Final

RECORD OF DECISION
FOR OPERABLE UNIT 32
ENVIRONMENTAL RESTORATION
PROGRAM SITE WP-14
LANGLEY AIR FORCE BASE, VIRGINIA

August 2008

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LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
bgs	below ground surface
BTAG	Biological Technical Advisory Group
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act ("Superfund")
CFR	Code of Federal Regulations
CNS	central nervous system
COC	contaminant of concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSFs	carcinogenic slope factors
CSM	conceptual site model
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ERP	Environmental Restoration Program
FS	Feasibility Study
HGL	HydroGeoLogic, Inc.
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
ID	identification
IRP	Installation Restoration Program
LOAEL	lowest observed adverse effect level
μg/kg	micrograms per kilogram
NASA	National Aeronautics and Space Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAEL	no observed adverse effect level
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbon

RAB	Restoration Advisory Board
Radian	Radian International, LLC
RBC	Risk-Based Concentration
RBSL	risk-based screening level
RfDs	noncarcinogenic reference doses
RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SI	Site Investigation
SRA	screening risk assessment
TAL	target analyte list
URS	URS Corporation
USAF	U.S. Air Force
U.S.C.	U.S. Code
UTL	upper tolerance limit
VDEQ	Virginia Department of Environmental Quality

FINAL
RECORD OF DECISION FOR OPERABLE UNIT 32
ENVIRONMENTAL RESTORATION PROGRAM SITE WP-14
LANGLEY AIR FORCE BASE, VIRGINIA
AUGUST 2008

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Operable Unit 32 (OU32), Environmental Restoration Program (ERP) Site WP-14
Langley Air Force Base (AFB), Virginia
U.S. Environmental Protection Agency (EPA) Identification (ID) # VA2800005033

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) documents the U.S. Air Force's (USAF) determination that No Action is necessary to address soils at OU32 (ERP Site WP-14) at Langley AFB near Hampton, Virginia. This determination was made 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; this ROD will become part of the Administrative Record pursuant to the NCP.

The USAF is the lead agency and provides funding for site clean-up activities at Langley AFB. The USAF and EPA Region III agree and the Virginia Department of Environmental Quality (VDEQ) concurs that No Action is required for soils at OU32 (ERP Site WP-14).

1.3 ASSESSMENT OF THE SITE

OU32 is one of 24 ERP OUs identified under CERCLA at Langley AFB. The results of site environmental studies show that there are no hazardous constituents present in site soils at concentrations posing a potential unacceptable threat to human health and the environment. No response action is necessary at ERP Site WP-14 to protect public health and the environment from actual or threatened releases of hazardous substances.

1.4 DESCRIPTION OF THE SELECTED REMEDY

Under CERCLA, "No Action" is necessary for OU26. The USAF's determination that no action is necessary at ERP WP-14 is based on an evaluation of site conditions and site-related risks which are detailed in the ERP Site WP-14 Remedial Investigation (RI) Report (Radian International, LLC [Radian], 2000) and the ERP Site WP-14 Final Risk Re-Evaluation Report (HydroGeoLogic, Inc. [HGL], 2005). This report indicates that current conditions are

protective of human health and the environment. The No Action decision applies to the site surface and subsurface soils only. Groundwater associated with Site WP-14 will be addressed as part of the remedy for ERP site OT-64, the basewide groundwater operable unit. There is no surface water or sediment at the site.

The Management Action Plan for Langley AFB is updated annually and includes the current CERCLA status and schedule of remedial actions for each OU at Langley AFB. The Management Action Plan and supplemental information can be found in the Information Repository maintained at Langley AFB (see Section 2.3).

1.5 STATUTORY DETERMINATIONS

No remedial action is necessary to ensure protection of human health and the environment. The Selected Remedy is protective of human health and the environment and will not result in hazardous substances, pollutants, or contaminants remaining on site above levels that prevent unlimited use and unrestricted exposure. Therefore, 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.

- Chemicals of potential concern (COPCs) and their respective concentrations (Section 2.7 and associated tables).
- Baseline risk represented by the COPCs (Section 2.7).
- Current and reasonably anticipated future land and resource use (Section 2.6).

Additional information can be found in the Administrative Record file for Langley AFB. There are no costs associated with the No Action decision and no contaminants of concern (COCs) requiring establishment of cleanup levels.

1.7 AUTHORIZING SIGNATURES

Richard J. Wheeler 9Sep08

RICHARD J. WHEELER Date
Colonel, USAF
Deputy Director of Installations and Mission Support (A7)

James J Burke 9/17/08

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

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2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

Langley AFB is located near Hampton, Virginia, between the Northwest Branch and 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 layout of ERP Site WP-14, a former chemical leach pit, 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 Air Force and the NASA Langley Research Center investigations and site cleanups are funded by NASA. The USAF is the lead agency for CERCLA activities at Langley AFB; the EPA is the lead regulatory agency, and VDEQ is the support agency.

ERP Site WP-14 is located in the north-central portion of Langley AFB, north of Weyland Road near the Firing-in Abutment. Currently, the site is an open grassy area. The grass is well-maintained. The ground surface is relatively flat except for a soil berm that borders the site to the north and west. According to Langley AFB personnel, the source of this berm is golf course soils and sediments. A drainage ditch leading into Tabbs Creek runs along the western edge of the berm and forms the west border of the site. The site has a current land use and anticipated future land use of light industrial. Adjacent land use includes business (administration), light industrial, and recreation.

ERP Site WP-14 was originally identified as containing a chemical leach pit adjacent to a former taxiway. The leach pit was used to collect washdown and spills associated with the loading of pesticides onto spray airplanes. The main contaminant entering the leach pit was reportedly malathion, but contamination from other pesticides is believed possible. The operational dates for WP-14 are unknown; however, aerial photographs from 1963 show a topographic depression believed to be the leach pit area.

2.2 INVESTIGATION HISTORY

The following subsections summarize the investigations that have been conducted to address surface soil and subsurface soil at ERP Site WP-14. As previously stated, the groundwater associated with ERP Site WP-14 will be addressed as part of ERP Site OT-64, the basewide groundwater operable unit. No surface water or sediment is present at ERP Site WP-14. No CERCLA enforcement activities have been conducted at Langley AFB.

2.2.1 Installation Restoration Program Records Search for Langley AFB (CH2M HILL, 1981)

The Installation Restoration Program (IRP) Records Search was conducted to determine the potential, if any, for migration of toxic and hazardous materials off the Langley AFB installation boundaries. ERP Site WP-14 was identified as a result of this records search.

2.2.2 Site Inspection and Screening Risk Assessment for 33 Installation Restoration Program Sites (Radian Corporation, 1996)

In 1993 and 1994, a Site Inspection (SI) was conducted to determine the presence or absence of contamination at 33 IRP sites, including WP-14. In September 1993, 24 subsurface soil samples were collected from 12 locations at WP-14. The locations for the soil samples were chosen based on site knowledge and aerial photograph analysis. In December 1994, three surface soil samples were collected in low-lying areas of the site. Pesticides and herbicides were found in surface and subsurface soils. With respect to Target Analyte List (TAL) metals, only cadmium (in surface and subsurface soils) and arsenic (subsurface soils only) exceeded background levels. Polynuclear aromatic hydrocarbons (PAHs) were found in some subsurface soils. A screening risk assessment (SRA) performed on these data indicated that constituent concentrations in surface soils resulted in acceptable risks for all receptors. For subsurface soils, cancer risk exceeded $1x10^{-5}$ and non-cancer hazard indices exceeded 1 for residential receptors.

The SRA concluded that remediation of surface soil at ERP Site WP-14 may not be needed to protect human health, and that remediation of subsurface soil may not be needed unless the subsurface soil is brought to the surface by intrusive activities. A screening level ecological risk assessment (SLERA) identified the potential for adverse effects from exposure of wildlife to organochlorine pesticides and metals.

2.2.3 Remedial Investigation (Radian, 2000)

An RI was performed to characterize further the potential contamination at ERP Site WP-14. RI activities included collection of soil and groundwater samples. As discussed in Section 1.4, groundwater at ERP Site WP-08 will be addressed as part of ERP Site OT-64, the basewide groundwater operable unit, and only soil results are discussed below.

The RI soil sampling was conducted in May 1997. Six surface soil samples and 18 subsurface soil samples were collected from nine locations. The pesticide dieldrin was detected in one surface soil sample above its background upper tolerance limit (UTL) of 28.5 micrograms per kilogram (μg/kg) and risk-based screening level (RBSL) of 40 μg/kg. Arsenic and manganese were present at or above both their background UTLs and RBSLs in two surface soil samples. Only two constituents were reported in subsurface soils at concentrations above background UTLs and RBSLs. Dieldrin was detected in two near-surface soil samples (0.5 to 2 feet below ground surface [bgs]) and one deeper sample (2 to 4 feet bgs) at concentrations that exceed the dieldrin background UTL of 1.42 μg/kg and RBSL of 40 μg/kg. Arsenic was found in three deeper samples at concentrations that exceed both the background UTL and RBSL for arsenic. In addition, benzo[a]pyrene, which was not detected in background samples, was found above the RBSL of 89 μg/kg in one near-surface soil sample and in one deeper subsurface soil sample.

The Final RI Report for the site (Radian, 2000) contained a human health risk assessment (HHRA) and a SLERA. The HHRA concluded that arsenic present in surface and subsurface soils posed an unacceptable risk to potential future residents, and that manganese in surface

soils posed potential unacceptable risk to construction workers. The SLERA determined that site-related chemicals did not pose a threat to ecological receptors.

No principal threat wastes have been identified at ERP Site WP-14.

2.2.4 Feasibility Study (URS Corporation [URS], 2001a)

A Feasibility Study (FS) was conducted to evaluate, screen, and develop remedial alternatives to address the arsenic and manganese contamination in soil that posed a potential threat to human health. Remedial action objectives were identified, and alternatives were developed to reduce risks to human health. The Final FS Report (URS, 2001a) evaluated a land use control remedy, and a remedy to achieve unrestricted use of the site (soil excavation with off-site disposal). The conclusion of the FS was that both alternatives were feasible, with excavation providing a higher level of protection for human health and the environment and achieving unlimited use and unrestricted exposure.

2.2.5 Proposed Plan (URS, 2001b)

Pursuant to CERCLA Section 117 (Chapter 42 U.S. Code [42 U.S.C.] Section 9617) and the NCP (Section 300.430(f)(3)(ii)(B), 40 Code of Federal Regulations [CFR]), a Proposed Plan (URS, 2001b) was prepared in October 2001. Based on the evaluation in the FS, excavation with off-site disposal was identified as the preferred alternative for ERP Site WP-14.

2.2.6 Pre-Remedial Action Activities (HGL, 2005)

After the original Proposed Plan was finalized and prior to identifying the Selected Remedy for ERP Site WP-14 in a final ROD, additional soil samples were collected to better define the area requiring excavation. In September 2004, 87 surface soil samples were collected. All samples were analyzed for manganese and 85 samples were analyzed for arsenic, based on the distribution in surface soils. Twelve subsurface samples were collected from 3.5 to 4.0 feet bgs. The subsurface soil samples were analyzed for arsenic.

No substantial arsenic and manganese contamination was observed in the September 2004 soil samples. Consequently, the September 2004 arsenic and manganese concentrations were combined with the SI data and RI data, and the risks to future residents and construction workers were re-calculated with this expanded data set as well as updated exposure assumptions. The SI, RI, and 2004 arsenic and manganese data sets are shown in Tables 2.1 through 2.6. This re-evaluation of the human health risk is presented in the *Final Risk Re-Evaluation Report for ERP Site WP-14* (HGL, 2005). As documented in this report, the human health risks calculated with the expanded data set and updated exposure assumptions demonstrate that arsenic and manganese in the soil do not pose an unacceptable threat to either a future resident or a future construction worker. This report concluded that excavation and off-site disposal of the soil at ERP Site WP-14 is not warranted and recommended that the site be closed with no further action.

2.2.7 Revised Proposed Plan (HGL, 2008)

A Revised Proposed Plan was prepared in January 2008 to document the determination that contaminants in the ERP Site WP-14 soils do not warrant remediation, and to identify No Action as the preferred alternative for the site.

2.3 COMMUNITY PARTICIPATION

The USAF and EPA provide information regarding the cleanup of Langley AFB to the public through a 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 activities conducted under the community relations program complied with the requirements of CERCLA Sections 113(k)(2)(B)(i-v) and 117, 42 U.S. Code (U.S.C.) Sections 9613(k)(2)(B)(i-v) and 9617.

For the original Proposed Plan for ERP Site WP-14, Langley AFB provided a public comment period from October 8, 2001 to November 7, 2001. An announcement for a public meeting, the comment period, and the availability of the Proposed Plan and supporting documentation was published in the *Daily Press*, a newspaper of general circulation in Hampton, Virginia, on October 7, 2001. Additionally, this information was published in the *Langley Flyer*, a Langley AFB newspaper, on October 5, 2001. A public meeting was held at the Chamberlin Hotel, located at 2 Fenwick Road in Hampton, Virginia, on October 15, 2001.

Langley AFB provided a public comment period from February 3 through March 4, 2008, for the Revised Proposed Plan for ERP Site WP-14. To fulfill the public participation requirement under Section 117(a) of CERCLA, as amended by SARA, a Notice of Availability of the Revised Proposed Plan and supporting documentation and the public notice for the public comment period and the public meeting was published in the *Daily Press* (Newport News) newspaper. The public meeting to present the Revised Proposed Plan was held on February 12, 2008, at the Machen Elementary School, located in Hampton, Virginia.

The Revised Proposed Plan and previous investigation reports for ERP Site WP-14 are available to the public in the Administrative Record and Information Repository 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 RESPONSE ACTION

The USAF 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 (see Section 2.3).

This ROD documents the rationale for determining that No Action is necessary for ERP Site WP-14 soils. Groundwater underlying the site will be addressed as part of ERP Site OT-64, the basewide groundwater operable unit (OU52). Surface water and sediment are not present at the site; consequently, these media are not part of this ROD. No Action will be the final action for soil at Site WP-14.

2.5 SITE CHARACTERISTICS

Because historical accounts of potentially hazardous material and waste handling activities were noted at the site, several investigations were conducted at ERP Site WP-14 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 Administrative Record files maintained at Langley AFB (see Section 2.3).

2.5.1 Conceptual Site Model

The source of exposure at ERP Site WP-14 is contaminated surface soil and subsurface soil. The conceptual site models (CSMs) for human health (Figure 2.3) and ecological receptors (Figure 2.4) show potential exposure pathways for ERP Site WP-14. The HHRA and SLERA were based on these CSMs. A detailed description of the selection of human exposure pathways is presented in Appendix A.1.

2.5.2 Site Overview

ERP Site WP-14 is located north of Weyland Road near the Firing-in Abutment, in the north-central portion of Langley AFB. The site encompasses an area that used to be a chemical leach pit. The washdown and spills associated with the loading of pesticides onto spray airplanes collected in the leach pit where the fluid seeped into the ground or evaporated. The main contaminant entering the leach pit was reportedly malathion, but contamination from other pesticides is believed possible. The operational dates for ERP Site WP-14 are unknown. However, aerial photographs from 1963 show a topographic depression believed to be the leach pit area. Currently, the site is vacant of all structures and is covered by grass that is periodically mowed.

Except for the berm along the northwest corner, the site is relatively flat. Surface runoff flows to a drainage ditch bordering the site to the west. Water in this ditch flows northwest into Tabbs Creek, which eventually discharges to the Northwest Branch of the Back River. There are no classified wetlands on or adjacent to ERP Site WP-14.

The current land use for ERP Site WP-14 is classified as light industrial. This land use is not expected to change in the future. Adjacent land is business (administration), light industrial, recreation, and open.

No areas of archaeological or historical importance have been identified at the site.

2.5.3 Sampling Strategy

The intent of the 1993-1994 SI and the 1997 RI was to collect surface soil and subsurface soil data to characterize the nature and extent of contamination and to assess the potential risks to human health and the environment at ERP Site WP-14. The locations of the SI soil samples were selected on the basis of aerial photography and historical site knowledge. The RI samples were located to provide additional information on the area near the taxiway, and to assess the presence of contamination along the earthen berm. The purpose of the soil sampling conducted in 2004 was to delineate the soil originally scheduled for a remedial action to address arsenic and manganese contamination. These soil sample locations were selected based on the arsenic and manganese data collected during the SI and the RI.

2.5.4 Nature and Extent of Contamination

Pesticides, herbicides, and PAHs were detected in the soil samples collected at ERP Site WP-14. Concentrations of the organic compounds tended to be low. Only dieldrin and benzo(a)pyrene were detected at concentrations greater than the RBSLs.

Arsenic, manganese, antimony, barium, and cadmium were detected in surface soil samples at concentrations greater than their respective background 95 percent upper tolerance levels (UTLs), suggesting that these metals are contaminants. Arsenic was the only metal identified as a contaminant in the subsurface soils. The highest arsenic and manganese concentrations in the surface soil tended to be in samples collected adjacent to the berm in the northwest corner of the site.

The primary contaminant migration pathway for soil at ERP Site WP-14 is infiltration and leaching of precipitation through the soil to the groundwater system. The groundwater beneath ERP Site WP-14 will be addressed as part of ERP Site OT-64, the basewide groundwater operable unit. Because of the flat and vegetated nature of the site, surface water runoff and erosion are expected to contribute minimally to contaminant migration.

2.6 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The current and anticipated future land use at ERP Site WP-14 is categorized as light industrial, as defined in the Base General Plan. Adjacent property is designated as open space to the south, light industrial (the Fire Training Area) to the north, recreational (the golf course) to the west, and business administration (under construction) to the east. The reasonably anticipated future land use for the site is to remain light industrial under the Base General Plan. The USAF has no plan to change the existing land or resource use in the foreseeable future.

2.7 SUMMARY OF SITE RISKS

A HHRA and SLERA were completed to identify and characterize the current and potential future risks associated with the ERP Site WP-14 soil if no remediation is implemented. The

SLERA and HHRA evaluated exposure of ecological and human receptors to chemicals in the site soil and site groundwater. As described previously, the groundwater beneath ERP Site WP-14 will be addressed as part of ERP Site OT-64. Therefore, this description of site risks only addresses exposure to the ERP Site WP-14 soil. A detailed discussion of potential risks is provided in the Final RI Report (Radian, 2000). The conclusions of the RI HHRA with respect to the construction worker and future child resident were modified by the Risk Re-Evaluation Report (HGL, 2005), which incorporated additional soil data for arsenic and manganese and revised the exposure assumptions for these two metals.

Based on the re-evaluation of risks to human health, the HHRA concluded that site contaminants do not pose a threat to human health. The SLERA determined that, if no further action is taken, contaminants in the site surface soil do not pose a threat to the environment. No response action is required to protect human health and the environment. Accordingly, this ROD documents the rationale for determining that No Action is necessary for ERP Site WP-14.

2.7.1 Human Health Risk Summary

2.7.1.1 Chemicals of Potential Concern

The initial screening of the RI data resulted in identification of several COPCs for the surface soil and subsurface soil. 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 soil and subsurface soil COPCs included metals, dieldrin, and benzo(a)pyrene. Detailed information for the selection of COPCs at ERP Site WP-14 is provided in Section 6.5.1 of the Final RI Report (Radian, 2000).

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 WP-14 are identified in the CSM (Figure 2.3), and are described in detail in Table A.1. A detailed discussion of the exposure assessment for all the scenarios considered in the HHRA is provided in Section 6.5.2 of the Final RI Report (Radian, 2000). The receptors evaluated in the ERP Site WP-14 HHRA were the other worker, construction worker, industrial worker, child trespasser/visitor, fisher, and resident (adult and child). Each receptor is described below.

- **Child Trespasser** – The child trespasser may play at the site, thereby being exposed to the site surface soil through incidental ingestion and dermal contact.
- **Fisher** – This receptor was developed to evaluate the exposure of individuals who catch and consume fish from the Back River to chemicals in the groundwater that discharges to the Back River. This receptor is not exposed to the soil at ERP Site WP-14. Therefore, this receptor is not discussed further in this risk summary.

- **Other Worker –** The other worker is intended to represent a groundskeeper who spends the majority of his time outdoors tending yards and gardens, trimming shrubs, and performing other general outdoor duties. Currently, the potential exposure pathways for the groundskeeper are incidental ingestion and dermal contact with surface soil, and inhalation of fugitive dust emissions from the surface soil; however, the risk assessment performed in the Final RI Report (Radian, 2000) also includes an evaluation of risk to this receptor associated with subsurface soil exposure.
- **Industrial Worker –** The industrial worker is intended to represent a utility line worker who performs infrequent minor excavations to repair underground utility lines. Exposure pathways include incidental ingestion and dermal contact with surface soil and subsurface soil, and inhalation of dust and volatile emissions generated by excavation activities.
- **Resident (adult and child) –** For the potential future resident receptor, exposure pathways include incidental ingestion and dermal contact with surface and subsurface soil.
- **Construction Worker –** For the future construction worker, exposure pathways include incidental ingestion and dermal contact with surface soil and subsurface soil, and inhalation of dust and volatile emissions generated by excavation activities.

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 (non-carcinogenic reference doses [RfDs] and carcinogenic slope factors [CSFs]) published in the Integrated Risk Information System and the Health Effects Assessment Summary Tables databases, or in the EPA Region III Risk-Based Concentration (RBC) Table. The equations and assumptions for calculating receptor exposures to chemicals in soil are presented in Appendix A.4. 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 6.5.3 and in Appendix F.2 of the Final RI Report (Radian, 2000).

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 (e.g., 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 is less than the RfD, 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 6.5.4 and Appendix G3 of the Final RI Report (Radian, 2000) and in the Risk Re-Evaluation Report (HGL, 2005). The risk estimates are presented in tabular form in Appendices A.7 (non-cancer detail), A.8 (cancer detail), A.9 (non-cancer and cancer summary).

The risk re-evaluation revised the risk calculations only for those receptors and chemicals for which unacceptable health risks had been identified during the RI. Thus, the risk re-evaluation quantified only exposure of the construction worker to manganese, and exposure of the resident (age-adjusted and child) to arsenic. The risk re-evaluation did not re-quantify risks to the other worker, child trespasser, and industrial worker; the risks for these receptors were obtained directly from the RI Report without alteration.

With three exceptions, the tables in Appendices A.7 and A.8 present the original risk assessment (Radian, 2000) results. Tables 7.19, 7.20, and 8.19 are from the Risk Re-

Evaluation Report (HGL, 2005). Tables 7.19 and 7.20 present revised non-cancer risk evaluations for the child resident exposure to arsenic and the construction worker exposure to manganese, respectively. Table 8.19 presents the revised cancer risk for exposure of the age-adjusted resident to arsenic.

To update the cumulative non-cancer hazard for the construction worker, the HQs for the non-manganese COPCs were obtained from the RI Report and were combined with the revised manganese HQ in Table 9.2.RME. Only the HQs associated with site-related chemicals were included; HQs for metals present because of background conditions were excluded. CERCLA does not address potential risks or hazards associated with background conditions.

The cumulative non-cancer hazard for the child resident was updated in the same manner as described for the construction worker. The results are presented in Table 9.6.RME.

The original HHRA evaluated cancer risk to the adult resident and child resident, but did not perform an age-adjusted analysis. The age-adjusted analysis, which was used for the revised arsenic evaluation, provides a more conservative assessment than either the adult resident or child resident. To combine the original HHRA cancer risks with the revised arsenic cancer risk, the child resident and adult resident risks for the non-arsenic COPCs were added, and the sums were combined with the revised arsenic cancer risk in Table 9.5.RME.

The final RME risk estimates presented in Appendix A.9 are summarized below. These summaries only include the calculated risks associated with exposure to soil (ingestion and dermal absorption) and soil particulates in air. Any risk contributions from groundwater presented in Appendices A.7, A.8, and A.9 are excluded from the values presented.

- **Child Trespasser** – RME estimates for exposure (ingestion, dermal contact, and inhalation) to surface soil are within acceptable risk levels. The total non-cancer HI is 0.2 and the cancer risk is 2×10^{-6} across all pathways.
- **Other Worker** – RME risk estimates for exposure (ingestion, dermal contact, and inhalation) to surface soil are within acceptable risk levels. Currently, the potential exposure pathways for the groundskeeper are incidental ingestion and dermal contact with surface soil, and inhalation of fugitive dust emissions from the surface soil; however, the risk assessment performed in the Final RI Report (Radian, 2000) also includes an evaluation of risk to this receptor associated with subsurface soil exposure. The total non-cancer HI is 0.4 and the cancer risk is 9×10^{-6} across the soil exposure pathways.
- **Resident adult and child** – The risk to residential receptors was recalculated in the Risk Re-Evaluation Report (HGL, 2005). The revised RME risk estimates for exposure (ingestion and dermal contact) to surface soil and subsurface soil resulted in a cancer risk estimate of 7×10^{-5} for the age-adjusted adult/child resident, predominantly due to arsenic. The age-adjusted adult/child resident provides the most conservative cancer risk analysis for the resident receptor. For the non-cancer analysis, the most conservative receptor is the child

resident. For the child resident, the highest target organ HI from exposure to site-related chemicals in the soil was 1.2 due to arsenic, which affects the skin and vascular system. This HI of 1.2 reflects the results of the risk re-evaluation with the expanded arsenic surface and subsurface soil data set. The HI for the central nervous system (CNS) is less than 1 (0.4, due to manganese). In the case of arsenic, with a daily chronic intake approximately equal to the chronic reference dose, it is unlikely that a future child resident would experience an adverse non-cancer health effect due to the arsenic at the site. Thus, no site-related chemical posed an unacceptable non-cancer hazard or cancer risk to the future adult or child resident.

- **Construction Worker –** RME risk estimates for exposure (ingestion, dermal contact, and inhalation of fugitive dust and volatile emissions) to surface soil and subsurface soil are within acceptable risk levels. The total cancer risk is 8 x 10^{-6}, and the site-related non-cancer HI attributable to manganese (CNS) is 0.1; the HI for arsenic (skin/vascular) is 0.3. The manganese HI reflects the risk re-evaluation with the expanded surface and subsurface soil data set.
- **Industrial Worker –** RME risk estimates for exposure (ingestion, dermal contact, and inhalation of fugitive dust and volatile emissions) to surface soil and subsurface soil are within acceptable risk levels. The total cancer risk is 6 x 10^{-7}, and the total non-cancer HI is 0.7.

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 6.5.5 of the Final RI Report (Radian, 2000). The uncertainties identified in the RI Report are also applicable to the risk re-evaluation conducted by HGL in 2005. The uncertainties identified in the RI were not considered to have a substantial impact on the conclusions of the original HHRA or the risk re-evaluation. Conservative assumptions were used in order to ensure that any resulting error would tend to overestimate risk.

2.7.2 Ecological Risk Assessment

2.7.2.1 Chemicals of Potential Ecological Concern

The first phase of the ecological risk assessment (ERA) at ERP Site WP-14 compared maximum concentrations of all analytes in surface and subsurface soil to EPA Region III Biological Technical Advisory Group (BTAG) screening values. The resulting chemicals of potential ecological concern (COPECs) identified in surface soil are presented in Appendix A.10.

2.7.2.2 Exposure and Ecological Effects Assessment

The ecological setting at ERP Site WP-14 consists of a mowed lawn that could provide an area for birds and animals to forage. Although there is a drainage ditch along the earthen berm, exposure to surface water was determined to be an incomplete pathway because of the infrequency with which the ditch contains water. Based on the CSM (Figure 2.4), the SLERA characterized potential risks to terrestrial receptors from exposure to surface soil. The terrestrial receptors selected for this assessment were the earthworm, deer mouse, red fox, American robin, and red-tailed hawk. These species were selected due to their potential presence at ERP Site WP-14 and their importance in the food chain. A detailed description of each ecological receptor is provided in Appendix H of the Final RI Report (Radian, 2000). Appendix A.10 presents the ecological exposure pathways of concern for the surface soil, including receptors, exposure routes, and assessment and measurement endpoints. No sensitive environments or endangered or threatened species have been identified at Langley AFB.

A toxicity/bioaccumulation study specific to Langley AFB was conducted using earthworms. The resulting toxicity data were used to estimate risks to earthworms at ERP Site WP-14. Food chain models were used to evaluate risks to the American robin, red-tailed hawk, deer mouse, and red fox. Equations used to determine the total daily dose for receptor species are provided in Appendix H of the Final RI Report (Radian, 2000). A detailed discussion of the exposure and ecological effects assessment considered in the ERA is provided in Section 6.6 of the Final RI Report (Radian, 2000).

2.7.2.3 Ecological Risk Characterization

To characterize potential ecological risks, HQs were determined for the chemicals of potential ecological concern and receptors. HQs were calculated by comparing maximum and mean site concentrations to the associated no observed adverse effects level (NOAEL) and lowest observed adverse effects level (LOAEL):

$$\text{NOAEL or LOAEL HQ} = [\text{Mean or Maximum Total Daily Dose}]/[\text{NOAEL or LOAEL}]$$

For each receptor, the SLERA 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 did not 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 the average chemical exposure level was less than the LOAEL (mean LOAEL-based $HQ < 1$), then the chemical did not pose an unacceptable threat to ecological receptors. Chemicals with mean LOAEL-based HQs greater than or equal to 1 were identified as COPECs and were evaluated in greater detail. The detailed evaluation considered a number of factors. First, the analysis identified those COPECs present at background levels. If a chemical's presence was due to background conditions, the chemical was eliminated as a COPEC because CERCLA does not address potential effects associated with background conditions. If a COPEC's presence was determined to be due to a site-related release, the

evaluation assessed the detection frequency, spatial distribution, chemical bioavailability, and conservatism of the toxicity values.

Aluminum, antimony, beryllium, thallium, and vanadium were identified as having the potential to pose a threat to ecological receptors. However, the concentrations of these five metals were consistent with background values, indicating that the metals were due to background conditions and not to historical use of the Site. CERCLA does not address potential effects associated with background conditions.

2.7.2.4 Uncertainty

The results of the SLERA 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 discussion of the uncertainties associated with the SLERA is included in Section 6.6.15 of the Final RI Report (Radian, 2000).

2.7.3 Conclusion

The chemicals potentially released at ERP Site WP-14 during historical use of the site do not pose a threat to human health or the environment. Therefore, no response action is necessary.

2.8 DOCUMENTATION OF SIGNIFICANT CHANGES

The *Revised Proposed Plan for Operable Unit 32 (ERP Site WP-14) at Langley AFB, Virginia* (HGL, 2008), was released for public comment in February 2008. The Revised Proposed Plan identified No Action is necessary for protection of human health and the environment. No comments were received during the public comment period; therefore, no significant changes to this decision identified in the Revised Proposed Plan were necessary or appropriate.

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TABLES

Table 2.1
Arsenic and Manganese in Surface Soils (mg/kg)
Site WP-14, Langley AFB, VA

	SI Results			RI Results							Data			Background		
Sample:	**14S01**	**14S02**	**14S03**	**14SS04**	**14SS05**	**14SS05 (DUP)**	**14SS06**	**14SS07**	**14SS08**	**14SS09**	**Summary**			**Summary Statistics**		
Depth (ft bgs):	**0.0-0.25**	**0.0-0.25**	**0.0-0.25**	**0.0-0.5**	**0.0-0.5**	**0.0-0.5**	**0.0-0.5**	**0.0-0.5**	**0.0-0.5**	**0.0-0.5**	**Min.**	**Mean**	**Max.**	**Mean**	**95% UCL**	**95% UTL**
Parameter																
Arsenic	6.35	29.4	3.2	28.1	31.1	32.3	2.88	2.78	20.2	8.53	2.78	16.484	32.3	8.99	11.9	23.8
Manganese	56.7	305	24.2	334	393	347	36	45.3	240	71.3	24.2	185.25	393	116	159	334

Table 2.2
Arsenic and Manganese in Near-Surface Sub-Surface Soils (mg/kg)
Site WP-14, Langley AFB, VA

	SI Results												Data Summary			Background Summary Statistics		
Sample:	**14B01**	**14B02**	**14B03**	**14B04**	**14B05**	**14B06**	**14B07**	**14B08**	**14B09**	**14B10**	**14B11**	**14B12**						
Depth (ft bgs):	**1.0-2.5**	**1.0-3.0**	**1.0-2.5**	**1.0-2.5**	**1.0-2.5**	**0.5-2.5**	**0.5-2.5**	**1.0-2.5**	**1.0-2.5**	**1.0-2.5**	**1.0-2.5**	**1.0-2.5**	**Min.**	**Mean**	**Max.**	**Mean**	**95% UCL**	**95% UTL**
Parameter																		
Arsenic	3.03	6.43	34.7	4.5	30.6	6.93	9.69	10.9	4.82	4.11	19.5	9.95	3.03	12.1	34.7	28.6	46.9	66.7
Manganese	44.3	32.2	543	24.8	123	109	122	127	41.8	23.4	1010	66.4	23.4	188.9	1010	333	588	1100

	RI Results											Data Summary			Background Summary Statistics		
Sample:	**14DPS1**	**14DPS2**	**12DPS2 (DUP)**	**14DPS3**	**14DPS4**	**14DPS5**	**14DPS6**	**14DPS7**	**14DPS7 (DUP)**	**14DPS8**	**14DPS9**						
Depth (ft bgs):	**0.5-2.0**	**0.5-2.0**	**0.5-2.0**	**0.5-2.0**	**0.5-2.0**	**0.5-2.0**	**0.5-2.0**	**0.5-2.0**	**0.5-2.0**	**0.5-2.0**	**0.5-2.0**	**Min.**	**Mean**	**Max.**	**Mean**	**95% UCL**	**95% UTL**
Parameter																	
Arsenic	5.37	30.3	36.2	16.7	22.2	3.64	6.74	15.9	18.6	6.6	22.6	3.64	16.8	36.2	28.6	46.9	66.7
Manganese	47.6	181	235	91.7	132	20.3	90.1	187	187	66.6	433	20.3	151.9	433	333	588	1100

Table 2.3
Arsenic and Manganese in Deeper Sub-Surface Soils (mg/kg)
Site WP-14, Langley AFB, VA

	SI Results														Data			Background Summary		
Sample:	14B01	14B02	14B02 (DUP)	14B03	14B04	14B05	14B05 (DUP)	14B06	14B07	14B08	14B09	14B10	14B11	14B12	Summary			Statistics		
Depth (ft bgs):	3.5-4.5	3.5-5.5	3.5-5.5	2.5-4.5	3.5-5.0	2.5-4.5	2.5-4.5	4.5-5.5	3.5-5.0	2.5-4.0	2.5-4.0	3.5-4.5	3.0-4.5	4.0-5.0	Min.	Mean	Max.	Mean	95% UCL	95% UTL
Parameter																				
Arsenic	30.8	44.2	22.2	50.8	59.3	157	40.9	46.6	38.7	48.9	64.3	8.88	13.6	35.9	8.88	47.2914	157	28.6	46.9	66.7
Manganese	208	181	50.4	163	273	919	671	166	510	636	200	306	66.5	285	50.4	331.064	919	333	588	1100

	RI Results									Data			Background Summary		
Sample:	14DPS1	14DPS2	14DPS3	14DPS4	14DPS5	14DPS6	14DPS7	14DPS8	14DPS9	Summary			Statistics		
Depth (ft bgs):	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	Min.	Mean	Max.	Mean	95% UCL	95% UTL
Parameter															
Arsenic	20.9	40.6	112	31.5	21.3	7.63	24.2	108	75.8	7.63	49.1033	112	28.6	46.9	66.7
Manganese	29.9	532	291	315	538	72.6	258	477	338	29.9	316.833	538	333	588	1100

Table 2.4
Arsenic Quantified in Surface Soil Samples (mg/kg)
September 2004 Pre-Confirmation Sampling
Site WP-14, Langley AFB, VA

Excavation Number	Sampling Quadrant								Sample Location	Background	Background
	Q1	Q12	Q2	Q23	Q3	Q34	Q4	Q14	Average	Mean	95% UTL
SO-1 (120 ft.)	**37.3**	13.9	23.7	**33.3**	18.9	-	-	-	**25.4**	8.99	23.8
SO-2 (120 ft.)	5.2	**26.1**	3.9	**53.1**	17.1	**30.3**	22.9	12.4	**21.4**	8.99	23.8
SO-3 (120 ft.)	23.1	4.0	4.6	17.0	-	-	-	**29.9**	**15.7**	8.99	23.8
SO-5 (120 ft.)	12.4	**30.1**	-	-	-	-	-	23.5	**22.0**	8.99	23.8
SO-1 (60 ft.)	14.4	**47.8**	**32.2**	**33.0**	**26.4**	6.7	13.6	**30.8**	**25.6**	8.99	23.8
SO-2 (60 ft.)	**33.2**	**45.3**	**38.6**	**28.1**	**40.9**	**35.9**	21.5	22.0	**33.2**	8.99	23.8
SO-3 (60 ft.)	23.3	4.1	-	**48.6**	20.9	**29.8**	**37.0**	**37.0**	**28.7**	8.99	23.8
SO-5 (60 ft.)	**41.0**	10.4	-	8.4	4.4	**30.5**	**47.2**	**31.7**	**24.8**	8.99	23.8
SO-1 (45 ft.)	**32.2**	-	**32.2**	-	**28.4**	-	21.8	-	**28.7**	8.99	23.8
SO-2 (45 ft.)	**29.5**	-	**37.2**	-	22.8	-	**40.0**	-	**32.4**	8.99	23.8
SO-3 (45 ft.)	22.9	-	-	-	22.7	-	**42.8**	-	**29.5**	8.99	23.8
SO-5 (45 ft.)	**36.5**	-	-	-	17.6	-	19.5	-	**24.5**	8.99	23.8
SO-1 (30 ft.)	11.1	-	18.4	-	16.1	-	11.8	-	**14.4**	8.99	23.8
SO-2 (30 ft.)	17.7	-	**30.0**	-	**25.8**	-	20.8	-	**23.6**	8.99	23.8
SO-3 (30 ft.)	11.0	-	2.3	-	21.8	-	14.4	-	**12.4**	8.99	23.8
SO-4 (30 ft.)	3.1	-	2.7	-	3.3	-	2.1	-	2.8	8.99	23.8
SO-5 (30 ft.)	16.9	-	7.7	-	13.0	-	10.2	-	**12.0**	8.99	23.8

Notes:

Sample location average values in bold exceed the background mean

Individual sample results in bold exceed the background 95% UTL.

Table 2.5
Manganese Quantified in Surface Soil Samples (mg/kg)
September 2004 Pre-Confirmation Sampling
Site WP-14, Langley AFB, VA

Excavation Number	Sampling Quadrant								Sample Location	Background	Background
	Q1	Q12	Q2	Q23	Q3	Q34	Q4	Q14	Average	Mean	95% UTL
SO-1 (120 ft.)	**466**	**365**	**349**	**543**	**681**	-	-	-	**480.8**	116	334
SO-2 (120 ft.)	292	310	316	**519**	213	**514**	**543**	238	**368.1**	116	334
SO-3 (120 ft.)	284	64.8	38.9	232	-	-	-	**448**	**213.5**	116	334
SO-5 (120 ft.)	200	280	-	-	-	-	-	**509**	**329.7**	116	334
SO-1 (60 ft.)	248	**568**	**433**	**433**	**354**	**388**	265	**435**	**390.5**	116	334
SO-2 (60 ft.)	**538**	**542**	**631**	**379**	**679**	**576**	**359**	320	**503.0**	116	334
SO-3 (60 ft.)	249	27.6	-	**1140**	331	**424**	**379**	**372**	**417.5**	116	334
SO-5 (60 ft.)	**475**	116	111	84.1	56.6	**395**	**644**	**363**	**280.6**	116	334
SO-1 (45 ft.)	**445**	-	**443**	-	**364**	-	239	-	**372.8**	116	334
SO-2 (45 ft.)	**447**	-	**587**	-	313	-	**870**	-	**554.3**	116	334
SO-3 (45 ft.)	**346**	-	-	-	191	-	**605**	-	**380.7**	116	334
SO-5 (45 ft.)	**645**	-	157	-	195	-	234	-	**307.8**	116	334
SO-1 (30-ft.)	290	-	**363**	-	**399**	-	286	-	**334.5**	116	334
SO-2 (30 ft.)	**463**	-	**512**	-	**443**	-	**430**	-	**462.0**	116	334
SO-3 (30 ft.)	236	-	35.1	-	**385**	-	136	-	**198.0**	116	334
SO-4 (30 ft.)	4.9	-	5.2	-	23.9	-	7.0	-	10.3	116	334
SO-5 (30 ft.)	316	-	163	-	198	-	198	-	**218.8**	116	334

Notes:

Sample location average values in bold exceed the background mean

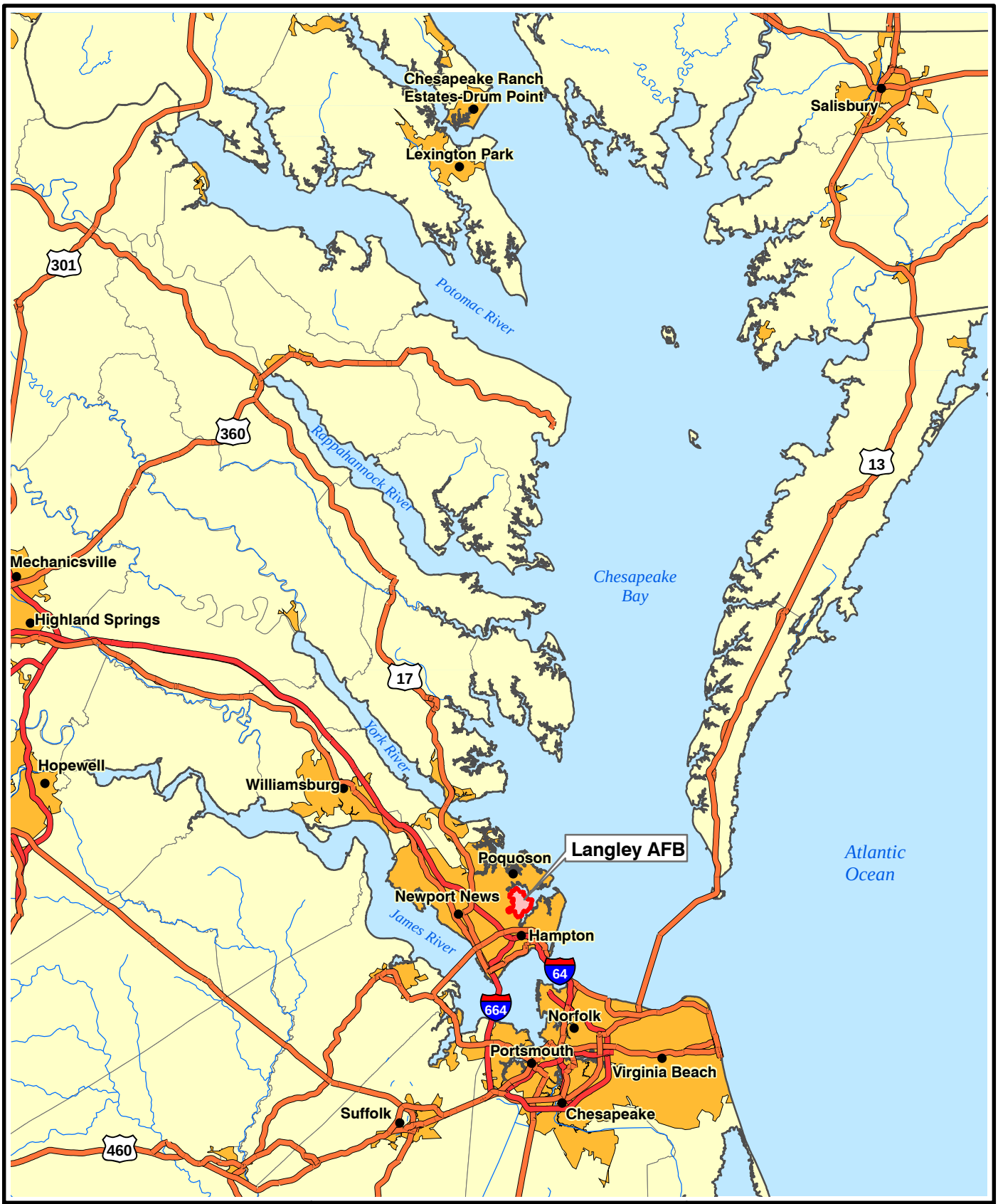
Individual sample results in bold exceed the background 95% UTL.

Table 2.6
Arsenic Quantified in Deeper Subsurface Samples (mg/kg)
September 2004 Pre-Confirmation Sampling
Site WP-14, Langley AFB, VA

Excavation Number	Sampling Quadrant				Sample Location	Background	Background
	Q1	Q2	Q3	Q4	Average	Mean	95% UTL
SS-3 (30 ft.)	15.5	17.6	11.5	14.1	14.7	28.6	66.7
SS-4 (30 ft.)	10.2	11.1	4.4	9.0	8.7	28.6	66.7
SS-5 (30 ft.)	11.3	17.6	21.8	20.8	17.9	28.6	66.7

Notes:
Sample location average values in bold exceed the background mean
Individual sample results in bold exceed the background 95% UTL.

FIGURES



Map Source:
HydroGeoLogic, Inc.
GIS Database, 2006

US Army Corps of Engineers

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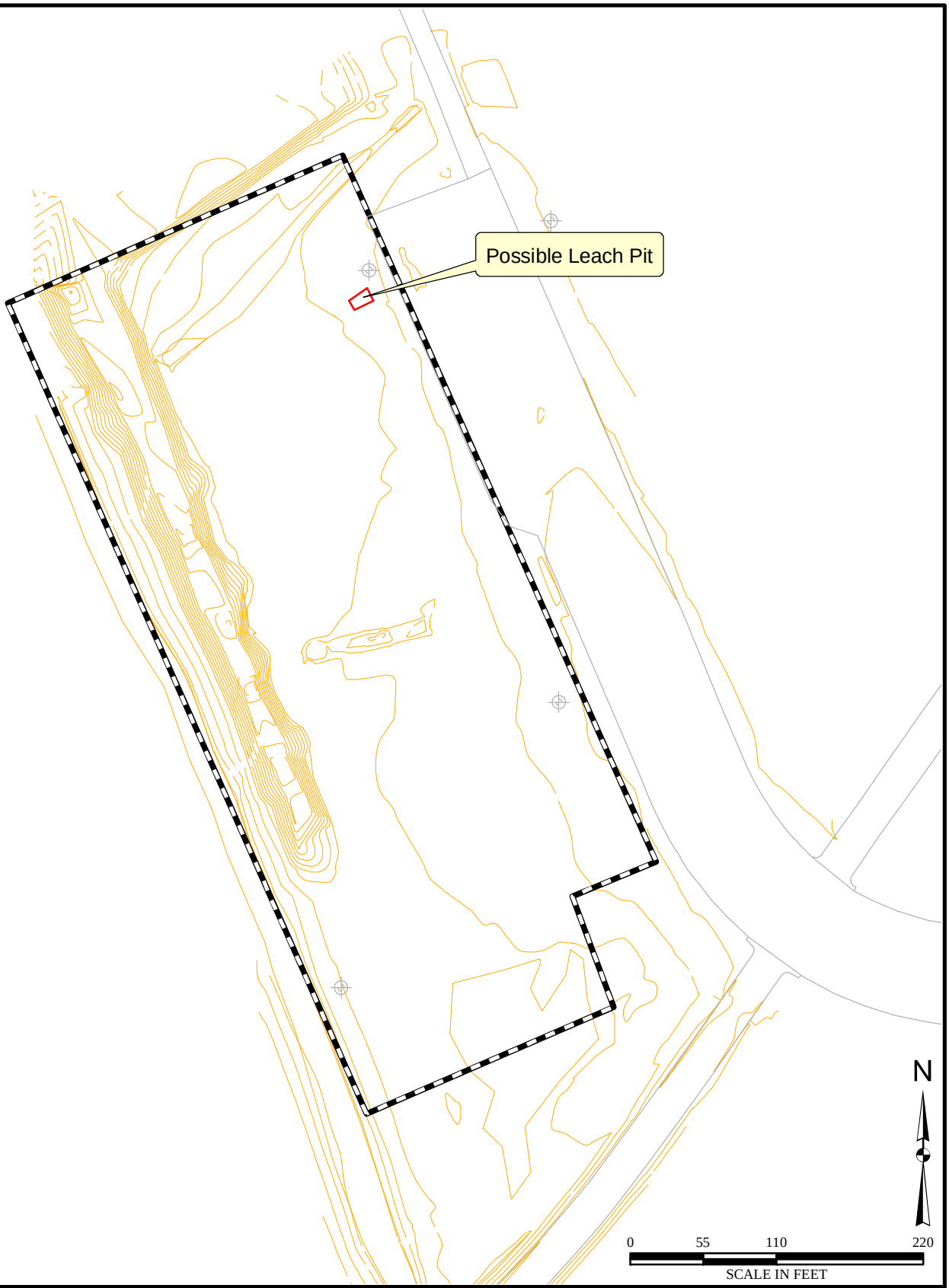
Figure 2.1
Location Map
Langley AFB



Map Source:
HGL GIS Database

US Army Corps of Engineers

O10.1.18 02-12-08 BF
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WP-14_RoD/Site_WP-14.mxd

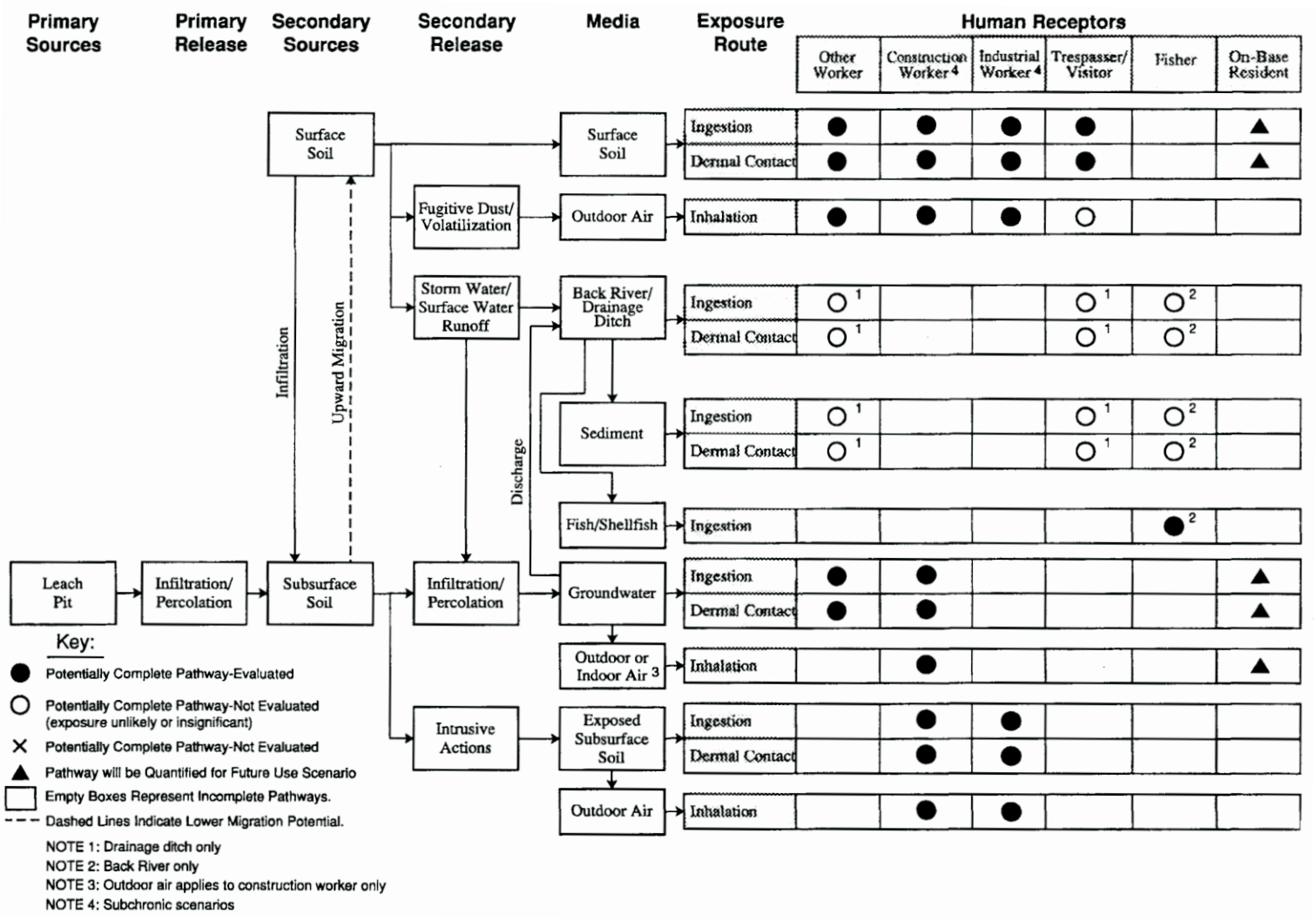
Legend

ERP Site

Aerial Photograph Finding (Radian, 1993)

Topographic Contour

Figure 2.2
ERP Site WP-14
Langley AFB



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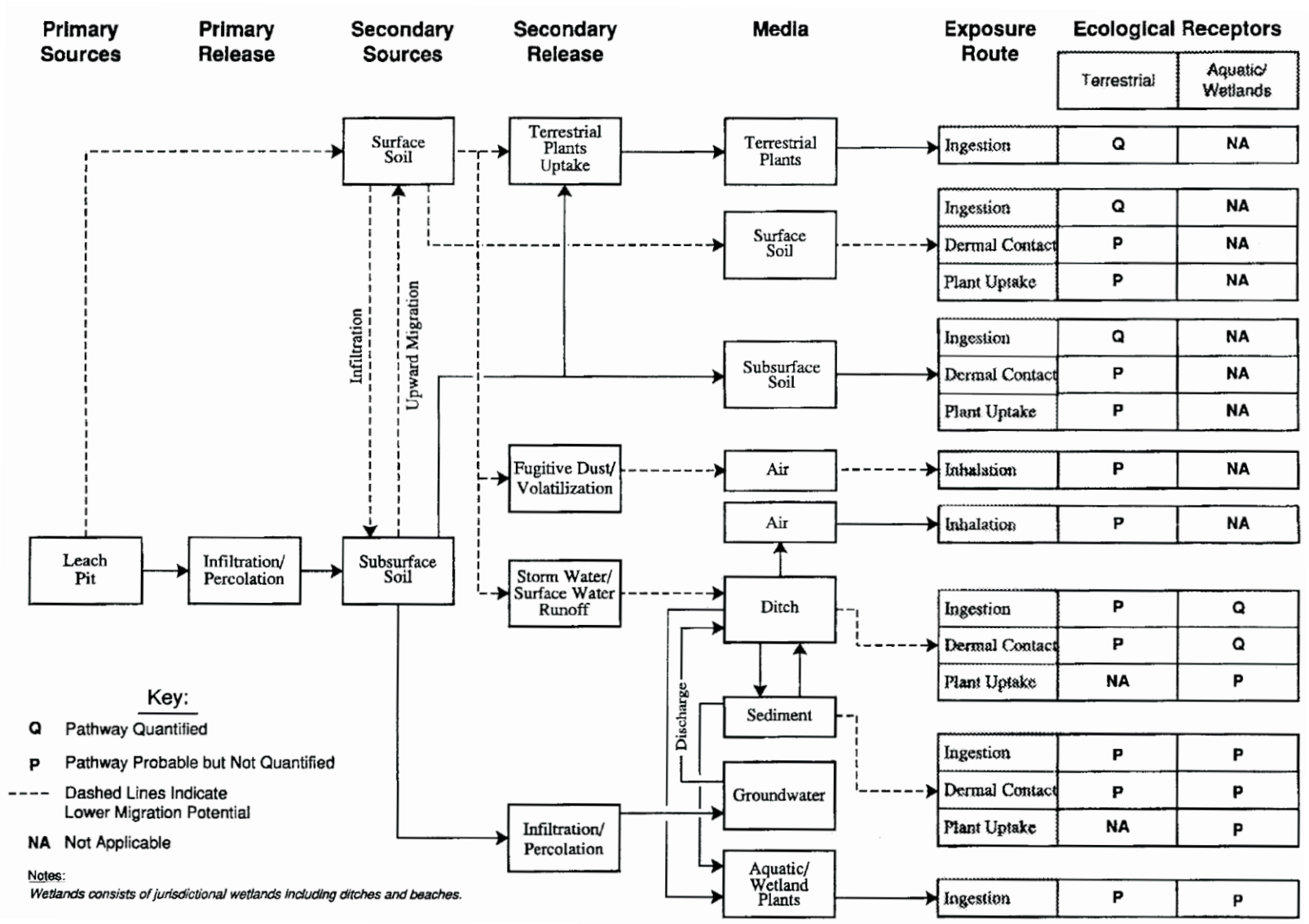
HGL HydroGeoLogic, Inc

US Army Corps of Engineers

Figure 2.3
WP-14 Human Health Conceptual Site Model
Langley AFB



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HGL HydroGeoLogic, Inc

US Army Corps of Engineers

Figure 2.4
WP-14 Ecological Conceptual Site Model
Langley AFB

3.0 RESPONSIVENESS SUMMARY

The public participation requirements set out in the NCP at 40 Code of Federal Regulations (CFR) 300.435(c)(2)(ii) have been met for ERP Site WP-14. No questions or comments were received in the public meeting for the Revised Proposed Plan held on February 12, 2008. No oral or written comments were received during the public comment period from February 3, 2008 through March 4, 2008.

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4.0 REFERENCES

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APPENDIX A

RISK TABLES

(Source: Radian, 2000 and HGL, 2005)

Appendix A.1

RAGS Part D Table 1's
Selection of Exposure Pathways

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

WP-14, 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 Soil	Surface Soil	Surface Soil at WP-14	Other Worker	Adult	Ingestion	On-site	Quant	Receptor incidentally ingest soil while conducting routine maintenance activities (e.g., mowing lawns, trimming shrubs).
						Dermal Absorption	On-site	Quant	Receptor could come into contact with soil while performing routine maintenance activities (e.g., mowing lawns, trimming shrubs).
				Construction Worker (1)	Adult	Ingestion	On-site	Quant	Receptor could incidentally ingest soil while infrequently working at the site (e.g., excavation).
						Dermal Absorption	On-site	Quant	Receptor could come into contact with soil while infrequently working at the site (e.g., excavation).
				Industrial Worker (1)	Adult	Ingestion	On-site	Quant	Receptor could incidentally ingest soil while infrequently working at the site (e.g., checking utility lines).
						Dermal Absorption	On-site	Quant	Receptor could come into contact with soil while infrequently working at the site (e.g., checking utility lines).
				Trespasser/Visitor	Child	Ingestion	On-site	Quant	Receptor could incidentally ingest soil while playing.
						Dermal Absorption	On-site	Quant	Receptor could come into contact with soil while playing.
				Fisher	Child	Ingestion	On-site	None	Receptor is most likely to spend more time near water and not in direct contact with soil at the site.
						Dermal Absorption	On-site	None	Receptor is most likely to spend more time near water and not in direct contact with soil at the site.
					Adult	Ingestion	On-site	None	Receptor is most likely to spend more time near water and not in direct contact with soil at the site.
						Dermal Absorption	On-site	None	Receptor is most likely to spend more time near water and not in direct contact with soil at the site.
		Plant Tissue	Ingestion of wild berries grown in surface soil at WP-14	Other Worker	Adult	Ingestion	On-site	None	Wild berries are not available at this site.
				Construction Worker (1)	Adult	Ingestion	On-site	None	Wild berries are not available at this site.
				Industrial Worker (1)	Adult	Ingestion	On-site	None	Wild berries are not available at this site.
				Trespasser/Visitor	Child	Ingestion	On-site	None	Wild berries are not available at this site.
				Fisher	Child	Ingestion	On-site	None	Wild berries are not available at this site.
					Adult	Ingestion	On-site	None	Wild berries are not available at this site.
		Air	Ambient air above WP-14 (vapors and particulates)	Other Worker	Adult	Inhalation	On-site	Quant	Receptor could inhale vapors/particulates from ambient air above the surface soil while working at the site.
				Construction Worker (1)	Adult	Inhalation	On-site	Quant	Receptor could inhale vapors/particulates from ambient air above the surface soil while excavating soil.
				Industrial Worker (1)	Adult	Inhalation	On-site	Quant	Receptor could inhale vapors/particulates from ambient air above the surface soil while infrequently working at the site.
				Trespasser/Visitor	Child	Inhalation	On-site	Quant	Receptor could inhale vapors/particulates from ambient air above the surface soil while trespassing or playing at the site.
				Fisher	Child	Inhalation	On-site	None	Receptor is most likely to spend more time near water than to be exposed to vapors/particulates via this pathway. Exposure pathway is insignificant.
					Adult	Inhalation	On-site	None	Receptor is most likely to spend more time near water than to be exposed to vapors/particulates via this pathway. Exposure pathway is insignificant.
	Subsurface Soil	Subsurface Soil	Subsurface Soil at WP-14	Other Worker	Adult	Ingestion	On-site	Quant	Receptor could incidentally ingest subsurface soil if it is excavated and brought to the surface during excavation activities.
						Dermal Absorption	On-site	Quant	Receptor could come into contact with subsurface soil if it is excavated and brought to the surface during excavation activities.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

WP-14, 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
				Construction Worker (1)	Adult	Ingestion	On-site	Quant	Receptor could incidentally ingest subsurface soil during excavation activities.
						Dermal Absorption	On-site	Quant	Receptor could come into contact with subsurface soil during excavation activities.
				Industrial Worker (1)	Adult	Ingestion	On-site	Quant	Receptor could incidentally ingest subsurface soil while repairing underground utility lines.
						Dermal Absorption	On-site	Quant	Receptor could come into contact with subsurface soil while repairing underground utility lines.
				Trespasser/Visitor	Child	Ingestion	On-site	None	Receptor is not likely to incidentally ingest subsurface soil at the site.
						Dermal Absorption	On-site	None	Receptor is not likely to come into contact with subsurface soil at the site.
				Fisher	Child	Ingestion	On-site	None	Receptor is likely to remain near water and away from subsurface soil at the site.
						Dermal Absorption	On-site	None	Receptor is likely to remain near water and away from subsurface soil at the site.
					Adult	Ingestion	On-site	None	Receptor is likely to remain near water and away from subsurface soil at the site.
						Dermal Absorption	On-site	None	Receptor is likely to remain near water and away from subsurface soil at the site.
		Air	Ambient air above WP-14 (vapors and particulates)	Other Worker	Adult	Inhalation	On-site	Quant	Receptor could inhale vapors/particulates from subsurface soil if it is excavated to the surface.
				Construction Worker (1)	Adult	Inhalation	On-site	Quant	Receptor could inhale vapors/particulates from subsurface soil during excavation activities.
				Industrial Worker (1)	Adult	Inhalation	On-site	Quant	Receptor could inhale vapors/particulates from subsurface soil during excavation activities.
				Trespasser/Visitor	Child	Inhalation	On-site	None	Unless exposed to subsurface soil, this receptor is unlikely to be exposed to vapors or particulates from ambient air at the site.
				Fisher	Child	Inhalation	On-site	None	Unless exposed to subsurface soil, this receptor is unlikely to be exposed to vapors or particulates from ambient air at the site.
					Adult	Inhalation	On-site	None	Unless exposed to subsurface soil, this receptor is unlikely to be exposed to vapors or particulates from ambient air at the site.
	Surface Water	Surface Water	Surface Water from Drainage Ditch (2)	Other Worker	Adult	Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
				Construction Worker (1)	Adult	Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
				Industrial Worker (1)	Adult	Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
				Trespasser/Visitor	Child	Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
				Fisher	Child	Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
					Adult	Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

WP-14, 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
		Animal Tissue	Fish/Shellfish from Drainage Ditch (2)	Other Worker	Adult	Ingestion	On-site	None	No fish/shellfish are found in the drainage ditch.
				Construction Worker (1)	Adult	Ingestion	On-site	None	No fish/shellfish are found in the drainage ditch.
				Industrial Worker (1)	Adult	Ingestion	On-site	None	No fish/shellfish are found in the drainage ditch.
				Trespasser/Visitor	Child	Ingestion	On-site	None	No fish/shellfish are found in the drainage ditch.
				Fisher (2)	Child	Ingestion	On-site	None	No fish/shellfish are found in the drainage ditch.
					Adult	Ingestion	On-site	None	No fish/shellfish are found in the drainage ditch.
	Sediment	Sediment	Sediment from Drainage Ditch (2)	Other Worker	Adult	Ingestion	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
						Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
				Construction Worker (1)	Adult	Ingestion	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
						Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
				Industrial Worker (1)	Adult	Ingestion	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
						Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
				Trespasser/Visitor	Child	Ingestion	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
						Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
				Fisher	Child	Ingestion	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
						Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
					Adult	Ingestion	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
						Dermal Absorption	On-site	None	Exposure to drainage ditch was evaluated under LF-10 and will not be addressed in this risk assessment. Physical barrier (dirt mound) prevents receptors from coming into contact with drainage ditch.
	Groundwater	Groundwater	Groundwater beneath WP-14	Other Worker	Adult	Ingestion	On-site	Quant	The unlikely scenario is assumed where the receptor could be exposed to groundwater if it is used as drinking water. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

WP-14, 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
						Dermal Absorption	On-site	Quant	The unlikely scenario is assumed where the receptor could be exposed to groundwater if it is used as drinking water. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
				Construction Worker (1)	Adult	Ingestion	On-site	Quant	The receptor is assumed to use the groundwater as drinking water. Restrictions will be placed on potable use of groundwater, if necessary, based on the future residential scenario.
						Dermal Absorption	On-site	Quant	The receptor may come into contact with groundwater while excavating because depth to groundwater is roughly 3 feet. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
				Industrial Worker (1)	Adult	Ingestion	On-site	None	Utility lines at Langley AFB are assumed to be 2.5 feet bgs whereas groundwater is roughly 3 feet bgs. Therefore, the industrial worker is not likely to incidentally ingest groundwater while digging for utility lines.
						Dermal Absorption	On-site	None	Utility lines at Langley AFB are assumed to be 2.5 feet bgs whereas groundwater is roughly 3 feet bgs. Therefore, the industrial worker is not likely to come into contact with groundwater while digging for utility lines.
				Trespasser/Visitor	Child	Ingestion	On-site	None	Groundwater is not used for domestic purposes. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
						Dermal Absorption	On-site	None	Groundwater is not used for domestic purposes. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
				Fisher	Child	Ingestion	On-site	None	Groundwater is not used for domestic purposes. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
						Dermal Absorption	On-site	None	Groundwater is not used for domestic purposes. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
					Adult	Ingestion	On-site	None	Groundwater is not used for domestic purposes. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
						Dermal Absorption	On-site	None	Groundwater is not used for domestic purposes. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
		Vapors	Vapors from Contact with Groundwater beneath WP-14	Other Worker	Adult	Inhalation	On-site	None	Only ingestion of drinking water from groundwater is being evaluated for this receptor. Exposure to ambient vapors is not a likely scenario for this receptor because the other worker is not involved with excavation activities.
				Construction Worker (1)	Adult	Inhalation	On-site	Quant	The construction worker may inhale ambient vapors from groundwater while excavating because depth to groundwater is roughly 3 feet.
				Industrial Worker (1)	Adult	Inhalation	On-site	None	Utility lines at Langley AFB are assumed to be 2.5 feet bgs whereas groundwater is roughly 3 feet bgs. Therefore, the industrial worker is not likely to inhale ambient vapors from groundwater while digging for utility lines. Also, the breathing zone is above the level of excavation.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

WP-14, 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
			Vapors while Showering with Groundwater beneath WP-14	Other Worker	Adult	Inhalation	On-site	None	Groundwater is not used for domestic purposes. Receptor is unlikely to shower using groundwater. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
				Construction Worker (1)	Adult	Inhalation	On-site	None	Groundwater is not used for domestic purposes. Receptor is unlikely to shower using groundwater. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
				Industrial Worker (1)	Adult	Inhalation	On-site	None	Groundwater is not used for domestic purposes. Receptor is unlikely to shower using groundwater. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
				Trespasser/Visitor	Child	Inhalation	On-site	None	Groundwater is not used for domestic purposes. Receptor is unlikely to shower using groundwater. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
				Fisher	Child	Inhalation	On-site	None	Groundwater is not used for domestic purposes. Receptor is unlikely to shower using groundwater. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
					Adult	Inhalation	On-site	None	Groundwater is not used for domestic purposes. Receptor is unlikely to shower using groundwater. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
		Surface Water	Surface Water from Tabbs Creek (2)	Other Worker	Adult	Dermal Absorption	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
				Construction Worker (1)	Adult	Dermal Absorption	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
				Industrial Worker (1)	Adult	Dermal Absorption	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
				Trespasser/Visitor	Child	Dermal Absorption	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
				Fisher	Child	Dermal Absorption	On-site	None	Receptor is indirectly exposed to surface water via fish ingestion pathway. Fish ingestion pathway is more conservative.
					Adult	Dermal Absorption	On-site	None	Receptor is indirectly exposed to surface water via fish ingestion pathway. Fish ingestion pathway is more conservative.
		Animal Tissue	Fish/Shellfish from Tabbs Creek (2)	Other Worker	Adult	Ingestion	On-site	None	Receptor is not likely to consume fish/shellfish from the Tabbs Creek.
				Construction Worker (1)	Adult	Ingestion	On-site	None	Receptor is not likely to consume fish/shellfish from the Tabbs Creek.
				Industrial Worker (1)	Adult	Ingestion	On-site	None	Receptor is not likely to consume fish/shellfish from the Tabbs Creek.
				Trespasser/Visitor	Child	Ingestion	On-site	None	Receptor is not likely to consume fish/shellfish from the Tabbs Creek.
				Fisher (2)	Child	Ingestion	On-site	Quant	Using a dilution factor with groundwater data, fish concentrations will be modeled because this receptor is likely to consume fish/shellfish from Tabbs Creek.
					Adult	Ingestion	On-site	Quant	Using a dilution factor with groundwater data, fish concentrations will be modeled because this receptor is likely to consume fish/shellfish from Tabbs Creek.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

WP-14, 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
		Sediment	Sediment from Tabbs Creek (2)	Other Worker	Adult	Ingestion	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
						Dermal Absorption	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
				Construction Worker (1)	Adult	Ingestion	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
						Dermal Absorption	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
				Industrial Worker (1)	Adult	Ingestion	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
						Dermal Absorption	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
				Trespasser/Visitor	Child	Ingestion	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
						Dermal Absorption	On-site	None	FT-41 lies between Tabbs Creek and WP-14. Exposure to Tabbs Creek was evaluated under FT-41 and will not be addressed in this risk assessment. Physical barriers (e.g., thick brush, marshy area, and controlled areas) prevents receptors from coming into contact with Tabbs Creek.
				Fisher	Child	Ingestion	On-site	None	Receptor is indirectly exposed to sediment via the fish ingestion pathway. Fish ingestion pathway is more conservative.
						Dermal Absorption	On-site	None	Receptor is indirectly exposed to sediment via the fish ingestion pathway. Fish ingestion pathway is more conservative.
					Adult	Ingestion	On-site	None	Receptor is indirectly exposed to sediment via the fish ingestion pathway. Fish ingestion pathway is more conservative.
						Dermal Absorption	On-site	None	Receptor is indirectly exposed to sediment via the fish ingestion pathway. Fish ingestion pathway is more conservative.
Future	Surface Soil	Surface Soil	Surface Soil at WP-14	Resident	Child	Ingestion	On-site	Quant	Resident may incidentally ingest surface soil while living on or near the site.
						Dermal Absorption	On-site	Quant	Resident may come into contact with surface soil while living on or near the site.
					Adult	Ingestion	On-site	Quant	Resident may incidentally ingest surface soil while living on or near the site.
						Dermal Absorption	On-site	Quant	Resident may come into contact with surface soil while living on or near the site.
					Child/Adult (3)	Ingestion	On-site	Quant	Resident may incidentally ingest surface soil while living on or near the site.
						Dermal Absorption	On-site	Quant	Resident may come into contact with surface soil while living on or near the site.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

WP-14, 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
	Subsurface Soil	Subsurface Soil	Subsurface Soil at WP-14	Resident	Child	Ingestion	On-site	Quant	Receptor may incidentally ingest subsurface soil while living on or near the site. The subsurface soil was brought to the surface from construction of a home at the site.
						Dermal Absorption	On-site	Quant	Receptor may incidentally ingest subsurface soil while living on or near the site. The subsurface soil was brought to the surface from construction of a home at the site.
					Adult	Ingestion	On-site	Quant	Receptor may incidentally ingest subsurface soil while living on or near the site. The subsurface soil was brought to the surface from construction of a home at the site.
						Dermal Absorption	On-site	Quant	Receptor may incidentally ingest subsurface soil while living on or near the site. The subsurface soil was brought to the surface from construction of a home at the site.
					Child/Adult (3)	Ingestion	On-site	Quant	Receptor may incidentally ingest subsurface soil while living on or near the site. The subsurface soil was brought to the surface from construction of a home at the site.
						Dermal Absorption	On-site	Quant	Receptor may incidentally ingest subsurface soil while living on or near the site. The subsurface soil was brought to the surface from construction of a home at the site.
	Groundwater	Groundwater	Groundwater beneath WP-14	Resident	Child	Ingestion	On-site	Quant	Current water bearing zones are not used for domestic purposes. Evaluated per EPA and VDEQ recommendations. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
						Dermal Absorption	On-site	Quant	Current water bearing zones are not used for domestic purposes. Evaluated per EPA and VDEQ recommendations. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
					Adult	Ingestion	On-site	Quant	Current water bearing zones are not used for domestic purposes. Evaluated per EPA and VDEQ recommendations. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
						Dermal Absorption	On-site	Quant	Current water bearing zones are not used for domestic purposes. Evaluated per EPA and VDEQ recommendations. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
					Child/Adult (3)	Ingestion	On-site	Quant	Current water bearing zones are not used for domestic purposes. Evaluated per EPA and VDEQ recommendations. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
						Dermal Absorption	On-site	Quant	Current water bearing zones are not used for domestic purposes. Evaluated per EPA and VDEQ recommendations. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.
		Vapors	Vapors while Showering with Groundwater beneath WP-14	Resident	Child	Inhalation	On-site	None	Receptor is assumed to not shower.
					Adult	Inhalation	On-site	Quant	Current water bearing zones are not used for domestic purposes. Evaluated per EPA and VDEQ recommendations. Restrictions will be placed on potable use of groundwater, if necessary, based on future residential scenario.

The following receptor name have been changed from the human health workplan (Radian, 1997) to be consistent with RAGS Part D format:

Other Worker = Groundskeeper

Industrial Worker = Utility Worker

Trespasser/Visitor = Trespasser

Fisher = Fish Consumer

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

WP-14, 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

(1) The construction worker and industrial worker scenarios are considered subchronic because of the infrequent and short duration of exposure to the receptor.

(2) No surface water or sediment data from the drainage ditch and Tabbs Creek will be used in this risk assessment. These pathways have been evaluated in previous risk assessments associated with LF-10 and FT-41. However, a dilution factor will be used with groundwater data to model concentrations in fish for the fisher scenario.

(3) For the child/adult resident, the combined risk is calculated for carcinogenic risk only.

Quant = Quantitative

bgs = below ground surface

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
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14*

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	7640		16300		mg/kg	14SS08	6/6	0.514 - 0.631	16300	N/A	7800 N	N/A	N/A	Yes	d
7440-36-0	Antimony	1.43	J	1.43	J	mg/kg	14SS05	1/4	0.215 - 0.264	1.43	N/A	3.1 N	N/A	N/A	No	b
7440-38-2	Arsenic	2.78		31.7		mg/kg	14SS05	6/6	0.194 - 0.237	31.7	N/A	0.43 C	N/A	N/A	Yes	e
7440-39-3	Barium	29.1		176	J/J	mg/kg	14SS05	6/6	0.0152 - 0.0187	176	N/A	550 N	N/A	N/A	No	b
7440-41-7	Beryllium	0.306		0.867		mg/kg	14SS08	6/6	0.0175 - 0.0214	0.867	N/A	16 N	N/A	N/A	No	b
7440-43-9	Cadmium	0.073		0.549		mg/kg	14SS05	6/6	0.0154 - 0.0189	0.549	N/A	3.9 N	N/A	N/A	No	b
7440-70-2	Calcium	1040		65500		mg/kg	14SS05	6/6	1.51 - 7.83	65500	N/A	4000000	N/A	N/A	No	c
7440-47-3	Chromium (total)	9.65		34		mg/kg	14SS08	6/6	0.0716 - 0.0878	34	N/A	23 N	N/A	N/A	Yes	d
7440-48-4	Cobalt	1.31		3.49		mg/kg	14SS08	6/6	0.0523 - 0.0641	3.49	N/A	470 N	N/A	N/A	No	b
7440-50-8	Copper	3.17		6.39		mg/kg	14SS05	6/6	0.135 - 0.165	6.39	N/A	310 N	N/A	N/A	No	b
7439-89-6	Iron	4410		33400		mg/kg	14SS04	6/6	1.07 - 1.31	33400	N/A	2300 N	N/A	N/A	Yes	d
7439-92-1	Lead	10.9		21.7		mg/kg	14SS05	6/6	0.120 - 0.147	21.7	N/A	400 C	N/A	N/A	No	b
7439-95-4	Magnesium	500		1530		mg/kg	14SS05	6/6	0.368 - 0.451	1530	N/A	1580000	N/A	N/A	No	c
7439-96-5	Manganese	36		370		mg/kg	14SS05	6/6	0.0126 - 0.0155	370	N/A	160 N	N/A	N/A	Yes	e
7440-02-0	Nickel	3.52		9.31		mg/kg	14SS08	6/6	0.0517 - 0.0633	9.31	N/A	160 N	N/A	N/A	No	b
7440-09-7	Potassium	307		753		mg/kg	14SS04	6/6	3.77 - 4.62	753	N/A	10000000	N/A	N/A	No	c
7440-23-5	Sodium	353		436		mg/kg	14SS05	2/2	14.5 - 15.3	436	N/A	2500000	N/A	N/A	No	c
7440-28-0	Thallium	0.0544		0.152		mg/kg	14SS09	6/6	0.0340 - 0.0523	0.152	N/A	0.55 N	N/A	N/A	No	b
7440-62-2	Vanadium	14.9		58.3		mg/kg	14SS08	6/6	0.0648 - 0.0795	58.3	N/A	55 N	N/A	N/A	Yes	d
7440-66-6	Zinc	11.8		52	J/J	mg/kg	14SS05	6/6	0.125 - 0.154	52	N/A	2300 N	N/A	N/A	No	b
	Organics															
93-76-5	2,4,5-T	0.00986	J	0.0192		mg/kg	14SS07	3/6	0.00137 - 0.00217	0.0192	N/A	78 N	N/A	N/A	No	b
94-82-6	2,4-DB	0.0403	J	0.101		mg/kg	14SS04	6/6	0.0159 - 0.0238	0.101	N/A	63 N	N/A	N/A	No	b
72-54-8	4,4'-DDD	0.00225		0.0149		mg/kg	14SS05	5/6	0.000400 - 0.00314	0.0149	N/A	2.7 C	N/A	N/A	No	b
72-55-9	4,4'-DDE	0.00982		0.0585		mg/kg	14SS06	6/6	0.000369 - 0.00191	0.0585	N/A	1.9 C	N/A	N/A	No	b
50-29-3	4,4'-DDT	0.00458		0.0319	J/J	mg/kg	14SS05	6/6	0.000296 - 0.00319	0.0319	N/A	1.9 C	N/A	N/A	No	b
67-64-1	Acetone	0.00933		0.00933		mg/kg	14SS09	1/6	0.00269 - 0.00289	0.00933	N/A	780 N	N/A	N/A	No	b
309-00-2	Aldrin	0.00704		0.00704		mg/kg	14SS05	1/6	0.000178 - 0.00125	0.00704	N/A	0.038 C	N/A	N/A	No	b
120-12-7	Anthracene	0.0222		0.0222		mg/kg	14SS05	1/6	0.00877 - 0.00966	0.0222	N/A	2300 N	N/A	N/A	No	b
56-55-3	Benz(a)anthracene	0.0398		0.148		mg/kg	14SS05	2/6	0.00775 - 0.00853	0.148	N/A	0.87 C	N/A	N/A	No	b
50-32-8	Benz(a)pyrene	0.0193		0.208		mg/kg	14SS05	3/6	0.00954 - 0.0105	0.208	N/A	0.087 C	N/A	N/A	Yes	d
205-99-2	Benzo(b)fluoranthene	0.0142	J	0.437	J/J	mg/kg	14SS05	5/6	0.00870 - 0.00958	0.437	N/A	0.87 C	N/A	N/A	No	b

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
191-24-2	Benzo(g,h,i)perylene	0.0309		0.115		mg/kg	14SS05	2/6	0.00926 - 0.0102	0.115	N/A	230 N	N/A	N/A	No	b
207-08-9	Benzo(k)fluoranthene	0.0142	J	0.437	J/J	mg/kg	14SS05	5/6	0.0108 - 0.0119	0.437	N/A	8.7 C	N/A	N/A	No	b
86-74-8	Carbazole	0.0203		0.0203		mg/kg	14SS05	1/6	0.0127 - 0.0140	0.0203	N/A	32 C	N/A	N/A	No	b
218-01-9	Chrysene	0.0164		0.225		mg/kg	14SS05	5/6	0.0109 - 0.0120	0.225	N/A	87 C	N/A	N/A	No	b
60-57-1	Dieldrin	0.00319		0.0675		mg/kg	14SS06	6/6	0.000278 - 0.00393	0.0675	N/A	0.04 C	N/A	N/A	Yes	e
88-85-7	Dinoseb	0.027		0.0363		mg/kg	14SS04	3/6	0.0204 - 0.0220	0.0363	N/A	7.8 N	N/A	N/A	No	b
206-44-0	Fluoranthene	0.0117		0.417		mg/kg	14SS05	5/6	0.0110 - 0.0121	0.417	N/A	310 N	N/A	N/A	No	b
1024-57-3	Heptachlor epoxide	0.00264	J	0.00264	J	mg/kg	14SS05	1/6	0.000193 - 0.00110	0.00264	N/A	0.07 C	N/A	N/A	No	b
193-39-5	Indeno(1,2,3-cd)pyrene	0.0285		0.116		mg/kg	14SS05	2/6	0.0116 - 0.0128	0.116	N/A	0.87 C	N/A	N/A	No	b
85-01-8	Phenanthrene	0.0157		0.158		mg/kg	14SS05	3/6	0.0120 - 0.0132	0.158	N/A	230 N	N/A	N/A	No	b
129-00-0	Pyrene	0.014		0.341		mg/kg	14SS05	5/6	0.0129 - 0.0142	0.341	N/A	230 N	N/A	N/A	No	b
5103-71-9	alpha-Chlordane	0.0029		0.0107		mg/kg	14SS05	2/6	0.000190 - 0.00159	0.0107	N/A	1.8 C	N/A	N/A	No	b
117-81-7	bis(2-Ethylhexyl)phthalate	0.0452		0.0452		mg/kg	14SS05	1/6	0.0363 - 0.0399	0.0452	N/A	46 C	N/A	N/A	No	b
5103-74-2	gamma-Chlordane	0.00631	J/J	0.00631	J/J	mg/kg	14SS05	1/6	0.000185 - 0.00110	0.00631	N/A	1.8 C	N/A	N/A	No	b

* Same data will be used for the following exposure points for both current/future and future scenarios: 1) surface soil at WP-14, and 2) ambient air above WP-14 (vapors and particulates). The surface soil data will be used to model ambient air exposure point concentrations; no additional screening of the modeled air concentrations will be performed.

(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 such a 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).

(7) Risk-Based Concentration Table, U.S. EPA Region III. October 1999. (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

J = Estimated Value

C = Carcinogenic

N = Non-Carcinogenic

TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14*

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	6350		20900		mg/kg	14DPS3	18/18	0.415 - 0.680	20900	N/A	7800 N	N/A	N/A	Yes	d
7440-36-0	Antimony	1	J	1.42		mg/kg	14DPS2	5/7	0.226 - 0.285	1.42	N/A	3.1 N	N/A	N/A	No	b
7440-38-2	Arsenic	3.64		112		mg/kg	14DPS3	18/18	0.156 - 0.256	112	N/A	0.43 C	N/A	N/A	Yes	e
7440-39-3	Barium	30.1		102		mg/kg	14DPS7	18/18	0.0123 - 0.0201	102	N/A	550 N	N/A	N/A	No	b
7440-41-7	Beryllium	0.305		1.32		mg/kg	14DPS7	18/18	0.0141 - 0.0231	1.32	N/A	16 N	N/A	N/A	No	b
7440-43-9	Cadmium	0.0464		0.322		mg/kg	14DPS2	18/18	0.0124 - 0.0204	0.322	N/A	3.9 N	N/A	N/A	No	b
7440-70-2	Calcium	872		15000		mg/kg	14DPS2	18/18	1.22 - 2.00	15000	N/A	4000000	N/A	N/A	No	c
7440-47-3	Chromium (total)	10.5		47.2		mg/kg	14DPS3	18/18	0.0577 - 0.0946	47.2	N/A	23 N	N/A	N/A	Yes	d
7440-48-4	Cobalt	1.13		9.42		mg/kg	14DPS5	18/18	0.0422 - 0.0691	9.42	N/A	470 N	N/A	N/A	No	b
7440-50-8	Copper	1.75		6.36		mg/kg	14DPS4	18/18	0.109 - 0.178	6.36	N/A	310 N	N/A	N/A	No	b
57-12-5	Cyanide	0.634	L	0.634	L	mg/kg	14DPS6	1/18	0.254 - 0.307	0.634	N/A	160 N	N/A	N/A	No	b
7439-89-6	Iron	5540		76800		mg/kg	14DPS8	18/18	0.860 - 1.41	76800	N/A	2300 N	N/A	N/A	Yes	d
7439-92-1	Lead	8		22.3		mg/kg	14DPS8	18/18	0.0969 - 0.159	22.3	N/A	400 C	N/A	N/A	No	b
7439-95-4	Magnesium	395		1780		mg/kg	14DPS9	18/18	0.297 - 0.486	1780	N/A	1580000	N/A	N/A	No	c
7439-96-5	Manganese	20.3		538		mg/kg	14DPS5	18/18	0.0102 - 0.0167	538	N/A	160 N	N/A	N/A	Yes	d
7440-02-0	Nickel	2.98		14.7		mg/kg	14DPS8	18/18	0.0416 - 0.0683	14.7	N/A	160 N	N/A	N/A	No	b
7440-09-7	Potassium	235		1480		mg/kg	14DPS9	18/18	3.04 - 4.98	1480	N/A	10000000	N/A	N/A	No	c
7440-23-5	Sodium	104		159		mg/kg	14DPS2	3/3	16.2 - 18.2	159	N/A	2500000	N/A	N/A	No	c
7440-28-0	Thallium	0.0521		0.15		mg/kg	14DPS7	18/18	0.0340 - 0.0593	0.15	N/A	0.55 N	N/A	N/A	No	b
7440-62-2	Vanadium	16.9		97.1		mg/kg	14DPS8	18/18	0.0523 - 0.0857	97.1	N/A	55 N	N/A	N/A	Yes	d
7440-66-6	Zinc	10.6		36.8		mg/kg	14DPS8	18/18	0.101 - 0.166	36.8	N/A	2300 N	N/A	N/A	No	b
	Organics															
93-76-5	2,4,5-T	0.00323	J	0.049		mg/kg	14DPS9	5/18	0.00141 - 0.00259	0.049	N/A	78 N	N/A	N/A	No	b
94-82-6	2,4-DB	0.0213		0.102		mg/kg	14DPS8	7/18	0.0163 - 0.0265	0.102	N/A	63 N	N/A	N/A	No	b
78-93-3	2-Butanone(MEK)	0.0307		0.0307		mg/kg	14DPS6	1/18	0.00238 - 0.00299	0.0307	N/A	4700 N	N/A	N/A	No	b
91-57-6	2-Methylnaphthalene	0.739		0.739		mg/kg	14DPS6	1/18	0.0316 - 0.0395	0.739	N/A	160 N	N/A	N/A	No	b
72-54-8	4,4'-DDD	0.00434		0.123		mg/kg	14DPS6	10/18	0.000441 - 0.00458	0.123	N/A	2.7 C	N/A	N/A	No	b
72-55-9	4,4'-DDE	0.00912		0.215		mg/kg	14DPS6	11/16	0.000276 - 0.00423	0.215	N/A	1.9 C	N/A	N/A	No	b
50-29-3	4,4'-DDT	0.00415		0.0867		mg/kg	14DPS4	9/15	0.000327 - 0.00344	0.0867	N/A	1.9 C	N/A	N/A	No	b
83-32-9	Acenaphthene	0.0521		0.0521		mg/kg	14DPS6	1/18	0.0187 - 0.0234	0.0521	N/A	470 N	N/A	N/A	No	b
208-96-8	Acenaphthylene	0.017		0.0833		mg/kg	14DPS6	3/18	0.00975 - 0.0122	0.0833	N/A	470 N	N/A	N/A	No	b
67-64-1	Acetone	0.17		0.17		mg/kg	14DPS6	1/18	0.00279 - 0.00351	0.17	N/A	780 N	N/A	N/A	No	b
309-00-2	Aldrin	0.000708	J	0.0025		mg/kg	14DPS6	5/18	0.000197 - 0.00204	0.0025	N/A	0.038 C	N/A	N/A	No	b
120-12-7	Anthracene	0.0215		0.0384		mg/kg	14DPS6	3/18	0.00902 - 0.0113	0.0384	N/A	2300 N	N/A	N/A	No	b
56-55-3	Benz(a)anthracene	0.0166		0.11		mg/kg	14DPS4	6/18	0.00797 - 0.00996	0.11	N/A	0.87 C	N/A	N/A	No	b

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
50-32-8	Benz(a)pyrene	0.0243		0.137		mg/kg	14DPS1	6/18	0.00982 - 0.0123	0.137	N/A	0.087 C	N/A	N/A	Yes	e
205-99-2	Benzo(b)fluoranthene	0.0195	J	0.23	J	mg/kg	14DPS1	8/18	0.00895 - 0.0112	0.23	N/A	0.87 C	N/A	N/A	No	b
191-24-2	Benzo(g,h,i)perylene	0.0215		0.0864		mg/kg	14DPS1	5/18	0.00953 - 0.0119	0.0864	N/A	230 N	N/A	N/A	No	b
207-08-9	Benzo(k)fluoranthene	0.0195	J	0.23	J	mg/kg	14DPS1	8/18	0.0112 - 0.0139	0.23	N/A	8.7 C	N/A	N/A	No	b
85-68-7	Butylbenzylphthalate	0.0239		0.0239		mg/kg	14DPS8	1/18	0.00721 - 0.00901	0.0239	N/A	1600 N	N/A	N/A	No	b
75-15-0	Carbon disulfide	0.00309		0.00309		mg/kg	14DPS6	1/18	0.000950 - 0.00119	0.00309	N/A	780 N	N/A	N/A	No	b
218-01-9	Chrysene	0.0191		0.139		mg/kg	14DPS1	7/18	0.0112 - 0.0140	0.139	N/A	87 C	N/A	N/A	No	b
84-74-2	Di-n-butylphthalate	0.0744		0.0744		mg/kg	14DPS4	1/18	0.0118 - 0.0147	0.0744	N/A	780 N	N/A	N/A	No	b
132-64-9	Dibenzofuran	0.0395		0.0395		mg/kg	14DPS6	1/18	0.0132 - 0.0165	0.0395	N/A	31 N	N/A	N/A	No	b
60-57-1	Dieldrin	0.00748	J/J	0.215		mg/kg	14DPS4	7/18	0.000274 - 0.00423	0.215	N/A	0.04 C	N/A	N/A	Yes	e
68334-30-5	Diesel	28.7		3610		mg/kg	14DPS6	2/2	1.15 - 63.3	3610	N/A	4700 N	N/A	N/A	No	b
33213-65-9	Endosulfan II	0.00106		0.00106		mg/kg	14DPS6	1/18	0.000303 - 0.00315	0.00106	N/A	47 N	N/A	N/A	No	b
53494-70-5	Endrin Ketone	0.0012		0.00174	J	mg/kg	14DPS8	2/18	0.000494 - 0.00502	0.00174	N/A	2.3 N	N/A	N/A	No	b
206-44-0	Fluoranthene	0.0149		0.269		mg/kg	14DPS1	8/18	0.0113 - 0.0141	0.269	N/A	310 N	N/A	N/A	No	b
86-73-7	Fluorene	0.127		0.127		mg/kg	14DPS6	1/18	0.0137 - 0.0172	0.127	N/A	310 N	N/A	N/A	No	b
76-44-8	Heptachlor	0.000304		0.000764		mg/kg	14DPS9	2/18	0.000117 - 0.00122	0.000764	N/A	0.14 C	N/A	N/A	No	b
193-39-5	Indeno(1,2,3-cd)pyrene	0.0179		0.0825		mg/kg	14DPS1	5/18	0.0120 - 0.0149	0.0825	N/A	0.87 C	N/A	N/A	No	b
72-43-5	Methoxychlor	0.00327		0.00327		mg/kg	14DPS6	1/18	0.00172 - 0.0179	0.00327	N/A	39 N	N/A	N/A	No	b
91-20-3	Naphthalene	0.0283		0.337		mg/kg	14DPS6	2/18	0.0154 - 0.0192	0.337	N/A	160 N	N/A	N/A	No	b
85-01-8	Phenanthrene	0.0176		0.26		mg/kg	14DPS6	5/18	0.0124 - 0.0154	0.26	N/A	230 N	N/A	N/A	No	b
129-00-0	Pyrene	0.0156		0.221		mg/kg	14DPS1	8/18	0.0133 - 0.0166	0.221	N/A	230 N	N/A	N/A	No	b
5103-71-9	alpha-Chlordane	0.00213		0.00653		mg/kg	14DPS1	3/18	0.000209 - 0.00217	0.00653	N/A	1.8 C	N/A	N/A	No	b
319-85-7	beta-BHC	0.000197	J	0.000449		mg/kg	14DPS2	3/18	0.000161 - 0.00178	0.000449	N/A	0.35 C	N/A	N/A	No	b
117-81-7	bis(2-Ethylhexyl)phthalate	0.0774		0.957		mg/kg	14DPS5	9/18	0.0373 - 0.0466	0.957	N/A	46 C	N/A	N/A	No	b
319-86-8	delta-BHC	0.0177		0.0177		mg/kg	14DPS6	1/12	0.000115 - 0.00126	0.0177	N/A	0.35 C	N/A	N/A	No	b
58-89-9	gamma-BHC(Lindane)	0.000294		0.0135		mg/kg	14DPS4	6/18	0.0000793 - 0.00100	0.0135	N/A	0.49 C	N/A	N/A	No	b
5103-74-2	gamma-Chlordane	0.000471	J	0.00361		mg/kg	14DPS6	5/18	0.000203 - 0.00214	0.00361	N/A	1.8 C	N/A	N/A	No	b

* Same data will be used for the following exposure points: 1) subsurface soil at WP-14, and 2) ambient air above WP-14 (vapors and particulates). The subsurface soil data will be used to model ambient air exposure point concentrations. No additional screening of the modeled air concentrations will be performed.

(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 such a 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).

(7) Risk-Based Concentration Table, U.S. EPA Region III. October 1999. (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. Maximur ed result is less than the Essential Nutrient intake value.

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

e. Maximum detected result exceeds screening toxicity value.

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

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

L = Biased Low

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
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14*

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 [T]	mg/kg	1.04E+04	1.33E+04	1.63E+04		mg/kg	1.33E+04	95% UCL-T	W-Test (1)	1.03E+04	Mean-T	W-Test (1)
Arsenic	mg/kg	1.57E+01	2.61E+01	3.17E+01		mg/kg	2.61E+01	95% UCL-N	W-Test (3)	1.57E+01	Mean-N	W-Test (3)
Chromium (total) [T]	mg/kg	2.00E+01	2.84E+01	3.40E+01		mg/kg	2.84E+01	95% UCL-N	W-Test (3)	2.00E+01	Mean-N	W-Test (3)
Iron [T]	mg/kg	1.78E+04	2.88E+04	3.34E+04		mg/kg	2.88E+04	95% UCL-N	W-Test (3)	1.78E+04	Mean-N	W-Test (3)
Manganese	mg/kg	1.83E+02	3.07E+02	3.70E+02		mg/kg	3.07E+02	95% UCL-N	W-Test (3)	1.83E+02	Mean-N	W-Test (3)
Vanadium [T]	mg/kg	3.83E+01	5.54E+01	5.83E+01		mg/kg	5.54E+01	95% UCL-N	W-Test (3)	3.83E+01	Mean-N	W-Test (3)
ORGANICS												
Benz(a)pyrene [T]	mg/kg	4.78E-02	1.14E-01	2.08E-01		mg/kg	1.14E-01	95% UCL-N	W-Test (4)	4.78E-02	Mean-N	W-Test (4)
Dieldrin	mg/kg	2.17E-02	1.61E-01	6.75E-02		mg/kg	6.75E-02	Max	W-Test (2)	2.14E-02	Mean-T	W-Test (1)

* Surface Soil EPCs will be used for the following exposure points for both current/future and future scenarios: 1) surface soil at WP-14, and 2) ambient air above WP-14 (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).

T - Total data set only.

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).

(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
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14*

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 [1]	mg/kg	1.33E+04	1.49E+04	2.09E+04		mg/kg	1.49E+04	95% UCL-N	W-Test (3)	1.33E+04	Mean-N	W-Test (3)
Arsenic	mg/kg	3.20E+01	6.26E+01	1.12E+02		mg/kg	6.26E+01	95% UCL-T	W-Test (1)	3.22E+01	Mean-T	W-Test (1)
Chromium (total) [1]	mg/kg	2.74E+01	3.22E+01	4.72E+01		mg/kg	3.22E+01	95% UCL-N	W-Test (3)	2.74E+01	Mean-N	W-Test (3)
Iron [1]	mg/kg	2.67E+04	4.01E+04	7.68E+04		mg/kg	4.01E+04	95% UCL-T	W-Test (1)	2.67E+04	Mean-T	W-Test (1)
Manganese [1]	mg/kg	2.29E+02	3.02E+02	5.38E+02		mg/kg	3.02E+02	95% UCL-N	W-Test (3)	2.29E+02	Mean-N	W-Test (3)
Vanadium [1]	mg/kg	5.65E+01	6.73E+01	9.71E+01		mg/kg	6.73E+01	95% UCL-N	W-Test (3)	5.65E+01	Mean-N	W-Test (3)
ORGANICS												
Benz(a)pyrene	mg/kg	2.72E-02	4.38E-02	1.37E-01		mg/kg	4.38E-02	95% UCL-N	W-Test (4)	2.72E-02	Mean-N	W-Test (4)
Dieldrin	mg/kg	2.48E-02	4.81E-02	2.15E-01		mg/kg	4.81E-02	95% UCL-N	W-Test (4)	2.48E-02	Mean-N	W-Test (4)

* Subsurface soil EPCs will be used for the following exposure points: 1) subsurface soil at WP-14, and 2) ambient air above WP-14 (vapors and particulates). Subsurface 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).

T - Total data set only.

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).

(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 3.3
Data Used in Risk Re-Evaluation
EXPOSURE POINT CONCENTRATION SUMMARY
WP-14, Langley AFB, Virginia

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Reasonable Maximum Exposure		
				Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	1.6E+02		2.7E+01	95%UCL-Axg	(1)
Manganese	mg/kg	1.1E+03		4.2E+02	97.5%UCL-Ch	(2)

* Surface soil & subsurface soil combined.
Statistical analyses performed using the EPA Software ProUCL, version 3.0.
For duplicate sample results, the maximum value was used in the calculation.

(1) Arsenic Data
The Site Investigation, Remedial Investigation, and 2004 data were pooled for the statistical analysis.
For the 3 sampling events, 148 soil samples representing depths from 0 to 4 feet below ground surface were analyzed for arsenic.
Arsenic was detected in all samples. The maximum detection was observed in a sample from the Site Investigation.
Data follow gamma distribution; use approximate gamma UCL (95%UCL-Axg)

(2) Manganese Data
The Site Investigation, Remedial Investigation, and 2004 data were pooled for the statistical analysis.
For the 3 sampling events, 138 soil samples representing depths from 0 to 4 feet below ground surface were analyzed for manganese.
Manganese was detected in all samples. The maximum detection was observed in a sample collected in 2004.
Data were non-parametric, use 97.5% Chebyshev (97.5%UCL-Ch)

Table 3.4
Data Used in Risk Re-Evaluation
EXPOSURE POINT CONCENTRATION SUMMARY
WP-14, Langley AFB, Virginia

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air

Chemical of Potential Concern	Units	Maximum Estimated Concentration	Maximum Qualifier	Reasonable Maximum Exposure		
				Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Manganese	mg/m3	1.7E-05		6.3E-06	97.5%UCL-Ch	(1)

Air EPC obtained by multipying manganese EPC for soil (Table 3.3) by 1/PEF.
PEF calculated to be 6.74×10^{7} m^3/kg.

(1) Soil data were non-parametric, use 97.5% Chebyshev (97.5%UCL-Ch)

Appendix A.4

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

TABLE 4.1

Daily Intake Equations for the Other Worker: Ingestion/Dermal Absorption of Soil

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Other Worker
Receptor Age: Adult

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Other Worker
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-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	CDI-S = $\frac{CS \times IR\text{-}S \times EF \times ED \times CF5 \times FI\text{-}S}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	IR-S	Ingestion Rate of Soil	mg/day	50	EPA, 1991	--	--	
	FI-S	Fraction of Exposure, Soil	unitless	0.5	(1)	--	--	
	EF	Exposure Frequency	days/year	50	(1)	--	--	
	ED	Exposure Duration	years	25	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	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	3,285	ED x 365 days/yr	
Dermal Absorption	CDI-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	CDI-S = $\frac{CS \times SA \times ABS \times AF \times EF \times ED \times CF5}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	2,000	EPA, 1992	--	--	
	EF	Exposure Frequency	days/year	50	(1)	--	--	
	ED	Exposure Duration	years	25	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AF	Adherence Factor	mg/cm^2-day	0.2	EPA, 1992	--	--	
	ABS	Absorption Factor	unitless	csv	--	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	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	3,285	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

csv = chemical-specific value

TABLE 4.2

Daily Intake Equations for the Other Worker: Inhalation of Vapors and Particulates from Soil

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (vapors and particulates)
Receptor Population: Other Worker
Receptor Age: Adult

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (vapors and particulates)
Receptor Population: Other Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CDI-A	Chronic Daily Intake, Air	mg/kg-day	calculated	–	–	–	CDI-A = (CS/(VF or PEF)) x IN-S x ET x EF x ED / BW x AT
	CS	Chemical Concentration in Soil	mg/kg	csv	--	–	--	
	IN-S	Inhalation Rate of Soil	m^3/hour	2.5	EPA, 1991	–	–	
	EF	Exposure Frequency	days/year	50	(1)	–	–	
	ET	Exposure Time	hr/day	8	(1)	–	–	
	ED	Exposure Duration	years	25	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	9,125	ED x 365 days/yr	3,285	ED x 365 days/yr	
	VF	Volatilization Factor	m^3/kg	calculated	(2)	–	–	
	PEF	Particulate Emission Factor	m^3/kg	1.0E+07	see Appendix F1	–	–	

(1) Professional Judgement (see Appendix F1)

(2) VF is used in equation if the COPC is a VOC, otherwise the PEF is used. Calculated VFs are found in Appendix F3.

csv = chemical-specific value

TABLE 4.3

Daily Intake Equations for the Construction Worker: Ingestion/Dermal Absorption of Soil

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future	Scenario Timeframe: Current/Future
Medium: Surface Soil	Medium: Subsurface Soil
Exposure Medium: Surface Soil	Exposure Medium: Subsurface Soil
Exposure Point: Surface Soil at WP-14	Exposure Point: Subsurface Soil at WP-14
Receptor Population: Construction Worker	Receptor Population: Construction Worker
Receptor Age: Adult	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-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	$CDI\text{-}S = \frac{CS \times IR\text{-}S \times EF \times ED \times CF5 \times FI\text{-}S}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	IR-S	Ingestion Rate of Soil	mg/day	158	(1)	--	--	
	FI-S	Fraction of Exposure, Soil	unitless	0.5	(1)	--	--	
	EF	Exposure Frequency	days/year	250	EPA, 1991	--	--	
	ED	Exposure Duration	years	1	(1)	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	365	ED x 365 days/yr	--	--	
Dermal Absorption	CDI-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	$CDI\text{-}S = \frac{CS \times SA \times ABS \times AF \times EF \times ED \times CF5}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	2,000	EPA, 1992	--	--	
	EF	Exposure Frequency	days/year	250	EPA, 1991	--	--	
	ED	Exposure Duration	years	1	--	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AF	Adherence Factor	mg/cm^2-day	0.2	EPA, 1992	--	--	
	ABS	Absorption Factor	unitless	csv	--	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	365	ED x 365 days/yr	--	--	

(1) Professional Judgement (see Appendix F1)

csv = chemical-specific value

TABLE 4.4

Daily Intake Equations for the Construction Worker: Inhalation of Vapors and Particulates from Soil

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (vapors and particulates)
Receptor Population: Construction Worker
Receptor Age: Adult

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (vapors and particulates)
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CDI-A	Chronic Daily Intake, Air	mg/kg-day	calculated	--	--	--	$CDI\text{-}A = \frac{CS/(VF \text{ or } PEF)) \times IN\text{-}S \times ET \times EF \times ED}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	IN-S	Inhalation Rate of Soil	m^3/hour	2.5	EPA, 1991	--	--	
	EF	Exposure Frequency	days/year	250	EPA, 1991	--	--	
	ET	Exposure Time	hr/day	8	(1)	--	--	
	ED	Exposure Duration	years	1	(1)	--	--	
	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	365	ED x 365 days/yr	--	--	
	VF	Volatilization Factor	m^3/kg	calculated	(2)	--	--	
	PEF	Particulate Emission Factor	m^3/kg	1.7E+06	see Appendix F1	--	--	

(1) Professional Judgement (see Appendix F1)

(2) VF is used in equation if the COPC is a VOC, otherwise the PEF is used. Calculated VFs are found in Appendix F3.

csv = chemical-specific value

TABLE 4.5

Daily Intake Equations for the Industrial Worker: Ingestion/Dermal Absorption of Soil

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Industrial Worker
Receptor Age: Adult

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Industrial Worker
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-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	$CDI\text{-}S = \frac{CS \times IR\text{-}S \times EF \times ED \times CF5 \times FI\text{-}S}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 1997	--	--	
	FI-S	Fraction of Exposure, Soil	unitless	0.5	(1)	--	--	
	EF	Exposure Frequency	days/year	20	(1)	--	--	
	ED	Exposure Duration	years	1	(1)	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	365	ED x 365 days/yr	--	--	
Dermal Absorption	CDI-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	$CDI\text{-}S = \frac{CS \times SA \times ABS \times AF \times EF \times ED \times CF5}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	2,000	EPA, 1992	--	--	
	EF	Exposure Frequency	days/year	20	(1)	--	--	
	ED	Exposure Duration	years	1	(1)	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AF	Adherence Factor	mg/cm^2-day	0.2	EPA, 1992	--	--	
	ABS	Absorption Factor	unitless	csv	--	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	365	ED x 365 days/yr	--	--	

(1) Professional Judgement (see Appendix F1)

csv = chemical-specific value

TABLE 4.6

Daily Intake Equations for the Industrial Worker: Inhalation of Vapors and Particulates from Soil

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (vapors and particulates)
Receptor Population: Industrial Worker
Receptor Age: Adult

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (vapors and particulates)
Receptor Population: Industrial Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CDI-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	$CDI\text{-}S = \frac{CS/(VF \text{ or } PEF)) \times IN\text{-}S \times ET \times EF \times ED}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	IN-S	Inhalation Rate of Soil	m^3/hour	2.5	EPA, 1991	--	--	
	EF	Exposure Frequency	days/year	20	(1)	--	--	
	ET	Exposure Time	hr/day	8	(1)	--	--	
	ED	Exposure Duration	years	1	(1)	--	--	
	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	365	ED x 365 days/yr	--	--	
	VF	Volatilization Factor	m^3/kg	calculated	(2)	--	--	
	PEF	Particulate Emission Factor	m^3/kg	1.7E+06	see Appendix F1	--	--	

(1) Professional Judgement (see Appendix F1)

(2) VF is used in the equation if COPC is a VOC, otherwise the PEF is used. Calculated VFs are found in Appendix F3.

csv = chemical-specific value

TABLE 4.7

Daily Intake Equations for the Trespasser/Visitor: Ingestion/Dermal Absorption of Surface Soil

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Trespasser/Visitor
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-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	CDI-S = $\frac{CS \times IR\text{-}S \times EF \times ED \times CF5 \times FI\text{-}S}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 1991	50	EPA, 1990	
	FI-S	Fraction of Exposure, Soil	unitless	0.17	(1)	--	--	
	EF	Exposure Frequency	days/year	50	EPA, 1993	--	--	
	ED	Exposure Duration	years	12	(1)	9	EPA, 1993	
	BW	Body Weight	kg	43	EPA, 1990	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	4,380	ED x 365 days/yr	3,285	ED x 365 days/yr	
Dermal Absorption	CDI-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	CDI-S = $\frac{CS \times SA \times ABS \times AF \times EF \times ED \times CF5}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	3,275	EPA, 1992	--	--	
	EF	Exposure Frequency	days/year	50	EPA, 1993	--	--	
	ED	Exposure Duration	years	12	(1)	9	EPA, 1993	
	BW	Body Weight	kg	43	EPA, 1990	--	--	
	AF	Adherence Factor	mg/cm^2-day	0.2	EPA, 1992	--	--	
	ABS	Absorption Factor	unitless	csv	--	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	4,380	ED x 365 days/yr	3,285	ED x 365 days/yr	

(1) Professional Judgement (see Appendix F1)

csv = chemical-specific value

TABLE 4.8

Daily Intake Equations for the Trespasser/Visitor: Inhalation of Vapors and Particulates from Surface Soil

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (vapors and particulates)
Receptor Population: Trespasser/Visitor
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CDI-A	Chronic Daily Intake, Air	mg/kg-day	calculated	–	–	–	$CDI\text{-}A = \frac{(CS/(VF \text{ or } PEF)) \times IN\text{-}S \times ET \times EF \times ED}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	–	–	–	
	IN-S	Inhalation Rate of Soil	m^3/hour	3	EPA, 1990	2.1	EPA, 1990	
	EF	Exposure Frequency	days/year	50	(1)	–	–	
	ET	Exposure Time	hr/day	4	(1)	–	–	
	ED	Exposure Duration	years	12	(1)	9	EPA, 1993	
	BW	Body Weight	kg	43	EPA, 1990	–	–	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	–		
	AT-N	Averaging Time (Non-Cancer)	days	4,380	ED x 365 days/yr	3,285	ED x 365 days/yr	
	VF	Volatilization Factor	m^3/kg	calculated	(2)	–	–	
	PEF	Particulate Emission Factor	m^3/kg	1.0E+07	see Appendix F1	–	–	

(1) Professional Judgement (see Appendix F1)

(2) VF is used in equation if the COPC is a VOC, otherwise the PEF is used. Calculated VFs are found in Appendix F3.

csv = chemical-specific value

TABLE 4.9

Daily Intake Equations for the Resident (Child): Ingestion/Dermal Absorption of Soil

WP-14, Langley Air Force Base

Scenario Timeframe: Future Medium: Surface Soil Exposure Medium: Surface Soil Exposure Point: Surface Soil at WP-14 Receptor Population: Resident Receptor Age: Child (2)	Scenario Timeframe: Future Medium: Subsurface Soil Exposure Medium: Subsurface Soil Exposure Point: Subsurface Soil at WP-14 Receptor Population: Resident Receptor Age: Child (2)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CDI-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	CDI-S = $\frac{CS \times IR\text{-}S \times EF \times ED \times CF5 \times FI\text{-}S}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	IR-S	Ingestion Rate of Soil	mg/day	200	EPA, 1997	100	EPA, 1997	
	FI-S	Fraction of Exposure, Soil	unitless	0.5	(1)	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1994	
	ED	Exposure Duration	years	6	EPA, 1997	1.8	EPA, 1993	
	BW	Body Weight	kg	15	EPA, 1997	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	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-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	CDI-S = $\frac{CS \times SA \times ABS \times AF \times EF \times ED \times CF5}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	1,825	EPA, 1992	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1994	
	ED	Exposure Duration	years	6	EPA, 1997	1.8	EPA, 1993	
	BW	Body Weight	kg	15	EPA, 1997	--	--	
	AF	Adherence Factor	mg/cm^2-day	0.2	EPA, 1992	--	--	
	ABS	Absorption Factor	unitless	csv	--	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	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) Combined child/adult cancer risk for these routes will be addressed by adding cancer risk of the child and adult together.

csv = chemical-specific value

TABLE 4.10

Daily Intake Equations for the Resident (Adult): Ingestion/Dermal Absorption of Soil

WP-14, Langley Air Force Base

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Resident
Receptor Age: Adult (2)

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Resident
Receptor Age: Adult (2)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CDI-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	$CDI\text{-}S = \frac{CS \times IR\text{-}S \times EF \times ED \times CF5 \times FI\text{-}S}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 1997	50	EPA, 1997	
	FI-S	Fraction of Exposure, Soil	unitless	0.5	(1)	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1994	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1994	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	ED x 365 days/yr	3285	ED x 365 days/yr	
Dermal Absorption	CDI-S	Chronic Daily Intake, Soil	mg/kg-day	calculated	--	--	--	$CDI\text{-}S = \frac{CS \times SA \times ABS \times AF \times EF \times ED \times CF5}{BW \times AT}$
	CS	Chemical Concentration in Soil	mg/kg	csv	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	5,000	EPA, 1992	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1994	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1994	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AF	Adherence Factor	mg/cm^2-day	0.2	EPA, 1992	--	--	
	ABS	Absorption Factor	unitless	csv	--	--	--	
	CF5	Conversion Factor 5	kg/mg	1.0E-06	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	70 x 365 days/yr	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	ED x 365 days/yr	3,285	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.

csv = chemical-specific value

Table 4.11

VALUES USED FOR DAILY INTAKE CALCULATIONS, RISK RE-EVALUATION

WP-14, Langley AFB, Virginia

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil
Exposure Point: Soil at WP-14
Receptor Population: Resident
Receptor Age: Child

	Parameter Code	Parameter Definition	Units	Value	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Arsenic Concentration in Soil	mg/kg	26.9	Table 3.3	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil	mg/day	200	EPA, 2002	CS x IR-S x EF x ED x CF x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	350	EPA, 1991	
	ED	Exposure Duration	years	6	EPA, 1991	
	CF	Conversion Factor	kg/mg	0.000001	- -	
	BW	Body Weight	kg	15	EPA, 1991	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	EPA, 1989	
Dermal Absorption	CS	Arsenic Concentration in Soil	mg/kg	26.9	Table 3.3	CDI (mg/kg-day) =
	SA	Skin Surface Area Available for Contact	cm^2	2,800	EPA, 2004	CS x SA x SSAF x DABS x CF x EF x
	SSAF	Soil to Skin Adherence Factor	mg/cm^2-day	0.2	EPA, 2004	ED x 1/BW x 1/AT
	DABS	Arsenic Dermal Absorption Factor Solids	--	0.032	EPA, 2004	
	CF	Conversion Factor	kg/mg	0.000001	- -	
	EF	Exposure Frequency	days/year	350	EPA, 1991	
	ED	Exposure Duration	years	6	EPA, 1991	
	BW	Body Weight	kg	15	EPA, 1991	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

EPA, 2004. Risk Assessment Guidance for Superfund, Vol. 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. OSWER 9285.7-02EP.

Table 4.12

VALUES USED FOR DAILY INTAKE CALCULATIONS, RISK RE-EVALUATION

WP-14, Langley AFB, Virginia

Scenario Timeframe: Future

Medium: Soil*

Exposure Medium: Soil

Exposure Point: Soil at WP-14

Receptor Population: Resident

Receptor Age: Child/Adult, Age-adjusted, non-mutagenic chemicals

Exposure Routes	Parameter Code	Parameter Definition	Units	Value	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Arsenic Concentration in Soil	mg/kg	26.9	Table 3.3	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S-A	Ingestion Rate of Soil, Adult	mg/day	100	EPA, 1991	CS x IR-S-Adj x EF x CF x 1/AT
	IR-S-C	Ingestion Rate of Soil, Child	mg/day	200	EPA, 2002	
	IR-S-Adj	Ingestion Rate of Soil, Age-adjusted	mg-year/kg-day	114.29	calculated	IR-S-Adj (mg-year/kg-day) =
	EF	Exposure Frequency	days/year	350	EPA, 1991	(ED-C x IR-S-C / BW-C) + (ED-A x IR-S-A / BW-A)
	ED-A	Exposure Duration, Adult	years	24	EPA, 1991	
	ED-C	Exposure Duration, Child	years	6	EPA, 1991	
	CF	Conversion Factor	kg/mg	0.000001	- -	
	BW-A	Body Weight , Adult	kg	70	EPA, 1991	
	BW-C	Body Weight, Child	kg	15	EPA, 1991	
	AT	Averaging Time (Cancer)	days	25,550	EPA, 1989	
Dermal	CS	Arsenic Concentration in Soil	mg/kg	26.9	Table 3.3	CDI (mg/kg-day) =
	SA-A	Skin Surface Area Available for Contact, Adult	cm^2	5,700	EPA, 2004	CS x DA-Adj x DABS x CF x EF x 1/AT
	SA-C	Skin Surface Area Available for Contact, Child	cm^2	2,800	EPA, 2004	
	SSAF-A	Soil to Skin Adherence Factor	mg/cm^2-day	0.07	EPA, 2004	DA-Adj (mg-year/kg-day) =
	SSAF-C	Soil to Skin Adherence Factor	mg/cm^2-day	0.2	EPA, 2004	[(ED-C x SA-C x SSAF-C / BW-C) +
	DA-Adj	Dermal Absorption, Age-adjusted	mg-year/kg-day	360.8	calculated	(ED-A x SA-A x SSAF-A / BW-A)]
	DABS	Arsenic Dermal Absorption Factor Solids	--	0.032	EPA, 2004	
	CF	Conversion Factor	kg/mg	0.000001	- -	
	EF	Exposure Frequency	days/year	350	EPA, 1991	
	ED-A	Exposure Duration, Adult	years	24	EPA, 1991	
	ED-C	Exposure Duration, Child	years	6	EPA, 1991	
	BW-A	Body Weight , Adult	kg	70	EPA, 1991	
	BW-C	Body Weight, Child	kg	15	EPA, 1991	
	AT	Averaging Time (Cancer)	days	25,550	EPA, 1989	

* Surface and subsurface soil

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

EPA, 2004. Risk Assessment Guidance for Superfund, Vol. 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. OSWER 9285.7-02EP.

Table 4.13

VALUES USED FOR DAILY INTAKE CALCULATIONS, RISK RE-EVALUATION

WP-14, Langley AFB, Virginia

Scenario Timeframe: Future

Medium: Soil*

Exposure Medium: Soil

Exposure Point: Soil at WP-14

Receptor Population: Construction Worker

Receptor Age: Adult

Exposure Routes	Parameter Code	Parameter Definition	Units	Value	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Manganese Concentration in Soil	mg/kg	423	Table 3.3	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil	mg/day	330	EPA, 2002	CS x IR-S x EF x ED x CF x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	1	EPA, 1991	
	CF	Conversion Factor	kg/mg	0.000001	- -	
	BW	Body Weight	kg	70	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	EPA, 1989	
Dermal Absorption	CS	Manganese Concentration in Soil	mg/kg	423	Table 3.3	CDI (mg/kg-day) =
	SA	Skin Surface Area Available for Contact	cm^2	3,300	EPA, 2002	CS x SA x SSAF x DABS x CF x EF x
	SSAF	Soil to Skin Adherence Factor	mg/cm^2-day	0.3	EPA, 2002	ED x 1/BW x 1/AT
	DABS	Manganese Dermal Absorption Factor Solids	--	0.01	EPA Region 3 default value for metals	
	CF	Conversion Factor	kg/mg	0.000001	- -	
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	1	EPA, 1991	
	BW	Body Weight	kg	70	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	EPA, 1989	

* Surface and subsurface soil

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

EPA, 2004. Risk Assessment Guidance for Superfund, Vol. 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. OSWER 9285.7-02EP.

Table 4.14

VALUES USED FOR DAILY INTAKE CALCULATIONS, RISK RE-EVALUATION

WP-14, Langley AFB, Virginia

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Soil at WP-14
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Routes	Parameter Code	Parameter Definition	Units	Value	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CA	Manganese Concentration in Air	mg/m^3	6.30E-06	Table 3.4	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR	Inhalation Rate	m^3/day	20	EPA, 1991	CA x IR x EF x ED x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	1	EPA, 1991	
	BW	Body Weight	kg	70	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

Appendix A.5

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

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

WP - 14, 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)
Aluminum [b, c]	Chronic	1.0E+00	mg/kg-day	27%	2.7E-01	mg/kg-day	Dev. NS	100	NCEA	08/26/96
Arsenic [a, c]	Chronic	3.0E-04	mg/kg-day	95%	2.9E-04	mg/kg-day	skin/vascular	3	IRIS	12/01/98
	Subchonic	3.0E-04	mg/kg-day	95%	2.9E-04	mg/kg-day	skin/vascular	3	HEAST	07/31/97
Benz(a)pyrene [b]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
bis(2-Ethylhexyl)phthalate	Chronic	2.0E-02	mg/kg-day	55%	1.1E-02	mg/kg-day	liver	1000	IRIS	01/25/99
Chromium (total) III [b, c]	Chronic	1.5E+00	mg/kg-day	1%	1.5E-02	mg/kg-day	spleen/liver	1000	IRIS	12/01/98
	Subchronic	1.0E+00	mg/kg-day	1%	1.0E-02	mg/kg-day	spleen/liver	1000	HEAST; NCEA	07/31/97;12/10/98
Chromium (total) VI [b, c]	Chronic	3.0E-03	mg/kg-day	1%	3.0E-05	mg/kg-day	GI tract/fetus/bone marrow/liver	900	IRIS	12/01/98
	Subchronic	2.0E-02	mg/kg-day	1%	2.0E-04	mg/kg-day	GI tract/fetus/bone marrow/liver	100	HEAST	07/31/97
Dieldrin	Chronic	5.0E-05	mg/kg-day	90%	4.5E-05	mg/kg-day	liver	100	IRIS	12/01/98
	Subchronic	5.0E-05	mg/kg-day	90%	4.5E-05	mg/kg-day	liver	100	HEAST	07/31/97
Iron [a, b, c]	Chronic	3.0E-01	mg/kg-day	100%	3.0E-01	mg/kg-day	blood/liver/GI tract	1	NCEA	01/05/99
Manganese (food) [a, c]	Chronic	1.4E-01	mg/kg-day	N/A	N/A	N/A	CNS	1	IRIS	12/01/98
	Subchronic	1.4E-01	mg/kg-day	N/A	N/A	N/A	CNS	1	HEAST	07/31/97
Manganese (non-food) [a, c]	Chronic	2.0E-02	mg/kg-day	5%	1.0E-03	mg/kg-day	CNS	1	IRIS	12/01/98
Vanadium [b, c]	Chronic	7.0E-03	mg/kg-day	2%	1.4E-04	mg/kg-day	liver	100	HEAST	07/31/97
	Subchronic	7.0E-03	mg/kg-day	2%	1.4E-04	mg/kg-day	liver	100	HEAST	07/31/97

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

(a) This COPC is in the total data set only for groundwater.

(b) This COPC is in the total data set only for surface soil.

(c) This COPC is in the total data set only for subsurface soil.

TABLE 5.2

NON-CANCER TOXICITY DATA – INHALATION

WP - 14, Langley Air Force Base

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (2) (MM/DD/YY)
Aluminum [b, c]	Chronic	5.0E-03	mg/m^3	1.0E-03	mg/kg-day	Dev. NS	300	NCEA	06/20/97
Arsenic [a, c]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benz(a)pyrene [b]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
bis(2-Ethylhexyl)phthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (total) III [b, c]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (total) VI [b, c]	Chronic	1.0E-04	mg/m^3	2.9E-05	mg/kg-day	lungs	300	IRIS	12/01/98
Dieldrin	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron [a, b, c]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese (food) [a, c]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese (non-food) [a, c]	Chronic	5.0E-05	mg/m^3	1.4E-05	mg/kg-day	CNS	1000	IRIS	12/01/98
Vanadium [b, c]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A = Not Available

(1) Doses were derived from inhalation reference concentrations (mg/m^3) from IRIS and HEAST by multiplying a conversion factor of 20 m^3/day per 70 kg by the reference concentraions.

(2) The date IRIS was searched.

The date of HEAST.

The date of the article provided by NCEA.

(a) This COPC is in the total data set only for groundwater.

(b) This COPC is in the total data set only for surface soil.

(c) This COPC is in the total data set only for subsurface soil.

TABLE 5.3

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Risk Re-Evaluation, WP-14, Langley AFB

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)
Arsenic	Chronic	3.E-04	mg/kg-day	1	3.E-04	mg/kg-day	Skin/vascular		IRIS	10/21/04
Manganese (nonfood)	Chronic	4.7E-02	mg/kg-day	0.04	1.9E-03	mg/kg-day	CNS		IRIS	10/21/04

Abbreviations:

CNS = central nervous system

IRIS = Integrated Risk Information System

(1) EPA, 2004: Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final, EPA/540/R/99/005, July 2004.

(2) Adjusted Dermal RfD = Oral RfD * Oral to Dermal Adjustment Factor.

(3) The date that IRIS was searched.

TABLE 5.4

NON-CANCER TOXICITY DATA -- INHALATION

Risk Re-Evaluation, WP-14, Langley AFB

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ (2)	Dates (3) (MM/DD/YY)
Manganese	Chronic	5.0E-05	mg/m3	1.4E-05	mg/kg-day	CNS	1000/1	IRIS	10/21/04

Abbreviations:

CNS = central nervous system

(1) To convert RfC to RfD, multiply RfC by (20 m3/day)(1/70 kg)

(2) IRIS = Integrated Risk Information System

(3) The date IRIS was searched.

Appendix A.6

RAGS Part D Table 6's
Cancer Toxicity Data

TABLE 6.1

CANCER TOXICITY DATA – ORAL/DERMAL

WP - 14, Langley Air Force Base

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
Aluminum [b, c]	N/A	27%	N/A	N/A	N/A	N/A	N/A
Arsenic [a, c]	1.5E+00	95%	1.6E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/01/98
Benz(a)pyrene [b]	7.3E+00	N/A	N/A	N/A	B2	IRIS	12/01/98
bis(2-Ethylhexyl)phthalate	1.4E-02	55%	2.5E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	12/01/98
Chromium (total) III [b, c]	N/A	1%	N/A	N/A	D	IRIS	01/21/99
Chromium (total) VI [b, c]	N/A	1%	N/A	N/A	D	IRIS	01/24/99
Dieldrin	1.6E+01	90%	1.8E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	12/01/98
Iron [a, b, c]	N/A	100%	N/A	N/A	N/A	N/A	N/A
Manganese (food) [a, c]	N/A	N/A	N/A	N/A	D	IRIS	01/24/99
Manganese (non-food) [a, c]	N/A	5%	N/A	N/A	D	IRIS	01/24/99
Vanadium [b, c]	N/A	2%	N/A	N/A	D	Tox Profile	08/08/00

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

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.

(a) This COPC is in the total data set only for groundwater.

(b) This COPC is in the total data set only for surface soil.

(c) This COPC is in the total data set only for subsurface soil.

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

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

TABLE 6.2

CANCER TOXICITY DATA – INHALATION

WP - 14, Langley Air Force Base

Chemical of Potential Concern	Unit Risk	Units	Adjustment (1)	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
Aluminum [b, c]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic [a, c]	4.3E-03	$(ug/m^3)^{-1}$	3,500	1.5E+01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/01/98
Benz(a)pyrene [b]	8.8E-04	$(ug/m^3)^{-1}$	3,500	3.1E+00	$(mg/kg\text{-}day)^{-1}$	B2	NCEA, IRIS	11/18/94, 12/01/98
bis(2-Ethylhexyl)phthalate	4.0E-06	$(ug/m^3)^{-1}$	3,500	1.4E-02	$(mg/kg\text{-}day)^{-1}$	B2	NCEA, IRIS	09/20/95, 12/01/98
Chromium (total) III [b, c]	N/A	N/A	N/A	N/A	N/A	D	IRIS	01/21/99
Chromium (total) VI [b, c]	1.2E-02	$(ug/m^3)^{-1}$	3,500	4.2E+01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/01/98
Dieldrin	4.6E-03	$(ug/m^3)^{-1}$	3,500	1.6E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	12/01/98
Iron [a, b, c]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese (food) [a, c]	N/A	N/A	N/A	N/A	N/A	D	IRIS	01/24/99
Manganese (non-food) [a, c]	N/A	N/A	N/A	N/A	N/A	D	IRIS	01/24/99
Vanadium [b, c]	N/A	N/A	N/A	N/A	N/A	D	Tox Profile	08/08/00

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

N/A= Not Available

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

(1) Adjustment Factor applied to Unit Risk to calculate Inhalation Slope Factor= 70kg x $1/20m^3$/day x 1000ug/mg

(2) The date IRIS was searched.

The date of HEAST.

The date of the article provided by NCEA.

(a) This COPC is in the total data set only for groundwater.

(b) This COPC is in the total data set only for surface soil.

(c) This COPC is in the total data set only for subsurface soil.

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

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

TABLE 6.3

CANCER TOXICITY DATA -- ORAL/DERMAL

Risk Re-Evaluation, WP-14, Langley AFB

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Cancer Slope Factor (2)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (MM/DD/YY) [3]
Arsenic	1.5E+00	1	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	10/21/04

IRIS = Integrated Risk Information System

Weight of Evidence:

A - Human carcinogen

(1) EPA 2004. RAGS Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).

(2) ORAL CSF/ Oral to Dermal Adjustment Factor = Adjusted Dermal CSF

(3) For IRIS values, date that IRIS was searched

Appendix A.7

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

TABLE 7.1.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION

OF SURFACE SOIL AT WP-14 FOR THE OTHER WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Other Worker
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	6.5E-04	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.0007
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.3E-06	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.004
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.4E-06	mg/kg-day	3.0E-03	mg/kg-day	N/A	N/A	0.0005
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	1.4E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.005
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	1.5E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.0008
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	2.7E-06	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.0004
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	3.3E-09	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.00007
	(Total)												0.01
Dermal Absorption	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	1.0E-04	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.0004
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	6.5E-07	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.002
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	2.2E-07	mg/kg-day	3.0E-05	mg/kg-day	N/A	N/A	0.007
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	2.3E-04	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.0008
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	2.4E-06	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.002
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	4.3E-07	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.003
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	5.3E-09	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.0001
	(Total)												0.02
												Total Hazard Index Across All Exposure Routes/Pathways	0.03

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

(2) Chronic reference dose.

NOTE: Aluminum, Chromium (total), Iron, and Vanadium are in the total data set only for surface soil.

TABLE 7.2.RME
RME CALCULATION OF NON-CANCER HAZARDS: INHALATION
OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE OTHER WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Other Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (3)	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E-03	mg/m^3	R	5.2E-05	mg/kg-day	1.0E-03	mg/kg-day	5.0E-03	--	0.05
	Arsenic	2.6E+01	mg/kg	2.6E-06	mg/m^3	R	1.0E-07	mg/kg-day	--	--	--	--	--
	Chromium (total) VI	2.8E+01	mg/kg	2.8E-06	mg/m^3	R	1.1E-07	mg/kg-day	2.9E-05	mg/kg-day	1.0E-04	mg/m^3	0.004
	Iron	2.9E+04	mg/kg	2.9E-03	mg/m^3	R	1.1E-04	mg/kg-day	--	--	--	--	--
	Manganese (non-food)	3.1E+02	mg/kg	3.1E-05	mg/m^3	R	1.2E-06	mg/kg-day	1.4E-05	mg/kg-day	5.0E-05	mg/m^3	0.08
	Vanadium	5.5E+01	mg/kg	5.5E-06	mg/m^3	R	2.2E-07	mg/kg-day	--	--	--	--	--
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	1.5E-08	mg/m^3	R	6.0E-10	mg/kg-day	--	--	--	--	--
	(Total)												0.1
												Total Hazard Index Across All Exposure Routes/Pathways	0.1

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

(2) Chronic reference dose.

(3) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table.

NOTE: Aluminum, Chromium (total), Iron, and Vanadium are in the total data set only for surface soil.

TABLE 7.3.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION

OF SUBSURFACE SOIL AT WP-14 FOR THE OTHER WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Other Worker
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E+04	mg/kg	M	7.3E-04	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.0007
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	3.1E-06	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.01
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	1.6E-06	mg/kg-day	3.0E-03	mg/kg-day	N/A	N/A	0.0005
	Iron	4.0E+04	mg/kg	4.0E+04	mg/kg	M	2.0E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.007
	Manganese (non-food)	3.0E+02	mg/kg	3.0E+02	mg/kg	M	1.5E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.0007
	Vanadium	6.7E+01	mg/kg	6.7E+01	mg/kg	M	3.3E-06	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.0005
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	2.4E-09	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.00005
	(Total)												0.02
Dermal Absorption	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E+04	mg/kg	M	1.2E-04	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.0004
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	1.6E-06	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.006
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	2.5E-07	mg/kg-day	3.0E-05	mg/kg-day	N/A	N/A	0.008
	Iron	4.0E+04	mg/kg	4.0E+04	mg/kg	M	3.1E-04	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.001
	Manganese (non-food)	3.0E+02	mg/kg	3.0E+02	mg/kg	M	2.4E-06	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.002
	Vanadium	6.7E+01	mg/kg	6.7E+01	mg/kg	M	5.3E-07	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.004
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	3.8E-09	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.00008
	(Total)												0.02
												Total Hazard Index Across All Exposure Routes/Pathways	0.04

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

(2) Chronic reference dose.

NOTE: Aluminum, Chromium (total), Iron, Manganese, and Vanadium are in the total data set only for subsurface soil.

TABLE 7.4.RME
RME CALCULATION OF NON-CANCER HAZARDS: INHALATION
OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE OTHER WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Other Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (3)	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E-03	mg/m^3	R	5.8E-05	mg/kg-day	1.0E-03	mg/kg-day	5.0E-03	--	0.06
	Arsenic	6.3E+01	mg/kg	6.3E-06	mg/m^3	R	2.5E-07	mg/kg-day	--	--	--	--	--
	Chromium (total) VI	3.2E+01	mg/kg	3.2E-06	mg/m^3	R	1.3E-07	mg/kg-day	2.9E-05	mg/kg-day	1.0E-04	mg/m^3	0.004
	Iron	4.0E+04	mg/kg	4.0E-03	mg/m^3	R	1.6E-04	mg/kg-day	--	--	--	--	--
	Manganese (non-food)	3.0E+02	mg/kg	3.0E-05	mg/m^3	R	1.2E-06	mg/kg-day	1.4E-05	mg/kg-day	5.0E-05	mg/m^3	0.08
	Vanadium	6.7E+01	mg/kg	6.7E-06	mg/m^3	R	2.6E-07	mg/kg-day	--	--	--	--	--
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	1.1E-08	mg/m^3	R	4.3E-10	mg/kg-day	--	--	--	--	--
	(Total)												0.1
												Total Hazard Index Across All Exposure Routes/Pathways	0.1

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

(2) Chronic reference dose.

(3) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table.

NOTE: Aluminum, Chromium (total), Iron, Manganese, and Vanadium are in the total data set only for subsurface soil.

TABLE 7.5.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE CONSTRUCTION WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Construction Worker
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	1.0E-02	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.01
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	2.0E-05	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.07
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	2.2E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.001
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	2.2E-02	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.07
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	2.4E-04	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.01
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	4.3E-05	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.006
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	5.2E-08	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.001
	(Total)												0.2
Dermal Absorption	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	5.2E-04	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.002
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	3.3E-06	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.01
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.1E-06	mg/kg-day	2.0E-04	mg/kg-day	N/A	N/A	0.006
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	1.1E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.004
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	1.2E-05	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.01
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	2.2E-06	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.02
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	2.6E-08	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.0006
	(Total)												0.05
												Total Hazard Index Across All Exposure Routes/Pathways	0.2

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

(2) Subchronic reference dose, except for the following analytes which used Chronic reference dose: Aluminum, Iron, and Manganese.

NOTE: Aluminum, Chromium (total), Iron, and Vanadium are in the total data set only for surface soil.

Manganese HQs shown on this table reflect the original risk assessment presented in the RI Report. These HQs were replaced with the HQs shown in Table 7.20, which reflect the expanded manganese data set.

TABLE 7.6.RME

RME CALCULATION OF NON-CANCER HAZARDS: INHALATION

OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE CONSTRUCTION WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (3)	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	7.8E-03	mg/m^3	R	1.5E-03	mg/kg-day	1.0E-03	mg/kg-day	--	--	2
	Arsenic	2.6E+01	mg/kg	1.5E-05	mg/m^3	R	3.0E-06	mg/kg-day	--	--	--	--	--
	Chromium (total) VI	2.8E+01	mg/kg	1.7E-05	mg/m^3	R	3.3E-06	mg/kg-day	2.9E-05	mg/kg-day	1.0E-04	mg/m^3	0.1
	Iron	2.9E+04	mg/kg	1.7E-02	mg/m^3	R	3.3E-03	mg/kg-day	--	--	--	--	--
	Manganese (non-food)	3.1E+02	mg/kg	1.8E-04	mg/m^3	R	3.5E-05	mg/kg-day	1.4E-05	mg/kg-day	5.0E-05	mg/m^3	2
	Vanadium	5.5E+01	mg/kg	3.3E-05	mg/m^3	R	6.4E-06	mg/kg-day	--	--	--	--	--
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	1.5E-08	mg/m^3	R	3.0E-09	mg/kg-day	--	--	--	--	--
	(Total)												4
												Total Hazard Index Across All Exposure Routes/Pathways	4

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

(2) Subchronic reference dose, except for the following analytes which used Chronic reference dose: Aluminum, Chromium VI, and Manganese.

(3) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table.

NOTE: Aluminum, Chromium (total), Iron, and Vanadium are in the total data set only for surface soil.

Manganese HQs shown on this table reflect the original risk assessment presented in the RI Report. These HQs were replaced with the HQs shown in Table 7.20, which reflect the expanded manganese data set.

TABLE 7.7.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION
OF SUBSURFACE SOIL AT WP-14 FOR THE CONSTRUCTION WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Construction Worker
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E+04	mg/kg	M	1.2E-02	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.01
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	4.8E-05	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.2
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	2.5E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.001
	Iron	4.0E+04	mg/kg	4.0E+04	mg/kg	M	3.1E-02	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.1
	Manganese (non-food)	3.0E+02	mg/kg	3.0E+02	mg/kg	M	2.3E-04	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.01
	Vanadium	6.7E+01	mg/kg	6.7E+01	mg/kg	M	5.2E-05	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.007
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	3.7E-08	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.0007
	(Total)												0.3
Dermal Absorption	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E+04	mg/kg	M	5.8E-04	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.002
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	7.8E-06	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.03
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	1.3E-06	mg/kg-day	2.0E-04	mg/kg-day	N/A	N/A	0.006
	Iron	4.0E+04	mg/kg	4.0E+04	mg/kg	M	1.6E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.005
	Manganese (non-food)	3.0E+02	mg/kg	3.0E+02	mg/kg	M	1.2E-05	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.01
	Vanadium	6.7E+01	mg/kg	6.7E+01	mg/kg	M	2.6E-06	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.02
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	1.9E-08	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.0004
	(Total)												0.07
												Total Hazard Index Across All Exposure Routes/Pathways	0.4

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

(2) Subchronic reference dose, except for the following analytes which used Chronic reference dose: Aluminum, Iron, and Manganese.

NOTE: Aluminum, Chromium (total), Iron, Manganese, and Vanadium are in the total data set only for subsurface soil.

Manganese HQs shown on this table reflect the original risk assessment presented in the RI Report. These HQs were replaced with the HQs shown in Table 7.20, which reflect the expanded manganese data set.

TABLE 7.8.RME
RME CALCULATION OF NON-CANCER HAZARDS: INHALATION
OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE CONSTRUCTION WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (3)	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	8.8E-03	mg/m^3	R	1.7E-03	mg/kg-day	1.0E-03	mg/kg-day	--	--	2
	Arsenic	6.3E+01	mg/kg	3.7E-05	mg/m^3	R	7.2E-06	mg/kg-day	--	--	--	--	--
	Chromium (total) VI	3.2E+01	mg/kg	1.9E-05	mg/m^3	R	3.7E-06	mg/kg-day	2.9E-05	mg/kg-day	1.0E-04	mg/m^3	0.1
	Iron	4.0E+04	mg/kg	2.4E-02	mg/m^3	R	4.6E-03	mg/kg-day	--	--	--	--	--
	Manganese (non-food)	3.0E+02	mg/kg	1.8E-04	mg/m^3	R	3.5E-05	mg/kg-day	1.4E-05	mg/kg-day	5.0E-05	mg/m^3	2
	Vanadium	6.7E+01	mg/kg	4.0E-05	mg/m^3	R	7.7E-06	mg/kg-day	--	--	--	--	--
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	1.1E-08	mg/m^3	R	2.1E-09	mg/kg-day	--	--	--	--	--
	(Total)												4
												Total Hazard Index Across All Exposure Routes/Pathways	4

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

(2) Subchronic reference dose, except for the following analytes which used Chronic reference dose: Aluminum, Chromium VI, and Manganese.

(3) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table.

NOTE: Aluminum, Chromium (total), Iron, Manganese, and Vanadium are in the total data set only for subsurface soil.

Manganese HQs shown on this table reflect the original risk assessment presented in the RI Report. These HQs were replaced with the HQs shown in Table 7.20, which reflect the expanded manganese data set.

TABLE 7.9.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE INDUSTRIAL WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Industrial Worker
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	5.2E-04	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.00
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.0E-06	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.00
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.1E-06	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.000
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	1.1E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.00
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	1.2E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.00
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	2.2E-06	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.000
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	2.6E-09	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.000
	(Total)												0.009
Dermal Absorption	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	4.2E-05	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.000
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	2.6E-07	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.00
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	8.9E-08	mg/kg-day	2.0E-04	mg/kg-day	N/A	N/A	0.000
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	9.0E-05	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.000
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	9.6E-07	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.00
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	1.7E-07	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.00
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	2.1E-09	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.0000
	(Total)												0.004
												Total Hazard Index Across All Exposure Routes/Pathways	0.01

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

(2) Subchronic reference dose, except for the following analytes which used Chronic reference dose: Aluminum, Iron, and Manganese.

NOTE: Aluminum, Chromium (total), Iron, and Vanadium are in the total data set only for surface soil.

TABLE 7.10.RME

RME CALCULATION OF NON-CANCER HAZARDS: INHALATION

OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE INDUSTRIAL WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Industrial Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (3)	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	7.8E-03	mg/m^3	R	1.2E-04	mg/kg-day	1.0E-03	mg/kg-day	--	--	0.1
	Arsenic	2.6E+01	mg/kg	1.5E-05	mg/m^3	R	2.4E-07	mg/kg-day	--	--	--	--	--
	Chromium (total) VI	2.8E+01	mg/kg	1.7E-05	mg/m^3	R	2.6E-07	mg/kg-day	2.9E-05	mg/kg-day	1.0E-04	mg/m^3	0.009
	Iron	2.9E+04	mg/kg	1.7E-02	mg/m^3	R	2.7E-04	mg/kg-day	--	--	--	--	--
	Manganese (non-food)	3.1E+02	mg/kg	1.8E-04	mg/m^3	R	2.8E-06	mg/kg-day	1.4E-05	mg/kg-day	5.0E-05	mg/m^3	0.2
	Vanadium	5.5E+01	mg/kg	3.3E-05	mg/m^3	R	5.1E-07	mg/kg-day	--	--	--	--	--
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	1.5E-08	mg/m^3	R	2.4E-10	mg/kg-day	--	--	--	--	--
	(Total)												0.3
												Total Hazard Index Across All Exposure Routes/Pathways	0.3

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

(2) Subchronic reference dose, except for the following analytes which used Chronic reference dose: Aluminum, Chromium VI, and Manganese.

(3) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table.

NOTE: Aluminum, Chromium (total), Iron, and Vanadium are in the total data set only for surface soil.

TABLE 7.11.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION
OF SUBSURFACE SOIL AT WP-14 FOR THE INDUSTRIAL WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Industrial Worker
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E+04	mg/kg	M	5.8E-04	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.0006
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	2.5E-06	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.008
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	1.3E-06	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.00006
	Iron	4.0E+04	mg/kg	4.0E+04	mg/kg	M	1.6E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.005
	Manganese (non-food)	3.0E+02	mg/kg	3.0E+02	mg/kg	M	1.2E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.0006
	Vanadium	6.7E+01	mg/kg	6.7E+01	mg/kg	M	2.6E-06	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.0004
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	1.9E-09	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.00004
	(Total)												0.02
Dermal Absorption	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E+04	mg/kg	M	4.7E-05	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.0002
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	6.3E-07	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.0022
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	1.0E-07	mg/kg-day	2.0E-04	mg/kg-day	N/A	N/A	0.0005
	Iron	4.0E+04	mg/kg	4.0E+04	mg/kg	M	1.3E-04	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.0004
	Manganese (non-food)	3.0E+02	mg/kg	3.0E+02	mg/kg	M	9.5E-07	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.0009
	Vanadium	6.7E+01	mg/kg	6.7E+01	mg/kg	M	2.1E-07	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.0015
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	1.5E-09	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.00003
	(Total)												0.006
												Total Hazard Index Across All Exposure Routes/Pathways	0.02

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

(2) Subchronic reference dose, except for the following analytes which used Chronic reference dose: Aluminum, Iron, and Manganese.

NOTE: Aluminum, Chromium (total), Iron, Manganese, and Vanadium are in the total data set only for subsurface soil.

TABLE 7.12.RME

RME CALCULATION OF NON-CANCER HAZARDS: INHALATION

OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE INDUSTRIAL WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Industrial Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (3)	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	8.8E-03	mg/m^3	R	1.4E-04	mg/kg-day	1.0E-03	mg/kg-day	--	--	0.14
	Arsenic	6.3E+01	mg/kg	3.7E-05	mg/m^3	R	5.8E-07	mg/kg-day	--	--	--	--	--
	Chromium (total) VI	3.2E+01	mg/kg	1.9E-05	mg/m^3	R	3.0E-07	mg/kg-day	2.9E-05	mg/kg-day	1.0E-04	mg/m^3	0.01
	Iron	4.0E+04	mg/kg	2.4E-02	mg/m^3	R	3.7E-04	mg/kg-day	--	--	--	--	--
	Manganese (non-food)	3.0E+02	mg/kg	1.8E-04	mg/m^3	R	2.8E-06	mg/kg-day	1.4E-05	mg/kg-day	5.0E-05	mg/m^3	0.19
	Vanadium	6.7E+01	mg/kg	4.0E-05	mg/m^3	R	6.2E-07	mg/kg-day	--	--	--	--	--
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	1.1E-08	mg/m^3	R	1.7E-10	mg/kg-day	--	--	--	--	--
	(Total)												0.3
												Total Hazard Index Across All Exposure Routes/Pathways	0.3

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

(2) Subchronic reference dose, except for the following analytes which used Chronic reference dose: Aluminum, Chromium VI, and Manganese.

(3) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table.

NOTE: Aluminum, Chromium (total), Iron, Manganese, and Vanadium are in the total data set only for subsurface soil.

TABLE 7.13.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE TRESPASSER/VISITOR

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Trespasser/Visitor
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	7.2E-04	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.0007
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.4E-06	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.005
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.5E-06	mg/kg-day	3.0E-03	mg/kg-day	N/A	N/A	0.0005
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	1.6E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.005
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	1.7E-05	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.0008
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	3.0E-06	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.0004
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	3.7E-09	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.00007
	(Total)												0.01
Dermal Absorption	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	2.8E-04	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.001
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.7E-06	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.006
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	5.9E-07	mg/kg-day	3.0E-05	mg/kg-day	N/A	N/A	0.02
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	6.0E-04	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.002
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	6.4E-06	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.006
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	1.2E-06	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.008
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	1.4E-08	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.0003
	(Total)												0.04
												Total Hazard Index Across All Exposure Routes/Pathways	0.06

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

(2) Chronic reference dose.

NOTE: Aluminum, Chromium (total), Iron, and Vanadium are in the total data set only for surface soil.

TABLE 7.14.RME
RME CALCULATION OF NON-CANCER HAZARDS: INHALATION
OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE TRESPASSER/VISITOR
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Trespasser/Visitor
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (3)	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E-03	mg/m^3	R	5.1E-05	mg/kg-day	1.0E-03	mg/kg-day	5.0E-03	--	0.05
	Arsenic	2.6E+01	mg/kg	2.6E-06	mg/m^3	R	1.0E-07	mg/kg-day	--	--	--	--	--
	Chromium (total) VI	2.8E+01	mg/kg	2.8E-06	mg/m^3	R	1.1E-07	mg/kg-day	2.9E-05	mg/kg-day	1.0E-04	mg/m^3	0.004
	Iron	2.9E+04	mg/kg	2.9E-03	mg/m^3	R	1.1E-04	mg/kg-day	--	--	--	--	--
	Manganese (non-food)	3.1E+02	mg/kg	3.1E-05	mg/m^3	R	1.2E-06	mg/kg-day	1.4E-05	mg/kg-day	5.0E-05	mg/m^3	0.08
	Vanadium	5.5E+01	mg/kg	5.5E-06	mg/m^3	R	2.1E-07	mg/kg-day	--	--	--	--	--
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	1.5E-08	mg/m^3	R	5.9E-10	mg/kg-day	--	--	--	--	--
	(Total)												0.1
												Total Hazard Index Across All Exposure Routes/Pathways	0.1

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

(2) Chronic reference dose.

(3) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table.

NOTE: Aluminum, Chromium (total), Iron, and Vanadium are in the total data set only for surface soil.

TABLE 7.15.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE CHILD RESIDENT
WP-14, Langley Air Force Base

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Resident
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	8.5E-02	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.09
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.7E-04	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.6
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.8E-04	mg/kg-day	3.0E-03	mg/kg-day	N/A	N/A	0.06
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	1.8E-01	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.6
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	2.0E-03	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.1
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	3.5E-04	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.05
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	4.3E-07	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.009
	(Total)												1
Dermal Absorption	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	3.1E-03	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.01
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.9E-05	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.07
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	6.6E-06	mg/kg-day	3.0E-05	mg/kg-day	N/A	N/A	0.2
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	6.7E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.02
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	7.2E-05	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.07
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	1.3E-05	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.09
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	1.6E-07	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.004
	(Total)												0.5
												Total Hazard Index Across All Exposure Routes/Pathways	2

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

(2) Chronic reference dose.

NOTE: Aluminum, Chromium (total), Iron, and Vanadium are in the total data set only for surface soil.

Arsenic HQs shown on this table reflect the original risk assessment presented in the RI Report. These HQs were replaced with the HQs shown in Table 7.19, which reflect the expanded arsenic data set.

TABLE 7.16.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE ADULT RESIDENT

WP-14, Langley Air Force Base

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Resident
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	9.1E-03	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.009
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.8E-05	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.06
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.9E-05	mg/kg-day	3.0E-03	mg/kg-day	N/A	N/A	0.006
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	2.0E-02	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.07
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	2.1E-04	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.01
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	3.8E-05	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.005
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	4.6E-08	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.0009
	(Total)												0.2
Dermal Absorption	**INORGANICS**												
	Aluminum	1.3E+04	mg/kg	1.3E+04	mg/kg	M	1.8E-03	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.007
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.1E-05	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.04
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	3.9E-06	mg/kg-day	3.0E-05	mg/kg-day	N/A	N/A	0.1
	Iron	2.9E+04	mg/kg	2.9E+04	mg/kg	M	3.9E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.01
	Manganese (non-food)	3.1E+02	mg/kg	3.1E+02	mg/kg	M	4.2E-05	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.04
	Vanadium	5.5E+01	mg/kg	5.5E+01	mg/kg	M	7.6E-06	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.05
	ORGANICS												
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	9.2E-08	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.002
	(Total)												0.3
												Total Hazard Index Across All Exposure Routes/Pathways	0.4

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

(2) Chronic reference dose.

NOTE: Aluminum, Chromium (total), Iron, and Vanadium are in the total data set only for surface soil.

TABLE 7.17.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION OF SUBSURFACE SOIL AT WP-14 FOR THE RESIDENT (CHILD)

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Resident
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E+04	mg/kg	M	9.5E-02	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.1
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	4.0E-04	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	1
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	2.1E-04	mg/kg-day	3.0E-03	mg/kg-day	N/A	N/A	0.07
	Iron	4.0E+04	mg/kg	4.0E+04	mg/kg	M	2.6E-01	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.9
	Manganese (non-food)	3.0E+02	mg/kg	3.0E+02	mg/kg	M	1.9E-03	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.1
	Vanadium	6.7E+01	mg/kg	6.7E+01	mg/kg	M	4.3E-04	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.06
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	3.1E-07	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.006
	(Total)												3
Dermal Absorption	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E+04	mg/kg	M	3.5E-03	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.01
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	4.7E-05	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.2
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	7.5E-06	mg/kg-day	3.0E-05	mg/kg-day	N/A	N/A	0.25
	Iron	4.0E+04	mg/kg	4.0E+04	mg/kg	M	9.4E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.03
	Manganese (non-food)	3.0E+02	mg/kg	3.0E+02	mg/kg	M	7.0E-05	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.07
	Vanadium	6.7E+01	mg/kg	6.7E+01	mg/kg	M	1.6E-05	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.1
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	1.1E-07	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.002
	(Total)												0.6
												Total Hazard Index Across All Exposure Routes/Pathways	3

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

(2) Subchronic reference dose, except for the following analytes which used Chronic reference dose: Aluminum, Iron, and Manganese.

NOTE: Aluminum, Chromium (total), Iron, Manganese, and Vanadium are in the total data set only for subsurface soil.

Arsenic HQs shown on this table reflect the original risk assessment presented in the RI Report. These HQs were replaced with the HQs shown in Table 7.19, which reflect the expanded arsenic data set.

TABLE 7.18.RME

RME CALCULATION OF NON-CANCER HAZARDS: INGESTION/DERMAL ABSORPTION

OF SUBSURFACE SOIL AT WP-14 FOR THE RESIDENT (ADULT)

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Resident
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 (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E+04	mg/kg	M	1.0E-02	mg/kg-day	1.0E+00	mg/kg-day	N/A	N/A	0.01
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	4.3E-05	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	0.1
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	2.2E-05	mg/kg-day	3.0E-03	mg/kg-day	N/A	N/A	0.007
	Iron	4.0E+04	mg/kg	4.0E+04	mg/kg	M	2.7E-02	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.09
	Manganese (non-food)	3.0E+02	mg/kg	3.0E+02	mg/kg	M	2.1E-04	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	0.01
	Vanadium	6.7E+01	mg/kg	6.7E+01	mg/kg	M	4.6E-05	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	0.007
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	3.3E-08	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	0.0007
	(Total)												0.3
Dermal Absorption	**INORGANICS**												
	Aluminum	1.5E+04	mg/kg	1.5E+04	mg/kg	M	2.0E-03	mg/kg-day	2.7E-01	mg/kg-day	N/A	N/A	0.008
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	2.7E-05	mg/kg-day	2.9E-04	mg/kg-day	N/A	N/A	0.1
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	4.4E-06	mg/kg-day	3.0E-05	mg/kg-day	N/A	N/A	0.15
	Iron	4.0E+04	mg/kg	4.0E+04	mg/kg	M	5.5E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	0.02
	Manganese (non-food)	3.0E+02	mg/kg	3.0E+02	mg/kg	M	4.1E-05	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	0.04
	Vanadium	6.7E+01	mg/kg	6.7E+01	mg/kg	M	9.2E-06	mg/kg-day	1.4E-04	mg/kg-day	N/A	N/A	0.07
	ORGANICS												
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	6.6E-08	mg/kg-day	4.5E-05	mg/kg-day	N/A	N/A	0.001
	(Total)												0.4
												Total Hazard Index Across All Exposure Routes/Pathways	0.6

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

(2) Subchronic reference dose, except for the following analytes which used Chronic reference dose: Aluminum, Iron, and Manganese.

NOTE: Aluminum, Chromium (total), Iron, Manganese, and Vanadium are in the total data set only for subsurface soil.

Table 7.19
Calculation of Arsenic Non-Cancer Hazards
Reasonable Maximum Exposure
Risk Re-Evaluation for ERP Site WP-14, Langley AFB, VA

Scenario Timeframe: Future
Medium: Future Surface Soil
Exposure Media: Combined surface and subsurface soil
Exposure Point: WP-14 Future Surface Soil
Direct Contact Exposure Pathway: Residential use
Receptor Population: Child Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Exposure Medium EPC Value	Exposure Medium EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	2.69E+01	mg/kg	2.69E+01	mg/kg	M	3.4E-04	mg/kg-day	3.0E-04	mg/kg-day	1.1
	Exposure Route Total										1.1
Dermal Contact	Arsenic	2.69E+01	mg/kg	2.69E+01	mg/kg	M	3.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.10
	Exposure Route Total										0.10
											1.2

(1) Medium-Specific (M) EPC selected for intake calculation.

(2) Chronic.

Table 7.20
Calculation of Manganese Non-Cancer Hazards
Reasonable Maximum Exposure
Risk Re-Evaluation for ERP Site WP-14, Langley AFB, VA

Scenario Timeframe: Future
Medium: Total Soil
Exposure Media: Soil and Air
Exposure Point: Soil and Ambient Air
Direct Contact Exposure Pathway: direct contact and soil-to-air
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Exposure Medium EPC Value	Exposure Medium EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Hazard Quotient
Ingestion	Manganese	4.2E+02	mg/kg	4.2E+02	mg/kg	M	1.4E-03	mg/kg-day	4.7E-02	mg/kg-day	0.029
	Exposure Route Total										0.029
Dermal Contact	Manganese	4.2E+02	mg/kg	4.2E+02	mg/kg	M	4.1E-05	mg/kg-day	1.9E-03	mg/kg-day	0.022
	Exposure Route Total										0.022
Inhalation	Manganese	4.2E+02	mg/kg	6.3E-06	mg/m3	E	1.2E-06	mg/kg-day	1.4E-05	mg/kg-day	0.086
	Exposure Route Total										0.086
											0.14

(1) Medium-Specific (M) or Exposure Medium-Specific (E) EPC selected for intake calculation.

(2) Subchronic RfD not available for manganese. Therefore, used chronic RfD.

Appendix A.8

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

TABLE 8.1.RME
RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE OTHER WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Other Worker
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	2.6E+01	mg/kg	2.6E+01	mg/kg	M	4.6E-07	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	6.8E-07
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	5.0E-07	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	2.0E-09	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	1.5E-08
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	1.2E-09	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	1.9E-08
	(Total)										7E-07
Dermal Absorption	**INORGANICS**										
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	2.3E-07	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	3.7E-07
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	7.9E-08	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	3.2E-09	mg/kg-day	--	--	--
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	1.9E-09	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	3.4E-08
	(Total)										4E-07
										Total Risk Across All Exposure Routes/Pathways	1E-06

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
NOTE: Benz(a)pyrene and Chromium (total) are in the total data set only for surface soil.

TABLE 8.2.RME
RME CALCULATION OF CANCER RISKS: INHALATION
OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE OTHER WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Other Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (2)	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	**INORGANICS**										
	Arsenic	2.6E+01	mg/kg	2.6E-06	mg/m^3	R	3.6E-08	mg/kg-day	1.5E+01	$mg/kg\text{-}day^{-1}$	5.5E-07
	Chromium (total) VI	2.8E+01	mg/kg	2.8E-06	mg/m^3	R	4.0E-08	mg/kg-day	4.2E+01	$mg/kg\text{-}day^{-1}$	1.7E-06
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	3.2E-09	mg/m^3	R	4.5E-11	mg/kg-day	3.1E+00	$mg/kg\text{-}day^{-1}$	1.4E-10
	Dieldrin	6.8E-02	mg/kg	1.5E-08	mg/m^3	R	2.1E-10	mg/kg-day	1.6E+01	$mg/kg\text{-}day^{-1}$	3.4E-09
	(Total)										2E-06
										Total Risk Across All Exposure Routes/Pathways	2E-06

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

(2) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table. EPA Region III calculated cancer risk from vapors and the results ranged from 5E-09 to 4E-08, therefore exposure to vapors is less conservative than exposure to particulates.

NOTE: Benz(a)pyrene and Chromium (total) are in the total data set only for surface soil.

TABLE 8.3.RME
RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SUBSURFACE SOIL AT WP-14 FOR THE OTHER WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Other Worker
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	6.3E+01	mg/kg	6.3E+01	mg/kg	M	1.1E-06	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	1.6E-06
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	5.6E-07	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	4.4E-02	mg/kg	M	7.7E-10	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	5.6E-09
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	8.4E-10	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	1.3E-08
	(Total)										2E-06
Dermal Absorption	**INORGANICS**										
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	5.6E-07	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	8.8E-07
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	9.0E-08	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	4.4E-02	mg/kg	M	1.2E-09	mg/kg-day	--	--	--
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	1.3E-09	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	2.4E-08
	(Total)										9E-07
										Total Risk Across All Exposure Routes/Pathways	3E-06

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
NOTE: Chromium (total) is in the total data set only for subsurface soil.

TABLE 8.4.RME
RME CALCULATION OF CANCER RISKS: INHALATION
OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE OTHER WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Other Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (2)	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	**INORGANICS**										
	Arsenic	6.3E+01	mg/kg	6.3E-06	mg/m^3	R	8.8E-08	mg/kg-day	1.5E+01	$mg/kg\text{-}day^{-1}$	1.3E-06
	Chromium (total) VI	3.2E+01	mg/kg	3.2E-06	mg/m^3	R	4.5E-08	mg/kg-day	4.2E+01	$mg/kg\text{-}day^{-1}$	1.9E-06
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	1.2E-09	mg/m^3	R	1.7E-11	mg/kg-day	3.1E+00	$mg/kg\text{-}day^{-1}$	5.4E-11
	Dieldrin	4.8E-02	mg/kg	1.1E-08	mg/m^3	R	1.5E-10	mg/kg-day	1.6E+01	$mg/kg\text{-}day^{-1}$	2.5E-09
	(Total)										3E-06
										Total Risk Across All Exposure Routes/Pathways	3E-06

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

(2) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table. EPA Region III calculated cancer risk from vapors and the results ranged from 5E-09 to 4E-08, therefore exposure to vapors is less conservative than exposure to particulates.

TABLE 8.5.RME

RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE CONSTRUCTION WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Construction Worker
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	2.6E+01	mg/kg	2.6E+01	mg/kg	M	2.9E-07	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	4.3E-07
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	3.1E-07	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	1.3E-09	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	9.2E-09
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	7.5E-10	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	1.2E-08
	(Total)										5E-07
Dermal Absorption	**INORGANICS**										
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	4.7E-08	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	7.4E-08
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.6E-08	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	6.4E-10	mg/kg-day	--	--	--
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	3.8E-10	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	6.7E-09
	(Total)										8E-08
										Total Risk Across All Exposure Routes/Pathways	5E-07

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

NOTE: Benz(a)pyrene and Chromium (total) are in the total data set only for surface soil.

TABLE 8.6.RME

RME CALCULATION OF CANCER RISKS: INHALATION

OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE CONSTRUCTION WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (2)	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	**INORGANICS**										
	Arsenic	2.6E+01	mg/kg	1.5E-05	mg/m^3	R	4.3E-08	mg/kg-day	1.5E+01	$mg/kg\text{-}day^{-1}$	6.5E-07
	Chromium (total) VI	2.8E+01	mg/kg	1.7E-05	mg/m^3	R	4.7E-08	mg/kg-day	4.2E+01	$mg/kg\text{-}day^{-1}$	2.0E-06
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	3.2E-09	mg/m^3	R	9.0E-12	mg/kg-day	3.1E+00	$mg/kg\text{-}day^{-1}$	2.8E-11
	Dieldrin	6.8E-02	mg/kg	1.5E-08	mg/m^3	R	4.3E-11	mg/kg-day	1.6E+01	$mg/kg\text{-}day^{-1}$	6.9E-10
	(Total)										3E-06
										Total Risk Across All Exposure Routes/Pathways	3E-06

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

(2) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table. EPA Region III calculated cancer risk from vapors and the results ranged from 5E-09 to 4E-08, therefore exposure to vapors is less conservative than exposure to particulates.

TABLE 8.7.RME

RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SUBSURFACE SOIL AT WP-14 FOR THE CONSTRUCTION WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Construction Worker
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	6.3E+01	mg/kg	6.3E+01	mg/kg	M	6.9E-07	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	1.0E-06
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	3.6E-07	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	4.4E-02	mg/kg	M	4.8E-10	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	3.5E-09
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	5.3E-10	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	8.5E-09
	(Total)										1E-06
Dermal Absorption	**INORGANICS**										
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	1.1E-07	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	1.8E-07
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	1.8E-08	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	4.4E-02	mg/kg	M	2.4E-10	mg/kg-day	--	--	--
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	2.7E-10	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	4.8E-09
	(Total)										2E-07
										Total Risk Across All Exposure Routes/Pathways	1E-06

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

NOTE: Chromium (total) is in the total data set only for subsurface soil.

TABLE 8.8.RME
RME CALCULATION OF CANCER RISKS: INHALATION
OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE CONSTRUCTION WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (2)	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	**INORGANICS**										
	Arsenic	6.3E+01	mg/kg	3.7E-05	mg/m^3	R	1.0E-07	mg/kg-day	1.5E+01	$mg/kg\text{-}day^{-1}$	1.6E-06
	Chromium (total) VI	3.2E+01	mg/kg	1.9E-05	mg/m^3	R	5.3E-08	mg/kg-day	4.2E+01	$mg/kg\text{-}day^{-1}$	2.2E-06
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	1.2E-09	mg/m^3	R	3.5E-12	mg/kg-day	3.1E+00	$mg/kg\text{-}day^{-1}$	1.1E-11
	Dieldrin	4.8E-02	mg/kg	1.1E-08	mg/m^3	R	3.1E-11	mg/kg-day	1.6E+01	$mg/kg\text{-}day^{-1}$	4.9E-10
	(Total)										4E-06
										Total Risk Across All Exposure Routes/Pathways	4E-06

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

(2) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table. EPA Region III calculated cancer risk from vapors and the results ranged from 5E-09 to 4E-08, therefore exposure to vapors is less conservative than exposure to particulates.

TABLE 8.9.RME

RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE INDUSTRIAL WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Industrial Worker
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	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.5E-08	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	2.2E-08
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.6E-08	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	6.4E-11	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	4.7E-10
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	3.8E-11	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	6.0E-10
	(Total)										2E-08
Dermal Absorption	**INORGANICS**										
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	3.7E-09	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	5.9E-09
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.3E-09	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	5.1E-11	mg/kg-day	--	--	--
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	3.0E-11	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	5.4E-10
	(Total)										6E-09
										Total Risk Across All Exposure Routes/Pathways	3E-08

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

NOTE: Benz(a)pyrene and Chromium (total) are in the total data set only for surface soil.

TABLE 8.10.RME
RME CALCULATION OF CANCER RISKS: INHALATION
OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE INDUSTRIAL WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Industrial Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (2)	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	**INORGANICS**										
	Arsenic	2.6E+01	mg/kg	1.5E-05	mg/m^3	R	3.4E-09	mg/kg-day	1.5E+01	$mg/kg\text{-}day^{-1}$	5.2E-08
	Chromium (total) VI	2.8E+01	mg/kg	1.7E-05	mg/m^3	R	3.7E-09	mg/kg-day	4.2E+01	$mg/kg\text{-}day^{-1}$	1.6E-07
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	3.2E-09	mg/m^3	R	7.2E-13	mg/kg-day	3.1E+00	$mg/kg\text{-}day^{-1}$	2.2E-12
	Dieldrin	6.8E-02	mg/kg	1.5E-08	mg/m^3	R	3.4E-12	mg/kg-day	1.6E+01	$mg/kg\text{-}day^{-1}$	5.5E-11
	(Total)										2E-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) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table. EPA Region III calculated cancer risk from vapors and the results ranged from 5E-09 to 4E-08, therefore exposure to vapors is less conservative than exposure to particulates.

TABLE 8.11.RME
RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SUBSURFACE SOIL AT WP-14 FOR THE INDUSTRIAL WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Industrial Worker
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	6.3E+01	mg/kg	6.3E+01	mg/kg	M	3.5E-08	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	5.3E-08
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	1.8E-08	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	4.4E-02	mg/kg	M	2.4E-11	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	1.8E-10
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	2.7E-11	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	4.3E-10
	(Total)										5E-08
Dermal Absorption	**INORGANICS**										
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	9.0E-09	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	1.4E-08
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	1.4E-09	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	4.4E-02	mg/kg	M	2.0E-11	mg/kg-day	--	--	--
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	2.2E-11	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	3.8E-10
	(Total)										1E-08
										Total Risk Across All Exposure Routes/Pathways	7E-08

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
NOTE: Chromium (total) is in the total data set only for subsurface soil.

TABLE 8.12.RME
RME CALCULATION OF CANCER RISKS: INHALATION
OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE INDUSTRIAL WORKER
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Industrial Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (2)	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	**INORGANICS**										
	Arsenic	6.3E+01	mg/kg	3.7E-05	mg/m^3	R	8.2E-09	mg/kg-day	1.5E+01	$mg/kg\text{-}day^{-1}$	1.2E-07
	Chromium (total) VI	3.2E+01	mg/kg	1.9E-05	mg/m^3	R	4.2E-09	mg/kg-day	4.2E+01	$mg/kg\text{-}day^{-1}$	1.8E-07
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	1.2E-09	mg/m^3	R	2.8E-13	mg/kg-day	3.1E+00	$mg/kg\text{-}day^{-1}$	8.6E-13
	Dieldrin	4.8E-02	mg/kg	1.1E-08	mg/m^3	R	2.5E-12	mg/kg-day	1.6E+01	$mg/kg\text{-}day^{-1}$	3.9E-11
	(Total)										3E-07
										Total Risk Across All Exposure Routes/Pathways	3E-07

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

(2) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table. EPA Region III calculated cancer risk from vapors and the results ranged from 5E-09 to 4E-08, therefore exposure to vapors is less conservative than exposure to particulates.

TABLE 8.13.RME

RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE TRESPASSER/VISITOR
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Trespasser/Visitor
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	2.6E+01	mg/kg	2.6E+01	mg/kg	M	2.4E-07	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	3.6E-07
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	2.6E-07	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	1.1E-09	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	7.7E-09
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	6.3E-10	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	1.0E-08
	(Total)										4E-07
Dermal Absorption	**INORGANICS**										
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	3.0E-07	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	4.7E-07
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.0E-07	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	4.1E-09	mg/kg-day	--	--	--
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	2.4E-09	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	4.3E-08
	(Total)										5E-07
										Total Risk Across All Exposure Routes/Pathways	9E-07

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

NOTE: Benz(a)pyrene and Chromium (total) are in the total data set only for surface soil.

TABLE 8.14.RME
RME CALCULATION OF CANCER RISKS: INHALATION
OF AMBIENT AIR ABOVE WP-14 (PARTICULATES) FOR THE TRESPASSER/VISITOR
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Ambient air above WP-14 (particulates)
Receptor Population: Trespasser/Visitor
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (2)	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	**INORGANICS**										
	Arsenic	2.6E+01	mg/kg	2.6E-06	mg/m^3	R	1.7E-08	mg/kg-day	1.5E+01	$mg/kg\text{-}day^{-1}$	2.6E-07
	Chromium (total) VI	2.8E+01	mg/kg	2.8E-06	mg/m^3	R	1.9E-08	mg/kg-day	4.2E+01	$mg/kg\text{-}day^{-1}$	7.8E-07
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	3.2E-09	mg/m^3	R	2.1E-11	mg/kg-day	3.1E+00	$mg/kg\text{-}day^{-1}$	6.6E-11
	Dieldrin	6.8E-02	mg/kg	1.5E-08	mg/m^3	R	1.0E-10	mg/kg-day	1.6E+01	$mg/kg\text{-}day^{-1}$	1.6E-09
	(Total)										1E-06
										Total Risk Across All Exposure Routes/Pathways	1E-06

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

(2) Particulate emission factor was used to calculate the route EPC. None of the COPCs are considered volatiles according to Region III RBC table. EPA Region III calculated cancer risk from vapors and the results ranged from 5E-09 to 4E-08, therefore exposure to vapors is less conservative than exposure to particulates.

TABLE 8.15.RME
RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE CHILD RESIDENT
WP-14, Langley Air Force Base

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Resident
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	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.4E-05	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	2.1E-05
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.6E-05	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	6.2E-08	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	4.6E-07
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	3.7E-08	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	5.9E-07
	(Total)										2E-05
Dermal Absorption	**INORGANICS**										
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	1.7E-06	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	2.6E-06
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	5.7E-07	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	2.3E-08	mg/kg-day	--	--	--
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	1.4E-08	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	2.4E-07
	(Total)										3E-06
										Total Risk Across All Exposure Routes/Pathways	3E-05

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

NOTE: Benz(a)pyrene and Chromium (total) are in the total data set only for surface soil.

Arsenic risks shown on this table reflect the original risk assessment presented in the RI Report. These risks were replaced with the risks shown in Table 8.19, which reflect the expanded arsenic data set.

TABLE 8.16.RME

RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SURFACE SOIL AT WP-14 FOR THE ADULT RESIDENT
WP-14, Langley Air Force Base

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil at WP-14
Receptor Population: Resident
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	2.6E+01	mg/kg	2.6E+01	mg/kg	M	6.1E-06	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	9.2E-06
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	6.7E-06	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	2.7E-08	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	2.0E-07
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	1.6E-08	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	2.5E-07
	(Total)										1E-05
Dermal Absorption	**INORGANICS**										
	Arsenic	2.6E+01	mg/kg	2.6E+01	mg/kg	M	3.9E-06	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	6.2E-06
	Chromium (total) VI	2.8E+01	mg/kg	2.8E+01	mg/kg	M	1.3E-06	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	1.1E-01	mg/kg	1.1E-01	mg/kg	M	5.4E-08	mg/kg-day	--	--	--
	Dieldrin	6.8E-02	mg/kg	6.8E-02	mg/kg	M	3.2E-08	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	5.6E-07
	(Total)										7E-06
										Total Risk Across All Exposure Routes/Pathways	2E-05

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

NOTE: Benz(a)pyrene and Chromium (total) are in the total data set only for surface soil.

Arsenic risks shown on this table reflect the original risk assessment presented in the RI Report. These risks were replaced with the risks shown in Table 8.19, which reflect the expanded arsenic data set.

TABLE 8.17.RME
RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SUBSURFACE SOIL AT WP-14 FOR THE RESIDENT (CHILD)
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Resident
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	6.3E+01	mg/kg	6.3E+01	mg/kg	M	3.4E-05	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	5.1E-05
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	1.8E-05	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	4.4E-02	mg/kg	M	2.4E-08	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	1.8E-07
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	2.6E-08	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	4.2E-07
	(Total)										5E-05
Dermal Absorption	**INORGANICS**										
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	4.0E-06	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	6.3E-06
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	6.4E-07	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	4.4E-02	mg/kg	M	8.8E-09	mg/kg-day	--	--	--
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	9.6E-09	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	1.7E-07
	(Total)										6E-06
										Total Risk Across All Exposure Routes/Pathways	6E-05

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
NOTE: Chromium (total) is in the total data set only for subsurface soil.

Arsenic risks shown on this table reflect the original risk assessment presented in the RI Report. These risks were replaced with the risks shown in Table 8.19, which reflect the expanded arsenic data set.

TABLE 8.18.RME
RME CALCULATION OF CANCER RISKS: INGESTION/DERMAL ABSORPTION
OF SUBSURFACE SOIL AT WP-14 FOR THE RESIDENT (ADULT)
WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil at WP-14
Receptor Population: Resident
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	6.3E+01	mg/kg	6.3E+01	mg/kg	M	1.5E-05	mg/kg-day	1.5E+00	mg/kg-day $^{-1}$	2.2E-05
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	7.6E-06	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	4.4E-02	mg/kg	M	1.0E-08	mg/kg-day	7.3E+00	mg/kg-day $^{-1}$	7.5E-08
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	1.1E-08	mg/kg-day	1.6E+01	mg/kg-day $^{-1}$	1.8E-07
	(Total)										2E-05
Dermal Absorption	**INORGANICS**										
	Arsenic	6.3E+01	mg/kg	6.3E+01	mg/kg	M	9.4E-06	mg/kg-day	1.6E+00	mg/kg-day $^{-1}$	1.5E-05
	Chromium (total) VI	3.2E+01	mg/kg	3.2E+01	mg/kg	M	1.5E-06	mg/kg-day	--	--	--
	ORGANICS										
	Benz(a)pyrene	4.4E-02	mg/kg	4.4E-02	mg/kg	M	2.1E-08	mg/kg-day	--	--	--
	Dieldrin	4.8E-02	mg/kg	4.8E-02	mg/kg	M	2.3E-08	mg/kg-day	1.8E+01	mg/kg-day $^{-1}$	4.0E-07
	(Total)										2E-05
										Total Risk Across All Exposure Routes/Pathways	4E-05

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
NOTE: Chromium (total) is in the total data set only for subsurface soil.

Arsenic risks shown on this table reflect the original risk assessment presented in the RI Report. These risks were replaced with the risks shown in Table 8.19, which reflect the expanded arsenic data set.

Table 8.19
Calculation of Arsenic Cancer Risks
Reasonable Maximum Exposure
Risk Re-Evaluation for ERP Site WP-14, Langley AFB, VA

Scenario Timeframe: Future
Medium: Future Surface Soil
Exposure Media: Combined surface and subsurface soil
Exposure Point: WP-14 Future Surface Soil
Direct Contact Exposure Pathway: Residential use
Receptor Population: Adult/Child Resident
Receptor Age: Age-Adjusted Adult/child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Exposure Medium EPC Value	Exposure Medium EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Slope Factor	Slope FactorUnits	ILCR
Ingestion	Arsenic	2.69E+01	mg/kg	2.69E+01	mg/kg	M	4.2E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	6.3E-05
	Exposure Route Total										
Dermal Contact	Arsenic	2.69E+01	mg/kg	2.69E+01	mg/kg	M	4.3E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	6.4E-06
	Exposure Route Total										
											7.0E-05

(1) Medium-Specific (M) EPC selected for intake 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 CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: OTHER WORKER

WP-14, 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 Soil	Surface Soil	Surface Soil at WP-14	**INORGANICS**					**INORGANICS**					
			Arsenic	6.8E-07	--	3.7E-07	1E-06	Aluminum	Dev. NS	0.00065	--	0.00039	0.001
			Chromium (total) VI	--	--	--	--	Arsenic	skin/vascular	0.0043	--	0.0023	0.007
			ORGANICS					Chromium (total) VI	GI tract/fetus/bone marrow/liver	0.00046	--	0.0074	0.008
			Benz(a)pyrene	1.5E-08	--	--	1E-08	Iron	blood/liver/GI tract	0.0047	--	0.00075	0.005
			Dieldrin	1.9E-08	--	3.4E-08	5E-08	Manganese (non-food)	CNS	0.00075	--	0.0024	0.003
			--	--	--	--	--	Vanadium	liver	0.00039	--	0.0031	0.003
			--	--	--	--	--	**ORGANICS**					
			--	--	--	--	--	Dieldrin	liver	0.000066	--	0.00012	0.0002
			(Total)	7E-07	--	4E-07	1E-06	(Total)		0.01	--	0.02	0.03
	Air	Ambient air above WP-14 (particulates)	**INORGANICS**					**INORGANICS**					
			Arsenic	--	5.5E-07	--	6E-07	Aluminum	Dev. NS	--	0.052	--	0.05
			Chromium (total) VI	--	1.7E-06	--	2E-06	Arsenic	--	--	--	--	--
			ORGANICS					Chromium (total) VI	lungs	--	0.0039	--	0.004
			Benz(a)pyrene	--	1.4E-10	--	1E-10	Iron	--	--	--	--	--
			Dieldrin	--	3.4E-09	--	3E-09	Manganese (non-food)	CNS	--	0.084	--	0.08
			--	--	--	--	--	Vanadium	--	--	--	--	--
			--	--	--	--	--	**ORGANICS**					
			--	--	--	--	--	Dieldrin	--	--	--	--	--
			(Total)	--	2E-06	--	2E-06	(Total)		--	0.1	--	0.1
Subsurface Soil	Subsurface Soil	Subsurface Soil at WP-14	**INORGANICS**					**INORGANICS**					
			Arsenic	1.6E-06	--	8.8E-07	3E-06	Aluminum	Dev. NS	0.00073	--	0.00043	0.001
			Chromium (total) VI	--	--	--	--	Arsenic	skin/vascular	0.010	--	0.0055	0.02
			ORGANICS					Chromium (total) VI	GI tract/fetus/bone marrow/liver	0.00053	--	0.0084	0.009
			Benz(a)pyrene	5.6E-09	--	--	6E-09	Iron	blood/liver/GI tract	0.0065	--	0.0010	0.008
			Dieldrin	1.3E-08	--	2.4E-08	4E-08	Manganese (non-food)	CNS	0.00074	--	0.0024	0.003
			--	--	--	--	--	Vanadium	liver	0.00047	--	0.0038	0.004
			--	--	--	--	--	**ORGANICS**					
			--	--	--	--	--	Dieldrin	liver	0.000047	--	0.000084	0.0001
			(Total)	2E-06	--	9E-07	3E-06	(Total)		0.02	--	0.02	0.04
	Air	Ambient air above WP-14 (particulates)	**INORGANICS**					**INORGANICS**					
			Arsenic	--	1.3E-06	--	1E-06	Aluminum	Dev. NS	--	0.058	--	0.06
			Chromium (total) VI	--	1.9E-06	--	2E-06	Arsenic	--	--	--	--	--
			ORGANICS					Chromium (total) VI	lungs	--	0.0044	--	0.004
			Benz(a)pyrene	--	5.4E-11	--	5E-11	Iron	--	--	--	--	--

TABLE 9.1.RME

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

WP-14, 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
			Dieldrin	--	2.5E-09	--	2E-09	Manganese (non-food)	CNS	--	0.083	--	0.08
			--	--	--	--	--	Vanadium	--	--	--	--	--
			--	--	--	--	--	**ORGANICS**					
			--	--	--	--	--	Dieldrin	--	--	--	--	--
			(Total)	--	3E-06	--	3E-06	(Total)		--	0.1	--	0.1
Groundwater	Groundwater	Groundwater at WP-14	**INORGANICS**					**INORGANICS**					
			Arsenic	9.5E-06	--	4.1E-08	1E-05	Arsenic	skin/vascular	0.059	--	0.00026	0.06
			ORGANICS					Iron	blood/liver/GI tract	0.013	--	0.000054	0.01
			bis(2-Ethylhexyl)phthalate	4.6E-08	--	1.4E-07	2E-07	Manganese (non-food)	CNS	0.031	--	0.0025	0.03
			Dieldrin	7.6E-08	--	6.5E-08	1E-07	**ORGANICS**					
			--	--	--	--	--	bis(2-Ethylhexyl)phthalate	liver	0.00046	--	0.0014	0.002
			--	--	--	--	--	Dieldrin	liver	0.00027	--	0.00023	0.0005
			(Total)	1E-05	--	3E-07	1E-05	(Total)		0.1	--	0.005	0.1
							Total Risk Across Surface Soil						Total Hazard Index Across Surface Soil
							3E-06						0.2
							Total Risk Across Subsurface Soil						Total Hazard Index Across Subsurface Soil
							6E-06						0.2
							Total Risk Across Groundwater						Total Hazard Index Across Groundwater
							1E-05						0.1
							Total Risk Across All Media and All Exposure Routes						Total Hazard Index Across All Media and All Exposure Routes
							2E-05						0.5

NOTE: Arsenic, Iron, and Manganese are in the total data set only for groundwater.

Aluminum, Benz(a)pyrene, Chromium (Total), Iron, and Vanadium are in the total data set only for surface soil.

Aluminum, Chromium (Total), Iron, Manganese, and Vanadium are in the total data set only for subsurface soil.

Total blood HI =	0.03
Total bone marrow HI =	0.02
Total CNS HI =	0.2
Total Dev. NS HI =	0.1
Total fetus HI =	0.02
Total GI tract HI =	0.04
Total liver HI =	0.05
Total lungs HI =	0.008

TABLE 9.2.RME

RME SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

Combined RI and Risk Re-Evaluation Results

ERP Site WP-14, Langley Air Force Base

Scenario Timeframe: Future
Receptor Population: Construction 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
Soil Analysis from the RI Report	Surface soil and Ambient Air	WP-14	Arsenic	4.3E-07	6.5E-07	7.4E-08	1E-06	Aluminum	Dev NS	Background Conditions			
			Chromium	--	2.0E-06	--	2.E-06	Arsenic	skin/vascular	0.067	--	0.011	0.08
			Benzo(a)pyrene	9.2E-09	2.8E-11	--	9.E-09	Chromium	GI tract/fetus/bone marrow/liver	Background Conditions			
			Dieldrin	1.2E-08	6.9E-10	6.7E-09	2.E-08	Iron	blood/liver/GI tract	Background Conditions			
								Manganese	CNS	Replaced with 2005 risk re-evaluation using pooled data set			
								Vanadium	Liver	Background Conditions			
								Dieldrin	Liver	0.001	--	0.0006	0.002
			Chemical Total	5.E-07	3.E-06	8.E-08	3.E-06	Chemical Total	- -	0.07	- -	0.01	0.08
	Subsurface Soil and Ambient Air	WP-14	Arsenic	1.0E-06	1.6E-06	1.8E-07	3E-06	Aluminum	Dev NS	Background Conditions			
			Chromium	--	2.2E-06	--	2.E-06	Arsenic	skin/vascular	0.16		0.03	0.19
			Benzo(a)pyrene	3.5E-09	1.1E-11	--	4.E-09	Chromium	GI tract/fetus/bone marrow/liver	Background Conditions			
			Dieldrin	8.5E-09	4.9E-10	4.8E-09	1.E-08	Iron	blood/liver/GI tract	Background Conditions			
				--		--		Manganese	CNS	Replaced with 2005 risk re-evaluation using pooled data set			
				--	--	--	--	Vanadium	Liver	Background Conditions			
				--	--	--	--	Dieldrin	Liver	0.0007		0.0004	0.001
			Chemical Total	1.0E-06	3.8E-06	1.8E-07	5.0E-06	Chemical Total		0.2		0.03	0.2
Soil Analysis from the Risk Re-Evaluation Report	Total Soil and Ambient Air	WP-14	Additional Analysis not performed because RI showed no unacceptable risks					Manganese	CNS	0.029	0.086	0.022	0.1
Total Cancer Risk across all exposure pathways and media							8.E-06	Total Non-Cancer HI across all exposure pathways and media					0.4

Total Skin/Vascular HI =	0.3
Total CNS HI =	0.1
Total Liver HI =	0.003

TABLE 9.3.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: INDUSTRIAL WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Industrial 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 Soil	Surface Soil	Surface Soil at WP-14	**INORGANICS**					**INORGANICS**					
			Arsenic	2.2E-08	--	5.9E-09	3E-08	Aluminum	Dev. NS	0.0005	--	0.0002	0.0007
			Chromium (total) VI	--	--	--	--	Arsenic	skin/vascular	0.003	--	0.0009	0.004
			ORGANICS					Chromium (total) VI	GI tract/fetus/bone marrow/liver	0.00006	--	0.0004	0.0005
			Benz(a)pyrene	4.7E-10	--	--	5E-10	Iron	blood/liver/GI tract	0.004	--	0.0003	0.004
			Dieldrin	6.0E-10	--	5.4E-10	1E-09	Manganese (non-food)	CNS	0.0006	--	0.001	0.002
			--	--	--	--	--	Vanadium	liver	0.0003	--	0.001	0.002
			--	--	--	--	--	**ORGANICS**					
			--	--	--	--	--	Dieldrin	liver	0.0001	--	0.00005	0.0001
			(Total)	2E-08	--	6E-09	3E-08	(Total)		0.009	--	0.004	0.01
	Air	Ambient air above WP-14 (particulates)	**INORGANICS**					**INORGANICS**					
			Arsenic	--	5.2E-08	--	5E-08	Aluminum	Dev. NS	--	0.1	--	0.1
			Chromium (total) VI	--	1.6E-07	--	2E-07	Arsenic	--	--	--	--	--
			ORGANICS					Chromium (total) VI	lungs	--	0.01	--	0.01
			Benz(a)pyrene	--	2.2E-12	--	2E-12	Iron	--	--	--	--	--
			Dieldrin	--	5.5E-11	--	6E-11	Manganese (non-food)	CNS	--	0.2	--	0.2
			--	--	--	--	--	Vanadium	--	--	--	--	--
			--	--	--	--	--	**ORGANICS**					
			--	--	--	--	--	Dieldrin	--	--	--	--	--
			(Total)	--	2E-07	--	2E-07	(Total)		--	0.3	--	0.3
Subsurface Soil	Subsurface Soil	Subsurface Soil at WP-14	**INORGANICS**					**INORGANICS**					
			Arsenic	5.3E-08	--	1.4E-08	7E-08	Aluminum	Dev. NS	0.0006	--	0.0002	0.0008
			Chromium (total) VI	--	--	--	--	Arsenic	skin/vascular	0.008	--	0.002	0.01
			ORGANICS					Chromium (total) VI	GI tract/fetus/bone marrow/liver	0.0001	--	0.0005	0.0006
			Benz(a)pyrene	1.8E-10	--	--	2E-10	Iron	blood/liver/GI tract	0.005	--	0.0004	0.006
			Dieldrin	4.3E-10	--	3.8E-10	8E-10	Manganese (non-food)	CNS	0.0006	--	0.001	0.002
			--	--	--	--	--	Vanadium	liver	0.0004	--	0.002	0.002
			--	--	--	--	--	**ORGANICS**					
			--	--	--	--	--	Dieldrin	liver	0.00004	--	0.000033	0.0001
			(Total)	5E-08	--	1E-08	7E-08	(Total)		0.02	--	0.006	0.02
	Air	Ambient air above WP-14 (particulates)	**INORGANICS**					**INORGANICS**					
			Arsenic	--	1.2E-07	--	1E-07	Aluminum	Dev. NS	--	0.1	--	0.1
			Chromium (total) VI	--	1.8E-07	--	2E-07	Arsenic	--	--	--	--	--
			ORGANICS					Chromium (total) VI	lungs	--	0.01	--	0.01
			Benz(a)pyrene	--	8.6E-13	--	9E-13	Iron	--	--	--	--	--
			Dieldrin	--	3.9E-11	--	4E-11	Manganese (non-food)	CNS	--	0.2	--	0.2
			--	--	--	--	--	Vanadium	--	--	--	--	--

TABLE 9.3.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: INDUSTRIAL WORKER

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Industrial 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
			--	--	--	--	--	ORGANICS					
			--	--	--	--	--	Dieldrin	--	--	--	--	--
			(Total)	--	3E-07	--	3E-07	(Total)		--	0.3	--	0.3
						Total Risk Across Surface Soil	2E-07					Total Hazard Index Across Surface Soil	0.3
						Total Risk Across Subsurface Soil	4E-07					Total Hazard Index Across Subsurface Soil	0.4
						Total Risk Across All Media and All Exposure Routes	6E-07					Total Hazard Index Across All Media and All Exposure Routes	0.7

NOTE: Aluminum, Benz(a)pyrene, Chromium (Total), Iron, and Vanadium are in the total data set only for surface soil.
Aluminum, Chromium (Total), Iron, Manganese, and Vanadium are in the total data set only for subsurface soil.

Total blood HI =	0.01
Total bone marrow HI =	0.001
Total CNS HI =	0.4
Total Dev. NS HI =	0.3
Total fetus HI =	0.001
Total GI tract HI =	0.01
Total liver HI =	0.01
Total lungs HI =	0.02

TABLE 9.4.RME

RME SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS FOR COPCs: TRESPASSER/VISITOR

WP-14, Langley Air Force Base

Scenario Timeframe: Current/Future
Receptor Population: Trespasser/Visitor
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 Soil	Surface Soil	Surface Soil at WP-14	**INORGANICS**					**INORGANICS**					
			Arsenic	3.6E-07	--	4.7E-07	8E-07	Aluminum	Dev. NS	0.00072	--	0.0010	0.002
			Chromium (total) VI	--	--	--	--	Arsenic	skin/vascular	0.0047	--	0.0061	0.01
			ORGANICS					Chromium (total) VI	GI tract/fetus/bone marrow/liver	0.00051	--	0.0198	0.02
			Benz(a)pyrene	7.7E-09	--	--	8E-09	Iron	blood/liver/GI tract	0.0052	--	0.0020	0.007
			Dieldrin	1.0E-08	--	4.3E-08	5E-08	Manganese (non-food)	CNS	0.00083	--	0.0064	0.007
			--	--	--	--	--	Vanadium	liver	0.00043	--	0.0083	0.009
			--	--	--	--	--	**ORGANICS**					
			--	--	--	--	--	Dieldrin	liver	0.000073	--	0.00031	0.0004
			(Total)	4E-07	--	5E-07	9E-07	(Total)		0.01	--	0.04	0.06
	Air	Ambient air above WP-14 (particulates)	**INORGANICS**					**INORGANICS**					
			Arsenic	--	2.6E-07	--	3E-07	Aluminum	Dev. NS	--	0.051	--	0.05
			Chromium (total) VI	--	7.8E-07	--	8E-07	Arsenic	--	--	--	--	--
			ORGANICS					Chromium (total) VI	lungs	--	0.0038	--	0.004
			Benz(a)pyrene	--	6.6E-11	--	7E-11	Iron	--	--	--	--	--
			Dieldrin	--	1.6E-09	--	2E-09	Manganese (non-food)	CNS	--	0.082	--	0.08
			--	--	--	--	--	Vanadium	--	--	--	--	--
			--	--	--	--	--	**ORGANICS**					
			--	--	--	--	--	Dieldrin	--	--	--	--	--
			(Total)	--	1E-06	--	1E-06	(Total)		--	0.1	--	0.1
							Total Risk Across Surface Soil						Total Hazard Index Across Surface Soil
							2E-06						0.2

Total Risk Across All Media and All Exposure Route: 2E-06

Total Hazard Index Across All Media and All Exposure Routes: 0.2

NOTE: Aluminum, Benz(a)pyrene, Chromium (Total), Iron, and Vanadium are in the total data set only for surface soil.

Total blood HI =	0.007
Total bone marrow HI =	0.02
Total Dev. NS HI =	0.05
Total fetus HI =	0.02
Total GI tract HI =	0.03
Total liver HI =	0.04
Total lungs HI =	0.004
Total skin HI =	0.01
Total vascular HI =	0.01

TABLE 9.5.RME

RME SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

Combined RI and Risk Re-Evaluation Results

ERP Site WP-14, Langley Air Force Base

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: age-adjusted

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
Soil Analysis from the RI Report	Surface soil and Ambient Air	WP-14	Arsenic	Replaced with 2005 risk re-evaluation using pooled data set			0E+00	Aluminum	Dev NS				
			Chromium	--	--	--	0.E+00	Arsenic	skin/vascular				
			Benzo(a)pyrene	6.5E-07	--	--	7.E-07	Chromium	GI tract/fetus/bone marrow/liver	NA - Non-cancer hazard analysis not performed on age-adjusted resident receptor			
			Dieldrin	8.5E-07	--	8.0E-07	2.E-06	Iron	blood/liver/GI tract				
								Manganese	CNS				
								Vanadium	Liver				
								Dieldrin	Liver				
			Chemical Total	2.E-06	0.E+00	8.E-07	2.E-06	Chemical Total	- -				
	Subsurface Soil and Ambient Air	WP-14	Arsenic	Replaced with 2005 risk re-evaluation using pooled data set			0E+00	Aluminum	Dev NS				
			Chromium	--	--	--	0.E+00	Arsenic	skin/vascular				
			Benzo(a)pyrene	2.5E-07	--	--	3.E-07	Chromium	GI tract/fetus/bone marrow/liver	NA - Non-cancer hazard analysis not performed on age-adjusted resident receptor			
			Dieldrin	6.0E-07	--	5.7E-07	1.E-06	Iron	blood/liver/GI tract				
				--		--		Manganese	CNS				
				--	--	--	--	Vanadium	Liver				
				--	--	--	--	Dieldrin	Liver				
			Chemical Total	8.5E-07	0.0E+00	5.7E-07	1.4E-06	Chemical Total					
Soil Analysis from the Risk Re-Evaluation Report	Total Soil and Ambient Air	WP-14	Arsenic	6.3E-05	--	6.4E-06	7.E-05			NA - Non-cancer hazard analysis not performed on age-adjusted resident receptor			
Total Cancer Risk across all exposure pathways and media							7.E-05	Total Non-Cancer HI across all exposure pathways and media					

Total Skin/Vascular HI =

Total CNS HI =

Total Liver HI =

TABLE 9.6.RME

RME SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

Combined RI and Risk Re-Evaluation Results

ERP Site WP-14, Langley Air Force Base

Scenario Timeframe: Future
Receptor Population: Resident
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
Soil Analysis from the RI Report	Surface soil and Ambient Air	WP-14	Arsenic				0E+00	Aluminum	Dev NS	Background Conditions			
			Chromium	Cancer risk analysis not revised for child resident because risks bounded by age-adjusted resident			0.E+00	Arsenic	skin/vascular	Replaced with 2005 risk re-evaluation using pooled data set			
			Benzo(a)pyrene				0.E+00	Chromium	GI tract/fetus/bone marrow/liver	Background Conditions			
			Dieldrin				0.E+00	Iron	blood/liver/GI tract	Background Conditions			
								Manganese	CNS	0.10	--	0.07	0.2
								Vanadium	Liver	Background Conditions			
								Dieldrin	Liver	0.009	--	0.0035	0.01
			Chemical Total	0.E+00	0.E+00	0.E+00	0.E+00	Chemical Total	- -	0.1	- -	0.08	0.2
	Subsurface Soil and Ambient Air	WP-14	Arsenic				0E+00	Aluminum	Dev NS	Background Conditions			
			Chromium	Cancer risk analysis not revised for child resident because risks bounded by age-adjusted resident			0.E+00	Arsenic	skin/vascular	Replaced with 2005 risk re-evaluation using pooled data set			
			Benzo(a)pyrene				0.E+00	Chromium	GI tract/fetus/bone marrow/liver	Background Conditions			
			Dieldrin				0.E+00	Iron	blood/liver/GI tract	Background Conditions			
				--		--		Manganese	CNS	0.10		0.07	0.2
				--	--	--	--	Vanadium	Liver	Background Conditions			
				--	--	--	--	Dieldrin	Liver	0.0061		0.0025	0.009
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00	Chemical Total		0.1		0.07	0.2
Soil Analysis from the Risk Re-Evaluation Report	Total Soil and Ambient Air	WP-14	Cancer risk analysis not revised for child resident because risks bounded by age-adjusted resident					Arsenic	skin/vascular	1.1	--	0.1	1.2
Total Cancer Risk across all exposure pathways and media							0.E+00	Total Non-Cancer HI across all exposure pathways and media					1.6

Total Skin/Vascular HI =	1.2
Total CNS HI =	0.3
Total Liver HI =	0.02

Appendix A.10

Ecological Risk Assessment Data

Table 10.1 Constituents of Interest—ERP Site WP-14

Parameter	Total Soil Concentration		Total Water Concentration	
	Maximum	Mean	Maximum	Mean
Inorganic Analytes (mg/L or mg/kg)				
Aluminum	20900	12600	NA	NA
Antimony	1.43	0.692	NA	NA
Arsenic	112	27.9	0.00978	0.00586
Barium	176	57.8	0.0484	0.0404
Beryllium	1.32	0.719	NA	NA
Cadmium	0.549	0.183	NA	NA
Calcium	65500	8150	232	160
Chromium (total)	47.2	25.5	NA	NA
Cobalt	9.42	3.16	NA	NA
Copper	6.39	4.27	NA	NA
Cyanide	0.634	0.157	NA	NA
Iron	76800	24400	2.03	1.81
Lead	22.3	14.2	NA	NA
Magnesium	1780	1020	12	6.97
Manganese	538	218	0.314	0.186
Nickel	14.7	7.71	NA	NA
Potassium	1480	589	2.32	1.78
Sodium	436	241	39.3	26.3
Thallium	0.152	0.104	NA	NA
Vanadium	97.1	52.0	NA	NA
Zinc	52.0	21.3	0.00357	0.00218
Volatile Organic Compounds (µg/L or µg/kg)				
2-Butanone (MEK)	30.7	2.53	NA	NA
Acetone	170	8.87	NA	NA
Benzene	NA	NA	0.134	0.0607
Carbon disulfide	3.09	0.625	0.318	0.134
Toluene	NA	NA	3.7	2.29
Semivolatile Organic Compounds (µg/L or µg/kg)				
2-Methylnaphthalene	739	47.4	NA	NA
Acenaphthene	52.1	12.0	NA	NA
Acenaphthylene	83.3	9.71	NA	NA
Anthracene	38.4	8.74	0.664	0.268
Benz(a)anthracene	148	24.5	NA	NA
Benz(a)pyrene	208	32.4	NA	NA
Benzo(b)fluoranthene	437	56.0	NA	NA
Benzo(g,h,i)perylene	115	21.3	NA	NA
Benzo(k)fluoranthene	437	56.6	NA	NA

Table 10.1 Constituents of Interest—ERP Site WP-14 (continued)

Parameter	Total Soil Concentration		Total Water Concentration	
	Maximum	Mean	Maximum	Mean
Butylbenzylphthalate	23.9	4.79	NA	NA
Carbazole	20.3	7.71	NA	NA
Chrysene	225	36.0	NA	NA
Di-n-butylphthalate	74.4	9.28	NA	NA
Dibenzofuran	39.5	8.59	NA	NA
Fluoranthene	417	56.4	1.29	0.427
Fluorene	127	12.5	NA	NA
Indeno(1,2,3-cd)pyrene	116	20.2	NA	NA
Naphthalene	337	23.0	NA	NA
Phenanthrene	260	37.6	2.77	0.802
Pyrene	341	51.9	1.73	0.546
bis(2-Ethylhexyl)phthalate	957	125	5.45	1.96
Pesticides (µg/L or µg/kg)				
4,4'-DDD	123	16.6	NA	NA
4,4'-DDE	215	44.6	NA	NA
4,4'-DDT	86.7	16.4	NA	NA
Aldrin	7.04	0.835	NA	NA
Dieldrin	215	24.0	0.00757	0.00341
Endosulfan II	1.06	0.591	NA	NA
Endrin ketone	1.74	0.983	NA	NA
Heptachlor	0.764	0.228	NA	NA
Heptachlor epoxide	2.64	0.402	NA	NA
Methoxychlor	3.27	2.92	NA	NA
alpha-Chlordane	10.7	1.38	NA	NA
beta-BHC	0.449	0.284	NA	NA
delta-BHC	17.7	1.18	NA	NA
gamma-BHC (Lindane)	13.5	0.874	NA	NA
gamma-Chlordane	6.31	0.844	NA	NA
Herbicides (µg/L or µg/kg)				
2,4,5-T	49.0	6.03	NA	NA
2,4-DB	102	38.4	NA	NA
Dinoseb	36.3	13.9	NA	NA
Hydrocarbons (µg/L or µg/kg)				
Diesel	3610000	1820000	NA	NA

NA = Not applicable

Table 10.2 Constituents of Interest Eliminated from Further Evaluation—ERP Site WP-14

Inorganic Analytes	Organic Compounds
Arsenic	Benzene
Barium	Toluene
Cadmium	Acenaphthene
Cobalt	Acenaphthylene
Copper	Anthracene

Table 10.3 Constituents of Potential Ecological Concern—ERP Site WP-14

Parameter	Total Soil Concentration		Total Water Concentration	
	Maximum	Mean	Maximum	Mean
Inorganic Analytes (mg/L or mg/kg)				
Aluminum	20900	12600	NA	NA
Antimony	1.43	0.692	NA	NA
Beryllium	1.32	0.719	NA	NA
Calcium	65500	8150	232	160
Chromium (total)	47.2	25.5	NA	NA
Cyanide	0.634	0.157	NA	NA
Iron	76800	24400	2.03	1.81
Lead	22.3	14.2	NA	NA
Magnesium	1780	1020	12	6.97
Manganese	538	218	0.314	0.186
Nickel	14.7	7.71	NA	NA
Potassium	1480	589	2.32	1.78
Sodium	436	241	39.3	26.3
Thallium	0.152	0.104	NA	NA
Vanadium	97.1	52.0	NA	NA
Zinc	52.0	21.3	0.00357	0.00218
Volatile Organic Compounds (µg/L or µg/kg)				
2-Butanone (MEK)	30.7	2.53	NA	NA
Acetone	170	8.87	NA	NA
Carbon disulfide	3.09	0.625	0.318	0.134
Semivolatile Organic Compounds (µg/L or µg/kg)				
2-Methylnaphthalene	739	47.4	NA	NA
Benz(a)anthracene	148	24.5	NA	NA
Benz(a)pyrene	208	32.4	NA	NA
Benzo(b)fluoranthene	437	56.0	NA	NA
Benzo(g,h,i)perylene	115	21.3	NA	NA
Benzo(k)fluoranthene	437	56.6	NA	NA
Butylbenzylphthalate	23.9	4.79	NA	NA
Carbazole	20.3	7.71	NA	NA
Chrysene	225	36.0	NA	NA
Di-n-butylphthalate	74.4	9.28	NA	NA
Dibenzofuran	39.5	8.59	NA	NA
Fluoranthene	417	56.4	1.29	0.427
Fluorene	127	12.5	NA	NA
Indeno(1,2,3-cd)pyren	116	20.2	NA	NA

Table 10.3 Constituents of Potential Ecological Concern—ERP Site WP-14 (continued)

Parameter	Total Soil Concentration		Total Water Concentration	
	Maximum	Mean	Maximum	Mean
Naphthalene	337	23.0	NA	NA
Phenanthrene	260	37.6	2.77	0.802
Pyrene	341	51.9	1.73	0.546
bis(2-Ethylhexyl)phth	957	125	5.45	1.96
Pesticides (µg/L or µg/kg)				
4,4'-DDD	123	16.6	NA	NA
4,4'-DDE	215	44.6	NA	NA
4,4'-DDT	86.7	16.4	NA	NA
Aldrin	7.04	0.835	NA	NA
Dieldrin	215	24.0	0.00757	0.00341
Endosulfan II	1.06	0.591	NA	NA
Endrin ketone	1.74	0.983	NA	NA
Heptachlor	0.764	0.228	NA	NA
Heptachlor epoxide	2.64	0.402	NA	NA
Methoxychlor	3.27	2.92	NA	NA
alpha-Chlordane	10.7	1.38	NA	NA
beta-BHC	0.449	0.284	NA	NA
delta-BHC	17.7	1.18	NA	NA
gamma-BHC (Lindane	13.5	0.874	NA	NA
gamma-Chlordane	6.31	0.844	NA	NA
Herbicides (µg/L or µg/kg)				
2,4,5-T	49.0	6.03	NA	NA
2,4-DB	102	38.4	NA	NA
Dinoseb	36.3	13.9	NA	NA
Hydrocarbons (µg/L or µg/kg)				
Diesel	3610000	1820000	NA	NA

NA = Not applicable

Table 10.4 Summary of Screening Assessment NOAEL-Based Hazard Quotients—ERP Site WP-14

COPEC	NOAEL-Based Hazard Quotient							
	Earthworm	Deer Mouse	American Robin	Red Fox	Red-tailed Hawk	Atlantic Croaker	Belted Kingfisher	Mink
Inorganic Analytes								
Aluminum-max	**2.46E+00**	**4.97E+03**	**4.48E+01**	**2.22E+02**	**7.97E+01**	NEP	NEP	NEP
Aluminum-mean	**1.48E+00**	**2.99E+03**	**2.70E+01**	**1.34E+02**	**4.81E+01**	NEP	NEP	NEP
Antimony-max	**4.77E+00**	**5.25E+00**	**2.70E+02**	7.84E-03	**4.80E+02**	NEP	NEP	NEP
Antimony-mean	**2.31E+00**	**2.54E+00**	**1.30E+02**	3.79E-03	**2.32E+02**	NEP	NEP	NEP
Beryllium-max	**2.49E+00**	9.17E-01	**5.18E+01**	3.29E-01	**9.23E+01**	NEP	NEP	NEP
Beryllium-mean	**1.36E+00**	5.00E-01	**2.82E+01**	1.79E-01	**5.03E+01**	NEP	NEP	NEP
Calcium-max	**2.43E+00**	**4.10E+01**	**5.46E+00**	**9.47E+00**	**9.72E+00**	**1.36E+00**	4.69E-02	8.93E-02
Calcium-mean	3.02E-01	**5.14E+00**	6.87E-01	**1.19E+00**	**1.21E+00**	9.41E-01	3.23E-02	6.16E-02
Chromium-max	**6.05E+00**	**6.60E+00**	**1.11E+01**	**2.37E+00**	**1.98E+01**	NEP	NEP	NEP
Chromium-mean	**3.27E+00**	**3.56E+00**	**6.01E+00**	**1.28E+00**	**1.07E+01**	NEP	NEP	NEP
Cyanide-max	**1.02E+01**	4.23E-03	2.17E-01	1.52E-03	3.87E-01	NEP	NEP	NEP
Cyanide-mean	**2.53E+00**	1.05E-03	5.38E-02	3.76E-04	9.59E-02	NEP	NEP	NEP
Iron-max	**9.48E+00**	9.39E-01	**6.39E+00**	3.37E-01	**1.14E+01**	5.08E-01	4.10E-04	1.71E-05
Iron-mean	**3.01E+00**	2.98E-01	**2.03E+00**	1.07E-01	**3.62E+00**	4.53E-01	3.66E-04	1.53E-05
Lead-max	1.72E-01	**1.28E+00**	**1.36E+00**	4.58E-01	**2.43E+00**	NEP	NEP	NEP
Lead-mean	1.09E-01	8.14E-01	8.69E-01	2.92E-01	**1.55E+00**	NEP	NEP	NEP
Magnesium-max	5.74E-01	**8.90E+00**	**7.43E+00**	**3.21E+00**	**1.32E+01**	2.45E-02	1.21E-01	6.33E-02
Magnesium-mean	3.29E-01	**5.10E+00**	**4.26E+00**	**1.84E+00**	**7.56E+00**	1.42E-02	7.03E-02	3.68E-02
Manganese-max	**6.90E+00**	**2.80E+00**	1.30E-01	**1.01E+00**	2.31E-01	**3.49E+00**	1.84E-04	1.13E-03
Manganese-mean	**2.79E+00**	**1.14E+00**	5.26E-02	4.08E-01	9.36E-02	**2.07E+00**	1.09E-04	6.69E-04
Nickel-max	**1.34E+00**	1.69E-01	4.47E-02	6.04E-02	7.97E-02	NEP	NEP	NEP
Nickel-mean	7.01E-01	8.84E-02	2.35E-02	3.17E-02	4.18E-02	NEP	NEP	NEP
Potassium-max	**1.14E+00**	**1.85E+00**	7.70E-01	2.96E-01	**1.37E+00**	1.22E-02	2.93E-03	1.79E-03
Potassium-mean	4.53E-01	7.37E-01	3.07E-01	1.18E-01	5.46E-01	9.37E-03	1.87E-03	1.37E-03
Sodium-max	1.82E-01	5.65E-01	6.38E-01	2.05E-01	**1.09E+00**	8.73E-03	1.32E-01	3.39E-02
Sodium-mean	1.00E-01	3.15E-01	3.57E-01	1.14E-01	6.04E-01	5.84E-03	8.84E-02	2.27E-02
Thallium-max	cnba	**9.42E+00**	**4.84E+02**	**3.38E+00**	**8.62E+02**	NEP	NEP	NEP
Thallium-mean	cnba	**6.44E+00**	**3.31E+02**	**2.31E+00**	**5.90E+02**	NEP	NEP	NEP
Vanadium-max	**1.49E+00**	**2.12E+02**	**2.01E+00**	**7.60E+01**	**3.57E+00**	NEP	NEP	NEP
Vanadium-mean	8.00E-01	**1.14E+02**	**1.07E+00**	**4.07E+01**	**1.91E+00**	NEP	NEP	NEP
Zinc-max	**3.25E+00**	1.49E-01	8.45E-01	5.35E-02	**1.50E+00**	1.98E-01	1.41E-04	7.06E-06
Zinc-mean	**1.33E+00**	6.10E-02	3.46E-01	2.19E-02	6.16E-01	1.21E-01	8.59E-05	4.31E-06

Table 10.4 Summary of Screening Assessment NOAEL-Based Hazard Quotients—ERP Site WP-14 (continued)

COPEC	NOAEL-Based Hazard Quotient							
	Earthworm	Deer Mouse	American Robin	Red Fox	Red-tailed Hawk	Atlantic Croaker	Belted Kingfisher	Mink
Volatile Organic Compounds								
2-Butanone(MEK)-max	cnba	7.95E-06	4.09E-04	2.85E-06	7.28E-04	NEP	NEP	NEP
2-Butanone(MEK)-mean	cnba	6.55E-07	3.37E-05	2.35E-07	6.00E-05	NEP	NEP	NEP
Acetone-max	cnba	7.80E-03	1.00E-04	2.80E-03	1.78E-04	NEP	NEP	NEP
Acetone-mean	cnba	4.07E-04	5.22E-06	1.46E-04	9.30E-06	NEP	NEP	NEP
Carbon disulfide-max	cnba	4.92E-06	2.58E-04	1.79E-06	4.38E-04	1.59E-03	6.06E-05	1.01E-05
Carbon disulfide-mean	cnba	1.04E-06	5.56E-05	3.81E-07	9.00E-05	6.70E-04	2.55E-05	4.24E-06
Semivolatile Organic Compounds								
2-Methylnapthalene-max	cnba	3.39E-01	**2.06E+00**	1.22E-01	**3.66E+00**	NEP	NEP	NEP
2-Methylnapthalene-mean	cnba	2.17E-02	1.32E-01	7.80E-03	**2.35E-01**	NEP	NEP	NEP
Benzo(a)anthracene-max	3.08E-01	4.71E-02	4.12E-01	1.69E-02	7.33E-01	NEP	NEP	NEP
Benzo(a)anthracene-mean	5.10E-02	7.80E-03	6.81E-02	2.80E-03	1.21E-01	NEP	NEP	NEP
Benzo(a)pyrene-max	**1.49E+00**	9.54E-02	5.79E-01	3.42E-02	**1.03E+00**	NEP	NEP	NEP
Benzo(a)pyrene-mean	2.31E-01	1.49E-02	9.01E-02	5.33E-03	1.61E-01	NEP	NEP	NEP
Benzo(b)fluoranthene-max	**1.75E+00**	6.26E-01	9.71E-01	2.25E-01	**1.73E+00**	NEP	NEP	NEP
Benzo(b)fluoranthene-mean	2.24E-01	8.02E-02	1.24E-01	2.88E-02	2.22E-01	NEP	NEP	NEP
Benzo(g,h,i)perylene-max	3.11E-01	5.27E-02	3.20E-01	1.89E-02	5.70E-01	NEP	NEP	NEP
Benzo(g,h,i)perylene-mean	5.76E-02	9.77E-03	5.92E-02	3.50E-03	1.06E-01	NEP	NEP	NEP
benzo(k)fluoranthene-max	**2.73E+01**	3.45E-01	**1.22E+00**	1.24E-01	**2.16E+00**	NEP	NEP	NEP
Benzo(k)fluoranthene-mean	3.54E-01	4.47E-02	1.57E-01	1.60E-02	2.80E-01	NEP	NEP	NEP
Bis(2-ethylhexyl)phthalate-max	**3.68E+00**	2.40E-02	2.06E-01	6.31E-03	3.65E-01	8.65E-05	2.83E-03	6.90E-05
Bis(2-ethylhexyl)phthalate-mean	4.81E-01	3.15E-03	2.70E-02	8.29E-04	4.78E-02	3.11E-05	1.32E-02	6.20E-04
Butylbenzylphthalate-max	cnba	1.43E-03	7.36E-01	5.14E-04	**1.31E+00**	NEP	NEP	NEP
Butylbenzylphthalate-mean	cnba	2.87E-04	1.48E-01	1.03E-04	2.63E-01	NEP	NEP	NEP
Carbazole-max	4.81E-01	9.31E-03	5.65E-02	3.34E-03	1.01E-01	NEP	NEP	NEP
Carbazole-mean	1.83E-01	3.54E-03	2.14E-02	1.27E-03	3.82E-02	NEP	NEP	NEP
Chrysene-max	4.02E-01	1.30E-01	6.26E-01	4.67E-02	**1.11E+00**	NEP	NEP	NEP
Chrysene-mean	6.43E-02	2.08E-02	1.00E-01	7.48E-03	1.78E-01	NEP	NEP	NEP
Di-n-butylphthalate-max	cnba	6.20E-05	1.59E-01	2.22E-05	2.84E-01	NEP	NEP	NEP
Di-n-butylphthalate-mean	cnba	7.74E-06	1.99E-02	2.78E-06	3.54E-02	NEP	NEP	NEP
Dibenzofuran-max	cnba	**1.13E+03**	**9.31E+03**	**4.06E+02**	**1.66E+04**	NEP	NEP	NEP
Dibenzofuran-mean	cnba	**2.46E+02**	**2.02E+03**	**8.83E+01**	**3.60E+03**	NEP	NEP	NEP
Fluoranthene-max	**2.09E+00**	1.53E-03	**1.16E+00**	5.50E-04	**2.07E+00**	**1.54E+00**	8.71E-03	3.27E-06
Fluoranthene-mean	2.82E-01	2.08E-04	1.58E-01	7.45E-05	2.80E-01	5.11E-01	2.88E-03	1.08E-06

Table 10.4 Summary of Screening Assessment NOAEL-Based Hazard Quotients—ERP Site WP-14 (continued)

COPEC	NOAEL-Based Hazard Quotient							
	Earthworm	Deer Mouse	American Robin	Red Fox	Red-tailed Hawk	Belted Kingfisher	Mink	
Fluorene-max	4.23E-03	4.66E-04	3.53E-01	2.09E-02	6.29E-01	NEP	NEP	NEP
Fluorene-mean	4.17E-04	4.59E-05	3.48E-02	2.06E-03	6.19E-02	NEP	NEP	NEP
Indeno(1,2,3-cd)pyrene-max	3.63E-01	3.55E-03	3.23E-01	1.27E-03	5.75E-01	NEP	NEP	NEP
Indeno(1,2,3-cd)pyrene-mean	6.31E-02	6.18E-04	5.62E-02	2.21E-04	1.00E-01	NEP	NEP	NEP
Naphthalene-max	cnba	1.55E-01	9.37E-01	5.54E-02	**1.67E+00**	NEP	NEP	NEP
Naphthalene-mean	cnba	1.05E-02	6.40E-02	3.78E-03	1.14E-01	NEP	NEP	NEP
Phenanthrene-max	4.64E-01	1.20E-01	1.61E-03	4.30E-02	2.86E-03	**2.77E+01**	4.83E-05	8.77E-04
Phenanthrene-mean	6.71E-02	1.74E-02	2.35E-04	6.25E-03	4.14E-04	**8.02E+00**	1.40E-05	2.54E-04
Pyrene-max	**2.84E+00**	2.09E-03	9.51E-01	7.50E-04	**1.69E+00**	**2.66E+01**	1.17E-02	7.30E-06
Pyrene-mean	4.33E-01	3.19E-04	1.45E-01	1.14E-04	2.57E-01	**8.40E+00**	3.69E-03	2.30E-06
Pesticides								
4,4'-DDD-max	**4.56E+01**	7.05E-02	6.31E-03	2.53E-02	1.12E-02	NEP	NEP	NEP
4,4'-DDD-mean	**6.15E+00**	9.51E-03	8.52E-04	3.41E-03	1.52E-03	NEP	NEP	NEP
4,4'-DDE-max	**9.35E+01**	5.19E-02	1.07E-02	1.86E-02	2.65E-02	NEP	NEP	NEP
4,4'-DDE-mean	**1.94E+01**	1.08E-02	2.21E-03	3.86E-03	5.49E-03	NEP	NEP	NEP
4,4'-DDT-max	**3.33E+01**	4.97E-02	3.52E-02	1.78E-02	**1.30E+01**	NEP	NEP	NEP
4,4'-DDT-mean	**6.31E+00**	9.40E-03	6.65E-03	3.37E-03	**2.46E+00**	NEP	NEP	NEP
Aldrin-max	**5.03E+00**	1.61E-02	3.75E-02	5.79E-03	3.84E-02	NEP	NEP	NEP
Aldrin-mean	5.96E-01	1.91E-03	4.45E-03	6.87E-04	4.55E-03	NEP	NEP	NEP
Dieldrin-max	**1.43E+02**	**1.52E+00**	4.26E-01	**1.77E+00**	**1.17E+00**	9.35E-01	5.62E-05	1.20E-04
Dieldrin-mean	**1.60E+01**	1.69E-01	4.75E-02	1.97E-01	1.31E-01	4.21E-01	2.53E-05	5.40E-05
Endosulfan II-max	**1.06E+01**	3.24E-03	2.50E-05	1.16E-03	4.45E-05	NEP	NEP	NEP
Endosulfan II-mean	**5.91E+00**	1.81E-03	1.39E-05	6.48E-04	2.48E-05	NEP	NEP	NEP
Endrin ketone-max	6.21E-01	8.67E-03	1.37E-03	3.11E-03	7.30E-02	NEP	NEP	NEP
Endrin ketone-mean	3.51E-01	4.90E-03	7.72E-04	1.76E-03	4.12E-02	NEP	NEP	NEP
Heptachlor-max	7.64E-03	5.39E-04	1.83E-04	1.26E-03	4.16E-03	NEP	NEP	NEP
Heptachlor-mean	2.28E-03	1.61E-04	5.47E-05	3.75E-04	1.24E-03	NEP	NEP	NEP
Heptachlor epoxide-max	**4.40E+01**	1.86E-03	6.33E-04	4.34E-03	1.44E-02	NEP	NEP	NEP
Heptachlor epoxide-mean	**6.70E+00**	2.84E-04	9.64E-05	6.61E-04	2.19E-03	NEP	NEP	NEP
Methoxychlor-max	3.99E-01	3.75E-04	2.75E-01	1.34E-04	4.90E-01	NEP	NEP	NEP
Methoxychlor-mean	3.56E-01	3.35E-04	2.46E-01	1.20E-04	4.38E-01	NEP	NEP	NEP
alpha-Chlordane-max	**1.14E+01**	1.07E-03	1.18E-03	3.83E-04	2.10E-03	NEP	NEP	NEP
alpha-Chlordane-mean	**1.47E+00**	1.38E-04	1.52E-04	4.93E-05	2.71E-04	NEP	NEP	NEP
beta-BHC-max	**4.99E+00**	5.28E-05	1.88E-04	1.89E-05	3.35E-04	NEP	NEP	NEP
beta-BHC-mean	**3.16E+00**	3.34E-05	1.19E-04	1.20E-05	2.12E-04	NEP	NEP	NEP

Table 10.4 Summary of Screening Assessment NOAEL-Based Hazard Quotients—ERP Site WP-14 (continued)

COPEC	NOAEL-Based Hazard Quotient							
	Earthworm	Deer Mouse	American Robin	Red Fox	Red-tailed Hawk	Atlantic Croaker	Belted Kingfisher	Mink
delta-BHC-max	**1.97E+02**	5.07E-03	7.41E-03	2.08E-01	1.32E-02	NEP	NEP	NEP
delta-BHC-mean	**1.31E+01**	3.38E-04	4.94E-04	1.39E-02	8.79E-04	NEP	NEP	NEP
gamma-BHC(Lindane)-max	4.35E-02	7.74E-04	6.64E-03	2.78E-04	2.83E-03	NEP	NEP	NEP
gamma-BHC(Lindane)-mean	2.82E-03	5.01E-05	4.30E-04	1.80E-05	1.83E-04	NEP	NEP	NEP
gamma-Chlordane-max	6.93E-03	6.29E-04	6.95E-04	2.26E-04	1.24E-03	NEP	NEP	NEP
gamma-Chlordane-mean	9.27E-04	8.41E-05	9.29E-05	3.02E-05	1.65E-04	NEP	NEP	NEP
Herbicides								
2,4,5-T-max	cnba	2.25E-03	3.72E-02	8.06E-04	6.63E-02	NEP	NEP	NEP
2,4,5-T-mean	cnba	2.77E-04	4.58E-03	9.92E-05	8.16E-03	NEP	NEP	NEP
2,4-DB-max	**1.36E+00**	8.22E-02	**4.22E+00**	2.95E-02	**7.52E+00**	NEP	NEP	NEP
2,4-DB-mean	5.12E-01	3.09E-02	**1.59E+00**	1.11E-02	**2.83E+00**	NEP	NEP	NEP
Dinoseb-max	cnba	5.94E-02	1.66E-03	2.13E-02	2.96E-03	NEP	NEP	NEP
Dinoseb-mean	cnba	2.28E-02	6.36E-04	8.16E-03	1.13E-03	NEP	NEP	NEP
Hydrocarbons								
Diesel-max	cnba	cnba	cnba	cnba	cnba	NEP	NEP	NEP
Diesel-mean	cnba	cnba	cnba	cnba	cnba	NEP	NEP	NEP

max - COPEC evaluated using maximum media concentrations

mean - COPEC evaluated using mean media concentrations

Bold values indicate that the NOAEL-Based hazard quotient is greater than or equal to 1.

NEP = No exposure pathway.

cnba = Could not be assessed due to lack of toxicological data.

Table 10.5 Summary of Screening Assessment LOAEL-Based Hazard Quotients—ERP Site WP-14

COPEC	LOAEL-Based Hazard Quotient							
	Earthworm	Deer Mouse	American Robin	Red Fox	Red-tailed Hawk	Atlantic Croaker	Belted Kingfisher	Mink
Inorganic Analytes								
Aluminum-max	**1.10E+00**	**4.97E+02**	**4.48E+00**	**2.22E+01**	**7.97E+00**	NEP	NEP	NEP
Aluminum-mean	6.63E-01	**2.99E+02**	**2.70E+00**	**1.34E+01**	**4.81E+00**	NEP	NEP	NEP
Antimony-max	**4.61E+00**	5.25E-01	**2.70E+01**	7.84E-04	**4.80E+01**	NEP	NEP	NEP
Antimony-mean	**2.23E+00**	2.54E-01	**1.30E+01**	3.79E-04	**2.32E+01**	NEP	NEP	NEP
Beryllium-max	**1.36E+00**	9.17E-02	**5.18E+00**	3.29E-02	**9.23E+00**	NEP	NEP	NEP
Beryllium-mean	7.41E-01	5.00E-02	**2.82E+00**	1.79E-02	**5.03E+00**	NEP	NEP	NEP
Calcium-max	2.18E-01	**4.10E+00**	5.46E-01	9.47E-01	9.72E-01	1.16E-01	4.69E-03	8.93E-03
Calcium-mean	2.72E-02	5.14E-01	6.87E-02	1.19E-01	1.21E-01	8.00E-02	3.23E-03	6.16E-03
Chromium-max	**1.21E+00**	6.60E-01	**1.11E+00**	2.37E-01	**1.98E+00**	NEP	NEP	NEP
Chromium-mean	6.54E-01	3.56E-01	6.01E-01	1.28E-01	**1.07E+00**	NEP	NEP	NEP
Cyanide-max	**2.05E+00**	4.23E-04	2.17E-02	1.52E-04	3.87E-02	NEP	NEP	NEP
Cyanide-mean	5.06E-01	1.05E-04	5.38E-03	3.76E-05	9.59E-03	NEP	NEP	NEP
Iron-max	**3.20E+00**	9.39E-02	6.39E-01	3.37E-02	**1.14E+00**	5.08E-02	4.10E-05	1.71E-06
Iron-mean	**1.02E+00**	2.98E-02	2.03E-01	1.07E-02	3.62E-01	4.53E-02	3.66E-05	1.53E-06
Lead-max	2.23E-02	1.28E-01	1.36E-01	4.58E-02	2.43E-01	NEP	NEP	NEP
Lead-mean	1.42E-02	8.14E-02	8.69E-02	2.92E-02	1.55E-01	NEP	NEP	NEP
Magnesium-max	5.93E-02	8.90E-01	7.43E-01	3.21E-01	**1.32E+00**	2.40E-03	1.21E-02	6.33E-03
Magnesium-mean	3.40E-02	5.10E-01	4.26E-01	1.84E-01	7.56E-01	1.39E-03	7.03E-03	3.68E-03
Manganese-max	**1.99E+00**	2.80E-01	1.30E-02	1.01E-01	2.31E-02	**1.43E+00**	1.84E-05	1.13E-04
Manganese-mean	8.07E-01	1.14E-01	5.26E-03	4.08E-02	9.36E-03	8.45E-01	1.09E-05	6.69E-05
Nickel-max	1.47E-01	1.69E-02	4.47E-03	6.04E-03	7.97E-03	NEP	NEP	NEP
Nickel-mean	7.71E-02	8.84E-03	2.35E-03	3.17E-03	4.18E-03	NEP	NEP	NEP
Potassium-max	1.48E-01	1.85E-01	7.70E-02	2.96E-02	1.37E-01	1.16E-03	2.93E-04	1.79E-04
Potassium-mean	5.89E-02	7.37E-02	3.07E-02	1.18E-02	5.46E-02	8.90E-04	2.25E-04	1.37E-04
Sodium-max	2.18E-02	5.65E-02	6.38E-02	2.05E-02	1.09E-01	7.86E-04	1.32E-02	3.39E-03
Sodium-mean	1.21E-02	3.15E-02	3.57E-02	1.14E-02	6.04E-02	5.26E-04	8.84E-03	2.27E-03
Thallium-max	cnba	9.42E-01	**4.84E+01**	3.38E-01	**8.62E+01**	NEP	NEP	NEP
Thallium-mean	cnba	6.44E-01	**3.31E+01**	2.31E-01	**5.90E+01**	NEP	NEP	NEP
Vanadium-max	1.62E-01	**2.12E+01**	2.01E-01	**7.60E+00**	3.57E-01	NEP	NEP	NEP
Vanadium-mean	8.67E-02	**1.14E+01**	1.07E-01	**4.07E+00**	1.91E-01	NEP	NEP	NEP
Zinc-max	3.25E-01	1.49E-02	8.45E-02	5.35E-03	1.50E-01	1.79E-02	1.41E-05	7.06E-07
Zinc-mean	1.33E-01	6.10E-03	3.46E-02	2.19E-03	6.16E-02	1.09E-02	8.59E-06	4.31E-07

Table 10.5 Summary of Screening Assessment LOAEL-Based Hazard Quotients—ERP Site WP-14 (continued)

COPEC	LOAEL-Based Hazard Quotient							
	Earthworm	Deer Mouse	American Robin	Red Fox	Red-tailed Hawk	Atlantic Croaker	Belted Kingfisher	Mink
Volatile Organic Compounds								
2-Butanone(MEK)-max	cnba	7.95E-07	4.09E-05	2.85E-07	7.28E-05	NEP	NEP	NEP
2-Butanone(MEK)-mean	cnba	6.55E-08	3.37E-06	2.35E-08	6.00E-06	NEP	NEP	NEP
Acetone-max	cnba	7.80E-04	1.00E-05	2.80E-04	1.78E-05	NEP	NEP	NEP
Acetone-mean	cnba	4.07E-05	5.22E-07	1.46E-05	9.30E-07	NEP	NEP	NEP
Carbon disulfide-max	cnba	4.92E-07	2.58E-05	1.79E-07	4.38E-05	1.59E-04	6.06E-06	1.01E-06
Carbon disulfide-mean	cnba	1.04E-07	5.56E-06	3.81E-08	9.00E-06	6.70E-05	2.55E-06	4.24E-07
Semivolatile Organic Compounds								
2-Methylnapthalene-max	cnba	3.39E-02	2.06E-01	1.22E-02	3.66E-01	NEP	NEP	NEP
2-Methylnapthalene-mean	cnba	2.17E-03	1.32E-02	7.80E-04	2.35E-02	NEP	NEP	NEP
Benzo(a)anthracene-max	1.23E-01	4.71E-03	4.12E-02	1.69E-03	7.33E-02	NEP	NEP	NEP
Benzo(a)anthracene-mean	2.04E-02	7.80E-04	6.81E-03	2.80E-04	1.21E-02	NEP	NEP	NEP
Benzo(a)pyrene-max	1.49E-01	9.54E-03	5.79E-02	3.42E-03	1.03E-01	NEP	NEP	NEP
Benzo(a)pyrene-mean	2.31E-02	1.49E-03	9.01E-03	5.33E-04	1.61E-02	NEP	NEP	NEP
Benzo(b)fluoranthene-max	3.97E-01	6.26E-02	9.71E-02	2.25E-02	1.73E-01	NEP	NEP	NEP
Benzo(b)fluoranthene-mean	5.09E-02	8.02E-03	1.24E-02	2.88E-03	2.22E-02	NEP	NEP	NEP
Benzo(g,h,i)perylene-max	6.05E-02	5.27E-03	3.20E-02	1.89E-03	5.70E-02	NEP	NEP	NEP
Benzo(g,h,i)perylene-mean	1.12E-02	9.77E-04	5.92E-03	3.50E-04	1.06E-02	NEP	NEP	NEP
benzo(k)fluoranthene-max	4.37E-01	3.45E-02	1.22E-01	1.24E-02	2.16E-01	NEP	NEP	NEP
Benzo(k)fluoranthene-mean	5.66E-02	4.47E-03	1.57E-02	1.60E-03	2.80E-02	NEP	NEP	NEP
Bis(2-ethylhexyl)phthalate-m	3.19E-01	2.40E-03	2.06E-02	6.31E-04	3.65E-02	8.65E-06	2.83E-04	6.90E-06
Bis(2-ethylhexyl)phthalate-m	4.17E-02	3.15E-04	2.70E-03	8.29E-05	4.78E-03	3.11E-06	1.32E-03	6.20E-05
Butylbenzylphthalate-max	cnba	1.43E-04	7.36E-02	5.14E-05	1.31E-01	NEP	NEP	NEP
Butylbenzylphthalate-mean	cnba	2.87E-05	1.48E-02	1.03E-05	2.63E-02	NEP	NEP	NEP
Carbazole-max	4.81E-02	9.31E-04	5.65E-03	3.34E-04	1.01E-02	NEP	NEP	NEP
Carbazole-mean	1.83E-02	3.54E-04	2.14E-03	1.27E-04	3.82E-03	NEP	NEP	NEP
Chrysene-max	1.73E-01	1.30E-02	6.26E-02	4.67E-03	1.11E-01	NEP	NEP	NEP
Chrysene-mean	2.77E-02	2.08E-03	1.00E-02	7.48E-04	1.78E-02	NEP	NEP	NEP
Di-n-butylphthalate-max	cnba	6.20E-06	1.59E-02	2.22E-06	2.84E-02	NEP	NEP	NEP
Di-n-butylphthalate-mean	cnba	7.74E-07	1.99E-03	2.78E-07	3.54E-03	NEP	NEP	NEP
Dibenzofuran-max	cnba	**1.13E+02**	**9.31E+02**	**4.06E+01**	**1.66E+03**	NEP	NEP	NEP
Dibenzofuran-mean	cnba	**2.46E+01**	**2.02E+02**	**8.83E+00**	**3.60E+02**	NEP	NEP	NEP

Table 10.5 Summary of Screening Assessment LOAEL-Based Hazard Quotients—ERP Site WP-14 (continued)

COPEC	LOAEL-Based Hazard Quotient							
	Earthworm	Deer Mouse	American Robin	Red Fox	Red-tailed Hawk	Atlantic Croaker	Belted Kingfisher	Mink
Fluoranthene-max	1.99E-01	1.53E-04	1.16E-01	5.50E-05	2.07E-01	1.54E-01	8.71E-04	3.27E-07
Fluoranthene-mean	2.69E-02	2.08E-05	1.58E-02	7.45E-06	2.80E-02	5.11E-02	2.88E-04	1.08E-07
Fluorene-max	4.23E-04	4.66E-05	3.53E-02	2.09E-03	6.29E-02	NEP	NEP	NEP
Fluorene-mean	4.17E-05	4.59E-06	3.48E-03	2.06E-04	6.19E-03	NEP	NEP	NEP
Indeno(1,2,3-cd)pyrene-max	1.05E-01	3.55E-04	3.23E-02	1.27E-04	5.75E-02	NEP	NEP	NEP
Indeno(1,2,3-cd)pyrene-mean	1.84E-02	6.18E-05	5.62E-03	2.21E-05	1.00E-02	NEP	NEP	NEP
Naphthalene-max	cnba	1.55E-02	9.37E-02	5.54E-03	1.67E-01	NEP	NEP	NEP
Naphthalene-mean	cnba	1.05E-03	6.40E-03	3.78E-04	1.14E-02	NEP	NEP	NEP
Phenanthrene-max	1.86E-01	1.20E-02	1.61E-04	4.30E-03	2.86E-04	**2.77E+00**	4.83E-06	8.77E-05
Phenanthrene-mean	2.69E-02	1.74E-03	2.35E-05	6.25E-04	4.14E-05	8.02E-01	1.40E-06	2.54E-05
Pyrene-max	1.48E-01	2.09E-04	9.51E-02	7.50E-05	1.69E-01	**2.66E+00**	1.17E-03	7.30E-07
Pyrene-mean	2.26E-02	3.19E-05	1.45E-02	1.14E-05	2.57E-02	8.40E-01	3.69E-04	2.30E-07
Pesticides								
4,4'-DDD-max	2.62E-01	7.05E-03	6.31E-04	2.53E-03	1.12E-03	NEP	NEP	NEP
4,4'-DDD-mean	3.53E-02	9.51E-04	8.52E-05	3.41E-04	1.52E-04	NEP	NEP	NEP
4,4'-DDE-max	4.67E-01	5.19E-03	1.07E-03	1.86E-03	2.65E-03	NEP	NEP	NEP
4,4'-DDE-mean	9.70E-02	1.08E-03	2.21E-04	3.86E-04	5.49E-04	NEP	NEP	NEP
4,4'-DDT-max	9.42E-02	4.97E-03	3.52E-03	1.78E-03	**1.30E+00**	NEP	NEP	NEP
4,4'-DDT-mean	1.78E-02	9.40E-04	6.65E-04	3.37E-04	2.46E-01	NEP	NEP	NEP
Aldrin-max	7.04E-01	1.61E-03	3.75E-03	5.79E-04	3.84E-03	NEP	NEP	NEP
Aldrin-mean	8.35E-02	1.91E-04	4.45E-04	6.87E-05	4.55E-04	NEP	NEP	NEP
Dieldrin-max	**1.95E+00**	1.52E-01	4.26E-02	1.77E-01	1.17E-01	4.21E-01	5.62E-06	1.20E-05
Dieldrin-mean	2.18E-01	1.69E-02	4.75E-03	1.97E-02	1.31E-02	1.89E-01	2.53E-06	5.40E-06
Endosulfan II-max	7.57E-01	3.24E-04	2.50E-06	1.16E-04	4.45E-06	NEP	NEP	NEP
Endosulfan II-mean	4.22E-01	1.81E-04	1.39E-06	6.48E-05	2.48E-06	NEP	NEP	NEP
Endrin ketone-max	5.80E-02	8.67E-04	1.37E-04	3.11E-04	7.30E-03	NEP	NEP	NEP
Endrin ketone-mean	3.28E-02	4.90E-04	7.72E-05	1.76E-04	4.12E-03	NEP	NEP	NEP
Heptachlor-max	7.64E-04	5.39E-05	1.83E-05	1.26E-04	4.16E-04	NEP	NEP	NEP
Heptachlor-mean	2.28E-04	1.61E-05	5.47E-06	3.75E-05	1.24E-04	NEP	NEP	NEP
Heptachlor epoxide-max	**4.40E+00**	1.86E-04	6.33E-05	4.34E-04	1.44E-03	NEP	NEP	NEP
Heptachlor epoxide-mean	6.70E-01	2.84E-05	9.64E-06	6.61E-05	2.19E-04	NEP	NEP	NEP
Methoxychlor-max	4.09E-02	3.75E-05	2.75E-02	1.34E-05	4.90E-02	NEP	NEP	NEP
Methoxychlor-mean	3.65E-02	3.35E-05	2.46E-02	1.20E-05	4.38E-02	NEP	NEP	NEP

Table 10.5 Summary of Screening Assessment LOAEL-Based Hazard Quotients—ERP Site WP-14 (continued)

COPEC	LOAEL-Based Hazard Quotient							
	Earthworm	Deer Mouse	American Robin	Red Fox	Red-tailed Hawk	Atlantic Croaker	Belted Kingfisher	Mink
alpha-Chlordane-max	8.23E-03	1.07E-04	1.18E-04	3.83E-05	2.10E-04	NEP	NEP	NEP
alpha-Chlordane-mean	1.06E-03	1.38E-05	1.52E-05	4.93E-06	2.71E-05	NEP	NEP	NEP
beta-BHC-max	4.83E-01	5.28E-06	1.88E-05	1.89E-06	3.35E-05	NEP	NEP	NEP
beta-BHC-mean	3.05E-01	3.34E-06	1.19E-05	1.20E-06	2.12E-05	NEP	NEP	NEP
delta-BHC-max	**1.90E+01**	5.07E-04	7.41E-04	2.08E-02	1.32E-03	NEP	NEP	NEP
delta-BHC-mean	**1.27E+00**	3.38E-05	4.94E-05	1.39E-03	8.79E-05	NEP	NEP	NEP
gamma-BHC(Lindane)-max	6.14E-03	7.74E-05	6.64E-04	2.78E-05	2.83E-04	NEP	NEP	NEP
gamma-BHC(Lindane)-mean	3.97E-04	5.01E-06	4.30E-05	1.80E-06	1.83E-05	NEP	NEP	NEP
gamma-Chlordane-max	4.85E-06	6.29E-05	6.95E-05	2.26E-05	1.24E-04	NEP	NEP	NEP
gamma-Chlordane-mean	6.49E-07	8.41E-06	9.29E-06	3.02E-06	1.65E-05	NEP	NEP	NEP
Herbicides								
2,4,5-T-max	cnba	2.25E-04	3.72E-03	8.06E-05	6.63E-03	NEP	NEP	NEP
2,4,5-T-mean	cnba	2.77E-05	4.58E-04	9.92E-06	8.16E-04	NEP	NEP	NEP
2,4-DB-max	1.46E-01	8.22E-03	4.22E-01	2.95E-03	7.52E-01	NEP	NEP	NEP
2,4-DB-mean	5.49E-02	3.09E-03	1.59E-01	1.11E-03	2.83E-01	NEP	NEP	NEP
Dinoseb-max	cnba	5.94E-03	1.66E-04	2.13E-03	2.96E-04	NEP	NEP	NEP
Dinoseb-mean	cnba	2.28E-03	6.36E-05	8.16E-04	1.13E-04	NEP	NEP	NEP
Hydrocarbons								
Diesel-max	cnba	cnba	cnba	cnba	cnba	NEP	NEP	NEP
Diesel-mean	cnba	cnba	cnba	cnba	cnba	NEP	NEP	NEP

max - COPEC evaluated using maximum media concentrations

mean - COPEC evaluated using mean media concentrations

Bold values indicate that the LOAEL-Based hazard quotient is greater than or equal to 1.

NEP = No exposure pathway.

cnba = Could not be assessed due to lack of toxicological data.

Table 10.6 Constituents of Potential Ecological Concern Eliminated from Further Evaluation—ERP Site WP-14

Inorganic Analytes	Volatile Organic Compounds	Semivolatile Organic Compounds	Herbicides	Pesticides	Hydrocarbons
Calcium	2-Butanone (MEK)	2-Methylnaphthalene	2,4,5-T	4,4'-DDD	Diesel
Cyanide	Acetone	Benzo(a)anthracene	2,4-DB	4,4'-DDE	
Lead	Carbon disulfide	Benzo(a)pyrene	Dinoseb	4,4'-DDT	
Magnesium		Benzo(b)fluoranthene		Aldrin	
Manganese		Benzo(g,h,i)perylene		Dieldrin	
Nickel		Benzo(k)fluoranthene		Endosulfan II	
Potassium		bis(2-Ethylhexyl)phthalate		Endrin ketone	
Sodium		Butylbenzylphthalate		Heptachlor	
Zinc		Carbazole		Heptachlor epoxide	
		Chrysene		Methoxychlor	
		Di-n-butylphthalate		alpha-Chlordane	
		Dibenzofuran		beta-BHC	
		Fluoranthene		delta-BHC	
		Fluorene		gamma-BHC (Lindane)	
		Indeno(1,2,3-cd)pyrene		gamma-Chlordane	
		Naphthalene			
		Phenanthrene			
		Pyrene			

Note: Delta-BHC, diesel, and dibenzofuran were removed because they were detected only in subsurface soil and not surface soil.

Table 10.7 Constituents of Concern—ERP Site WP-14

Parameter	Surface Soil Concentration	
	Maximum	Mean
Inorganic Analytes		
Aluminum	16300	10400
Antimony	1.43	0.446
Beryllium	0.867	0.528
Chromium (total)	34.0	20.0
Iron	33400	17800
Thallium	0.152	0.0974
Vanadium	58.3	38.3

Note: Surface water and sediment data are not available for WP-14.

Table 10.8 Summary of Baseline Assessment NOAEL-Based Hazard Quotients—ERP Site WP-14

COC	NOAEL-Based Hazard Quotient				
	Earthworm	Deer Mouse	American Robin	Red Fox	Red-tailed Hawk
Inorganic Analytes					
Aluminum-max	**1.92E+00**	**9.46E+02**	**6.81E+00**	3.91E-01	1.46E-02
Aluminum-mean	**1.22E+00**	**6.04E+02**	**4.34E+00**	2.49E-01	9.34E-03
Antimony-max	**4.77E+00**	**3.24E+01**	**1.02E+03**	4.33E-04	**3.00E+00**
Antimony-mean	**1.49E+00**	**1.01E+01**	**3.17E+02**	1.35E-04	9.35E-01
Beryllium-max	**1.64E+00**	**3.03E+00**	**1.05E+02**	9.70E-03	3.07E-01
Beryllium-mean	9.96E-01	**1.84E+00**	**6.37E+01**	5.91E-03	1.87E-01
Chromium-max	**4.36E+00**	**2.79E+00**	**3.22E+00**	9.07E-03	8.32E-03
Chromium-mean	**2.56E+00**	**1.64E+00**	**1.89E+00**	5.34E-03	4.89E-03
Iron-max	**4.12E+00**	2.12E-01	**1.00E+00**	6.90E-04	2.54E-03
Iron-mean	**2.20E+00**	1.13E-01	5.34E-01	3.68E-04	1.35E-03
Thallium-max	cnba	**9.42E+00**	**3.15E+02**	4.46E-03	1.11E-01
Thallium-mean	cnba	**6.04E+00**	**2.02E+02**	2.85E-03	7.11E-02
Vanadium-max	8.97E-01	**4.98E+01**	3.42E-01	1.63E-01	8.25E-04
Vanadium-mean	5.89E-01	**3.27E+01**	2.24E-01	1.07E-01	5.42E-04

max - COC evaluated using maximum media concentrations
mean - COC evaluated using mean media concentrations
Bold values indicate that the NOAEL-Based hazard quotient is greater than or equal to 1.
cnba = Could not be assessed due to lack of toxicological data.

Table 10.9 Summary of Baseline Assessment LOAEL-Based Hazard Quotients—ERP Site WP-14

COC	LOAEL-Based Hazard Quotient				
	Earthworm	Deer Mouse	American Robin	Red Fox	Red-tailed Hawk
Inorganic Analytes					
Aluminum-max	8.58E-01	**9.46E+01**	6.81E-01	3.91E-02	1.46E-03
Aluminum-mean	5.47E-01	**6.04E+01**	4.34E-01	2.49E-02	9.34E-04
Antimony-max	**4.61E+00**	**3.24E+00**	**1.02E+02**	4.33E-05	3.00E-01
Antimony-mean	**1.44E+00**	**1.01E+00**	**3.17E+01**	1.35E-05	9.35E-02
Beryllium-max	8.94E-01	3.03E-01	**1.05E+01**	9.70E-04	3.07E-02
Beryllium-mean	5.44E-01	1.84E-01	**6.37E+00**	5.91E-04	1.87E-02
Chromium-max	8.72E-01	2.79E-01	3.22E-01	9.07E-04	8.32E-04
Chromium-mean	5.13E-01	1.64E-01	1.89E-01	5.34E-04	4.89E-04
Iron-max	**1.39E+00**	2.12E-02	1.00E-01	6.90E-05	2.54E-04
Iron-mean	7.42E-01	1.13E-02	5.34E-02	3.68E-05	1.35E-04
Thallium-max	cnba	9.42E-01	**3.15E+01**	4.46E-04	1.11E-02
Thallium-mean	cnba	6.04E-01	**2.02E+01**	2.85E-04	7.11E-03
Vanadium-max	9.72E-02	**4.98E+00**	3.42E-02	1.63E-02	8.25E-05
Vanadium-mean	6.38E-02	**3.27E+00**	2.24E-02	1.07E-02	5.42E-05

max - COC evaluated using maximum media concentrations
mean - COC evaluated using mean media concentrations
Bold values indicate the LOAEL-Based hazard quotient is greater than or equal to 1.
cnba = Could not be assessed due to lack of toxicological data.

Table 10.10 Mean LOAEL Hazard Quotients >1 for Ecological Receptors
Operational Unit 32 (WP-14)
Langley Air Force Base, Virginia

Receptor Name	Exposure Medium	Analyte	Hazard Quotient[1]	COC?	Rationale
Earth Worm	Surface Soil	Antimony	1.44E+00	No	Concentrations consistent with background conditions; HQ only slightly greater than 1
Deer Mouse	Surface Soil	Aluminum	6.04E+01	No	Concentrations consistent with background conditions; bioavailability assumption was overly conservative
		Antimony	1.01E+00	No	Concentrations consistent with background conditions; HQ only slightly greater than 1
		Vanadium	3.27E+00	No	Consistent with background conditions
American Robin	Surface Soil	Antimony	3.17E+01	No	Consistent with background conditions; highly conservative analysis
		Beryllium	6.37E+00	No	Consistent with background conditions; highly conservative analysis
		Thallium	2.02E+01	No	Consistent with background conditions; highly conservative analysis

Notes:
[1]Hazard quotients presented are based on mean COC concentrations and LOAEL values, using Langley site-specific toxicological data for earthworms
Note - toxicity testing performed as part of the overall Langley AFB toxicity study, not as part of the RI for WP-14