Pyrene-mean	1.02E-01	**5.01E+01**	NC	NC
Phenol-max	NC	NC	**1.40E+01**	NC
Phenol-mean	NC	NC	**3.19E+00**	NC
2-Methylphenol-max	NC	4.27E-01	NC	NC
2-Methylphenol-mean	NC	1.37E-01	NC	NC

Table 7.4-2

Summary of Baseline Assessment LOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
Pesticides & PCBs				
4,4'-DDD-max	**1.60E+00**	NC	NC	NC
4,4'-DDD-mean	2.20E-01	NC	NC	NC
4,4'-DDE-max	3.09E-01	NC	NC	NC
4,4'-DDE-mean	6.22E-02	NC	NC	NC
4,4'-DDT-max	**3.31E+00**	NC	NC	NC
4,4'-DDT-mean	3.65E-01	NC	NC	NC
Aldrin-max	1.84E-01	NC	NC	NC
Aldrin-mean	3.37E-02	NC	NC	NC
Arochlor 5432-max	**7.20E+01**	**2.65E+04**	NC	NC
Arochlor 5432-mean	**6.81E+00**	**2.55E+03**	NC	NC
Arochlor 6040-max	**3.80E+00**	**1.39E+03**	NC	NC
Arochlor 6040-mean	6.12E-01	**2.25E+02**	NC	NC
Arochlor 6062-max	**7.60E+00**	**2.79E+03**	NC	NC
Arochlor 6062-mean	6.08E-01	**2.23E+02**	NC	NC
Arochlor 6070-max	**1.50E+00**	**5.51E+02**	NC	NC
Arochlor 6070-mean	3.88E-01	**1.42E+02**	NC	NC
alpha-BHC-max	NC	**3.54E+02**	NC	NC
alpha-BHC-mean	NC	**8.17E+01**	NC	NC
beta-BHC-max	NC	5.92E-01	NC	NC
beta-BHC-mean	NC	5.82E-02	NC	NC
delta-BHC-max	NC	3.93E-02	NC	NC
delta-BHC-mean	NC	6.45E-03	NC	NC
gamma-BHC(Lindane)-max	NC	**7.33E+01**	NC	NC
gamma-BHC(Lindane)-mean	NC	**6.13E+01**	NC	NC
alpha-Chlordane-max	NC	**8.30E+01**	NC	NC
alpha-Chlordane-mean	NC	**2.29E+01**	NC	NC
Endosulfan I-max	**6.00E+00**	NC	NC	NC

Table 7.4-2

Summary of Baseline Assessment LOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
Endosulfan I-mean	**1.66E+00**	NC	NC	NC
Endosulfan II-max	**5.50E+01**	NC	NC	NC
Endosulfan II-mean	**4.91E+00**	NC	NC	NC
Endosulfan Sulfate-max	**6.50E+01**	NC	NC	NC
Endosulfan Sulfate-mean	**1.05E+01**	NC	NC	NC
Endrin-max	**4.34E+01**	6.04E-04	NC	NC
Endrin-mean	**1.43E+00**	1.99E-05	NC	NC
Endrin Ketone-max	**1.23E+01**	NC	NC	NC
Endrin Ketone-mean	8.18E-01	NC	NC	NC
Endrin Aldehyde-max	**1.02E+04**	NC	NC	NC
Endrin Aldehyde-mean	**5.95E+02**	NC	NC	NC
PCB-1248-max	NC	**2.56E+01**	NC	NC
PCB-1248-mean	NC	**7.23E+00**	NC	NC
PCB-1260-max	NC	**9.04E+02**	NC	NC
PCB-1260-mean	NC	**2.09E+02**	NC	NC
PCB-1254-max	**4.18E+01**	**1.57E+04**	NC	5.67E-02
PCB-1254-mean	**1.89E+00**	**8.75E+02**	NC	3.18E-03
MCPA-max	NC	**4.99E+00**	NC	5.58E-02
MCPA-mean	NC	7.65E-01	NC	8.56E-03
MCPP-max	NC	NC	**2.75E+02**	1.38E-01
MCPP-mean	NC	NC	**1.31E+02**	6.61E-02

Table 7.4-2

Summary of Baseline Assessment LOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
gamma-Chlordane-max	**2.84E+00**	**4.34E+03**	NC	NC
gamma-Chlordane-mean	1.32E-01	**2.02E+02**	NC	NC
Heptachlor-max	6.00E-01	**4.24E+01**	NC	NC
Heptachlor-mean	2.84E-01	**2.01E+01**	NC	NC
Heptachlor epoxide-max	8.75E-01	**9.40E+01**	NC	NC
Heptachlor epoxide-mean	2.05E-01	**2.42E+01**	NC	NC
Methoxychlor-max	**5.23E+03**	**8.52E+02**	NC	NC
Methoxychlor-mean	**2.00E+02**	**3.26E+01**	NC	NC
2,4-DB-max	NC	3.95E-02	NC	NC
2,4-DB-mean	NC	9.64E-03	NC	NC

For each COPEC, the top value was calculated using maximum media concentrations. The bottom value was calculated using mean media concentrations.
Bold values indicate the LOAEL-based hazard quotient is greater than or equal to one.

NC =Not Calculated, Chemical was eliminated during SERA

Table 7.4-2

Summary of Baseline Assessment LOAEL-Based Hazard Quotients
Site SS-63

COPEC (maximum concentration) (mean Concentration)	Benthic Invertebrate	Atlantic Croaker	Belted Kingfisher	Mink
Selenium-max	2.43E-01	7.83E-01	NC	8.98E-03
Selenium-mean	1.03E-01	4.81E-01	NC	5.89E-03
Silver-max	2.09E-01	**9.27E+00**	NC	NC
Silver-mean	6.72E-02	**3.10E+00**	NC	NC
Thallium-max	NC	1.84E-01	NC	2.38E-02
Thallium-mean	NC	9.15E-02	NC	1.19E-02
Vanadium-max	NC	8.22E-01	NC	5.26E-03
Vanadium-mean	NC	3.64E-01	NC	2.34E-03
Zinc-max	NC	4.44E-01	3.12E-02	NC
Zinc-mean	NC	1.21E-01	2.43E-02	NC
Semivolatile Organic Compounds				
2-Methylnaphthalene-max	NC	**1.34E+00**	NC	NC
2-Methylnaphthalene-mean	NC	**1.34E+00**	NC	NC
Acenaphthene-max	NC	2.24E-01	NC	1.79E-01
Acenaphthene-mean	NC	1.90E-02	NC	1.52E-02
Acenaphthylene-max	8.86E-01	4.93E-01	NC	NC
Acenaphthylene-mean	8.86E-01	4.93E-01	NC	NC
Anthracene-max	**9.37E+02**	**8.80E+01**	NC	1.87E-02
Anthracene-mean	**4.31E+01**	**4.05E+00**	NC	8.62E-04
Benz(a)anthracene-max	**2.57E+00**	**9.44E+01**	NC	1.10E-02
Benz(a)anthracene-mean	1.11E-01	**4.13E+00**	NC	4.75E-04
Benzo(a)pyrene-max	**2.74E+00**	**3.36E+02**	NC	1.69E-02
Benzo(a)pyrene-mean	1.23E-01	**1.52E+01**	NC	7.58E-04
Benzo(b)fluoranthene-max	9.95E-01	**2.44E+02**	NC	3.83E-02
Benzo(b)fluoranthene-mean	5.10E-02	**1.27E+01**	NC	1.97E-03
Benzo(g,h,i)perylene-max	**2.27E+00**	**1.95E+02**	NC	9.80E-03
Benzo(g,h,i)perylene-mean	1.06E-01	**9.30E+00**	NC	4.57E-04
Benzo(k)fluoranthene-max	**1.19E+00**	**2.91E+02**	NC	2.53E-02
Benzo(k)fluoranthene-mean	5.60E-02	**1.37E+01**	NC	1.19E-03

APPENDIX B

ARARs

Table B.1
Summary of Federal and State ARARs
Langley Air Force Base, Virginia
ERP Site SS-63

FEDERAL		
Environmental Laws and Regulations	**Requirement Synopsis**	**Status**
National Environmental Policy Act of 1969		
Procedure for Implementing the National Environmental Policy Act and Assessing the Environmental Effects Abroad of EPA Actions		
Federal Executive Order 11988 40 CFR Part 6, Appendix A 40 CFR 6.302 (b), (d), (g) and (h)	Any activity located in a floodplain must comply with the provisions of this Executive Order. The Order requires that Federal activities in floodplains must reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and preserve the natural and beneficial values served by floodplains. Most of Langley AFB is located in the 100-year floodplain. The remedy must comply with the substantive provisions of the Exec. Order; however, CERCLA actions are exempt from the permit provision.	A
Federal Endangered Species Act of 1973: 16 U.S.C. § 1536 (a) (1) and (2)		
Interagency Cooperation Endangered Species Act of 1973, As Amended		
50 CFR Sections 402.10 (a) and (c)	Requires a determination as to whether any action is likely to jeopardize the continued existence of any endangered species or the critical habitat designated for such species. Endangered or threatened species have not been documented as roosting, nesting or living on Langley AFB, but the possibility of an incidental occurrence exists during the implementation of the remedial action at ERP Site SS-63 Southwest Branch.	R/A
Clean Water Act (Federal Water Pollution Control Act): 33 U.S.C. § 1344 (Section 404)		
Section 404(B)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material		
40 CFR 230	Regulates dredging and discharge of dredged materials (spoils) in navigable waters of the United States. The degradation Section requires that degradation or destruction of wetlands and other aquatic sites be avoided to the extent possible. Dredged or fill material must not be discharged to navigable waters if the activity contributes to the violation of Virginia water quality standards; violates any toxic effluent standard covered in CWA Sec. 307; jeopardizes endangered or threatened species; or violates requirements of Title III of the Marine Protection, Research, and Sanctuaries Act of 1972. In the case where a wetland has already been severely degraded due to prior discharges of waste, dredging activities conducted as part of the remedy would serve as an economic benefit and, therefore, the lead agency would not be obligated under Section 404 to mitigate the impacts which preceded the remedial fill operation. However, for those dredging actions that impact a wetland and cannot be avoided or minimized, enhancement, restoration, or creation of another wetland may be required. The remedy must comply with the substantive provisions of the Clean Water Act; however, CERCLA actions are exempt from the permit provision.	A

Table B.1 (continued)
Summary of Federal and State ARARs
Langley Air Force Base, Virginia
ERP Site SS-63

FEDERAL		
Environmental Laws and Regulations	**Requirement Synopsis**	**Status**
Toxic Substances Control Act		
Polychlorinated Biphenols (PCBs) Manufacturing, Processing, Distribution in Commerce and Use Prohibitions		
40 CFR 761.61 Sections (a)(5)(ii) and (c)	Allows for off-site disposal of PCB-contaminated waste, if the waste is dewatered onsite or transported offsite in appropriate containers. Establishes locations where PCB remediation waste may be disposed.	R/A
Coastal Zone Management Act		
15 CFR 930.30 and 930.34	Ensures that all Federal agency activities are undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of approved management programs. Requires Federal agencies to perform a consistency determination on activities affecting any coastal use or resource. Because the contaminated sediment is within a water body in the Virginia coastal zone, planned remedial activities will affect a coastal resource.	A

STATE		
Environmental Laws and Regulations	**Requirement Synopsis**	**Status**
Title 4 – Conservation and Natural Resources		
Agency 15 – Department of Game and Inland Fisheries		
Chapter 20 – Definitions and Miscellaneous in General		
4 VAC 15-20-130 and -140	These regulations adopt the federal list of endangered or threatened species and expand upon that list for purposes of actions in the Commonwealth of Virginia. Endangered or threatened species have not been documented as roosting, nesting or living on Langley AFB, but the possibility of an incidental occurrence exists during the implementation of the remedial action at ERP Site SS-63 Southwest Branch.	R/A
Agency 20 – Marine Resources Commission		
Chapter 390 – Wetlands Mitigation Compensation Policy		
4 VAC 20-390-10, -30, -40, and -50	Requires that any activity which would destroy tidal wetland be undertaken only if in the public interest and, then, the destroyed wetlands must be mitigated with creation of wetlands. This ARAR includes the substance of the requirement, not the requirement to procure a permit. Wetlands along the Southwest Branch shoreline may be impacted by the remedial action.	A

Table B.1 (continued)
Summary of Federal and State ARARs
Langley Air Force Base, Virginia
ERP Site SS-63

STATE		
Environmental Laws and Regulations	**Requirement Synopsis**	**Status**
Agency 50 – Virginia Soil and Water Conservation Board		
Chapter 30 – Erosion and Sediment Control Regulations		
4 VAC 50-30-10, -40, and -60	Establishes minimum standards for the control of erosion, sediment deposition, and runoff, and requires that an erosion and sediment control plan be implemented and maintained.	R/A
Title 9 – Environment		
Agency 5 – State Air Pollution Control Board		
Chapter 30 – Ambient Air Quality Standards		
9 VAC 5-30-10, -60, -65, and -66	These regulations are designed to ensure that ambient concentrations of air pollutants are consistent with established criteria, and, unless specified otherwise, apply throughout the Commonwealth of Virginia. Any air emissions from the remedial activities at the Site must meet these standards.	A
Agency 10 – Chesapeake Bay Local Assistance Board		
Chapter 20 – Chesapeake Bay Preservation Act Designation and Management Regulations		
9 VAC 10-20-120 and -130	Locally- designated tidal and non-tidal wetlands are subject to limitations regarding land-disturbing activities, removal of vegetation, use of impervious cover, erosion and sediment control, storm water management, and other aspects of land use that may have effects on water quality. The Back River, where ERP Site SS-63 is located, is a tributary of the Chesapeake Bay.	A
Agency 20 –Virginia Waste Management Board		
Chapter 80 – Solid Waste Management Regulations		
9 VAC 20-80-140	Defines a solid waste as any discarded material. This definition would apply to wastes generated by the ERP Site SS-63 Southwest Branch remedial action, including IDW.	A
9 VAC 20-80-630 and -650	Section 630 establishes procedures for the disposal of special wastes. Special wastes are defined as wastes that require special handling and precautions. Nonhazardous wastes generated during the ERP Site SS-63 remedial action, including IDW and materials containing PCBs, will be considered handled as a special waste. Section 650 clarifies PCB disposal requirements at 40 CFR 761, and makes clear that PCB remediation waste containing PCB concentrations between 1.0 ppm and 50 ppm are restricted to disposal in sanitary landfills or industrial waste landfills with leachate collection, liners, and appropriate ground water monitoring systems.	A

Table B.1 (continued)
Summary of Federal and State ARARs
Langley Air Force Base, Virginia
ERP Site SS-63

STATE		
Environmental Laws and Regulations	**Requirement Synopsis**	**Status**
Title 9 – Environment		
Agency 25 – State Water Control Board		
Chapter 31 – Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation		
9 VAC 25-31-50, -100.G.7, -220.A.1, -220.B.1, -220.D, and -220.E	Regulates the discharge of wastes and deleterious substances into State waters. Prohibits discharges of wastes that would alter the physical, chemical, or biological properties of a State water and result in detrimental effects on the beneficial use of the water. Under CERCLA, an onsite discharge of waste water to a surface water must meet the substantive requirements of VPDES, but it is not necessary to obtain a permit or comply with the administrative requirements of the permitting process. For an offsite discharge, it would be necessary to comply with the administrative requirements of the regulation.	A
Chapter 32 – Virginia Pollution Abatement (VPA) Permit Regulation		
9 VAC 25-32-30, -80, and -100	Prohibits direct discharges into water except in accordance with Virginia Pollution Abatement permits issued pursuant to the State Water Quality Control Law. While CERCLA does not require that permits be obtained for remedial activities, it is necessary for the remedial action to comply with effluent limitations that would be established under a permit and notification requirements in the event of exceedances of limits.	R/A
Chapter 210 – Virginia Water Protection Permit Program Regulation		
9 VAC 25-210-10, -50, -110 and -115	Prohibition on discharging any pollutant into, or adjacent to surface waters that would alter the physical, chemical or biological properties of surface waters and make them detrimental to the public health, or to animal or aquatic life. Includes Section 115 for substantive requirements only and does not include administrative permitting requirements.	A
Chapter 260 – Water Quality Standards		
9 VAC 25-260-10, -20, -30, -50 (class II), -140, -160, -185 and -290.	Establishes water quality standards to protect surface waters. If contaminants are discharged to a surface water body, the cleanup level at the discharge point would be the more stringent of the established cleanup levels for the Virginia or Federal surface water standard or criterion for protection of aquatic life.	R/A

Table B.1 (continued)
Summary of Federal and State ARARs
Langley Air Force Base, Virginia
ERP Site SS-63

STATE		
Environmental Laws and Regulations	**Requirement Synopsis**	**Status**
Title 9 – Environment		
Chapter 380 – Wetlands Policy		
9 VAC 25-380-30	This policy establishes the preservation and protection of wetlands ecosystems by: requiring proper control of any construction activities and of non-point sources to prevent discharges which would impair the quality of the wetland area; ensuring that wastewaters will be kept below a level that would not alter the natural, physical, chemical, or biological integrity of the wetland; minimizing the alteration of the quality and quantity of the natural flow of water to the ecosystem; protection of the wetlands from adverse dredging or filling practices, solid waste management practices, siltation, or the addition of contamination from non-point source wastes and through construction activities; and preventing violations of applicable water quality standards.	A

Key: A = Applicable R/A = Relevant and Appropriate
Note: For offsite activities, all applicable regulations apply at the time of the remedial action.