THE UNITED STATES AIR FORCE
INSTALLATION RESTORATION PROGRAM

DECISION DOCUMENT FOR PERFORMANCE-BASED REMEDIATION SOURCE AREAS SO065, SO069, SO070, SO071, SO073, SS084, AND TU506

EIELSON PERFORMANCE-BASED REMEDIATION

EIELSON AIR FORCE BASE, ALASKA

PREPARED FOR

AIR FORCE CIVIL ENGINEER CENTER

CONTRACT NO. FA-8903-09-D-8568

FINAL

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AF103	U.S. Air Force Base Form 103
AF332	U.S. Air Force Base Form 332
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AST	aboveground storage tank
bgs	below ground surface
BTV	background threshold value
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Civil Engineer Squadron
COC	chemical of concern
COEC	chemicals of ecological concern
CSM	conceptual site model
cy	cubic yard(s)
DD	Decision Document
DRO	diesel-range organics
EIAP	Environmental Impact Analysis Process
EPA	U.S. Environmental Protection Agency
GRO	gasoline-range organics
HI	hazard index
JD	The result is estimated based on the relative percent difference between the primary sample and the field duplicate sample.
JL+	The result is potentially biased high based on a greater recovery than the upper control limit.
JM+	The result was an estimated value because the analyte failed recovery criteria in the matrix spike or matrix spike duplicate sample, or both. Results were biased high because the recovery was greater than the UCL. The qualifier was applied to positive detections in the parent sample.
LUC	land use control

ACRONYMS AND ABBREVIATIONS (Continued)

LUCIP	Land Use Control Implementation Plan
MDC	maximum detected concentration
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	monitored natural attenuation
n/a	not applicable
NFA	no further action
PAH	polycyclic aromatic hydrocarbon
PBR	Performance-Based Remediation
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PID	photoionization detector
POL	petroleum, oil, and lubricants
ppm	parts per million
PSG	passive soil gas
PSL	project screening level
RAO	remedial action objective
RRO	residual-range organics
SC	site characterization
SCR	site characterization report
SCRI	Site Characterization Report I (USAF 2018b)
SVOC	semivolatile organic compound
TMB	trimethylbenzene
TPH	total petroleum hydrocarbons
UCL	upper control limit
USAF	U.S. Air Force
UST	underground storage tank
UTL	upper tolerance limit

ACRONYMS AND ABBREVIATIONS (Continued)

UU/UE	unlimited use and unrestricted exposure
VOC	volatile organic compound

ACRONYMS AND ABBREVIATIONS (Continued)

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EXECUTIVE SUMMARY

This Decision Document describes the remedial actions at Eielson Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506, all of which are associated with potential contamination resulting from petroleum, storage, distribution, and/or use. The U.S. Air Force (USAF) is managing remediation of petroleum, oil, and lubricants (POL) or petroleum-related contamination at these source areas in accordance with the State-Eielson Agreement (USAF 2014e), herein referred to as the two-party agreement. Any Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) constituents remaining will be addressed by transferring source areas back to the *Eielson Air Force Base, Federal Facility Agreement Under CERCLA Section 120* (USAF 2013a), herein referred to as the three-party agreement. Source areas addressed are recommended for either no further action (NFA) when no POL- or petroleum-related chemicals of concern (COCs) are present, remediation by means of excavation where only POL- or petroleum-related soil contamination is present, or a combination of excavation and monitored natural attenuation (MNA) or long-term monitoring where both POL- or petroleum-related soil and groundwater contamination are present. The selected remedial actions for each source area and the supporting rationale are summarized in Table ES-1.

Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506 have completed the source evaluation process required by the Eielson Federal Facilities Agreement (USAF 1990), and have been transferred to the two-party agreement based on source area results as documented in the *Site Characterization Report I Source Areas ST011, SD021, SD022, SD023, SD024, DP025, ST027, SS030, ST058, SO065, SO069, SO070, SO071, SO073, SO075, SS078, SS084, SO504, TU506, MY512, and MY518* (USAF 2018b). At the time these source areas were transferred from the three-party agreement to two-party agreement for site characterization (SC), only POL- or petroleum-related contamination was known at each source area. The USAF intends to address POL- or petroleum-related contamination under the two-party agreement. Source areas will be transferred back to the three-party agreement for any remaining remedial action under CERCLA. No sampling for perfluorooctanoic acid (PFOA) and/or perfluorooctane sulfonate (PFOS) was conducted as part of SC activities; any source areas with suspected

PFOA/PFOS or remaining CERCLA constituents will be addressed under the three-party agreement. There is no confirmed PFOA or PFOS contamination in groundwater at these source areas. The estimated PFOA and PFOS groundwater plume at Eielson Air Force Base is displayed on Figure A-1 in Appendix A.

The remedial action objectives for these source areas include:

- Protect human health and the environment from risks associated with exposure to POL- or petroleum-related COCs at concentrations greater than Alaska Department of Environmental Conservation (ADEC) cleanup levels in soil and groundwater.
- Limit or eliminate the potential for POL- or petroleum-related contaminant migration from soil to sediment, surface water, and groundwater or from soil, sediment, surface water, or groundwater to indoor or outdoor air.
- Limit or eliminate the potential for human exposure to POL- or petroleum-related soil contamination above ADEC cleanup levels until source area conditions support unlimited use and unrestricted exposure (UU/UE).

Table ES-1
Remedies for Applicable Source Areas

Source Area	Remedial Action	Rationale
SO065	NFA	• No further investigation is required for POL. • Soil is not a petroleum-impacted medium at this source area. • Groundwater is not a petroleum-impacted medium at this source area. • Any CERCLA constituents remaining will be addressed under the three-party agreement.
SO069	NFA	• No further investigation is required for POL. • Soil is not a petroleum-impacted medium at this source area. • Groundwater is not a petroleum-impacted medium at this source area. • Any CERCLA constituents remaining will be addressed under the three-party agreement.
SO070	NFA	• No further investigation is required for POL. • Soil is not a petroleum-impacted medium at this source area. • Groundwater is not a petroleum-impacted medium at this source area. • Any CERCLA constituents remaining will be addressed under the three-party agreement.

Table ES-1 (Continued)
Remedies for Applicable Source Areas

Source Area	Remedial Action	Rationale
SO071	Excavation	• Where no infrastructure is present, excavation will effectively remove the exposure risk posed by POL- or petroleum-related contamination in soil. • Excavation cannot occur at this time where infrastructure is present. Limitations to excavation may include the location of Building 1814, which is expected to be demolished prior to the implementation of the remedy; however, it is unknown when the building will be demolished. Soil contamination will be left in place until land use changes. Once land use change occurs, excavation will effectively remove the exposure risk posed by contamination in soil. • Groundwater is not a petroleum-impacted medium at this source area. • LUCs (e.g., dig restrictions) will be implemented until the remedy action occurs and until cleanup levels are attained for residual POL- or petroleum-related soil contamination, and/or until such a time that complete removal of soil contamination is practical. • LUCs will be reviewed periodically, not to exceed every five years, until UU/UE is achieved. • Any CERCLA constituents remaining will be addressed under the three-party agreement.
SO073	NFA	• No further investigation is required for POL. • Soil is not a petroleum-impacted medium at this source area. • Groundwater is not a petroleum-impacted medium at this source area. • Any CERCLA constituents remaining will be addressed under the three-party agreement.
SS084	Excavation and MNA	• Where no infrastructure is present, excavation will effectively remove the exposure risk posed by POL-related contamination in soil. • MNA of POL-related contamination in groundwater will occur until concentrations are below cleanup levels. • LUCs (e.g., dig restrictions and groundwater use restrictions) will be implemented until the remedy action occurs and until cleanup levels are attained for residual POL-related soil and groundwater contamination, and/or until such a time that complete removal of soil contamination is practical and cleanup levels are attained for groundwater contamination. • LUCs will be reviewed periodically, not to exceed every five years, until UU/UE is achieved. • If groundwater concentrations are greater than cleanup levels for one or both semi-annual monitoring events within one year, Periodic Review will determine continued remediation and will be undertaken at a frequency not exceeding five years unless a longer timeframe is agreed upon by USAF and ADEC. This applies only to POL contamination; all other non-petroleum-related contamination will be addressed under the three-party agreement. • Any CERCLA constituents remaining will be addressed under the three-party agreement.
TU506	Excavation	• Where no infrastructure is present, excavation will effectively remove the exposure risk posed by POL-related contamination in soil. • Groundwater is not a petroleum-impacted medium at this source area. • LUCs (e.g., dig restrictions) will be implemented until the remedy action occurs and until cleanup levels are attained for residual POL-related soil contamination, and/or until such a time that complete removal of soil contamination is practical. • LUCs will be reviewed periodically, not to exceed every five years, until UU/UE is achieved. • Any CERCLA constituents remaining will be addressed under the three-party agreement.

Note:
For definitions, refer to the Acronyms and Abbreviations section.

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PART 1: SITE NAMES AND LOCATIONS

Facility Name:	Eielson Air Force Base, Alaska
Site Locations:	Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506
Latitude/Longitude:	Eielson AFB, Alaska; Latitude: 64.7, Longitude: -147.0
ADEC Source Area File No:	See Table 2-1
ADEC Hazard ID No:	See Table 2-1
Operating Unit/Site:	See Table 2-1
Owner and Point of Contact:	U.S. Government (Managed by USAF) Kristina Smith USAF Restoration Program Manager 2310 Central Avenue, Suite 213 Eielson AFB, AK 99702 Phone number: 907-377-4299

The Alaska Department of Environmental Conservation (ADEC) provides regulatory oversight of the environmental restoration actions at Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506 (Figure A-1 in Appendix A) in accordance with the State-Eielson Eielson Air Force Base (AFB) Petroleum Site Restoration Agreement signed in April 2014 (U.S. Air Force [USAF] 2014e) and Article 3 of Alaska Administrative Code (AAC) Title 18, Chapter 75 (18 AAC 75) (ADEC 2017c).

USAF is managing remediation of petroleum, oil, and lubricants (POL) and petroleum-related contamination at Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506 in accordance with the State-Eielson Agreement (USAF 2014e) and the Defense Environmental Restoration Program (Title 10, §2701 et seq. of the U.S. Code [USC]; Executive Order 125080; 52 Federal Register 2923 [23 January 1987]). Any Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) constituents remaining will be addressed by transferring source areas back to the *Eielson Air Force Base, Federal Facility Agreement Under CERCLA Section 120* (USAF 2013a), herein referred to as the three-party agreement.

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PART 2: INTRODUCTION

This Decision Document (DD) includes Eielson source areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506 associated with potential contamination resulting from petroleum storage, distribution, and/or use. Source areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506 are not associated with an Operable Unit and have completed the source evaluation process required by the Eielson Federal Facilities Agreement (USAF 1990). The Memorandum to Site File (USAF 2018a) transferred regulatory oversight and also stipulated that these seven source areas would receive no further action (NFA) under CERCLA. Table 2-1 lists the source areas and their location coordinates. Figure A-1 (Appendix A) displays the source area locations on Eielson AFB.

The source-area-specific background information and assessments presented in this DD were primarily obtained from the 2018 *Site Characterization Report I Source Areas ST011, SD021, SD022, SD023, SD024, DP025, ST027, SS030, ST058, SO065, SO069, SO070, SO071, SO073, SO075, SS078, SS084, SO504, TU506, MY512, and MY518* (USAF 2018b), herein referred to as SCRI.

Table 2-1
Site Names and Locations

Source Area	Source Area Reference	Latitude	Longitude	ADEC File No., Hazard ID
SO065	Building 1444 (Facility 6126)/Vehicle Operations Heated Parking	64.734541	-147.040962	107.38.128, 26492
SO069	Building 1474 (Facility 6134)	64.733846	-147.032639	107.38.134, 26507
SO070	Building 1826 (Facility 6154)/Vehicle Operations Heated Parking	64.738160	-147.048258	107.38.135, 26508
SO071	Building 1814 (Facility 6162)	64.735491	-147.049437	107.38.136, 26509
SO073	Building 1434 (Facility 6164)/Vehicle Operations Heated Parking	64.734871	-147.046417	107.38.138, 26516
SS084	Former Army Artillery Site	64.627396	-147.066748	107.38.112, 25923
TU506	Building 1476 (Facility 6136)	64.733718	-147.030006	107.38.163, 26964

Notes:
Latitude and longitude are in the World Geodetic System 84 coordinate system.
For definitions, refer to the Acronyms and Abbreviations section.

2.1 EIELSON AFB GENERAL ENVIRONMENTAL SETTING

Eielson AFB is located within the Fairbanks North Star Borough in the east-central portion of interior Alaska, approximately 2 miles east of the Tanana River and 25 miles southeast of Fairbanks, Alaska. Eielson AFB encompasses an area of roughly 19,700 acres (Figure A-1 in Appendix A). The Trans-Alaska Pipeline transects the facility for approximately 5 miles.

2.1.1 Climate

Eielson AFB is situated in a continental climatic zone that covers interior Alaska. This climate zone is characterized by low precipitation and low humidity, both a result of the blockage of moist maritime air masses by the Brooks Range to the north and the Alaska Range to the south. Interior Alaska also experiences extreme seasonal fluctuations in daylight and temperature. The average summer temperature is 57 degrees Fahrenheit (°F) while the average winter temperature is -4°F. Annual precipitation averages 12 inches of rain and 69 inches of snow. Rainfall is generally highest in July and August (Alaska Climate Research Center 2018).

2.1.2 Regional Geology

Eielson AFB is built on the Tanana Basin, a tectonic basin filled with alluvium, primarily shed from the Alaska Range. Along the eastern edge of the base, metamorphic bedrock of the Yukon-Tanana Terrane (historically referred to as the Birch Creek Schist) crops out as the Yukon-Tanana Uplands. Moose Creek Bluff, a metamorphic bedrock inselberg, rises above the floodplain 3 miles to the northwest of the base. Tanana River deposits fill the basin beneath Eielson AFB and consist of unconsolidated fluvial sands and gravels, with rare silt. Where unmodified by human activity, the uppermost 10 to 15 feet of basin fill commonly consists of silts and sands (Péwé and Reger 1983). Below this, the basin fill consists of sub-equal proportions of well-graded sand with variable amounts of gravel interbedded with poorly graded sand and rare intervals of silt. Even at depth, this material is unconsolidated and lacking any degree of cementation.

Engineer Hill has a maximum elevation of approximately 900 feet above mean sea level. Lily Lake is located at the base of the hill at approximately 570 feet above mean sea level. Engineer Hill is composed of Paleozoic quartz-mica schist, phyllite, and quartzite (Foster et al 1994). During drilling, bedrock was encountered at approximately 30 feet below ground surface (bgs). The local aquifer is below 50 feet bgs and is characterized as fractured with low transmissivity.

2.1.3 Regional Hydrology

The Alaska Range forms the southern margin of the Tanana Basin and supplies most of the water to this basin in the form of glacier melt. The low hills of the Yukon-Tanana Uplands to the north supply a smaller amount of water derived from snowmelt and summer rains. In the Eielson-Fairbanks area, the floodplain of the Tanana River, which flows through the Tanana Basin, is approximately 11 miles wide. Several surface water bodies are within the Eielson AFB boundary including Garrison Slough, Piledriver Slough, Moose Creek, French Creek, Lily Lake, multiple ponds, and lakes (USAF 1996).

The groundwater hydrology beneath Eielson AFB is dominated by a strong connection to the Tanana River, which serves as a practically inexhaustible source of recharge or sink for discharge. Free exchange between in-river flow and groundwater causes water table elevations to match river elevations, with groundwater flow approximately parallel to river flow in the vicinity of Eielson AFB. Other inputs to the groundwater system include minor contributions from Moose Creek and French Creek, originating in the nearby uplands, and from local recharge derived from snow melt and summer rains. Groundwater is typically encountered at 8 to 10 feet bgs within the main developed area of Eielson AFB. Seasonally, groundwater elevations fluctuate by approximately 2 feet, with the highest water levels occurring during the spring thaw in May and early June (USAF 2015c).

The eastern portion of Eielson AFB is underlain by unconsolidated sediment that acts as an unconfined aquifer overlying fractured metamorphic bedrock. The unconfined aquifer extends from near the ground surface to a depth of approximately 250 to 400 feet bgs. The hydrogeological properties of the bedrock are unknown, but it likely acts as an aquitard at depth.

Some outcrops or shallow occurrences of bedrock locally produce usable quantities of water near the eastern edge of the base. Fractured bedrock is generally much less conductive than the fluvial soils of the unconfined aquifer. The aquifer's primary sources of recharge include the Tanana River, its tributaries, and vertical percolation of rainfall and snowmelt. The direction of groundwater flow in the shallow aquifer is north-northwest, which is parallel to the flow of the Tanana River. Flow may be locally influenced by buried stream channels where the hydraulic conductivity is greater than surrounding sediments, local surface drainages, groundwater production wells, and zones of permafrost.

2.2 CLEANUP LEVEL CHANGES

The SCRI references the soil and groundwater cleanup levels listed in Worksheet #15 of the Performance-Based Remediation (PBR) *Programmatic Quality Assurance Project Plan Addendum No. 2* (USAF 2017), which were largely based on 2017 ADEC cleanup levels (ADEC 2017c). In 2018, ADEC promulgated new cleanup levels for several analytes that became effective on 29 September 2018 (ADEC 2018b) and are outlined in regulation Tables B1 and C of 18 AAC 75 (ADEC 2018b). Cleanup levels for 22 compounds were modified, three new compounds were added, and one compound was removed. To account for these cleanup level changes, the maximum detected concentrations (MDCs) of all analytes were rescreened against the 2018 revised cleanup levels to ensure that analytes with concentrations greater than the 2018 cleanup levels were evaluated for possible inclusion as chemicals of concern (COCs) in this DD. A small number of analytes that did not exceed 2017 ADEC cleanup levels (ADEC 2017c) but exceed 2018 ADEC cleanup levels (ADEC 2018b) were added as COCs. In addition, some COCs proposed in the SCRI with concentrations less than the 2018 cleanup levels were removed from the lists of COCs and chemicals of potential concern (COPCs) presented in this DD. The changes based on this rescreening process are described by source area throughout Part 3 of this DD.

2.3 IDENTIFICATION OF POL-RELATED CHEMICALS OF CONCERN AND NON-PETROLEUM-RELATED CHEMICALS OF POTENTAL CONCERN

The final list of COCs for each source area was determined through a multi-step process detailed in the SCRI (USAF 2018b). Historical and recent sampling data for each source area were compiled into matrix-specific lists. In the SCRI, all analytes were compared to the most stringent 2017 ADEC cleanup levels, as presented in Tables B1, B2, and C (ADEC 2017c), in addition to one-tenth of their respective human health cleanup levels for cumulative risk evaluation using the ADEC online calculator (ADEC 2017b). COPCs with concentrations greater than the 2017 cleanup levels and/or for which the calculated risk exceeded a 1×10^{-5} lifetime cancer risk value or a hazard index (HI) of 1in the Cumulative Risk Evaluation were retained as POL- or petroleum-related COCs or as non-petroleum-related COPCs to be addressed under the three-party agreement, except as noted in the SCRI (USAF 2018b). Additional screening against the revised 2018 cleanup levels was done as described in Section 2.2; in addition, the cumulative risk for each site was re-calculated based on the 2018 cleanup levels (see Appendix C).

2.3.1 Background Metals

Metals contamination is outside the scope of this DD and will be addressed under the three-party agreement. Previous investigations identified high concentrations of naturally occurring metals, including arsenic in soil and groundwater at Eielson AFB (USAF 2014c). In 2012 and 2013, background studies for soil and groundwater were conducted to establish accepted background threshold values (BTVs) for fluvial soil, loess, and groundwater at Eielson AFB (USAF 2014a, 2014d). The 95-percent upper tolerance limit (UTL) reported in the 2012 and 2013 background studies was typically used as the BTV, except where the MDC exceeded the upper prediction limit and/or UTL, in which case the MDC was used as the BTV (USAF 2014a, 2014d). The BTVs for thallium in the soil background dataset, and aluminum, chromium, mercury, selenium, silver, and thallium in the groundwater background dataset, no longer have ADEC support, as discussed in the technical memorandum *Comparing Eielson Background to Site Metals Concentrations* (USAF 2019a).

Soil and groundwater metals results included in the SCRI (USAF 2018b) were compared to accepted BTVs for soil and groundwater (USAF 2014a, 2014d) as part of an initial threshold comparison. Hypothesis testing was completed where metals in soil or groundwater exceeded both the project screening levels (PSLs) and BTVs. The purpose of the hypothesis testing was to provide a statistical site-to-background comparison for metals in soil and groundwater. All statistical tests followed the methodology described in the technical memorandum entitled *Comparing Eielson Background to Site Metals Concentrations* and references cited therein (USAF 2019a). The results of the initial threshold comparisons and hypothesis tests, along with all input and output files and tables of excluded data, are presented in Appendix M of the SCRI.

Based on the results of hypothesis testing, metals in groundwater at Source Area SS084 were included in the list of proposed COPCs in the SCRI. A 95-percent upper control limit (UCL) was calculated where metals concentrations were not consistent with the background population (i.e., failed the hypothesis test). In addition, a 95-percent UCL was calculated where the MDC at a source area exceeded the PSL and there was no accepted BTV. The calculated 95-percent UCLs were compared to the PSL for reference purposes (refer to Table M-1.9 for soil and Table M-1.10 for groundwater in Appendix M of the SCRI [USAF 2018b]).

This report references the UTLs for fluvial soil as BTVs for all source areas including Engineer Hill (Source Areas SO065, SO069, SO070, SO071, SO073 and TU506). The substrate at Engineer Hill is geologically distinct from the fluvial soil found at lower elevations elsewhere on the main part of Eielson AFB due to near surface fractured and weathered bedrock. The Engineer Hill substrate is demonstrated to contain concentrations of arsenic well above those seen for the soil types described in the Eielson background study. Although no fluvial soil is present at Engineer Hill, some of the sampled material included gravel fill that presumably originated from fluvial deposits elsewhere at Eielson AFB.

2.3.1.1 Thallium

The majority of the historical soil sample results reported in the 2012 Phase 1 Source Evaluation (USAF 2013b) indicated thallium concentrations are above the PSLs at Source Areas SO065,

SO069, SO070, SO071, SO073, and TU506. However, many of the 2012 thallium results were qualified due to method blank contamination. Based on the qualified 2012 thallium results, the widespread detections at similar levels for multiple source areas, and the lack of similar thallium detections in recent samples, thallium will not be proposed as a non-petroleum-related COPC based on historical (2012) data alone.

2.3.1.2 Chromium Speciation

Chromium speciation in soil and groundwater was not performed during the PBR investigations at the source areas addressed in this DD due to the lack of known or suspected anthropogenic sources of chromium VI at these source areas. More specifically, the source areas included in this DD do not fit into any of the following categories for site type, which were deemed by project stakeholders to be sites with a probable history of chromium VI usage: unlined landfills, auto body or paint shops, corrosion control shops, used oil sites, metal-plating or finishing shops, photo development sites, coal ash disposal sites, and unlined wastewater treatment facility ponds. Based on the history of activities at each source area, as described in Sections 3.1 through 3.7, analytical results for total chromium are not expected to be the result of anthropogenic activities. Therefore, the absence of chromium speciation data is not considered a data gap for the sites addressed in this DD, and Total Chromium (III) has not been proposed as a non-petroleum-related COPC at any site in this DD because Total Chromium (III) results did not exceed the ADEC cleanup level in soil or groundwater (i.e., Source Areas SO065, SO070, SO071, SS084, and TU506).

2.3.2 PAHs in Surface and Near Surface Soil

Polycyclic aromatic hydrocarbons (PAHs) are frequently detected at concentrations greater than ADEC cleanup levels in surface and near surface soil samples collected across Eielson AFB. Due to the wide distribution of PAH detections in absence of collocated fuels, the USAF and regulatory stakeholders are establishing an Eielson-wide approach. PAHs with non-petrogenic signatures that occur in the absence of collocated fuel exceedances are termed "non-petroleum-related COPCs" and will be addressed under the three-party agreement after

the petroleum response is complete. PAH contamination not collocated with fuel contamination most likely has no direct relationship to historical source area activities. Frequent detections occurring along roadways and at locations adjacent to the airfield are typically due to non-petrogenic sources such as combustion from vehicles and aircraft.

2.3.3 Perfluorinated Compounds

No sampling for perfluorooctanoic acid (PFOA) and/or perfluorooctane sulfonate (PFOS) was conducted as part of site characterization (SC) activities, and there is no confirmed PFOA/PFOS contamination in groundwater at the source areas described in this DD. A separate basewide effort to identify and delineate PFOA/PFOS is underway. Additionally, the potential risks to human health attributable to PFOA and PFOS are not included in the cumulative risk calculations or proposed remedies described in Part 3 of this DD.

2.4 CONCEPTUAL SITE MODEL DEVELOPMENT

Only those analytes exceeding one-tenth the ADEC human health-based cleanup levels were considered when developing the conceptual site models (CSMs) (ADEC 2017a). Although no remedies are proposed for background metal and PAH contamination unrelated to site use, these constituents were incorporated into the CSMs. Receptors include residents, commercial or industrial workers, site visitors, trespassers, recreational users, and construction workers. Although residents do not presently inhabit source areas except MY518 due to their industrial nature, hypothetical future residents are considered potential future receptors as a conservative approach. The CSM forms for each source area will be reevaluated and revised once remedial activities have been completed or if changes to site conditions or land use occur. The CSM forms for each source area are found in Appendix B.

ADEC ecoscoping forms were completed for each source area to assess the potential for ecological risk. The assessment identified that Source Areas SO065, SO069, SO070, SO071, SO073, and TU506 did not require additional assessment because they did not contain ecological habitat or are fenced industrial compounds that are inaccessible to wildlife. A Screening Level Ecological Risk Assessment was completed for Source Area SS084 due to

the presence of habitat that supports a valued species and is included in Appendix F of the SCRI (USAF 2018b).

2.5 LAND USE CONTROLS

Land use controls (LUCs) (i.e., dig and groundwater use restrictions) are recommended to protect human health and the environment at source areas requiring remedial activity before being eligible for unlimited use and unrestricted exposure (UU/UE). Presently, soil and groundwater LUCs areas proposed in the SC Report (SCR) are in place, as described in the *Land Use Control Implementation Plan* (LUCIP)*, Eielson Air Force Base, Alaska* (USAF 2015a); these shall be retained, revised, reviewed, and approved by ADEC, and documented in future versions of the LUCIP. Soil and groundwater LUC boundaries for each source area are depicted on figures in Appendix A.

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PART 3: ASSESSMENT OF SITES

This section presents conclusions drawn from environmental investigations conducted at Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506. Supporting information is available in the SCRI (USAF 2018b), including the remedies evaluated and the basis for action at all source areas included in this DD.

3.1 SOURCE AREA SO065 – BUILDING 1444 (FACILITY 6126)/VEHICLE OPERATIONS HEATED PARKING

Source Area SO065 is located at Building 1444 (Facility 6126) on Engineer Hill (Figure A-1). Engineer Hill is a munitions storage and maintenance compound situated on an isolated hill north-northeast of the main developed and industrialized portion of Eielson AFB (USAF 2013b). Contamination sources are suspected to be a former aboveground storage tank (AST) and a condensate drain (USAF 2013b).

3.1.1 SO065 Background

Detailed descriptions of environmental investigations and analytical results at Source Area SO065 are presented in Section 4.10 of the SCRI (USAF 2018b). A timeline of environmental investigations at SO065 is provided here:

- During the 1994 Phase 2 Source Evaluation Report, no evidence was found of regular use or release of solvents or petroleum products at Engineer Hill source areas. No stressed vegetation, oil sheens, unusual odors, refuse, drums, or stained soil were observed (USAF 1994).
- During the 2012 Phase 1 Source Evaluation Report investigation, soil borings were advanced at SO065 (USAF 2013b). Soil samples were collected and analyzed for gasoline-range organics (GRO), diesel-range organics (DRO), residual-range organics (RRO), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. For surface soil samples, benzo(a)anthracene, benzo(a)pyrene, naphthalene, and thallium exceeded SCR PSLs and chromium exceeded the BTV. For subsurface soil samples, only thallium exceeded the PSL (USAF 2013b, USAF 2018b).
- In 2015, a source area inspection was conducted inside and outside of Building 1444. The inspection identified one floor drain exiting the southwest corner of the building and discharging to the ground surface and one plugged floor drain that likely exited the southeast

corner of the building although the discharge point could not be confirmed during the inspection. No AST was observed during the inspection (USAF 2018b).

- In 2016, one soil boring (SO065SB06) was advanced and six surface soil samples were collected. The subsurface soil sample was collected from the same interval where thallium was analyzed for and identified in 2012. Thallium did not exceed the PSL in this sample. Four of the surface soil samples were analyzed for PAHs and metals and two were analyzed for DRO, GRO, RRO, VOCs, PAHs, and metals (USAF 2018b). Benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, and naphthalene exceeded the PSLs in one of six surface soil samples. Chromium concentrations exceeded the BTV in two of the six surface soil samples.

3.1.1.1 Operational History

Source Area SO065 is associated with the Engineer Hill munitions storage and maintenance area that was built in 1957 (USAF 2013b). Munitions storage igloos at Engineer Hill are typically constructed of reinforced concrete and have sloped concrete floors that drain to the open ground surface via a grooved concrete channel, approximately 4 inches wide and 8 inches deep leading to a condensate drain exiting the igloo.

3.1.1.2 Known or Suspected Sources of Contamination

The suspected primary sources of contamination were assumed to be surface leaks and spills from a former AST and a condensate drain. A concrete pad east of Building 1444 was observed during the 2012 Source Evaluation Report (USAF 2013b) and may have once supported an AST. No records have been found to indicate an AST may have been located at or in the vicinity of Building 1444. Specific volumes of the suspected releases are not known. No staining or stressed vegetation has been observed at Source Area SO065 and no source-area-related contamination has been identified in SO065.

3.1.1.3 Current and Anticipated Future Land Use

Building 1444 at Source Area SO065 is scheduled for demolition in 2019 (USAF 2018b). The structure will be removed while the foundation will remain intact onsite. No changes to current site use are anticipated and no construction is planned.

3.1.2 Assessment of SO065

CSMs, POL-related COCs, non-petroleum-related COPCs, and the extent of contamination were evaluated to assist in selecting the appropriate remedy for Source Area SO065. The CSM scoping and graphic forms are presented in Appendix B. There are no current or future receptors because of the lack of POL- or petroleum-related contamination at SO065.

3.1.2.1 POL-Related Chemicals of Concern and Non-Petroleum-Related Chemicals of Potential Concern

No POL-related COCs have been retained at SO065. The non-petroleum-related soil COPCs for Source Area SO065 are listed in Table 3-1, along with the corresponding 2017 and 2018 cleanup levels. Any CERCLA constituents (e.g., PAHs) will be addressed under the three-party agreement, but exposure is insignificant due to three factors:

- The site is located in a remote area behind a locked gate on Engineer Hill, far from the developed part of Eielson AFB, and short-term exposure to benzo(a)pyrene and naphthalene at the site are not expected to cause effects.
- Military escort is required to gain access to the site. People are not expected to be on the site for more than 10 days per year, and short-term exposure to contaminant levels present at the site are not expected to cause effects.
- Benzo(a)pyrene and naphthalene are limited in extent, volume, and toxicity and are not expected to cause a significant exposure threat.

The following analyte was not retained as a non-petroleum-related soil COPC in the SCRI even though the calculated risk exceeded a 1×10^{-5} lifetime cancer risk value or an HI of 1 in the Cumulative Risk Evaluation:

- Based on the 2012 qualified thallium results at SO065, the widespread detections at similar levels for multiple source areas, and the lack of similar thallium detections in recent samples, thallium is not a non-petroleum-related soil COPC at SO065 (USAF 2018b).

Table 3-1
Non-Petroleum-Related Soil COPCs at Source Area SO065 with Comparison of Cleanup Levels

COPC	MDC (mg/kg)	Year of Maximum Detection[1]	ADEC 2017 Soil Cleanup Level[2] (mg/kg)	ADEC 2018 Soil Cleanup Level[3] (mg/kg)
Benzo(a)pyrene[4]	1.84	2012	0.20	**1.5**
Naphthalene[4]	1.25 J	2012	0.038	0.038

Notes:
[1] The MDC in soil is the MDC for any specific analyte.
[2] 18 AAC 75 Table B1, Method Two most conservative of under 40-inch zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2017c).
[3] 18 AAC 75 Table B1, Method Two most conservative of under 40-inch-zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2018b).
[4] Non-petroleum-related COPC to be addressed under the three-party agreement; remediation is not within the scope of this DD.
Bold values indicate cleanup level change.
For definitions, refer to the Acronyms and Abbreviations section.

3.1.2.2 Lateral and Vertical Extent of Contaminated Area

There is no remaining POL- or petroleum-related contamination as a result of a release at Source Area SO065.

3.1.3 Description of Remedy for SO065

NFA is the remedy for POL- or petroleum-related contamination at this site. PAH contamination at SO065 will be addressed under the three-party agreement.

3.1.3.1 Remedial Action Objectives

No remedial action objectives (RAOs) are necessary at Source Area SO065 because no POL- or petroleum-related contamination is present.

3.1.4 Site Closure

Site closure is recommended for Source Area SO065 based on the historical results and SC activities from the SCR (USAF 2018b). Any CERCLA constituents (e.g., PAHs and metals) will be addressed under the three-party agreement. All analytical data, as published in the SCRI,

will be maintained by the USAF and made available to ADEC upon request for at least 50 years after submission of the report to ADEC.

3.1.4.1 Support for Site NFA on Petroleum Determination

No POL- or petroleum-related contaminants as a result of the source area release were detected at concentrations greater than ADEC cleanup levels; the SCRI (USAF 2018b) describes investigative methods and analytical results for Source Area SO065. PAHs have been detected above ADEC cleanup levels at the source area; however, due to the presence of PAH detections in absence of collocated fuels, the site will be addressed under the three-party agreement. Additionally, the USAF and regulatory stakeholders are establishing an Eielson-wide approach to address these contaminants.

3.2 SOURCE AREA SO069 – BUILDING 1474 (FACILITY 6134)

Source Area SO069 is located at Building 1474 (Facility 6134) on Engineer Hill (Figure A-1). Engineer Hill is a munitions storage and maintenance compound situated on an isolated hill north-northeast of the main developed and industrialized portion of Eielson AFB (USAF 2013b). Contamination sources are suspected to be spills and leaks from an underground storage tank (UST) and a condensate drain (USAF 2013b).

3.2.1 SO069 Background

Detailed descriptions of environmental investigations and analytical results at Source Area SO069 are presented in Section 4.11 of the SCRI (USAF 2018b) and are summarized in this section. A timeline of environmental investigations at SO069 is also provided:

- According to the 1994 Phase 2 Source Evaluation Report (USAF), 500-gallon ASTs were installed and connected to various facilities in 1986, including Building 1474. In 1993, all the USTs and piping were leak-tested, and no evidence of leaking tanks or pipelines was observed (USAF 1994). Additional information provided by the USAF in March 2015 indicated a single 1,000-gallon single-wall outdoor UST was installed at Building 1474 to replace an indoor 500-gallon AST. There are no records of release or records of potential contamination associated with the 1,000-gallon UST.

- In 2007, a 1,000-gallon UST was removed from Source Area TU506 (Building 1476), immediately east of Building 1474. Confirmation samples were collected from the bottom of the excavation on the vent side of the UST (USAF 2013b). Confirmation samples indicated benzene at a concentration of 0.064 milligrams per kilogram (mg/kg) in one soil sample collected at the bottom of the excavation on the vent side of the UST (USAF 2013b).
- In 2012, investigation activities conducted as part of the Phase 1 Source Evaluation identified a UST containing diesel fuel located to the southeast of Building 1474. No other USTs were identified at SO069 (USAF 2013b). Also in 2012, soil borings were advanced and subsurface soil samples and surface soil samples were collected and analyzed for DRO, RRO, GRO, VOCs, SVOCs, and metals (USAF 2013b). Surface and subsurface soil samples contained benzo(a)anthracene, naphthalene, manganese, and thallium in concentrations that exceeded PSLs (USAF 2013b). Because of the proximity of the 2012 soil samples to the driveway and Engineer Hill Road, particulates from vehicular exhaust may have settled on surface soils (USAF 2013b). No other analytes were present above cleanup levels.
- In 2015, a source area inspection was conducted inside and outside of Building 1474. The inspection identified two floor drains discharging to the ground surface (USAF 2018b). A 1,000-gallon UST fill pipe and vent labeled "Diesel Arctic Blend" was observed to the south of the building. However, due to snow cover, the inspection was unable to identify visual indications of contamination.
- In 2016, surface soil samples were collected in the vicinity of historical PAH and metal exceedances, close to the condensate drain outlets of Building 1474, and from the diesel-containing UST excavation footprint. Soil samples were analyzed for GRO, DRO, RRO, VOCs, PAHs, and metals (USAF 2018b). Benzo(a)pyrene exceeded the PSL in two surface samples and naphthalene exceeded the PSL in one surface soil sample.

3.2.1.1 Operational History

Building 1474 was built in 1957 for the storage of explosive munitions and is typical of munitions storage igloos (USAF 2013b). In 1986, a 500-gallon AST was installed and connected to Building 1474. In 1993, a UST and associated piping was leak-tested; no evidence of leaking tanks or pipelines was observed (USAF 1994). Additional information provided by the USAF in March 2015 indicated a single 1,000-gallon single-wall outdoor UST was installed at Building 1474 to replace an indoor 500-gallon AST.

3.2.1.2 Known or Suspected Sources of Contamination

The suspected primary source of contamination is subsurface leaks and spills from fuel storage and transfer practices associated with a former UST and surface leaks from floor drains associated with Building 1474 (USAF 2013b, 2018b). Specific volumes of the suspected releases are not known. No contamination associated with the suspected sources of contamination was identified at SO069.

3.2.1.3 Current and Anticipated Future Land Use

Source Area SO069 is expected to continue to be a munitions storage and maintenance area. No changes to current site use are anticipated and no construction is planned.

3.2.2 Assessment of SO069

CSMs, POL-related COCs, non-petroleum-related COPCs, and the extent of contamination were evaluated to assist in selecting the appropriate remedy for Source Area SO069. The CSM scoping and graphic forms are presented in Appendix B. There are no current or future receptors because of the lack of POL-related contamination at SO069.

3.2.2.1 POL-Related Chemicals of Concern and Non-Petroleum-Related Chemicals of Potential Concern

No POL-related COCs have been retained at SO069. Any CERCLA constituents (e.g., PAHs) will be addressed under the three-party agreement. The following analyte was not retained as a non-petroleum-related soil COPC in the SCRI even though the calculated risk exceeded a 1×10^{-5} lifetime cancer risk value or an HI of 1 in the Cumulative Risk Evaluation:

> Based on the 2012 qualified thallium results at SO069, the widespread detections at similar levels for multiple source areas, and the lack of similar thallium detections in recent samples, thallium is not a non-petroleum-related soil COPC at SO069 (USAF 2018b).

3.2.2.2 Lateral and Vertical Extent of Contaminated Area

There is no remaining POL-related contamination as a result of a release at Source Area SO069.

3.2.3 Description of Remedy for SO069

NFA is the remedy for POL-related contamination at this site. Any CERCLA constituents (e.g., PAHs) will be addressed under the three-party agreement.

3.2.3.1 Remedial Action Objectives

No RAOs are necessary at Source Area SO069 because no POL-related contamination is present.

3.2.4 Site Closure

Site closure of POL is recommended for Source Area SO069 based on the historical results and SC activities from the SCRI (USAF 2018b). Any CERCLA constituents (e.g., PAHs and metals) will be addressed under the three-party agreement. All analytical data, as published in the SCRI, will be maintained by the USAF and made available to ADEC upon request for at least 50 years after submission of the report to ADEC.

3.2.4.1 Support for Site NFA on Petroleum Determination

No POL- or petroleum-related contaminants as a result of the source area release were detected at concentrations greater than ADEC cleanup levels; the SCRI (USAF 2018b) describes investigative methods and analytical results for Source Area SO069. PAHs have been detected above ADEC cleanup levels at the source area; however, due to the presence of PAH detections in absence of collocated fuels, the USAF and regulatory stakeholders are establishing an Eielson-wide approach to address these contaminants.

3.3 SOURCE AREA SO070 – BUILDING 1826 (FACILITY 6154)/VEHICLE OPERATIONS HEATED PARKING

Source Area SO070 is located at Building 1826 (Facility 6154) on Engineer Hill (Figure A-1). Engineer Hill is a munitions storage and maintenance compound situated on an isolated hill north-northeast of the main developed and industrialized portion of Eielson AFB

(USAF 2013b). Source Area ST056 is located south of Building 1826. Contamination sources are suspected to include vehicle exhaust, a diesel AST, and a condensate drain (USAF 2013b).

3.3.1 SO070 Background

Detailed descriptions of environmental investigations and analytical results at Source Area SO070 are presented in Section 4.12 of SCRI (USAF 2018b) and summarized in this section. A timeline of environmental investigations at SO070 is also provided:

- A Phase 1 Source Evaluation was conducted in 2012. No surface staining or stressed vegetation was observed during the 2012 investigation. In 2012, three soil borings were advanced, and six subsurface soil samples and six surface soil samples were collected and analyzed for GRO, DRO, RRO, VOCs, SVOCs, polychlorinated biphenyls (PCBs), and metals. There were no odors or evidence of solvents associated with any of the three borings. Groundwater was not intersected in any soil boring (USAF 2013b). Surface soil samples contained benzo(a)anthracene, naphthalene, and thallium in concentrations that exceeded the PSL and chromium that exceeded the BTV. Subsurface soil samples contained thallium exceeding the PSL and arsenic and chromium above the PSLs and BTVs. Potential sources of contamination identified during the Phase 1 Source Evaluation include vehicle exhaust, a diesel AST, and a floor drain. Following the 2012 Phase 1 Source Evaluation, the lateral extent of PAH contamination in surface soil was undefined and potential surface soil contamination at the AST and drain outfall had not been characterized (USAF 2013b).
- In 2015 during Stage I SC activities, Building 1826 was inspected. One floor drain containing frozen water was found in the southwest end of Building 1826. Five surface soil samples were collected to define the lateral extent of PAH contamination. During Stage II SC activities, four additional surface soil samples were collected and analyzed for PAHs (USAF 2018b). The PAHs benzo(a)anthracene, and/or naphthalene exceeded PSLs in six of nine surface soil samples. The exceedances ranged from slightly above to a factor of 2 above the ADEC migration to groundwater criteria.

3.3.1.1 Operational History

Building 1826 was constructed in 1957 to provide heated parking for vehicle operations; vehicles were commonly stored and repaired in Building 1826 (USAF 1994). The 2012 Phase I Source Evaluation Report described a diesel AST located on a concrete pad on the southwestern side of Building 1826 (USAF 2013b). A 4-inch polyvinyl chloride pipe was seen sticking out of the ground along the eastern wall of Building 1826, possibly installed as part of source area

investigation activities at Source Area ST056 (USAF 2013b). During a 2015 source area inspection, a floor drain containing frozen water was identified (USAF 2018b).

3.3.1.2 Known or Suspected Sources of Contamination

The suspected primary sources of contamination are surface leaks and spills associated with a diesel AST, vehicle exhaust, and a floor drain (USAF 2013b). Specific volumes of the suspected releases are not known. No records of a release and no contamination associated with suspected sources of contamination were identified at SO070.

3.3.1.3 Current and Anticipated Future Land Use

Building 1826 at Source Area SO070 is not currently scheduled for demolition. The industrial nature of the site is unlikely to change in the near future. No changes to current site use are anticipated and no construction is planned.

3.3.2 Assessment of SO070

CSMs, POL-related COCs, non-petroleum-related COPCs, and the extent of contamination were evaluated to assist in selecting the appropriate remedy for Source Area SO070. The CSM scoping and graphic forms are presented in Appendix B. There are no current or future receptors because of the lack of POL- or petroleum-related contamination at SO070.

3.3.2.1 POL-Related Chemicals of Concern and Non-Petroleum-Related Chemicals of Potential Concern

No POL- or petroleum-related COCs have been retained at SO070. The non-petroleum-related soil COPC for Source Area SO070 is listed in Table 3-2, along with the corresponding 2017 and 2018 cleanup levels. Any CERCLA constituents (e.g., PAHs and metals) will be addressed under the three-party agreement, but exposure is insignificant due to three factors:

- The site is located in a remote area behind a locked gate on Engineer Hill, far from the developed part of Eielson AFB, and short-term exposure to naphthalene at the site is not expected to cause effects.

- Military escort is required to gain access to the site. People are not expected to be on the site for more than 10 days a year and short-term exposure to contaminant levels present at the site are not expected to cause effects.
- Naphthalene is limited in extent, volume, and toxicity and is not expected to cause a significant exposure threat.

The following analytes were not retained as non-petroleum-related soil COPCs in the SCRI even though the calculated risk exceeded a 1×10^{-5} lifetime cancer risk value or an HI of 1 in the Cumulative Risk Evaluation:

- Hypothesis testing was completed for arsenic in soil, which was detected above the PSL and BTV at Source Area SO070. The results indicate that concentrations of arsenic are consistent with background concentrations (USAF 2018b).
- Based on the 2012 qualified thallium results at SO070, the widespread detections at similar levels for multiple source areas, and the lack of similar thallium detections in recent samples, thallium is not a non-petroleum-related soil COPC at SO070 (USAF 2018b).

Table 3-2
Non-Petroleum-Related Soil COPC at Source Area SO070 with Comparison of Cleanup Levels

COPC	MDC (mg/kg)	Year of Maximum Detection[1]	ADEC 2017 Soil Cleanup Level[2] (mg/kg)	ADEC 2018 Soil Cleanup Level[3] (mg/kg)
Naphthalene[4]	0.97	2015	0.038	0.038

Notes:
[1] The MDC in soil is the MDC for any specific analyte.
[2] 18 AAC 75 Table B1, Method Two most conservative of under 40-inch zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2017c).
[3] 18 AAC 75 Table B1, Method Two most conservative of under 40-inch-zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2018b).
[4] Non-petroleum-related COPC to be addressed under the three-party agreement; remediation is not within the scope of this DD.
For definitions, refer to the Acronyms and Abbreviations section.

3.3.2.2 Lateral and Vertical Extent of Contaminated Area

There is no remaining POL-related contamination as a result of a release at Source Area SO070.

3.3.3 Description of Remedy for SO070

NFA is the remedy for POL- or petroleum-related contamination at this site. PAH contamination at SO070 will be addressed under the three-party agreement.

3.3.3.1 Remedial Action Objectives

No RAOs are necessary at Source Area SO070 because no POL-related contamination is present.

3.3.4 Site Closure

Site closure is recommended for Source Area SO070 based on the historical results and SC activities from the SCRI (USAF 2018b). Any CERCLA constituents (e.g., PAHs and metals) will be addressed under the three-party agreement. All analytical data, as published in the SCRI, will be maintained by the USAF and made available to ADEC upon request for at least 50 years after submission of the report to ADEC.

3.3.4.1 Support for Site NFA on Petroleum Determination

No POL- or petroleum-related contaminants as a result of the source area release were detected at concentrations greater than ADEC cleanup levels; the SCRI (USAF 2018b) describes investigative methods and analytical results for Source Area SO070. PAHs have been detected above ADEC cleanup levels at the source area; however, due to the presence of PAH detections in absence of collocated fuels, the site will be addressed under the three-party agreement. Additionally, the USAF and regulatory stakeholders are establishing an Eielson-wide approach to address these contaminants.

3.4 SOURCE AREA SO071 – BUILDING 1814 (FACILITY 6162)

Source Area SO071 is located at Building 1814 (Facility 6162) on Engineer Hill (Figures A-2.1 through A-2.4). Engineer Hill is a munitions storage and maintenance compound situated on an isolated hill north-northeast of the main developed and industrialized portion of Eielson AFB

(USAF 2013b). Contamination sources are suspected to include leaks, spills, and direct discharge from former USTs, ASTs, tank piping, and a condensate drain (USAF 2013b).

3.4.1 SO071 Background

Detailed descriptions of environmental investigations and analytical results at Source Area SO071 are presented in Section 4.13 of the SCRI (USAF 2018b) and the results are summarized in this section. Soil sample locations are presented on Figures A-2.1 through A-2.4 (Appendix A). A timeline of environmental investigations at SO071 is also provided.

During the Phase I Source Evaluation in 2012, subsurface and surface soil samples were collected from three soil boring locations (USAF 2013b). Soil samples were analyzed for GRO, DRO, RRO, VOCs, SVOCs, and metals. Surface soil samples had concentrations of thallium above the PSL and chromium above the PSL and BTV, and subsurface samples had thallium concentrations above the PSL and arsenic, chromium, and iron above the PSLs and BTVs. Naphthalene in sample EIC511DP003S001-01, collected immediately west of Building 1814, exceeds the PSL (USAF 2018b).

In 2015, the exterior of Building 1814 was inspected (USAF 2018b). A UST was removed in August 2015. Field screening results were below 20 parts per million (ppm) after the excavation was complete. The UST site spill was reported to and closed by ADEC Prevention, Preparedness, and Response. Less than 1 cubic yard (cy) of petroleum-contaminated soil was excavated from the UST location.

In 2016 and 2017, four stages of SC at SO071 occurred and were completed as follows:

- In 2016, Stage I screening and sampling included subsurface and surface soil samples (USAF 2018b). Two surface soil samples were collected to delineate PAHs in surface soil west of Building 1814 and were analyzed for PAHs and metals. Two surface soil samples were collected near the drainage outfalls, and were analyzed for GRO, DRO, RRO, VOCs, PAHs, and metals. A subsurface soil sample was collected adjacent to the historical metal exceedances and was analyzed for thallium only. Following a review of Stage I analytical results, additional surface soil samples were collected to determine the lateral extent of DRO, PAHs, and metals.

- During Stage II, a near surface soil sample and surface soil samples were collected (USAF 2018b). One sample was analyzed only for PAHs and metals, and the remainder were analyzed for GRO, DRO, RRO PAHs, and metals.
- During Stage III, additional surface soil samples were collected in 2017. Soil samples were collected and analyzed for PAHs and metals (USAF 2018b). Two additional surface soil samples (SO071SS09 and SO071SS10) were collected and analyzed for DRO, RRO, PAHs, pesticides, and metals. During sample collection, a drain outfall was observed on the western side of Engineer Hill Road near SO071SS10, and one sample of opportunity (SO071OTFLL) was collected and analyzed for VOCs, low-level VOCs, PAHs, and metals.
- During Stage IV, surface soil samples were collected to delineate benzo(a)pyrene and naphthalene and were analyzed for PAHs and metals (USAF 2018b).

The 2016 and 2017 results of the four stages of the SO071 SC were as follows:

- DRO was not previously identified as a chemical of potential concern at this source area but exceeded PSLs in surface soil at SO071SS03. Additional sampling under Stage II of this investigation did not replicate this result in surface soil (0 to 0.5 feet) or near surface soil (0.5 to 2 feet) at SO071SB07 (USAF 2018b).
- In surface soil, DRO and PAHs exceeded PSLs at SO071SS03. Stage II samples collected at the same location exceeded PSLs for PAHs at the surface (0 to 0.5 feet bgs), but only naphthalene exceeded the PSLs at depth (0.5 to 2 feet bgs). Naphthalene exceeded the PSL in SO071SS01, immediately south of the historical exceedance in EIC511DP003S001-01. No analytes exceeded the PSLs to the west at SO071SS02. Naphthalene exceeded the PSL at Stage III surface soil sample location SO071SS09 and at the drain outfall west of Engineer Hill Road, but concentrations were below the human health criteria. In surface soil, all metals are below BTVs except antimony and chromium at SO071SS01 and chromium at SO071SS12 (USAF 2018b).
- During Phase I sampling, soil boring SO071SB05 was advanced near a historical subsurface thallium exceedance; thallium does not exceed the PSL in any soil samples collected from SO071SB05 (USAF 2018b).

3.4.1.1 Operational History

Building 1814 was built in 1957 for the storage of explosive munitions (USAF 2013b). A diesel-containing UST on a paved area to the southwest of Building 1814 was noted during the 2012 Phase I Source Evaluation, along with an AST to the north of Building 1814 and an aboveground utilidor behind the building to the east (USAF 2013b). In 2015, one floor drain

exiting the northwest corner of the building and discharging to the ground surface was found during a site inspection (USAF 2018b). A UST fill pipe and vent labeled "Diesel Arctic Blend" was seen to the west of Building 1814. In August 2015, a 1,000-gallon heating oil UST was removed from Source Area SO071, immediately southwest of Building 1814. The UST was removed in response to a petroleum spill; the specific volume of the release is unknown. Approximately 0.7 cy of suspected contaminated soil was removed during the UST removal. Field screening results were below 20 ppm after the excavation was complete (ADEC 2018a). In September 2015, a 1,000-gallon AST containing heating fuel was installed southwest of Building 1814 (U.S. Army Corps of Engineers 2016). In 2016, the heating oil diesel UST to the southeast of Building 1814 was no longer present and had been replaced by a diesel AST (USAF 2018b).

3.4.1.2 Known or Suspected Sources of Contamination

The suspected primary sources of contamination are surface leaks and spills from a former AST and floor drain, and subsurface leaks and spills from a former UST (USAF 2013b). Specific volumes of the contaminant releases are unknown. Soil results indicate the highest levels of petroleum and petroleum-related compounds are found directly west of Building 1814.

3.4.1.3 Current and Anticipated Future Land Use

Building 1814 is not currently scheduled for demolition. The industrial nature of the site is unlikely to change in the near future. No changes to current site use are anticipated and no construction is planned.

3.4.2 Assessment of SO071

CSMs, POL-related COCs, non-petroleum-related COPCs, and the extent of contamination were evaluated to assist in selecting the appropriate remedy for Source Area SO071. The CSM scoping and graphic forms are presented in Appendix B.

Exposure media and pathways at SO071 are dermal exposure or ingestion of contaminated soil (surface and subsurface). Inhalation of volatile compounds in air as a result of soil contamination is a potential future exposure pathway. Soil contamination does not extend to groundwater. Current and future receptors for soil media include commercial or industrial workers and construction workers. Future receptors include hypothetical residents. The area is not used for hunting, subsistence, or farming. SO071 is not considered ecological habitat due to the industrial nature of the site.

3.4.2.1 POL-Related Chemicals of Concern and Non-Petroleum-Related COPCs

The POL-related soil COCs for Source Area SO071 are listed in Table 3-3, along with their corresponding 2017 and 2018 cleanup levels. Benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene were proposed as COCs in soil in the SCRI because the MDCs exceeded the 2017 ADEC cleanup levels (ADEC 2017c). However, the MDCs are less than the 2018 ADEC cleanup levels (ADEC 2018b); therefore, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene are not listed as soil COCs or COPCs for this DD. No POL-related groundwater COCs were identified at Source Area SO071.

The following analytes were not retained as non-petroleum-related soil COPCs in the SCRI even though the calculated risk exceeded a 1×10^{-5} lifetime cancer risk value or an HI of 1 in the Cumulative Risk Evaluation:

- Hypothesis testing was completed for arsenic and iron in soil, which were detected above the PSLs and BTVs at Source Area SO071. The results indicate that concentrations of arsenic and iron are consistent with background concentrations (USAF 2018b).
- Based on the 2012 qualified thallium results at SO071, the widespread detections at similar levels for multiple source areas, and the lack of similar thallium detections in recent samples, thallium is not a non-petroleum-related soil COPC at SO071 (USAF 2018b).

Table 3-3
POL-Related Soil COCs at Source Area SO071 with Comparison of Cleanup Levels

COC	MDC (mg/kg)	Year of Maximum Detection[1]	ADEC 2017 Soil Cleanup Level[2] (mg/kg)	ADEC 2018 Soil Cleanup Level[3] (mg/kg)
DRO	1400 JD	2016	250	250
Benzo(a)anthracene	12 JD	2016	0.28	**0.7**
Benzo(a)pyrene	13 JL+,JD	2016	0.20	**1.5**
Dibenzo(a,h)anthracene	2 JL+,JD	2016	0.87	**1.5**
1-Methylnaphthalene	2.5 JD	2016	0.41	0.41
2-Methylnaphthalene	4.1 JD	2016	1.3	1.3
Naphthalene	13 JD	2016	0.038	0.038

Notes:
[1] The MDC in soil is the MDC for any specific analyte.
[2] 18 AAC 75 Table B1, Method Two most conservative of under-40-inch-zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2017c).
[3] 18 AAC 75 Table B1, Method Two most conservative of under-40-inch-zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2018b).
Benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene were identified as proposed COCs in soil in the SCRI; however, the MDCs do not exceed the 2018 ADEC cleanup levels.
JD = The result is estimated based on the relative percent difference between the primary sample and the field duplicate sample.
JL+ = The result is potentially biased high based on a greater recovery than the UCL.
Bold values indicate cleanup level change.
For definitions, refer to the Acronyms and Abbreviations section.

3.4.2.2 Lateral and Vertical Extent of Contaminated Area

The maximum lateral extent of soil contamination at Source Area SO071 is presented on Figure A-2.4.

Soil

DRO and collocated PAH exceedances in soil are present immediately west of Building 1814. The contaminated soil extends approximately 2 feet bgs and covers an area of approximately 247 square feet. The estimated volume of contaminated soil is 18.3 cy. The inferred vertical extent and estimated volume of soil contamination is presented in Table 3-4.

Table 3-4
POL-Related Contaminated Soil at Source Area SO071

Depth of Contamination (feet)	Area of Contamination (square feet)	Estimated Volume of Contamination[1] (cy)
0 to 2	247	18.3

Notes:
[1] Estimated volume of contamination is in place volume and does not account for expansion of material.
For definitions, refer to the Acronyms and Abbreviations section.

3.4.3 Description of Remedy for SO071

The RAOs, remedy, remedy components, and cleanup levels for POL-related COCs are presented in the following subsections. Non-petroleum-related PAH and metal contamination will be addressed under the three-party agreement.

3.4.3.1 Remedial Action Objectives

The following RAOs address POL-related soil contamination at Source Area SO071:

- Protect human health and the environment from risks associated with exposure to POL-related COCs listed in Table 3-3 at concentrations greater than ADEC cleanup levels in soil.
- Limit or eliminate the potential for contaminant migration from soil to groundwater or from soil or groundwater to indoor or outdoor air.
- Limit or eliminate the potential for human exposure to soil contamination above ADEC cleanup levels until source area conditions support UU/UE.

3.4.3.2 Remedy and Remedy Components

Excavation and offsite disposal of contaminated soil is the remedy to address DRO and PAH contamination in soil at Source Area SO071. The contamination at SO071 currently presents a potential risk to human health and the environment. Until the final remedy can be performed, interim LUCs are recommended to mitigate exposure potential (Figure A-2.4). Remedy components are described in the following subsection.

Excavation

- All soil at SO071 having POL- or petroleum-related COC concentrations greater than applicable cleanup levels will be removed to the extent practicable. If limitations to excavation are encountered during removal activities, the USAF will notify ADEC and identify a course of action. Limitations to excavation may include the location of Building 1814, which is expected to be demolished prior to the implementation of this remedy; however, it is unknown when the building will be demolished. Shallow bedrock (at 15 feet bgs) is not expected to impede excavation.
- Existing sample results will guide initial excavation activities. Field screening of soil will be used to guide excavation until suspected clean boundaries have been achieved. Confirmation samples will be collected from suspected clean boundaries and submitted for laboratory analysis of soil COCs (Table 3-3).
- Excavation will be considered complete once analytical results are below cleanup levels or contamination has been removed to the extent practicable, as agreed to by the USAF and ADEC.
- Where present, overburden will be stockpiled onsite and used as backfill. Overburden was excluded from the volume calculation. Overburden will be sampled prior to use as backfill. Clean fill from an approved borrow source will be utilized as needed.

LUCs will be adopted as interim remedial actions to protect human health and the environment and remain in place until UU/UE is achieved. Interim restrictions on soil and groundwater use as well as site access are already in place as described in the LUCIP, Eielson AFB, Alaska (USAF 2015a), and shall be retained, revised, reviewed, and approved by ADEC and documented in future versions of the LUCIP.

3.4.3.3 Cleanup Levels for POL-Related COCs at SO071

The regulatory-based cleanup levels for POL-related COCs at Source Area SO071 are shown in Table 3-5. The soil cleanup levels are the most conservative of 18 AAC 75 Tables B1 and B2, Method Two under 40-inch zone human health and migration to groundwater (ADEC 2018b).

Table 3-5
Cleanup Levels for POL-Related Soil COCs at SO071

COC	Soil Cleanup Level[1] (mg/kg)
DRO	250
Benzo(a)anthracene	0.7
Benzo(a)pyrene	1.5
Dibenzo(a,h)anthracene	1.5
1-Methylnaphthalene	0.41
2-Methylnaphthalene	1.3
Naphthalene	0.038

Notes:
[1] 18 AAC 75 Table B1, Method Two most conservative of under-40-inch-zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2018b).
For definitions, refer to the Acronyms and Abbreviations section.

3.5 SOURCE AREA SO073 – BUILDING 1434 (FACILITY 6164)/VEHICLE OPERATIONS HEATED PARKING

Source Area SO073 is located at Building 1434 (Facility 6164) on Engineer Hill (Figure A-1). Engineer Hill is a munitions storage and maintenance compound situated on an isolated hill north-northeast of the main developed and industrialized portion of Eielson AFB (USAF 2013b). Contamination sources are suspected to include spills and leaks from ASTs and floor drains (USAF 2013b).

3.5.1 SO073 Background

Detailed descriptions of environmental investigations and analytical results at Source Area SO073 are presented in Section 4.14 of the SCRI (USAF 2018b) and are summarized in this section in the timeline of environmental investigations at SO073:

- In 2012, soil borings were advanced, and subsurface and surface soil samples were sampled and analyzed for GRO, DRO, RRO, VOCs, SVOCs, and metals (USAF 2013b). There was no evidence of solvents or fuels in soil. Groundwater was not encountered in any of the soil borings (USAF 2013b). One surface soil sample contained PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, naphthalene, and 2-methylnaphthalene) at concentrations that exceeded PSLs. Arsenic, chromium, and thallium concentrations exceed PSLs in surface and subsurface soil samples, but do not exceed BTVs (where applicable).

- In 2015, a source area inspection was conducted inside and outside of Building 1434. Two floor drains were identified inside the building; the discharge points were not confirmed during the inspection. No ASTs, UST fill pipes, or vents were identified.
- In 2016, surface soil samples were collected to the southeast of Building 1434 adjacent to the drainage outfalls, and across Engineer Hill Road. Surface soil samples collected at the drainage outfalls were analyzed for GRO, DRO, RRO, PAHs, and metals. Surface soil samples collected along the parking area and road south of Building 1434 were analyzed for PAHs and metals. One near surface soil boring was advanced adjacent to the 2012 thallium exceedance. The near surface soil sample was analyzed for metals. Naphthalene and pentachlorophenol (PCP) exceeded PSLs in surface soil at SO073. PCP did not exceed the alternate screening level and was nondetect in all but one sample. Arsenic, chromium, and iron concentrations exceeded PSLs in all soil samples, but did not exceed BTVs. Thallium concentrations did not exceed PSLs in any surface or subsurface soil samples. No subsurface samples were collected at SO073 and bedrock was not intersected during surface soil sampling (USAF 2018b).

3.5.1.1 Operational History

Building 1434 was built in 1957 for the storage of explosive munitions (USAF 2013b). During the 2012 Phase I Source Evaluation, a concrete pad surrounded by gravel was noted on the east side of Building 1434; no records indicate the placement of an AST, but the location may have once supported one. Gravel was also present on the west side of Building 1434. During a 2015 source area inspection, one floor drain was identified exiting the southwest corner of the building and one floor drain was identified possibly exiting the southeast corner of the building; the discharge point was not confirmed (USAF 2018b).

3.5.1.2 Known or Suspected Sources of Contamination

The suspected primary release mechanism at Source Area SO073 was assumed to be surface spills and leaks from an AST and two floor drains. Specific volumes of the suspected releases are not known. No contamination associated with the suspected sources of contamination was identified at SO073. PAH contamination will be addressed as a separate sitewide investigation (see Section 2.3.2).

3.5.1.3 Current and Anticipated Future Land Use

Building 1434 is not currently scheduled for demolition. The industrial nature of the site is unlikely to change in the near future. No changes to current activities are anticipated and no construction is planned.

3.5.2 Assessment of SO073

CSMs, POL-related COCs, non-petroleum-related COPCs, and the extent of contamination were evaluated to assist in selecting the appropriate remedy for Source Area SO073. The CSM scoping and graphic forms are presented in Appendix B. There are no current or future receptors because of the lack of POL- or petroleum-related contamination at SO073.

3.5.2.1 POL-Related Chemicals of Concern and Non-Petroleum-Related Chemicals of Potential Concern

The non-petroleum-related soil COPCs for Source Area SO073 are listed in Table 3-6, along with the corresponding 2017 and 2018 cleanup levels. Any CERCLA constituents (e.g., PAHs) will be addressed under the three-party agreement. No POL- or petroleum-related COCs have been retained at SO073.

The following analyte was not retained as a non-petroleum-related soil COPC in the SCRI even though the calculated risk exceeded a 1×10^{-5} lifetime cancer risk value or an HI of 1 in the Cumulative Risk Evaluation:

- Based on the 2012 qualified thallium results at SO073, the widespread detections at similar levels for multiple source areas, and the lack of similar thallium detections in recent samples, thallium is not a non-petroleum-related soil COPC at SO073 (USAF 2018b).

Table 3-6
Non-Petroleum-Related Soil COPCs at Source Area SO073 with Comparison of Cleanup Levels

COPC	MDC (mg/kg)	Year of Maximum Detection[1]	ADEC 2017 Soil Cleanup Level[2] (mg/kg)	ADEC 2018 Soil Cleanup Level[3] (mg/kg)
Benzo(a)pyrene[4]	6.81	2012	0.20	**1.5**
Naphthalene[4]	5.4	2012	0.038	0.038

Notes:
[1] The MDC in soil is the MDC for any specific analyte.
[2] 18 AAC 75 Table B1, Method Two most conservative of under 40-inch zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2017c).
[3] 18 AAC 75 Table B1, Method Two most conservative of under 40-inch zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2018b).
[4] Non-petroleum-related COPC is to be addressed under the three-party agreement; remediation is not within the scope of this DD.
Bold values indicate cleanup level change.
For definitions, refer to the Acronyms and Abbreviations section.

3.5.2.2 Lateral and Vertical Extent of Contaminated Area

There is no remaining POL- or petroleum-related contamination as a result of a release at Source Area SO073.

3.5.3 Description of Remedy for SO073

NFA is the remedy for POL- or petroleum-related contamination at this site. PAH contamination at SO073 will be addressed under the three-party agreement.

3.5.3.1 Remedial Action Objectives

No RAOs are necessary at Source Area SO073 because no POL- or petroleum-related contamination is present.

3.5.4 Site Closure

Site closure is recommended for Source Area SO073 based on the historical results and SC activities from the SCR (USAF 2018b). Any CERCLA constituents (e.g., PAHs and metals) will be addressed under the three-party agreement. All analytical data, as published in the SCRI,

will be maintained by the USAF and made available to ADEC upon request for at least 50 years after submission of the report to ADEC.

3.5.4.1 Support for Site NFA on Petroleum Determination

No POL- or petroleum-related contaminants as a result of the source area release were detected at concentrations greater than ADEC cleanup levels; the SCRI (USAF 2018b) describes investigative methods and analytical results for Source Area SO073. PAHs have been detected above ADEC cleanup levels at the source area; however, due to the presence of PAH detections in absence of collocated fuels, the site will be addressed under the three-party agreement. Additionally, the USAF and regulatory stakeholders are establishing an Eielson-wide approach to address these contaminants.

3.6 SOURCE AREA SS084 – FORMER ARMY ARTILLERY SITE

Source Area SS084 is located to the south of the Eielson AFB flight line and to the east of the Richardson Highway (Figures A-3.1 through A-3.7). Seven distinct areas of contamination were identified during a source area visit in 1997 (USAF 2001). Contamination sources are suspected to be from spills and leaks from former and existing ASTs and USTs, a sewage system, spills from gun maintenance, and abandoned drums (USAF 2014b).

3.6.1 SS084 Background

Detailed descriptions of environmental investigations and analytical results at Source Area SS084 are presented in Section 4.17 of the SCRI (USAF 2018b) and are summarized in this section. Soil and groundwater sample locations are presented on Figures A-3.1 through A-3.7 (Appendix A). A timeline of environmental investigations at SS084 is also provided:

- In 1997, field screening samples were collected to screen for hydrocarbon vapors in areas of suspected contamination during an initial source area investigation. Analytical soil samples were collected at locations where contamination was suspected based on visual indicators, source area history, and recommendations by Eielson AFB personnel; debris types were documented. Following the 1997 source area investigation, base personnel made recommendations for debris removal and summarized safety hazards to be addressed

(USAF 2001). No visible evidence of soil contamination was observed at that time (USAF 2014b).

- Between 1997 and 2001, a cleanup effort included the removal of the AST, UST, impacted soils, debris, most of the drums, and potentially hazardous structures. No samples were collected for laboratory analysis during this cleanup effort (USAF 2001).
- As part of the 2013 Phase 2 Source Evaluation, surface and subsurface soil sampling, installation of soil borings with continuous coring, groundwater sampling, and passive soil gas (PSG) surveys were conducted. Soil and groundwater samples (depending on the area of concern) were analyzed for GRO, DRO, RRO, VOCs, PCBs, PAHs, lead, and metals (USAF 2014b). Results by Area for the 2013 Phase 2 Source Evaluation were as follows:
  - **Area 01:** One surface soil sample (0.5 to 1 feet bgs), two subsurface soil samples (one from 3 to 4 feet bgs and one from 5.5 to 6.5 feet bgs), and one groundwater sample from the water supply well were collected. All samples were analyzed for GRO, DRO, RRO, VOCs, PAHs, and metals. A PSG survey consisting of 56 sampling points was also completed. The surface soil sample collected at the bottom of the sewage crib trench contained DRO, PAHs, and metals exceeding PSLs. Subsurface soil samples were collected adjacent to the abandoned piping south of the former AST and indicated DRO contamination. Groundwater in the former water supply well contained DRO and organic compounds, but at concentrations below PSLs. Antimony, cadmium, chromium, copper, lead, manganese, mercury, and silver exceeded BTVs. The PSG survey results indicated total petroleum hydrocarbons (TPH) contamination in the southern and north-central portions of the sampling grid. No analytes exceeded PSLs in the location of the former AST (USAF 2014b).
  - **Area 02:** Two surface soil samples (0.5 to 1 feet bgs), two subsurface soil samples (one from 3 to 4 feet bgs and one from 9 to 10 feet bgs), and one groundwater sample were collected. A PSG survey consisting of 15 sampling points was also completed. One surface sample was collected directly beneath a black layered material, and the other was collected at the location of the former drum. The two subsurface samples were collected from one boring. Surface and subsurface samples were analyzed for GRO, DRO, RRO, VOCs, and lead. Subsurface samples and the sample beneath the black layered material were also analyzed for PAHs. The groundwater sample was analyzed for GRO, DRO, RRO, VOCs, PAHs, and metals. DRO and metals (chromium, cobalt, and manganese) were present in groundwater at concentrations exceeding PSLs. The PSG survey results indicated elevated TPH in the eastern portion of sampling grid; the approximate location where the formerly removed drum was located (USAF 2014b).
  - **Area 03:** One surface soil sample (0.5 to 1 foot bgs) and five photoionization detector (PID) readings were recorded at the location of the former drum. The highest PID reading was 0.5 ppm. The soil sample was analyzed for GRO, DRO,

RRO, VOCs, PAHs, and lead. The sample results did not indicate any contamination (USAF 2014b).

- **Area 04**: A PSG survey consisting of 15 sampling locations was conducted. Freon-11 was detected in 9 of the 15 samples. TPH was detected in only one location but did not exceed the PSL. Area 04 previously contained multiple drums and scattered debris, and based on the PSG survey results, relatively few of the drums likely contained petroleum products (USAF 2014b).
- **Area 05:** One surface sample was collected from 6 to 8 inches below the existing drum. The sample was analyzed for GRO, DRO, RRO, VOCs, PAHs, and lead. The sample results did not indicate any contamination (USAF 2014b).
- **Area 06:** One surface soil sample (0.5 to 1 feet bgs), two subsurface soil samples (one from 3.5 to 4.5 feet bgs and one from 6.5 to 7.5 feet bgs), and one groundwater sample were collected. A PSG survey consisting of 12 sampling points was also completed. Soil and groundwater samples were analyzed for GRO, DRO, RRO, VOCs, PAHs, and lead. Additionally, the groundwater sample was analyzed for metals. The surface sample was collected at the approximate location of the former UST, and results indicated no contamination. The two subsurface samples were collected from a single soil boring located adjacent to abandoned piping and indicated elevated cadmium levels; however, these are below the current PSL. The groundwater sample was collected adjacent to the soil boring and contained arsenic and manganese above PSLs. The PSG survey results indicated scattered detections of VOCs and TPH with the highest TPH mass on the southern edge of the survey grid and generally upgradient of Area 06 (USAF 2014b).
- **Transformer Area:** Three composite surface soil samples were collected and analyzed for PCBs. One was collected around the existing transformer (later removed) and two were collected from around the former transformer stand. The soil samples collected did not identify any PCB contamination associated in the underlying or surrounding soil (USAF 2014b).

- In July 2015, Stage I of the SC was conducted to characterize the soil and/or groundwater contamination at Areas 01, 02, 03, 04, 06, and the Transformer Area. In September 2015, Stage II SC activities were conducted at Areas 01 and 06 to address data gaps based on Stage I SC results. In August 2016 and 2017, respectively, Stage III and Stage IV SC activities were conducted to address data gaps based on Stage I and Stage II SC activities. Results by Area for the 2015, 2016 and 2017 SC activities were as follows:
  - **Area 01:** GRO, DRO, 1-methylnaphthalene, 2-methylnaphthalene, ethylbenzene, naphthalene, 1,2,4-trimethylbenzene (TMB), 1,3,5-TMB, chloroform, and total xylenes exceed PSLs in subsurface soil samples at Area 01. Iron, chromium, and arsenic exceed PSLs in most soil samples collected at Area 01 but are generally below BTVs. DRO, RRO, 1,2,4-TMB, naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, ethylbenzene, and 1,1,2,2-tetrachloroethane exceeded PSLs

in groundwater at Area 01. Metals exceed PSLs and BTVs in all groundwater grab samples from Area 01 that were analyzed for metals. Arsenic, chromium, cobalt, iron, lead, and manganese exceed PSLs and BTVs (where applicable) in groundwater at Area 01.

- **Area 02:** DRO exceeds the PSL at 0.5 to 4 feet bgs in soil boring SS084SB13 only. Although all soil samples at Area 02 exceed PSLs for iron, chromium, and arsenic, chromium is the only metal that also exceeds the BTV. Elevated metal concentrations are not spatially associated with DRO exceedances.
- **Area 03:** All analytical results at Area 03 are below PSLs.
- **Area 04:** All analytical results at Area 04 are below PSLs.
- **Area 06:** Only 1,2,4-TMB exceeds PSLs in the vadose zone in soil boring SS084SB19 at Area 06. Concentrations of 1,2,4-TMB are below the PSL in the soil sample collected from the groundwater interface in the same boring. Metals in soil are below BTVs at Area 06. DRO, arsenic, chromium, cobalt, iron, and manganese exceed PSLs in groundwater at Area 06. Arsenic, chromium, cobalt, iron, and manganese exceed PSLs and BTVs (where applicable) in groundwater at sample location SS084TW14; only chromium exceeds the PSL and BTV in SS084TW15. These elevated metal concentrations do not correlate with fuel contamination and are likely naturally occurring at Source Area SS084.
- **Transformer Area:** One discrete analytical surface soil sample, SS084SS06, was collected adjacent to the transformer stand and analyzed for PCBs to verify the results of previous composite samples. PCBs were not detected in this sample.

3.6.1.1 Operational History

Source Area SS084 was identified during an aerial survey in 1994. SS084 is a former anti-aircraft artillery facility also known as Former Army Artillery Site Area of Concern 16. SS084 is divided into seven areas, as described here:

- **Area 01 (formerly referred to as Area 1601):** Area 01 consisted of 15 concrete pads and general debris. On one concrete pad, floor drains were observed, possibly from a shower and bathhouse. An AST was observed on another concrete pad, with piping identified to the south of the AST. Northeast of the concrete pads, a sewage system was identified, consisting of a pump house and a wooden crib with debris. One polyethylene and one metal drum were also discovered at Area 01. The AST and drums were removed during the 1997 field effort (USAF 2001).
- **Area 02 (formerly referred to as Area 1602):** Area 02 consisted of one large concrete pad with concrete equipment mounts approximately 300 feet west of Area 01. One empty drum

was found to the west of the concrete pad. A pipe was identified heading northeast from the pad to an unknown location. Several patches of an unidentified black layered material were identified. The drum was removed during the 1997 field effort (USAF 2001).

- **Area 03 (formerly referred to as Area 1603):** Area 03 consisted of a single empty drum and is located approximately 3,000 feet to the northwest of Area 01. The drum was removed during the 1997 field effort (USAF 2001).
- **Area 04 (formerly referred to as Area 1604):** Area 04 consisted of multiple drums and scattered debris about 600 feet south of Area 01. Most of the debris was partially buried and some drums and debris were fully buried. Following the removal action in 1997, the area was considered NFA (USAF 2001).
- **Area 05 (formerly referred to as Area 1605):** Area 05 consisted of a single empty drum in a wooded area about 200 feet south of Area 02. The drum was not removed during the 1997 field effort because access was limited by thick overgrowth and a wetlands area (USAF 2001).
- **Area 06 (formerly referred to as Area 1606):** Area 06 consisted of a large concrete pad bisected by the Richardson Highway fence. A crumpled and ripped 500-gallon tank was located on the north side of the pad. A label on the tank identified it as a UST. The original location of this UST is unknown, and no information is available regarding the initial removal. The remnants of the tank were removed during the 1997 field effort (USAF 2001).
- **Transformer Area:** The Transformer Area comprised two separate locations: an electric pole where a transformer was mounted (the transformer was removed in 2013), and a nearby transformer stand. During historical operations, the stand may have contained several transformers (USAF 2001).

In 2012, additional locations of interest, including a ramp thought to be related to anti-aircraft artillery gun emplacements, a bank of transformers, several patches of a black layered material, a water supply well, and a concrete structure and trench were identified at Source Area SS084 (USAF 2014b).

3.6.1.2 Known or Suspected Sources of Contamination

Seven different suspected contamination areas at Source Area SS084 are associated with past releases from former and existing ASTs, USTs, a sewage system, concrete pad operations, spills from gun maintenance, and abandoned drums (USAF 2014b). During the SC in 2015, contamination was identified at Areas 01, 02, and 06. The suspected primary sources of contamination at Area 01 are surface leaks and spills from a former sewage crib, pumphouse,

AST, and concrete pad operations and subsurface leaks. The suspected primary source of contamination at Area 02 is surface leaks from abandoned drums. The suspected primary sources of contamination at Area 06 are subsurface leaks from a former UST and surface leaks and spills from former concrete pad operations. Specific volumes of the suspected releases at Areas 01, 02, and 06 are not known. Both soil and groundwater results indicate the highest levels of petroleum and petroleum-related compounds are found at Area 01, approximately 150 feet west of the former pumphouse.

3.6.1.3 Current and Anticipated Future Land Use

Source Area SS084 is a non-industrial and forested area. There are no buildings at the source area. No changes to current site use are anticipated and no construction is planned.

3.6.2 Assessment of SS084

CSMs, POL-related COCs, non-petroleum-related COPCs, and the extent of contamination were evaluated to assist in selecting the appropriate remedy for Source Area SS084. The CSM scoping and graphic forms are presented in Appendix B.

Exposure media and pathways at SS084 are dermal exposure or ingestion of contaminated soil (surface and subsurface) and the potential for future ingestion, dermal contact, or inhalation of groundwater contaminants. Inhalation of VOCs in air as a result of soil and groundwater contamination is a potential exposure pathway. Current and future receptors for soil and groundwater media include commercial or industrial workers and construction workers. Future receptors include hypothetical residents. The area is not used for hunting, subsistence, or farming.

An ecological risk assessment was conducted in 2017 to evaluate the likelihood of adverse ecological effects that may occur or are occurring as a result of exposure to one or more chemical stressors (USAF 2018b). The chemicals of ecological concern (COEC) from the SS084 ecological risk assessment included zinc, lead, cadmium, and xylenes within Area 01. The locations of the COECs in Area 01 were considered when designing inferred excavation

extents and will be removed upon remedy completion. No further ecological evaluation was necessary (Appendix E of the SCRI [USAF 2018b]).

3.6.2.1 POL-Related Chemicals of Concern and Non-Petroleum-Related Chemicals of Potential Concern

The POL-related soil and groundwater COCs and non-petroleum-related COPCs for Source Area SS084 are listed in Table 3-7 and Table 3-8, along with their corresponding 2017 and 2018 cleanup levels. Dibenzo(a,h)anthracene was proposed as a COC in soil in the SCRI because the MDC exceeded the 2017 ADEC cleanup level (ADEC 2017c). However, the MDC is less than the 2018 ADEC cleanup level (ADEC 2018b); therefore, dibenzo(a,h)anthracene is not listed as a soil COC or COPC for this DD.

The following analyte was not retained as a non-petroleum-related groundwater COPC in the SCRI even though the calculated risk exceeded a 1×10^{-5} lifetime cancer risk value or an HI of 1 in the Cumulative Risk Evaluation:

- Based on the 2012 qualified thallium results at SO073, the widespread detections at similar levels for multiple source areas, and the lack of similar thallium detections in recent samples, thallium is not a non-petroleum-related soil COPC at SO073 (USAF 2018b).

Table 3-7
POL-Related Soil COCs, Non-Petroleum-Related COPCs, and COECs at Source Area SS084 with Comparison of Cleanup Levels

COC or COEC	MDC (mg/kg)	Year of Maximum Detection[1]	ADEC 2017 Soil Cleanup Level[2] (mg/kg)	ADEC 2018 Soil Cleanup Level[3] (mg/kg)
Antimony[5]	16	2013	4.6	4.6
Benzo(a)anthracene	2.1	2013	0.28	**0.7**
Benzo(a)pyrene	3.5 J	2013	0.2	**1.5**
Cadmium[5]	11	2013	9.1	9.1
DRO	26000	2015	250	250
Ethylbenzene	0.26	2015	0.13	0.13
GRO	8900	2015	300	300
Lead	1200	2013	400	400
Mercury[5]	2.6	2013	0.36	0.36
1-Methylnaphthalene	39	2015	0.41	0.41
2-Methylnaphthalene	44	2015	1.3	1.3
Naphthalene	12	2015	0.038	0.038
Silver[5]	13	2013	11	11
1,2,4-TMB	13	2015	0.16	**0.61**
1,3,5-TMB	5.8	2015	1.3	**0.66**
Xylenes	1.6	2015	1.5	1.5
Zinc[4,5]	2300	2013	4900	4900

Notes:
[1] The MDC in soil is the MDC for any specific analyte.
[2] 18 AAC 75 Table B1, Method Two most conservative of under-40-inch-zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2017c).
[3] 18 AAC 75 Table B1, Method Two most conservative of under-40-inch-zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2018b).
[4] Added as a COC in soil based on the results of the Environmental Risk Assessment (refer to the SCRI, Section 4.17.8 [USAF 2018b]).
[5] Non-petroleum-related COPC is to be addressed under the three-party agreement; remediation is not within the scope of this DD.
Dibenzo(a)anthracene was identified as a proposed COC in soil in the SCRI; however, the MDC does not exceed the 2018 ADEC cleanup level.
J = The analyte was positively identified; however, the associated result was less than the limit of quantitation but greater than or equal to the detection limits.
Bold values indicate cleanup level change.
For definitions, refer to the Acronyms and Abbreviations section.

Table 3-8
POL-Related Groundwater COCs and Non-Petroleum-Related COPCs at Source Area SS084 with Comparison of Cleanup Levels

COC	MDC (mg/L)	Year of Maximum Detection[1]	ADEC 2017 Groundwater Cleanup Level[2] (mg/L)	ADEC 2018 Groundwater Cleanup Level[3] (mg/L)
DRO	180	2015	1.5	1.5
Ethylbenzene	0.018	2015	0.015	0.015
1-Methylnaphthalene	0.099	2015	0.011	0.011
2-Methylnaphthalene	0.081	2015	0.036	0.036
Naphthalene	0.2	2015	0.0017	0.0017
RRO	8.7	2015	1.1	1.1
1,2,4-TMB	0.12	2015	0.015	**0.056**
Arsenic[4,6]	0.0577	2015	0.00052	0.00052
Cobalt[4,5,6]	0.0328	2015	0.006	0.006
Iron[4,5,6]	85	2015	14	14
Lead[4]	0.0285	2015	0.015	0.015
Manganese[4,6]	22.2	2015	-	**0.43**

Notes:
[1] The MDC in groundwater is the maximum of the most recent sampling year for any specific analyte.
[2] 18 AAC 75 Table C, groundwater cleanup levels (ADEC 2017c).
[3] 18 AAC 75 Table C, groundwater cleanup levels (ADEC 2018b).
[4] Added as a COC in groundwater based on the results of hypothesis testing (SCRI, Appendix M).
[5] ADEC has not established a groundwater cleanup level for cobalt and iron in ADEC 18 AAC 75, Table C (ADEC 2018b). The human health cleanup levels for cobalt and iron were calculated by ADEC during review of the PBR SCRII (USAF 2019b); calculations were performed using the ADEC Method 3 Calculator and parameters from the EPA Regional Screening Level.
[6] Non-petroleum-related COPC is to be addressed under the three-party agreement; remediation is not within the scope of this DD.
- No 2017 cleanup level was assigned for manganese in groundwater (ADEC 2017c).
Bold values indicate cleanup level change.
For definitions, refer to the Acronyms and Abbreviations section.

3.6.2.2 Lateral and Vertical Extent of Contaminated Area

The maximum lateral extents of soil and groundwater contamination at Source Area SS084 are presented on Figure A-3.7.

Soil

Fuel-, VOC-, PAH-, and metals-contaminated soil at Source Area SS084 was identified at Areas 01 and 06. Contamination in Area 01 extends vertically from the surface to approximately 6.5 feet bgs and covers an approximate area of 86,140 square feet. Contamination in Area 02 is present just south of the former abandoned drums, extending vertically from the surface to approximately 4 feet bgs and covering an area of approximately 983 square feet. Contamination

in Area 06 extends vertically from the surface to approximately 7 feet bgs and covers an area approximately 983 square feet. The total estimated volume to be excavated is 27,519 cy.

Contamination is anticipated to extend to a depth near or at the groundwater table in Area 01. The groundwater interface may exist as a smear zone due to seasonal fluctuations. Therefore, when calculating contaminated soil volumes in these areas, the depth of contaminated soil was extended by 2 feet to account for seasonal fluctuations of the groundwater table. Table 3-9 summarizes the estimated contaminated soil in each area.

Table 3-9
POL-Related Contaminated Soil at Source Area SS084

Area	Depth of Contamination (feet)	Area of Contamination (square feet)	Estimated Volume of Contamination[1] (cy)
01	0 to 6.5*	86,140	27,118
02	0 to 4	983	146
06	0 to 7	983	255
		Total	27,519

Notes:
[1] Estimated volume of contamination is in place volume and does not account for expansion of material.
*Depth of contaminated soil extended by 2 feet to account for seasonal fluctuations of the groundwater table.

Groundwater

Plumes of fuel-, VOC-, PAH-, and metals-impacted groundwater have been delineated or extents have been inferred based on known SS084 source contamination.

3.6.3 Description of Remedy for SS084

The RAOs, remedy, remedy components, and cleanup levels for POL-related COCs are presented in the following subsections. Any CERCLA constituents remaining will be addressed under the three-party agreement.

3.6.3.1 Remedial Action Objectives

The following RAOs address POL-related soil and groundwater contamination at Source Area SS084:

- Protect human health and the environment from risks associated with exposure to POL-related COCs listed in Table 3-7 at concentrations greater than ADEC cleanup levels in soil.
- Protect human health and the environment from risks associated with exposure to POL-related COCs listed in Table 3-8 concentrations greater than ADEC cleanup levels in groundwater.
- Limit or eliminate the potential for contaminant migration from soil to groundwater or from soil or groundwater to indoor or outdoor air.
- Limit or eliminate the potential for human exposure to soil and groundwater contamination above ADEC cleanup levels until site conditions support UU/UE.

3.6.3.2 Remedy and Remedy Components

Excavation with offsite disposal of contaminated soil and monitored natural attenuation (MNA) for groundwater is the remedy at Source Area SS084. The soil and groundwater contamination at SS084 currently present a potential risk to human health and the environment. Until the remedy can be performed, interim LUCs are recommended to mitigate exposure potential (Figure A-3.7). Remedy components are described in the following subsections.

Excavation

- All soil having POL-related COC concentrations greater than applicable cleanup levels will be removed to the extent practicable. If limitations to excavation are encountered during removal activities, the USAF will notify ADEC and identify a course of action. Limitations to excavation may include high groundwater, depending on the seasonal variability. No existing structures remain onsite. Contaminated soil is in areas with no existing infrastructure that would limit excavation. The vadose zone thickness of approximately 5 to 9 feet in Area 01 would not pose any technical challenges to reach contaminated soil.
- Existing sample results will guide initial excavation activities. Field screening of soil will be used to guide excavation until suspected clean boundaries have been achieved. Confirmation samples will be collected from suspected clean boundaries and submitted for laboratory analysis of soil COCs (Table 3-7).

- Excavation will be considered complete once analytical results are below cleanup levels or contamination has been removed to the extent practicable, as agreed to by the USAF and ADEC. Clean fill from an approved borrow source will be utilized as needed.

Monitored Natural Attenuation

- Groundwater monitoring for POL-related groundwater COCs (Table 3-8) shall be conducted annually until concentrations are stable and below the applicable cleanup levels for three consecutive monitoring events. Results from groundwater monitoring will be documented in an annual monitoring report. Periodic Review will determine continued remediation and will be undertaken at a frequency not exceeding five years unless a longer timeframe is agreed upon by USAF and ADEC.
- Monitoring for POL-related metals COCs in groundwater (i.e., lead) will comply with the following:
  - Monitoring will include at least two groundwater sampling events, and both unfiltered and filtered groundwater samples will be collected.
  - Filtered samples will be analyzed to evaluate any bias introduced by the filtering process.
  - If lead concentrations in filtered groundwater are less than applicable cleanup levels for two consecutive events, monitoring for metals COCs will cease; monitoring for other COCs may continue as needed.
  - These monitoring requirements apply only to POL-related metals; other non-petroleum-related metals contamination in groundwater (e.g., arsenic, cobalt, iron, and manganese) will be addressed under the three-party agreement.
- In addition to the monitoring of POL-related groundwater COCs (Table 3-8), MNA of groundwater will include periodic assessment of the mechanism of attenuation (e.g., biodegradation) in order to predict a cleanup date. MNA-specific parameters include dissolved oxygen, nutrients, methane, and oxidation reduction potential. MNA assessment will be conducted in conjunction with monitoring efforts to determine whether geochemical conditions remain conducive to biodegradation and will be undertaken at a frequency not exceeding five years unless a longer timeframe is agreed upon by USAF and ADEC.
- Based on the size of the source area and the release locations, seven new monitoring wells will be installed: one in-plume and four downgradient of the groundwater plume at Area 01, and one in-plume and one northeast of the groundwater plume at Area 06 (Figure A-3.7).

LUCs will be adopted as interim remedial actions to protect human health and the environment and remain in place until UU/UE is achieved. Interim restrictions on soil and groundwater use

as well as site access are already in place as described in the LUCIP, Eielson AFB, Alaska (USAF 2015a), and shall be retained, revised, reviewed and approved by ADEC, and documented in future versions of the LUCIP.

3.6.3.3 Cleanup Levels for POL-Related COCs and Non-Petroleum-Related COPCs at SS084

The regulatory-based cleanup levels for POL-related COCs and non-petroleum-related COPCs at Source Area SS084 are shown in Table 3-10 and Table 3-11. The soil cleanup levels are the most conservative of 18 AAC 75 Tables B1 and B2, Method Two under 40-inch zone human health and migration to groundwater (ADEC 2017c). Groundwater cleanup levels are the 18 AAC 75 Table C human health cleanup levels. Ecological cleanup levels for COECs were not developed since all areas contributing to ecological risk are within the excavation boundary.

Table 3-10
Cleanup Levels for POL-Related Soil COCs and Non-Petroleum-Related Soil COPCs at SS084

COC[2] or COPC	Soil Cleanup Level[1] (mg/kg)
Antimony	4.6
Benzo(a)anthracene	0.7
Benzo(a)pyrene	1.5
Cadmium[3]	9.1
DRO	250
Ethylbenzene	0.13
GRO	300
Lead	400
Mercury[3]	0.36
1-Methylnaphthalene	0.41
2-Methylnaphthalene	1.3
Naphthalene	0.038
Silver[3]	11
1,2,4-TMB	0.61
1,3,5-TMB	0.66
Xylenes	1.5

Notes:
[1] 18 AAC 75 Table B1, Method Two most conservative of under-40-inch-zone human health or migration to groundwater and Table B2, Method Two under 40-inch zone migration to groundwater (ADEC 2018b).
[2] An ecological cleanup level for zinc was not developed since all areas contributing to ecological risk are within the excavation boundary.
[3] COPC is to be addressed under the three-party agreement; remediation is not within the scope of this DD.
For definitions, refer to the Acronyms and Abbreviations section.

Table 3-11
Cleanup Levels for POL-Related Groundwater COCs and Non-Petroleum-Related COPCs at SS084

COC or COPC	Groundwater Cleanup Level[1] (mg/L)
DRO	1.5
Ethylbenzene	0.015
1-Methylnaphthalene	0.011
2-Methylnaphthalene	0.036
Naphthalene	0.0017
RRO	1.1
1,2,4-TMB	0.056
Arsenic[3]	0.00052
Cobalt[2,3]	0.006
Iron[2,3]	14
Lead	0.015
Manganese[3]	0.43

Notes:
[1] 18 AAC 75 Table C, groundwater cleanup levels (ADEC 2018b).
[2] ADEC has not established a groundwater cleanup level for cobalt and iron in ADEC 18 AAC 75, Table C (ADEC 2018b). The human health cleanup levels for cobalt and iron were calculated by ADEC during review of the PBR SCRII (USAF 2019b); calculations were performed using the ADEC Method 3 Calculator and parameters from the EPA Regional Screening Level and are available from ADEC upon request.
[3] COPC is to be addressed under the three-party agreement; remediation is not within the scope of this DD.
For definitions, refer to the Acronyms and Abbreviations section.

3.7 SOURCE AREA TU506 – BUILDING 1476 (FACILITY 6136)

Source Area TU506 is located at Building 1476 (Facility 6136) on Engineer Hill (Figure A-4.1 through A-4.4). Engineer Hill is a munitions storage and maintenance compound situated on an isolated hill north-northeast of the main developed and industrialized portion of Eielson AFB (USAF 2013b). Contamination sources are suspected to be leaks from a former UST (USAF 2013b).

3.7.1 TU506 Background

Detailed descriptions of environmental investigations and analytical results at Source Area TU506 are presented in Section 4.19 of the SCRI (USAF 2018b) and are summarized in this

section. Soil sample locations are presented on Figures A-4.1 through A-4.4 (Appendix A). A timeline of environmental investigations at TU506 is also provided:

- A 1,000-gallon UST that stored heating oil was formerly associated with Building 1476 (USAF 2013b). In 1986, USTs were installed and connected to various facilities, including Building 1476. In 1993, all USTs and piping were leak-tested, and all passed. No evidence of leaking tanks or pipelines was observed (USAF 1994).
- During the 2007 UST removal, a soil screening of the excavation site was completed (USAF 2013b). One soil sample was taken from each sidewall and two samples were taken from the excavation bottom. Soil samples were analyzed for DRO, RRO, and benzene, toluene, ethylbenzene, and xylenes. Field screening and headspace samples were screened with a PID during the UST excavation; all PID results were 0.0 ppm. One soil sample collected from the excavation sidewall, at 6.5 bgs on the side of the UST vent, contained benzene exceeding the PSL. Analytical results of the remaining soil samples did not exceed PSLs (USAF 2013b).
- In 2012, 7 surface soil samples and seven subsurface soil samples were collected from three soil borings near the south side of Building 1476 and the former UST location (USAF 2013b). Soil samples were analyzed for GRO, DRO, RRO, VOCs, SVOCs, PAHs, and metals. Surface soil samples contained PAHs [benzo(a)anthracene, benzo(a)pyrene, 2-methylnaphthalene, and naphthalene], dibenzofuran and metals (arsenic, cobalt, iron, and manganese) at concentrations exceeding PSLs. Subsurface soil samples contained benzo(a)pyrene and metals (arsenic, chromium, cobalt, iron, manganese, and molybdenum) at concentrations exceeding PSLs. Metal concentrations in soil did not exceed BTVs. Groundwater quality has not been assessed at this source area because drilling refusal was met above the water table (USAF 2013b). During the 2012 source evaluation, field crews noted that the areas north and south of the building were surfaced in gravel. No surface staining or stressed vegetation was observed (USAF 2013b).
- During Stage I SC sampling in 2016, two soil borings were advanced, and one surface soil sample and one subsurface soil sample were collected from each boring (USAF 2018b). Two surface soil samples were also collected near the drain outlets and analyzed for GRO, DRO, RRO, VOCs, PAHs, and metals. Three surface soil samples were collected near 2012 Source Evaluation sample locations that exceeded PSLs for benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene and were analyzed for PAHs and metals. All subsurface soil samples were collected at depths of 6.5 to 7 feet bgs and analyzed for VOCs only.
- During Stage II SC sampling in 2016, one surface soil sample was collected to address data gaps and was analyzed for PAHs (USAF 2018b). PAHs exceed PSLs in the two surface soil samples (TU506SS03 and TU506SS04) collected near the drain outlets. PAH concentrations range from 1-methylnaphthalene slightly above the PSL to naphthalene 200 times above the PSL. Arsenic, chromium, and iron exceed PSLs in all soil samples analyzed

for metals but are generally below BTVs; chromium concentrations exceed the BTV in samples TU506SS06 and TU506SS07. Metal concentrations at TU506 have no known anthropogenic source.

- The former UST was the likely source of benzene in soil during 2007 sampling. Soil borings TU506SB01 and TU506SB02 were advanced to characterize subsurface soil and delineate the extent of benzene contamination at the former UST location. No analytes exceeded PSLs, and benzene was not detected in subsurface soil samples.

3.7.1.1 Operational History

A 1000-gallon UST that stored heating oil was formerly associated with Building 1476 (USAF 2013b). The UST was installed in 1986 (Battelle Pacific Northwest Laboratories 1994). In 1993, the UST and piping connected to Building 1476 was leak-tested and passed (USAF 1994). In 2007, the 1000-gallon UST was removed (USAF 2013b).

3.7.1.2 Known or Suspected Sources of Contamination

The suspected primary source of contamination was assumed to be subsurface leaks and spills from a 1000-gallon UST. Specific volumes of the suspected releases are not known.

3.7.1.3 Current and Anticipated Future Land Use

Building 1476 is currently scheduled for demolition at Source Area TU506 (USAF 2018b). The structure will be removed while the foundation will remain intact onsite. The industrial nature of the site is unlikely to change in the near future. No changes to current site use are anticipated and no construction is planned.

3.7.2 Assessment of TU506

CSMs, POL-related COCs, non-petroleum-related COPCs, and the extent of contamination were evaluated to assist in selecting the appropriate remedy for Source Area TU506. The CSM scoping and graphic forms are presented in Appendix B.

Exposure media and pathways at TU506 are dermal exposure or ingestion of contaminated soil (surface and subsurface). Inhalation of volatile compounds in air as a result of soil contamination is a potential future exposure pathway. Soil contamination does not extend to groundwater. Current and future receptors for soil media include commercial or industrial workers and construction workers. Future receptors include hypothetical residents. The area is not used for hunting, subsistence, or farming.

3.7.2.1 POL-Related Chemicals of Concern and Non-Petroleum-Related Chemicals of Potential Concern

The POL-related soil COCs for Source Area TU506 are listed in Table 3-12, along with their corresponding 2017 and 2018 cleanup levels. Benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were proposed as COCs in soil in the SCRI because the MDCs exceeded the 2017 ADEC cleanup levels (ADEC 2017c). However, the MDCs are less than the 2018 ADEC cleanup levels (ADEC 2018b); therefore, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene are not listed as soil COCs or COPCs for this DD. No groundwater samples were collected and no groundwater COCs or COPCs were identified at Source Area TU506.

The following analyte was not retained as a non-petroleum-related soil COPC in the SCRI even though the calculated risk exceeded a 1×10^{-5} lifetime cancer risk value or an HI of 1 in the Cumulative Risk Evaluation:

- Based on the 2012 qualified thallium results at TU506, the widespread detections at similar levels for multiple source areas, and the lack of similar thallium detections in recent samples, thallium is not a non-petroleum-related soil COPC at TU506 (USAF 2018b).

Table 3-12
POL-Related Soil COCs at Source Area TU506 with Comparison of Cleanup Levels

COC	MDC (mg/kg)	Year of Maximum Detection[1]	ADEC 2017 Soil Cleanup Level[2] (mg/kg)	ADEC 2018 Soil Cleanup Level[3] (mg/kg)
Benzo(a)anthracene	6.25	2012	0.28	**0.7**
Benzo(a)pyrene	6.8	2016	0.20	**1.5**
Dibenzofuran	2.3	2012	0.97	0.97
1-Methylnaphthalene	1.4	2016	0.41	0.41
2-Methylnaphthalene	4.3	2012	1.3	1.3
Naphthalene	14.8	2012	0.038	0.038

Notes:
[1] The MDC in soil is the MDC for any specific analyte.
[2] 18 AAC 75 Table B1, Method Two most conservative of under-40-inch-zone human health or migration to groundwater (ADEC 2017c).
[3] 18 AAC 75 Table B1, Method Two most conservative of under-40-inch-zone human health or migration to groundwater (ADEC 2018b).
Benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were identified as proposed COCs in soil in the SCRI; however, the MDCs do not exceed the 2018 ADEC cleanup levels.
Bold values indicate cleanup level change.
For definitions, refer to the Acronyms and Abbreviations section.

3.7.2.2 Lateral and Vertical Extent of Contaminated Area

The maximum lateral extents of soil contamination at Source Area TU506 are presented on Figure A-4.4.

Soil

PAH exceedances in soil are present in three separate areas: Area 01 is southwest of Building 1476; Area 02 is southeast of Building 1476, and Area 03 is south and across the roadway from Building 1476. A dibenzofuran exceedance was also detected during soil sampling in Area 01. In Area 01, the contamination in soil extends to approximately 6 feet bgs and covers an area of approximately 1,130 square feet. In Area 02, the contaminated soil extends to approximately 3 feet bgs and covers an area of 1,035 square feet. In Area 03, the contamination in soil extends to approximately 1-foot bgs and covers an area of 950 square feet. The total estimated volume of contaminated soil at TU506 is 400 cy. The inferred vertical extent and estimated volume of soil contamination is presented in Table 3-13.

Table 3-13
POL-Related Contaminated Soil at Source Area TU506

Contamination Area	Depth of Contamination (feet)	Area of Contamination (square feet)	Estimated Volume of Contamination[1] (cy)
01	0 to 6	1,130	250
02	0 to 3	1,035	115
03	0 to 1	950	35
		Total	400

Notes:
[1] Estimated volume of contamination is in place volume and does not account for expansion of material.
For definitions, refer to the Acronyms and Abbreviations section.

3.7.3 Description of Remedy for TU506

The RAOs, remedy, remedy components, and cleanup levels for POL-related COCs are presented in the following subsections. Any CERCLA constituents remaining will be addressed under the three-party agreement.

3.7.3.1 Remedial Action Objectives

The following RAOs address POL-related soil contamination at Source Area TU506:

- Protect human health and the environment from risks associated with exposure to POL-related COCs listed in Table 3-12 at concentrations greater than ADEC cleanup levels in soil.
- Limit or eliminate the potential for contaminant migration from soil to groundwater or from soil or groundwater to indoor or outdoor air.
- Limit or eliminate the potential for human exposure to soil contamination above ADEC cleanup levels until source area conditions support UU/UE.

3.7.3.2 Remedy and Remedy Components

Excavation and offsite disposal of contaminated soil is the remedy to address PAH and dibenzofuran contamination in soil at Source Area TU506. The contamination at TU506 currently presents a potential risk to human health and the environment. Until the final remedy

can be performed, interim LUCs are recommended to mitigate exposure potential (Figure A-4.4). Remedy components are described in the following subsection.

Excavation

- All soil at TU506 having POL-related COC concentrations greater than applicable cleanup levels will be removed to the extent practicable. If limitations to excavation are encountered during removal activities, the USAF will notify ADEC and identify a course of action.
- Existing sample results will guide initial excavation activities. Field screening of soil will be used to guide excavation until suspected clean boundaries have been achieved. Confirmation samples will be collected from suspected clean boundaries and submitted for laboratory analysis of soil COCs (Table 3-12).
- Excavation will be considered complete once analytical results are below cleanup levels or contamination has been removed to the extent practicable, as agreed to by USAF and ADEC.
- Clean overburden for stockpiling and backfilling is not anticipated to be generated during excavation at TU506. Clean fill from an approved borrow source will be utilized as needed.

LUCs will be adopted as interim remedial actions to protect human health and the environment and remain in place until UU/UE is achieved. Interim restrictions on soil and groundwater use as well as site access are already in place as described in the LUCIP (USAF 2015a), and shall be retained, revised, reviewed and approved by ADEC, and documented in future versions of the LUCIP.

3.7.3.3 Cleanup Levels for POL-Related COCs at TU506

The regulatory-based cleanup levels for POL-related COCs at Source Area TU506 are shown in Table 3-14. The soil cleanup levels are the most conservative of 18 AAC 75 Table B1, Method Two under 40-inch zone human health and migration to groundwater (ADEC 2018b).

Table 3-14
Cleanup Levels for POL-Related Soil COCs at TU506

COC	Soil Cleanup Level[1] (mg/kg)
Benzo(a)anthracene	0.7
Benzo(a)pyrene	1.5
Dibenzofuran	0.97
1-Methylnaphthalene	0.41
2-Methylnaphthalene	1.3
Naphthalene	0.038

Notes:
[1] 18 AAC 75 Table B1, Method Two most conservative of human health or migration to groundwater (ADEC 2018b).
For definitions, refer to the Acronyms and Abbreviations section.

PART 4: WASTE MANAGEMENT

Nonhazardous waste will be generated as part of remedy implementation at Source Areas SO071, SS084, and TU506. Anticipated waste streams are listed in Table 4-1.

Table 4-1
Projected Remedial Activities Waste

Source Area	Types of Anticipated Waste			
	Excavated Soil	Purge Water	Decontamination Water	General Trash
SO071	X		X	X
SS084	X	X	X	X
TU506	X		X	X

Note:
Waste generated by remedial activities at all source areas are anticipated to be nonhazardous.

Contaminated waste will be characterized, transported, and treated at an approved treatment facility in accordance with 18 AAC 60 (ADEC 2017d) and 18 AAC 75.325-390 (ADEC 2017c). Specific details regarding disposal and treatment of wastes generated from remediation efforts at each source area will be described in a future cleanup work plan that will be provided to ADEC for review and approval prior to implementation of the remedies described in this DD.

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PART 5: LAND USE CONTROLS

LUCs are legal, administrative, and/or physical mechanisms for implementing restrictions to land use and access in order to limit the exposure of future landowners and/or users of the property to hazardous or toxic substances and/or to maintain the integrity of the remedial action until the property is suitable for UU/UE. The USAF is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. The USAF shall retain ultimate responsibility for remedy integrity. LUCs shall be implemented in accordance with the *Air Force Land-Use Control Checklist for Active-Duty Bases on the National Priorities List* (USAF 2015b):

Resource Uses and Risk-Exposure Assumptions.

a. The state has designated all groundwater of the state as potential drinking water. Eielson AFB currently does not use groundwater at or downgradient of the source areas addressed in this DD as drinking water sources and does not plan to do so in the future. Production intake wells that are used for drinking water at Eielson AFB are sufficiently distant and upgradient to Source Areas SO065, SO069, SO070, SO071, SO073, SS084, or TU506 that the drinking water exposure pathway is incomplete and will remain incomplete. However, to assess the need for LUCs, contamination present in the groundwater was assessed for risk under a drinking water use scenario.

b. The Base General Plan designates land use at source areas presented in this DD as industrial for both current and future classification. However, to assess the need for LUCs, contamination at the source area was assessed for UU/UE, particularly residential use.

Risks Necessitating the LUCs.

a. Residual soil contamination is not safe for residential use or for industrial or construction workers involved in soil disturbance. LUCs are, therefore, necessary to preclude such uses and to control the disposition and use of any soil excavated.

b. Groundwater is not safe for drinking or dermal absorption because contamination exceeds applicable ADEC cleanup levels. Accordingly, Eielson AFB must impose LUCs to ensure the groundwater is not used for drinking water purposes and prevent dermal exposure until it is remediated to cleanup levels.

c. Impacted surface water is not safe for recreational use, such as swimming or fishing. Accordingly, Eielson AFB must impose LUCs to ensure surface water is not used for recreational use until it is remediated to cleanup levels.

Performance Objectives.

a. Prevent ground-disturbing construction activities or ensure safe soil management procedures in areas with residual contamination. The Eielson AFB construction review process will also prevent any use of potentially contaminated groundwater.

b. Prevent access to or use of the groundwater until cleanup levels are met.

c. Maintain the integrity of future monitoring wells.

d. Prohibit the development and use of property for residential housing, elementary and secondary schools, or child care facilities and playgrounds.

Location of LUCs. The LUC areas will be revised from the LUCIP interim boundaries and separated into soil and groundwater areas where access and use restrictions apply. Boundaries are shown on figures in Appendix A for each source area.

Duration of LUCs. LUCs will be maintained until the concentrations of COCs in the soil and groundwater are at levels that allow for UU/UE.

Description of Each LUC and How It Achieves Specific LUC Performance. The internal procedures that the USAF will use to implement the LUCs include but are not limited to the following:

a. **Base Civil Engineer Work Requests –** One tool for achieving the LUC performance objectives is USAF Form 332 (AF332) or Base Civil Engineer Work Request. This form must be submitted and approved before the start of any construction project at Eielson AFB. One step in the approval process for this form is a comparison of the construction site with all constraints that are described in the Base General Plan. The AF332 serves as the document for communicating any construction constraints to the appropriate offices. Any constraints at the site result in the disapproval of the form unless the requester makes appropriate modifications to the construction plans.

b. **Excavation Permits** – Eielson AFB also uses the USAF Form 103 (AF103), Base Work Clearance Request or Excavation Permit to enforce soil and sediment disturbance restrictions. The requester submits the permit to the Civil Engineer Squadron (CES) for any project that involves mechanical soil or sediment excavation, such as trench digging for underground utilities or soil excavation for building foundations. If constraints involving soil disturbance or worker safety exist at the excavation area, the permit describes the appropriate procedures that workers must implement before the start of excavation to prevent unknowing exposure to contamination.

c. **Base Environmental Impact Analysis Process (EIAP)** – An EIAP is conducted pursuant to the National Environmental Policy Act, as promulgated for the USAF in 32 Code of Federal Regulations 989, to assess the potential environmental impact of any federal action initiated by or involving Eielson AFB. An USAF Form 813 (AF813) initiates the EIAP. Both AF332s and excavation permits are subject to an evaluation under the EIAP. The proponent of a proposed action is required to submit the AF332 or excavation permit with AF813 so that the appropriate environmental analysis of the proposed action and alternatives to the proposed action is accomplished prior to any construction or excavation activities. The EIAP works to ensure proposed construction and excavation sites take into account the constraints that are described in the Base General Plan and known to the Air Force Civil Engineer Center (AFCEC) Environmental Restoration Installation Support Team. The EIAP also ensures that all environmental factors, such as LUCs, are considered in the selection of locations for construction projects.

d. **Eielson AFB General Plan** – The Base General Plan is a long-range planning tool that designates current and future land uses. It also provides a framework for selecting the locations of future facilities needed to carry out the Eielson AFB mission. The Base General Plan describes the specific LUCs for each site, the reasons for the controls, and the areas where the controls are applied. For a LUC to remain protective, Eielson AFB personnel must have access to information concerning its existence, purpose, and maintenance requirements. The Base General Plan provides the important information to ensure that LUC management takes place and that the presence of LUCs is effectively communicated.

e. **Base Well Permitting System** – All Eielson AFB groundwater monitoring, extraction, and injection wells are managed under the GeoBase and Installation Real Property facility. Approval of the construction of new wells is received during the regulatory review and acceptance of work plans for groundwater remedial actions and technology demonstration projects. All modifications to the Eielson AFB well network receive Eielson AFB approval through the submission and approval of the AF332 and the AF103, as described in paragraph 16a (Base Civil Engineer Work Requests).

f. **Environmental Restoration Program Atlas** – The Environmental Restoration Program Atlas is a document that describes the LUCs, Base Administrative Controls, and Institutional Controls for each site in the Eielson AFB Environmental Restoration Program. The document also contains figures of the fuels, solvents, or fuels and solvents plumes across sites, LUC boundaries, source area boundaries, as well as program and non-program monitoring well locations. The EIAP is implemented by the 354th CES.

General Performance Responsibility. The USAF is responsible for implementing, maintaining, monitoring, reporting, and enforcing LUCs.

Specific Performance Responsibility to Bind Contractors and Tenants. The USAF shall inform, monitor, enforce, and bind, where appropriate, authorized lessees, tenants, contractors, and other authorized occupants of the source areas regarding the LUCs affecting the source areas.

Specific Performance Responsibility for Transferring Sites. Although the USAF may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the USAF shall retain ultimate responsibility for remedy implementation and protectiveness.

Notification and Corrective Measures Requirement. The USAF will notify ADEC as soon as practicable, but no longer than 10 days after discovery, of any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs. The USAF will take prompt measures within 30 days to notify ADEC of the violation or deficiency and prevent its recurrence. In this notification, the USAF will identify any corrective measures it has taken or any corrective measures it plans to take and the estimated time frame for completing them. For corrective measures taken after the notification, the USAF shall notify ADEC when the measures are complete.

Notification of Transfers. The USAF must provide notice to ADEC at least six months prior to any transfer or sale of property containing LUCs so that ADEC can be involved in discussions to ensure that appropriate provisions are included in the transfer or conveyance documents to maintain effective LUCs. If it is not possible for the facility to notify ADEC at least six months prior to any transfer or sale, then the facility will notify ADEC as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to LUCs. The USAF agrees to provide ADEC with such notice, within the same time frames, for federal-to-federal transfer of property accountability. The USAF shall provide either access to or a copy of the executed deed or transfer assembly to ADEC.

Concurrence Language. The USAF shall not modify or terminate LUCs, modify land uses that might impact the effectiveness of the LUCs, take any anticipated action that might disrupt

the effectiveness of the LUCs, or take any action that might alter or negate the need for LUCs without 45 days' notice prior to the change seeking and obtaining approval from ADEC of any required DD modification.

Monitoring Language. The USAF will monitor and inspect all source areas subject to LUCs at least annually.

Reporting Language. The USAF will report annually, to ADEC on the frequency, scope, and nature of LUC monitoring activities, the results or such monitoring, any changes to the LUCs, and any corrective measures resulting from monitoring during the time period.

The USAF will notify ADEC in advance of any changes to internal procedures associated with the remedy that might affect the LUCs. Implementation of these LUCs will replace interim LUCs and will meet the requirements of the settlement agreement between the USAF, ADEC, and the U.S. Environmental Protection Agency (EPA) (USAF 2013a).

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PART 6: SCHEDULE

Soil removal and/or monitoring well installation at Source Areas SO071, SS084, and TU506 are currently planned for summer 2021. At source areas requiring monitoring well installations (SS084), monitoring wells will be developed and sampled per the ADEC *Monitoring Well Guidance* (ADEC 2013) for source-area-specific COCs (Section 3.0), as well as baseline MNA parameters. Beyond the year of installation and initial sampling, the monitoring wells will be sampled annually until groundwater contaminant concentrations show statistically stable or decreasing trends for two consecutive events (for metals) or three consecutive years (for non-metals) below the applicable cleanup levels, at which time the monitoring frequency, analyses performed, and wells sampled may be reevaluated.

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PART 7: COMMUNITY PARTICIPATION

An Administrative Record has been established for Eielson AFB by the 354 CES Environmental Restoration Section. The Administrative Record is the legal record for the Environmental Restoration Program process at USAF installations and includes copies of all technical reports, regulatory correspondence, meeting minutes, and other documents relied upon for restoration decisions. The Administrative Record is accessible to the public and available electronically at http://afcec.publicadmin-record.us.af.mil/. The USAF contact for public affairs is Eielson AFB 354th Fighter Wing Public Affairs, which can be reached at 907-377-2116.

Upon finalization and approval of this DD by the USAF and ADEC, it will be made available by adding the document to the Administrative Record. The public will be informed of the availability of the final DD by the USAF through a published notice in the *Fairbanks Daily News-Miner*. The notice will include a brief description of the final DD for Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506.

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PART 8: REOPENER CLAUSE AND SIGNATURE BLOCK

The final compliance determination will be made by ADEC, in accordance with 18 AAC 75.380, utilizing all applicable cleanup levels and maximum concentrations remaining at Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506. After reviewing the final cleanup report, ADEC will determine if these seven source areas have been adequately characterized for POL- or petroleum-related contamination under 18 AAC 75.335 and have achieved the applicable requirements under the site cleanup rules. Once ADEC determines the seven source areas have been adequately characterized within the limited ability to access soil contamination beneath buildings, roads, and other obstructions and that each source area meets the applicable requirements under the site cleanup rules, ADEC will issue a written determination that the petroleum cleanup is complete under the current LUCs. The determination may be reviewed and modified in the future if information becomes available indicating the presence of contaminants, exposures that may cause unacceptable risk to human health or the environment, or a change in current land use. If sites are closed and LUCs are implemented to ensure that people are not exposed above human health soil cleanup levels or Table C groundwater cleanup levels, then a notice of activity and use limitation will be completed. ADEC will, as necessary to ensure protection of human health, safety, or welfare, as well as of the environment, require a responsible person to conduct additional actions that meet the requirements.

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AUTHORIZING SIGNATURES

This signature sheet documents the decision made for petroleum contamination at Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506 on Eielson AFB.

The USAF has selected the remedies for SO065, SO069, SO070, SO071, SO073, SS084, and TU506.

This decision will be reviewed and may be modified in the future if information becomes available that indicates the presence of contaminants or exposures that may cause unacceptable risk to human health or the environment. If additional contaminants are discovered, the USAF and ADEC will determine compliance levels for soil and groundwater cleanup actions.

LOPEZ.JUDY.M.1291747988 Digitally signed by LOPEZ.JUDY.M.1291747988 Date: 2022.01.03 13:38:36 -06'00'

Judy M. Lopez, GS-15, P.E. Date

Director, Environmental Management

Air Force Civil Engineer Center

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AUTHORIZING SIGNATURES

This signature sheet documents the decision made for petroleum contamination at Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506 on Eielson AFB.

The USAF has selected the remedies for SO065, SO069, SO070, SO071, SO073, SS084, and TU506. By signing this declaration, ADEC concurs that proper implementation of the selected remedies will comply with State of Alaska environmental laws.

This decision will be reviewed and may be modified in the future if information becomes available that indicates the presence of contaminants or exposures that may cause unacceptable risk to human health or the environment. If additional contaminants are discovered, the USAF and ADEC will determine compliance levels for soil and groundwater cleanup actions.

9 FEB 2022

MELINDA BRUNNER, DSMOA Manager — Date

Federal Facilities Section, Contaminated Sites Program

Alaska Department of Environmental Conservation

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PART 9: REFERENCES

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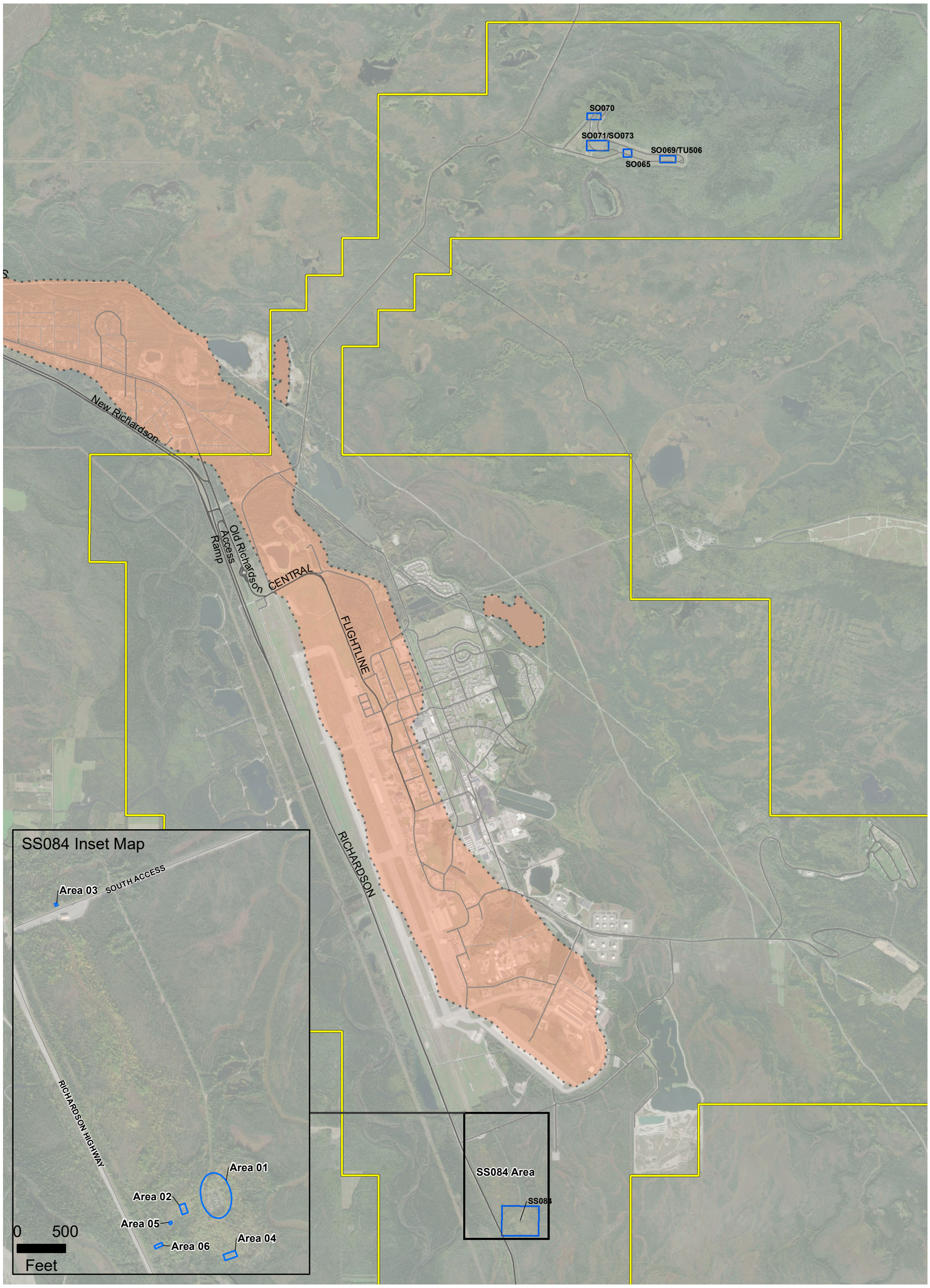
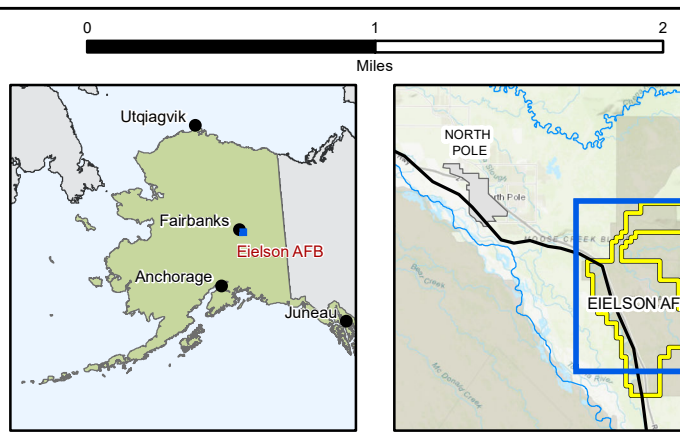
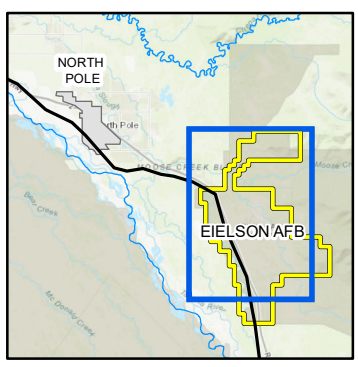
APPENDIX A
Figures







0 1 2
Miles

- Railroad
- Primary Road
- Secondary Road
- Source Area Location
- PFOS/PFOA Groundwater Plume
- EAFB Installation Area

N

WGS 1984 UTM Zone 6N

Note:
Eielson Air Force Base PFOS and PFOA plume reference data from multiple sources. The plume is incompletely delineated to the northeast and southwest (ADEC 2020).

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LOCATION AND VICINITY

DECISION DOCUMENT FOR PBR SOURCE AREAS
SO065, SO069, SO070, SO071, SO073, SS084, AND TU506

EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE: 30 APR 2020	PROJECT MANAGER: H. AMSKOLD	FIGURE NO: A-1

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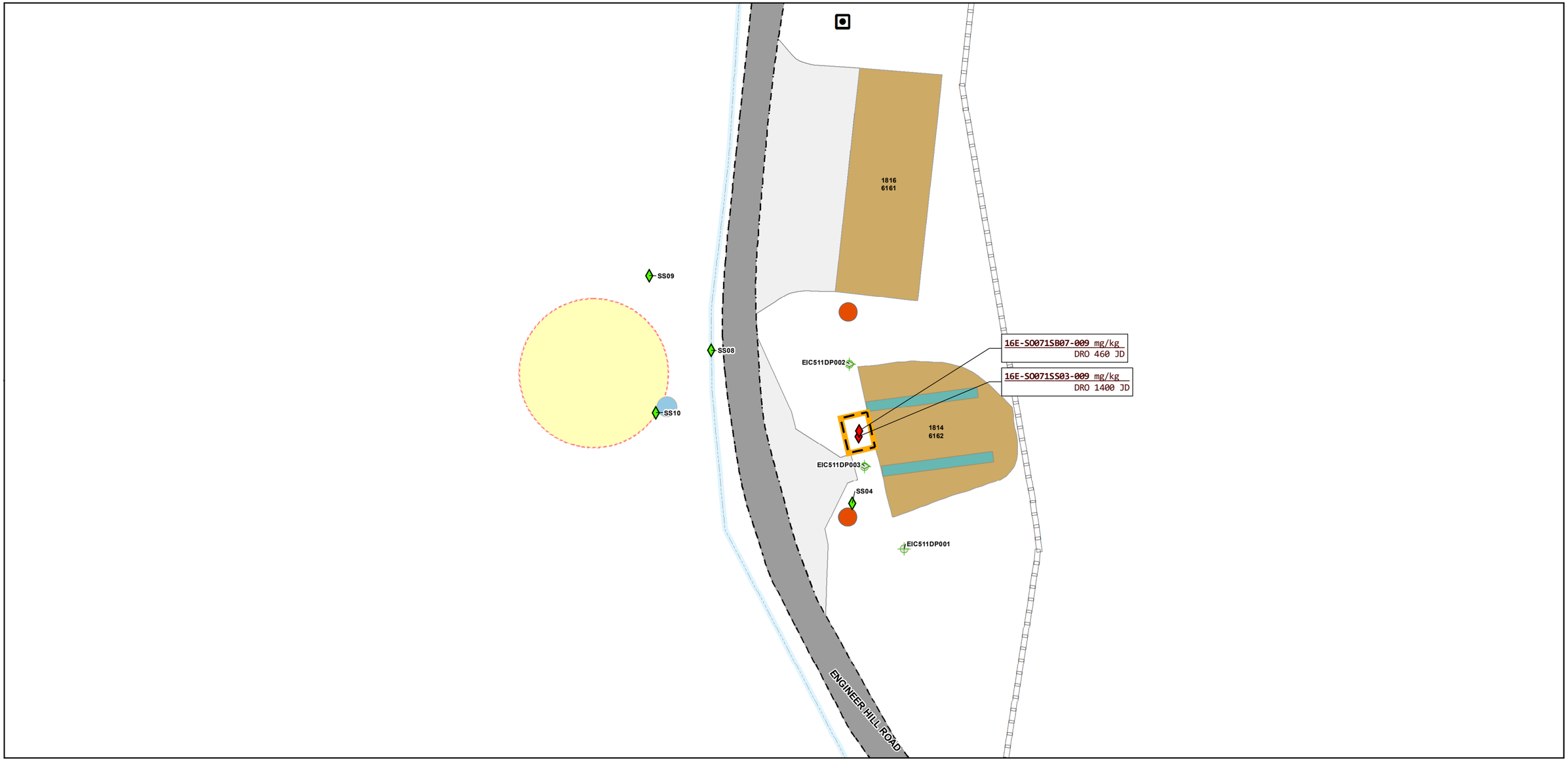


PBR Results - Fuels in Surface Soil

- Surface Soil - Exceedance (2)
- Surface Soil - No Exceedance (4)

Non-PBR Results - Fuels In Surface Soil

- Surface Soil - No Exceedance (2)

Non-PBR Results - Fuels In Subsurface Soil

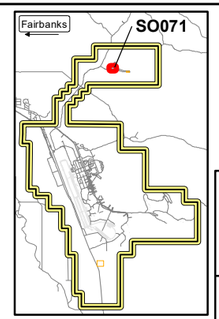
- Subsurface Soil - No Exceedance (3)
- Estimated Extent of COC Contamination in Soil
- Concrete Pad
- Aboveground Storage Tank
- Former Underground Storage Tank
- Utilidor (2017)
- Drainage Outfall
- Passive Soil Gas Sample Area
- Condensate Drain
- Highest Historical Passive Soil Gas Results
- Structure/Building
- Road Area
- Pavement Section
- Eielson AFB Boundary

Notes:

Soil results were compared to PSLs (18 AAC 75 Tables B1 and B2, most conservative of under-40-inch-zone human health or migration to groundwater cleanup levels [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:

ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



0 40 80
Feet

1:600
1 inch = 50 feet
WGS 1984 UTM Zone 6N

N

SO071
FUEL COCS IN SOIL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE: 29 APR 2020	PROJECT MANAGER: H. AMSKOLD	FIGURE NO: A-2.1

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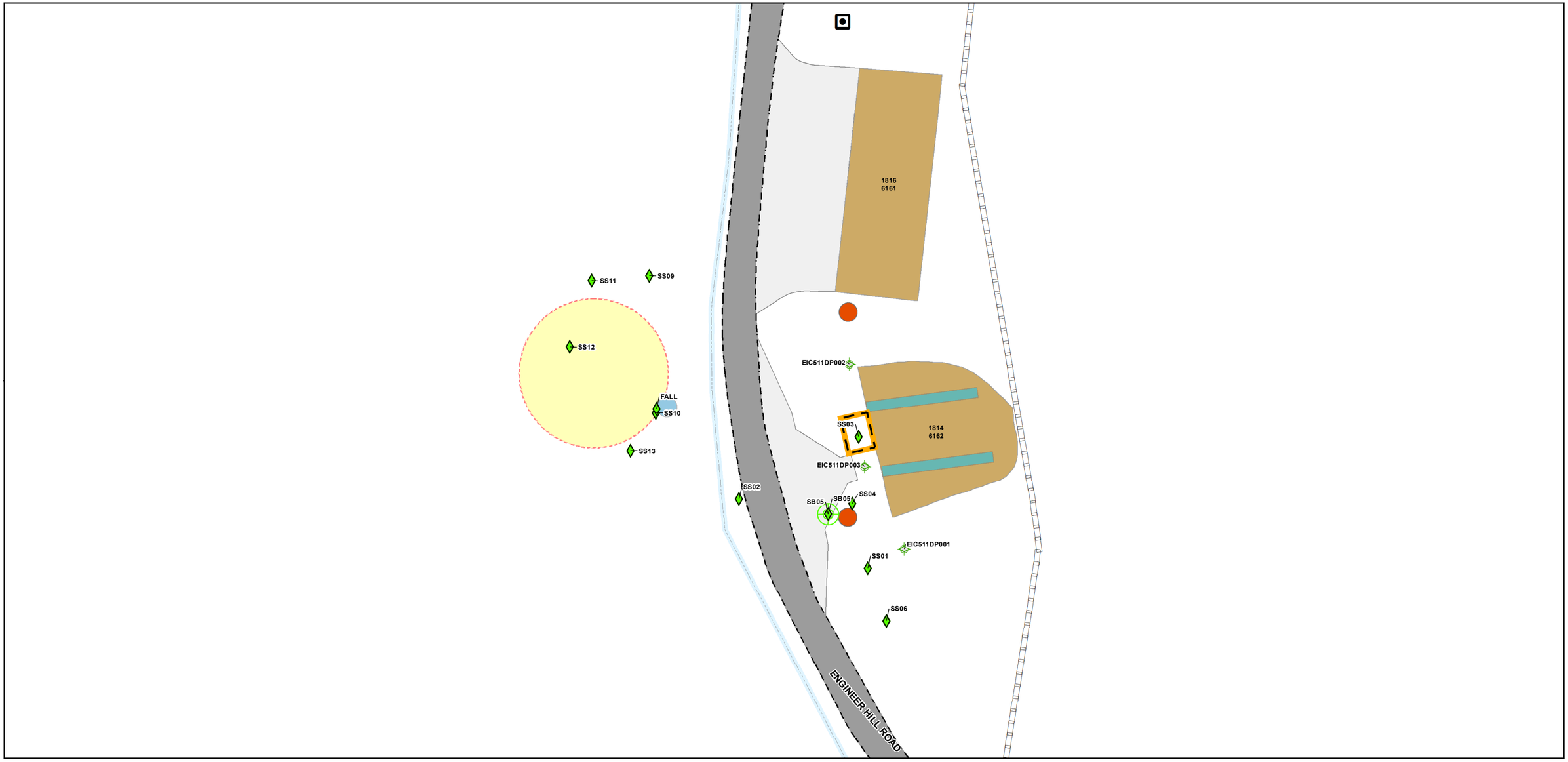


PBR Results - Metals in Surface Soil

- Surface Soil - No Exceedance (12)

PBR Results - Metals in Subsurface Soil

- Subsurface Soil - No Exceedance (1)

Non-PBR Results - Metals In Surface Soil

- Surface Soil - No Exceedance (3)

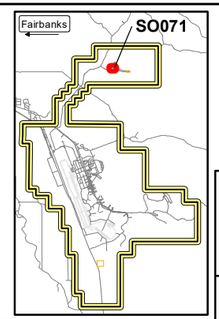
Non-PBR Results - Metals In Subsurface Soil

- Subsurface Soil - No Exceedance (3)
- Estimated Extent of COC Contamination in Soil

- Concrete Pad
- Aboveground Storage Tank
- Former Underground Storage Tank
- Utilidor (2017)
- Drainage Outfall
- Passive Soil Gas Sample Area
- Condensate Drain
- Highest Historical Passive Soil Gas Results
- Structure/Building
- Road Area
- Pavement Section
- Eielson AFB Boundary

Notes:
Soil results were compared to PSLs (18 AAC 75 Tables B1 and B2, most conservative of under-40-inch-zone human health or migration to groundwater cleanup levels [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
Bold soil results also exceed BTVs.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:
ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



0 40 80
Feet

1:600
1 inch = 50 feet
WGS 1984 UTM Zone 6N

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SO071
METAL COCS IN SOIL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE: 29 APR 2020	PROJECT MANAGER: H. AMSKOLD	FIGURE NO: A-2.2

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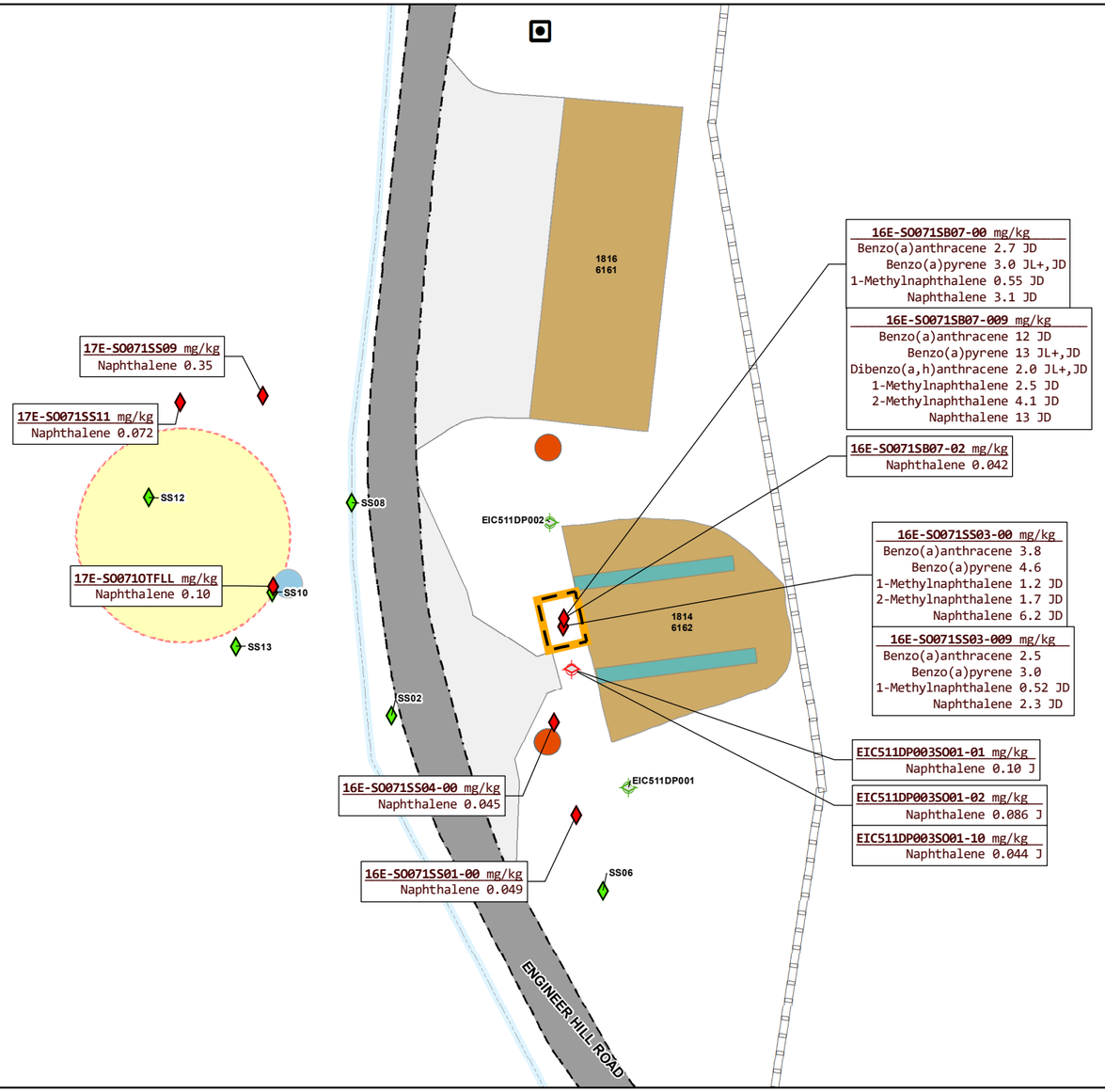


PBR Results - VOCs and SVOCs In Surface Soil
- Surface Soil - Exceedance (7)
- Surface Soil - No Exceedance (6)

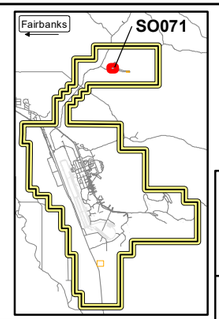
Non-PBR Results - VOCs and SVOCs In Surface Soil
- Surface Soil - Exceedance (1)
- Surface Soil - No Exceedance (2)

Non-PBR Results - VOC and SVOCs In Subsurface Soil
- Subsurface Soil - Exceedance (1)
- Subsurface Soil - No Exceedance (2)
- Estimated Extent of COC Contamination in Soil

- Concrete Pad
- Aboveground Storage Tank
- Former Underground Storage Tank
- Utilidor (2017)
- Drainage Outfall
- Passive Soil Gas Sample Area
- Condensate Drain
- Highest Historical Passive Soil Gas Results
- Structure/Building
- Road Area
- Pavement Section
- Eielson AFB Boundary

Notes:
Soil results were compared to PSLs (18 AAC 75 Tables B1 and B2, most conservative of under-40-inch-zone human health or migration to groundwater cleanup levels [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:
ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



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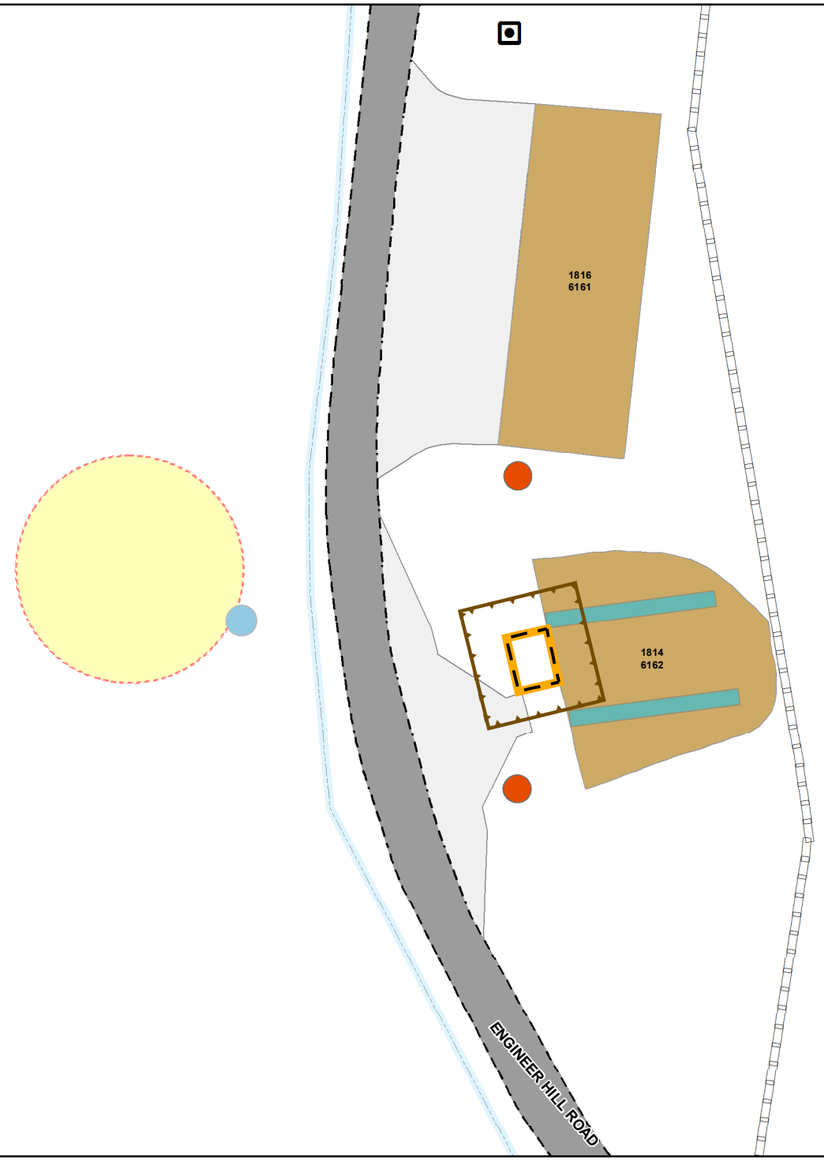
Feet

1:600
1 inch = 50 feet
WGS 1984 UTM Zone 6N

N

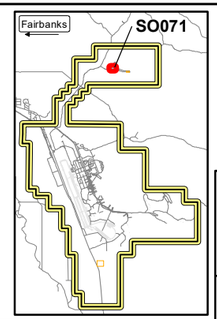
SO071
VOC AND SVOC COCS IN SOIL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS | DATE: 29 APR 2020 | PROJECT MANAGER: H. AMSKOLD | FIGURE NO: A-2.3



Proposed Soil Land Use Control Area
Estimated Extent of COC Contamination in Soil
Concrete Pad
Aboveground Storage Tank
Former Underground Storage Tank
Utilidor (2017)
Drainage Outfall
Passive Soil Gas Sample Area
Condensate Drain
Highest Historical Passive Soil Gas Results
Structure/Building
Road Area
Pavement Section
Eielson AFB Boundary

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
Buildings are labeled with Building-Number above the Facility-ID, when known.



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1:600
1 inch = 50 feet
WGS 1984 UTM Zone 6N

N

SO071
INTERIM LAND USE CONTROL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE: 29 APR 2020	PROJECT MANAGER: H. AMSKOLD	FIGURE NO: A-2.4

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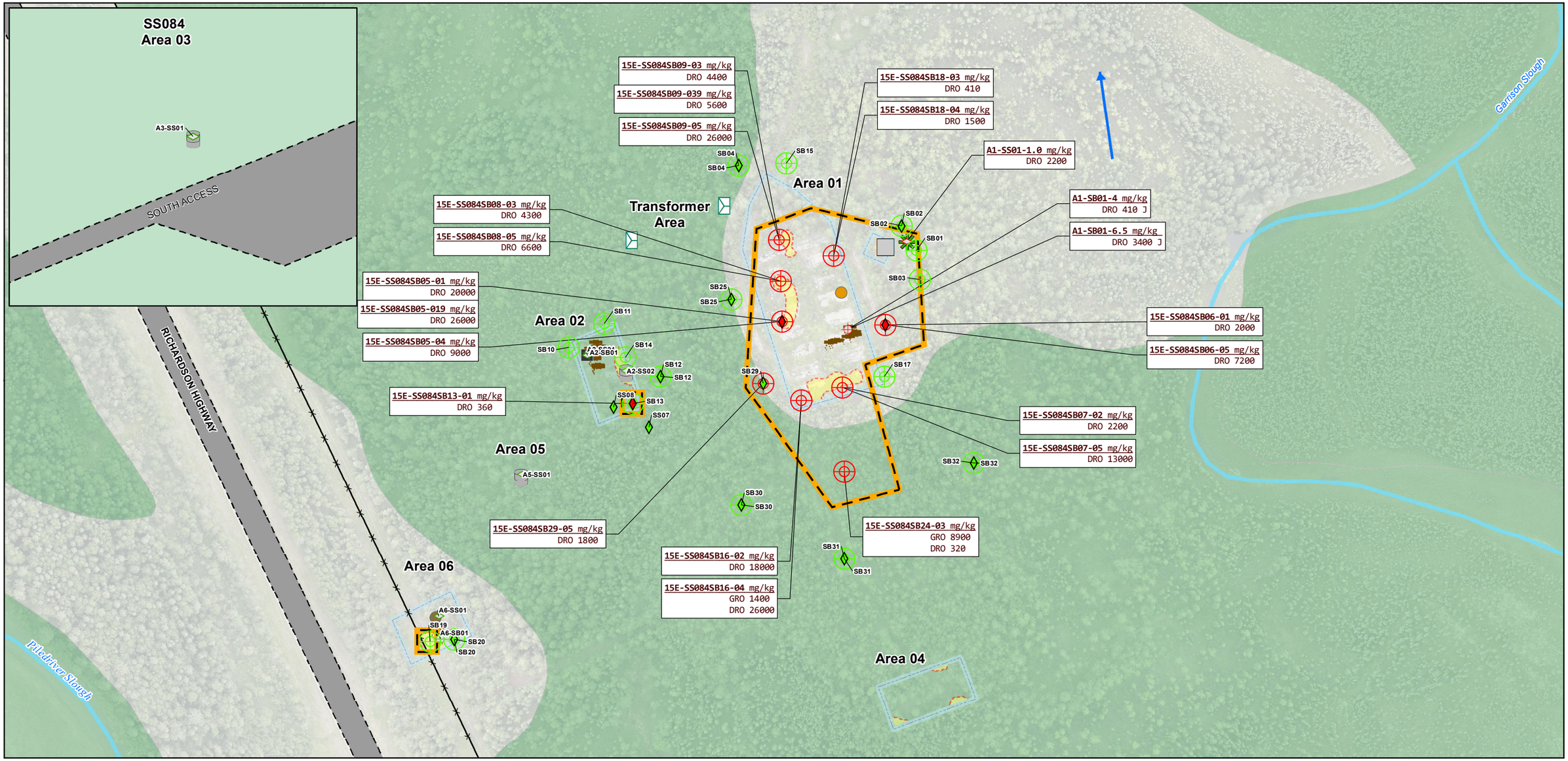


PBR Results - Fuels in Surface Soil

- Surface Soil - Exceedance (3)
- Surface Soil - No Exceedance (11)

PBR Results - Fuels in Subsurface Soil

- Subsurface Soil - Exceedance (9)
- Subsurface Soil - No Exceedance (17)

Non-PBR Results - Fuels In Surface Soil

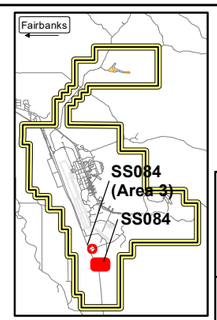
- Surface Soil - Exceedance (1)
- Surface Soil - No Exceedance (4)

Non-PBR Results - Fuels In Subsurface Soil

- Subsurface Soil - Exceedance (1)
- Subsurface Soil - No Exceedance (2)
- Estimated Extent of COC Contamination in Soil
- Fence
- Black Layered Material
- Pumphouse
- Piping
- Drum Location
- Wooden Sewage Crib/Trench
- Former Transformer
- Former Aboveground Storage Tank
- Former Underground Storage Tank
- Passive Soil Gas Sample Area
- Highest Historical Passive Soil Gas Results
- Approximate Regional Groundwater Flow Direction (IWMP 2015)
- Road Area
- Surface Water
- Freshwater Forested/Shrub Wetland
- Eielson AFB Boundary

Notes:
Soil results were compared to PSLs (18 AAC 75 Tables B1 and B2, most conservative of under-40-inch-zone human health or migration to groundwater cleanup levels [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:
ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



0 140 280
Feet
1:1,800
1 inch = 150 feet
WGS 1984 UTM Zone 6N

N

SS084
FUEL COCS IN SOIL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO:
	29 APR 2020	H. AMSKOLD	A-3.1

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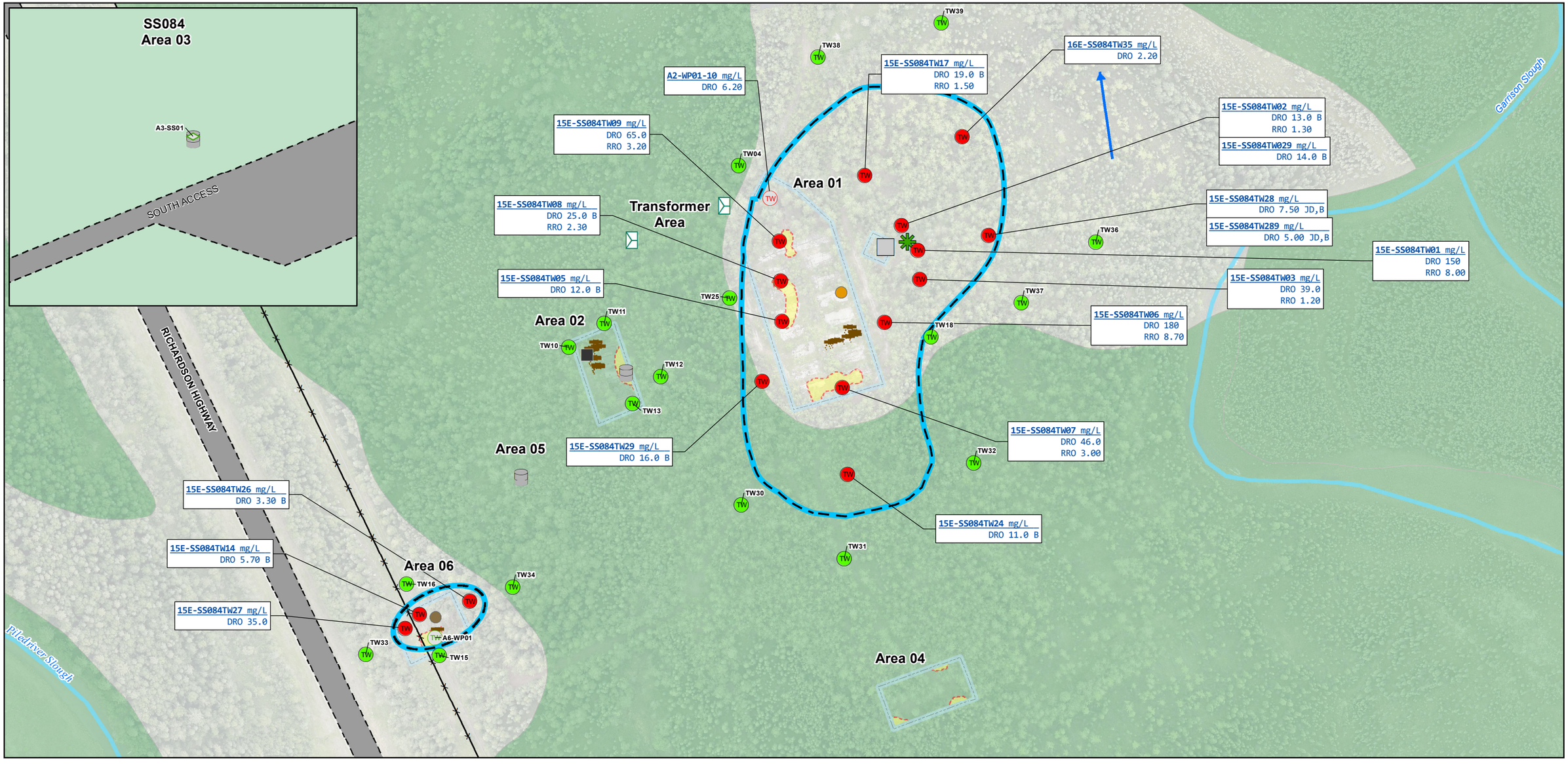


PBR Results - Fuels in Water

- Temporary Well - Exceedance (16)
- Temporary Well - No Exceedance (18)

Non-PBR Results - Fuels In Water

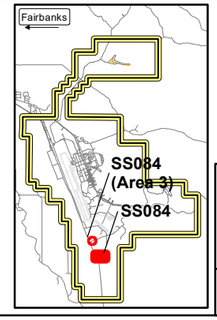
- Temporary Well - Exceedance (1)
- Temporary Well - No Exceedacne (1)
- Estimated Extent of COC Contamination in Groundwater
- Fence
- Black Layered Material
- Pumphouse
- Piping
- Drum Location
- Wooden Sewage Crib/Trench
- Former Transformer
- Former Aboveground Storage Tank
- Former Underground Storage Tank
- Passive Soil Gas Sample Area
- Highest Historical Passive Soil Gas Results
- Approximate Regional Groundwater Flow Direction (IWMP 2015)
- Road Area
- Surface Water
- Freshwater Forested/Shrub Wetland
- Eielson AFB Boundary

Notes:

Groundwater results were compared to PSLs (18 AAC 75 Table C cleanup level [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:

ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



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Feet

1:1,800
1 inch = 150 feet
WGS 1984 UTM Zone 6N

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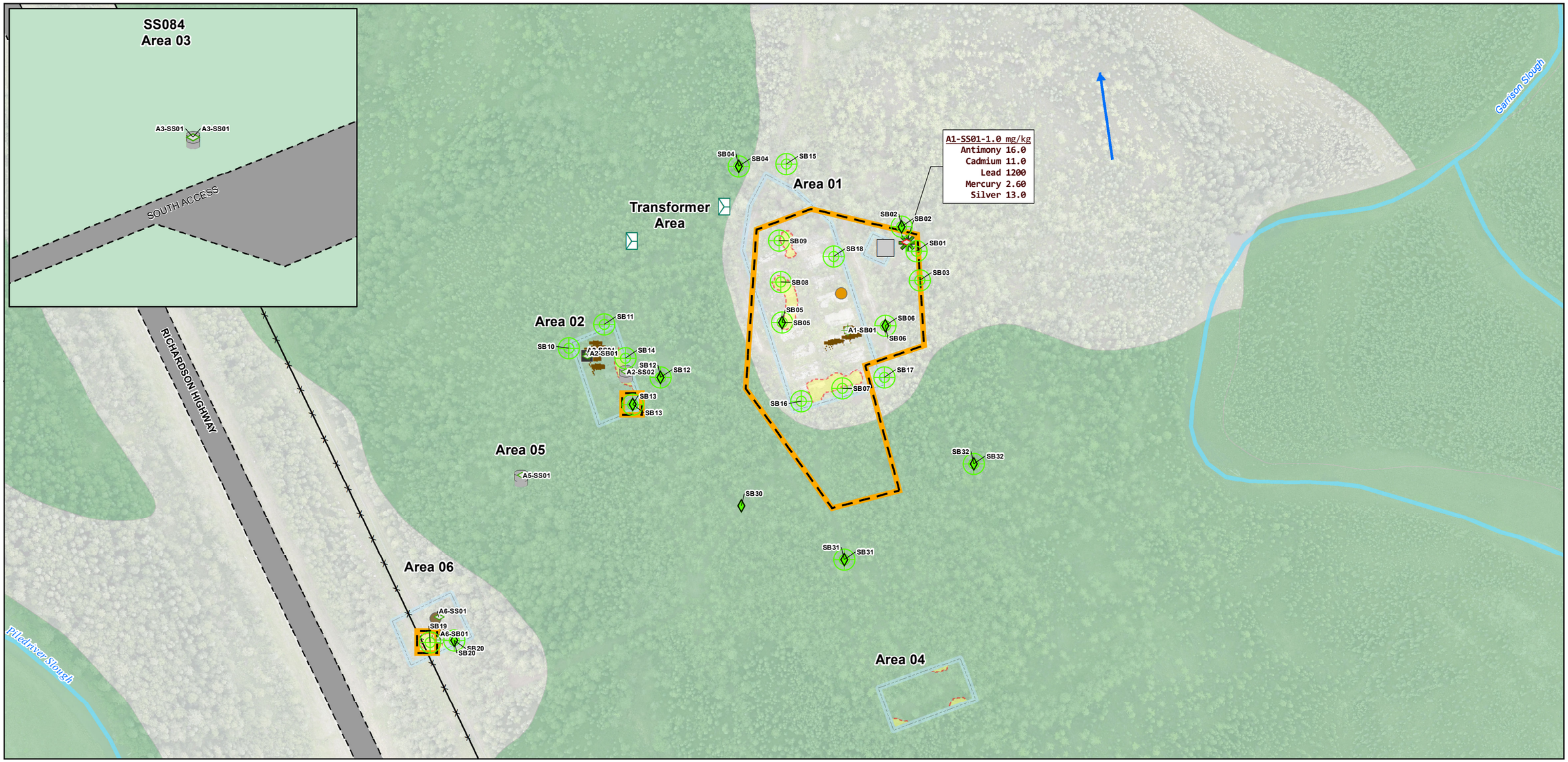
SS084
FUEL COCS IN WATER
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO:
	29 APR 2020	H. AMSKOLD	A-3.2



PBR Results - Metals in Surface Soil

- Surface Soil - No Exceedance (10)

PBR Results - Metals in Subsurface Soil

- Subsurface Soil - No Exceedance (22)

Non-PBR Results - Metals In Surface Soil

- Surface Soil - Exceedance (1)
- Surface Soil - No Exceedance (4)

Non-PBR Results - Metals In Subsurface Soil

- Subsurface Soil - No Exceedance (3)

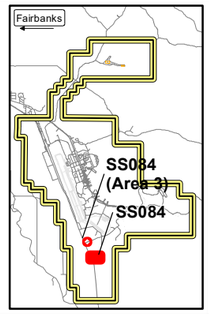
- Estimated Extent of COC Contamination in Soil
- Fence
- Black Layered Material
- Pumphouse
- Piping
- Drum Location
- Wooden Sewage Crib/Trench
- Former Transformer
- Former Aboveground Storage Tank
- Former Underground Storage Tank
- Passive Soil Gas Sample Area
- Highest Historical Passive Soil Gas Results
- Approximate Regional Groundwater Flow Direction (IWMP 2015)
- Road Area
- Surface Water
- Freshwater Forested/Shrub Wetland
- Eielson AFB Boundary

Notes:

Soil results were compared to PSLs (18 AAC 75 Tables B1 and B2, most conservative of under-40-inch-zone human health or migration to groundwater cleanup levels [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
Bold soil results also exceed BTVs.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:

ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



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Feet

1:1,800
1 inch = 150 feet
WGS 1984 UTM Zone 6N

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SS084
METAL COCS IN SOIL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO:
	29 APR 2020	H. AMSKOLD	A-3.3

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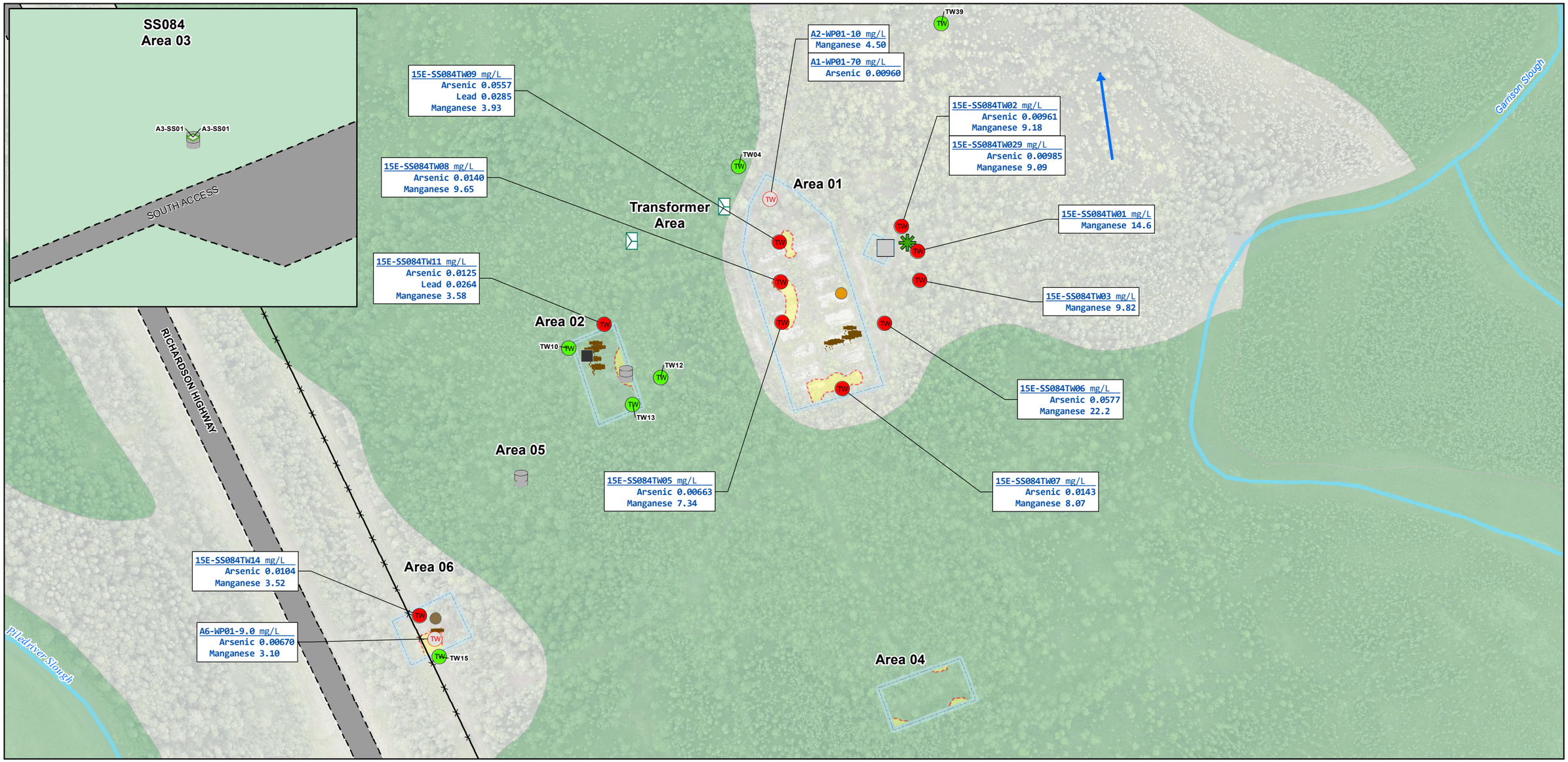


PBR Results - Metals in Water

- Temporary Well - Exceedance (10)
- Temporary Well - No Exceedance (6)

Non-PBR Results - Metals In Water

- Temporary Well - Exceedance (2)
- Fence
- Black Layered Material
- Pumphouse
- Piping
- Drum Location
- Wooden Sewage Crib/Trench
- Former Transformer
- Former Aboveground Storage Tank
- Former Underground Storage Tank
- Passive Soil Gas Sample Area
- Highest Historical Passive Soil Gas Results
- Approximate Regional Groundwater Flow Direction (IWMP 2015)
- Road Area
- Surface Water
- Freshwater Forested/Shrub Wetland
- Eielson AFB Boundary

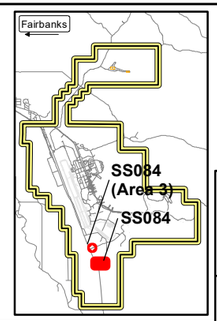
Notes:

Groundwater results were compared to PSLs (18 AAC 75 Table C cleanup level [ADEC 2018]) except RSL tables [EPA 2017] for iron, cobalt, and manganese to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:

ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.

EPA. 2017 (June). Regional Screening Levels (RSLs) — Generic Tables. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017.



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Feet

1:1,800
1 inch = 150 feet
WGS 1984 UTM Zone 6N

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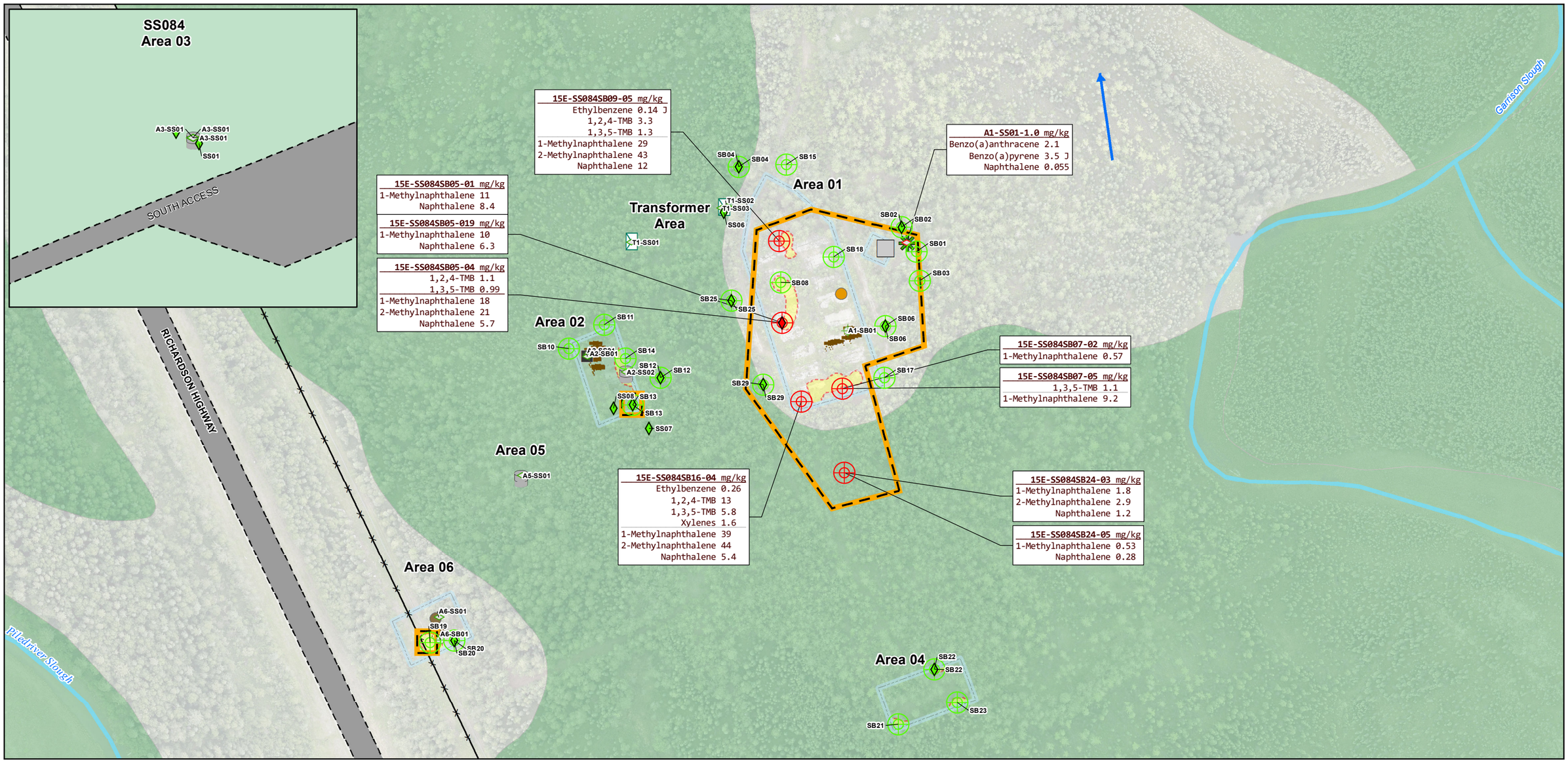
SS084
METAL COCS IN WATER
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO:
	29 APR 2020	H. AMSKOLD	A-3.4



PBR Results - VOCs and SVOCs In Surface Soil

- Surface Soil - Exceedance (1)
- Surface Soil - No Exceedance (12)

PBR Results - VOCs and SVOCs In Subsurface Soil

- Subsurface Soil - Exceedance (5)
- Subsurface Soil - No Exceedance (21)

Non-PBR Results - VOCs and SVOCs In Surface Soil

- Surface Soil - Exceedance (1)
- Surface Soil - No Exceedance (7)

Non-PBR Results - VOC and SVOCs In Subsurface Soil

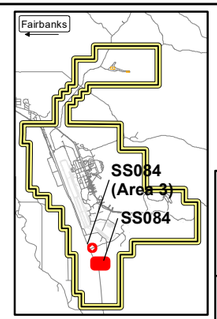
- Subsurface Soil - No Exceedance (3)
- Estimated Extent of COC Contamination in Soil
- Fence
- Black Layered Material
- Pumphouse
- Piping
- Drum Location
- Wooden Sewage Crib/Trench
- Former Transformer
- Former Aboveground Storage Tank
- Former Underground Storage Tank
- Passive Soil Gas Sample Area
- Highest Historical Passive Soil Gas Results
- Approximate Regional Groundwater Flow Direction (IWMP 2015)
- Road Area
- Surface Water
- Freshwater Forested/Shrub Wetland
- Eielson AFB Boundary

Notes:

Soil results were compared to PSLs (18 AAC 75 Tables B1 and B2, most conservative of under-40-inch-zone human health or migration to groundwater cleanup levels [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:

ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



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Feet

1:1,800
1 inch = 150 feet
WGS 1984 UTM Zone 6N

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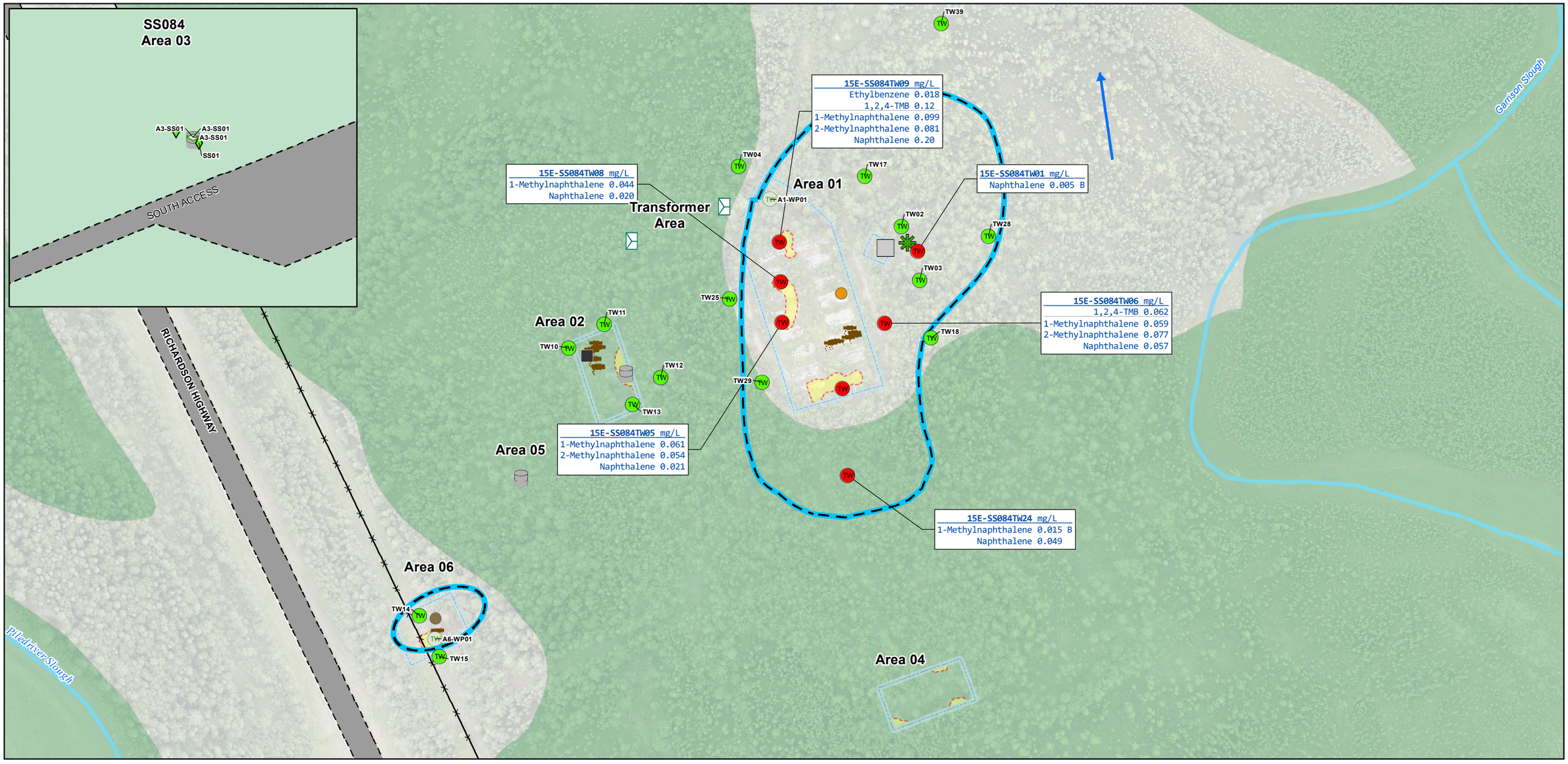
SS084
VOC AND SVOC COCS IN SOIL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE: 29 APR 2020	PROJECT MANAGER: H. AMSKOLD	FIGURE NO: A-3.5



PBR Results - VOCs and SVOCs in Water

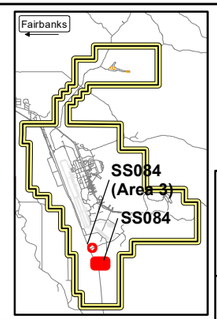
- Temporary Well - Exceedance (7)
- Temporary Well - No Exceedance (15)

Non-PBR Results - VOCs and SVOCs In Water

- Temporary Well - No Exceedacne (2)
- Estimated Extent of COC Contamination in Groundwater
- Fence
- Black Layered Material
- Pumphouse
- Piping
- Drum Location
- Wooden Sewage Crib/Trench
- Former Transformer
- Former Abovegound Storage Tank
- Former Underground Storage Tank
- Passive Soil Gas Sample Area
- Highest Historical Passive Soil Gas Results
- Approximate Regional Groundwater Flow Direction (IWMP 2015)
- Road Area
- Surface Water
- Freshwater Forested/Shrub Wetland
- Eielson AFB Boundary

Notes:
Groundwater results were compared to PSLs (18 AAC 75 Table C cleanup level [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:
ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



0 140 280
Feet

1:1,800
1 inch = 150 feet
WGS 1984 UTM Zone 6N

N

SS084
VOC AND SVOC COCS IN WATER
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO:
	29 APR 2020	H. AMSKOLD	A-3.6

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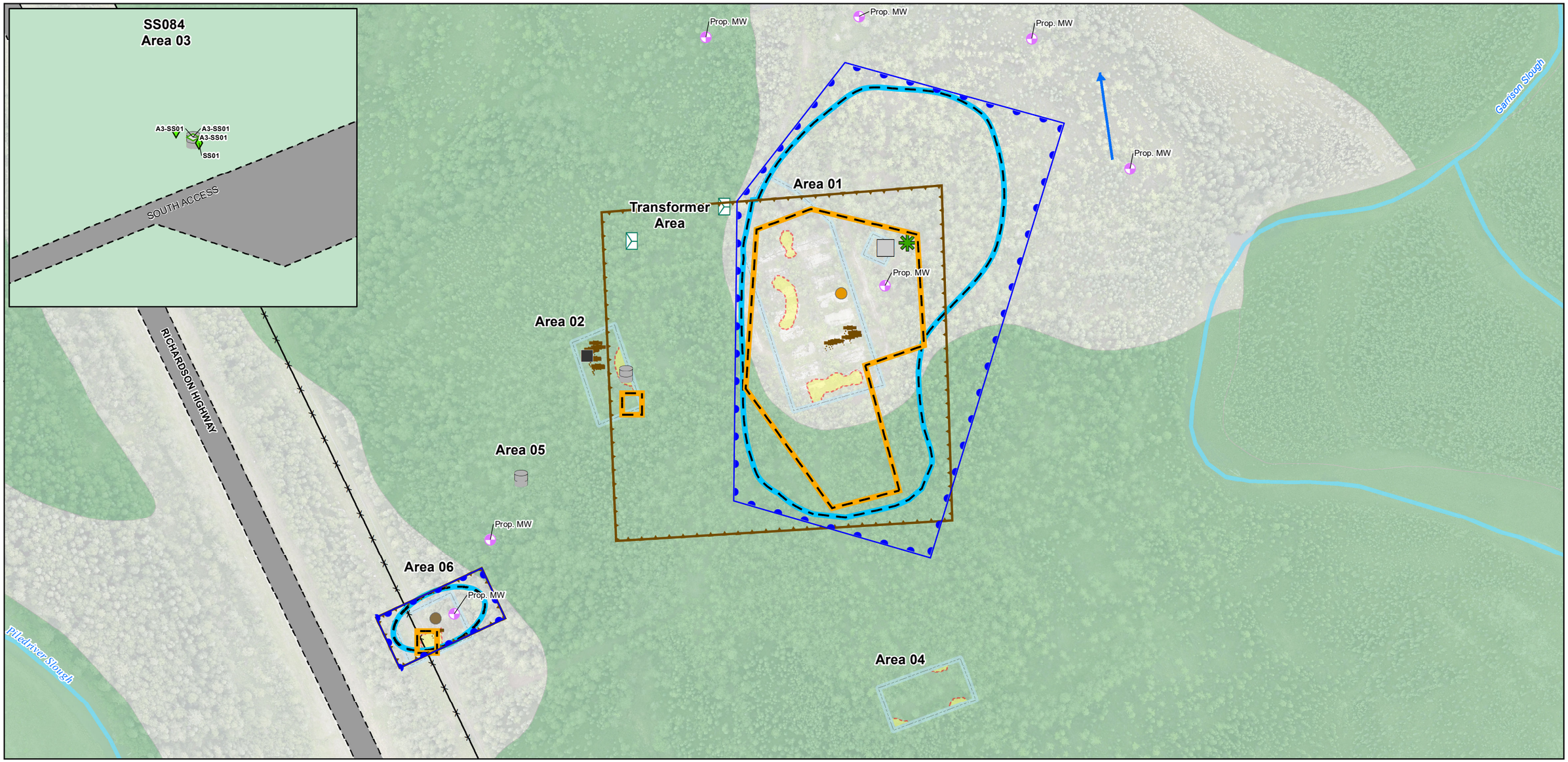
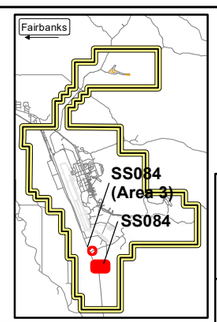


Proposed Groundwater Land Use Control Area
Proposed Soil Land Use Control Area
Proposed Monitoring Well (7)
Estimated Extent of COC Contamination in Soil
Estimated Extent of COC Contamination in Groundwater
Fence
Black Layered Material
Pumphouse
Piping
Drum Location
Wooden Sewage Crib/Trench
Former Transformer
Former Aboveground Storage Tank
Former Underground Storage Tank
Passive Soil Gas Sample Area
Highest Historical Passive Soil Gas Results
Approximate Regional Groundwater Flow Direction (IWMP 2015)
Road Area
Surface Water
Freshwater Forested/Shrub Wetland
Eielson AFB Boundary

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
Buildings are labeled with Building-Number above the Facility-ID, when known.



0 140 280
Feet
1:1,800
1 inch = 150 feet
WGS 1984 UTM Zone 6N

N

SS084
INTERIM LAND USE CONTROL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE: 29 APR 2020	PROJECT MANAGER: H. AMSKOLD	FIGURE NO: A-3.7

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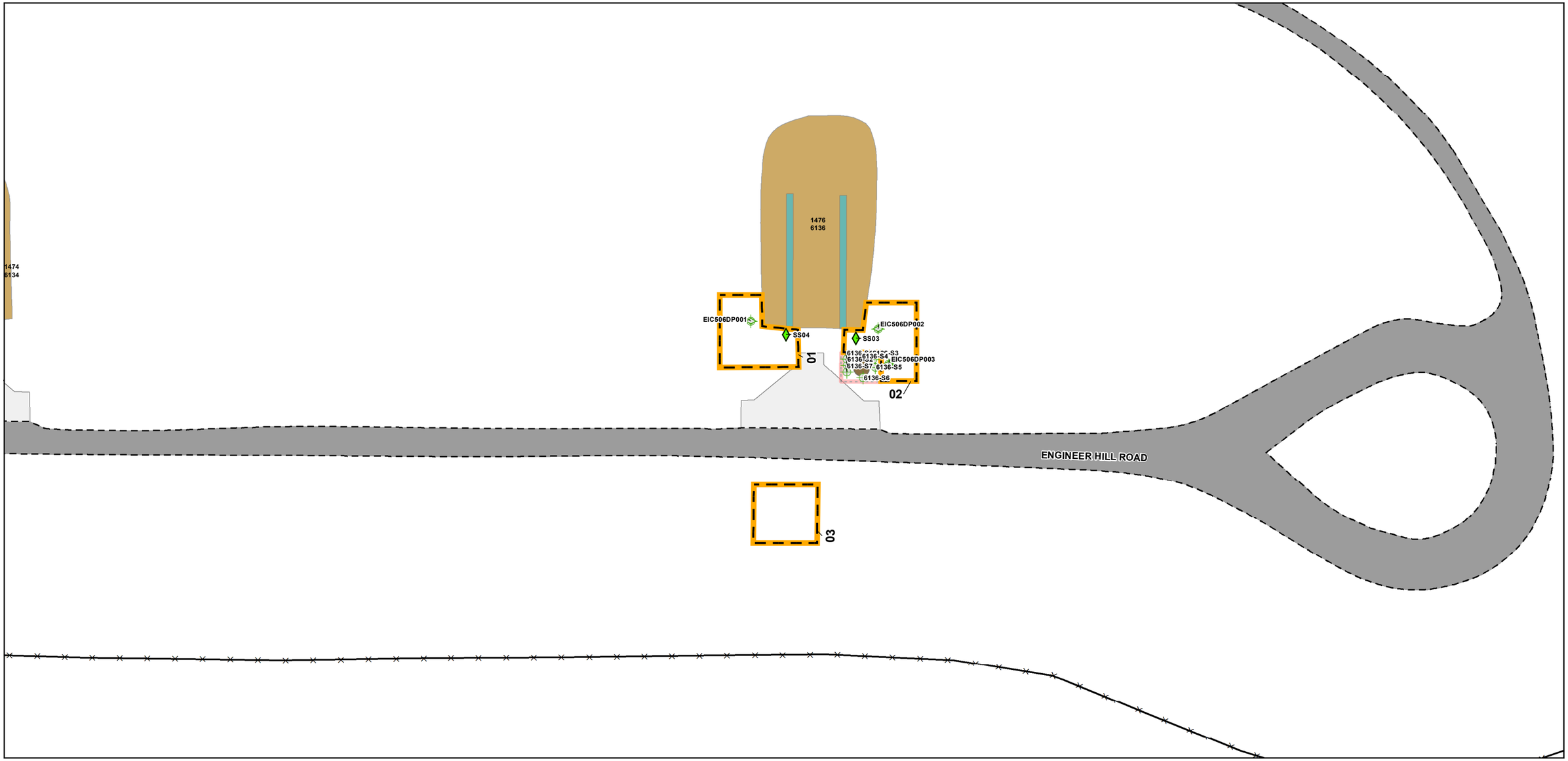


PBR Results - Fuels in Surface Soil

- Surface Soil - No Exceedance (2)

Non-PBR Results - Fuels In Surface Soil

- Surface Soil - No Exceedance (3)

Non-PBR Results - Fuels In Subsurface Soil

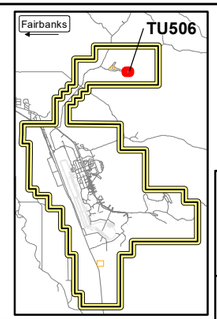
- Subsurface Soil - No Exceedance (10)
- Estimated Extent of COC Contamination in Soil
- Fence
- Former Underground Storage Tank
- Excavation
- Condensate Drain
- Structure/Building
- Road Area
- Pavement Section
- Eielson AFB Boundary

Notes:

Soil results were compared to PSLs (18 AAC 75 Tables B1 and B2, most conservative of under-40-inch-zone human health or migration to groundwater cleanup levels [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:

ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



0 40 80
Feet

1:600
1 inch = 50 feet
WGS 1984 UTM Zone 6N

N

TU506
FUEL COCS IN SOIL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE: 29 APR 2020	PROJECT MANAGER: H. AMSKOLD	FIGURE NO: A-4.1

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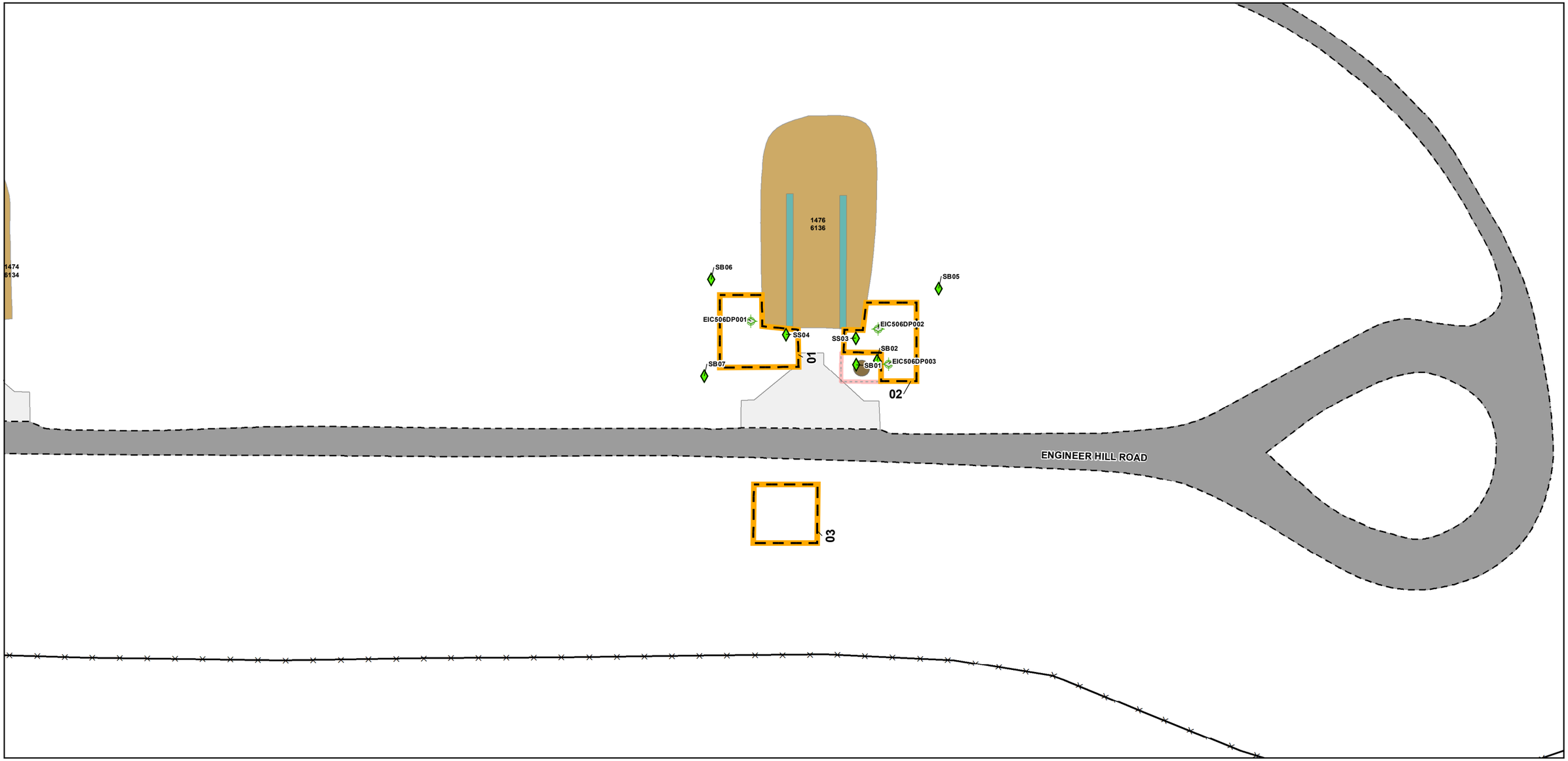


PBR Results - Metals in Surface Soil

- Surface Soil - No Exceedance (7)

Non-PBR Results - Metals In Surface Soil

- Surface Soil - No Exceedance (3)

Non-PBR Results - Metals In Subsurface Soil

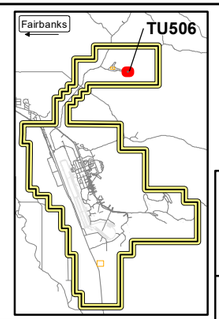
- Subsurface Soil - No Exceedance (3)
- Estimated Extent of COC Contamination in Soil
- Fence
- Former Underground Storage Tank
- Excavation
- Condensate Drain
- Structure/Building
- Road Area
- Pavement Section
- Eielson AFB Boundary

Notes:

Soil results were compared to PSLs (18 AAC 75 Tables B1 and B2, most conservative of under-40-inch-zone human health or migration to groundwater cleanup levels [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
Bold soil results also exceed BTVs.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:

ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



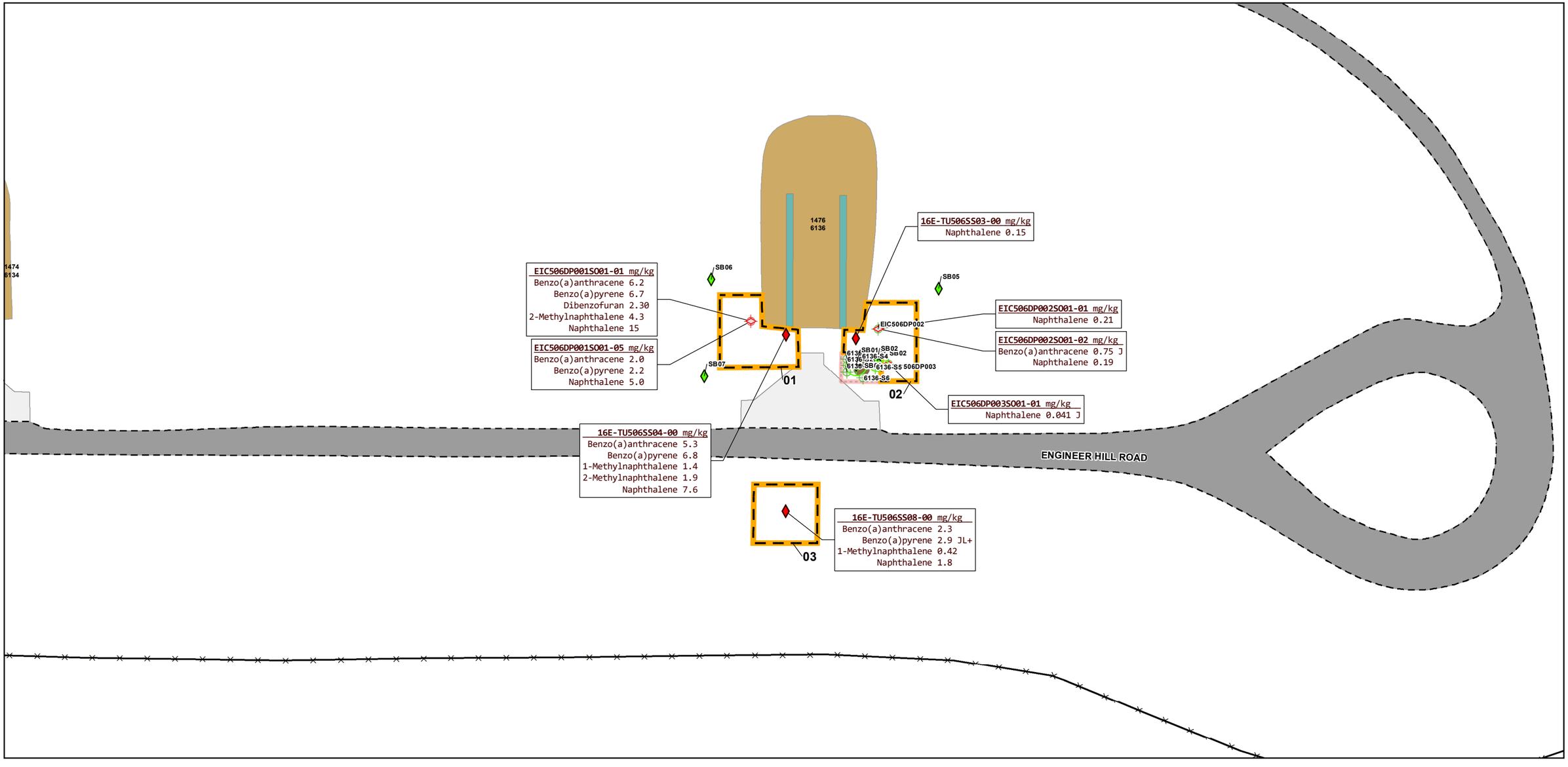
0 40 80
Feet

1:600
1 inch = 50 feet
WGS 1984 UTM Zone 6N

N

TU506
METAL COCS IN SOIL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE: 29 APR 2020	PROJECT MANAGER: H. AMSKOLD	FIGURE NO: A-4.2



PBR Results - VOCs and SVOCs In Surface Soil

- Surface Soil - Exceedance (3)
- Surface Soil - No Exceedance (5)

PBR Results - VOCs and SVOCs In Subsurface Soil

- Subsurface Soil - No Exceedance (2)

Non-PBR Results - VOCs and SVOCs In Surface Soil

- Surface Soil - Exceedance (3)

Non-PBR Results - VOC and SVOCs In Subsurface Soil

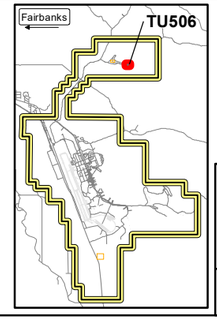
- Subsurface Soil - Exceedance (1)
- Subsurface Soil - No Exceedance (9)
- Estimated Extent of COC Contamination in Soil
- Fence
- Former Underground Storage Tank
- Excavation
- Condensate Drain
- Structure/Building
- Road Area
- Pavement Section
- Eielson AFB Boundary

Notes:

Soil results were compared to PSLs (18 AAC 75 Tables B1 and B2, most conservative of under-40-inch-zone human health or migration to groundwater cleanup levels [ADEC 2018]) to identify exceedances.
Locations without annotation yielded no exceedances.
Annotation shows the sample ID and lists the associated exceedances.
A '-9' at the end of the sample ID signifies a duplicate sample.
For definitions, refer to the Acronyms and Abbreviations section.
For qualifiers, refer to the Analytical Data Qualifiers Section in the Data Quality Assessment.
Buildings are labeled with Building-Number above the Facility-ID, when known.

Reference:

ADEC. 2018 (October). Oil and Other Hazardous Pollution Control Regulations—Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances. 18 AAC 75.



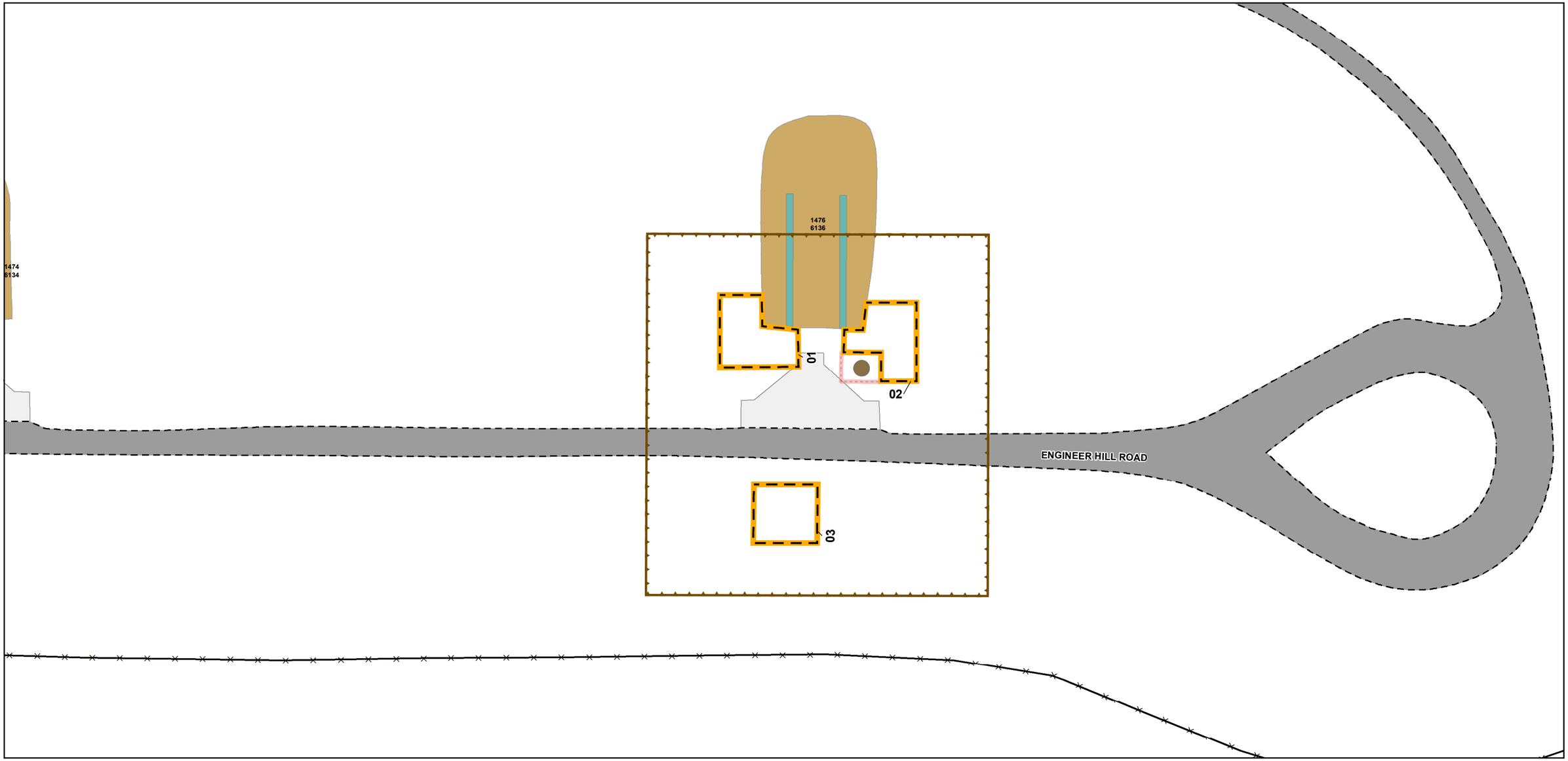
0 40 80
Feet

1:600
1 inch = 50 feet
WGS 1984 UTM Zone 6N

N

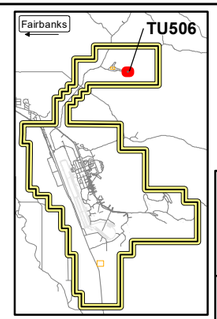
TU506
VOC AND SVOC COCS IN SOIL PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE: 29 APR 2020	PROJECT MANAGER: H. AMSKOLD	FIGURE NO: A-4.3



- Proposed Soil Land Use Control Area
- Estimated Extent of COC Contamination in Soil
- Fence
- Former Underground Storage Tank
- Excavation
- Condensate Drain
- Structure/Building
- Road Area
- Pavement Section
- Eielson AFB Boundary

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
Buildings are labeled with Building-Number above the Facility-ID, when known.



0 40 80
Feet

1:600
1 inch = 50 feet
WGS 1984 UTM Zone 6N

N

TU506
INTERIM LAND USE CONTROL
PBR AND NON-PBR SAMPLING RESULTS
EIELSON AIR FORCE BASE, ALASKA

JACOBS	DATE: 29 APR 2020	PROJECT MANAGER: H. AMSKOLD	FIGURE NO: A-4.4

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APPENDIX B
Conceptual Site Models

Human Health Conceptual Site Model
Scoping Form and Standardized Graphic

Site Name: SO065 Building 1444 (Facility 6126)/ Vehicle Operations Heated Parking

File Number:

Completed by: Jacobs Engineering

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☐ USTs
- ☐ ASTs
- ☐ Dispensers/fuel loading racks
- ☐ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☒ Other: Condensate Drains

Release Mechanisms *(check potential release mechanisms at the site)*

- ☐ Spills
- ☐ Leaks
- ☒ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☐ Subsurface soil (>2 feet bgs)
- ☐ Air
- ☐ Sediment
- ☐ Groundwater
- ☐ Surface water
- ☐ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☒ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☐ Subsistence harvester (i.e. gathers wild foods)
- ☐ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☐ Recreational user
- ☐ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

Benzo(a)pyrene, benzo(a)anthracene, dibenzo(a,h)anthracene and naphthalene and metals (chromium and thallium) exceed 1/10th of the ADEC health-based cleanup levels in surface soil.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

PAHs and metals are contaminants of concern for dermal absorption at SO065.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☐

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Incomplete

Comments:

Drinking water is not currently obtained from supply wells at Engineer Hill. Migration of contamination to groundwater is unlikely due to the depth to groundwater (>100 ft bgs).

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☐

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

There is no surface water at this source area.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☐

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Incomplete

Comments:

SO065 is located within a fenced industrial compound that is inaccessible for recreation or wildlife.

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

No volatile contaminants exceed 1/10th of the ADEC health-based cleanup levels in soil at this source area.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

No volatile contaminants exceed 1/10th of the ADEC health-based cleanup levels in soil at this source area. Groundwater has not been sampled but is not expected to be a complete pathway based on contaminant concentrations in soil. There are currently no occupied buildings on site.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. There is no surface water at this source area and due to the depth to groundwater (>100ft bgs), no dermal exposure would occur during activities such as construction.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. No volatile contaminants exceed 1/10th of the ADEC health-based cleanup levels in soil at this source area. Groundwater has not been sampled but is not expected to be a complete pathway based on contaminant concentrations in soil.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

This site is paved and landscaped with grass. The inhalation pathway is not expected to be complete, but inhalation of particulates has been calculated under the ADEC Resident Cumulative Risk Calculator for Soil (see Appendix F). The maximum detected chromium concentration at this site (37.7 mg/kg) is above both the BTV of 29 mg/kg and 1/10th of the ADEC Table B1 under 40-inch zone human health cleanup level of 3.9 mg/kg. .

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

There is no sediment at this source area.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

Metals at concentrations below established BTVs for Eielson AFB are not considered site contaminants for the purposes of this CSM and were not included in risk screening using the ADEC Cumulative Risk Evaluation tool. Although no fluvial soil is present at Engineer Hill, some of the sampled material included gravel fill that presumably originated from fluvial deposits elsewhere at Eielson AFB.

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: SO065 Building 1444 (Facility 6126)/ Vehicle Operations Heated Parking

Completed By: Jacobs Engineering

Date Completed: 2018-05-23

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1)

Check the media that could be directly affected by the release.

(2)

For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.

Media / Transport Mechanisms

Surface Soil (0-2 ft bgs) — ☑

- Direct release to surface soil — *check soil*
- ☑ *Migration to subsurface* — *check soil*
- ☐ *Migration to groundwater* — *check groundwater*
- ☑ *Volatilization* — *check air*
- ☐ *Runoff or erosion* — *check surface water*
- ☐ *Uptake by plants or animals* — *check biota*
- ☑ *Other (list):* dispersed as dust

Subsurface Soil (2-15 ft bgs) — ☐

- Direct release to subsurface soil — *check soil*
- ☐ *Migration to groundwater* — *check groundwater*
- ☐ *Volatilization* — *check air*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Ground-water — ☐

- Direct release to groundwater — *check groundwater*
- ☐ *Volatilization* — *check air*
- ☐ *Flow to surface water body* — *check surface water*
- ☐ *Flow to sediment* — *check sediment*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Surface Water — ☐

- Direct release to surface water — *check surface water*
- ☐ *Volatilization* — *check air*
- ☐ *Sedimentation* — *check sediment*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Sediment — ☐

- Direct release to sediment — *check sediment*
- ☐ *Resuspension, runoff, or erosion* — *check surface water*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

(3)

Check all exposure media identified in (2).

(4)

*Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5)

Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.

Current & Future Receptors

Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ soil	☑ Incidental Soil Ingestion	F	C/F	C/F	C/F			
	☑ Dermal Absorption of Contaminants from Soil	F	C/F	C/F	C/F			
	☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
☐ groundwater	☐ Ingestion of Groundwater							
	☐ Dermal Absorption of Contaminants in Groundwater							
	☐ Inhalation of Volatile Compounds in Tap Water							
☑ air	☐ Inhalation of Outdoor Air							
	☐ Inhalation of Indoor Air							
	☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
☐ surface water	☐ Ingestion of Surface Water							
	☐ Dermal Absorption of Contaminants in Surface Water							
	☐ Inhalation of Volatile Compounds in Tap Water							
☐ sediment	☐ Direct Contact with Sediment							
☐ biota	☐ Ingestion of Wild or Farmed Foods							

Revised, 10/01/2010

Human Health Conceptual Site Model
Scoping Form and Standardized Graphic

Site Name: SO069 BUILDING 1474 (FACILITY 6134)

File Number:

Completed by: Jacobs Engineering

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☒ USTs
- ☐ ASTs
- ☐ Dispensers/fuel loading racks
- ☐ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☒ Other: Condensate Drains

Release Mechanisms *(check potential release mechanisms at the site)*

- ☒ Spills
- ☒ Leaks
- ☒ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☐ Air
- ☐ Sediment
- ☐ Groundwater
- ☐ Surface water
- ☐ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☒ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☐ Subsistence harvester (i.e. gathers wild foods)
- ☐ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☐ Recreational user
- ☐ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

RRO and PAHs exceed 1/10th of the ADEC health-based cleanup levels in surface soil.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene are listed in Appendix B and exceed 1/10th of the ADEC health-based cleanup levels in surface soil.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☐

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Drinking water is not currently obtained from supply wells at Engineer Hill. Migration of contamination to groundwater is unlikely due to the depth to groundwater (>100 ft bgs).

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☐

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

There is no surface water present at this source area.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☐

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Incomplete

Comments:

SO069 is located within a fenced industrial compound that is inaccessible for recreation or wildlife.

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

RRO exceeds 1/10th of the ADEC health-based cleanup levels in surface soil and is listed in Appendix D. Exposure to RRO is insignificant since the site is located in a remote area behind a locked gate on Engineer Hill and short term exposure is not expected to cause effects, military escort is required to gain access to the site, and there were no RRO exceedances. RRO is limited in extent, volume, and toxicity and is not expected to cause a significant exposure threat.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

No volatile contaminants that affect the indoor air inhalation pathway exceed 1/10th of the ADEC health-based cleanup levels in soil. There are currently no occupied buildings on site.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. There is no surface water at this source area. Due to the depth to groundwater (>100ft bgs), no dermal exposure would occur during activities such as construction.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

RRO exceeds 1/10th of the ADEC health-based cleanup levels in surface soil but groundwater is not expected to be a complete pathway based on contaminant concentrations in soil. Groundwater is not currently used for household purposes.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

This site is partially paved and partially landscaped with grass. The fugitive dust inhalation pathway is not expected to be complete, but inhalation of particulates has been calculated under the ADEC Resident Cumulative Risk Calculator for Soil (see Appendix F). The maximum detected chromium concentration at this site (29.5 mg/kg) is below the BTV of 29 mg/kg but exceeds 1/10th of the ADEC Table B1 under 40-inch zone human health cleanup level of 3.9 mg/kg. .

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

There is no sediment at this source area.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

Metals at concentrations below established BTVs for Eielson AFB are not considered site contaminants for the purposes of this CSM and were not included in risk screening using the ADEC Cumulative Risk Evaluation tool. Although no fluvial soil is present at Engineer Hill, some of the sampled material included gravel fill that presumably originated from fluvial deposits elsewhere at Eielson AFB.

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: SO069 BUILDING 1474 (FACILITY 6134)

Completed By: Jacobs Engineering

Date Completed: 2018-04-18

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1)

Check the media that could be directly affected by the release.

(2)

For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.

(3)

Check all exposure media identified in (2).

(4)

*Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5)

Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.

Current & Future Receptors

Media	Transport Mechanisms	Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ Surface Soil (0-2 ft bgs)	☑ Direct release to surface soil — check soil ☑ Migration to subsurface — check soil ☐ Migration to groundwater — check groundwater ☑ Volatilization — check air ☐ Runoff or erosion — check surface water ☐ Uptake by plants or animals — check biota ☑ Other (list): dispersed as dust	☑ soil	☑ Incidental Soil Ingestion	F	C/F	C/F	C/F			
			☑ Dermal Absorption of Contaminants from Soil	F	C/F	C/F	C/F			
			☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
☑ Subsurface Soil (2-15 ft bgs)	☑ Direct release to subsurface soil — check soil ☐ Migration to groundwater — check groundwater ☑ Volatilization — check air ☐ Uptake by plants or animals — check biota ☐ Other (list):	☐ groundwater	☐ Ingestion of Groundwater							
			☐ Dermal Absorption of Contaminants in Groundwater							
			☐ Inhalation of Volatile Compounds in Tap Water							
☐ Ground-water	☐ Direct release to groundwater — check groundwater ☐ Volatilization — check air ☐ Flow to surface water body — check surface water ☐ Flow to sediment — check sediment ☐ Uptake by plants or animals — check biota ☐ Other (list):	☑ air	☑ Inhalation of Outdoor Air	I	I	I	I			
			☐ Inhalation of Indoor Air							
			☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
☐ Surface Water	☐ Direct release to surface water — check surface water ☐ Volatilization — check air ☐ Sedimentation — check sediment ☐ Uptake by plants or animals — check biota ☐ Other (list):	☐ surface water	☐ Ingestion of Surface Water							
			☐ Dermal Absorption of Contaminants in Surface Water							
			☐ Inhalation of Volatile Compounds in Tap Water							
☐ Sediment	☐ Direct release to sediment — check sediment ☐ Resuspension, runoff, or erosion — check surface water ☐ Uptake by plants or animals — check biota ☐ Other (list):	☐ sediment	☐ Direct Contact with Sediment							
		☐ biota	☐ Ingestion of Wild or Farmed Foods							

Revised, 10/01/2010

Human Health Conceptual Site Model
Scoping Form and Standardized Graphic

Site Name: SO070 – BUILDING 1826 (FACILITY 6154)/VEHICLE OPERATIONS HEATED F

File Number: 107.38.135

Completed by: Jacobs Engineering

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☐ USTs
- ☒ ASTs
- ☐ Dispensers/fuel loading racks
- ☐ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☐ Other:

Release Mechanisms *(check potential release mechanisms at the site)*

- ☒ Spills
- ☒ Leaks
- ☐ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☐ Subsurface soil (>2 feet bgs)
- ☐ Air
- ☐ Sediment
- ☐ Groundwater
- ☐ Surface water
- ☐ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☒ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☐ Subsistence harvester (i.e. gathers wild foods)
- ☐ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☐ Recreational user
- ☐ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

PAHs and metals exceed 1/10th of the ADEC health-based cleanup levels in surface soil.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Benzo(a)pyrene, benzo(a)anthracene, and other PAHs can permeate the skin and are present in surface soil.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☐

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Incomplete

Comments:

Drinking water is not currently obtained from supply wells at Engineer Hill. Contaminant migration to groundwater is unlikely due to the depth to groundwater (<100 ft bgs).

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☐

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

There is no surface water at or near the site.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☐

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Incomplete

Comments:

SO070 is located within a fenced industrial compound that is inaccessible for recreation or wildlife.

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

No volatile contaminants are present in soil.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

No volatile contaminants exceed 1/10th of the ADEC health-based cleanup levels in soil at this source area. Groundwater has not been sampled but is not expected to be a complete pathway based on contaminant concentrations in soil. There are currently no occupied buildings on site. The existing Building 6154 is scheduled to be demolished.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. There is no surface water at this source area. Due to the depth to groundwater (>100ft bgs), no dermal exposure would occur during activities such as construction.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. No volatile contaminants exceed 1/10th of the ADEC health-based cleanup levels in soil at this source area. Groundwater has not been sampled but is not expected to be a complete pathway based on contaminant concentrations in soil.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

This site is paved and landscaped with grass. The fugitive dust inhalation pathway is not expected to be complete, but inhalation of particulates has been calculated under the ADEC Resident Cumulative Risk Calculator for Soil (see Appendix F). The maximum detected chromium concentration at this site (37.1 mg/kg) is above both the BTV of 29 mg/kg and 1/10th of the ADEC Table B1 under 40-inch zone human health cleanup level of 3.9 mg/kg.

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

There is no sediment at this source area.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

Metals at concentrations below established BTVs for Eielson AFB are not considered site contaminants for the purposes of this CSM and were not included in risk screening using the ADEC Cumulative Risk Evaluation tool. Although no fluvial soil is present at Engineer Hill, some of the sampled material included gravel fill that presumably originated from fluvial deposits elsewhere at Eielson AFB.

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: SO070 – BUILDING 1826 (FACILITY 6154)/VEHICLE OPERATIONS HEAT

Completed By: Jacobs Engineering Inc

Date Completed: 2018-05-23

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1)

Check the media that could be directly affected by the release.

(2)

For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.

Media / Transport Mechanisms

Surface Soil (0-2 ft bgs) — ☑

- Direct release to surface soil — *check soil*
- ☑ *Migration to subsurface* — *check soil*
- ☐ *Migration to groundwater* — *check groundwater*
- ☐ *Volatilization* — *check air*
- ☐ *Runoff or erosion* — *check surface water*
- ☐ *Uptake by plants or animals* — *check biota*
- ☑ *Other (list):* dispersed as dust

Subsurface Soil (2-15 ft bgs) — ☐

- Direct release to subsurface soil — *check soil*
- ☐ *Migration to groundwater* — *check groundwater*
- ☐ *Volatilization* — *check air*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Ground-water — ☐

- Direct release to groundwater — *check groundwater*
- ☐ *Volatilization* — *check air*
- ☐ *Flow to surface water body* — *check surface water*
- ☐ *Flow to sediment* — *check sediment*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Surface Water — ☐

- Direct release to surface water — *check surface water*
- ☐ *Volatilization* — *check air*
- ☐ *Sedimentation* — *check sediment*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Sediment — ☐

- Direct release to sediment — *check sediment*
- ☐ *Resuspension, runoff, or erosion* — *check surface water*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

(3)

Check all exposure media identified in (2).

(4)

*Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5)

Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.

Current & Future Receptors

Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ soil	☑ Incidental Soil Ingestion	F	C/F	C/F	C/F			
	☑ Dermal Absorption of Contaminants from Soil	F	C/F	C/F	C/F			
	☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
☐ groundwater	☐ Ingestion of Groundwater							
	☐ Dermal Absorption of Contaminants in Groundwater							
	☐ Inhalation of Volatile Compounds in Tap Water							
☑ air	☐ Inhalation of Outdoor Air							
	☐ Inhalation of Indoor Air							
	☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
☐ surface water	☐ Ingestion of Surface Water							
	☐ Dermal Absorption of Contaminants in Surface Water							
	☐ Inhalation of Volatile Compounds in Tap Water							
☐ sediment	☐ Direct Contact with Sediment							
☐ biota	☐ Ingestion of Wild or Farmed Foods							

Revised, 10/01/2010

Human Health Conceptual Site Model
Scoping Form and Standardized Graphic

Site Name: Source Area SO071 BUILDING 1814 (FACILITY 6162)

File Number:

Completed by: Jacobs Engineering

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☒ USTs
- ☒ ASTs
- ☐ Dispensers/fuel loading racks
- ☐ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☒ Other: Condensate Drains

Release Mechanisms *(check potential release mechanisms at the site)*

- ☒ Spills
- ☒ Leaks
- ☒ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☐ Air
- ☐ Sediment
- ☐ Groundwater
- ☐ Surface water
- ☐ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☒ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☐ Subsistence harvester (i.e. gathers wild foods)
- ☐ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☒ Recreational user
- ☒ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

DRO, RRO, PAHs and metals exceed 1/10th of the ADEC health-based cleanup levels in surface soil.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

DRO, RRO, and PAHs exceed 1/10th of the ADEC health-based cleanup levels in surface soil.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☐

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Incomplete

Comments:

Drinking water is not currently obtained from supply wells at Engineer Hill. Migration of contamination to groundwater is unlikely due to the depth of the Groundwater (>100ft bgs).

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☐

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

There is no surface water present at this source area.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☐

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Incomplete

Comments:

This source area is located within a fenced industrial compound that is inaccessible for recreation or wildlife.

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

DRO, RRO, and napthalene exceed 1/10th of the ADEC health-based cleanup levels in surface soil and are listed in Appendix D.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Napthalene exceeds 1/10th of the ADEC health-based cleanup levels in surface soil and is listed in Appendix D. There are currently no occupied buildings at this source area; this pathway is considered complete for future receptors only.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. There is no surface water at this source area. Due to the depth to groundwater (>100ft bgs), no dermal exposure would occur during activities such as construction.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. Groundwater has not been sampled but is not expected to be a complete pathway based on contaminant concentrations in soil.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

This site is paved and landscaped with grass. The fugitive dust inhalation pathway is not expected to be complete, but inhalation of particulates has been calculated under the ADEC Resident Cumulative Risk Calculator for Soil (see Appendix F). The maximum detected chromium concentration at this site (127 mg/kg) is above both the BTV of 29 mg/kg and 1/10th of the ADEC Table B1 under 40-inch zone human health cleanup level of 3.9 mg/kg.

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

There is no sediment present at this source area.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

Metals at concentrations below established BTVs for Eielson AFB are not considered site contaminants for the purposes of this CSM and were not included in risk screening using the ADEC Cumulative Risk Evaluation tool. Although no fluvial soil is present at Engineer Hill, some of the sampled material included gravel fill that presumably originated from fluvial deposits elsewhere at Eielson AFB.

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: SO071 BUILDING 1814 (FACILITY 6162)

Completed By: Jacobs Engineering

Date Completed: 2018-05-23

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1)

Check the media that could be directly affected by the release.

(2)

For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.

(3)

Check all exposure media identified in (2).

(4)

*Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5)

Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.

Current & Future Receptors

Media	Transport Mechanisms	Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ Surface Soil (0-2 ft bgs)	☑ Direct release to surface soil — check soil	☑ soil	☑ Incidental Soil Ingestion	F	C/F	C/F	C/F			
	☑ Migration to subsurface — check soil		☑ Dermal Absorption of Contaminants from Soil	F	C/F	C/F	C/F			
	☐ Migration to groundwater — check groundwater		☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
	☑ Volatilization — check air	☐ groundwater	☐ Ingestion of Groundwater							
	☐ Runoff or erosion — check surface water		☐ Dermal Absorption of Contaminants in Groundwater							
	☐ Uptake by plants or animals — check biota		☐ Inhalation of Volatile Compounds in Tap Water							
	☑ Other (list): dispersed as dust	☑ air	☑ Inhalation of Outdoor Air	F	C/F	C/F	C/F			
☑ Subsurface Soil (2-15 ft bgs)	☑ Direct release to subsurface soil — check soil		☑ Inhalation of Indoor Air	F		F				
	☐ Migration to groundwater — check groundwater		☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
	☑ Volatilization — check air	☐ surface water	☐ Ingestion of Surface Water							
	☐ Uptake by plants or animals — check biota		☐ Dermal Absorption of Contaminants in Surface Water							
	☐ Other (list):		☐ Inhalation of Volatile Compounds in Tap Water							
☐ Ground-water	☐ Direct release to groundwater — check groundwater	☐ sediment	☐ Direct Contact with Sediment							
	☐ Volatilization — check air	☐ biota	☐ Ingestion of Wild or Farmed Foods							
	☐ Flow to surface water body — check surface water									
	☐ Flow to sediment — check sediment									
	☐ Uptake by plants or animals — check biota									
	☐ Other (list):									
☐ Surface Water	☐ Direct release to surface water — check surface water									
	☐ Volatilization — check air									
	☐ Sedimentation — check sediment									
	☐ Uptake by plants or animals — check biota									
	☐ Other (list):									
☐ Sediment	☐ Direct release to sediment — check sediment									
	☐ Resuspension, runoff, or erosion — check surface water									
	☐ Uptake by plants or animals — check biota									
	☐ Other (list):									

Revised, 10/01/2010

Human Health Conceptual Site Model
Scoping Form and Standardized Graphic

Site Name: SO073 – BUILDING 1434 (FACILITY 6164)

File Number:

Completed by: Jacobs Engineering

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☐ USTs
- ☐ ASTs
- ☐ Dispensers/fuel loading racks
- ☐ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☒ Other: Condensate Drains

Release Mechanisms *(check potential release mechanisms at the site)*

- ☐ Spills
- ☐ Leaks
- ☒ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☐ Subsurface soil (>2 feet bgs)
- ☐ Air
- ☐ Sediment
- ☐ Groundwater
- ☐ Surface water
- ☐ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☒ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☐ Subsistence harvester (i.e. gathers wild foods)
- ☐ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☒ Recreational user
- ☒ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

PAHs, naphthalene, and metals exceed 1/10th of the ADEC health-based cleanup levels in surface soil at SO073.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Naphthalene exceeds 1/10th of the ADEC health-based cleanup levels in one historic surface soil sample at SO073, but is not identified as a COC. More recent sampling did not identify napthalene above 1/ 10th ADEC Human Health criteria or stricter MTG criteria. Exposure is insignificant based on the location and limited extent of contamination at the site.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☐

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the ground-water is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Incomplete

Comments:

Drinking water is not currently obtained from supply wells at Engineer Hill. Migration to groundwater is unlikely due to the depth to groundwater (>100ft bgs).

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☐

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

There is no surface water at or near this source area.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☐

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Incomplete

Comments:

SO073 is located within a fenced industrial compound that is inaccessible for recreation or wildlife.

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Naphthalene exceeds 1/10th of the ADEC health-based cleanup levels in one historic surface soil sample at SO073, but is not identified as a COC. More recent sampling did not identify napthalene above 1/ 10th ADEC Human Health criteria or stricter MTG criteria. Exposure is insignificant based on the location and limited extent of contamination at the site.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Naphthalene exceeds 1/10th of the ADEC health-based cleanup levels in one historic surface soil sample at SO073, but is not identified as a COC. More recent sampling did not identify napthalene above 1/ 10th ADEC Human Health criteria or stricter MTG criteria. Exposure is insignificant based on the location and limited extent of contamination at the site. There are no continuously occupied buildings on site.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. There is no surface water at this source area. Due to the depth to groundwater (>100ft bgs), no dermal exposure would occur during activities such as construction.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. Groundwater has not been sampled but is not expected to be a complete pathway based on contaminant concentrations in soil.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

This site is paved and landscaped with grass. The fugitive dust inhalation pathway is not expected to be complete, but inhalation of particulates has been calculated under the ADEC Resident Cumulative Risk Calculator for Soil (see Appendix F). The maximum detected chromium concentration at this site (53.9 mg/kg) is above both the BTV of 29 mg/kg and 1/10th of the ADEC Table B1 under 40-inch zone human health cleanup level of 3.9 mg/kg.

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

There is no sediment at this source area.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

Metals at concentrations below established BTVs for Eielson AFB are not considered site contaminants for the purposes of this CSM and were not included in risk screening using the ADEC Cumulative Risk Evaluation tool. Although no fluvial soil is present at Engineer Hill, some of the sampled material included gravel fill that presumably originated from fluvial deposits elsewhere at Eielson AFB.

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: SO073 BUILDING 1434 (FACILITY 6164)

Completed By: Jacobs Engineering

Date Completed: 2018-05-23

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1) *Check the media that could be directly affected by the release.*

(2) *For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.*

(3) *Check all exposure media identified in (2).*

(4) *Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5) *Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.*

Current & Future Receptors

Media	Transport Mechanisms	Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ Surface Soil (0-2 ft bgs)	☑ Direct release to surface soil — check soil	☑ soil	☑ Incidental Soil Ingestion	F	C/F	C/F	C/F			
	☑ Migration to subsurface — check soil		☑ Dermal Absorption of Contaminants from Soil	I	I	I	I			
	☐ Migration to groundwater — check groundwater		☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
	☑ Volatilization — check air									
	☐ Runoff or erosion — check surface water									
	☐ Uptake by plants or animals — check biota									
	☑ Other (list): Dispersal as dust									
☐ Subsurface Soil (2-15 ft bgs)	☐ Direct release to subsurface soil — check soil	☐ groundwater	☐ Ingestion of Groundwater							
	☐ Migration to groundwater — check groundwater		☐ Dermal Absorption of Contaminants in Groundwater							
	☐ Volatilization — check air		☐ Inhalation of Volatile Compounds in Tap Water							
	☐ Uptake by plants or animals — check biota									
	☐ Other (list):									
☐ Ground-water	☐ Direct release to groundwater — check groundwater	☑ air	☑ Inhalation of Outdoor Air	I	I	I	I			
	☐ Volatilization — check air		☑ Inhalation of Indoor Air	I		I				
	☐ Flow to surface water body — check surface water		☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
	☐ Flow to sediment — check sediment									
	☐ Uptake by plants or animals — check biota									
	☐ Other (list):									
☐ Surface Water	☐ Direct release to surface water — check surface water	☐ surface water	☐ Ingestion of Surface Water							
	☐ Volatilization — check air		☐ Dermal Absorption of Contaminants in Surface Water							
	☐ Sedimentation — check sediment		☐ Inhalation of Volatile Compounds in Tap Water							
	☐ Uptake by plants or animals — check biota									
	☐ Other (list):									
☐ Sediment	☐ Direct release to sediment — check sediment	☐ sediment	☐ Direct Contact with Sediment							
	☐ Resuspension, runoff, or erosion — check surface water									
	☐ Uptake by plants or animals — check biota	☐ biota	☐ Ingestion of Wild or Farmed Foods							
	☐ Other (list):									

Revised, 10/01/2010

Human Health Conceptual Site Model
Scoping Form and Standardized Graphic

Site Name: SS084 Former Army Artillery Site

File Number:

Completed by: Jacobs Engineering

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☒ USTs
- ☒ ASTs
- ☐ Dispensers/fuel loading racks
- ☒ Drums
- ☐ Vehicles
- ☐ Landfills
- ☒ Transformers
- ☒ Other: Gun maintenance, anti-aircraft artillery

Release Mechanisms *(check potential release mechanisms at the site)*

- ☒ Spills
- ☒ Leaks
- ☒ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☒ Air
- ☐ Sediment
- ☒ Groundwater
- ☐ Surface water
- ☒ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☒ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☒ Subsistence harvester (i.e. gathers wild foods)
- ☒ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☒ Recreational user
- ☐ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

GRO, DRO, RRO, 1,2,4-TMB, 1,3,5-TMB, 1-methylnapthalene, 2-methylnaphthalene, PAHs, naphthalene, n-butylbenzene and metals (antimony, arsenic, cadmium, chromium, lead, and mercury) exceed 1/10th of the ADEC health-based cleanup levels in soil between 0 and 15 feet bgs.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

1-methylnapthalene, 2-methylnaphthalene, PAHs, naphthalene and metals (arsenic and cadmium) exceed 1/10th of the ADEC health-based cleanup levels in soil between 0 and 15 feet bgs and are compounds of concern for dermal exposure.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☒

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

DRO, GRO, RRO, 1,2,4-TMB, 1,3,5-TMB, 1,1,2,2-tetrachloroethane, 1-methylnapthalene, 2-methylnaphthalene, naphthalene, 2-hexanone, 4-methylphenol, bis(2ethylhexyl)phthalate, ethylbenzene, xylenes and metals (antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, and vanadium) exceed 1/10th of the ADEC cleanup levels in unfiltered groundwater.

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☐

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

There is no surface water present at this source area.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☒

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Complete

Comments:

Site SS084 is a large wooded area. PAHs and metals (arsenic, cadmium, coper, lead, and mercury) exceed 1/10th of the ADEC health-based cleanup levels in soil. A screening level ecological risk assessment and baseline ecological risk assessment were completed for SS084.

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Volatile compounds (1,2,4-TMB, 1,3,5-TMB, 1-methylnapthalene, 2-methylnaphthalene, naphthalene, n-butylbenzene) exceed 1/10th of the ADEC health-based cleanup levels in soil and are volatile.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Volatile contaminants are present in soil and groundwater. There are no buildings at this source area. This pathway is complete for future receptors only.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Dermal exposure to contaminants in groundwater could potentially occur during construction activities. Water at SS084 is not currently used for household purposes. There is no surface water at this source area.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

There are no buildings at this source area. This pathway is complete for future receptors only.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

This site is forested. The fugitive dust inhalation pathway is not expected to be complete, but inhalation of particulates has been calculated under the ADEC Resident Cumulative Risk Calculator for Soil (see Appendix F). The maximum detected chromium concentration at this site (130 mg/kg) is above both the BTV of 29 mg/kg and 1/10th of the ADEC Table B1 under 40-inch zone human health cleanup level of 3.9 mg/kg.

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Sediment is not present at this source area.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

Metals at concentrations below established BTVs for Eielson AFB are not considered site contaminants for the purposes of this CSM and were not included in risk screening using the ADEC Cumulative Risk Evaluation tool.

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: SS084 FORMER ARMY ARTILLERY SITE

Completed By: Jacobs Engineering

Date Completed: 2018-05-23

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1) *Check the media that could be directly affected by the release.*

(2) *For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.*

Media	Transport Mechanisms	
☑ Surface Soil (0-2 ft bgs)	☑ Direct release to surface soil	check soil
	☑ Migration to subsurface	check soil
	☑ Migration to groundwater	check groundwater
	☑ Volatilization	check air
	☐ Runoff or erosion	check surface water
	☑ Uptake by plants or animals	check biota
	☐ Other (list):	
☑ Subsurface Soil (2-15 ft bgs)	☑ Direct release to subsurface soil	check soil
	☑ Migration to groundwater	check groundwater
	☑ Volatilization	check air
	☑ Uptake by plants or animals	check biota
	☐ Other (list):	
☑ Ground-water	☑ Direct release to groundwater	check groundwater
	☑ Volatilization	check air
	☐ Flow to surface water body	check surface water
	☐ Flow to sediment	check sediment
	☑ Uptake by plants or animals	check biota
	☐ Other (list):	
☐ Surface Water	☐ Direct release to surface water	check surface water
	☐ Volatilization	check air
	☐ Sedimentation	check sediment
	☐ Uptake by plants or animals	check biota
	☐ Other (list):	
☐ Sediment	☐ Direct release to sediment	check sediment
	☐ Resuspension, runoff, or erosion	check surface water
	☐ Uptake by plants or animals	check biota
	☐ Other (list):	

(3) *Check all exposure media identified in (2).*

(4) *Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5) *Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.*

Current & Future Receptors

Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ soil	☑ Incidental Soil Ingestion	F	C/F	C/F	C/F	C/F		
	☑ Dermal Absorption of Contaminants from Soil	F	C/F	C/F	C/F	C/F		
	☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F	C/F		
☑ groundwater	☑ Ingestion of Groundwater	F	F	F				
	☑ Dermal Absorption of Contaminants in Groundwater	F	F	F	C/F			
	☑ Inhalation of Volatile Compounds in Tap Water	F						
☑ air	☑ Inhalation of Outdoor Air	F	C/F	C/F	C/F	C/F		
	☑ Inhalation of Indoor Air	F		F				
	☑ Inhalation of Fugitive Dust	C/F	C/F	C/F	C/F	C/F		
☐ surface water	☐ Ingestion of Surface Water							
	☐ Dermal Absorption of Contaminants in Surface Water							
	☐ Inhalation of Volatile Compounds in Tap Water							
☐ sediment	☐ Direct Contact with Sediment							
☑ biota	☑ Ingestion of Wild or Farmed Foods						C/F	

Revised, 10/01/2010

Human Health Conceptual Site Model
Scoping Form and Standardized Graphic

Site Name: TU506 BUILDING 1476 (FACILITY 6136)

File Number:

Completed by: Jacobs Engineering

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☒ USTs
- ☐ ASTs
- ☐ Dispensers/fuel loading racks
- ☐ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☐ Other:

Release Mechanisms *(check potential release mechanisms at the site)*

- ☐ Spills
- ☒ Leaks
- ☐ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☐ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☐ Air
- ☐ Sediment
- ☐ Groundwater
- ☐ Surface water
- ☐ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☒ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☐ Subsistence harvester (i.e. gathers wild foods)
- ☐ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☒ Recreational user
- ☒ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

PAHs and metals exceed 1/10th of the ADEC health-based cleanup levels in surface soil.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

PAHs and metals exceed 1/10th of the ADEC health-based cleanup levels in surface soil.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☐

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Drinking water is not currently obtained from supply wells at Engineer Hill. Migration of contamination to groundwater is unlikely as the water table is located in excess of 100 ft bgs.

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☐

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

There is no surface water present at this source area.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☐

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Incomplete

Comments:

TU076 is located within a fenced industrial compound that is inaccessible for recreation or wildlife.

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Napthalene exceeds 1/10th of the ADEC health-based cleanup levels in surface soil.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

There are no continuously occupied buildings present at this source area. Napthalene exceeds 1/10th of the ADEC health-based cleanup levels in surface soil. There are currently no occupied buildings on site; this pathway is complete for future receptors only.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. There is no surface water at this source area and due to the depth of groundwater (>100ft bgs) it is unlikely that exposure would occur during activities such as construction.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater is not currently used for household purposes. Groundwater has not been sampled but is not expected to be a complete pathway based on contaminant concentrations in soil.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

This site is partially paved and landscaped with grass and vegetation. The fugitive dust inhalation pathway is not expected to be complete, but inhalation of particulates has been calculated under the ADEC Resident Cumulative Risk Calculator for Soil (see Appendix F). The maximum detected chromium concentration at this site (37.1 mg/kg) is above both the BTV of 29 mg/kg and 1/10th of the ADEC Table B1 under 40-inch zone human health cleanup level of 3.9 mg/kg.

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

There is no sediment present at this source area.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

Metals at concentrations below established BTVs for Eielson AFB are not considered site contaminants for the purposes of this CSM and were not included in risk screening using the ADEC Cumulative Risk Evaluation tool. Although no fluvial soil is present at Engineer Hill, some of the sampled material included gravel fill that presumably originated from fluvial deposits elsewhere at Eielson AFB.

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: TU506 BUILDING 1476 (FACILITY 6136)

Completed By: Jacobs Engineering

Date Completed: 2018-05-23

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1)

Check the media that could be directly affected by the release.

(2)

For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.

(3)

Check all exposure media identified in (2).

(4)

*Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5)

Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.

Current & Future Receptors

Media	Transport Mechanisms	Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ Surface Soil (0-2 ft bgs)	☑ Direct release to surface soil — check soil	☑ soil	☑ Incidental Soil Ingestion	F	C/F	C/F	C/F			
	☑ Migration to subsurface — check soil		☑ Dermal Absorption of Contaminants from Soil	F	C/F	C/F	C/F			
	☐ Migration to groundwater — check groundwater		☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
	☑ Volatilization — check air									
	☐ Runoff or erosion — check surface water									
	☐ Uptake by plants or animals — check biota									
	☑ Other (list): dispersed as dust									
☑ Subsurface Soil (2-15 ft bgs)	☑ Direct release to subsurface soil — check soil									
	☐ Migration to groundwater — check groundwater									
	☑ Volatilization — check air									
	☐ Uptake by plants or animals — check biota									
	☐ Other (list):									
☐ Ground-water	☐ Direct release to groundwater — check groundwater	☐ groundwater	☐ Ingestion of Groundwater							
	☐ Volatilization — check air		☐ Dermal Absorption of Contaminants in Groundwater							
	☐ Flow to surface water body — check surface water		☐ Inhalation of Volatile Compounds in Tap Water							
	☐ Flow to sediment — check sediment									
	☐ Uptake by plants or animals — check biota									
	☐ Other (list):									
☐ Surface Water	☐ Direct release to surface water — check surface water	☑ air	☑ Inhalation of Outdoor Air	F	C/F	C/F	C/F			
	☐ Volatilization — check air		☑ Inhalation of Indoor Air	F		F				
	☐ Sedimentation — check sediment		☑ Inhalation of Fugitive Dust	F	C/F	C/F	C/F			
	☐ Uptake by plants or animals — check biota									
	☐ Other (list):									
☐ Sediment	☐ Direct release to sediment — check sediment	☐ surface water	☐ Ingestion of Surface Water							
	☐ Resuspension, runoff, or erosion — check surface water		☐ Dermal Absorption of Contaminants in Surface Water							
	☐ Uptake by plants or animals — check biota		☐ Inhalation of Volatile Compounds in Tap Water							
	☐ Other (list):	☐ sediment	☐ Direct Contact with Sediment							
		☐ biota	☐ Ingestion of Wild or Farmed Foods							

Revised, 10/01/2010

APPENDIX C
Cumulative Risk Evaluations

(Based On 2018 ADEC Cleanup Levels)

Decision Document for PBR Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506
Table C-1 Soil Maximum Detections

SCR	Source Area	Analyte	Result (mg/kg)	PSL (mg/kg)	ADEC HH (mg/kg)	BTV (mg/kg)	Sample ID	Year	Sample Date	Exceeds PSL?	Exceeds HH/10?	Exceeds BTV?	COPC? (Exceeds PSL or HH/10)	Included in CRE? (Exceeds HH/10 and BTV)
1	SO065	Benzo(a)anthracene	**1.63 J**	0.7	14	-	EIC507DP002SO01-01	2012	6/24/2012	Yes	Yes	-	Yes	Yes
1	SO065	Benzo(a)pyrene	**1.84**	1.5	1.5	-	EIC507DP002SO01-01	2012	6/24/2012	Yes	Yes	-	Yes	Yes
1	SO065	Benzo(b)fluoranthene	1.92	15	15	-	EIC507DP002SO01-01	2012	6/24/2012	No	Yes	-	Yes	Yes
1	SO065	Dibenzo(a,h)anthracene	0.22	1.5	1.5	-	16E-SO065SS05-00	2016	7/21/2016	No	Yes	-	Yes	Yes
1	SO065	Chromium	**37.7**	0.089	3.9	29.03	16E-SO065SS02-00	2016	7/21/2016	Yes	Yes	Yes	Yes	Yes
1	SO065	Thallium	**2.1 J**	0.19	1	-	EIC507DP003SO01-10	2012	6/24/2012	Yes	Yes	-	Yes	Yes
1	SO069	RRO	1500	10000	10000	-	EIC509DP001SO01-01	2012	6/27/2012	No	Yes	-	Yes	Yes
1	SO069	Benzo(a)pyrene	1.28 J	1.5	1.5	-	EIC509DP001SO01-01	2012	6/27/2012	No	Yes	-	Yes	Yes
1	SO069	Manganese	**602**	370	2700	557.7	EIC509DP001SO01-20	2012	6/27/2012	Yes	Yes	Yes	Yes	Yes
1	SO069	Thallium	**1.75 J**	0.19	1	-	EIC509DP001SO01-10	2012	6/27/2012	Yes	Yes	-	Yes	Yes
1	SO070	Benzo(a)pyrene	1.1	1.5	1.5	-	15E-SO070SS03	2015	7/23/2015	No	Yes	-	Yes	Yes
1	SO070	Benzo(a)pyrene	1.1	1.5	1.5	-	15E-SO070SS09-0.5	2015	10/7/2015	No	Yes	-	Yes	Yes
1	SO070	Dibenzo(a,h)anthracene	0.16	1.5	1.5	-	15E-SO070SS03	2015	7/23/2015	No	Yes	-	Yes	Yes
1	SO070	Arsenic	**90.6**	0.2	8.8	23.54	EIC510DP001SO01-31	2012	6/21/2012	Yes	Yes	Yes	Yes	Yes
1	SO070	Chromium	**37.1**	0.089	3.9	29.03	EIC510DP002SO01-02	2012	6/21/2012	Yes	Yes	Yes	Yes	Yes
1	SO070	Thallium	**1.22 J**	0.19	1	-	EIC510DP002SO01-01	2012	6/21/2012	Yes	Yes	-	Yes	Yes
1	SO070	Vanadium	59	510	510	58.2	EIC510DP002SO01-02	2012	6/21/2012	No	Yes	Yes	Yes	Yes
1	SO071	DRO	**1400 JD**	250	10250	-	16E-SO071SS03-009	2016	7/21/2016	Yes	Yes	-	Yes	Yes
1	SO071	RRO	4700 JD	10000	10000	-	16E-SO071SS03-009	2016	7/21/2016	No	Yes	-	Yes	Yes
1	SO071	Benzo(a)anthracene	**12 JD**	0.7	14	-	16E-SO071SB07-009	2016	9/26/2016	Yes	Yes	-	Yes	Yes
1	SO071	Benzo(a)pyrene	**13 JL+,JD**	1.5	1.5	-	16E-SO071SB07-009	2016	9/26/2016	Yes	Yes	-	Yes	Yes
1	SO071	Benzo(b)fluoranthene	14 JD	15	15	-	16E-SO071SB07-009	2016	9/26/2016	No	Yes	-	Yes	Yes
1	SO071	Dibenzo(a,h)anthracene	**2 JL+,JD**	1.5	1.5	-	16E-SO071SB07-009	2016	9/26/2016	Yes	Yes	-	Yes	Yes
1	SO071	Indeno(1,2,3-cd)pyrene	6 JD	15	15	-	16E-SO071SB07-009	2016	9/26/2016	No	Yes	-	Yes	Yes
1	SO071	Naphthalene	**13 JD**	0.038	29	-	16E-SO071SB07-009	2016	9/26/2016	Yes	Yes	-	Yes	Yes
1	SO071	Antimony	**6.04**	4.6	41	1.175	16E-SO071SS01-00	2016	7/21/2016	Yes	Yes	Yes	Yes	Yes
1	SO071	Arsenic	**36.2**	0.2	8.8	23.54	EIC511DP003SO01-10	2012	6/23/2012	Yes	Yes	Yes	Yes	Yes
1	SO071	Chromium	**127 J**	0.089	3.9	29.03	EIC511DP002SO01-02	2012	6/23/2012	Yes	Yes	Yes	Yes	Yes
1	SO071	Lead	71.1	400	400	12.32	17E-SO071OTFLL	2017	7/17/2017	No	Yes	Yes	Yes	Yes
1	SO071	Thallium	**2.7 J**	0.19	1	-	EIC511DP003SO01-10	2012	6/23/2012	Yes	Yes	-	Yes	Yes
1	SO071	Vanadium	137	510	510	58.2	EIC511DP003SO01-10	2012	6/23/2012	No	Yes	Yes	Yes	Yes
1	SO073	Benzo(a)anthracene	**5.77**	0.7	14	-	EIC514DP002SO01-01	2012	6/23/2012	Yes	Yes	-	Yes	Yes
1	SO073	Benzo(a)pyrene	**6.81**	1.5	1.5	-	EIC514DP002SO01-01	2012	6/23/2012	Yes	Yes	-	Yes	Yes
1	SO073	Benzo(b)fluoranthene	7.24	15	15	-	EIC514DP002SO01-01	2012	6/23/2012	No	Yes	-	Yes	Yes
1	SO073	Indeno(1,2,3-cd)pyrene	3.66	15	15	-	EIC514DP002SO01-01	2012	6/23/2012	No	Yes	-	Yes	Yes
1	SO073	Naphthalene	**5.4**	0.038	29	-	EIC514DP002SO01-01	2012	6/23/2012	Yes	Yes	-	Yes	Yes
1	SO073	Chromium	**53.9**	0.089	3.9	29.03	EIC514DP003SO01-02	2012	6/23/2012	Yes	Yes	Yes	Yes	Yes
1	SO073	Thallium	**2.7 J**	0.19	1	-	EIC514DP003SO01-02	2012	6/23/2012	Yes	Yes	-	Yes	Yes
1	SS084	GRO	**8900**	300	1400	-	15E-SS084SB24-03	2015	9/23/2015	Yes	Yes	-	Yes	Yes
1	SS084	DRO	**26000**	250	10250	-	15E-SS084SB05-019	2015	7/21/2015	Yes	Yes	-	Yes	Yes
1	SS084	DRO	**26000**	250	10250	-	15E-SS084SB09-05	2015	7/17/2015	Yes	Yes	-	Yes	Yes
1	SS084	DRO	**26000**	250	10250	-	15E-SS084SB16-04	2015	7/21/2015	Yes	Yes	-	Yes	Yes
1	SS084	RRO	3600	10000	10000	-	A1-SS01-1.0	2013	8/20/2013	No	Yes	-	Yes	Yes
1	SS084	n-Butylbenzene	3.1	20	20	-	15E-SS084SB16-04	2015	7/21/2015	No	Yes	-	Yes	Yes
1	SS084	1,2,4-TMB	**13**	0.61	43	-	15E-SS084SB16-04	2015	7/21/2015	Yes	Yes	-	Yes	Yes
1	SS084	1,3,5-TMB	**5.8**	0.66	37	-	15E-SS084SB16-04	2015	7/21/2015	Yes	Yes	-	Yes	Yes
1	SS084	Benzo(a)anthracene	**2.1**	0.7	14	-	A1-SS01-1.0	2013	8/20/2013	Yes	Yes	-	Yes	Yes

Decision Document for PBR Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506
Table C-1 Soil Maximum Detections

SCR	Source Area	Analyte	Result (mg/kg)	PSL (mg/kg)	ADEC HH (mg/kg)	BTV (mg/kg)	Sample ID	Year	Sample Date	Exceeds PSL?	Exceeds HH/10?	Exceeds BTV?	COPC? (Exceeds PSL or HH/10)	Included in CRE? (Exceeds HH/10 and BTV)
1	SS084	Benzo(a)pyrene	**3.5 J**	1.5	1.5	-	A1-SS01-1.0	2013	8/20/2013	Yes	Yes	-	Yes	Yes
1	SS084	Benzo(b)fluoranthene	2 J	15	15	-	A1-SS01-1.0	2013	8/20/2013	No	Yes	-	Yes	Yes
1	SS084	Dibenzo(a,h)anthracene	0.53 J	1.5	1.5	-	A1-SS01-1.0	2013	8/20/2013	No	Yes	-	Yes	Yes
1	SS084	1-Methylnaphthalene	**39**	0.41	68	-	15E-SS084SB16-04	2015	7/21/2015	Yes	Yes	-	Yes	Yes
1	SS084	2-Methylnaphthalene	**44**	1.3	310	-	15E-SS084SB16-04	2015	7/21/2015	Yes	Yes	-	Yes	Yes
1	SS084	Naphthalene	**12**	0.038	29	-	15E-SS084SB09-05	2015	7/17/2015	Yes	Yes	-	Yes	Yes
1	SS084	Antimony	**16**	4.6	41	1.175	A1-SS01-1.0	2013	8/20/2013	Yes	Yes	Yes	Yes	Yes
1	SS084	Arsenic	**36.8**	0.2	8.8	23.54	15E-SS084SB17-05	2015	7/21/2015	Yes	Yes	Yes	Yes	Yes
1	SS084	Cadmium	**11**	9.1	92	0.303	A1-SS01-1.0	2013	8/20/2013	Yes	Yes	Yes	Yes	Yes
1	SS084	Chromium	**130**	0.089	3.9	29.03	A1-SS01-1.0	2013	8/20/2013	Yes	Yes	Yes	Yes	Yes
1	SS084	Lead	**1200**	400	400	12.32	A1-SS01-1.0	2013	8/20/2013	Yes	Yes	Yes	Yes	Yes
1	SS084	Manganese	**1100**	370	2700	557.7	A1-SS01-1.0	2013	8/20/2013	Yes	Yes	Yes	Yes	Yes
1	SS084	Mercury	**2.6**	0.36	3.1	0.0411	A1-SS01-1.0	2013	8/20/2013	Yes	Yes	Yes	Yes	Yes
1	TU506	Benzo(a)anthracene	**6.25**	0.7	14	-	EIC506DP001SO01-01	2012	6/26/2012	Yes	Yes	-	Yes	Yes
1	TU506	Benzo(a)pyrene	**6.8**	1.5	1.5	-	16E-TU506SS04-00	2016	7/21/2016	Yes	Yes	-	Yes	Yes
1	TU506	Benzo(b)fluoranthene	7.1	15	15	-	16E-TU506SS04-00	2016	7/21/2016	No	Yes	-	Yes	Yes
1	TU506	Dibenzo(a,h)anthracene	1	1.5	1.5	-	16E-TU506SS04-00	2016	7/21/2016	No	Yes	-	Yes	Yes
1	TU506	Indeno(1,2,3-cd)pyrene	3.34	15	15	-	EIC506DP001SO01-01	2012	6/26/2012	No	Yes	-	Yes	Yes
1	TU506	Naphthalene	**14.8**	0.038	29	-	EIC506DP001SO01-01	2012	6/26/2012	Yes	Yes	-	Yes	Yes
1	TU506	Chromium	**37.1**	0.089	3.9	29.03	16E-TU506SB07-00	2016	7/21/2016	Yes	Yes	Yes	Yes	Yes
1	TU506	Thallium	**1.09 J**	0.19	1	-	EIC506DP003SO01-10	2012	6/27/2012	Yes	Yes	-	Yes	Yes

Notes:

Bold = Exceeds PSL

= Exceeds 1/10 HH

For definitions, refer to the Acronyms and Abbreviations section in the DD.

Data Qualifiers

J = The analyte was positively identified; however, the associated result was less than the limit of quantitation but greater than or equal to the detection limits.

JD = The result is estimated based on the relative percent difference between the primary sample and the field duplicate sample.

JL+ = The result is potentially biased high based on a greater recovery than the UCL.

Decision Document for PBR Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506
Table C-2 Groundwater Maximum Detections

SCR	Source Area	Result (µg/L)	Analyte	Result (mg/L)	PSL/ ADEC HH (mg/L)	BTV (mg/L)	Sample ID	Year	Sample Date	Exceeds PSL/ ADEC HH?	Exceeds HH/10?	Exceeds BTV?	COPC? (Exceeds HH/10)	Included in CRE? (Exceeds HH/10 and BTV)
1	SS084	970	GRO	0.97	2.2	-	15E-SS084TW09	2015	7/17/2015	No	Yes	-	Yes	Yes
1	SS084	180000	DRO	**180**	1.5	-	15E-SS084TW06	2015	7/21/2015	Yes	Yes	-	Yes	Yes
1	SS084	8700	RRO	**8.7**	1.1	-	15E-SS084TW06	2015	7/21/2015	Yes	Yes	-	Yes	Yes
1	SS084	18	Ethylbenzene	**0.018**	0.015	-	15E-SS084TW09	2015	7/17/2015	Yes	Yes	-	Yes	Yes
1	SS084	4.8	2-Hexanone	0.0048 J	0.038	-	15E-SS084TW01	2015	7/21/2015	No	Yes	-	Yes	Yes
1	SS084	3.2	1,1,2,2-Tetrachloroethane	**0.0032 JM+, JD**	0.00076	-	15E-SS084TW08	2015	7/18/2015	Yes	Yes	-	Yes	Yes
1	SS084	120	1,2,4-TMB	**0.12**	0.056	-	15E-SS084TW09	2015	7/17/2015	Yes	Yes	-	Yes	Yes
1	SS084	34	1,3,5-TMB	0.034	0.06	-	15E-SS084TW09	2015	7/17/2015	No	Yes	-	Yes	Yes
1	SS084	51	Xylenes	0.051	0.19	-	15E-SS084TW09	2015	7/17/2015	No	Yes	-	Yes	Yes
1	SS084	53	bis(2-Ethylhexyl)phthalate	0.053	0.056	-	15E-SS084TW07	2015	7/21/2015	No	Yes	-	Yes	Yes
1	SS084	99	1-Methylnaphthalene	**0.099**	0.011	-	15E-SS084TW09	2015	7/17/2015	Yes	Yes	-	Yes	Yes
1	SS084	81	2-Methylnaphthalene	**0.081**	0.036	-	15E-SS084TW09	2015	7/17/2015	Yes	Yes	-	Yes	Yes
1	SS084	220	4-Methylphenol	0.22	1.9	-	15E-SS084TW06	2015	7/21/2015	No	Yes	-	Yes	Yes
1	SS084	200	Naphthalene	**0.2**	0.0017	-	15E-SS084TW09	2015	7/17/2015	Yes	Yes	-	Yes	Yes
1	SS084	3.57	Antimony	0.00357	0.0078	0.00059	15E-SS084TW09	2015	7/17/2015	No	Yes	Yes	Yes	Yes
1	SS084	57.7	Arsenic	**0.0577**	0.00052	0.0054	15E-SS084TW06	2015	7/21/2015	Yes	Yes	Yes	Yes	Yes
1	SS084	448	Barium	0.448	3.8	0.18	15E-SS084TW06	2015	7/21/2015	No	Yes	Yes	Yes	Yes
1	SS084	1.55	Cadmium	0.00155	0.0092	0.00023	15E-SS084TW09	2015	7/17/2015	No	Yes	Yes	Yes	Yes
1	SS084	27.1	Chromium	**0.0271**	0.00035	-	15E-SS084TW11	2015	7/21/2015	Yes	Yes	-	Yes	Yes
1	SS084	113	Copper	0.113	0.8	0.0025	15E-SS084TW03	2015	7/21/2015	No	Yes	Yes	Yes	Yes
1	SS084	28.5	Lead	**0.0285**	0.015	0.00037	15E-SS084TW09	2015	7/17/2015	Yes	Yes	Yes	Yes	Yes
1	SS084	22200	Manganese	**22.2**	0.43	3	15E-SS084TW06	2015	7/21/2015	Yes	Yes	Yes	Yes	Yes
1	SS084	0.203	Mercury	0.000203 J	0.00052	-	15E-SS084TW01	2015	7/21/2015	No	Yes	-	Yes	Yes
1	SS084	65.7	Nickel	0.0657	0.39	0.0075	15E-SS084TW06	2015	7/21/2015	No	Yes	Yes	Yes	Yes
1	SS084	0.197	Thallium	0.000197 J	0.0002	-	15E-SS084TW11	2015	7/21/2015	No	Yes	-	Yes	Yes
1	SS084	40.7	Vanadium	0.0407	0.086	0.005	15E-SS084TW11	2015	7/21/2015	No	Yes	Yes	Yes	Yes

Notes:

Bold = Exceeds PSL

= Exceeds 1/10 HH

For definitions, refer to the Acronyms and Abbreviations section in the DD.

Data Qualifiers

J = The analyte was positively identified; however, the associated result was less than the limit of quantitation but greater than or equal to the detection limits.

JD = The result is estimated based on the relative percent difference between the primary sample and the field duplicate sample.

JM+ = The result was an estimated value because the analyte failed recovery criteria in the matrix spike or matrix spike duplicate sample, or both. Results were biased high because the recovery was greater than the UCL. The qualifier was applied to positive detections in the parent sample.

Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{resc} (exposure duration - resident) yr	26
ED_{resc} (exposure duration - child) yr	6
ED_{resa} (exposure duration - adult) yr	20
ET_{resc} (exposure time - resident) hr/day	24
ET_{resc} (exposure time - child) hr/day	24
ET_{resa} (exposure time - adult) hr/day	24
BW_{resa} (body weight - adult) kg	80
BW_{resc} (body weight - child) kg	15
SA_{resa} (skin surface area - adult) cm^2/day	6032
SA_{resc} (skin surface area - child) cm^2/day	2373
LT (lifetime - resident) yr	70
$EF_{resc<40"}$ (exposure frequency - resident) day/yr	270
$EF_{resc<40"}$ (exposure frequency - child) day/yr	270
$EF_{resa<40"}$ (exposure frequency - adult) day/yr	270
IRS_{resa} (soil intake rate - adult) mg/day	100
IRS_{resc} (soil intake rate - child) mg/day	200
AF_{resa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{resc} (skin adherence factor - child) mg/cm^2	0.2
$IFS_{resc<40"-adj}$ (age-adjusted soil ingestion factor) mg/kg	28350
$DFS_{resc<40"-adj}$ (age-adjusted soil dermal factor) mg/kg	79758
$IFSM_{resc<40"-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	128700
$DFSM_{resc<40"-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	330372
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-26} (skin adherence factor) mg/cm^2	0.07
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	80
BW_{16-26} (body weight) kg	80
ED_{0-2} (exposure duration) yr	2
ED_{2-6} (exposure duration) yr	4

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{6-16} (exposure duration) yr	10
ED_{16-26} (exposure duration) yr	10
$EF_{0-2<40"}$ (exposure frequency) day/yr	270
$EF_{2-6<40"}$ (exposure frequency) day/yr	270
$EF_{6-16<40"}$ (exposure frequency) day/yr	270
$EF_{16-26<40"}$ (exposure frequency) day/yr	270
ET_{0-2} (exposure time) hr/day	24
ET_{2-6} (exposure time) hr/day	24
ET_{6-16} (exposure time) hr/day	24
ET_{16-26} (exposure time) hr/day	24
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-26} (soil intake rate) mg/day	100
SA_{0-2} (skin surface area) cm^2/day	2373
SA_{2-6} (skin surface area) cm^2/day	2373
SA_{6-16} (skin surface area) cm^2/day	6032
SA_{16-26} (skin surface area) cm^2/day	6032
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
PEF (particulate emission factor) m^3/kg	1.36E+09
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependent on U_m/U_t) unitless	0.194
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
foc (fraction organic carbon in soil) g/g	0.001
p_b (dry soil bulk density) g/cm^3	1.5

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
p_s (soil particle density) g/cm ^{3}	2.65
θ $_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15
θ $_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396
n (total soil porosity) L_{pore}/L_{soil}	0.43396
T (exposure interval) s	819936000
A (VF Dispersion Constant)	16.2302
B (VF Dispersion Constant)	18.7762
C (VF Dispersion Constant)	216.108

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Mutagen?	Volatile?	Chronic RfD (mg/kg-day)	Chronic RfD Ref	Chronic RfC (mg/m^3)	Chronic RfC Ref	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	IUR Ref	GIABS	ABS	MW	ρ (g/cm^3)
Benz[a]anthracene (56-55-3)	Yes	Yes	-		-		1.00E-01	W	6.00E-05	W	1	0.13	228.3	1.27E+00
Benzo[a]pyrene (50-32-8)	Yes	No	3.00E-04	I	2.00E-06	I	1.00E+00	I	6.00E-04	I	1	0.13	252.32	-
Benzo[b]fluoranthene (205-99-2)	Yes	No	-		-		1.00E-01	W	6.00E-05	W	1	0.13	252.32	-
Chromium(III), Insoluble Salts (16065-83-1)	No	No	1.50E+00	I	-		-		-		0.013	-	52	5.22E+00
Dibenz[a,h]anthracene (53-70-3)	Yes	No	-		-		1.00E+00	W	6.00E-04	W	1	0.13	278.36	-
Thallium (Soluble Salts) (7440-28-0)	No	No	1.00E-05	S	-		-		-		1	-	204.38	1.18E+01
**Total Risk/HI*			-		-		-		-		-	-	-	-

Output generated 19AUG2019:19:41:33

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	H`	Volatilization Factor (m^3/kg)	K_{oc} (cm^3/g)	K_d (cm^3/g)	Particulate Emission Factor (m^3/kg)	RBA	Concentration (mg/kg)	Ingestion Noncarcinogenic CDI Child
Benz[a]anthracene (56-55-3)	2.61E-02	6.75E-06	4.91E-04	2.48E+06	1.77E+05	1.77E+02	1.36E+09	1.00E+00	1.63E+00	-
Benzo[a]pyrene (50-32-8)	4.76E-02	5.56E-06	1.87E-05	-	5.87E+05	-	1.36E+09	1.00E+00	1.84E+00	1.81E-05
Benzo[b]fluoranthene (205-99-2)	4.76E-02	5.56E-06	2.69E-05	-	5.99E+05	-	1.36E+09	1.00E+00	1.92E+00	-
Chromium(III), Insoluble Salts (16065-83-1)	-	-	-	-	-	1.80E+06	1.36E+09	1.00E+00	3.77E+01	3.72E-04
Dibenz[a,h]anthracene (53-70-3)	4.46E-02	5.21E-06	5.76E-06	-	1.91E+06	-	1.36E+09	1.00E+00	2.20E-01	-
Thallium (Soluble Salts) (7440-28-0)	-	-	-	-	-	7.10E+01	1.36E+09	1.00E+00	2.10E+00	2.07E-05
**Total Risk/HI*	-	-	-	-	-	-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation Noncarcinogenic (Volatiles) CDI Child	Inhalation Noncarcinogenic (Particulates) CDI Child	Dermal Noncarcinogenic CDI Child	Ingestion Carcinogenic CDI	Inhalation (Volatiles) Carcinogenic CDI	Inhalation (Particulates) Carcinogenic CDI	Dermal Carcinogenic CDI	Ingestion HI Child
Benz[a]anthracene (56-55-3)	-	-	-	8.21E-06	5.01E-04	9.12E-07	2.74E-06	-
Benzo[a]pyrene (50-32-8)	-	1.00E-09	5.60E-06	9.27E-06	-	1.03E-06	3.09E-06	6.05E-02
Benzo[b]fluoranthene (205-99-2)	-	-	-	9.67E-06	-	1.07E-06	3.23E-06	-
Chromium(III), Insoluble Salts (16065-83-1)	-	-	-	-	-	-	-	2.48E-04
Dibenz[a,h]anthracene (53-70-3)	-	-	-	1.11E-06	-	1.23E-07	3.70E-07	-
Thallium (Soluble Salts) (7440-28-0)	-	-	-	-	-	-	-	2.07E+00
**Total Risk/HI*	-	-	-	-	-	-	-	*2.13E+00*

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation (Volatiles) HI Child	Inhalation (Particulates) HI Child	Dermal HI Child	Noncarcinogenic HI Child	Ingestion Risk	Inhalation (Volatiles) Risk	Inhalation (Particulates) Risk	Dermal Risk	Carcinogenic Risk
Benz[a]anthracene (56-55-3)	-	-	-	**-**	8.21E-07	3.00E-08	5.47E-11	2.74E-07	**1.13E-06**
Benzo[a]pyrene (50-32-8)	-	5.00E-04	1.87E-02	**7.97E-02**	9.27E-06	-	6.18E-10	3.09E-06	**1.24E-05**
Benzo[b]fluoranthene (205-99-2)	-	-	-	**-**	9.67E-07	-	6.44E-11	3.23E-07	**1.29E-06**
Chromium(III), Insoluble Salts (16065-83-1)	-	-	-	**2.48E-04**	-	-	-	-	**-**
Dibenz[a,h]anthracene (53-70-3)	-	-	-	**-**	1.11E-06	-	7.38E-11	3.70E-07	**1.48E-06**
Thallium (Soluble Salts) (7440-28-0)	-	-	-	**2.07E+00**	-	-	-	-	**-**
**Total Risk/HI*	*-*	*5.00E-04*	*1.87E-02*	***2.15E+00***	*1.22E-05*	*3.00E-08*	*8.11E-10*	*4.06E-06*	***1.63E-05***

Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{resc} (exposure duration - resident) yr	26
ED_{resc} (exposure duration - child) yr	6
ED_{resa} (exposure duration - adult) yr	20
ET_{resc} (exposure time - resident) hr/day	24
ET_{resc} (exposure time - child) hr/day	24
ET_{resa} (exposure time - adult) hr/day	24
BW_{resa} (body weight - adult) kg	80
BW_{resc} (body weight - child) kg	15
SA_{resa} (skin surface area - adult) cm^2/day	6032
SA_{resc} (skin surface area - child) cm^2/day	2373
LT (lifetime - resident) yr	70
$EF_{resc<40"}$ (exposure frequency - resident) day/yr	270
$EF_{resc<40"}$ (exposure frequency - child) day/yr	270
$EF_{resa<40"}$ (exposure frequency - adult) day/yr	270
IRS_{resa} (soil intake rate - adult) mg/day	100
IRS_{resc} (soil intake rate - child) mg/day	200
AF_{resa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{resc} (skin adherence factor - child) mg/cm^2	0.2
$IFS_{resc<40"-adj}$ (age-adjusted soil ingestion factor) mg/kg	28350
$DFS_{resc<40"-adj}$ (age-adjusted soil dermal factor) mg/kg	79758
$IFSM_{resc<40"-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	128700
$DFSM_{resc<40"-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	330372
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-26} (skin adherence factor) mg/cm^2	0.07
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	80
BW_{16-26} (body weight) kg	80
ED_{0-2} (exposure duration) yr	2
ED_{2-6} (exposure duration) yr	4

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{6-16} (exposure duration) yr	10
ED_{16-26} (exposure duration) yr	10
$EF_{0-2<40"}$ (exposure frequency) day/yr	270
$EF_{2-6<40"}$ (exposure frequency) day/yr	270
$EF_{6-16<40"}$ (exposure frequency) day/yr	270
$EF_{16-26<40"}$ (exposure frequency) day/yr	270
ET_{0-2} (exposure time) hr/day	24
ET_{2-6} (exposure time) hr/day	24
ET_{6-16} (exposure time) hr/day	24
ET_{16-26} (exposure time) hr/day	24
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-26} (soil intake rate) mg/day	100
SA_{0-2} (skin surface area) cm^2/day	2373
SA_{2-6} (skin surface area) cm^2/day	2373
SA_{6-16} (skin surface area) cm^2/day	6032
SA_{16-26} (skin surface area) cm^2/day	6032
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
PEF (particulate emission factor) m^3/kg	1.36E+09
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependent on U_m/U_t) unitless	0.194
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
foc (fraction organic carbon in soil) g/g	0.001
p_b (dry soil bulk density) g/cm^3	1.5

Output generated 19AUG2019:19:43:36

Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
p_s (soil particle density) g/cm ^{3}	2.65
θ $_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15
θ $_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396
n (total soil porosity) L_{pore}/L_{soil}	0.43396
T (exposure interval) s	819936000
A (VF Dispersion Constant)	16.2302
B (VF Dispersion Constant)	18.7762
C (VF Dispersion Constant)	216.108

Output generated 19AUG2019:19:43:36

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Mutagen?	Volatile?	Chronic RfD (mg/kg-day)	Chronic RfD Ref	Chronic RfC (mg/m^3)	Chronic RfC Ref	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	IUR Ref	GIABS	ABS	MW	ρ (g/cm^3)
Benzo[a]pyrene (50-32-8)	Yes	No	3.00E-04	I	2.00E-06	I	1.00E+00	I	6.00E-04	I	1	0.13	252.32	-
Manganese (Non-diet) (7439-96-5)	No	No	2.40E-02	S	5.00E-05	I	-		-		0.04	-	54.938	7.30E+00
Thallium (Soluble Salts) (7440-28-0)	No	No	1.00E-05	S	-		-		-		1	-	204.38	1.18E+01
**Total Risk/HI*			-		-		-		-		-	-	-	-

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Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	H`	Volatilization Factor (m^3/kg)	K_{oc} (cm^3/g)	K_d (cm^3/g)	Particulate Emission Factor (m^3/kg)	RBA	Concentration (mg/kg)	Ingestion Noncarcinogenic CDI Child
Benzo[a]pyrene (50-32-8)	4.76E-02	5.56E-06	1.87E-05	-	5.87E+05	-	1.36E+09	1.00E+00	1.28E+00	1.26E-05
Manganese (Non-diet) (7439-96-5)	-	-	-	-	-	6.50E+01	1.36E+09	1.00E+00	6.02E+02	5.94E-03
Thallium (Soluble Salts) (7440-28-0)	-	-	-	-	-	7.10E+01	1.36E+09	1.00E+00	1.75E+00	1.73E-05
**Total Risk/HI*	-	-	-	-	-	-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation Noncarcinogenic (Volatiles) CDI Child	Inhalation Noncarcinogenic (Particulates) CDI Child	Dermal Noncarcinogenic CDI Child	Ingestion Carcinogenic CDI	Inhalation (Volatiles) Carcinogenic CDI	Inhalation (Particulates) Carcinogenic CDI	Dermal Carcinogenic CDI	Ingestion HI Child
Benzo[a]pyrene (50-32-8)	-	6.96E-10	3.89E-06	6.45E-06	-	7.16E-07	2.15E-06	4.21E-02
Manganese (Non-diet) (7439-96-5)	-	3.27E-07	-	-	-	-	-	2.47E-01
Thallium (Soluble Salts) (7440-28-0)	-	-	-	-	-	-	-	1.73E+00
**Total Risk/HI*	-	-	-	-	-	-	-	*2.02E+00*

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation (Volatiles) HI Child	Inhalation (Particulates) HI Child	Dermal HI Child	Noncarcinogenic HI Child	Ingestion Risk	Inhalation (Volatiles) Risk	Inhalation (Particulates) Risk	Dermal Risk	Carcinogenic Risk
Benzo[a]pyrene (50-32-8)	-	3.48E-04	1.30E-02	**5.54E-02**	6.45E-06	-	4.30E-10	2.15E-06	**8.60E-06**
Manganese (Non-diet) (7439-96-5)	-	6.55E-03	-	**2.54E-01**	-	-	-	-	**-**
Thallium (Soluble Salts) (7440-28-0)	-	-	-	**1.73E+00**	-	-	-	-	**-**
**Total Risk/HI*	*-*	*6.90E-03*	*1.30E-02*	***2.04E+00***	*6.45E-06*	*-*	*4.30E-10*	*2.15E-06*	***8.60E-06***

Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{resc} (exposure duration - resident) yr	26
ED_{resc} (exposure duration - child) yr	6
ED_{resa} (exposure duration - adult) yr	20
ET_{resc} (exposure time - resident) hr/day	24
ET_{resc} (exposure time - child) hr/day	24
ET_{resa} (exposure time - adult) hr/day	24
BW_{resa} (body weight - adult) kg	80
BW_{resc} (body weight - child) kg	15
SA_{resa} (skin surface area - adult) cm^2/day	6032
SA_{resc} (skin surface area - child) cm^2/day	2373
LT (lifetime - resident) yr	70
$EF_{resc<40"}$ (exposure frequency - resident) day/yr	270
$EF_{resc<40"}$ (exposure frequency - child) day/yr	270
$EF_{resa<40"}$ (exposure frequency - adult) day/yr	270
IRS_{resa} (soil intake rate - adult) mg/day	100
IRS_{resc} (soil intake rate - child) mg/day	200
AF_{resa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{resc} (skin adherence factor - child) mg/cm^2	0.2
$IFS_{resc<40"-adj}$ (age-adjusted soil ingestion factor) mg/kg	28350
$DFS_{resc<40"-adj}$ (age-adjusted soil dermal factor) mg/kg	79758
$IFSM_{resc<40"-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	128700
$DFSM_{resc<40"-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	330372
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-26} (skin adherence factor) mg/cm^2	0.07
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	80
BW_{16-26} (body weight) kg	80
ED_{0-2} (exposure duration) yr	2
ED_{2-6} (exposure duration) yr	4

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{6-16} (exposure duration) yr	10
ED_{16-26} (exposure duration) yr	10
$EF_{0-2<40"}$ (exposure frequency) day/yr	270
$EF_{2-6<40"}$ (exposure frequency) day/yr	270
$EF_{6-16<40"}$ (exposure frequency) day/yr	270
$EF_{16-26<40"}$ (exposure frequency) day/yr	270
ET_{0-2} (exposure time) hr/day	24
ET_{2-6} (exposure time) hr/day	24
ET_{6-16} (exposure time) hr/day	24
ET_{16-26} (exposure time) hr/day	24
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-26} (soil intake rate) mg/day	100
SA_{0-2} (skin surface area) cm^2/day	2373
SA_{2-6} (skin surface area) cm^2/day	2373
SA_{6-16} (skin surface area) cm^2/day	6032
SA_{16-26} (skin surface area) cm^2/day	6032
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
PEF (particulate emission factor) m^3/kg	1.36E+09
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependent on U_m/U_t) unitless	0.194
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
foc (fraction organic carbon in soil) g/g	0.001
p_b (dry soil bulk density) g/cm^3	1.5

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
p_s (soil particle density) g/cm ^{3}	2.65
θ $_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15
θ $_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396
n (total soil porosity) L_{pore}/L_{soil}	0.43396
T (exposure interval) s	819936000
A (VF Dispersion Constant)	16.2302
B (VF Dispersion Constant)	18.7762
C (VF Dispersion Constant)	216.108

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Mutagen?	Volatile?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(\mu^3)^{-1}$	IUR Ref	GIABS	ABS	MW	Density (g/cm^3)	D_{ia} (cm^2/s)
Arsenic, Inorganic	No	No	3.00E-04	U	1.50E-05	U	1.50E+00	U	4.30E-03	U	1	0.03	7.49E+01	4.90E+00	-
Benzo[a]pyrene	Yes	No	3.00E-04	U	2.00E-06	U	1.00E+00	U	6.00E-04	U	1	0.13	2.52E+02	-	4.76E-02
Chromium(III), Insoluble Salts	No	No	1.50E+00	U	-		-		-		0.013	-	5.20E+01	5.22E+00	-
Dibenz[a,h]anthracene	Yes	No	-		-		1.00E+00	U	6.00E-04	U	1	0.13	2.78E+02	-	4.46E-02
Thallium (Soluble Salts)	No	No	1.00E-05	U	-		-		-		1	-	2.04E+02	1.18E+01	-
Vanadium and Compounds	No	No	5.04E-03	U	1.00E-04	U	-		-		0.026	-	5.09E+01	6.00E+00	-
Cobalt	No	No	3.00E-04	U	6.00E-06	U	-		-		1	-	5.89E+01	8.86E+00	-
Iron	No	No	7.00E-01	U	-		-		-		1	-	5.58E+01	7.87E+00	-
**Total Risk/HI*			-		-		-		-		-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	D_{iw} (cm^2/s)	Henry's Law Constant (unitless)	Volatilization Factor (m^3/kg)	K_{oc} (cm^3/g)	K_d (cm^3/g)	Particulate Emission Factor (m^3/kg)	RBA	Concentration (mg/kg)	Ingestion Noncarcinogenic CDI Child	Inhalation Noncarcinogenic (Volatiles) CDI Child
Arsenic, Inorganic	-	-	-	-	2.90E+01	1.36E+09	0.6	9.06E+01	5.36E-04	-
Benzo[a]pyrene	5.56E-06	1.87E-05	-	5.87E+05	-	1.36E+09	1	1.10E+00	1.08E-05	-
Chromium(III), Insoluble Salts	-	-	-	-	1.80E+06	1.36E+09	1	3.71E+01	3.66E-04	-
Dibenz[a,h]anthracene	5.21E-06	5.76E-06	-	1.91E+06	-	1.36E+09	1	1.60E-01	-	-
Thallium (Soluble Salts)	-	-	-	-	7.10E+01	1.36E+09	1	1.22E+00	1.20E-05	-
Vanadium and Compounds	-	-	-	-	1.00E+03	1.36E+09	1	5.90E+01	5.82E-04	-
Cobalt	-	-	-	-	4.50E+01	1.36E+09	1	1.73E+01	1.71E-04	-
Iron	-	-	-	-	2.50E+01	1.36E+09	1	3.43E+04	3.38E-01	-
**Total Risk/HI*	-	-	-	-	-	-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation Noncarcinogenic (Particulates) CDI Child	Dermal Noncarcinogenic CDI Child	Ingestion Carcinogenic CDI	Inhalation (Volatiles) Carcinogenic CDI	Inhalation (Particulates) Carcinogenic CDI	Dermal Carcinogenic CDI	Ingestion HI Child	Inhalation (Volatiles) HI Child	Inhalation (Particulates) HI Child
Arsenic, Inorganic	4.93E-08	6.36E-05	6.03E-05	-	1.83E-05	8.48E-06	1.79E+00	-	3.29E-03
Benzo[a]pyrene	5.98E-10	3.35E-06	5.54E-06	-	6.15E-07	1.85E-06	3.62E-02	-	2.99E-04
Chromium(III), Insoluble Salts	-	-	-	-	-	-	2.44E-04	-	-
Dibenz[a,h]anthracene	-	-	8.06E-07	-	8.95E-08	2.69E-07	-	-	-
Thallium (Soluble Salts)	-	-	-	-	-	-	1.20E+00	-	-
Vanadium and Compounds	3.21E-08	-	-	-	-	-	1.15E-01	-	3.21E-04
Cobalt	9.41E-09	-	-	-	-	-	5.69E-01	-	1.57E-03
Iron	-	-	-	-	-	-	4.83E-01	-	-
**Total Risk/HI*	-	-	-	-	-	-	*4.19E+00*	-	*5.47E-03*

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Dermal HI Child	Noncarcinogenic HI Child	Ingestion Risk	Inhalation (Volatiles) Risk	Inhalation (Particulates) Risk	Dermal Risk	Carcinogenic Risk
Arsenic, Inorganic	2.12E-01	**2.00E+00**	9.05E-05	-	7.87E-08	1.27E-05	**1.03E-04**
Benzo[a]pyrene	1.12E-02	**4.76E-02**	5.54E-06	-	3.69E-10	1.85E-06	**7.39E-06**
Chromium(III), Insoluble Salts	-	**2.44E-04**	-	-	-	-	**-**
Dibenz[a,h]anthracene	-	**-**	8.06E-07	-	5.37E-11	2.69E-07	**1.07E-06**
Thallium (Soluble Salts)	-	**1.20E+00**	-	-	-	-	**-**
Vanadium and Compounds	-	**1.16E-01**	-	-	-	-	**-**
Cobalt	-	**5.70E-01**	-	-	-	-	**-**
Iron	-	**4.83E-01**	-	-	-	-	**-**
**Total Risk/HI*	*2.23E-01*	***4.42E+00***	*9.68E-05*	-	*7.91E-08*	*1.48E-05*	***1.12E-04***

Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{resc} (exposure duration - resident) yr	26
ED_{resc} (exposure duration - child) yr	6
ED_{resa} (exposure duration - adult) yr	20
ET_{resc} (exposure time - resident) hr/day	24
ET_{resc} (exposure time - child) hr/day	24
ET_{resa} (exposure time - adult) hr/day	24
BW_{resa} (body weight - adult) kg	80
BW_{resc} (body weight - child) kg	15
SA_{resa} (skin surface area - adult) cm^2/day	6032
SA_{resc} (skin surface area - child) cm^2/day	2373
LT (lifetime - resident) yr	70
$EF_{resc<40"}$ (exposure frequency - resident) day/yr	270
$EF_{resc<40"}$ (exposure frequency - child) day/yr	270
$EF_{resa<40"}$ (exposure frequency - adult) day/yr	270
IRS_{resa} (soil intake rate - adult) mg/day	100
IRS_{resc} (soil intake rate - child) mg/day	200
AF_{resa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{resc} (skin adherence factor - child) mg/cm^2	0.2
$IFS_{resc<40"-adj}$ (age-adjusted soil ingestion factor) mg/kg	28350
$DFS_{resc<40"-adj}$ (age-adjusted soil dermal factor) mg/kg	79758
$IFSM_{resc<40"-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	128700
$DFSM_{resc<40"-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	330372
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-26} (skin adherence factor) mg/cm^2	0.07
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	80
BW_{16-26} (body weight) kg	80
ED_{0-2} (exposure duration) yr	2
ED_{2-6} (exposure duration) yr	4

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{6-16} (exposure duration) yr	10
ED_{16-26} (exposure duration) yr	10
$EF_{0-2<40"}$ (exposure frequency) day/yr	270
$EF_{2-6<40"}$ (exposure frequency) day/yr	270
$EF_{6-16<40"}$ (exposure frequency) day/yr	270
$EF_{16-26<40"}$ (exposure frequency) day/yr	270
ET_{0-2} (exposure time) hr/day	24
ET_{2-6} (exposure time) hr/day	24
ET_{6-16} (exposure time) hr/day	24
ET_{16-26} (exposure time) hr/day	24
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-26} (soil intake rate) mg/day	100
SA_{0-2} (skin surface area) cm^2/day	2373
SA_{2-6} (skin surface area) cm^2/day	2373
SA_{6-16} (skin surface area) cm^2/day	6032
SA_{16-26} (skin surface area) cm^2/day	6032
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
PEF (particulate emission factor) m^3/kg	1.36E+09
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependent on U_m/U_t) unitless	0.194
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
foc (fraction organic carbon in soil) g/g	0.001
p_b (dry soil bulk density) g/cm^3	1.5

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
p_s (soil particle density) g/cm ^{3}	2.65
θ $_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15
θ $_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396
n (total soil porosity) L_{pore}/L_{soil}	0.43396
T (exposure interval) s	819936000
A (VF Dispersion Constant)	16.2302
B (VF Dispersion Constant)	18.7762
C (VF Dispersion Constant)	216.108

Output generated 19AUG2019:19:58:49

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Mutagen?	Volatile?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(\mu^3)^{-1}$	IUR Ref	GIABS	ABS	MW	Density (g/cm^3)	D_{ia} (cm^2/s)
Antimony (metallic)	No	No	4.00E-04	U	-		-		-		0.15	-	1.22E+02	6.68E+00	-
Arsenic, Inorganic	No	No	3.00E-04	U	1.50E-05	U	1.50E+00	U	4.30E-03	U	1	0.03	7.49E+01	4.90E+00	-
Benz[a]anthracene	Yes	Yes	-		-		1.00E-01	U	6.00E-05	U	1	0.13	2.28E+02	1.27E+00	2.61E-02
Benzo[a]pyrene	Yes	No	3.00E-04	U	2.00E-06	U	1.00E+00	U	6.00E-04	U	1	0.13	2.52E+02	-	4.76E-02
Benzo[b]fluoranthene	Yes	No	-		-		1.00E-01	U	6.00E-05	U	1	0.13	2.52E+02	-	4.76E-02
Chromium(III), Insoluble Salts	No	No	1.50E+00	U	-		-		-		0.013	-	5.20E+01	5.22E+00	-
Dibenz[a,h]anthracene	Yes	No	-		-		1.00E+00	U	6.00E-04	U	1	0.13	2.78E+02	-	4.46E-02
Indeno[1,2,3-cd]pyrene	Yes	No	-		-		1.00E-01	U	6.00E-05	U	1	0.13	2.76E+02	-	4.48E-02
Naphthalene	No	Yes	2.00E-02	U	3.00E-03	U	-		3.40E-05	U	1	0.13	1.28E+02	1.03E+00	6.05E-02
Thallium (Soluble Salts)	No	No	1.00E-05	U	-		-		-		1	-	2.04E+02	1.18E+01	-
Vanadium and Compounds	No	No	5.04E-03	U	1.00E-04	U	-		-		0.026	-	5.09E+01	6.00E+00	-
Cobalt	No	No	3.00E-04	U	6.00E-06	U	-		-		1	-	5.89E+01	8.86E+00	-
Iron	No	No	7.00E-01	U	-		-		-		1	-	5.58E+01	7.87E+00	-
**Total Risk/HI*			-		-		-		-		-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	D_{iw} (cm^2/s)	Henry's Law Constant (unitless)	Volatilization Factor (m^3/kg)	K_{oc} (cm^3/g)	K_d (cm^3/g)	Particulate Emission Factor (m^3/kg)	RBA	Concentration (mg/kg)	Ingestion Noncarcinogenic CDI Child	Inhalation Noncarcinogenic (Volatiles) CDI Child
Antimony (metallic)	-	-	-	-	4.50E+01	1.36E+09	1	6.04E+00	5.96E-05	-
Arsenic, Inorganic	-	-	-	-	2.90E+01	1.36E+09	0.6	3.62E+01	2.14E-04	-
Benz[a]anthracene	6.75E-06	4.91E-04	2.48E+06	1.77E+05	1.77E+02	1.36E+09	1	1.20E+01	-	-
Benzo[a]pyrene	5.56E-06	1.87E-05	-	5.87E+05	-	1.36E+09	1	1.30E+01	1.28E-04	-
Benzo[b]fluoranthene	5.56E-06	2.69E-05	-	5.99E+05	-	1.36E+09	1	1.40E+01	-	-
Chromium(III), Insoluble Salts	-	-	-	-	1.80E+06	1.36E+09	1	1.27E+02	1.25E-03	-
Dibenz[a,h]anthracene	5.21E-06	5.76E-06	-	1.91E+06	-	1.36E+09	1	2.00E+00	-	-
Indeno[1,2,3-cd]pyrene	5.23E-06	1.42E-05	-	1.95E+06	-	1.36E+09	1	6.00E+00	-	-
Naphthalene	8.38E-06	1.80E-02	2.67E+04	1.54E+03	1.54E+00	1.36E+09	1	1.30E+01	1.28E-04	3.60E-04
Thallium (Soluble Salts)	-	-	-	-	7.10E+01	1.36E+09	1	2.70E+00	2.66E-05	-
Vanadium and Compounds	-	-	-	-	1.00E+03	1.36E+09	1	1.37E+02	1.35E-03	-
Cobalt	-	-	-	-	4.50E+01	1.36E+09	1	1.85E+01	1.82E-04	-
Iron	-	-	-	-	2.50E+01	1.36E+09	1	7.63E+04	7.53E-01	-
**Total Risk/HI*	-	-	-	-	-	-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation Noncarcinogenic (Particulates) CDI Child	Dermal Noncarcinogenic CDI Child	Ingestion Carcinogenic CDI	Inhalation (Volatiles) Carcinogenic CDI	Inhalation (Particulates) Carcinogenic CDI	Dermal Carcinogenic CDI	Ingestion HI Child	Inhalation (Volatiles) HI Child
Antimony (metallic)	-	-	-	-	-	-	1.49E-01	-
Arsenic, Inorganic	1.97E-08	2.54E-05	2.41E-05	-	7.31E-06	3.39E-06	7.14E-01	-
Benz[a]anthracene	-	-	6.04E-05	3.68E-03	6.71E-06	2.02E-05	-	-
Benzo[a]pyrene	7.07E-09	3.96E-05	6.55E-05	-	7.27E-06	2.19E-05	4.27E-01	-
Benzo[b]fluoranthene	-	-	7.05E-05	-	7.83E-06	2.35E-05	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	8.35E-04	-
Dibenz[a,h]anthracene	-	-	1.01E-05	-	1.12E-06	3.36E-06	-	-
Indeno[1,2,3-cd]pyrene	-	-	3.02E-05	-	3.36E-06	1.01E-05	-	-
Naphthalene	7.07E-09	3.96E-05	-	1.34E-01	2.63E-06	-	6.41E-03	1.20E-01
Thallium (Soluble Salts)	-	-	-	-	-	-	2.66E+00	-
Vanadium and Compounds	7.45E-08	-	-	-	-	-	2.68E-01	-
Cobalt	1.01E-08	-	-	-	-	-	6.08E-01	-
Iron	-	-	-	-	-	-	1.08E+00	-
**Total Risk/HI*	-	-	-	-	-	-	*5.91E+00*	*1.20E-01*

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation (Particulates) HI Child	Dermal HI Child	Noncarcinogenic HI Child	Ingestion Risk	Inhalation (Volatiles) Risk	Inhalation (Particulates) Risk	Dermal Risk	Carcinogenic Risk
Antimony (metallic)	-	-	**1.49E-01**	-	-	-	-	**-**
Arsenic, Inorganic	1.31E-03	8.47E-02	**8.00E-01**	3.62E-05	-	3.14E-08	5.09E-06	**4.13E-05**
Benz[a]anthracene	-	-	**-**	6.04E-06	2.21E-07	4.03E-10	2.02E-06	**8.28E-06**
Benzo[a]pyrene	3.54E-03	1.32E-01	**5.63E-01**	6.55E-05	-	4.36E-09	2.19E-05	**8.73E-05**
Benzo[b]fluoranthene	-	-	**-**	7.05E-06	-	4.70E-10	2.35E-06	**9.41E-06**
Chromium(III), Insoluble Salts	-	-	**8.35E-04**	-	-	-	-	**-**
Dibenz[a,h]anthracene	-	-	**-**	1.01E-05	-	6.71E-10	3.36E-06	**1.34E-05**
Indeno[1,2,3-cd]pyrene	-	-	**-**	3.02E-06	-	2.01E-10	1.01E-06	**4.03E-06**
Naphthalene	2.36E-06	1.98E-03	**1.28E-01**	-	4.55E-06	8.93E-11	-	**4.55E-06**
Thallium (Soluble Salts)	-	-	**2.66E+00**	-	-	-	-	**-**
Vanadium and Compounds	7.45E-04	-	**2.69E-01**	-	-	-	-	**-**
Cobalt	1.68E-03	-	**6.10E-01**	-	-	-	-	**-**
Iron	-	-	**1.08E+00**	-	-	-	-	**-**
**Total Risk/HI*	*7.27E-03*	*2.19E-01*	***6.26E+00***	*1.28E-04*	*4.77E-06*	*3.76E-08*	*3.57E-05*	***1.68E-04***

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{resc} (exposure duration - resident) yr	26
ED_{resc} (exposure duration - child) yr	6
ED_{resa} (exposure duration - adult) yr	20
ET_{resc} (exposure time - resident) hr/day	24
ET_{resc} (exposure time - child) hr/day	24
ET_{resa} (exposure time - adult) hr/day	24
BW_{resa} (body weight - adult) kg	80
BW_{resc} (body weight - child) kg	15
SA_{resa} (skin surface area - adult) cm^2/day	6032
SA_{resc} (skin surface area - child) cm^2/day	2373
LT (lifetime - resident) yr	70
$EF_{resc<40"}$ (exposure frequency - resident) day/yr	270
$EF_{resc<40"}$ (exposure frequency - child) day/yr	270
$EF_{resa<40"}$ (exposure frequency - adult) day/yr	270
IRS_{resa} (soil intake rate - adult) mg/day	100
IRS_{resc} (soil intake rate - child) mg/day	200
AF_{resa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{resc} (skin adherence factor - child) mg/cm^2	0.2
$IFS_{resc<40"-adj}$ (age-adjusted soil ingestion factor) mg/kg	28350
$DFS_{resc<40"-adj}$ (age-adjusted soil dermal factor) mg/kg	79758
$IFSM_{resc<40"-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	128700
$DFSM_{resc<40"-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	330372
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-26} (skin adherence factor) mg/cm^2	0.07
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	80
BW_{16-26} (body weight) kg	80
ED_{0-2} (exposure duration) yr	2
ED_{2-6} (exposure duration) yr	4

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{6-16} (exposure duration) yr	10
ED_{16-26} (exposure duration) yr	10
$EF_{0-2<40"}$ (exposure frequency) day/yr	270
$EF_{2-6<40"}$ (exposure frequency) day/yr	270
$EF_{6-16<40"}$ (exposure frequency) day/yr	270
$EF_{16-26<40"}$ (exposure frequency) day/yr	270
ET_{0-2} (exposure time) hr/day	24
ET_{2-6} (exposure time) hr/day	24
ET_{6-16} (exposure time) hr/day	24
ET_{16-26} (exposure time) hr/day	24
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-26} (soil intake rate) mg/day	100
SA_{0-2} (skin surface area) cm^2/day	2373
SA_{2-6} (skin surface area) cm^2/day	2373
SA_{6-16} (skin surface area) cm^2/day	6032
SA_{16-26} (skin surface area) cm^2/day	6032
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
PEF (particulate emission factor) m^3/kg	1.36E+09
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependent on U_m/U_t) unitless	0.194
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
foc (fraction organic carbon in soil) g/g	0.001
p_b (dry soil bulk density) g/cm^3	1.5

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
p_s (soil particle density) g/cm ^{3}	2.65
θ $_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15
θ $_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396
n (total soil porosity) L_{pore}/L_{soil}	0.43396
T (exposure interval) s	819936000
A (VF Dispersion Constant)	16.2302
B (VF Dispersion Constant)	18.7762
C (VF Dispersion Constant)	216.108

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Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Mutagen?	Volatile?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(\mu^3)^{-1}$	IUR Ref	GIABS	ABS	MW	Density (g/cm^3)	D_{ia} (cm^2/s)
Benz[a]anthracene	Yes	Yes	-		-		1.00E-01	U	6.00E-05	U	1	0.13	2.28E+02	1.27E+00	2.61E-02
Benzo[a]pyrene	Yes	No	3.00E-04	U	2.00E-06	U	1.00E+00	U	6.00E-04	U	1	0.13	2.52E+02	-	4.76E-02
Benzo[b]fluoranthene	Yes	No	-		-		1.00E-01	U	6.00E-05	U	1	0.13	2.52E+02	-	4.76E-02
Chromium(III), Insoluble Salts	No	No	1.50E+00	U	-		-		-		0.013	-	5.20E+01	5.22E+00	-
Indeno[1,2,3-cd]pyrene	Yes	No	-		-		1.00E-01	U	6.00E-05	U	1	0.13	2.76E+02	-	4.48E-02
Naphthalene	No	Yes	2.00E-02	U	3.00E-03	U	-		3.40E-05	U	1	0.13	1.28E+02	1.03E+00	6.05E-02
Thallium (Soluble Salts)	No	No	1.00E-05	U	-		-		-		1	-	2.04E+02	1.18E+01	-
Iron	No	No	7.00E-01	U	-		-		-		1	-	5.58E+01	7.87E+00	-
**Total Risk/HI*			-		-		-		-		-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	D_{iw} (cm^2/s)	Henry's Law Constant (unitless)	Volatilization Factor (m^3/kg)	K_{oc} (cm^3/g)	K_d (cm^3/g)	Particulate Emission Factor (m^3/kg)	RBA	Concentration (mg/kg)	Ingestion Noncarcinogenic CDI Child	Inhalation Noncarcinogenic (Volatiles) CDI Child
Benz[a]anthracene	6.75E-06	4.91E-04	2.48E+06	1.77E+05	1.77E+02	1.36E+09	1	5.77E+00	-	-
Benzo[a]pyrene	5.56E-06	1.87E-05	-	5.87E+05	-	1.36E+09	1	6.81E+00	6.72E-05	-
Benzo[b]fluoranthene	5.56E-06	2.69E-05	-	5.99E+05	-	1.36E+09	1	7.24E+00	-	-
Chromium(III), Insoluble Salts	-	-	-	-	1.80E+06	1.36E+09	1	5.39E+01	5.32E-04	-
Indeno[1,2,3-cd]pyrene	5.23E-06	1.42E-05	-	1.95E+06	-	1.36E+09	1	3.66E+00	-	-
Naphthalene	8.38E-06	1.80E-02	2.67E+04	1.54E+03	1.54E+00	1.36E+09	1	5.40E+00	5.33E-05	1.50E-04
Thallium (Soluble Salts)	-	-	-	-	7.10E+01	1.36E+09	1	2.70E+00	2.66E-05	-
Iron	-	-	-	-	2.50E+01	1.36E+09	1	4.74E+04	4.68E-01	-
**Total Risk/HI*	-	-	-	-	-	-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation Noncarcinogenic (Particulates) CDI Child	Dermal Noncarcinogenic CDI Child	Ingestion Carcinogenic CDI	Inhalation (Volatiles) Carcinogenic CDI	Inhalation (Particulates) Carcinogenic CDI	Dermal Carcinogenic CDI	Ingestion HI Child	Inhalation (Volatiles) HI Child
Benz[a]anthracene	-	-	2.91E-05	1.77E-03	3.23E-06	9.70E-06	-	-
Benzo[a]pyrene	3.70E-09	2.07E-05	3.43E-05	-	3.81E-06	1.14E-05	2.24E-01	-
Benzo[b]fluoranthene	-	-	3.65E-05	-	4.05E-06	1.22E-05	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	3.54E-04	-
Indeno[1,2,3-cd]pyrene	-	-	1.84E-05	-	2.05E-06	6.15E-06	-	-
Naphthalene	2.94E-09	1.64E-05	-	5.56E-02	1.09E-06	-	2.66E-03	4.99E-02
Thallium (Soluble Salts)	-	-	-	-	-	-	2.66E+00	-
Iron	-	-	-	-	-	-	6.68E-01	-
**Total Risk/HI*	-	-	-	-	-	-	*3.56E+00*	*4.99E-02*

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation (Particulates) HI Child	Dermal HI Child	Noncarcinogenic HI Child	Ingestion Risk	Inhalation (Volatiles) Risk	Inhalation (Particulates) Risk	Dermal Risk	Carcinogenic Risk
Benz[a]anthracene	-	-	**-**	2.91E-06	1.06E-07	1.94E-10	9.70E-07	**3.98E-06**
Benzo[a]pyrene	1.85E-03	6.91E-02	**2.95E-01**	3.43E-05	-	2.29E-09	1.14E-05	**4.58E-05**
Benzo[b]fluoranthene	-	-	**-**	3.65E-06	-	2.43E-10	1.22E-06	**4.86E-06**
Chromium(III), Insoluble Salts	-	-	**3.54E-04**	-	-	-	-	**-**
Indeno[1,2,3-cd]pyrene	-	-	**-**	1.84E-06	-	1.23E-10	6.15E-07	**2.46E-06**
Naphthalene	9.79E-07	8.22E-04	**5.34E-02**	-	1.89E-06	3.71E-11	-	**1.89E-06**
Thallium (Soluble Salts)	-	-	**2.66E+00**	-	-	-	-	**-**
Iron	-	-	**6.68E-01**	-	-	-	-	**-**
**Total Risk/HI*	*1.85E-03*	*6.99E-02*	***3.68E+00***	*4.27E-05*	*2.00E-06*	*2.88E-09*	*1.42E-05*	***5.89E-05***

Site-specific Risk Models
Resident Soil (<40 in. Zone) Inputs

Variable	Value
ED_{resc} (exposure duration - resident) yr	26
ED_{resc} (exposure duration - child) yr	6
ED_{resa} (exposure duration - adult) yr	20
ET_{resc} (exposure time - resident) hr/day	24
ET_{resc} (exposure time - child) hr/day	24
ET_{resa} (exposure time - adult) hr/day	24
BW_{resa} (body weight - adult) kg	80
BW_{resc} (body weight - child) kg	15
SA_{resa} (skin surface area - adult) cm^2/day	6032
SA_{resc} (skin surface area - child) cm^2/day	2373
LT (lifetime - resident) yr	70
$EF_{resc\ lt\ 40\ in}$ (exposure frequency - resident) day/yr	270
$EF_{resc\ lt\ 40\ in}$ (exposure frequency - child) day/yr	270
$EF_{resa\ lt\ 40\ in}$ (exposure frequency - adult) day/yr	270
IRS_{resa} (soil intake rate - adult) mg/day	100
IRS_{resc} (soil intake rate - child) mg/day	200
AF_{resa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{resc} (skin adherence factor - child) mg/cm^2	0.2
$IFS_{res\ lt\ 40\ in\ adj}$ (age-adjusted soil ingestion factor) mg/kg	28350
$DFS_{res\ lt\ 40\ in\ adj}$ (age-adjusted soil dermal factor) mg/kg	79758
$IFSM_{res\ lt\ 40\ in\ adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	128700
$DFSM_{res\ lt\ 40\ in\ adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	330372
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-26} (skin adherence factor) mg/cm^2	0.07
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	80
BW_{16-26} (body weight) kg	80
ED_{0-2} (exposure duration) yr	2
ED_{2-6} (exposure duration) yr	4
ED_{6-16} (exposure duration) yr	10

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Site-specific Risk Models
Resident Soil (<40 in. Zone) Inputs

Variable	Value
ED_{16-26} (exposure duration) yr	10
$EF_{0-2\ lt\ 40\ in}$ (exposure frequency) day/yr	270
$EF_{2-6\ lt\ 40\ in}$ (exposure frequency) day/yr	270
$EF_{6-16\ lt\ 40\ in}$ (exposure frequency) day/yr	270
$EF_{16-26\ lt\ 40\ in}$ (exposure frequency) day/yr	270
ET_{0-2} (exposure time) hr/day	24
ET_{2-6} (exposure time) hr/day	24
ET_{6-16} (exposure time) hr/day	24
ET_{16-26} (exposure time) hr/day	24
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-26} (soil intake rate) mg/day	100
SA_{0-2} (skin surface area) cm^2/day	2373
SA_{2-6} (skin surface area) cm^2/day	2373
SA_{6-16} (skin surface area) cm^2/day	6032
SA_{16-26} (skin surface area) cm^2/day	6032
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
PEF (particulate emission factor) m^3/kg	1.36E09
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V(fraction of vegetative cover) unitless	0.5
U_m(mean annual wind speed) m/s	4.69
U_t(equivalent threshold value)	11.32
F(x) (function dependent on U_m/U_t) unitless	0.194
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
foc (fraction organic carbon in soil) g/g	0.001
p_b (dry soil bulk density) g/cm^3	1.5
p_s (soil particle density) g/cm^3	2.65
$Theta_w$ (water-filled soil porosity)L_{water}/L_{soil}	0.15

Output generated 13JAN2021:14:58:41

Site-specific Risk Models
Resident Soil (<40 in. Zone) Inputs

Variable	Value
Theta$_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396
n (total soil porosity) L_{pore}/L_{soil}	0.43396
T (exposure interval) s	819936000
A (VF Dispersion Constant)	16.2302
B (VF Dispersion Constant)	18.7762
C (VF Dispersion Constant)	216.108

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40 in. Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Mutagen?	Volatile?	Chronic RfD (mg/kg-day)	Chronic RfD Ref	Chronic RfC (mg/m^3)	Chronic RfC Ref	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	IUR Ref	GIABS	ABS	MW
Antimony (metallic)	No	No	4.00E-04	I	-		-		-		0.15	-	121.76
Arsenic, Inorganic	No	No	3.00E-04	I	1.50E-05	C	1.50E+00	I	4.30E-03	I	1	0.03	74.922
Benz[a]anthracene	Yes	Yes	-		-		1.00E-01	W	6.00E-05	W	1	0.13	228.3
Benzo[a]pyrene	Yes	No	3.00E-04	I	2.00E-06	I	1.00E+00	I	6.00E-04	I	1	0.13	252.32
Benzo[b]fluoranthene	Yes	No	-		-		1.00E-01	W	6.00E-05	W	1	0.13	252.32
Butylbenzene, n-	No	Yes	5.00E-02	P	-		-		-		1	-	134.22
Cadmium (Diet)	No	No	1.00E-03	I	1.00E-05	A	-		1.80E-03	I	0.025	0.001	112.4
Chromium, Total	No	No	1.50E+00	S	-		-		-		0.013	-	51.996
Dibenz[a,h]anthracene	Yes	No	-		-		1.00E+00	W	6.00E-04	W	1	0.13	278.36
Lead and Compounds	No	No	-		-		-		-		1	-	207.2
Mercury (elemental)	No	Yes	1.60E-04	C	3.00E-04	I	-		-		1	-	200.59
Methylnaphthalene, 1-	No	Yes	7.00E-02	A	-		2.90E-02	P	-		1	0.13	142.2
Methylnaphthalene, 2-	No	Yes	4.00E-03	I	-		-		-		1	0.13	142.2
Naphthalene	No	Yes	2.00E-02	I	3.00E-03	I	-		3.40E-05	C	1	0.13	128.18
Trimethylbenzene, 1,2,4-	No	Yes	1.00E-02	I	6.00E-02	I	-		-		1	-	120.2
Trimethylbenzene, 1,3,5-	No	Yes	1.00E-02	I	6.00E-02	I	-		-		1	-	120.2
**Total Risk/HI*			-		-		-		-		-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40 in. Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

ρ (g/cm^3)	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	H`	Volatilization Factor (m^3/kg)	K_{oc} (cm^3/g)	K_d (cm^3/g)	Particulate Emission Factor (m^3/kg)	RBA	Concentration (mg/kg)	Ingestion Noncarcinogenic CDI Child
6.68E+00	-	-	-	-	-	4.50E+01	1.36E+09	1.00E+00	1.60E+01	1.58E-04
4.90E+00	-	-	-	-	-	2.90E+01	1.36E+09	6.00E-01	3.68E+01	2.18E-04
1.27E+00	2.61E-02	6.75E-06	4.91E-04	2.48E+06	1.77E+05	1.77E+02	1.36E+09	1.00E+00	2.10E+00	-
1.35E+00	4.76E-02	5.56E-06	1.87E-05	-	5.87E+05	-	1.36E+09	1.00E+00	3.50E+00	3.45E-05
1.30E+00	4.76E-02	5.56E-06	2.69E-05	-	5.99E+05	-	1.36E+09	1.00E+00	2.00E+00	-
8.60E-01	5.28E-02	7.33E-06	6.50E-01	4.84E+03	1.48E+03	1.48E+00	1.36E+09	1.00E+00	3.10E+00	3.06E-05
8.69E+00	-	-	-	-	-	7.50E+01	1.36E+09	1.00E+00	1.10E+01	1.08E-04
7.15E+00	-	-	-	-	-	1.80E+06	1.36E+09	1.00E+00	1.30E+02	1.28E-03
1.28E+00	4.46E-02	5.21E-06	5.76E-06	-	1.91E+06	-	1.36E+09	1.00E+00	5.30E-01	-
1.13E+01	-	-	-	-	-	9.00E+02	1.36E+09	1.00E+00	1.20E+03	-
1.35E+01	3.07E-02	6.30E-06	3.52E-01	4.77E+04	-	5.20E+01	1.36E+09	1.00E+00	2.60E+00	2.56E-05
1.02E+00	5.28E-02	7.85E-06	2.10E-02	3.35E+04	2.53E+03	2.53E+00	1.36E+09	1.00E+00	3.90E+01	3.85E-04
1.01E+00	5.24E-02	7.78E-06	2.12E-02	3.31E+04	2.48E+03	2.48E+00	1.36E+09	1.00E+00	4.40E+01	4.34E-04
1.03E+00	6.05E-02	8.38E-06	1.80E-02	2.67E+04	1.54E+03	1.54E+00	1.36E+09	1.00E+00	1.20E+01	1.18E-04
8.76E-01	6.07E-02	7.92E-06	2.52E-01	4.85E+03	6.14E+02	6.14E-01	1.36E+09	1.00E+00	1.30E+01	1.28E-04
8.62E-01	6.02E-02	7.84E-06	3.59E-01	4.10E+03	6.02E+02	6.02E-01	1.36E+09	1.00E+00	5.80E+00	5.72E-05
-	-	-	-	-	-	-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40 in. Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
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Inhalation Noncarcinogenic (Volatiles) CDI Child	Inhalation Noncarcinogenic (Particulates) CDI Child	Dermal Noncarcinogenic CDI Child	Ingestion Carcinogenic CDI	Inhalation (Volatiles) Carcinogenic CDI	Inhalation (Particulates) Carcinogenic CDI	Dermal Carcinogenic CDI	Ingestion HI Child	Inhalation (Volatiles) HI Child
-	-	-	-	-	-	-	3.95E-01	-
-	2.00E-08	2.58E-05	2.45E-05	-	7.43E-06	3.45E-06	7.26E-01	-
-	-	-	1.06E-05	6.45E-04	1.17E-06	3.53E-06	-	-
-	1.90E-09	1.06E-05	1.76E-05	-	1.96E-06	5.88E-06	1.15E-01	-
-	-	-	1.01E-05	-	1.12E-06	3.36E-06	-	-
-	-	-	-	-	-	-	6.12E-04	-
-	5.98E-09	2.57E-07	-	-	2.22E-06	-	1.08E-01	-
-	-	-	-	-	-	-	8.55E-04	-
-	-	-	2.67E-06	-	2.97E-07	8.91E-07	-	-
-	-	-	-	-	-	-	-	-
4.03E-05	1.41E-09	-	-	-	-	-	1.60E-01	1.34E-01
-	-	1.19E-04	4.33E-05	-	-	1.58E-05	5.50E-03	-
-	-	1.34E-04	-	-	-	-	1.08E-01	-
3.32E-04	6.53E-09	3.65E-05	-	1.23E-01	2.42E-06	-	5.92E-03	1.11E-01
1.98E-03	7.07E-09	-	-	-	-	-	1.28E-02	3.30E-02
1.05E-03	3.15E-09	-	-	-	-	-	5.72E-03	1.74E-02
-	-	-	-	-	-	-	*1.64E+00*	*2.95E-01*

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40 in. Precipitation Zone)

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I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Inhalation (Particulates) HI Child	Dermal HI Child	Noncarcinogenic HI Child	Ingestion Risk	Inhalation (Volatiles) Risk	Inhalation (Particulates) Risk	Dermal Risk	Carcinogenic Risk
-	-	**3.95E-01**	-	-	-	-	**-**
1.33E-03	8.61E-02	**8.13E-01**	3.67E-05	-	3.20E-08	5.17E-06	**4.20E-05**
-	-	**-**	1.06E-06	3.87E-08	7.05E-11	3.53E-07	**1.45E-06**
9.52E-04	3.55E-02	**1.52E-01**	1.76E-05	-	1.17E-09	5.88E-06	**2.35E-05**
-	-	**-**	1.01E-06	-	6.71E-11	3.36E-07	**1.34E-06**
-	-	**6.12E-04**	-	-	-	-	**-**
5.98E-04	1.03E-02	**1.19E-01**	-	-	4.00E-09	-	**4.00E-09**
-	-	**8.55E-04**	-	-	-	-	**-**
-	-	**-**	2.67E-06	-	1.78E-10	8.91E-07	**3.56E-06**
-	-	**-**	-	-	-	-	**-**
4.71E-06	-	**2.95E-01**	-	-	-	-	**-**
-	1.70E-03	**7.19E-03**	1.25E-06	-	-	4.59E-07	**1.71E-06**
-	3.35E-02	**1.42E-01**	-	-	-	-	**-**
2.18E-06	1.83E-03	**1.18E-01**	-	4.20E-06	8.24E-11	-	**4.20E-06**
1.18E-07	-	**4.59E-02**	-	-	-	-	**-**
5.26E-08	-	**2.31E-02**	-	-	-	-	**-**
2.89E-03	*1.69E-01*	***2.11E+00***	*6.04E-05*	*4.23E-06*	*3.75E-08*	*1.31E-05*	***7.77E-05***

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{ress} (exposure duration - resident) yr	26
ED_{ressc} (exposure duration - child) yr	6
ED_{ressa} (exposure duration - adult) yr	20
ET_{ress} (exposure time - resident) hr/day	24
ET_{ressc} (exposure time - child) hr/day	24
ET_{ressa} (exposure time - adult) hr/day	24
BW_{ressa} (body weight - adult) kg	80
BW_{ressc} (body weight - child) kg	15
SA_{ressa} (skin surface area - adult) cm^2/day	6032
SA_{ressc} (skin surface area - child) cm^2/day	2373
LT (lifetime - resident) yr	70
$EF_{ress<40"}$ (exposure frequency - resident) day/yr	270
$EF_{ressc<40"}$ (exposure frequency - child) day/yr	270
$EF_{ressa<40"}$ (exposure frequency - adult) day/yr	270
IRS_{ressa} (soil intake rate - adult) mg/day	100
IRS_{ressc} (soil intake rate - child) mg/day	200
AF_{ressa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{ressc} (skin adherence factor - child) mg/cm^2	0.2
$IFS_{ress<40"-adj}$ (age-adjusted soil ingestion factor) mg/kg	28350
$DFS_{ress<40"-adj}$ (age-adjusted soil dermal factor) mg/kg	79758
$IFSM_{ress<40"-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	128700
$DFSM_{ress<40"-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	330372
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-26} (skin adherence factor) mg/cm^2	0.07
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	80
BW_{16-26} (body weight) kg	80
ED_{0-2} (exposure duration) yr	2
ED_{2-6} (exposure duration) yr	4

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
ED_{6-16} (exposure duration) yr	10
ED_{16-26} (exposure duration) yr	10
$EF_{0-2<40"}$ (exposure frequency) day/yr	270
$EF_{2-6<40"}$ (exposure frequency) day/yr	270
$EF_{6-16<40"}$ (exposure frequency) day/yr	270
$EF_{16-26<40"}$ (exposure frequency) day/yr	270
ET_{0-2} (exposure time) hr/day	24
ET_{2-6} (exposure time) hr/day	24
ET_{6-16} (exposure time) hr/day	24
ET_{16-26} (exposure time) hr/day	24
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-26} (soil intake rate) mg/day	100
SA_{0-2} (skin surface area) cm^2/day	2373
SA_{2-6} (skin surface area) cm^2/day	2373
SA_{6-16} (skin surface area) cm^2/day	6032
SA_{16-26} (skin surface area) cm^2/day	6032
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
PEF (particulate emission factor) m^3/kg	1.36E+09
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependent on U_m/U_t) unitless	0.194
A_c (acres)	0.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.7736
foc (fraction organic carbon in soil) g/g	0.001
p_b (dry soil bulk density) g/cm^3	1.5

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Site-specific Risk Models
Resident Equation Inputs
Soil (<40" Precipitation Zone)

Variable	Value
p_s (soil particle density) g/cm ^{3}	2.65
θ $_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15
θ $_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396
n (total soil porosity) L_{pore}/L_{soil}	0.43396
T (exposure interval) s	819936000
A (VF Dispersion Constant)	16.2302
B (VF Dispersion Constant)	18.7762
C (VF Dispersion Constant)	216.108

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Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Mutagen?	Volatile?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(\mu^3)^{-1}$	IUR Ref	GIABS	ABS	MW	Density (g/cm^3)	D_{ia} (cm^2/s)
Benz[a]anthracene	Yes	Yes	-		-		1.00E-01	U	6.00E-05	U	1	0.13	2.28E+02	1.27E+00	2.61E-02
Benzo[a]pyrene	Yes	No	3.00E-04	U	2.00E-06	U	1.00E+00	U	6.00E-04	U	1	0.13	2.52E+02	-	4.76E-02
Benzo[b]fluoranthene	Yes	No	-		-		1.00E-01	U	6.00E-05	U	1	0.13	2.52E+02	-	4.76E-02
Chromium(III), Insoluble Salts	No	No	1.50E+00	U	-		-		-		0.013	-	5.20E+01	5.22E+00	-
Dibenz[a,h]anthracene	Yes	No	-		-		1.00E+00	U	6.00E-04	U	1	0.13	2.78E+02	-	4.46E-02
Indeno[1,2,3-cd]pyrene	Yes	No	-		-		1.00E-01	U	6.00E-05	U	1	0.13	2.76E+02	-	4.48E-02
Naphthalene	No	Yes	2.00E-02	U	3.00E-03	U	-		3.40E-05	U	1	0.13	1.28E+02	1.03E+00	6.05E-02
Thallium (Soluble Salts)	No	No	1.00E-05	U	-		-		-		1	-	2.04E+02	1.18E+01	-
Cobalt	No	No	3.00E-04	U	6.00E-06	U	-		-		1	-	5.89E+01	8.86E+00	-
**Total Risk/HI*			-		-		-		-		-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	D_{iw} (cm^2/s)	Henry's Law Constant (unitless)	Volatilization Factor (m^3/kg)	K_{oc} (cm^3/g)	K_d (cm^3/g)	Particulate Emission Factor (m^3/kg)	RBA	Concentration (mg/kg)	Ingestion Noncarcinogenic CDI Child	Inhalation Noncarcinogenic (Volatiles) CDI Child
Benz[a]anthracene	6.75E-06	4.91E-04	2.48E+06	1.77E+05	1.77E+02	1.36E+09	1	6.25E+00	-	-
Benzo[a]pyrene	5.56E-06	1.87E-05	-	5.87E+05	-	1.36E+09	1	6.80E+00	6.71E-05	-
Benzo[b]fluoranthene	5.56E-06	2.69E-05	-	5.99E+05	-	1.36E+09	1	7.10E+00	-	-
Chromium(III), Insoluble Salts	-	-	-	-	1.80E+06	1.36E+09	1	3.71E+01	3.66E-04	-
Dibenz[a,h]anthracene	5.21E-06	5.76E-06	-	1.91E+06	-	1.36E+09	1	1.00E+00	-	-
Indeno[1,2,3-cd]pyrene	5.23E-06	1.42E-05	-	1.95E+06	-	1.36E+09	1	3.34E+00	-	-
Naphthalene	8.38E-06	1.80E-02	2.67E+04	1.54E+03	1.54E+00	1.36E+09	1	1.48E+01	1.46E-04	4.10E-04
Thallium (Soluble Salts)	-	-	-	-	7.10E+01	1.36E+09	1	1.09E+00	1.08E-05	-
Cobalt	-	-	-	-	4.50E+01	1.36E+09	1	1.50E+01	1.48E-04	-
**Total Risk/HI*	-	-	-	-	-	-	-	-	-	-

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
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I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation Noncarcinogenic (Particulates) CDI Child	Dermal Noncarcinogenic CDI Child	Ingestion Carcinogenic CDI	Inhalation (Volatiles) Carcinogenic CDI	Inhalation (Particulates) Carcinogenic CDI	Dermal Carcinogenic CDI	Ingestion HI Child	Inhalation (Volatiles) HI Child
Benz[a]anthracene	-	-	3.15E-05	1.92E-03	3.50E-06	1.05E-05	-	-
Benzo[a]pyrene	3.70E-09	2.07E-05	3.43E-05	-	3.80E-06	1.14E-05	2.24E-01	-
Benzo[b]fluoranthene	-	-	3.58E-05	-	3.97E-06	1.19E-05	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	2.44E-04	-
Dibenz[a,h]anthracene	-	-	5.04E-06	-	5.59E-07	1.68E-06	-	-
Indeno[1,2,3-cd]pyrene	-	-	1.68E-05	-	1.87E-06	5.61E-06	-	-
Naphthalene	8.05E-09	4.50E-05	-	1.52E-01	2.99E-06	-	7.30E-03	1.37E-01
Thallium (Soluble Salts)	-	-	-	-	-	-	1.08E+00	-
Cobalt	8.16E-09	-	-	-	-	-	4.93E-01	-
**Total Risk/HI*	-	-	-	-	-	-	*1.80E+00*	*1.37E-01*

Site-specific Risk Models
Resident Cumulative Risk
Soil (<40" Precipitation Zone)

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL), ca** (Where nc SL < 10 x ca SL),
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I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

Chemical	Inhalation (Particulates) HI Child	Dermal HI Child	Noncarcinogenic HI Child	Ingestion Risk	Inhalation (Volatiles) Risk	Inhalation (Particulates) Risk	Dermal Risk	Carcinogenic Risk
Benz[a]anthracene	-	-	**-**	3.15E-06	1.15E-07	2.10E-10	1.05E-06	**4.31E-06**
Benzo[a]pyrene	1.85E-03	6.90E-02	**2.94E-01**	3.43E-05	-	2.28E-09	1.14E-05	**4.57E-05**
Benzo[b]fluoranthene	-	-	**-**	3.58E-06	-	2.38E-10	1.19E-06	**4.77E-06**
Chromium(III), Insoluble Salts	-	-	**2.44E-04**	-	-	-	-	**-**
Dibenz[a,h]anthracene	-	-	**-**	5.04E-06	-	3.36E-10	1.68E-06	**6.72E-06**
Indeno[1,2,3-cd]pyrene	-	-	**-**	1.68E-06	-	1.12E-10	5.61E-07	**2.24E-06**
Naphthalene	2.68E-06	2.25E-03	**1.46E-01**	-	5.18E-06	1.02E-10	-	**5.18E-06**
Thallium (Soluble Salts)	-	-	**1.08E+00**	-	-	-	-	**-**
Cobalt	1.36E-03	-	**4.95E-01**	-	-	-	-	**-**
**Total Risk/HI*	*3.21E-03*	*7.12E-02*	***2.01E+00***	*4.77E-05*	*5.30E-06*	*3.28E-09*	*1.59E-05*	***6.89E-05***

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Site-specific Risk Models
Equation Inputs
Groundwater

Variable	Value
LT (lifetime - resident) year	70
K (volatilization factor of Andelman) L/m ^{3}	0.5
l_{sc} (apparent thickness of stratum corneum) cm	0.001
ED_{resw} (exposure duration - resident) year	26
ED_{reswc} (exposure duration - child) year	6
ED_{reswa} (exposure duration - adult) year	20
ED_{0-2} (mutagenic exposure duration first phase) year	2
ED_{2-6} (mutagenic exposure duration second phase) year	4
ED_{6-16} (mutagenic exposure duration third phase) year	10
ED_{16-26} (mutagenic exposure duration fourth phase) year	10
EF_{resw} (exposure frequency) day/year	350
EF_{reswc} (exposure frequency - child) day/year	350
EF_{reswa} (exposure frequency - adult) day/year	350
EF_{0-2} (mutagenic exposure frequency first phase) day/year	350
EF_{2-6} (mutagenic exposure frequency second phase) day/year	350
EF_{6-16} (mutagenic exposure frequency third phase) day/year	350
EF_{16-26} (mutagenic exposure frequency fourth phase) day/year	350
$ET_{resw-adj}$ (age-adjusted exposure time) hour/event	0.67077
$ET_{resw-madj}$ (mutagenic age-adjusted exposure time) hour/event	0.67077
ET_{resw} (exposure time) hour/day	24
ET_{reswc} (dermal exposure time - child) hour/event	0.54
ET_{reswa} (dermal exposure time - adult) hour/event	0.71
ET_{reswc} (inhalation exposure time - child) hour/day	24
ET_{reswa} (inhalation exposure time - adult) hour/day	24
ET_{0-2} (mutagenic inhalation exposure time first phase) hour/day	24
ET_{2-6} (mutagenic inhalation exposure time second phase) hour/day	24
ET_{6-16} (mutagenic inhalation exposure time third phase) hour/day	24
ET_{16-26} (mutagenic inhalation exposure time fourth phase) hour/day	24
ET_{0-2} (mutagenic dermal exposure time first phase) hour/event	0.54
ET_{2-6} (mutagenic dermal exposure time second phase) hour/event	0.54
ET_{6-16} (mutagenic dermal exposure time third phase) hour/event	0.71
ET_{16-26} (mutagenic dermal exposure time fourth phase) hour/event	0.71

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Site-specific Risk Models
Equation Inputs
Groundwater

Variable	Value
BW_{reswa} (body weight - adult) kg	80
BW_{reswc} (body weight - child) kg	15
BW_{0-2} (mutagenic body weight) kg	15
BW_{2-6} (mutagenic body weight) kg	15
BW_{6-16} (mutagenic body weight) kg	80
BW_{16-26} (mutagenic body weight) kg	80
$IFW_{res-adj}$ (adjusted intake factor) L/kg	327.95
$IFWM_{res-adj}$ (mutagenic adjusted intake factor) L/kg	1019.9
IRW_{reswc} (water intake rate - child) L/day	0.78
IRW_{reswa} (water intake rate - adult) L/day	2.5
IRW_{0-2} (mutagenic water intake rate) L/day	0.78
IRW_{2-6} (mutagenic water intake rate) L/day	0.78
IRW_{6-16} (mutagenic water intake rate) L/day	2.5
IRW_{16-26} (mutagenic water intake rate) L/day	2.5
EV_{reswa} (events - adult) per day	1
EV_{reswc} (events - child) per day	1
EV_{0-2} (mutagenic events) per day	1
EV_{2-6} (mutagenic events) per day	1
EV_{6-16} (mutagenic events) per day	1
EV_{16-26} (mutagenic events) per day	1
$DFW_{res-adj}$ (age-adjusted dermal factor) cm^2-event/kg	2610650
$DFWM_{res-adj}$ (mutagenic age-adjusted dermal factor) cm^2-event/kg	8191633
SA_{reswc} (skin surface area - child) cm^2	6365
SA_{reswa} (skin surface area - adult) cm^2	19652
SA_{0-2} (mutagenic skin surface area) cm^2	6365
SA_{2-6} (mutagenic skin surface area) cm^2	6365
SA_{6-16} (mutagenic skin surface area) cm^2	19652
SA_{16-26} (mutagenic skin surface area) cm^2	19652

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Site-specific Risk Models
Cumulative Risk
Groundwater

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I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

*The sum of PFHpA, PFHxS, PFNA, PFOS, and PFOA concentrations should not exceed 0.07 ug/L.

Chemical	Mutagen?	Volatile?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(\mu^3)^{-1}$	IUR Ref	GIABS	MW	log K_{ow} (L/kg)	In EPD?
Antimony (metallic)	No	No	4.00E-04	U	-		-		-		0.15	1.22E+02	-	Yes
Arsenic, Inorganic	No	No	3.00E-04	U	1.50E-05	U	1.50E+00	U	4.30E-03	U	1	7.49E+01	-	Yes
Barium	No	No	2.00E-01	U	5.00E-04	U	-		-		0.07	1.37E+02	-	Yes
Bis(2-ethylhexyl)phthalate	No	No	2.00E-02	U	-		1.40E-02	U	2.40E-06	U	1	3.91E+02	7.60E+00	
Cadmium (Water)	No	No	5.00E-04	U	1.00E-05	U	-		1.80E-03	U	0.05	1.12E+02	-	Yes
Chromium(III), Insoluble Salts	No	No	1.50E+00	U	-		-		-		0.013	5.20E+01	-	Yes
Copper	No	No	4.00E-02	U	-		-		-		1	6.35E+01	-	Yes
Cresol, p-	No	No	1.00E-01	U	6.00E-01	U	-		-		1	1.08E+02	1.94E+00	Yes
Ethylbenzene	No	Yes	1.00E-01	U	1.00E+00	U	1.10E-02	U	2.50E-06	U	1	1.06E+02	3.15E+00	Yes
Hexanone, 2-	No	Yes	5.00E-03	U	3.00E-02	U	-		-		1	1.00E+02	1.38E+00	Yes
Manganese (Non-diet)	No	No	2.40E-02	U	5.00E-05	U	-		-		0.04	5.49E+01	-	Yes
Mercury (elemental)	No	Yes	1.60E-04	U	3.00E-04	U	-		-		1	2.01E+02	6.20E-01	Yes
Methylnaphthalene, 1-	No	Yes	7.00E-02	U	-		2.90E-02	U	-		1	1.42E+02	3.87E+00	Yes
Methylnaphthalene, 2-	No	Yes	4.00E-03	U	-		-		-		1	1.42E+02	3.86E+00	Yes
Naphthalene	No	Yes	2.00E-02	U	3.00E-03	U	-		3.40E-05	U	1	1.28E+02	3.30E+00	Yes
Nickel Soluble Salts	No	No	2.00E-02	U	9.00E-05	U	-		2.60E-04	U	0.04	5.87E+01	-	Yes
Tetrachloroethane, 1,1,2,2-	No	Yes	2.00E-02	U	-		2.00E-01	U	5.80E-05	U	1	1.68E+02	2.39E+00	Yes
Thallium (Soluble Salts)	No	No	1.00E-05	U	-		-		-		1	2.04E+02	-	Yes
Trimethylbenzene, 1,2,4-	No	Yes	1.00E-02	U	6.00E-02	U	-		-		1	1.20E+02	3.63E+00	Yes
Trimethylbenzene, 1,3,5-	No	Yes	1.00E-02	U	6.00E-02	U	-		-		1	1.20E+02	3.42E+00	Yes
Vanadium and Compounds	No	No	5.04E-03	U	1.00E-04	U	-		-		0.026	5.09E+01	-	Yes
Xylenes	No	Yes	2.00E-01	U	1.00E-01	U	-		-		1	1.06E+02	3.16E+00	Yes
Cobalt	No	No	3.00E-04	U	6.00E-06	U	-		-		1	5.89E+01	-	Yes

Site-specific Risk Models
Cumulative Risk
Groundwater

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I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

*The sum of PFHpA, PFHxS, PFNA, PFOS, and PFOA concentrations should not exceed 0.07 ug/L.

Chemical	Concentration (µg/L)	Ingestion Noncarcinogenic CDI Child	Inhalation Noncarcinogenic (Volatiles) CDI Child	Dermal Noncarcinogenic CDI Child	Ingestion Carcinogenic CDI	Inhalation (Volatiles) Carcinogenic CDI	Dermal Carcinogenic CDI	Ingestion HI Child
Antimony (metallic)	3.57E+00	1.78E-04	-	7.84E-07	-	-	-	4.45E-01
Arsenic, Inorganic	5.77E+01	2.88E-03	-	1.27E-05	7.41E-04	-	3.95E-06	9.59E+00
Barium	4.48E+02	2.23E-02	-	9.84E-05	-	-	-	1.12E-01
Bis(2-ethylhexyl)phthalate	5.30E+01	2.64E-03	-	-	6.80E-04	-	-	1.32E-01
Cadmium (Water)	1.55E+00	7.73E-05	-	3.41E-07	1.99E-05	-	1.06E-07	1.55E-01
Chromium(III), Insoluble Salts	2.71E+01	1.35E-03	-	5.95E-06	-	-	-	9.01E-04
Copper	1.13E+02	5.63E-03	-	2.48E-05	-	-	-	1.41E-01
Cresol, p-	2.20E+02	1.10E-02	-	8.93E-04	-	-	-	1.10E-01
Ethylbenzene	1.80E+01	8.98E-04	8.63E-03	4.72E-04	2.31E-04	3.21E+00	1.32E-04	8.98E-03
Hexanone, 2-	4.80E+00	2.39E-04	2.30E-03	8.71E-06	-	-	-	4.79E-02
Manganese (Non-diet)	2.22E+04	1.11E+00	-	4.88E-03	-	-	-	4.61E+01
Mercury (elemental)	2.03E-01	1.01E-05	9.73E-05	4.46E-08	-	-	-	6.33E-02
Methylnaphthalene, 1-	9.90E+01	4.94E-03	-	6.18E-03	1.27E-03	-	1.73E-03	7.05E-02
Methylnaphthalene, 2-	8.10E+01	4.04E-03	-	4.98E-03	-	-	-	1.01E+00
Naphthalene	2.00E+02	9.97E-03	9.59E-02	5.71E-03	2.57E-03	3.56E+01	1.60E-03	4.99E-01
Nickel Soluble Salts	6.57E+01	3.28E-03	-	2.89E-06	8.43E-04	-	9.01E-07	1.64E-01
Tetrachloroethane, 1,1,2,2-	3.20E+00	1.60E-04	-	1.76E-05	4.11E-05	5.70E-01	4.92E-06	7.98E-03
Thallium (Soluble Salts)	1.97E-01	9.82E-06	-	4.33E-08	-	-	-	9.82E-01
Trimethylbenzene, 1,2,4-	1.20E+02	5.98E-03	5.75E-02	5.98E-03	-	-	-	5.98E-01
Trimethylbenzene, 1,3,5-	3.40E+01	1.70E-03	1.63E-02	1.23E-03	-	-	-	1.70E-01
Vanadium and Compounds	4.07E+01	2.03E-03	-	8.94E-06	-	-	-	4.03E-01
Xylenes	5.10E+01	2.54E-03	2.45E-02	1.36E-03	-	-	-	1.27E-02
Cobalt	3.28E+01	1.64E-03	-	2.88E-06	-	-	-	5.45E+00

Site-specific Risk Models
Cumulative Risk
Groundwater

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*The sum of PFHpA, PFHxS, PFNA, PFOS, and PFOA concentrations should not exceed 0.07 ug/L.

Chemical	Inhalation (Volatiles) HI Child	Dermal HI Child	Noncarcinogenic HI Child	Ingestion Risk	Inhalation (Volatiles) Risk	Dermal Risk	Carcinogenic Risk
Antimony (metallic)	-	1.31E-02	**4.58E-01**	-	-	-	-
Arsenic, Inorganic	-	4.23E-02	**9.63E+00**	1.11E-03	-	5.93E-06	**1.12E-03**
Barium	-	7.03E-03	**1.19E-01**	-	-	-	-
Bis(2-ethylhexyl)phthalate	-	-	**1.32E-01**	9.52E-06	-	-	**9.52E-06**
Cadmium (Water)	-	1.36E-02	**1.68E-01**	-	-	-	-
Chromium(III), Insoluble Salts	-	3.05E-04	**1.21E-03**	-	-	-	-
Copper	-	6.21E-04	**1.41E-01**	-	-	-	-
Cresol, p-	-	8.93E-03	**1.19E-01**	-	-	-	-
Ethylbenzene	8.63E-03	4.72E-03	**2.23E-02**	2.54E-06	8.01E-06	1.45E-06	**1.20E-05**
Hexanone, 2-	7.67E-02	1.74E-03	**1.26E-01**	-	-	-	-
Manganese (Non-diet)	-	5.08E+00	**5.12E+01**	-	-	-	-
Mercury (elemental)	3.24E-01	2.79E-04	**3.88E-01**	-	-	-	-
Methylnaphthalene, 1-	-	8.83E-02	**1.59E-01**	3.69E-05	-	5.01E-05	**8.70E-05**
Methylnaphthalene, 2-	-	1.24E+00	**2.25E+00**	-	-	-	-
Naphthalene	3.20E+01	2.85E-01	**3.27E+01**	-	1.21E-03	-	**1.21E-03**
Nickel Soluble Salts	-	3.61E-03	**1.67E-01**	-	-	-	-
Tetrachloroethane, 1,1,2,2-	-	8.78E-04	**8.86E-03**	8.21E-06	3.31E-05	9.83E-07	**4.22E-05**
Thallium (Soluble Salts)	-	4.33E-03	**9.87E-01**	-	-	-	-
Trimethylbenzene, 1,2,4-	9.59E-01	5.98E-01	**2.16E+00**	-	-	-	-
Trimethylbenzene, 1,3,5-	2.72E-01	1.23E-01	**5.64E-01**	-	-	-	-
Vanadium and Compounds	-	6.82E-02	**4.71E-01**	-	-	-	-
Xylenes	2.45E-01	6.78E-03	**2.64E-01**	-	-	-	-
Cobalt	-	9.61E-03	**5.46E+00**	-	-	-	-

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Cumulative Risk
Groundwater

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*The sum of PFHpA, PFHxS, PFNA, PFOS, and PFOA concentrations should not exceed 0.07 ug/L.

Chemical	Mutagen?	Volatile?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(\mu^3)^{-1}$	IUR Ref	GIABS	MW	log K_{ow} (L/kg)	In EPD?
Iron	No	No	7.00E-01	U	-		-		-		1	5.58E+01	-	Yes
*Total Risk/HI			-		-		-		-		-	-	-	

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Site-specific Risk Models
Cumulative Risk
Groundwater

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max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
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*The sum of PFHpA, PFHxS, PFNA, PFOS, and PFOA concentrations should not exceed 0.07 ug/L.

Chemical	Concentration (μg/L)	Ingestion Noncarcinogenic CDI Child	Inhalation Noncarcinogenic (Volatiles) CDI Child	Dermal Noncarcinogenic CDI Child	Ingestion Carcinogenic CDI	Inhalation (Volatiles) Carcinogenic CDI	Dermal Carcinogenic CDI	Ingestion HI Child
Iron	8.50E+04	4.24E+00	-	1.87E-02	-	-	-	6.05E+00
**Total Risk/HI*	-	-	-	-	-	-	-	*7.24E+01*

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Site-specific Risk Models
Cumulative Risk
Groundwater

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max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat, sol=SL exceeds Solubility
I=IRIS; D=Drinking Water/Health Advisory Goals; P=PPRTV; A=ATSDR; C=Cal EPA; X=APPENDIX PPRTV SCREEN; H=HEAST; S=SURROGATE; W=RPF

*The sum of PFHpA, PFHxS, PFNA, PFOS, and PFOA concentrations should not exceed 0.07 ug/L.

Chemical	Inhalation (Volatiles) HI Child	Dermal HI Child	Noncarcinogenic HI Child	Ingestion Risk	Inhalation (Volatiles) Risk	Dermal Risk	Carcinogenic Risk
Iron	-	2.67E-02	**6.08E+00**	-	-	-	-
**Total Risk/HI*	*3.38E+01*	*7.63E+00*	***1.14E+02***	*1.17E-03*	*1.25E-03*	*5.85E-05*	***2.48E-03***

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APPENDIX D
Response to Comments

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation

DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program

610 University Ave
Fairbanks, Alaska, 99709-3643
Main: 907.451.2180
Fax: 907.451.5105
www.dec.alaska.gov

May 05, 2021

File No: 107.38.006

Kristina Smith
Installation Restoration Program
AFCEC CZOP
2310 Central Avenue, Suite 213
Eielson AFB, AK 99702

Re: **DEC Backcheck and Approval for the *Draft Final Decision Document for Performance Based Remediation, Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506, Eielson Air Force Base, Alaska***

Dear Ms. Smith:

The Alaska Department of Environmental Conservation (DEC) has completed a backcheck review of the above referenced Decision Document. This Decision Document describes the remedial actions for Eielson Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506, all of which are associated with potential contamination resulting from petroleum, storage, distribution, and/or use. DEC is accepting all responses to comments (see enclosed) for the draft final document.

Please finalize the document for signature. Once DEC has received a signed final version, DEC will sign and provide a copy for the Air Force administrative record. If you have any questions, please do not hesitate to contact the DEC project manager at (907) 451-2180, or by email at dennis.shepard@alaska.gov.

Sincerely,

Digitally signed by Dennis Shepard
Date: 2021.05.05 17:18:08 -08'00'

Dennis Shepard
Remedial Project Manager

cc via email: Joe Price, AFCEC
Mike Boese, AFCEC
Roy Willis, AFCEC
Dustan Bott, EPA
Melinda Brunner, DEC
Axl Levan, DEC

Enclosure: DEC Comment Matrix

DEC Comments for the *Draft Decision Document for Performance Based Remediation, Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506, Eielson Air Force Base, Alaska*

September 22, 2020

Reviewer: Alaska Department of Environmental Conservation

Comment No.	Page	Section	Comment / Recommendation	Response
1.	General RAO's		The outdoor and indoor inhalation pathway is marked complete on CSM forms for TU506, SS084, SO073, SO071, and the outdoor inhalation pathway is marked complete for SS069. However, there is no Remedial Action Objective identified to "Limit or eliminate the potential for contaminant migration from soil or groundwater to indoor or outdoor air."	Accept. The overarching RAO in the Executive Summary will be revised to: "…POL or petroleum-related contaminant migration from soil to sediment, surface water, and groundwater or from soil, sediment, surface water, or groundwater to indoor or outdoor air." **DEC Accept 5/05/2021** A RAO for SO071, SS084, TU506 has been modified to, "Limit or eliminate the potential for contaminant migration from soil to groundwater **or** from soil or groundwater to indoor or outdoor air." **DEC Accept 5/05/2021** No RAOs are proposed for NFA sites (SO069, SO073). The CSM forms for SO069 and SO073 will be revised for clarity. **DEC Accept 5/05/2021**

Comment No.	Page	Section	Comment / Recommendation	Response
				<u>SO069</u> -At SO069, the outdoor inhalation pathway is marked complete due to RRO exceeding 1/10th of human health criteria but RRO is not identified as a COC. The scoping and graphic CSMs will be revised to indicate that RRO exposure is insignificant due to three factors: -The site is located in a remote area behind a locked gate on Engineer Hill, far from the developed part of EAFB, and short-term exposure to RRO at the site is not expected to cause effects. -Military escort is required to gain access to the site. People are not expected to be on the site for more than 10 days a year and short-term exposure to contaminant levels present at the site are not expected to cause effects. -There were no RRO exceedances at this source area. RRO is limited in extent, volume, and toxicity and is not expected to cause a significant exposure threat. **DEC Accept 5/05/2021** **<u>SO073</u>** -At SO073, naphthalene exceeds 1/10th ADEC Human Health criteria in one historic surface soil sample only but is not identified as a COC.

Comment No.	Page	Section	Comment / Recommendation	Response
				More recent sampling did not identify naphthalene above 1/10th ADEC Human Health criteria or stricter MTG criteria. -The scoping and graphic CSMs will be revised to indicate that exposure will be described as insignificant for dermal absorption of contaminants from soil, indoor inhalation, and outdoor inhalation based on the location and limited extent of contamination at the site, as described above. **DEC Accept 5/05/2021**
2.	General		Table ES-1, Remedies for Applicable Source Areas: For each SITE where there are remaining data gaps, or metals or PAHs are not fully addressed, the decision document needs to specify the SITE returns to the three-party agreement once the petroleum remedy has been implemented. Please clarify for each site requiring additional investigation of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) constituents, that the site will be transferred back to the 3-party, and constituents remaining will be addressed under the Eielson AFB, Eielson Federal Facilities Agreement	Accept. The following will be added for each site in Table ES-1: "Any CERCLA constituents remaining will be addressed under the three-party agreement." **DEC Accept 5/05/2021** Additionally, the following text has been added at the end of Part 1: "Any Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) constituents remaining will be addressed by transferring source areas back to the *Eielson Air Force Base, Federal Facility Agreement Under CERCLA Section 120* (USAF 2013a), herein referred to as the three-party agreement." **DEC Accept 5/05/2021**

Comment No.	Page	Section	Comment / Recommendation	Response
3.	ES-2	Table ES-1	@SO071 Excavation, Text states: "Excavation cannot occur at this time where infrastructure is present. Limitations to excavation may include the location of Building 1814, which is expected to be demolished prior to the implementation of the remedy." It is unclear how long the building will remain before the remedy is implemented. Please clarify.	Accept. The text will be revised to state: "Limitations to excavation may include the location of Building 1814, which is expected to be demolished prior to the implementation of this remedy; however, it is unknown when the building will be demolished." **DEC Accept 5/05/2021**
			@ SS084, Text states: "LUCs (e.g., dig restrictions and groundwater use restrictions) will be implemented until the remedy action occurs and until cleanup levels are attained for residual soil and groundwater contamination, and/or until such a time that complete removal of soil contamination is practical." This wording implies that LUCs can be eliminated if removal of soil contamination is practicable however, UU/UE for groundwater would need to be achieved for this to be true. Please add.	Accept. The bullet will be revised to state: "… and/or until such a time that complete removal of soil contamination is practical and cleanup levels are attained for groundwater contamination." **DEC Accept 5/05/2021**
			@TU506, Text states: "Groundwater is not an impacted medium at this source area. Then in the next bullet, LUCs (e.g., dig restrictions) will be implemented until the remedy action occurs and until cleanup levels are attained for residual soil and groundwater." Please clarify that groundwater is not impacted.	Accept. The bullet will be revised to state: "LUCs (e.g., dig restrictions) will be implemented until the remedy action occurs and until cleanup levels are attained for residual POL-related soil ~~and groundwater~~ contamination, and/or until such a time…." **DEC Accept 5/05/2021**
			General comment Table ES-1: For each remedy where contamination may remain in place after excavation, or GW is being treated by MNA, please add a periodic review of the protectiveness of the remedy, not to exceed every five years, until UU/UE is achieved.	Accept. The following will be added as a bullet for source areas SO071, SS084, and TU506:

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				"LUCs will be reviewed periodically, not to exceed every five years, until UU/UE is achieved." **DEC Accept 5/05/2021** For Source Area SS084, an additional bullet will be added: "If groundwater concentrations are greater than cleanup levels for one or both semi-annual monitoring events within one year, periodic review will determine continued remediation and will be undertaken at a frequency not exceeding 5 years unless a longer timeframe is agreed upon by USAF and ADEC. This applies only to POL contamination; all other non-petroleum-related contamination will be addressed under the three-party agreement." **DEC Accept 5/05/2021**
4.	1-1	Part 1	Text states: "USAF is managing remediation of contamination at Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506 in accordance with the State-Eielson Agreement" Please revise to: "…remediation of petroleum contamination…"	Accept. The text will be revised to state: "USAF is managing remediation of POL and petroleum-related contamination at Source Areas SO065, SO069, SO070, SO071, SO073, SS084, and TU506 in accordance with the State-Eielson Agreement…" **DEC Accept 5/05/2021**
5.	2-5	2.3	Text states: "In SCRI, all analytes were compared to one-tenth of their respective 2017 human health cleanup levels, as presented in Tables B1, B2, and C.."	Accept. During the investigation phase (SC phase), analytes were compared directly to ADEC Table

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			However, Air Force should be comparing directly to the B2 levels, not one tenth of them. Please revise.	B1 (most conservative of human health under 40-inch zone and migration to groundwater for soil) and B2 cleanup levels. Separately, analytes were compared to one-tenth of 2017 ADEC human health cleanup levels to determine which analytes would be included in CRE. The statement as presented in Section 2.3 will be revised for clarity. **DEC Accept 5/05/2021** At this stage (Decision Document), analytical results are compared directly to ADEC cleanup levels (RAOs). **DEC Accept 5/05/2021** Additionally, the Section 2.3 header will be revised to state "2.3 IDENTIFICATION OF POL-RELATED CHEMICALS OF CONCERN AND NON-PETROLEUM-RELATED CHEMICALS OF POTENTAL CONCERN" **DEC Accept 5/05/2021** The last sentence in Section 2.3 will be revised to state: "…were retained as petroleum-related COCs or as CERCLA-related COPCs to be addressed under the three-party agreement, except as…"

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				DEC Accept 5/05/2021 The following text will be added before the first sentence of Section 2.3.1: "Metals contamination is outside the scope of this DD and will be addressed under the three-party agreement." **DEC Accept 5/05/2021** Section 2.3.1.1 will be revised to refer to thallium as a non-petroleum-related COPC. **DEC Accept 5/05/2021** Section 2.3.2 will be revised to refer to PAHs with no petrogenic signatures as non-petroleum-related COPCs. **DEC Accept 5/05/2021** The section 3.1.2.1 header will be revised to state: "3.1.2.1 3.1.2.1 POL-Related Chemicals of Concern and Non-Petroleum-Related Chemicals of Potential Concern" **DEC Accept 5/05/2021**
6.	2-6	2.3.1	2nd paragraph, text states: "however, metals exceedances in groundwater are not believed to be anthropogenic in origin due to the prevalence of naturally occurring metals in unfiltered groundwater across Eielson AFB, the lack of corresponding soil anomalies in collocated soil borings, and the lack of known or suspected anthropogenic sources of metals at these source areas."	Accept. The text will be revised as requested. **DEC Accept 5/05/2021**

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			Please remove this editorial language.	
7.	2-7	2.3.1.2	Text states: "corrosion control ships, used oil sites," Replace with shops. Please revise. Text states: "Therefore, the absence of chromium speciation data is not considered a data gap for the sites addressed in this DD, and chromium will not be proposed as a COC at source areas where total chromium exceeds the PSL in soil or groundwater (i.e., Source Areas SO065, SO070, SO071, SS084, and TU506)." Please clarify that the DEC cleanup level for Total Chromium was not exceeded on any site.	Accept. The text will be revised to state "corrosion control shops, …" **DEC Accept 5/05/2021** Accept. The SCR and DD present total chromium results because no chromium speciation was done. All sites had results exceeding the previous ADEC Total Chromium cleanup level of 25, but no Cr results exceeded the DEC cleanup level for Total Chromium(III), Insoluble Salts of 1.0×10^5. Site analytical data reporting total chromium results are presumed to represent chromium III unless site-specific evidence indicates a potential chromium VI source (such as unlined landfills, used oil storage areas, metals shops, photo development sites, and unlined wastewater treatment facility ponds). The last sentence in Section 2.3.1 will be revised to state: "Therefore, the absence of chromium speciation data is not considered a data gap for the sites addressed in this DD, and Total Chromium (III) has not been proposed as a non-petroleum-related COPC at any site in this DD, because Total Chromium (III) results did not exceed the ADEC cleanup level in soil or groundwater (i.e.,

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				Source Areas SO065, SO070, SO071, SS084, and TU506)." **DEC Accept 5/05/2021**
8.	2-8	2.3.3	Text states: "No sampling for perfluorooctanoic acid (PFOA) and/or perfluorooctane sulfonate (PFOS) was conducted as part of site characterization (SC) activities, but information from the ADEC Contaminated Sites Database indicates that PFOA/PFOS is not present in groundwater at the source areas described in this DD (Figure A-1)." However, the Air Force has conducted limited PFAS investigations in a PA-SI and an expanded SI and identified areas of groundwater exceedances of the EPA lifetime health advisory for PFOS and or PFOA throughout Eielson Air Force Base and downgradient locations. The ADEC plume map only consolidates the information provided by the Air Force from the sampling efforts. Please revise the sentence to indicate there is no known PFAS contamination. The Air Force has sampled for and identified PFAS in the soil and groundwater within the Eielson NPL site, and the information from the ADEC plume map just consolidates that data. ADEC makes no representation that PFOA/PFOS is absent from the source areas, where PFAS has not been characterized. Please remove the reference to the ADEC plume map.	Accept. The text in Section 2.3.3 will be revised to state: "No sampling for perfluorooctanoic acid (PFOA) and/or perfluorooctane sulfonate (PFOS) was conducted as part of site characterization (SC) activities, and there is no confirmed PFOA/PFOS contamination in groundwater at the source areas described in this DD. A separate basewide effort to identify and delineate PFOA/PFOS is underway." **DEC Accept 5/05/2021**
9.	2-9	2.5	Text states: "Presently, soil and groundwater LUCs areas proposed in the site characterization (SC) report are in place, as described in the Land Use Control Implementation Plan [LUCIP], Eielson Air Force Base, Alaska (USAF 2015a); these shall be retained, revised, and documented in future versions of the LUCIP." Please add that any proposed LUCIP changes will be reviewed and approved by DEC prior to implementation.	Accept. The text will be revised to state: "…these shall be retained, revised, <u>reviewed and approved by ADEC</u>, and documented in future versions of the LUCIP." **DEC Accept 5/05/2021**
10.	3-1	3.1.1	2nd Bullet, During the 2012 Phase 1 source evaluation. Please summarize results of that sampling.	Accept. The following text will be added to the end of the 2012 Phase 1 SE bullet:

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				"For surface soil samples, benzo(a)anthracene, benzo(a)pyrene, naphthalene, and thallium exceeded SCR PSLs and chromium exceeded the BTV. For subsurface soil samples, only thallium exceeded the PSL (USAF 2013c, USAF 2018b)." **DEC Accept 5/05/2021**
11.	3-2	3.1.1	1st Bullet, In 2016, one soil boring (SO065SB06) was advanced. Please summarize results of the sampling.	Accept. The bullet will be clarified: • "In 2016, one soil boring (SO065SB06) was advanced and six surface soil samples were collected. The subsurface soil sample was collected from the same interval where thallium was identified in 2012 and analyzed for thallium. Thallium did not exceed PSL in this sample. Four of the surface soil samples were analyzed for PAHs and metals and two were analyzed for DRO, GRO, RRO, VOCs, PAHs, and metals (USAF 2018b). Benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, and naphthalene exceeded the PSLs in one of six surface soil samples. Chromium concentrations

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				exceeded the BTV in two of the six surface soil samples." **DEC Accept 5/05/2021**
12.	3-3	3.1.2.1 & 3.1.2.2	Text states: "No POL-related COCs have been retained at SO065." And "There is no remaining POL-related contamination as a result of a release at Source Area SO065." However, Naphthalene was identified in soil sample 16E-SO065SS05-00, at a concentration of 0.27 mg/kg which is above the ADEC 18 AAC 75.341(c) Table B1, under 40-inch zone migration to groundwater cleanup level. The SCR1 report also identifies two historical samples (with concentrations above the migration to groundwater cleanup level (0.038 mg/kg). Naphthalene should not be dismissed from the list of COCs, because it is above an applicable cleanup level.	Agree. Benzo(a)pyrene and naphthalene will be added as non-petroleum-related COPCs at S0065 due to concentrations that contribute to carcinogenic risk and exceed the human health criteria (ADEC Table B1 Method Two, under 40-inch zone). Although benzo(a)pyrene and naphthalene have been added as non-petroleum-related COPCs and will be addressed under the three-party agreement, exposure is insignificant due to the following three factors: 1) The site is located in a remote area behind a locked gate on Engineer Hill, far from the developed part of EAFB, and short-term exposure to benzo(a)pyrene at the site is not expected to cause effects; 2) Military escort is required to gain access to the site. People

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				are not expected to be on the site for more than 10 days a year and short-term exposure to contaminant levels present at the site are not expected to cause effects; 3) Benzo(a)pyrene and naphthalene are limited in extent, volume, and toxicity and are not expected to cause a significant exposure threat. The remedy will remain as NFA and the benzo(a)pyrene and naphthalene contamination will be addressed under the three-party agreement in accordance with the Eielson Federal Facilities Agreement, and an approved PAH remedy. Text and table additions have been made to Sections 3.1.2.1 and 3.1.3 to identify benzo(a)pyrene and naphthalene as non-petroleum-related COPCs at SO065. **DEC Accept 5/05/2021** Additionally, the title of Table 3-1 will be revised to: "Non-Petroleum-Related Soil COPCs at Source Area SO065 with Comparison of Cleanup

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				Levels" and the following table note has been added: " [4] Non-petroleum-related COPC to be addressed under the three-party agreement; remediation is not within the scope of this DD." **DEC Accept 5/05/2021**
13.	3-3	3.1.4	Text states: "Site closure is recommended for Source Area SO065 based on the historical results and SC activities from the SCR" Clarify "for petroleum". However, PAHs and metals will need further investigation and will be addressed under the Eielson Air Force Base, Federal Facility Agreement Under CERCLA Section 120 when the site is transferred after the petroleum response is complete.	Accept. The following text will be added to Sections 3.1.4, 3.2.4, 3.3.4, and 3.5.4: "Any CERCLA constituents (e.g., PAHs and metals) will be addressed under the three-party agreement." **DEC Accept 5/05/2021**
14.	2-7, 3-3 & 3.9	2.3.2, 3.1.4.1 & 3.3.4.1	Text states: "PAHs have been occasionally detected above ADEC cleanup levels at the source area; however, due to the presence of PAH detections in absence of collocated fuels, the USAF and regulatory stakeholders are establishing an Eielson-wide approach to address these contaminants." However, the Eielson-wide PAH approach has not been fully reviewed or approved for implementing. In the absence of an approved PAH remedy, naphthalene should be retained as a COC. A no further action remedy could still be proposed and evaluated for site SO065. The paragraph needs to be revised throughout the document to indicate that PAH contamination is present above DEC cleanup levels (where applicable) and a COC for the site, the contamination will be	Agree. See Comment #12 for additional discussion on adding benzo(a)pyrene and naphthalene as non-petroleum-related COPCs at SO065. In the absence of co-located fuel exceedances, naphthalene will be added as a non-petroleum-related COPC at S0070 and the remedy will remain NFA for POL. Although naphthalene has been added as a non-petroleum-related COPC and will be addressed under the three-party agreement, exposure is insignificant due to the following three factors:

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			addressed under the three party agreement in accordance with the Eielson Federal Facilities Agreement, and an approved PAH remedy.	1) The site is located in a remote area behind a locked gate on Engineer Hill, far from the developed part of EAFB, and short-term exposure to naphthalene at the site is not expected to cause effects; 2) Military escort is required to gain access to the site. People are not expected to be on the site for more than 10 days a year and short-term exposure to contaminant levels present at the site are not expected to cause effects; 3) Naphthalene is limited in extent, volume, and toxicity and is not expected to cause a significant exposure threat. The remedy will remain as NFA for POL and the naphthalene contamination will be addressed under the three-party agreement in accordance with the Eielson Federal Facilities Agreement, and an approved PAH remedy. Text and table additions have been made the appropriate sections to identify naphthalene as a non-petroleum-related COPC at SO070. **DEC Accept 5/05/2021** Additionally, Table 3-2 has been added and titled: "Non-Petroleum-Related Soil COPC at Source Area SO070 with Comparison of Cleanup

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				Levels". **DEC Accept 5/05/2021** In Section 2.3.2, the text will be revised to, "PAHs with non-petrogenic signature that occur in the absence of co-located fuel exceedances are termed 'non-petroleum-related COPCs' and will be addressed under the three-party agreement after the petroleum response is complete." **DEC Accept 5/05/2021** In Sections 3.1.4.1, 3.3.4.1, and 3.5.4.1, the text will be revised to: "PAHs have been detected above ADEC cleanup levels at the source area; however, due to the presence of PAH detections in absence of collocated fuels, the site will be addressed under the three-party agreement. Additionally, the USAF and regulatory stakeholders are establishing an Eielson-wide approach to address these contaminants." **DEC Accept 5/05/2021** Benzo(a)pyrene and naphthalene will be added as non-petroleum-related COPCs at SO073 due to concentrations that contribute to carcinogenic risk and exceed the

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				human health criteria (ADEC Table B1 Method Two, under 40-inch zone). Although benzo(a)pyrene and naphthalene will be added as COPCs and will be addressed under the three-party agreement, exposure is insignificant due to the following three factors: 1) The site is located in a remote area behind a locked gate on Engineer Hill, far from the developed part of EAFB, and short-term exposure to benzo(a)pyrene and naphthalene at the site is not expected to cause effects; 2) Military escort is required to gain access to the site. People are not expected to be on the site for more than 10 days a year and short-term exposure to contaminant levels present at the site are not expected to cause effects; 3) Benzo(a)pyrene and naphthalene are limited in extent, volume, and toxicity

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				and are not expected to cause a significant exposure threat. **DEC Accept 5/05/2021** The remedy will remain as NFA and the benzo(a)pyrene and naphthalene contamination will be addressed under the three-party agreement in accordance with the Eielson Federal Facilities Agreement, and an approved PAH remedy. Text and table additions have been made to Sections 3.5.2.1 and 3.5.3 to identify benzo(a)pyrene and naphthalene as non-petroleum-related COPCs at SO073. **DEC Accept 5/05/2021** Table 3-6 has been added and titled: "Non-Petroleum-Related Soil COPCs at Source Area SO073 with Comparison of Cleanup Levels". **DEC Accept 5/05/2021**
15.	3-4	3.2.1	Please provide a summary of the results from each investigation.	Accept. Section 3.2.1 will be revised as requested. **DEC Accept 5/05/2021**
16.	3-7	3.3.1	Please provide a summary of the results from each investigation.	Accept. Section 3.3.1 will be revised as requested. **DEC Accept 5/05/2021**
17.	3-8	3.3.2	Text states: "CSMs, COCs, and the extent of contamination were evaluated to assist in selecting the appropriate remedy for Source Area SO070. The CSM scoping and graphic forms are presented in	Accept. In the absence of co-located fuel exceedances, naphthalene will be identified as a

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			Appendix B. There are no current or future receptors because of the lack of POL-related contamination at SO070." However, there is significant naphthalene contamination exceeding the ADEC 18 AAC 75.341(c) Table B1, under 40-inch zone migration to groundwater cleanup level, and in the absence of an approved PAH remedy, naphthalene should be retained as a COC.	non-petroleum-related COPC at SO070 and the remedy will remain NFA for POL. Text and table additions have been made to Sections 3.3.2.1 and 3.3.3 to identify naphthalene as a non-petroleum-related COPC at SO070. PAH contamination will be addressed under the three-party agreement. See comment response #14 for additional text in Section 3.3.4.1. **DEC Accept 5/05/2021**
18.	3-9 & 3-10	3.4.1	Please provide a summary of the results from each investigation. Text states: "In 2015, the exterior of Building 1814 was inspected (USAF 2018b). A UST was removed in August 2015. Field screening results were below 20 ppm after the excavation was complete (ADEC 2018)." Please add: the UST site spill was reported to and closed by DEC Prevention, Preparedness, and Response (PPR). 2/3 cubic yards of petroleum contaminated soil were excavated from the UST location. DEC has an email on record from the USAF dated August 02, 2016, indicating that confirmation samples were collected, and results would be provided to PPR to support closing the historical spill reported.	Accept. Section 3.4.1 will be revised as requested. **DEC Accept 5/05/2021**Accept. The following text will be added at the end of the paragraph: "The UST site spill was reported to and closed by ADEC Prevention, Preparedness, and Response. Less than 1 cy of petroleum-contaminated soil was excavated from the UST location." The August 02, 2016 email referenced in the comment could not be located. **DEC Accept 5/05/2021**
19.	3-11	3.4.2.1	Text states: "therefore, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene were removed from the list of groundwater COCs for this DD. Shouldn't this say soil COCs?	Accept. The text will be revised to state: "therefore, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene are not listed as soil COCs or COPCs for this DD." **DEC Accept 5/05/2021**

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20.	3-11	Table 3-1	Table note 1. [1]MDC in soil is maximum value for any specific analyte. Please revise to: "maximum detected concentration" on all tables in the document where applicable.	Accept. The Table notes will be revised to state "maximum detected concentration" (not value). **DEC Accept 5/05/2021**
21.	3-14	3.4.3.2	1st Bullet, text states: "Limitations to excavation may include the location of Building 1814, which is expected to be demolished prior to the implementation of this remedy." Why would Building 1814 limit excavation if it is scheduled to be demolished prior to remedy implementation? 3rd Bullet, Text states: "Excavation will be considered complete once analytical results are below cleanup levels or contamination has been removed to the extent practicable." Please add: As agreed to by the USAF and DEC.	Accept. The text will be revised to state: "Limitations to excavation may include the location of Building 1814, which is expected to be demolished prior to the implementation of this remedy; however, it is unknown when the building will be demolished." **DEC Accept 5/05/2021** Accept. The text in the third bullet will be revised to state: "Excavation will be considered complete once analytical results are below cleanup levels or contamination has been removed to the extent practicable, as agreed to by the USAF and ADEC." **DEC Accept 5/05/2021**
22.	3-14	3.4.3.2	Text states: "Interim restrictions on soil and groundwater use as well as site access are already in place as described in the LUCIP, Eielson AFB, Alaska (USAF 2015a), and shall be retained, revised, and documented in future versions of the LUCIP" Please add that any proposed LUC changes will be reviewed and approved by DEC.	Accept. The text will be revised to state: "…and shall be retained, revised, reviewed and approved by ADEC, and documented in future versions of the LUCIP. **DEC Accept 5/05/2021**
23.	3-15	3.5.1	Please provide a summary of the results from each investigation.	Accept. Section 3.5.1 will be revised as requested. **DEC Accept 5/05/2021**

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24.	3-16	3.5.1.3	Text states: "Building 1434 is currently scheduled for demolition in 2019 (USAF 2018b)." Please update this information. Was the building removed?	Accept. Section 3.5.1.3 will be revised to, "Building 1434 is not currently scheduled for demolition. The industrial nature of the site is unlikely to change in the near future." **DEC Accept 5/05/2021**
25.	3-17	3.5.4.1	There is significant naphthalene contamination exceeding the ADEC 18 AAC 75.341(c) Table B1, under 40-inch zone migration to groundwater cleanup level, and in the absence of an approved PAH remedy, naphthalene should be retained as a COC. The decision document for POL needs to track the exceedance of PAHs and specify that the contamination is proposed to be addressed under the three-party agreement in accordance with the Eielson Federal Facilities Agreement, and an approved PAH remedy.	Accept. In the absence of co-located fuel exceedances, benzo(a)pyrene and naphthalene will be added as non-petroleum-related COPCs at SO073 and the remedy will remain NFA for POL. (See also Comment #14 for additional discussion.) **DEC Accept 5/05/2021** In Section 3.5.4.1, the text will be revised to, "PAHs have been detected above ADEC cleanup levels at the source area; however, due to the presence of PAH detections in absence of collocated fuels, the site will be addressed under the three-party agreement. Additionally, the USAF and regulatory stakeholders are establishing an Eielson-wide approach to address these contaminants." **DEC Accept 5/05/2021**
26.	3-18 & 3-19	3.6.1	Please provide a summary of the results from each investigation.	Accept. Section 3.6.1 will be revised as requested. **DEC Accept 5/05/2021**

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27.	3-23	Table 3-5	Note 5: "calculations were performed using the ADEC Method 3 Calculator and parameters from the EPA Regional Screening Level and are available from ADEC upon request." The Air Force should have a copy of the calculations and/or be able to reproduce them.	Accept. For the non-petroleum-related COPCs cobalt and iron, parameters from the EPA RSL tables were manually entered into the Method 3 calculator. These human-health cleanup levels are as follows for soil and groundwater, respectively: • Cobalt: 30 mg/kg, 0.006 mg/L • Iron: 77,000 mg/kg, 14 mg/L • Manganese: 2,700 mg/kg, 0.43 mg/L The soil levels for cobalt and iron are greater than the EPA RSLs (23 mg/kg and 55,000 mg/kg, respectively) but are selected for consistency with the ADEC Cumulative Risk calculator. **DEC Accept 5/05/2021** The phrase "and are available from ADEC upon request" referred to the related input/output files, and will be removed from the text. **DEC Accept 5/05/2021**
28.	3-25	3.6.3.2	3rd Bullet, Text states: "Excavation will be considered complete once analytical results are below cleanup levels or contamination has been removed to the extent practicable." Please add: As agreed upon by DEC and the USAF.	Accept. The text in the third bullet will be revised to state: "Excavation will be considered complete once analytical results are below cleanup levels or contamination has been removed to

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				the extent practicable, as agreed to by the USAF and ADEC." **DEC Accept 5/05/2021**
29.	3-26	3.6.3.2	2nd Bullet, Text states: "Monitoring for metals in groundwater will include at least two monitoring events. If concentrations of metals COCs (Table 3-5) in filtered groundwater are less than applicable cleanup levels for two consecutive events, monitoring will cease." Per DEC Field Sampling Guidance: Water samples typically should not be filtered prior to analysis. If filtering is approved by CSP in a site-specific work plan, both filtered and non-filtered samples will need to be collected and analyzed so the effects (bias) of the filtering process on the contaminant concentrations can be evaluated. Please indicate that both filtered and unfiltered samples will be collected. 3rd Bullet, Text states: "In addition to the monitoring of groundwater COCs (Table 3-5), MNA of groundwater will include periodic assessment of the mechanism of attenuation. Please add that the periodic assessment will be undertaken at a frequency not exceeding 5 years unless agreed by USAF and DEC..	Accept. The first bullet will be revised to state: "Groundwater monitoring for POL-related groundwater COCs (Table 3-8) shall be conducted annually until concentrations are stable and below the applicable cleanup levels for three consecutive monitoring events. Results from groundwater monitoring will be documented in an annual monitoring report. Periodic review will determine continued remediation and will be undertaken at a frequency not exceeding five years unless a longer timeframe is agreed upon by USAF and ADEC." **DEC Accept 5/05/2021** The second bullet will be revised to state: "Monitoring for POL-related metals COCs in groundwater (i.e., lead) will comply with the following. Monitoring will include at least two groundwater sampling events; both unfiltered and filtered groundwater samples will be collected. Filtered samples will be analyzed to evaluate any bias introduced by the filtering

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				process. If lead concentrations in filtered groundwater are less than applicable cleanup levels for two consecutive events, monitoring for metals COCs will cease; monitoring for other COCs may continue as needed. These monitoring requirements apply only to POL-related metals; other non-petroleum-related metals contamination in groundwater (e.g., arsenic, cobalt, iron, and manganese) will be addressed under the three-party agreement." **DEC Accept 5/05/2021** Accept. The last sentence of the third bullet will be revised to state: "MNA assessment will be conducted in conjunction with monitoring efforts to determine whether geochemical conditions remain conducive to biodegradation and will be undertaken at a frequency not exceeding 5 years unless agreed by USAF and ADEC." **DEC Accept 5/05/2021**
30.	3-26, 3-33	3.6.3.2 & 3.7.3.2	Interim restrictions on soil and groundwater use as well as site access are already in place as described in the LUCIP, Eielson AFB, Alaska (USAF 2015a), and shall be retained, revised, and documented in future versions of the LUCIP.	Accept. The text in Sections 3.6.3.2 and 3.7.3.2 will be revised to state: "…these shall be retained, revised, reviewed and approved by ADEC, and documented in future versions of the LUCIP."

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			Please add that any proposed LUCIP changes will be reviewed and approved by DEC.	**DEC Accept 5/05/2021**
31.	3-26	3.6.3.3	Text states: "Groundwater cleanup levels are the Table C human health cleanup levels." Add 18 AAC 75.345 reference to groundwater cleanup levels.	The text will be revised to state: "Groundwater cleanup levels are the 18 AAC 75 Table C human health cleanup levels." **DEC Accept 5/05/2021**
32.	3-29	3.7.1	Please provide a summary of the results from each investigation.	Accept. Section 3.7.1 will be revised as requested. **DEC Accept 5/05/2021**
33.	3-30	3.7.2.1	Text states: "No groundwater COCs were identified at Source Area TU506." However, The SCR1 report indicates that Groundwater samples were not collected." Please revise the sentence to indicate that groundwater samples were not collected and groundwater COCs were not identified.	Accept. The text will be revised to state: "No groundwater samples were collected and no groundwater COCs or COPCs were identified at Source Area TU506." **DEC Accept 5/05/2021**
34.	3-32	3.7.3.2	Text states: "Excavation will be considered complete once analytical results are below cleanup levels or contamination has been removed to the extent practicable." Please add: As agreed upon by DEC and the USAF. Add this clarification here, and wherever this sentence appears in the document.	Accept. The text will be revised to state: "Excavation will be considered complete once analytical results are below cleanup levels or contamination has been removed to the extent practicable, as agreed to by USAF and ADEC." This clarification will be added as applicable throughout the document (Sections 3.4.3.2 and 3.6.3.2). **DEC Accept 5/05/2021**
35.	4-1	Part 4	Text states: "Waste contaminated with POL will be characterized, transported, and treated at an approved treatment facility in accordance	Accept. The text will be revised to state:

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			with 18 AAC 60 (ADEC 2017d)." However, the waste may contain metals, so this should be left "Contaminated waste will be characterized…" Please revise. Also, the Characterization, Transport, Treatment and Approved Treatment Facilities are approved in accordance with 18 AAC 75.325-18 AAC 75.390. Please revise the reference.	"Contaminated waste will be characterized, transported, and treated at an approved treatment facility in accordance with 18 AAC 60 (ADEC 2017d) and 18 AAC 75.325-390 (ADEC 2017c)." **DEC Accept 5/05/2021**
36.	5-1	Part 5	Production intake wells that are used for drinking water at Eielson AFB are sufficiently distant and upgradient to Source Areas SO065, SO069, SO070, SO071, SO073, SS084, or TU506 that the drinking water exposure pathway is incomplete Are there any unused drinking water wells at Engineer Hill?	There are currently no drinking water wells on Engineer Hill. Production wells OWS56 and NWS56WH were installed in the bedrock aquifer in 1976 and 1990, respectively (USAF 1991b). These production wells were used as water supply wells until 2002 (USAF 2008c). Former production well NWS56WH is now used as a groundwater monitoring well (USAF 2018a). **DEC Accept 5/05/2021**
37.	5-3	Bullet f.	f. Environmental Restoration Program Atlas – The Atlas should also provide a figure showing the known extents of the PFAS plume. The Atlas should also identify areas where a notice of activity and use limitation (NAUL) has been established.	Accept. A figure showing the known extents of the PFAS plume and current controls was added to the 2020 ERP Atlas. **DEC Accept 5/05/2021**
38.	5-4		Notification and Corrective Measures Requirement. Text states: "The USAF will take prompt measures to correct the violation or deficiency and prevent its recurrence." Please add: will take prompt measures within 30 days..	Accept. The text will be revised to state: "The USAF will take prompt measures within 30 days to notify ADEC of the violation or deficiency and prevent its recurrence." **DEC Accept 5/05/2021**

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39.	5-5		Top of page, Text states: "without 45 days notice prior to the change seeking and obtaining approval from ADEC of any required Record of Decision modification." Please revise to indicate "Decision Document".	Accept. The text will be revised to state: "…without 45 days notice prior to the change seeking and obtaining approval from ADEC of any required DD modification." **DEC Accept 5/05/2021**
40.	8-1	Part 8	Text states: "ADEC will issue a written determination that the cleanup is complete under the current LUCs. The determination may be reviewed and modified in the future if new information becomes available indicating the presence of contaminants, exposures that may cause unacceptable risk to human health or the environment." Please revise: written determination that the petroleum cleanup is complete under the current LUCs. Please remove "new" from the second sentence. Note: If the sites are closed with LUCs to ensure that people are not exposed above human health soil cleanup levels, or Table C groundwater cleanup levels, then a notice of activity and use limitation (NAUL) would be required.	Accept. The text will be revised to state: "…ADEC will issue a written determination that the petroleum cleanup is complete under the current LUCs. The determination may be reviewed and modified in the future if information becomes available indicating the presence of contaminants…" **DEC Accept 5/05/2021** Accept. The following sentence will be added to the end of Part 8: "If sites are closed and LUCs are implemented to ensure that people are not exposed above human health soil cleanup levels or Table C groundwater cleanup levels, then a notice of activity and use limitation will be completed." **DEC Accept 5/05/2021**
End of Comments.				

Jacobs Initiated Changes (JICs):

Comment No.	Page	Section	JIC	Response
1.	ES-1	ES-1	Based on comments from DD1b (5 sites) the following changes have been incorporated: The following text has been added to the first paragraph of the executive summary: "The USAF is managing remediation of petroleum, oil, or lubricants (POL) or petroleum-related contamination at these source areas in accordance with the State-Eielson Agreement (U.S. Air Force [USAF] 2014d), herein referred to as the two-party agreement. Any Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) constituents remaining will be addressed by transferring source areas back to the *Eielson Air Force Base, Federal Facility Agreement Under CERCLA Section 120* (USAF 2013a), herein referred to as the three-party agreement." The following text has been added to the last paragraph of the executive summary: "At the time these source areas were transferred from the three-party agreement to two-party agreement for site characterization (SC), only POL or petroleum-related contamination was known at each source area. The USAF intends to address POL or petroleum-related contamination under the two-party agreement. Source areas will be transferred back to the three-party agreement for any remaining remedial action under CERCLA. No sampling for perfluorooctanoic acid (PFOA) and/or perfluorooctane sulfonate (PFOS) was conducted as part of SC activities; any source areas with suspected PFOA/PFOS or remaining CERCLA constituents will be addressed under the three-party agreement."	**DEC Accept 5/05/2021**

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2.	Part 3	3.4.3.2 3.6.3.2 3.7.3.2	Based on comments from DD1b (5 sites) the following changes have been incorporated: Text states: "LUCs are recommended as interim remedial actions to protect human health and the environment until the site is eligible for UU/UE." Please revise: LUCs will be implemented …and remain in place until UU/UE is achieved. LUCs will be adopted as interim… The 1st sentence of the paragraphs in Sections 3.4.3.2, 3.6.3.2, and 3.7.3.2 will be revised to state: "LUCs will be adopted as interim remedial actions to protect human health and the environment and remain in place until UU/UE is achieved."	**DEC Accept 5/05/2021**
3.	Part 3	3.1.4.1, 3.2.4.1, 3.3.4.1, and 3.5.4.1	Based on comments from DD1b (5 sites) the following changes have been incorporated: Support for Site Closure Determination Please rename this section. "Support for Site NFA on Petroleum Determination" or something similar. See comment above. The Section 3.1.4.1, 3.2.4.1, 3.3.4.1, and 3.5.4.1 headings will be revised to state: "Support for Site NFA on Petroleum Determination"	**DEC Accept 5/05/2021**
4.	Part 3	3.1.2.1, 3.2.2.1, 3.3.2.1, 3.4.2.1, 3.5.2.1, and 3.7.2.1	Based on comments from DD1b (5 sites) the following changes have been incorporated: Text states: "Chemicals of potential concern with concentrations greater than the 2017 cleanup levels and/or for which the calculated risk exceeded a 1×10-5 lifetime cancer risk value or a hazard index (HI) of 1 in the Cumulative Risk Evaluation were retained as COCs, except as noted in the SCRI. Please identify the exceptions for each source area in the decision document. Additional discussion will be added to Sections 3.1.2.1, 3.2.2.1, 3.3.2.1, 3.4.2.1, 3.5.2.1, and 3.7.2.1 to identify the exceptions noted in the SCRI.	**DEC Accept 5/05/2021**
5.	Part 3	3.2	Benzo(a)pyrene will be added as a COC at SS078 due to concentrations that contribute to carcinogenic risk and exceed the human health criteria (ADEC Table B1 Method Two, under 40-inch zone).	**DEC Accept 5/05/2021** However, it is part of DD1b.

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6.	8-1	Part 8	Based on comments from DD1b (5 sites) the following change has been incorporated: Text states: "ADEC will determine if these five source areas have been adequately characterized." Please add: for POL or petroleum related contamination… The following underlined text has been added: "…characterized <u>for POL or petroleum related contamination</u> under…"	**DEC Accept 5/05/2021**
7	Part 3	3.X.2	Analytes that are not POL-related will be referred to as non-petroleum-related COPCs that will be addressed under the Three-Party agreement. Text, table headers, and tables notes have been revised to reflect this distinction.	**DEC Accept 5/05/2021**
8	2-3	2.3	The Section 2.3 header will be revised to: " POL-RELATED CHEMICALS OF CONCERN AND NON-PETROLEUM-RELATED CHEMICALS OF POTENTAL CONCERN IDENTIFICATION" The second to last sentence in section 2.3 will be revised to state "…or petroleum-related COCs or as non-petroleum-related COPCs to be addressed under the three-party agreement, except as…" The first sentence in Section 2.3.1 will be revised to: "Metals contamination is outside the scope of this DD and will be addressed under the three-party agreement..." Section 2.3.1.1 will be revised to refer to thallium as a non-petroleum-related COPC. Section 2.3.2 will be revised to refer to PAHs with no petrogenic signatures as non-petroleum-related COPCs.	**DEC Accept 5/05/2021**
End of JICs.				