Record of Decision

SS047 (Nike Site Summit)
Joint Base Elmendorf-Richardson, Alaska

Final

Prepared By

United States Air Force

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

July 2017

Table of Contents

List of Tables

List of Figures

List of Appendices

Acronyms and Abbreviations

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AHRS	Alaska Heritage Resource Survey
amsl	above mean sea level
ARLIS	Alaska Resources Library and Information Services
ARAR	Applicable or Relevant and Appropriate Requirement
Army	U.S. Army
bgs	below ground surface
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSM	conceptual site model
EPA	Environmental Protection Agency
EPC	exposure point concentrations
ERA	ecological risk assessment
ERBCL	ecological risk-based cleanup level
FFA	Federal Facilities Agreement
FONSS	Friends of Nike Site Summit
FS	Feasibility Study
HHERA	human health and ecological risk assessment
HHRA	human health risk assessment
HI	Hazard Index
HQ	hazard quotient
IC	institutional control
ILCR	incremental lifetime cancer risk
ISCO	in situ chemical oxidation
JBER	Joint Base Elmendorf-Richardson
JBER-R	JBER-Richardson
LSS	Lower Site Summit
LUC	land use control
mg/kg	milligrams per kilogram
mg/kg-d	milligrams per kilogram per day
NCP	National Contingency Plan
NPV	net present value
NRHP	National Register of Historic Places

Acronyms and Abbreviations (Cont.)

O&M	operations and maintenance
ORNL	Oak Ridge National Laboratories
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PAL	project action limit
PA/SI	Preliminary Assessment and Site Inspection
PHC	petroleum hydrocarbon
RAO	remedial action objective
RBCL	risk based cleanup level
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RFI	Remedial Field Investigation
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SFS	Supplemental Feasibility Study
SVOC	semi-volatile organic compound
TBC	to be considered
TMV	Toxicity, Mobility, and Volume
TRV	toxicity reference value
USAF	U.S. Air Force
USS	Upper Site Summit
UST	underground storage tank
UU/UE	unlimited use and unrestricted exposure
VOC	volatile organic compound

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PART I – DECLARATION

SITE NAME AND LOCATION

Facility Name:	Fort Richardson, Alaska – U.S. Army (Army), currently known as Joint Base Elmendorf–Richardson (JBER)
Site Location:	JBER, adjacent to the cities of Anchorage and Eagle River, Alaska
EPA ID Number:	AK6214522157
Site:	Spill Site (SS) 047 (also known as Nike Site Summit)

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedy for environmental contamination at SS047 on JBER, Alaska. The selected remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for Fort Richardson, SS047.

The U.S. Environmental Protection Agency (EPA) and the State of Alaska Department of Environmental Conservation (ADEC) concur with the selected remedy.

ASSESSMENT OF SITE

The response actions selected in this ROD are necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release, or threat of release, may present an imminent and substantial endangerment to public health or welfare or the environment.

DESCRIPTION OF SELECTED REMEDY

The selected remedy for SS047 addresses several source areas that have released the following contaminants:

- Upper Site Summit (USS) – Former Motor Pool Maintenance Building and Foundation (Action Area USS-F) and Septic System and Outfall (Action Area USS-K):
  - Surface soil: cadmium, lead, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene.
- Lower Site Summit (LSS) – Launch Control Building (Action Area LSS-Q); Missile Launch Pad and Control Buildings 1 and 2 (Action Area LSS-B); Vehicle Maintenance Shop (Action Area LSS-H); and Septic Tank and Outfall (Action Area LSS-U):
  - Surface soil: cadmium, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl) phthalate, and pentachlorophenol.

- Subsurface soil: 1,1,2-trichloroethane, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene.

The selected remedy for SS047 will address the potential threat to human health and the environment from contaminated soil. The remedy will excavate and dispose of soil contaminated with CERCLA hazardous substances, also referred to as CERCLA-contaminated soil, which will be transported off-site to an EPA-approved disposal facility. The selected remedy will reduce contamination at the site to attain the chemical-specific applicable or relevant and appropriate requirements (ARARs) established for SS047. The remedy is part of a basewide effort to clean up CERCLA contaminated areas.

The major components of the remedy selected for each area at SS047 are based on the findings of the *SS047 – Nike Site Summit, Supplemental Feasibility Study, Final, May 2015* (SFS), and are described below.

USS – *Excavation and Off-Site Disposal of Surface Soil.* During the remedial investigation (RI), metals and semi-volatile organic compounds (SVOCs) were identified in surface soil above cleanup levels. Remediation at USS will be as follows:

- Surface soil contamination is limited primarily to two specific point releases and is relatively small in area (Action Areas USS-F and USS-K).
- Approximately 44 cubic yards of soil will be removed from Action Areas USS-F and USS-K and transported offsite to an EPA-approved disposal facility.

LSS – *Excavation and Off-Site Disposal of Surface and Subsurface Soil.* During the RI, SVOCs were identified in surface soil and volatile organic compounds (VOCs) and SVOCs were identified in subsurface soil above cleanup levels. Remediation at LSS will be as follows:

- Surface soil contamination is associated primarily with localized releases at Action Areas LSS-B, LSS-H, LSS-Q, and LSS-U.
- Subsurface soil contamination is present in the vicinity of Action Area LSS-Q, the Launch Control Building.
- A combined total of approximately 263 cubic yards of contaminated soil will be excavated from these four action areas and transported offsite to an EPA-approved disposal facility.

Area A – *No Action under CERCLA.* The CERCLA petroleum exclusion rule applies to this area.

Area B – *No Further Action.* There are no contaminants of concern (COCs) at Area B.

Area C – *No Action under CERCLA.* The CERCLA petroleum exclusion rule applies to this area.

Area D – *No Further Action.* There is no evidence of site-related contamination.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and uses permanent solutions to the maximum extent practicable. These remedies also satisfy the statutory requirements of CERCLA and attain the mandates of CERCLA §121 and, to the extent practicable, the NCP.

The NCP establishes the expectation that treatment will be used to address the principal threats posed by a site whenever practicable (40 Code of Federal Regulations [CFR] 300.430 (a)(1)(iii)(A)) to permanently and significantly reduce the toxicity, mobility, or volume of hazardous contaminants. The selected remedy for SS047 does not satisfy the statutory preference for treatment as a principal element of the remedy, because soil contamination will be relocated to a disposal facility. Although the soil will not be treated, the contaminated soil will be removed from SS047, reducing CERCLA contaminant concentrations to levels that allow for unlimited use and unrestricted exposure (UU/UE).

Because the remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for UU/UE, a Five-Year review will not be required for this remedial action.

ROD DATA CERTIFICATION CHECKLIST

Table D-1 serves as the data certification checklist, which identifies the sections where the required elements can be found in the Decision Summary (Part II) of this ROD. Items in the checklist do not apply to all areas of SS047; therefore, the data certification checklist is presented in table format.

Additional information can be found in the Administrative Record file for SS047, JBER, Alaska, a copy of which is located at Alaska Resources Library and Information Services (ARLIS), located at the University of Alaska, Anchorage/Alaska Pacific University Consortium Library, Anchorage Campus, 3211 Providence Drive, Anchorage, Alaska 99508.

Table D-1 ROD Data Certification Checklist

Data	ROD Section Number					
	USS	**LSS**	**Area A[1]**	**Area B[2]**	**Area C[1]**	**Area D[2]**
COCs and their respective concentrations.	7.3	7.3	5	NA	5	NA
Baseline risk represented by the COCs.	7.1 and 7.2	7.1 and 7.2	NA	NA	NA	NA
Cleanup levels established for COCs and the basis for these levels.	8	8	NA	NA	NA	NA
How source materials constituting principal threats are addressed.	11	11	NA	NA	NA	NA
Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD.	6	6	6	6	6	6
Potential land and groundwater use that will be available at the site as a result of the Selected Remedy.	6	6	NA	NA	NA	NA
Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.	10	10	NA	NA	NA	NA
Key factor(s) that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).	12.1	12.2	NA	NA	NA	NA

Key:
1 – The selected remedy is No Action under CERCLA. Response actions will be managed under 18 Alaska Administrative Code 75.
2 – The selected remedy is No Further Action.
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COCs – Chemicals of concern
LSS – Lower Site Summit
NA – Not applicable
ROD – Record of Decision
USS – Upper Site Summit

AUTHORIZING SIGNATURES

The following signature sheets document the U.S. Air Force's (USAF) selection of remedies detailed in this ROD for SS047 at JBER, Alaska. They also indicate the EPA and ADEC's concurrence with the selected remedy.

Lead Agency Selection
SS047 Record of Decision
Joint Base Elmendorf-Richardson, Alaska

This signature sheet documents the U.S. Air Force's selection of the remedies contained in the Record of Decision for SS047 at Joint Base Elmendorf-Richardson, Alaska.

J. DALE CLARK, P.E., GS-14, DAF
Deputy Director, Environmental Management Directorate

9/28/17
Date

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U.S. EPA Selection Page
SS047 Record of Decision
Joint Base Elmendorf-Richardson, Alaska

This signature sheet documents the U.S. Environmental Protection Agency's selection of the remedies contained in the Record of Decision for SS047 at Joint Base Elmendorf-Richardson, Alaska.

Sheryl Bilbrey — 1/16/18

SHERYL BILBREY — Date
Director
United States Environmental Protection Agency Region 10
Office of Environmental Cleanup

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ADEC Concurrence Page
SS047 Record of Decision,
Joint Base Elmendorf-Richardson, Alaska

The State of Alaska Department of Environmental Conservation agrees that, if properly implemented, the selected remedies for SS047 will comply with State law. 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.

Kimberly DeRuyter

KIM DeRUYTER, Environmental Program Manager
Contaminated Sites Program, Federal Facilities Section
Alaska Department of Environmental Conservation

2/20/18
Date

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PART II – DECISION SUMMARY

The Decision Summary provides an overview of site characteristics, the alternatives evaluated, and the analysis of those options. The Decision Summary also identifies the selected remedy, explains how the remedy fulfills statutory and regulatory requirements, and provides a substantive summary of the SS047 Administrative Record file that supports the remedy selection decision.

1.0 SITE NAME, LOCATION, AND DESCRIPTION

Fort Richardson (EPA Identification Number AK6214522157), currently known as JBER-Richardson (JBER-R) is located in south-central Alaska, adjacent to the cities of Anchorage and Eagle River. The Knik Arm of Cook Inlet borders the north and west sides of the installation; Chugach State Park lies to the south and southeast; the community of Eagle River lies along the eastern border; and the Municipality of Anchorage forms the southwest boundary. JBER, which comprises the former Elmendorf Air Force Base (JBER-E) and JBER-R, encompasses 73,272 acres – with elevations ranging from sea level along the Knik Arm shoreline to 3,800 feet above mean sea level (amsl) in the Chugach Mountains.

SS047 is located approximately 12.5 miles east of Anchorage, Alaska, near the eastern boundary of JBER, where JBER borders with the Chugach State Park (**Figure 1-1**). The site is on a ridgeline in the Chugach Mountains, adjacent to Mount Gordon Lyon, and covers approximately 244 acres.

Access to SS047 is along an approximately 1.5-mile gated, gravel road beginning at Arctic Valley Road (**Figure 1-2**). Access to and use of the site requires coordination with JBER Range Control, because the access road and portions of SS047 itself are within an active firing range. The area is also used for military training that can take precedence over other activities.

As the lead agency for remedial activities, the USAF has conducted environmental restoration at SS047 in accordance with CERCLA under the Environmental Restoration Program, which was established by Section 211 of SARA of 1986 and codified at 10 United States Code (USC) §§ 2701 et seq. EPA Region 10 and ADEC provide oversight of the environmental restoration actions in accordance with the Federal Facilities Agreement (FFA). SS047 was used as a Nike Hercules missile site, a ground-based defensive system. As described in Section 2.1, contamination present at SS047 is likely associated with historic fuel leaks or spills. There are also indications of chlorinated solvent releases that are likely associated with historic vehicle and/or missile maintenance activities.

Funding for remedial activities is provided by the Environmental Restoration Account; a funding source approved by Congress to clean up contaminated sites on U.S. Department of Defense installations.

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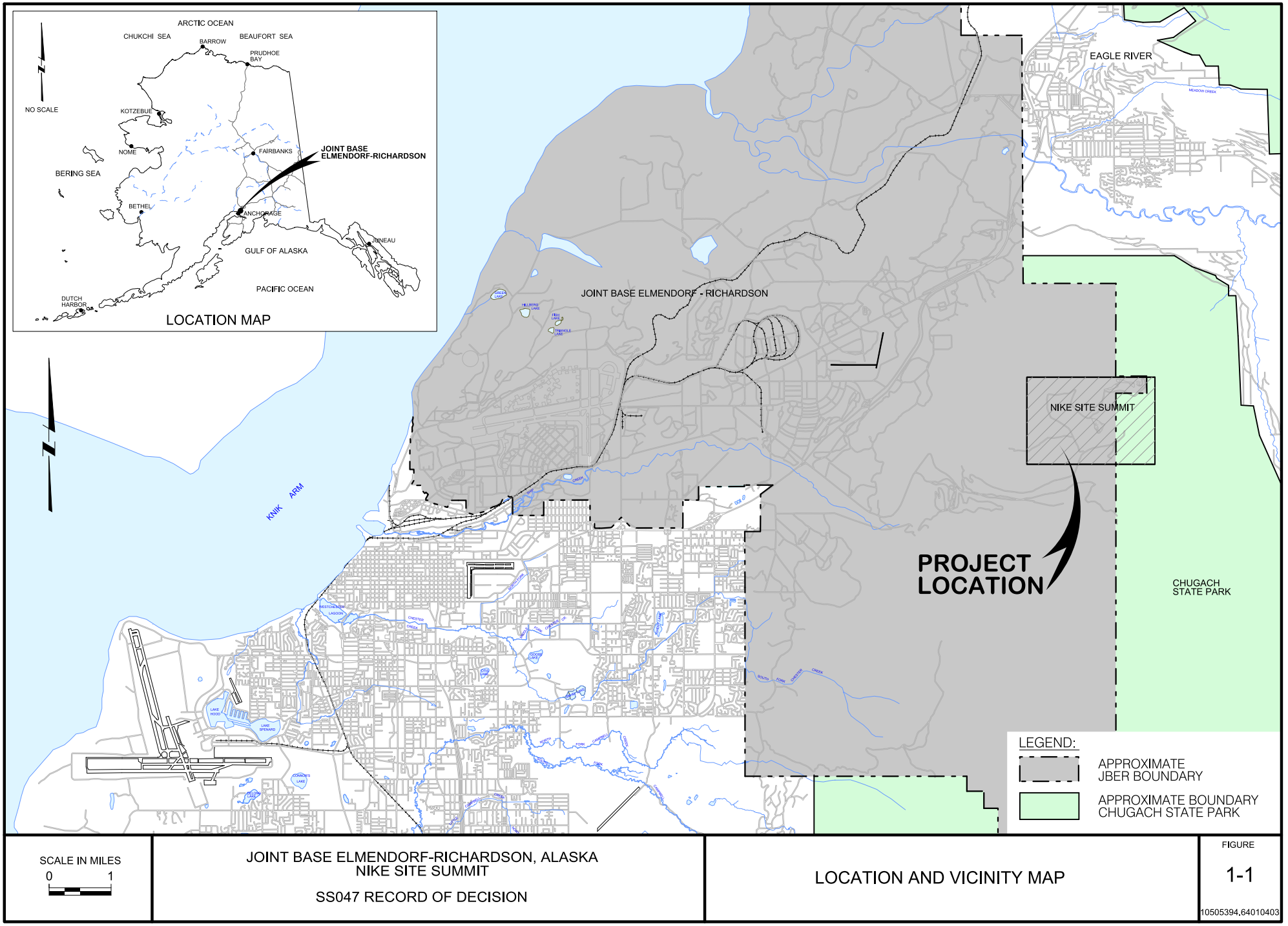
TIME: 26-APR-2017 11:15 FILE: C:\D\CAD\Proj\AFCEC\2016-2017 JBER-Nike Site Summit (10505394)_185750655\2016-2017 SS047_ROD\draft_April 26-2017\FIG 1-1 - Location and Vicinity Map.dgn



SCALE IN MILES
0 1

JOINT BASE ELMENDORF-RICHARDSON, ALASKA
NIKE SITE SUMMIT

SS047 RECORD OF DECISION

LOCATION AND VICINITY MAP

FIGURE
1-1

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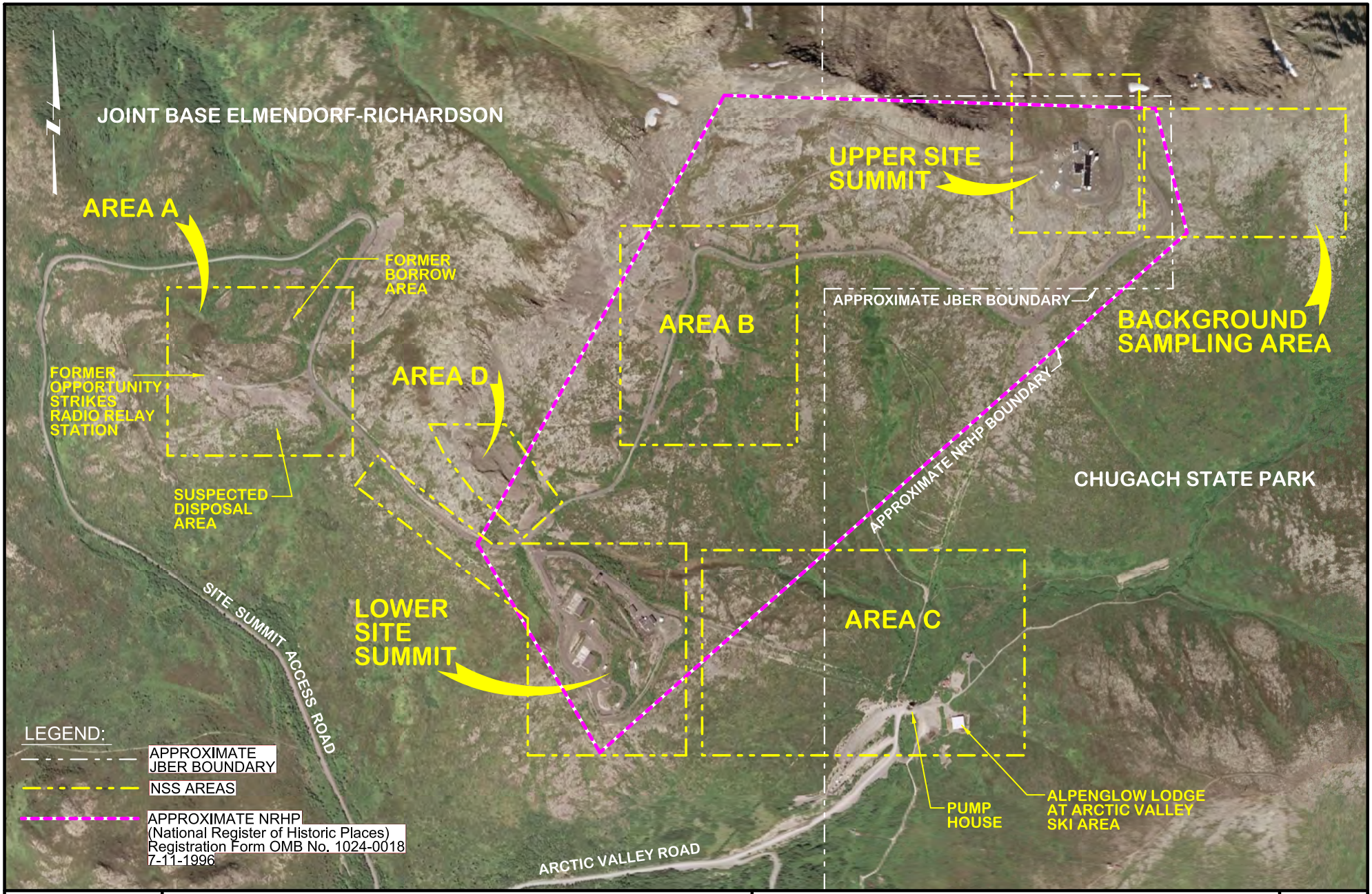
TIME: 26-APR-2017 11:16 FILE: C:\D\CAD\Proj\AFCEC\2016-2017 JBER-Nike Site Summit (10505394)_185750655\2016-2017 SS047_ROD\draft_April 26-2017\FIG 1-2 - SS047 Area Map.dgn



APPROXIMATE SCALE IN FEET
0 500

JOINT BASE ELMENDORF-RICHARDSON, ALASKA
NIKE SITE SUMMIT

SS047 RECORD OF DECISION

SS047 AREA MAP

FIGURE
1-2

10505394.64010403

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2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

SS047 is also known as Nike Site Summit, which was used as a Nike Hercules missile site and was in operation from 1959 to 1979. This ground-based defensive system provided protection to Fort Richardson, Elmendorf Air Force Base, and the City of Anchorage against aerial attack during the Cold War. In the event of an aerial attack, guided missiles would be fired to destroy incoming aircraft.

Multiple Nike sites were built in rings around areas in need of defense and would have deployed armed missiles to destroy attacking aircraft formations. Army soldiers under the Army Air Defense Command operated Nike Hercules batteries around the clock. Each battery required a minimum of 125 soldiers to operate the system, provide security, and support those living on site.

Alaska had eight Nike sites, with five batteries in Fairbanks and three in Anchorage. Several unique design features were employed in Alaska to accommodate the severe weather. Retractable clamshell covers were built over the radar for sheltered maintenance and periodic deicing. The launch buildings were built above ground, and the housing complex and integrated fire control functions were combined in one building.

Nike Site Summit was built atop a mountain, which required blasting of the mountain to build level areas that were used for barracks and maintenance shops at USS and for the missile launch pads and facilities at LSS. Crushed bedrock was used as a road bed. Blasting was also required to install underground storage tanks (USTs).

Alaska was one of the few states in the country that practiced live missile firings. Nike Site Summit hosted the Annual Service Practice for Anchorage area batteries from 1960 to 1964, when population growth rendered the exercise unsafe. In 1979, the Army deactivated this site and removed all sensitive equipment.

In 1994, the Alaska State Historic Preservation Office (SHPO) nominated Nike Site Summit for listing on the National Register of Historic Places (NRHP) due to its significance during the Cold War Era. Nike Site Summit was placed on the NRHP in 1996 (Registration Form Alaska Heritage Resource Survey [AHRS] Site No. ANC-789, Site Summit, Anchorage Alaska).

In 2007, the Army conducted an Environmental Assessment to determine the best management of the historic facilities at Nike Site Summit in relation to demolition and preservation with respect to its NRHP status. Approximately 244 acres, of which approximately 180 acres are located within JBER, are a part of the NRHP Historical Area.

2.1 Identification of Activities Leading to the Current Contamination at SS047

Contamination at SS047 is the result of past military operations and former disposal practices. Activities that may have resulted in releases at SS047 include: fuel and solvent disposal practices associated with vehicle maintenance; missile storage; uncontrolled spills and leaks emanating from maintenance of missiles; explosives storage; septic systems; and spills and leaks from USTs (gasoline and diesel) and aboveground heating oil tanks.

SS047 is an Environmental Restoration Program site located on JBER-R and consists of the following source areas:

- USS – former Battery Control Area.
- LSS – former Missile Launch Area.
- Area A – former Opportunity Strikes Radio Relay Station (wireless communications system), former Borrow Pit Area, and Suspected Disposal Area.
- Area B – High Explosives Magazine and Guided Missile Magazine.
- Area C – former Pump House.
- Area D – former Borrow Pit Area.

At USS, CERCLA hazardous substances have been identified as COCs in surface soil (0 to 2 feet below ground surface [bgs]), and at LSS, COCs have been identified in both surface and subsurface (greater than 2 feet bgs) soil. No sources of contamination were identified at Areas B and D.

Contamination at Areas A and C is limited to petroleum (non-CERCLA COCs) only. CERCLA Section 101(14) excludes certain substances from the definition of hazardous substance, thus exempting them from CERCLA. These substances include petroleum, meaning "crude oil or any fraction thereof." The EPA interprets this to include hazardous substances that are normally mixed with or added to crude oil or crude oil fractions during the refining process. Contamination resulting from spills of heating oil, diesel fuel, jet fuel, and gasoline are exempt from CERCLA; however, contamination caused by petroleum spills are regulated under 18 Alaska Administrative Code (AAC) 75, *Oil and Other Hazardous Substances Pollution Control, 2017*. As part of an informal dispute resolution agreement, the USAF, EPA, and ADEC agreed that contamination resulting from petroleum hydrocarbons would be identified as No Action under CERCLA and managed under Alaska State laws and regulations. Cleanup of action areas where only non-CERCLA hazardous substances have been detected will be managed under 18 AAC 75, and the remedies for those action areas will be determined under State law in a separate Decision Document.

2.2 Regulatory and Enforcement Activities

In 1994, the EPA added Fort Richardson to the National Priorities List (NPL). On December 5, 1994, the Army, EPA Region 10, and ADEC signed a FFA for Fort Richardson. The contaminated areas of Fort Richardson were divided into four operable units (OUs), each to be managed as a separate region and investigated according to different schedules.

In October 2010, Fort Richardson was realigned with Elmendorf Air Force Base forming JBER. The USAF assumed the responsibility of cleanup of contaminated sites on JBER-R under the Fort Richardson FFA. SS047 was added to the FFA on May 31, 2011, and a schedule for cleanup was negotiated and included in the Fort Richardson FFA.

In April 2014, the EPA invoked an informal dispute in accordance with the procedures outlined in the Fort Richardson FFA, Section 20.21, to delay finalization of the SS047 ROD until consensus was reached on comments that were provided on the draft ROD. In July 2014, an agreement was made among the USAF, EPA, and ADEC that the EPA's concerns would be addressed and that response actions would be re-evaluated and documented in a SFS. The SFS was completed in May 2015 in accordance with the Informal Dispute Resolution Agreement.

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3.0 COMMUNITY PARTICIPATION

NCP Section 300.430(f)(3) establishes a number of public participation activities that the lead agency must conduct following preparation of the Proposed Plan and review by the support agencies. Components of these items and documentation of how each component was satisfied for SS047 are described in **Tables 3-1** and **3-2**.

A Proposed Plan was prepared and sent out for public comment in July 2013, and a public meeting was held on 1 August 2013 to present and receive public comments on the preferred alternatives for remedial action at SS047. The USAF received comments on the July 2013 Proposed Plan during the public comment period. However, in July 2014, the USAF, EPA, and ADEC agreed that the response actions for SS047 would be re-evaluated based on the results of an Informal Dispute and would be presented in a SFS. The revised preferred alternatives evaluated in the SFS were published in October 2016, in a Revised Proposed Plan for remedial action at SS047. Continued public participation is encouraged through regular meetings with the Community Environmental Board and through ongoing communication with the Friends of Nike Site Summit (FONSS), an Anchorage community organization dedicated to the preservation and interpretation of Nike Site Summit.

A copy of the Administrative Record for SS047 is available for public review at ARLIS, which is located at the University of Alaska, Anchorage/Alaska Pacific University Consortium Library, Anchorage Campus, 3211 Providence Drive, Anchorage, Alaska 99508. The index to SS047 documents in the Administrative Record is provided in **Appendix A**.

Table 3-1 Public Notification of Document Availability

Requirement:	Satisfied by:
Notice of availability of the Proposed Plan and RI/FS must be made in a general circulation major local newspaper.	Notice of availability for the 2016 Proposed Plan was published in the: • *Mat-Su Valley Frontiersman* on 5 and 19 October 2016 • *Anchorage Press* on 6 and 20 October 2016 • *Arctic Warrior* on 7 and 21 October 2016 • *Chugiak-Eagle River Star* on 6, 13, and 20 October 2016 • *Alaska Dispatch News* on 2 and 19 October 2016
Notice of availability must include a brief abstract of the Proposed Plan which describes the alternatives evaluated and identifies the preferred alternative (NCP Section 300.430(f)(3)(i)(A))	Notice of availability included all of these components.
Notice of availability should consist of the following information: • Site name and location. • Date and location of public meeting. • Identification of lead and support agencies. • Alternatives evaluated in the detailed analysis. • Identification of preferred alternative. • Request for public comments. • Public participation opportunities including: – Location of information repositories and Administrative Record file. – Methods by which the public may submit written and oral comments, including a contact person. – Dates of public comment period. Contact person for the community advisory group (e.g., Restoration Advisory Board), if applicable.	

Key:
NCP – National Contingency Plan
RI/FS – Remedial Investigation/Feasibility Study

Table 3-2 Public Comment Period Requirements

Requirement:	*Satisfied by:*
Lead agency should make document available to public for review on same date as newspaper notification.	The notification of availability and the Proposed Plan were made available to the public on 2 October 2016.
Lead agency must ensure that all information that forms the basis for selecting the response action is included as part of the Administrative Record file and made available to the public during the public comment period.	JBER maintains the Administrative Record file for SS047. All data collected and all CERCLA primary documents produced for SS047 are maintained as part of this file at the ARLIS, which is available to the public.
CERCLA Section 117(a)(2) requires the lead agency to provide the public with a reasonable opportunity to submit written and oral comments on the Proposed Plan. NCP Section 300.430(f)(3)(i) requires the lead agency to allow the public a minimum of 30 days to comment on the RI/FS and the Proposed Plan and other supporting information located in the Administrative Record and information repository.	The USAF provided a public comment period for the Proposed Plan from 3 October 2016 through 3 November 2016.
The lead agency must extend the public comment period by at least 30 additional days upon timely request.	The USAF received no requests to extend the public comment period.
The lead agency must provide the opportunity for a public meeting to be held at or near the site during the public comment period. A transcript of this meeting must be made available to the public and be maintained in the Administrative Record and information repository for the site (pursuant to NCP Section 300.430(f)(3)(i)(E)).	A public meeting was held on 19 October 2016 at the Fairview Community Recreation Center, Anchorage, Alaska. A transcript of this meeting has been added to the Administrative Record file and information repository.

Key:
ARLIS – Alaska Resources Library and Information Services
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
JBER – Joint Base Elmendorf-Richardson
NCP – National Contingency Plan
RI/FS – Remedial Investigation/Feasibility Study
USAF – U.S. Air Force

The USAF received comments on the Proposed Plan (July 2013) during the public comment period held from 17 July to 16 August 2013. Additionally, USAF received one written comment and five verbal comments during the public meeting on the Revised Proposed Plan (October 2016) during the public comment period held from 3 October to 3 November 2016. The USAF's responses to comments received on the July 2013 and October 2016 Proposed Plans are addressed in the Responsiveness Summary, which is provided as Part III of this ROD.

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4.0 SCOPE AND ROLE OF THE SS047 RESPONSE ACTION

In addition to SS047, there are 10 other areas at JBER-R in various stages of cleanup: TU043; AT035; DA090; TU117; SS090; and five OUs, which were created to manage the basewide response action. These areas are shown on **Figure 4-1**. Each OU is managed as a separate region and investigated according to its own schedule. The Army has already selected remedies for the five OUs at JBER-R. After the RODs were developed and remedies for the OUs implemented, contamination (metals, VOCs, SVOCs, and petroleum hydrocarbons [PHCs]) was identified in soil at SS047.

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Eagle River Flats (OUC)

Poleline Road (OUB)

Roosevelt Road Transmitter Site (OUA)

Armored Vehicle Maintenance Area (OUE)

Bldg 35752 & Bldg 35750 (OUE)

AT035

TU117

SS090

DA090

TU043

SS047- Nike Site Summit

Upper Site Summit

Lower Site Summit

OVAL LAKE

UPPER SIXMILE LAKE

GREEN LAKE

HILLBERG LAKE

FISH LAKE

TRIANGLE LAKE

POTTER LAKE

GWEN LAKE

LAKE KIOWA

THOMPSON LAKE

MCVEIGH MARSH

DISHNO POND

COOLING POND

WATER TRAP POND

Project Location

Knik

Eklutna

Knik Arm

Anchorage

Turnagain Arm

Hope

- CERCLA Sites
- Building
- Airfield
- JBER Boundary
- JBER-Richardson Boundary

All Locations Are Approximate

0 0.5 1 1.5 2

Miles

N

WGS 1984 UTM Zone 6N

JOINT BASE ELMENDORF-RICHARDSON, ALASKA
NIKE SITE SUMMIT
SS047 RECORD OF DECISION
JBER-R Overview Map

FIGURE NO:
4-1

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5.0 SITE CHARACTERISTICS

This section presents a comprehensive overview of SS047, including geographical and topographical information, a description of the nature and extent of contamination, and the conceptual site model (CSM). Results of two previous investigations at SS047 are presented for context only. This ROD does not address risks from or remediation of PHCs.

5.1 Physical Description

The following six contaminant source areas, as shown on Figure 1-2, are included in SS047, which covers an approximately 180-acre area:

- USS – Former Battery Control Area, located at an elevation of 3,900 feet amsl, currently housing several commercial antenna installations and multiple structures over an estimated 20-acre area.
- LSS – Former Missile Launch Area, includes approximately 30 acres located at an elevation of about 3,100 feet amsl, and consists of former facilities such as launch control buildings, electrical substations, and a vehicle maintenance shop.
- Area A – Former Opportunity Strikes Radio Relay Station, a Former Borrow Area, and a Suspected Disposal Area, located at an elevation of approximately 2,950 feet amsl and covers an area of approximately 35 acres.
- Area B – High Explosive and Guided Missile Magazines, includes approximately 40 acres located about midway between USS and LSS, along the east side of the gravel road, at an elevation of 3,200 feet amsl.
- Area C – Pump House, located off of Arctic Valley Road, includes approximately 50 acres at an estimated elevation of 2,500 feet amsl.
- Area D – Former Borrow Area, includes approximately 5 acres located adjacent to LSS at 3,200 feet amsl.

5.1.1 Physiography and Climate

SS047 is located on a ridgeline in the Chugach Mountains at the 2,500- to 3,900-foot elevations. SS047 has a subarctic climate with strong maritime influences. Site temperatures vary from minus 13 degrees Fahrenheit (ºF) in the winter to 80ºF in the summer. The average annual total precipitation in the Anchorage Bowl is 16.08 inches of rainfall and 70.5 inches of snowfall. Average annual snowfall at the Arctic Valley Ski Area, adjacent to SS047, is approximately 250 inches. Conditions at SS047 include high wind velocity, high levels of snowfall, and low annual temperatures.

USS is located at an elevation of 3,900 feet amsl, and is characterized by limited vegetation and disturbed soils. Surface and subsurface soil consist primarily of angular and rounded gravel fill material atop of bedrock. LSS is located at an elevation of about 3,100 feet amsl.

5.1.2 Geology

SS047 lies atop the western edge of the Front Range of the Chugach Mountains, Anchorage, Alaska. Surface materials are dense, with outcroppings of bedrock, hornfels, talus, and rocky-gravelly soil. Surficial materials are dense in areas that have been undisturbed. Many areas at SS047 contain gravel building pads that were constructed by leveling and spreading local terrain, as well as using materials obtained from borrow sources at Areas A and D.

5.1.3 Hydrology and Groundwater Use

Subsurface hydrology at SS047 is limited to information gathered during the RI performed in the summer and fall of 2010 and 2011. The results of the RI are summarized in the *Remedial Field Investigation Report, Volume 2 of 3, Final, May 2012* (RFI Report). Groundwater conditions at SS047 were also evaluated as part of the SFS.

A public well located approximately 15 feet north-northwest of the Alpenglow Lodge at Arctic Valley Ski Area, shown on **Figure 5-1**, is upslope from the lodge and known to have water present at 20 feet bgs. The Alpenglow Well, by the nature of its location, cannot be in contact with runoff or groundwater originating from SS047. Water originating from SS047 is hydraulically separate from the shallow aquifer in which the Alpenglow Well is situated. Additionally, the Alpenglow Well is both upslope and upgradient of the surface water/ groundwater divide created by the valley between SS047 and Alpenglow Lodge; therefore, there is no potential for hydraulic connectivity between water originating from SS047. The Alpenglow Well is not indicative of groundwater conditions at SS047, because the well lies just above the toe of the valley floor rather than atop bedrock mountain peaks. No other drinking water wells are known to exist in the vicinity of SS047.

5.1.3.1 USS

Small quantities of perched water were identified in bedrock excavations at USS and were initially classified as groundwater in the RI. Water was found only in areas of depressed bedrock where former USTs had previously been located and had accumulated in these depressions after rainfall events or during a snowmelt period. This water was later reclassified as "pit water," which is a direct result of precipitation, either rainfall or snowmelt, at USS.

5.1.3.2 LSS

The results of the RI indicated that subsurface water at LSS appears to follow the contours of the bedrock and is most plentiful in the area where the former UST was located. Groundwater is shallowest nearest the excavated bedrock behind the Launch Control Building and steadily drops as it heads downslope toward the northeast edge of the LSS construction pad. The RI concluded that this perched aquifer is only present on the north/northeast side of the LSS and is discontinuous, as evidenced by a borehole on the eastern edge of the site that did not encounter groundwater and met with refusal at 25 feet bgs, whereas adjacent boreholes encountered groundwater at lesser depths (approximately 16 feet bgs on average).

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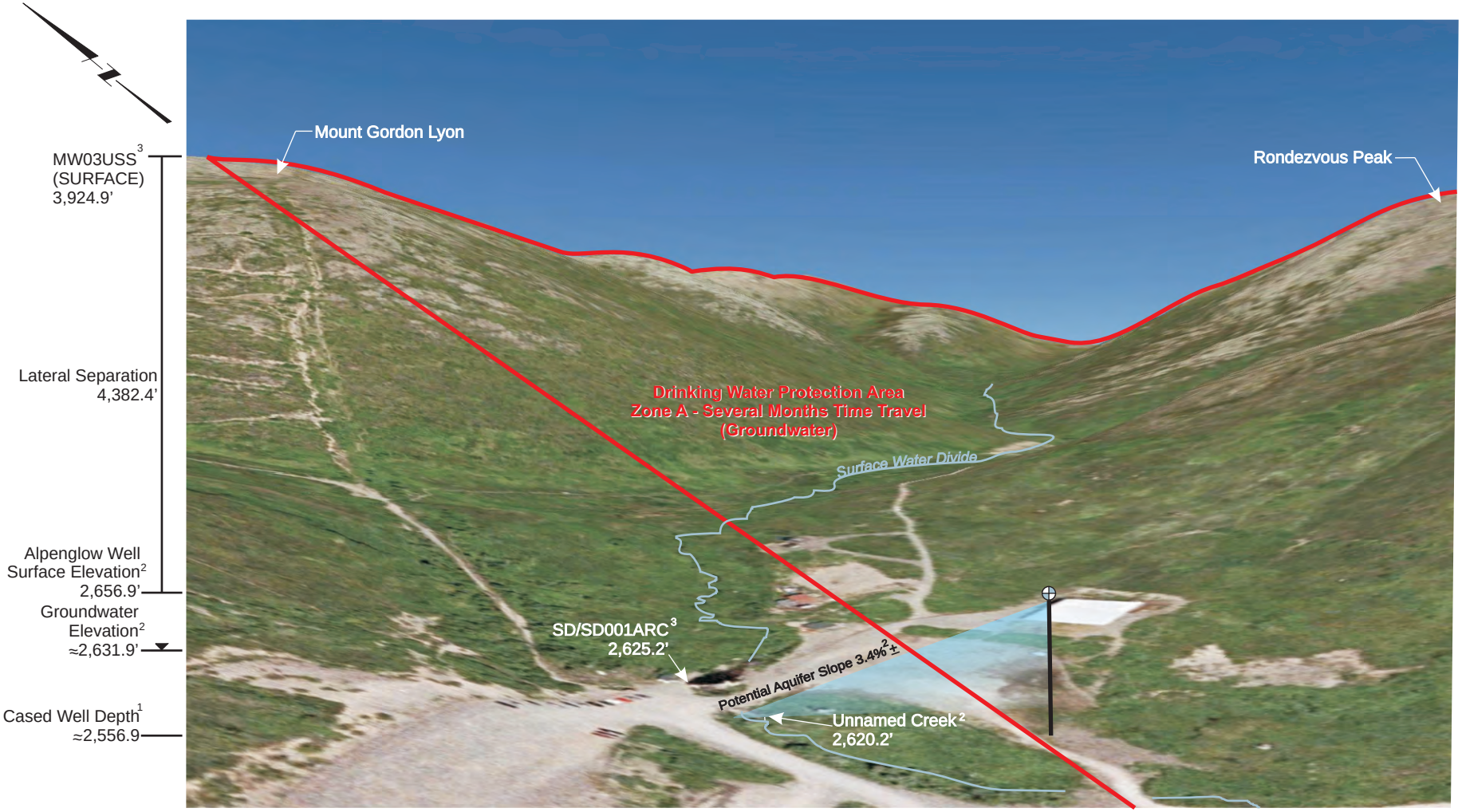

NOTES:

1 PUBLIC WATER SYSTEM # 217908
WELL LOG INFORMATION FROM
PENN JERSEY DRILLING COMPANY
SEPTEMBER 1972.

2 GROUNDWATER AQUIFER PLAN AND PROFILE
FROM HAWTHORNE ENGINEERING, 7/9/1992.

3 NIKE SITE SUMMIT SAMPLE ELEVATIONS
2010 REMEDIAL FIELD INVESTIGATION
9/13-14/2010

4 ZONE A - DRINKING WATER PROTECTION AREA - Alaska Department of Environmental Conservation
http://map.dec.state.ak.us/ArcGIS/rest/services/EH/DWP_Drinking_Water_Protection_Area_ArcGISOnline/MapServer

NO SCALE

JOINT BASE ELMENDORF-RICHARDSON, ALASKA
NIKE SITE SUMMIT

SS047 RECORD OF DECISION

ALPENGLOW WELL - RELATIVE DISTANCES
FROM UPPER SITE SUMMIT

FIGURE

5-1

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The groundwater basin model used as part of the SFS groundwater assessment confirmed the conclusions of the RI that groundwater at LSS is the following: bounded by bedrock, discontinuous, present primarily in the former UST cavity, and only encountered on the north/northeast side of the LSS site.

The SFS included a groundwater assessment to evaluate the quantity and potential impact of groundwater at LSS. The results indicated that groundwater at LSS does not support a drinking water source, due to limited recharge volumes and low permeability of the groundwater-bearing strata at LSS, which results in low yield. This low yield does not meet the EPA's classification of a drinking water source, which must produce a minimum of 150 gallons per day for a family of four. Several of the LSS wells were pumped dry during the purge process that is conducted prior to collecting a groundwater sample. Using the *EPA Guidelines for Ground-Water Classification, June 1988*, LSS groundwater is a Class IIIA, insufficient yield water source. Additionally, the groundwater determination demonstrated that any contamination from LSS would pose a minimal risk to a downgradient groundwater source within the catchment basin area evaluated in Arctic Valley, due to low solubility and concentrations of contaminants.

5.1.4 Surface Water Hydrology

Surface drainage from SS047 leads directly downslope and predominately towards an unnamed tributary of Ship Creek, which lies between SS047 and the Arctic Valley Ski Area ridgeline. The only known surface water body at SS047 consists of a ponded area at Area C. The pond forms behind a weir that was installed in an unnamed tributary of Ship Creek to provide water for SS047 during its operative years. The tributary and pond collect seasonal surface snowmelt and precipitation runoff from the watershed between Mount Gordon Lyon and Rendezvous Peak.

5.1.5 Ecological Setting

The predominant vegetation at SS047 includes lichens, mosses, low shrubs and berries (including blueberry, crowberry, bearberry, and lingonberry), and herbaceous plants. In the deeper swales and gullies, there are likely to be low, dense-forming willows and small trees. No special status plants are known to exist at SS047.

A variety of herbivorous, carnivorous, or omnivorous birds and mammals occur in the vicinity of SS047. Ecological species present at SS047 include, but are not limited to, the following: ptarmigan (*Lagopus* sp.), water pipit (*Anthus spinoletta*), golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), Dall sheep (*Ovis dalli*), brown bear (*Ursus arctos*), black bear (*Ursus americanus*), coyote (*Canis latrans*), wolf (*Canis lupus*), shrews (*Sorex* sp.), and voles (*Microtus* sp.).

A more detailed appraisal of SS047 ecology is provided in a human health and ecological risk assessment (HHERA) in the *Nike Site Summit – Remedial Investigation Report – Volume 3 of 3 – Human Health and Ecological Risk Assessment Report, Final, May 2012*. Additionally, area-specific characterization results, as well as descriptions of past remedial actions (i.e., UST removals) were presented in the *Nike Site Summit Feasibility Study, Final,* February 2013. The results of all previous investigations were used as a preliminary framework for the Feasibility

Study (FS). A SFS, completed in 2015, included a reassessment of the original HHERA based on the results of an informal dispute resolution.

5.2 Preliminary Assessment/Site Investigation

In 1995 and 1996, a limited preliminary assessment and site inspection (PA/SI – *Fort Richardson Two-Party Non-UST POL Preliminary Assessment/ Site Investigation, Final, July 1995*) and Addendum (*Final Site Assessment Report Addendum, Fort Richardson Two-Party Non-UST POL Preliminary Assessment/Site Investigation, Final, October 1996*) were conducted by Dowl/ Ogden at the six following areas within SS047:

- USS – Former Battery Control Area
- LSS – Former Missile Launch Area
- Area A – Former Opportunity Strikes Radio Relay Station, a Former Borrow Area, and a Suspected Disposal Area
- Area B – High Explosive and Guided Missile Magazines
- Area C – Pump House
- Area D – Former Borrow Area

The PA/SI was conducted to identify and characterize environmental contamination at SS047 and to evaluate possible environmental impacts from past operations and disposal practice. As described in Section 2.1, contamination at SS047 is attributed to past military operations and former disposal practices.

Surface soil and surface water samples were collected and analyzed for: diesel-range organics (DRO), gasoline-range organics (GRO), metals, total petroleum hydrocarbons (TPHs), and VOCs. Surface water samples collected downgradient from SS047 did not identify potential impacts to the adjacent Ship Creek watershed. Based on the analytical results of the soil samples, the PA/SI identified two areas (USS and LSS) for further CERCLA investigation.

Further investigation of USS was recommended to characterize and delineate releases from USTs, the aboveground storage tank, and French drains in the Vehicle Maintenance Shop and boiler room of the Launch Control Building. The PA/SI Report also recommended developing a remedial action plan to address contaminated soils at USS. For LSS, the PA/SI recommended further investigation to evaluate releases from the French drains in the Motor Pool Building and boiler rooms of the Composite Building and to determine the source of contaminants detected in water samples from sumps in the missile launch bunkers. In addition, limited action was recommended to: characterize and delineate solvent and polynuclear aromatic hydrocarbon (PAH) contamination at LSS, develop a remedial action plan for addressing PHC-contaminated soils, and investigate and close a 20,000-gallon UST.

Because the Nike Site Summit Hercules missiles contained nuclear warheads, a radiological survey was performed at SS047 as part of the PA/SI and no radiological materials were detected above background levels. Additionally, the Army collected an explosive wipe sample at SS047 as part

of the *Environmental Assessment, Management of Nike Site Summit, Fort Richardson, Alaska, June 2007,* and no explosives were detected.

5.3 Remedial Investigation

In 2010 and 2011, a RI was conducted at SS047. The RI used the Triad process and focused on determining the type and scope of contamination at each area of SS047 in accordance with CERCLA, as amended by SARA. The Triad approach emphasizes: better investigation preparation (systematic project planning); greater flexibility while performing field work (dynamic work strategies); and real-time measurement technologies, including field-generated data; and provides a framework for the integrated involvement of regulators and stakeholders.

During the RI, field investigations were conducted at USS, LSS, Area A, Area B, Area C, and Area D, as well as one background area. Site histories, known and potential contaminant sources, PA/SI results, and physical characteristics were used to determine sampling locations and analytes at each area. Complete details of these sampling activities and analytical results are provided in the *Nike Site Summit – Remedial Investigation Report – Volume 1 of 3 – Analytical Data Report, Final. May 2012* (Analytical Data Report) and the RFI Report.

The results of the surface (0 to 2 feet bgs) and subsurface soil (greater than 2 feet bgs) samples provided additional information on the nature and extent of contamination at SS047. The RI identified both CERCLA and non-CERCLA COCs in the soil at USS and LSS, as detailed in the following subsections.

5.3.1 USS

Surface soil, subsurface soil, and water samples collected at USS during the RI confirmed PA/SI results and provided additional information on the nature and extent of contamination at SS047. The findings of the RI are summarized below by USS action area and shown on **Figure 5-2**:

- **Former Motor Pool Maintenance Building and Foundation (Action Area USS-F)** – This building included a floor drain and lube-pit that likely received wastes from vehicle maintenance operations. The floor drain and lube-pit have been backfilled with soil; therefore, mobilization of any potential contamination from either within the lines or the lube-pit has been minimized. Cadmium was detected in surface soil at a concentration of 2.92 milligrams per kilogram (mg/kg), which exceeds its project action limit (PAL) of 1.49 mg/kg. The source of contamination is wastes from vehicle maintenance operations discharged from the floor drain or lube-pit.
- **Septic System and Outfall (Action Area USS-K)** – Sanitary wastes and possibly other wastes (oils, paints, and sediment) were collected and piped into a small concrete septic tank. Effluent from this system discharged directly onto the alpine tundra north of the facility. The septic tank has been backfilled with soil; therefore, further mobilization of potential contamination from either within the lines or the tank to the outfall has been minimized. Cadmium, lead, and SVOCs were detected above their respective PALs in surface soil near the septic system outfall. The source of contamination is fluids and sediment discharged from the septic system.

Action areas are defined as areas where sample results exceed cleanup levels. The current action areas identified have changed since the original FS following an informal dispute resolution. The informal dispute resolution agreement allowed the "migration-to-groundwater" exposure pathway to be removed from evaluation, because the pit water at USS is not considered a potential future drinking water source; therefore, groundwater is not considered a media of concern at USS.

Due to past military activities and disposal practices, CERCLA contaminants are present in surface soil at USS Action Areas USS-F and USS-K, as follows:

- **Former Motor Pool Maintenance Building and Foundation (Action Area USS-F)** – Cadmium was detected above its cleanup level in a surface soil sample collected at the outfall from the Motor Pool Maintenance Building. The contaminated soil consists of approximately 100 square feet to a depth of 2 feet (estimated volume of 7 cubic yards).
- **Septic System and Outfall (Action Area USS-K)** – The following CERCLA SVOCs and metals were detected at concentrations above their respective cleanup levels in surface soil samples taken near the septic system outfall: benzo(a)anthracene; benzo(a)pyrene, benzo(b)fluoranthene, cadmium, and lead. The contaminated soil consists of approximately 500 square feet to a depth of 2 feet (estimated volume of 37 cubic yards).

The CERCLA action areas for USS (Action Areas USS-F and USS-K) are shown on Figure 5-2 in green. Although the full extent of contamination at Areas USS-F and USS-K are not bounded by clean samples, the physical locations of the samples with contamination above soil cleanup levels are sufficient to determine the appropriate remedy and provide a reasonable approximation of the extent of contaminated soil based on the two outfalls, the discharge erosion pattern, and site topography.

5.3.2 LSS

The RI included surface soil, subsurface soil, and groundwater sampling at LSS. Groundwater samples confirmed PA/SI results and provided additional information on the nature and extent of contamination at SS047. The findings of the RI are summarized below by LSS source area and shown on **Figure 5-3**:

- **Missile Launch Pad and Control Building 1 & 2 (Action Area LSS-B)** – Surface soil analytical results indicate several possible release mechanisms near these features: surface spills of fuel, spills of lubricants used for the cable or guide rails, and combustion byproducts from missile launches. COCs identified in surface soil at the terminus of the Launch Pads consist of benzo(a)pyrene, benzo(b)fluoranthene and cadmium.
- **Vehicle Maintenance Shop (Action Area LSS-H)** – Disposal of waste oils and cleaning fluids from the Vehicle Maintenance Shop through the floor drains and lube pit presumably caused soil contamination at the terminus of the shop drain line from the shop. Cadmium in surface soil is the only CERCLA COC identified at this action area.

LEGEND:

- A — ACTION AREA
- B(a)P - 2.23 (0.2) — SURFACE SOIL ACTION AREA AT OR ABOVE PCL
- (0.2) — PROPOSED CLEANUP LEVEL (PCL)
- USEPA/ CERCLA REGULATED COC'S (ACTION AREA)
- SURFACE SOIL SAMPLE LOCATION

Metals
Cd = Cadmium
Pb = Lead

Semivolatile Organic Compounds
B(a)A = Benzo(a)anthracene
B(a)P = Benzo(a)pyrene
B(b)F = Benzo(b)flouranthene

ALL CONCENTRATIONS AND PCLS ARE IN MILLIGRAMS PER KILOGRAM (mg/kg)

N

SS12USS

K B(a)A - 3.47 (2.0)
B(a)P - 2.23 (0.2)
B(b)F - 10.6 (2.0)
Cd - 23.9 (1.49)
Pb - 950 (204)

SS11USS

SEPTIC SYSTEM OUTFALL

APPROIMATE LOCATION OF SEPTIC LINE

SEPTIC TANK

APPROIMATE LOCATION OF SEPTIC LINE

HIPAR BUILDING

HIPAR FOUNDATION

TARGET TRACKING RADAR

THIRD PARTY COMMUNICATION BUILDINGS & EQUIPMENT

TARGET RANGING RADAR

THIRD PARTY COMMUNICATION BUILDINGS & EQUIPMENT

BATTERY CONTROL & BARRACKS BUILDING

MOTOR POOL MAINTENANCE BUILDING FOUNDATION

OUTFALL FROM MOTOR POOL MAINTENANCE BUILDING

MISSILE RANGING RADAR

SS10USS

APPROIMATE LOCATION OF BURIED DRAIN LINE

F Cd - 2.92 (1.49)

ELECTRICAL SUBSTATION C

SCALE IN FEET
0 30'

JOINT BASE ELMENDORF-RICHARDSON, ALASKA
NIKE SITE SUMMIT

SS047 RECORD OF DECISION

UPPER SITE SUMMIT
SAMPLE LOCATIONS AND ACTION AREAS

FIGURE
5-2

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TIME: 28-APR-2017 14:43 FILE: C:\D\CAD\Proj\AFCEC\2016-2017 JBER-Nike Site Summit (10505394)_185750655\2016-2017 SS047_ROD\draft_April 26-2017\FIG 5-3 - Lower Site Summit - Sample Locations and Action Areas.dgn

0 60'

JOINT BASE ELMENDORF-RICHARDSON, ALASKA
NIKE SITE SUMMIT

SS047 RECORD OF DECISION

LOWER SITE SUMMIT
SAMPLE LOCATIONS AND ACTIONS AREAS

FIGURE
5-3

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- **Launch Control Building (Action Area LSS-Q)** – A source of contamination located near the Launch Control Building was a former aboveground storage tank on the south side of the building. The RI analytical results indicate that surface and/or subsurface fuel releases occurred from this tank. The presence of PHCs, VOCs, and SVOCs suggests that surface spills of petroleum (possibly mixed with solvents) occurred in this area. COCs identified at the Launch Control Building consist of benzo(a)pyrene and benzo(b)fluoranthene in surface soil and VOCs and SVOCs in subsurface soil.
- **Septic Tank and Septic System Outfall (Action Area LSS-U)** – Waste oil, diesel fuel, and cleaning fluids in the septic tank discharge were released to the surface soil northwest of the Septic Tank Pump House. COCs identified at the Septic System Outfall include cadmium and SVOCs in surface soil.

Action areas are defined as areas where sample results exceed the cleanup levels. The current action areas identified have changed since the original FS following an informal dispute resolution. The information dispute resolution agreement allowed the "migration-to-groundwater" exposure pathway to be removed from evaluation, because groundwater at LSS has insufficient yield to be classified as a drinking water source; therefore, groundwater is not considered a media of concern at LSS.

Due to past military activities and disposal practices, CERCLA contaminants are present in surface and subsurface soil at LSS Action Areas LSS-B, LSS-H, LSS-Q, and LSS-U, as follows:

- **Missile Launch Pad and Control Buildings 1 and 2 (Action Area LSS-B)** – Benzo(a)pyrene, benzo(b)fluoranthene, and cadmium were detected in surface soil at concentrations exceeding their respective cleanup levels. Further action under CERCLA is warranted to address surface soil contamination at this action area. The contaminated soil consists of approximately 1,000 square feet to a depth of 2 feet (estimated volume of 74 cubic yards).
- **Vehicle Maintenance Shop (Action Area LSS-H)** – Cadmium was detected in surface soil at a concentration exceeding its cleanup level. Further action under CERCLA is warranted to address surface soil contamination at this action area. The contaminated soil consists of approximately 100 square feet to a depth of 2 feet (estimated volume of 7.4 cubic yards).
- **Launch Control Building (Action Area LSS-Q)** – Benzo(a)pyrene and benzo(b)fluoranthene were detected in surface soil at Action Area LSS-Q at concentrations exceeding their cleanup levels. In addition, the following VOCs and SVOCs were detected at concentrations above their respective cleanup levels in subsurface soil at this action area: 1,1,2-trichloroethane; 1,2,3-trichloropropane; 1,2-dibromo,3-chloropropane; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenz(a,h)anthracene; and indeno(1,2,3-c,d)pyrene. Further action under CERCLA is warranted to address surface and subsurface soil contamination at this action area. The contaminated soil consists of approximately 900 square feet to a depth of 5 feet (estimated volume of 167 cubic yards).
- **Septic Tank and Septic System Outfall (Action Area LSS-U)** – The following contaminants were detected at concentrations above their respective cleanup levels in surface soil near the septic system outfall: benzo(a)pyrene; benzo(b)fluoranthene; bis(2-

ethylhexyl) phthalate; pentachlorophenol; and cadmium. Further action under CERCLA is warranted to address surface soil contamination at this action area. The contaminated soil consists of approximately 200 square feet to a depth of 2 feet (estimated volume of 15 cubic yards).

The CERCLA action areas for LSS (Action Areas LSS-B, LSS-H, LSS-Q, and LSS-U) are shown on Figure 5-3 in green. Although the full extent of contamination at Areas LSS-B, LSS-H, LSS-Q, and LSS-U are not bounded by clean samples, the physical locations of the samples with contamination above soil cleanup levels are sufficient to determine the appropriate remedy and provide a reasonable approximation of the extent of contaminated soil based on their presumed sources, erosion patterns, and site topography.

5.3.3 Background Sampling

Twelve surface soil samples collected in 2010 from locations upgradient of potential SS047 sources of contamination were analyzed for Resource Conservation and Recovery Act (RCRA) 8 metals, with the addition of nickel and vanadium. Background sample locations were distributed over areas of elevation and terrain similar to SS047 to determine ambient concentrations that potentially represent naturally-occurring geologic and depositional conditions for the area not attributable to site activities. Background data are provided in the RI Analytical Data Report.

6.0 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

JBER is part of the U.S. Department of Defense and is jointly administered by the USAF and Army. There are currently no manned operations at SS047 facilities; however, the area is used by military personnel for various aspects of military training. Access to the site is controlled, but trespass onto the property is known to occur. There is also recreational use near the site, because the boundary of JBER in the vicinity of SS047 is adjacent to Chugach State Park.

Arctic Valley Ski Area is located in Area C and access by the public is not restricted. The ski area is used by non-military personnel visiting the area recreationally. FONSS maintains structures at both USS and LSS and organize guided tours to the facilities. Several modern commercial communication structures and antennas are located at USS.

As the lead agency, the USAF has the authority to determine the future anticipated land use of SS047. The USAF has determined that the most likely indefinite future land use at these areas is consistent with current land uses. The USAF plans to retain ownership and/or provisional use of all property at SS047 for the foreseeable future.

Land at SS047 is designated in the Base Master Plan as training use only, for both current and future use; however, to assess the need for land use controls (LUCs), contamination present at the site was assessed for UU/UE – in particular, residential use.

There is no groundwater at USS and a groundwater assessment conducted as part of the SFS concluded that LSS groundwater does not meet the EPA's classification of a drinking water source due to low yield.

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7.0 SUMMARY OF SITE RISKS

This section summarizes the HHERA, focusing on the chemicals of potential concern (COPCs) at USS and LSS, and issues that are the basis for the response actions at SS047. This section does not provide a complete summary of the baseline risk assessment conducted for the site, but focuses on the information that is driving the need for specific remedial actions described in this ROD. Remedial actions driven by risks associated with petroleum COPCs at USS, LSS, Area A and Area C will be presented in a separate Decision Document.

A baseline HHERA was performed for SS047 as part of the RI. Details on the original estimated human health and ecological risks and hazards for USS, LSS, Area A and Area C are presented in the RI HHERA.

The baseline HHERA was revised in accordance with the *SS047 Nike Site Summit, Informal Dispute Resolution Memorandum, Joint Base Elmendorf-Richardson (JBER), Alaska, 28 July 2014*, and details on the changes to the risk and hazards at USS and LSS are provided in the SFS. There were no changes to the risks and hazards derived in the RI HHERA for Area A and Area C. The changes to the risk analysis that resulted from the informal dispute resolution include: elimination of the groundwater pathway as a complete exposure pathway; exclusion of areas contaminated by petroleum only from the risk assessment; and updates to risk assumptions for small mammal foraging areas.

7.1 Summary of Human Health Risk Assessment

A baseline risk assessment estimates what risks the site poses if no action is taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action.

A human health risk assessment (HHRA) estimates the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media, now or in the future. Two measurable outcomes of an HHRA are the incremental lifetime cancer risk (ILCR) and non-cancer hazard index (HI). The ILCR is the likelihood of one additional person, over the national average, to develop cancer from exposure to site contamination. The EPA's risk management range includes ILCR criteria between 1×10^{-6} (1 person in 1,000,000) and 1×10^{-4} (1 person in 10,000). The national average of developing cancer is about 1 in 3 people. An ILCR greater than 1×10^{-6} serves as the point of departure. Sites with risk in excess of this point of departure may require a response action. The HI expresses the likelihood that exposure to a site contaminant will cause a negative health effect other than cancer. An HI greater than 1 indicates a potential for a non-cancerous health effect to result from exposure to a site contaminant.

An HHRA is divided into four primary tasks: identification of COPCs (hazard assessment), exposure assessment, toxicity assessment, and risk characterization. Risk characterization is the summarizing step of the risk assessment. The risk characterization integrates information from the preceding components of the risk assessment and synthesizes an overall conclusion about risk that is complete, informative, and useful for decision-makers. The risk assessment process

identifies COCs that represent an ongoing or potential threat to human health for particular groups of people at particular locations. This section focuses on the COCs identified as the risk drivers for response actions described in this ROD and does not summarize the entire risk assessment.

There are many uncertainties in assessing risks to people from chemicals occurring in the environment. Uncertainty reflects limitations in knowledge and assumptions that must be made in order to quantify health risks. Risk assessments involve several components, including analysis of toxicity and exposure, each with inherent uncertainty. Specific uncertainties are discussed in Section 7.1.4.

7.1.1 Identification of Chemicals of Potential Concern

At the start of the risk assessment process, all data are evaluated for inclusion in the risk assessment in accordance with the ADEC's *Risk Assessment Procedures Manual, November 2011* and the EPA's *Guidance for Data Usability in Risk Assessment, Part A, December 1992*. For an analytical result to be usable for assessing risk, the sample collection, preparation, and analytical methods should appropriately identify the chemical form or species, and the specified sample detection limit should be at or below a concentration that is associated with toxicologically relevant levels (e.g., published risk-based screening levels or action levels).

EPA's *Risk Assessment Guidance for Superfund, December 1989*, specifies that only field investigation analytical data that meet the following specific requirements (EPA Level III or higher data) are appropriate for use in a quantitative HHRA:

- Low detection limits.
- A wide range of calibrated analyses.
- Matrix recovery information.
- Laboratory process control information.
- Known precision and accuracy.

All chemical data from the RFI were evaluated for inclusion in the risk assessment based on the following criteria established in ADEC's *Risk Assessment Procedures Manual, November 2011*:

- Analytical data sufficient for adequate site characterization is available.
- Data was collected consistent with ADEC and EPA guidance.
- Sampling and analytical procedures give accurate, chemical-specific concentrations.
- Analytical laboratory data was validated.
- Method detection limits and sample quantitation limits are below screening criteria.
- Qualified data are appropriately used and explained in the uncertainty section (i.e., discussion on potential bias from qualified data and how it might result in the over or under estimation of risk).
- Rejected data are not used for risk assessment purposes.

Additionally, in accordance with ADEC's *Guidelines for Data Reporting, Data Reduction, and Treatment of Non-detect Values, August 2008*, the following process was used to select either the field duplicate, or respective primary sample result, for use in the risk assessment:

- If both duplicate results are detected, the higher of the two detected concentrations was used.
- In the case of mixed detected and non-detect results, the detected concentration was selected.
- If all duplicate results are non-detect, then the lower detection limit was selected.

The data used in the risk assessment was deemed to be of sufficient quality and quantity for its intended use.

After the data are evaluated, COPCS are selected, usually by comparing risk-based screening values to site concentrations of contaminants. In general, if site concentrations of contaminants exceeded their respective screening concentrations, then the contaminants were retained as COPCs for further evaluation in the risk assessment. COCs, on the other hand, are those chemicals at the end of the risk assessment process that exceed target health goals and are also the risk drivers upon which remedial actions should be focused in order to reduce concentrations to the point where human health and/or ecological receptors are protected from the COCs. COCs are defined by the EPA as, "those COPCs and media/exposure points that trigger the need for cleanup (the risk drivers)."

This section identifies those chemicals associated with unacceptable risk, which is the basis for the proposed remedial action. Although other chemicals were detected at the site, these COCs are the primary risk-driving chemicals. The detection frequency (number of samples in which the chemical was detected divided by the total number of samples analyzed), maximum concentrations detected, and the basis for the cleanup levels for each COC in each medium investigated are detailed in Section 8.

Protective methods and assumptions were used in selecting COPCs, in accordance with State of Alaska regulations (18 AAC 75) and EPA regulations and guidance. Human health COPC screening for soil was based on comparisons of maximum concentrations of chemicals detected in surface soil (0 to 2 feet bgs) and subsurface soil (2 to 15 feet bgs) to the following:

- One-tenth of the ADEC Method Two Soil Cleanup Level (under 40-inch zone) for carcinogenic and noncarcinogenic chemicals compiled from Tables B1 and B2 in 18 AAC 75, equivalent to a one-in-one million risk for carcinogenic chemicals and a noncancer hazard quotient of 0.1 to account for potential cumulative effects, OR
- EPA 2011 *Regional Screening Levels* (RSLs) for carcinogenic chemicals (equivalent to a one-in-one million risk) and one-tenth of the EPA RSLs for noncarcinogens (equivalent to a noncancer hazard quotient of 0.1), where ADEC Method Two Soil Cleanup Levels are not available.
- Site-specific background concentrations for metals at SS047.

Chemicals without risk-based screening benchmarks were screened based on toxicity information for surrogate chemicals to the extent appropriate. Chemicals that exceed criteria and benchmarks, and chemicals without screening benchmarks or appropriate surrogates, were proposed for further evaluation in the baseline HHRA. Soil screening benchmarks used in the HHRA are presented in **Table 7-1**.

There is some degree of uncertainty associated with the use of standardized screening criteria for COPC selection. Screening criteria are created to conservatively protect human health. These criteria do not reflect site-specific exposures and likely overestimate exposures to site-specific receptors. However, the associated uncertainty is low, because chemicals retained in this conservative process were evaluated with more site-specific methods in Tier II baseline HHRA calculations. **Table 7-2** lists the COPCs evaluated in the HHRA for USS and LSS.

7.1.2 Exposure Assessment

The populations and exposure pathways that were qualitatively and quantitatively evaluated are presented in **Figures 7-1** and **7-2** for USS and LSS, respectively. A CSM was developed to aid in determining reasonable exposure scenarios and pathways based on current and future populations and current and reasonably anticipated future land uses. The means by which people may be exposed to contaminated media is also discussed. Potential uncertainties in the exposure assessment phase of the HHRA for SS047 and down-gradient off-site drainages include, but are not limited to: the selection of receptors, exposure pathways and assumptions, exposure point concentrations (EPCs), available contaminant characterization data, and toxicity values.

Receptors quantitatively evaluated in the HHRA for SS047 consisted of site workers, site visitors, and hypothetical future residents. The current land use at SS047 is not anticipated to change; however, future resident was used as a potential receptor to provide a conservative estimate of possible risks. The chemicals, exposure pathways, and populations associated with unacceptable risk are highlighted, because they serve as the primary basis for remedial action. The HHRA is also used to derive site-specific risk-based cleanup levels (RBCLs).

The exposure pathways evaluated for human health were based on the COPCs identified for SS047; however, during the informal dispute resolution, the USAF, EPA, and ADEC agreed that there is not a migration-to-groundwater pathway at SS047 and contamination resulting from PHCs would not be further evaluated for this risk assessment and would be removed from further evaluation in this ROD due to the CERCLA Petroleum-Exclusion Rule. As a result, the HHRA prepared as part of the SFS identified soils (surface and subsurface) as the only contaminated medium at SS047 and potential risks were evaluated at two areas (USS and LSS) where CERCLA hazardous substances were identified as COPCs. There were no contaminants identified at Areas B and D, and Areas A and C have only contaminants associated with PHCs and so are excluded from regulation under CERCLA. Therefore, risks associated with these four areas were not re-evaluated in the SFS.

Table 7-1 Soil Screening Benchmarks Used in the Human Health Risk Assessment at SS047

Analyte	CAS Number	Regulatory Criterion[a] (mg/Kg)		Screening Benchmark[b] (mg/Kg)	Cancer / Noncancer	Source
Inorganics						
Arsenic	7440-38-2	4.5		0.45	cancer	ADEC, 2011
Barium	7440-39-3	20,300		2,030	noncancer	ADEC, 2011
Cadmium	7440-43-9	79		7.9	cancer	ADEC, 2011
Chromium, Hexavalent	18540-29-9	300	c	30	noncancer	ADEC, 2011
Chromium, Trivalent	16065-83-1	152,000	c	15,200	noncancer	ADEC, 2011
Chromium, Total	7440-47-3	300	c	30	noncancer	ADEC, 2011
Lead	7439-92-1	400	d	400	cancer	ADEC, 2011
Mercury	7439-97-6	18		1.8	noncancer	ADEC, 2011
Nickel	7440-02-0	2,000		200	noncancer	ADEC, 2011
Selenium	7782-49-2	510		51	noncancer	ADEC, 2011
Silver	7440-22-4	510		51	noncancer	ADEC, 2011
Vanadium	7440-62-2	710		71	noncancer	ADEC, 2011
Volatile Organic Compounds (VOCs)						
1,1,1-Trichloroethane	71-55-6	360		36	noncancer	ADEC, 2011
1,1,2,2-Tetrachloroethane	79-34-5	5.5		0.55	cancer	ADEC, 2011
1,1,2-Trichloroethane	79-00-5	11		1.1	cancer	ADEC, 2011
1,2,3-Trichlorobenzene	87-61-6	49		4.9	noncancer	USEPA, 2011
1,2,3-Trichloropropane	96-18-4	0.17		0.017	cancer	ADEC, 2011
1,2,4-Trichlorobenzene	120-82-1	41		4.1	noncancer	ADEC, 2011
1,2,4-Trimethylbenzene	95-63-6	49		4.9	noncancer	ADEC, 2011
1,2-Dibromo-3-chloropropane	96-12-8	0.0054		0.0054	cancer	USEPA, 2011
1,2-Dibromoethane (EDB)	106-93-4	0.60		0.060	cancer	ADEC, 2011
1,2-Dichloroethane	107-06-2	4.8		0.48	cancer	ADEC, 2011
1,3,5-Trimethylbenzene	108-67-8	42		4.2	noncancer	ADEC, 2011
2-Butanone (MEK)	78-93-3	23,300		2,330	noncancer	ADEC, 2011
2-Hexanone	591-78-6	210		21	noncancer	USEPA, 2011
4-Chlorotoluene	106-43-4	1,600		160	noncancer	USEPA, 2011
4-Methyl-2-pentanone(MIBK)	108-10-1	2,100		210	noncancer	ADEC, 2011
Acetone	67-64-1	68,600		6,860	noncancer	ADEC, 2011
Benzene	71-43-2	11		1.1	cancer	ADEC, 2011
Carbon Disulfide	75-15-0	250		25	noncancer	ADEC, 2011
Dibenzofuran	132-64-9	200		20	noncancer	ADEC, 2011
Ethylbenzene	100-41-4	110		11	cancer	ADEC, 2011
Isopropylbenzene	98-82-8	62		6.2	noncancer	ADEC, 2011
m,p-Xylene (Sum of isomers)	108-38-3/106-42-3	63	e	6.3	noncancer	ADEC, 2011
Methylene chloride	75-09-2	160		16	cancer	ADEC, 2011
n-Butylbenzene	104-51-8	42		4.2	noncancer	ADEC, 2011
n-Propylbenzene	103-65-1	42		4.2	noncancer	ADEC, 2011

Table 7-1 (Cont.) Soil Screening Benchmarks Used in the Human Health Risk Assessment at SS047

Analyte	CAS Number	Regulatory Criterion[a] (mg/Kg)		Screening Benchmark[b] (mg/Kg)	Cancer / Noncancer	Source
Volatile Organic Compounds (VOCs) – Cont.						
o-Xylene	95-47-6	63	e	6.3	noncancer	ADEC, 2011
p-Isopropyltoluene	99-87-6	62	f	6.2	noncancer	ADEC, 2011
sec-Butylbenzene	135-98-8	41		4.1	noncancer	ADEC, 2011
Styrene	100-42-5	200		20	noncancer	ADEC, 2011
Toluene	108-88-3	220		22	noncancer	ADEC, 2011
trans-1,3-Dichloropropene	542-75-6	83		8.3	cancer	ADEC, 2011
Trichloroethylene (TCE)	79-01-6	0.57		0.057	cancer	ADEC, 2011
Xylenes, Total	1330-20-7	63		6.3	noncancer	ADEC, 2011
Semi-Volatile Organic Compounds (SVOCs)						
2,4-Dimethylphenol	105-67-9	1,300		130	noncancer	ADEC, 2011
4-Chloroaniline	106-47-8	90		9.0	cancer	ADEC, 2011
Benzoic Acid	65-85-0	317,000		31,700	noncancer	ADEC, 2011
Benzyl butyl phthalate	85-68-7	2,900		290	cancer	ADEC, 2011
bis(2-ethylhexyl) phthalate	117-81-7	220		22	cancer	ADEC, 2011
Di-n-octylphthalate	117-84-0	3,100		310	noncancer	ADEC, 2011
Pentachlorophenol	87-86-5	39		3.9	cancer	ADEC, 2011
Polycyclic Aromatic Hydrocarbons (PAHs)						
2-Methylnaphthalene	91-57-6	280		28	noncancer	ADEC, 2011
Acenaphthene	83-32-9	2,800		280	noncancer	ADEC, 2011
Acenaphthylene	208-96-8	2,800		280	noncancer	ADEC, 2011
Anthracene	120-12-7	20,600		2,060	noncancer	ADEC, 2011
Benzo(a)anthracene	56-55-3	4.9		0.49	cancer	ADEC, 2011
Benzo(a)pyrene	50-32-8	0.49		0.049	cancer	ADEC, 2011
Benzo(b)fluoranthene	205-99-2	4.9		0.49	cancer	ADEC, 2011
Benzo(g,h,i)perylene	191-24-2	1,400		140	noncancer	ADEC, 2011
Benzo(k)fluoranthene	207-08-9	49		4.9	cancer	ADEC, 2011
Chrysene	218-01-9	490		49	cancer	ADEC, 2011
Dibenz(a,h)anthracene	53-70-3	0.49		0.049	cancer	ADEC, 2011
Fluoranthene	206-44-0	1,900		190	noncancer	ADEC, 2011
Fluorene	86-73-7	2,300		230	noncancer	ADEC, 2011
Indeno(1,2,3-c,d)Pyrene	193-39-5	4.9		0.49	cancer	ADEC, 2011
Naphthalene	91-20-3	28		2.8	noncancer	ADEC, 2011
Phenanthrene	85-01-8	20,600		2,060	noncancer	ADEC, 2011
Pyrene	129-00-0	1,400		140	noncancer	ADEC, 2011
Polychlorinated Biphenyls (PCBs)						
PCB-1254 (Aroclor 1254)	11097-69-1	1	g	0.1	cancer	ADEC, 2011
PCB-1260 (Aroclor 1260)	11096-82-5	1	g	0.1	cancer	ADEC, 2011
Energetics						
Perchlorate	7790-98-9	71		7.1	noncancer	ADEC, 2011

Table 7-1 (Cont.) Soil Screening Benchmarks Used in the Human Health Risk Assessment at SS047

Analyte	CAS Number	Regulatory Criterion[a] (mg/Kg)		Screening Benchmark[b] (mg/Kg)	Cancer / Noncancer	Source
Total Petroleum Hydrocarbons (TPHs)						
Diesel Range Organics (DRO)	na	10,250	h	10,250	noncancer	ADEC, 2011
Gasoline Range Organics (GRO)	na	1,400	h	1,400	noncancer	ADEC, 2011
Residual Range Organics (RRO)	na	10,000	h	10,000	noncancer	ADEC, 2011

Key:

AAC – Alaska Administrative Code

ADEC – Alaska Department of Environmental Conservation

a – Regulatory Criteria are derived from the following hierarchy:

1. Minimum of the Direct Contact and Inhalation pathways listed in 18 AAC 75, Tables B1 and B2, Under 40-inch Zone (ADEC, 2011).
2. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites - Residential Soil (USEPA, 2011).

b – Benchmark Criteria are based on regulatory cancer risk of 1 x 10-6 or a hazard index of 0.1.

c – Total chromium data will be compared to the soil screening benchmark for trivalent chromium at sites where hexavalent chromium data are available. For sites where hexavalent chromium data are unavailable, total chromium data will be compared to the soil screening benchmark for total chromium, which is equivalent to the soil screening benchmark for hexavalent chromium.

CAS – Chemical Abstracts Service

d – Lead is not included in the cumulative hazard estimate (ADEC, 2008); therefore, the regulatory criterion was not divided by 10. The regulatory criteria is based on the residential cleanup value calculated according to the Cumulative Risk Guidance (ADEC, 2008c).

e – Total xylenes used as a surrogate.

f – Isopropylbenzene used as a surrogate.

g – PCBs used as a surrogate.

h – Because petroleum hydrocarbons are not included in the cumulative hazard estimate, the regulatory criteria were not divided by 10.

mg/kg – milligrams per kilogram

na – not available

USEPA – U.S. Environmental Protection Agency

Sources:

ADEC, 2008. Cumulative Risk Guidance. June.

ADEC, 2011. Oil and Other Hazardous Substances Pollution Control – 18 AAC 75. Revised as of October 1.

USEPA, 2011. Regional Screening Levels. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm.

Table 7-2 Toxicity Values Used in the Human Health Risk Assessment at SS047

Chemical of Potential Concern	CAS Number	Cancer Slope Factor (mg/Kg-d)-1		URF ($\mu g/m^3)^{-1}$	Chronic Reference Dose (mg/Kg-d)		RfC (mg/m^3)	ABS_{GI} [a] (%)	Critical Effect
		Oral	Dermal[b]	Inhalation	Oral	Dermal[b]	Inhalation		
Inorganics									
Arsenic	7440-38-2	1.5E+00 I	1.5E+00 I	4.3E-03 I	3.0E-04 I	3.0E-04 R	1.5E-05 C	95%	Dermal effects: Hyperpigmentation and keratosis
Cadmium, Soil	7440-43-9	na	na	1.8E-03 I	1.0E-03 I	2.5E-05 R	2.0E-05 C	2.5%	Hematologic: proteinuria
Chromium, Trivalent	16065-83-1	na	na	na	1.5E+00 I	2.0E-02 R	na	1.3%	na
Chromium, Hexavalent	18540-29-9	5.0E-01 J	2.0E+01 R	8.4E-02 I[c]	3.0E-03 I	7.5E-05	1.0E-04 I	2.5%	Respiratory Effects
Lead	7439-92-1	na [d]	na [d]	na [d]	na [d]	na [d]	na [d]	na	na
Mercury	7487-94-7	na	na	na	3.0E-04 I	2.1E-05 R	3.0E-05 C	7%	Neurological, neuro-behavioral and immunological effects
Nickel	7440-02-0	na	na	2.6E-04 C	2.0E-02 I	8.0E-04 R	9.0E-05 AT	4%	Decreased body and organ weights
Vanadium	7440-62-2	na	na	na	5.0E-03 I[e]	1.3E-04 R	na	2.6%	Decreased hair cystine
Volatile Organic Compounds (VOCs)									
1,1,2,2-Tetrachloroethane	79-34-5	2.0E-01 I	2.0E-01 R	5.8E-05 C	2.0E-02 I	2.0E-02 R	na	100%	Hepatotoxicity
1,1,2-Trichloroethane	79-00-5	5.70E-02 I	5.70E-02 R	1.6E-05 I	4.0E-03 I	4.0E-03 R	2.0E-04 X	100%	Alterations in clinical chemistry
1,2,3-Trichloropropane	96-18-4	3.00E+01 I	3.00E+01 R	2.0E-03 A	4.0E-03 I	4.0E-03 R	3.0E-04 I	100%	Hepatotoxicity and respiratory effects.
1,2,4-Trimethylbenzene	95-63-6	na	na	na	5.0E-02 A	5.0E-02 R	7.0E-03 P	100%	na
1,2-Dibromo-3-chloropropane	96-12-8	8.0E-01 P	8.0E-01 R	6.0E-03 P	2.0E-04 P	2.0E-04 R	2.0E-04 I	100%	Testicular effects
1,2-Dichloroethane	107-06-2	9.1E-02 I	9.1E-02 R	2.6E-05 I	6.0E-03 X	2.0E-02 R	7.0E-03 P	100%	na
1,3,5-Trimethylbenzene	108-67-8	na	na	na	1.0E-02 X	1.0E-02 R	7.0E-03 A	100%	na
Ethylbenzene	100-41-4	1.1E-02 C	1.1E-02 R	2.5E-06 C	1.0E-01 I	1.0E-01 R	1.0E+00 I	100%	Hepatotoxicity, nephrotoxicity, and developmental effects

Table 7-2 (Cont.) Toxicity Values Used in the Human Health Risk Assessment at SS047

Chemical of Potential Concern	CAS Number	Cancer Slope Factor (mg/Kg-d)-1		URF $(\mu g/m^3)^{-1}$	Chronic Reference Dose (mg/Kg-d)		RfC (mg/m^3)	ABS_{GI} [a] (%)	Critical Effect
		Oral	Dermal[b]	Inhalation	Oral	Dermal[b]	Inhalation		
Volatile Organic Compounds (VOCs) – Cont.									
Methylene chloride	75-09-2	7.5E-03 I	7.5E-03 R	4.7E-07 I	6.0E-02 I	6.0E-02 R	1.0E+00 AT	100%	Hepatotoxicity
n-Butylbenzene	104-51-8	na	na	na	5.0E-02 P	1.0E-02 R	3.5E-02 A	na	na
n-Propylbenzene	103-65-1	na	na	na	1.0E-01 X	1.0E-01 R	1.0E+00 X	100%	Hepatotoxicity and nephrotoxicity
sec-Butylbenzene	135-98-8	na	na	na	1.0E-02 A	1.0E-02 R	3.5E-02 A	100%	Kidney Effects
Trichloroethylene (TCE)	79-01-6	4.6E-02 I	4.6E-02 R	4.1E-06 I	5.0E-04 I	5.0E-04 R	2.0E-03 I	100%	Hepatic, Renal and Neurotoxicity
Semi-Volatile Organic Compounds (SVOCs)									
Pentachlorophenol	87-86-5	4.0E-01 I	4.0E-01 R	5.1E-06 C	5.0E-03 I	5.0E-03 R	na	100%	Hepatotoxicity
Polynuclear Aromatic Hydrocarbons (PAHs)									
Acenaphthene	83-32-9	na	na	na	6.0E-02 I	6.0E-02 R	na	89%	Hepatotoxicity
Anthracene	120-12-7	na	na	na	3.0E-01 I	3.0E-01 R	na	89%	na
Benzo(a)anthracene	56-55-3	7.3E-01 T	7.3E-01 R	1.1E-04 C	na	na	na	89%	na
Benzo(a)pyrene	50-32-8	7.3E+00 I	7.3E+00 R	1.1E-03 C	na	na	na	89%	na
Benzo(b)fluoranthene	205-99-2	7.3E-01 T	7.3E-01 R	1.1E-04 C	na	na	na	89%	na
Benzo(k)fluoranthene	207-08-9	7.3E-02 T	7.3E-02 R	1.1E-04 C	na	na	na	89%	na
Dibenz(a,h)anthracene	53-70-3	7.3E+00 T	7.3E+00 R	1.2E-03 C	na	na	na	89%	na
Fluorene	86-73-7	na	na	na	4.0E-02 I	4.0E-02 R	na	89%	Hemotoxicity
Indeno(1,2,3-c,d)pyrene	193-39-5	7.3E-01 T	7.3E-01 R	1.1E-04 C	na	na	na	89%	na
Naphthalene	91-20-3	na	na	3.4E-05 C	2.0E-02 I	2.0E-02 R	3.0E-03 I	89%	Decreased body weight; Nasal, olfactory and respiratory effects
Phenanthrene	85-01-8	na	na	na	3.0E-01 A	3.0E-01 R	na	89%	na
Pyrene	129-00-0	na	na	na	3.0E-02 I	3.0E-02 R	na	89%	Nephrotoxicity

Table 7-2 (Cont.) Toxicity Values Used in the Human Health Risk Assessment at SS047

Toxicity values were selected according to the following hierarchy of sources:

I – EPA IRIS Database, 2012
P – EPA Provisional Peer Reviewed Toxicity Values (PPRTVs), 2012
AT – Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels, 2010
C – Office of Environmental Health Hazard Assessment CalEPA Toxicity Values, 2012
X – EPA PPRTV Appendix, 2010
A – ADEC Cleanup Levels Guidance, 2008
R – Route-to-Route Extrapolation.

As well as other professionally peer reviewed documents as needed, including:
J – New Jersey Department of Environmental Protection, 2009
T – EPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons, 1993

Key:

µg/m^3 – micrograms per cubic meter
% – Percent
ABS_{GI} – oral absorption efficiencies
ADEC – Alaska Department of Environmental Conservation
CAS – Chemical Abstracts Service
CSF – cancer slope factor
IRIS – Integrated Risk Information System
mg/Kg-d – milligrams per kilogram per day
mg/m^3 – milligrams per cubic meter
na – not available
RAGS – Risk Assessment Guidance for Superfund
RfC – Reference Concentration
RfD – Reference Dose
SF – slope factor
USEPA – U.S. Environmental Protection Agency
URF – Unit Risk Factor

a – Values are from Exhibit 4-1 USEPA RAGS Part E. Where no specific ABS_{GI} is available, the ABS_{GI} is assumed to be 100% (USEPA, 2004).

b – The following equations are used as recommended by the USEPA (2004) to estimate dermal CSF and RfDs from the ingestion toxicity values when ABS_{GI} is less than 50%: Dermal RfD = Oral RfD x ABS_{GI} and Dermal CSF = Oral SF/ABS_{GI}. When ABS_{GI} is greater than 50%, the dermal CSF and/or RfD is assumed to be equal to the oral CSF and/or RfD (USEPA, 2004).

c – Chromium VI oral toxicity value was multiplied by 7 as a health-protective assumption (USEPA, 2011).

d – Per ADEC (2011) guidance, lead is evaluated using biokinetic models; refer to Section 4.3.3 of the Human Health and Ecological Risk Assessment (USAF, 2012).

e – Vanadium oral RfD is based on IRIS vanadium pentoxide value, with a factor applied to account for the weight of oxygen (USEPA, 2011).

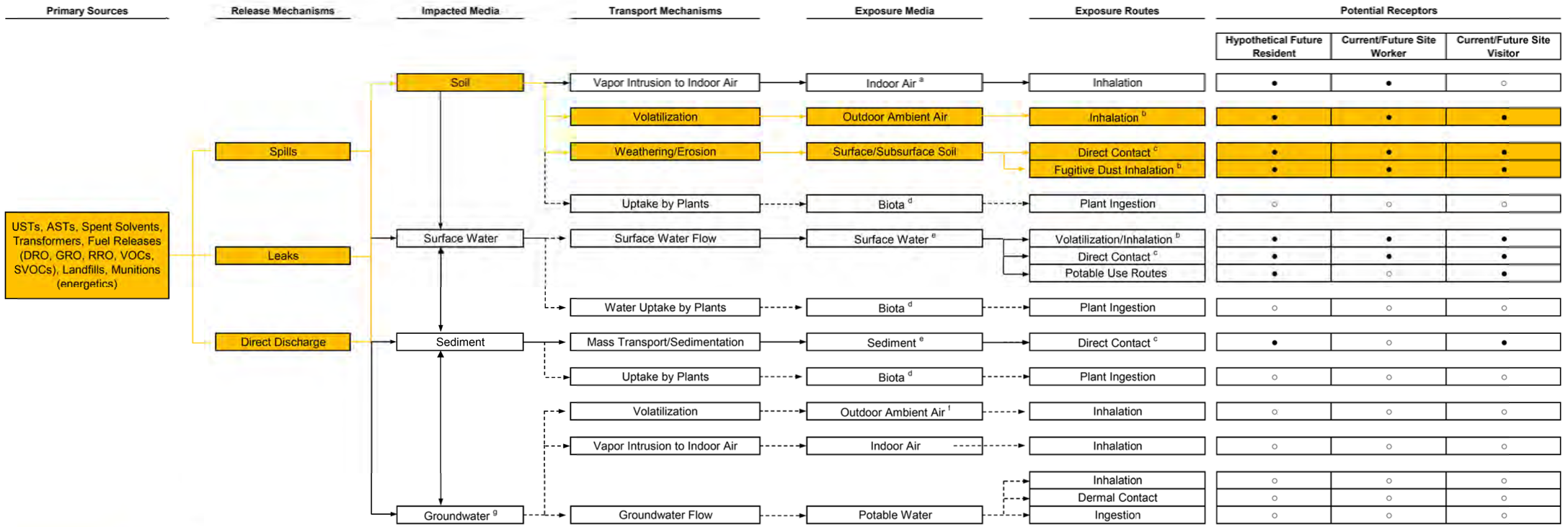
Sources:

ADEC. 2011. Risk Assessment Procedures Manual. ADEC, Division of Spill Prevention and Response. Contaminated Sites Program. November.

USAF. 2012. Nike Site Summit – Remedial Investigation Report – Volume 3 of 3 – human Health and Ecological Risk Assessment Report, Final. May.

USEPA. 2004. Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). USEPA/540/R/99/005.

USEPA. 2011. ProUCL Version 4.1 User Guide (Draft): Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. EPA/600/R-07/041. May.



Notes:

[a] Modeling of indoor air VOC concentrations from soil VOC concentrations is imprecise, and soil data are not suitable for quantitative vapor intrusion assessment (ADEC, 2009c). Therefore, the soil to indoor air pathway was not quantitatively evaluated.

[b] Nike Site Summit is located on the top of a mountain where wind speeds are consistently high, and it is likely that rapid dispersal in ambient air would prevent significant inhalation exposures. However, the inhalation of volatile contaminants and fugitive dust pathways were conservatively included in the risk and hazard calculations for soil.

[c] Direct Contact means exposure through both incidental ingestion and dermal absorption of soil, sediment, or surface water.

[d] There is little vegetation at Upper Site Summit and it is primarily dominated by mosses and lichens.

[e] No surface water or sediment is present at the Upper Site Summit. However, it is possible for contamination derived from the Upper Site Summit to impact surface water and sediment in off-site locations following transport with groundwater. No COPCs were identified in surface water samples collected downgradient of the Upper Site Summit; therefore, surface water and sediment pathways are assumed to be potentially complete but insignificant.

[f] The groundwater to outdoor ambient air pathway is potentially complete, but insignificant compared to exposure to groundwater derived VOCs in indoor air.

[g] Groundwater at the Upper Site Summit is not present in sufficient quantities to supply a potable water well; however, there is potential for contaminated groundwater derived from the Upper Site Summit to impact surface water at off site locations. The groundwater to surface water pathway was evaluated through analysis of downgradient surface water samples (refer to footnote 'e').

ASTs - Aboveground Storage Tanks
DRO - diesel range organics
GRO - gasoline range organics
RRO - residual range organics
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds
USTs - Underground Storage Tanks

NO SCALE

JOINT BASE ELMENDORF-RICHARDSON, ALASKA
NIKE SITE SUMMIT
SS047 RECORD OF DECISION

UPPER SITE SUMMIT - HUMAN HEALTH CONCEPTUAL SITE MODEL

FIGURE
7-1

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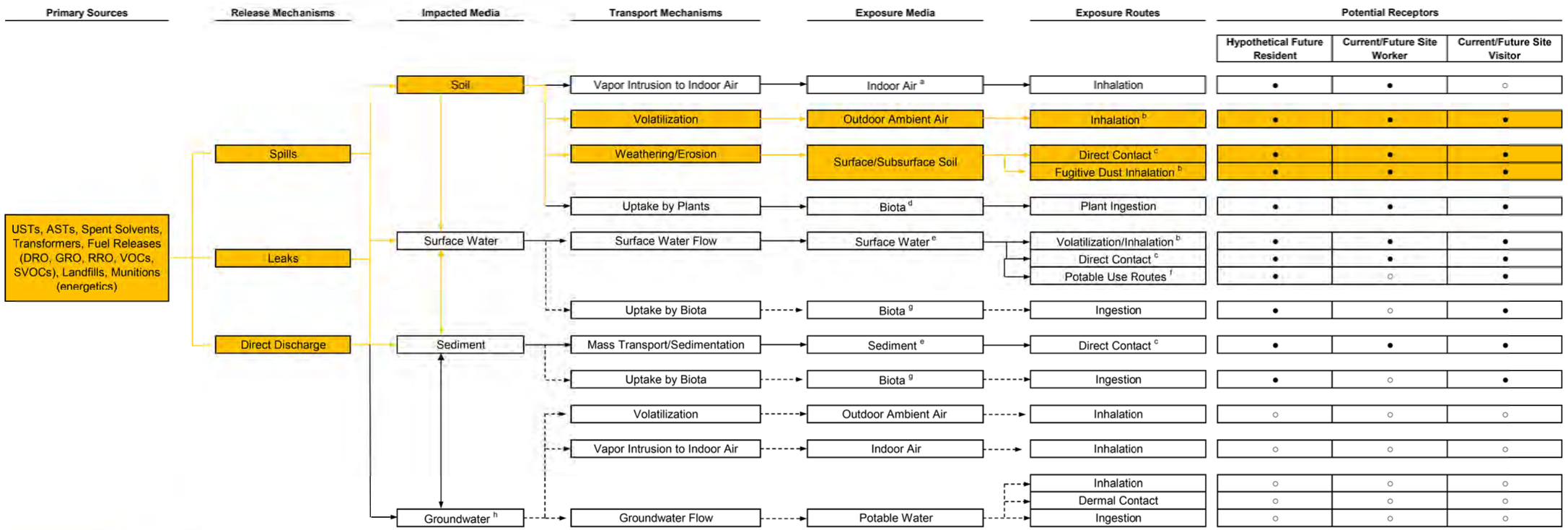

Notes:

[a] Modeling of indoor air VOC concentrations from soil VOC concentrations is imprecise, and soil data are not suitable for quantitative vapor intrusion assessment (ADEC, 2009c). Therefore, the soil to indoor air pathway was not quantitatively evaluated.

[b] Nike Site Summit is located on the top of a mountain where wind speeds are consistently high, and it is likely that rapid dispersal in ambient air would prevent significant exposures. However, the inhalation of volatile contaminants and fugitive dust pathways were conservatively included in the risk and hazard calculations for soil.

[c] Direct Contact means exposure through both incidental ingestion and dermal absorption of soil, sediment, or surface water.

[d] Recreational foraging is frequent at times when berries are growing on the slopes bordering Nike Site Summit, however, berry consumption is assumed to be only a small portion of the diet and this exposure pathway is considered to be complete but insignificant.

[e] Exposures to surface water and sediment is a potentially complete pathway for the pond at Area C and for off-site drainages downgradient of the Nike Site Summit. However, no chemicals detected in samples collected from surface water or sediment at the Area C pond or downgradient drainages were retained for evaluation in the human health risk assessment following screening. Therefore, surface water and sediment exposure pathways are considered to be potentially complete but insignificant.

[f] Potable use routes for surface water in the Area C pond and downgradient off-site drainages include direct consumption by current/future site visitors and hypothetical future residents, and potential pumping of water from the pond at Area C to hypothetical future homes.

[g] No biota were observed in the Area C pond during visual assessments made as part of the 2010 RI. Therefore, consumption of biota from Area C pond is an incomplete pathway. Consumption of biota from downgradient off-site drainages is possible. However, no COPCs were identified in downgradient off-site surface water samples; therefore, biota consumption pathways are assumed to be potentially complete but insignificant.

[h] Groundwater at the Lower Site Summit is present in insufficient yields to serve as a potable water supply; as a result, all groundwater-related exposure pathways at the Lower Site Summit are incomplete.

ASTs - Aboveground Storage Tanks
DRO - diesel range organics
GRO - gasoline range organics
RRO - residual range organics
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds
USTs - Underground Storage Tanks

NO SCALE

JOINT BASE ELMENDORF-RICHARDSON, ALASKA
NIKE SITE SUMMIT

SS047 RECORD OF DECISION

LOWER SITE SUMMIT - HUMAN HEALTH CONCEPTUAL SITE MODEL

FIGURE
7-2

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Soil exposure pathways used in the HHRA consisted of ingestion, dermal contact, and inhalation of dust and VOCs. Standard assumptions associated with these pathways are designed to capture the reasonable maximum exposure scenarios; therefore, uncertainty associated with exposure modeling is expected to lead to over-estimates of risk and hazard.

The media-specific EPCs used to quantify exposures for human health receptors may result in uncertainty in the exposure dose estimates. To address this potential uncertainty, maximum or 95 percent upper confidence limit (95% UCL) on the mean concentrations were generally used to estimate exposure doses, consistent with guidance from the EPA (*Risk Assessment Guidance for Superfund (RAGS). Volume I: Human Health Evaluation Manual (Part A), Interim Final, USEPA/540/1-89/002. December 1989* and *Guidance for Data Usability in Risk Assessment, Part A. USEPA/540/R-92/003. December 1992*) and ADEC (*Risk Assessment Procedures Manual. ADEC, Division of Spill Prevention and Response. Contaminated Sites Program. November 2011*). Where the number of samples or detection frequency was insufficient to calculate 95% UCL on the mean concentration, the maximum detected concentration was used to quantify exposure doses and risk estimates. Based on the above considerations, the exposure doses used in the HHRA for SS047 are believed to represent protective, upper bound estimates of exposure.

To provide a conservative estimate of risk, the HHRA included ingestion, dermal contact, and the direct inhalation of VOCs from ambient air as a complete and significant pathways for soil. The potential human exposure pathway associated with ambient air and soil evaluated in the risk assessment was direct inhalation of soil-derived volatile COPCs in outdoor ambient air by site workers, site visitors, and hypothetical future residents. The HHRA also evaluated potential risks associated with ingestion of or dermal contact with contaminated soil.

Exposure assumptions define the magnitude, frequency, and duration of potentially exposed populations for each of the exposure pathways selected for quantitative evaluation. The information required to quantify exposure includes the daily intake or contact rates of environmental media (e.g., the amount of air inhaled in 8 hours), duration of exposure, and other population characteristics affecting exposure. These exposure factors are combined with the EPCs to calculate a chemical does. In general, EPA default factors were used in the evaluation of the recreational visitors and future residents; EPA's soil screening guidance defaults were used in the evaluation of the site worker exposure.

7.1.3 Toxicity Assessment

The toxicity assessment evaluates the relationship between the dose of a chemical and the occurrence of toxic effects. This section describes the carcinogenic and non-carcinogenic toxicity criteria used to calculate the potential risk for each COC. Carcinogenic toxicity is the tendency of a chemical to cause cancer. Non-carcinogenic toxicity includes all other adverse health effects of a chemical. Toxicity data used in the risk assessment is presented in Table 7-2. When available, separate toxicity criteria are listed for ingestion (oral intake, swallowing), inhalation (breathing into the lungs), and dermal (absorption through the skin) routes of exposure.

For carcinogenic COCs, the toxicity criterion is the slope factor – a number that, when multiplied by the daily dose of the chemical, yields the expected incidence of cancer in a population. The

slope factor is the value used for assessing cancer risks. Slope factors and weight of evidence/cancer guideline descriptions are listed in Table 7-2, along with the source of each slope factor and date of its publication.

For non-carcinogenic chemicals, the toxicity criterion is the reference dose (RfD). The RfD is the value used for evaluating non-cancer effects, and is the maximum daily dose of the chemical that is not expected to cause any adverse effect on human health. These criteria are from the EPA's on-line database, Integrated Risk Information System (IRIS). Where IRIS criteria were not available, other EPA sources of toxicity criteria were used to assess potential risks.

7.1.4 Risk Characterization

This section of the HHRA combines the results of the exposure assessment with the toxicity criteria identified for the COCs and pathways. Carcinogenic risks and non-carcinogenic impacts for each COC are presented for all populations and media of interest, including both current and future land use settings. Cumulative risks, including all COPCs and pathways, for all relevant pathways and populations are also described. The results of the HHRA are interpreted within the context of the CERCLA and State of Alaska acceptable risk range at SS047.

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

$$Risk = CDI \times SF$$

Where:

Risk = a unitless probability (e.g., 2×10^{-5}) of an individual's likelihood of developing cancer

CDI = chronic daily intake averaged over 70 years in milligrams per kilogram per day (mg/kg-day)

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

These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-5}). An excess lifetime cancer risk of 1×10^{-5} indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 100,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes – such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. The EPA's acceptable risk management range for site-related exposure is 1×10^{-4} to 1×10^{-6} (1 in 10,000 to 1 in 1,000,000).

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a RfD derived for a similar exposure period. A RfD represents a daily individual intake that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of site-related daily intake to the RfD is called a hazard quotient (HQ).

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

Where: CDI = chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

An HQ less than or equal to 1 indicates that a receptor's dose of a single contaminant is less than or equal to the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely.

The HI is generated by adding the HQs for all COCs and pathways at a site that affect the same target organ (e.g., liver), or that act through the same mechanism of action within a medium or across all media to which an individual may reasonably be exposed. An HI less than or equal to 1 indicates that adverse effects are unlikely from additive exposure to site chemicals. An HI greater than 1 indicates a potential for a non-cancerous health effect to result from exposure to a contaminant.

The results of the risk characterization indicate that future exposures to contaminants in surface soil at USS and surface soil and subsurface soil at LSS could pose an unacceptable threat of cancer and non-cancer effects. The human health risk estimates for the media and receptors evaluated are presented in **Table 7-3**.

Table 7-3 Cumulative Risk Estimates for Human Receptors at USS and LSS

Medium	Site Workers		Site Visitors		Residential	
	ILCR	HI	ILCR	HI	ILCR	HI
Surface Soil at USS	7E-06	<1	6E-07	<1	**3E-05**	<1
Surface Soil at LSS	**3E-05**	<1	3E-06	<1	**6E-05**	<1
Subsurface Soil at LSS	**2E-04**	<1	**2E-05**	<1	**4E-04**	**>1**

Key:
< – less than
HI – hazard index
ILCR – incremental lifetime cancer risk
LSS – Lower Site Summit
USS – Upper Site Summit
Values in **bold/red** exceed the project acceptable risk criterion of 10^{-5}.

Arsenic contributes to the ILCRs for residential receptors exposed to USS surface soil or LSS subsurface soil. However, this risk is due to naturally-occurring arsenic concentrations in soil. Two samples identified arsenic at concentrations above the 16.5 mg/kg background value. These detections were determined to be attributable to the gravel fill material rather than the result of a discharge or spill. These samples were, therefore, excluded from cleanup requirements. Due to

the measured arsenic concentrations being the result of naturally-occurring material found at SS047, there is no proposed cleanup level for arsenic attributed to natural sources.

The estimated human health risk at USS is from future resident contact with the following contaminants in surface soil:

- Benzo(a)anthracene above the ADEC cleanup level of 2.0 mg/kg.
- Benzo(a)pyrene above the ADEC cleanup level of 0.20 mg/kg.
- Benzo(b)fluoranthene above the ADEC cleanup level of 2.0 mg/kg.
- Lead above the ADEC cleanup level of 400 mg/kg. However, the proposed cleanup level for lead is an ecological risk-based cleanup level (ERBCL) of 204 mg/kg, as it is lower than the ADEC cleanup level.

Chemical- and medium-specific RBCLs were calculated for applicable human and ecological risk drivers identified in the HHERA, in accordance with ADEC Method Four procedures described in 18 AAC 75.340, 18 AAC 75.345, and ADEC's *Cleanup Levels Guidance, June 2008*. Briefly, chemical- and medium-specific RBCLs for the protection of human health were derived by back-calculating concentrations of chemical risk drivers in site media equivalent to a chemical-specific ILCR of 1×10^{-5} or an HQ of 1. Additional details on how RBCLs were calculated are provided in the SFS.

The estimated human health risk at LSS is from site worker, site visitor, or future resident contact with the following contaminants in soil:

<u>Surface Soil</u>

- Pentachlorophenol – An RBCL for this chemical was calculated at 10.7 mg/kg. However, the proposed cleanup level for pentachlorophenol is an ERBCL of 7.67 mg/kg, as it is lower than the human health RBCL.

<u>Subsurface Soil</u>

- 1,2-Dibromo-3-chloropropane – An RBCL for this chemical was calculated at 0.104 mg/kg.
- 1,2,3-Trichloropropane above the ADEC cleanup level of 0.066 mg/kg.
- 1,1,2-Trichloroethane – A RBCL for this chemical was calculated at 0.831 mg/kg.
- Benzo(a)anthracene above the ADEC cleanup level of 2.0 mg/kg.
- Benzo(a)pyrene above the ADEC cleanup level of 0.20 mg/kg.
- Benzo(b)fluoranthene above the ADEC cleanup level of 2.0 mg/kg.
- Dibenz(a,h)anthracene above the ADEC cleanup level of 0.20 mg/kg.
- Indeno(1,2,3-c,d)pyrene above the ADEC cleanup level of 2.0 mg/kg.

There are many uncertainties in assessing risks from chemicals occurring in the environment, as detailed in the original HHERA in the RI Report. Uncertainty reflects limitations in knowledge and simplifying assumptions that must be made in order to quantify health or ecological risks. Risk assessments involve several components, including analysis of toxicity and exposure, each with inherent uncertainty. The major uncertainties include: representing chemical concentrations

in environmental media, quantifying how people or wildlife come in contact with chemicals, interpreting the toxicological significance of the exposure, and predicting how conditions may change in the future. Other uncertainties include the following:

- Contaminant source characterization: The biased nature of sampling known or suspected source areas is expected to result in a protective assessment of potential risks.
- Background data: The incorporation of background data into the HHERA creates uncertainty because no two data sets are exactly equivalent and there is a possibility of error from statistical comparisons among data sets.

The major uncertainties affecting the SFS HHERA, including uncertainties related to COPC or identification, exposure assessment, toxicity characterization, and risk characterization, are detailed in the RI HHERA.

7.2 Summary of Ecological Risk Assessment

An ecological risk assessment (ERA) is the process for evaluating risks to ecological receptors due to hazardous substances, pollutants, or contaminants in the environment. An ERA was conducted at SS047 to determine if plants or animals are exposed to contaminants, and if the exposure could have an adverse ecological effect (e.g., mortality, reproductive failure, etc.). The purpose for conducting the ERA is to: 1) identify and characterize the current and potential threats to the environment from a hazardous substance release; 2) evaluate the ecological impacts of alternative remediation strategies; and 3) establish cleanup levels that will protect the natural resources at risk.

This section summarizes the approaches and findings of an ERA that was performed for SS047 as part of the RI. The ERA estimated site risks to ecological receptors if no remedial actions were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section does not provide a complete description of the ERA conducted for SS047, but focuses on the information that drives the need for the specific remedial action described in this ROD. Details of the ERA for SS047 are provided in the RI HHERA.

An ERA is a qualitative and/or quantitative appraisal of the actual or potential effects of site releases on plants and animals. There are four primary sections in the ERA, as summarized in the ROD: 1) identification of COCs through a risk screening process; 2) ecological exposure assessment; 3) ecological effects assessment; and 4) ecological risk characterization. This information is extensive and is provided in Appendix D of the RI HHERA.

Ecological risk characterization is the summarizing step of the ERA process; it integrates information from the preceding components of the risk assessment and synthesizes an overall conclusion about risk that is complete, informative, and useful for decision makers. The risk assessment process identifies ecological COCs in the various exposure media that represent an ongoing or potential threat to ecological receptors at particular locations.

The ERA identified unacceptable risks associated with chemicals present at SS047; however, the results of the ERA conducted during the RI have changed due to updates to the small mammal

foraging area assumptions resulting from the informal dispute resolution and documented in the SFS. The primary driver of the ERBCL determined in the RI was ingestion of PHC-contaminated soils by the masked shrew or tundra vole. Following review of the specific locations at SS047 where fuel spills have occurred, those detections on gravel pads were eliminated from evaluation in the ERA since this would not be an area in which mammals forage.

7.2.1 Identification of Chemicals of Concern

This section identifies those chemicals associated with unacceptable ecological risk at USS and LSS that are the basis for the proposed remedial actions. Although other chemicals were detected at USS and LSS, these COCs are the primary risk-driving chemicals. The EPCs for chemicals and media of concern for USS and LSS are presented in Section 7.3.

As described in Section 7.1.1, all data are evaluated for inclusion in the risk assessment in accordance with the ADEC and EPA guidance and regulations at the start of the risk assessment process. Ecological chemicals of potential ecological concern (COPEC) screening for soil was based on comparison of maximum concentrations of chemicals detected in surface soils to ecological benchmark criteria, based on the following hierarchy:

1. ADEC's 2009 *Soil Ecological Risk-Based Screening Concentration in Ecoscoping Guidance.*
2. EPA's 2005 Ecological Screening Levels for soil.
3. The lower of Oak Ridge National Laboratories' (ORNL) 1997 soil invertebrate benchmarks or plant benchmarks.
4. The lower of ORNL mammalian or avian dietary wildlife benchmarks, 1996.

Chemicals exceeding the above ecological benchmarks AND background levels established for SS047 (inorganics only) were identified as preliminary COPECs for surface soil. Subsurface soil was not evaluated for ecological receptors, because they are unlikely to come into contact with subsurface soils for any significant length of time. Soil screening benchmarks for the ERA are presented in **Tables 7-4** and **7-5**.

7.2.2 Ecological Exposure Assessment

This section describes the ecological setting on and near SS047 and the types of habitats present, including any ecologically sensitive areas that have been identified. Complete exposure pathways and chemical-specific EPCs for each receptor of interest are also presented in this section.

The ecological exposure analysis begins with development of a site-specific CSM. The CSM is a descriptive and graphical presentation of relationships between chemical contaminants and potentially exposed receptors. The ecological CSM identifies chemical sources, ecological

Table 7-4 Ecological Toxicity Reference Values for Mammalian Indicator Receptors

Chemicals of Potential Ecological Concern	Benchmark Dose (mg/kg-day)	Effect	Benchmark Species	Benchmark Species Body Weight (kg)	Allometric TRV (mg/kg-day)			
					Masked Shrew *(Sorex cinereus)*	**Tundra Vole** *(Microtus oeconomus)*	**Least Weasel** *(Mustela rixosa)*	**Northern Bog Lemming** *(Synaptomys borealis)*
Inorganics								
Arsenic	1.0E+00	Growth	Dog	1.0E+01	7.2E+00	3.9E+00	4.0E+00	NA
Barium	5.2E+01	Reproduction and Growth	rat/mouse	1.5E-01	1.2E+02	6.7E+01	7.0E+01	7.5E+01
Cadmium	7.7E-01	Growth	rat	4.3E-01	2.4E+00	1.3E+00	1.4E+00	NA
Chromium, Hexavalent	9.2E+00	Reproduction and Growth	rat/mouse	8.5E-02	1.9E+01	1.0E+01	1.1E+01	NA
Chromium, Total	2.4E+00	Growth	rat/mouse/pig/cattle	2.0E+00	1.1E+01	6.0E+00	6.2E+00	6.7E+00
Lead	4.7E+00	Growth	Rat	3.0E-01	1.3E+01	7.2E+00	7.6E+00	NA
Mercury	1.0E+00	Reproduction	mink	1.0E+00	3.9E+00	2.1E+00	2.2E+00	NA
Nickel	1.7E+00	Reproduction	Mouse	2.5E-02	2.6E+00	1.4E+00	1.5E+00	NA
Selenium	1.4E-01	Growth	pig	1.8E+01	1.1E+00	6.1E-01	6.4E-01	NA
Silver	6.0E+00	Growth	pig	8.9E+00	4.0E+01	2.2E+01	2.3E+01	NA
Vanadium	4.2E+00	Reproduction and Growth	mouse	4.7E-02	7.5E+00	4.0E+00	4.2E+00	NA
Volatile Organic Compounds (VOCs)								
1,2,4-Trimethylbenzene	2.1E+00	Reproduction	mouse	3.0E-02	3.3E+00	1.8E+00	1.9E+00	NA
1,3,5-Trimethylbenzene	2.1E+00	Reproduction	mouse	3.0E-02	3.3E+00	1.8E+00	1.9E+00	NA
2-Hexanone	5.0E+00	Neurotoxicity	rat	7.1E-01	1.8E+01	9.6E+00	1.0E+01	NA
Carbon Disulfide	1.1E+01	Reproduction	rabbit	1.1E+00	4.4E+01	2.4E+01	2.5E+01	NA
Dibenzofuran	6.6E+01	Growth	rat	2.5E-01	1.8E+02	9.6E+01	1.0E+02	NA
Isopropylbenzene	5.5E+01	Kidney Toxicity	rat	3.5E-01	1.6E+02	8.8E+01	9.2E+01	NA
n-Butylbenzene	4.9E+01	Liver and Kidney Toxicity	rat	3.5E-01	1.4E+02	7.8E+01	8.1E+01	NA
n-Propylbenzene	4.9E+01	Liver and Kidney Toxicity	rat	3.5E-01	1.4E+02	7.8E+01	8.1E+01	NA
p-Isopropyltoluene	2.1E+00	Reproduction	mouse	3.0E-02	3.3E+00	1.8E+00	1.9E+00	NA
trans-1,3-Dichloropropene	5.1E+00	Gastrointestinal	rat	3.5E-01	1.5E+01	8.2E+00	8.5E+00	NA

Table 7-4 (Cont.) Ecological Toxicity Reference Values for Mammalian Indicator Receptors

Chemicals of Potential Ecological Concern	Benchmark Dose (mg/kg-day)	Effect	Benchmark Species	Benchmark Species Body Weight (kg)	Allometric TRV (mg/kg-day)			
					Masked Shrew *(Sorex cinereus)*	**Tundra Vole** *(Microtus oeconomus)*	**Least Weasel** *(Mustela rixosa)*	**Northern Bog Lemming** *(Synaptomys borealis)*
Volatile Organic Compounds (VOCs) – Cont.								
Trichloroethylene (TCE)	7.0E-01	Liver Toxicity	mouse	3.0E-02	1.1E+00	6.1E-01	6.3E-01	NA
Semi-Volatile Organic Compounds (SVOCs)								
Benzoic Acid	4.4E+00	No Adverse Effects	human	7.0E+01	4.9E+01	2.7E+01	2.8E+01	NA
bis(2-ethylhexyl) phthalate	1.8E+01	Reproduction	mouse	3.0E-02	2.9E+01	1.6E+01	1.7E+01	NA
Pentachlorophenol	8.4E+00	Reproduction and Growth	Various	2.9E-01	2.4E+01	1.3E+01	1.3E+01	NA
Polynuclear Aromatic Hydrocarbons (PAHs)								
Anthracene	6.6E+01	NA	rat	2.5E-01	1.8E+02	9.6E+01	1.0E+02	NA
Benzo(a)anthracene	6.2E-01	NA	mouse	3.8E-02	1.0E+00	5.7E-01	5.9E-01	NA
Benzo(a)pyrene	6.2E-01	NA	mouse	3.8E-02	1.0E+00	5.7E-01	5.9E-01	NA
Benzo(b)fluoranthene	6.2E-01	NA	mouse	3.8E-02	1.0E+00	5.7E-01	5.9E-01	NA
Benzo(k)fluoranthene	6.2E-01	NA	mouse	3.8E-02	1.0E+00	5.7E-01	5.9E-01	NA
Chrysene	6.2E-01	NA	mouse	3.8E-02	1.0E+00	5.7E-01	5.9E-01	NA
Dibenz(a,h)anthracene	6.2E-01	NA	mouse	3.8E-02	1.0E+00	5.7E-01	5.9E-01	NA
Indeno(1,2,3-c,d)Pyrene	6.2E-01	NA	mouse	3.8E-02	1.0E+00	5.7E-01	5.9E-01	NA
Naphthalene	6.6E+01	NA	rat	2.5E-01	1.8E+02	9.6E+01	1.0E+02	NA
Phenanthrene	6.6E+01	NA	rat	2.5E-01	1.8E+02	9.6E+01	1.0E+02	NA
Pyrene	6.2E-01	NA	mouse	3.8E-02	1.0E+00	5.7E-01	5.9E-01	NA
Energetics								
Perchlorate	6.4E+00	Neurotoxicity	rabbit	3.8E+00	3.5E+01	1.9E+01	1.9E+01	NA

Key:
kg – kilogram(s)
mg/kg-day – milligrams per kilogram per day (dry weight)
NA – not applicable
TRV – Toxicity Reference Value

Source: *SS047 – Nike Site Summit, Supplemental Feasibility Study, Final, May 2015*.

Table 7-5 Ecological Toxicity Reference Values for Avian Indicator Receptors

Chemicals of Potential Ecological Concern	Benchmark Dose (mg/kg-day)	Effect	Benchmark Species	Benchmark Species Body Weight (kg)	Allometric TRV (mg/kg-day)					
					Dark-eyed Junco *(Junco hyemalis)*	**American Robin** *(Turdus migratorius)*	**Northern Shrike** *(Laninus excubitor)*	**Mallard** *(Anas platyrhynchos)*	**American Dipper** *(Cinclus mexicanus)*	**Common Snipe** *(Gallinago gallinago)*
Inorganics										
Arsenic	2.2E+00	Reproduction, Growth and Mortality	Chicken	1.6E+00	6.4E+00	4.7E+00	4.9E+00	NA	NA	NA
Barium	2.1E+01	Mortality	Chicken	1.2E-01	3.1E+01	2.3E+01	2.4E+01	1.2E+01	2.5E+01	2.1E+01
Cadmium	1.5E+00	Reproduction and Growth	Various	5.8E-01	3.3E+00	2.4E+00	2.5E+00	NA	NA	NA
Chromium, Hexavalent	--	--	--	--	--	--	--	NA	NA	NA
Chromium, Total	2.7E+00	Reproduction and Growth	Chicken, duck, turkey	1.1E+00	6.9E+00	5.1E+00	5.3E+00	2.6E+00	5.6E+00	4.7E+00
Lead	1.6E+00	Reproduction	Chicken	1.8E+00	4.8E+00	3.5E+00	3.7E+00	NA	NA	NA
Mercury	4.5E-01	Reproduction	Japanese Quail	1.5E-01	7.1E-01	5.2E-01	5.5E-01	NA	NA	NA
Nickel	6.7E+00	Reproduction and Growth	Chicken, duck	9.0E-01	1.7E+01	1.2E+01	1.3E+01	NA	NA	NA
Selenium	2.9E-01	Mortality	Chicken	3.3E-01	5.6E-01	4.1E-01	4.3E-01	NA	NA	NA
Silver	2.0E+00	Growth	Turkey	6.6E-01	4.6E+00	3.4E+00	3.6E+00	NA	NA	NA
Vanadium	3.4E-01	Growth	Chicken	1.0E+00	8.8E-01	6.5E-01	6.8E-01	NA	NA	NA
Volatile Organic Compounds (VOCs)										
1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	NA	NA	NA
1,3,5-Trimethylbenzene	--	--	--	--	--	--	--	NA	NA	NA
2-Hexanone	--	--	--	--	--	--	--	NA	NA	NA
Carbon Disulfide	--	--	--	--	--	--	--	NA	NA	NA
Dibenzofuran	1.0E+00	Mortality	Red-Winged Blackbird	5.5E-02	1.3E+00	9.2E-01	9.7E-01	NA	NA	NA
Isopropylbenzene	9.8E-01	Mortality	Red-Winged Blackbird	5.5E-02	1.2E+00	8.9E-01	9.3E-01	NA	NA	NA
n-Butylbenzene	--	--	--	--	--	--	--	NA	NA	NA
n-Propylbenzene	--	--	--	--	--	--	--	NA	NA	NA
p-Isopropyltoluene	3.2E+00	Mortality	Red-Winged Blackbird	5.5E-02	3.9E+00	2.9E+00	3.0E+00	NA	NA	NA

Table 7-5 (Cont.) Ecological Toxicity Reference Values for Avian Indicator Receptors

Chemicals of Potential Ecological Concern	Benchmark Dose (mg/kg-day)	Effect	Benchmark Species	Benchmark Species Body Weight (kg)	Allometric TRV (mg/kg-day)					
					Dark-eyed Junco *(Junco hyemalis)*	**American Robin** *(Turdus migratorius)*	**Northern Shrike** *(Laninus excubitor)*	**Mallard** *(Anas platyrhynchos)*	**American Dipper** *(Cinclus mexicanus)*	**Common Snipe** *(Gallinago gallinago)*
Volatile Organic Compounds (VOCs) – Cont.										
trans-1,3-Dichloropropene	--	--	--	--	--	--	--	NA	NA	NA
Trichloroethylene (TCE)	--	--	--	--	--	--	--	NA	NA	NA
Semi-Volatile Organic Compounds (SVOCs)										
Benzoic Acid	1.0E+00	Mortality	Red-Winged Blackbird	5.5E-02	1.2E+00	9.1E-01	9.5E-01	NA	NA	NA
bis(2-ethylhexyl) phthalate	1.1E+00	Reproductive	Ringed dove	1.6E-01	1.8E+00	1.3E+00	1.4E+00	NA	NA	NA
Pentachlorophenol	6.7E+00	Growth	Chicken	6.6E-01	7.7E+00	5.7E+00	5.9E+00	NA	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)										
Anthracene	1.1E+00	NA	Red-Winged Blackbird	5.5E-02	1.4E+00	1.0E+00	1.1E+00	NA	NA	NA
Benzo(a)anthracene	2.0E+01	NA	Chicken	1.5E+00	5.5E+01	4.1E+01	4.3E+01	NA	NA	NA
Benzo(a)pyrene	2.0E+01	NA	Chicken	1.5E+00	5.5E+01	4.1E+01	4.3E+01	NA	NA	NA
Benzo(b)fluoranthene	2.0E+01	NA	Chicken	1.5E+00	5.5E+01	4.1E+01	4.3E+01	NA	NA	NA
Benzo(k)fluoranthene	2.0E+01	NA	Chicken	1.5E+00	5.5E+01	4.1E+01	4.3E+01	NA	NA	NA
Chrysene	2.0E+01	NA	Chicken	1.5E+00	5.5E+01	4.1E+01	4.3E+01	NA	NA	NA
Dibenz(a,h)anthracene	2.0E+01	NA	Chicken	1.5E+00	5.5E+01	4.1E+01	4.3E+01	NA	NA	NA
Indeno(1,2,3-c,d) Pyrene	--	NA	--	--	--	--	--	NA	NA	NA
Naphthalene	4.2E+01	NA	Mallard Duck	1.0E+00	1.1E+02	7.8E+01	8.1E+01	NA	NA	NA
Phenanthrene	1.1E+00	NA	Red-Winged Blackbird	5.5E-02	1.4E+00	1.0E+00	1.1E+00	NA	NA	NA
Pyrene	1.1E+00	NA	Red-Winged Blackbird	5.5E-02	1.4E+00	1.0E+00	1.1E+00	NA	NA	NA
Energetics										
Perchlorate	1.3E+01	Growth	Bob White Quail	1.7E-01	2.1E+01	1.6E+01	1.6E+01	NA	NA	NA

Key:
-- – not available
kg – kilogram(s)
mg/kg-day – milligrams per kilogram per day (dry weight)
NA – not applicable
TRV – Toxicity Reference Value

Source: *SS047 – Nike Site Summit, Supplemental Feasibility Study, Final, May 2015*.

habitats and receptors, and complete exposure pathways between contaminant sources and ecological resources. SS047 is adjacent to the 495,000-acre Chugach State Park, and a variety of herbivorous, carnivorous, or omnivorous birds and mammals occur at or in the vicinity of SS047 and downgradient off-site drainages. There are no Federal or State designated rare, endangered, or threatened species at SS047.

Ecological species present at SS047 include, but are not limited to: ptarmigan (*Lagopus* sp.), water pipit (*Anthus spinoletta*), golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), Dall sheep (*Ovis dalli*), brown bear (*Ursus arctos*), black bear (*Ursus americanus*), coyote (*Canis latrans*), wolf (*Canis lupus*), shrews (*Sorex* sp.), and voles (*Microtus* sp.). A more detailed appraisal of SS047 ecology is provided in the RI HHERA.

Although SS047 is moderately to highly disturbed, open spaces in and around SS047 consist of tundra and low shrub vegetation. These vegetated areas may provide habitat, breeding areas, or forage for various birds and mammals. Complete exposure pathways exist between terrestrial ecological receptors inhabiting the area and potentially contaminated media, including surface soil. No aquatic receptors are present at SS047; however, there is potential for lower tropic level aquatic receptors to utilize the off-site downgradient drainages.

As depicted in the ecological CSM for SS047 (**Figure 7-3**), exposure pathways between surface soil COPECs and terrestrial birds and mammals are complete for SS047. Potential surface soil exposure pathways for terrestrial receptors include direct contact and inhalation pathways (i.e., incidental surface soil ingestion, dermal contact with surface soil, and inhalation of dust), as well as uptake by biota (i.e., plants and animals) and food chain transfer.

Sources of potential exposure identified in the ecological CSM include ambient air, surface soil, sediment, and surface water (Figure 7-3). The following exposure pathways were quantitatively evaluated in the SFS ERA for SS047: uptake of surface soil COPECs by plants and subsequent food chain transfer to upper trophic level receptors, and incidental ingestion of soil while foraging. Data from soil samples collected from gravel pads within SS047 were eliminated from the ERA, because mammals would not forage in these areas.

7.2.3 Ecological Effects Assessment

The ecological effects assessment describes how toxicity information was used in the characterization of potential ecological effects for indicator receptors. Ecological effects assessments for predictive ERAs require the use of ecological toxicity reference values (TRVs) obtained from the literature. Two types of ecological TRVs were used in the ERA, consistent with the nature of the ecological indicator receptors:

- Media-based TRVs for lower trophic level receptors (e.g., sediment benthic invertebrates).
- Dietary-based TRVs for upper trophic level receptors (i.e., herbivorous, omnivorous, invertivorous, or carnivorous birds and mammals).

The TRVs developed as part of the ecological effects assessment for upper trophic level mammalian and avian receptors are presented in Tables 7-4 and 7-5, respectively. Details of the

methodology used for calculating risk-based screening concentrations for the exposure media are described in RI HHERA.

7.2.4 Ecological Risk Characterization

This section presents a brief summary of the environmental risks identified at SS047, the basis for the risks, how the risks were determined, and COC concentrations that are expected to protect ecological receptors.

Ecological risk characterization integrates results of the exposure dose analysis and the effects assessment. For higher trophic level receptors, estimated exposure doses for each chemical and indicator receptor were compared to ecological TRVs to calculate a chemical-specific HQ.

The equation for calculating the ecological HQ is:

$$HQ = \frac{Dose}{TRV}$$

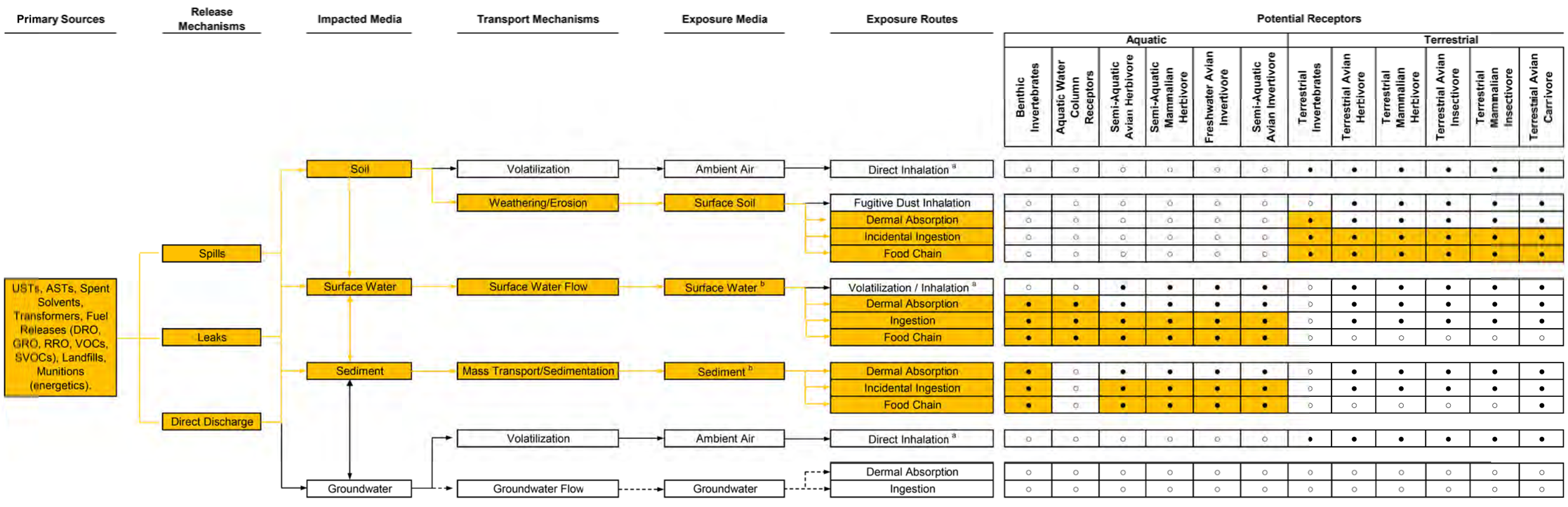
Where: HQ = Hazard quotient (unitless).
Dose = Modeled exposure dose for indicator species (mg/kg-day).
TRV = Toxicity reference value for the indicator species (mg/kg-day).

The HQ value scheme is derived from toxicity testing in an aquatic framework, and a high HQ may not necessarily mean that representative ecological receptors are experiencing adverse health effects. For example, TRVs used in predictive ERAs are typically no observable adverse effect level (NOAEL)-based. Therefore, environmental exposures higher than the TRV may be without adverse effect.

HQ values exceeding 1.0 are generally considered to be indicative of potential biological or ecological effects on representative receptors. HQ values above 1.0 do not necessarily indicate that a biological or ecological effect will occur, only that a lower threshold has been exceeded. Evaluating the significance of HQ values was conducted in a manner generally consistent with Menzie et al. (*Evaluating Ecological Risks and Developing Remedial Objectives at Forested Wetland Systems in New England. In: Application of Ecological Risk Assessment to Hazardous Waste Site Remediation, Water Environment Federation,* Alexandria, VA. Pp. 89-100. 1992):

- HQ less than 1: no adverse effects on representative receptors.
- HQ between 1 and 10: limited potential for adverse effects on representative receptors.
- HQ between 10 and 100: potentially adverse effects on representative receptors.
- HQ exceeds 100: significant potential for adverse effects on representative receptors.

Note that these HQ ranges and anticipated outcomes are only guidelines. Site-specific factors such as spatial distribution and detection frequency of COPECs, uncertainty of assumptions used in exposure determination, and study endpoint used to determine toxicity benchmarks, were considered when reviewing specific HQs.



Notes:

[a] Nike Site Summit is located on the top of a mountain where wind speeds are consistently high and it is not likely that significant exposures to outdoor air will occur due to rapid ambient air dispersal.

[b] Permanent surface water or semi-permanent surface water is present only in the Area C pond and the small drainages flowing in to and out of the pond. The Area C Pond is a small, man-made structure that does not support aquatic water column species and aquatic dependent terrestrial species; however, aquatic and semi-aquatic ecological receptors may utilize the downgradient off-site drainages.

ASTs - Aboveground Storage Tanks
DRO - diesel range organics
GRO - gasoline range organics
RRO - residual range organics
SVOCs - semi-volatile organic compounds
USTs - Underground Storage Tanks
VOCs - volatile organic compounds

NO SCALE	JOINT BASE ELMENDORF-RICHARDSON, ALASKA NIKE SITE SUMMIT SS047 RECORD OF DECISION	SS047 ECOLOGICAL CONCEPTUAL EXPOSURE SITE MODEL	FIGURE 7-3

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In order to evaluate potential cumulative effects of exposure to multiple COPECs, ecological HIs were calculated for COPECs having similar mechanisms of action, or within specific chemical classes. Cumulative HI estimates were calculated as the sum of individual HQ estimates for COPECs with a similar mechanism of action, or from a specific chemical class. Only COPECs with individual HQ estimates greater than or equal to 0.1 were included in the cumulative HI estimate; COPECs with HQs less than 0.1 were deemed not to contribute significantly to the cumulative HI and were excluded from this calculation. Cumulative HI estimates were calculated for the following mechanisms of action (based on the toxicology of COPECs with HQ estimates greater than 0.1): growth/body weight changes, reproductive/developmental effects, and liver/kidney effects. In addition, cumulative HI estimates were calculated for the following chemical classes: PAHs, chlorinated pesticides, and polychlorinated biphenyls (PCBs).

The ADEC risk management level is set at an ecological HI of 1. Consistent with ADEC guidance (*Cleanup Levels Guidance. Division of Spill Prevention and Response. Contaminated Sites Program. June 9*), chemicals and areas associated with ecological HI estimates greater than 1 are retained for further evaluation. Options for further evaluation of areas with ecological HI estimates in excess of 1 may include, but are not limited to, ecological field validation studies, additional investigations of ambient conditions, or remedial options. The ecological hazard estimates for the media and receptors evaluated in the ERA are presented in **Table 7-6**.

Table 7-6 Summary of Ecological Hazard Estimates for COCs at USS and LSS

Risk Driver	EPC[a] Soil (mg/kg)	Ecological Hazard Estimates (HQ)					
		Tundra Vole	Masked Shrew	Least Weasel	American Robin	Dark-eyed Junco	Northern Shrike
Surface Soil at USS							
Cadmium	9.62	0.36	**4.4**	0.066	0.17	0.019	0.048
Lead	386	0.45	**1.7**	0.28	0.35	0.11	0.072
Surface Soil at LSS							
bis(2-ethylhexyl) phthalate	5.44	0.0016	**2.4**	0.00075	**9.9**	0.012	**2.9**
Cadmium	9.62	0.36	**4.4**	0.066	0.17	0.019	0.048
Pentachlorophenol	46.5	**4.2**	**6.1**	0.015	**2.7**	**2.1**	0.68
Risk Criterion:		1					

Key:
% – percent
a – The EPC is the lower of the maximum detected concentration or 95% upper confidence limit on the mean concentration measured in soil samples. For analytes with either fewer than five detects, or, if five or more detects, a detection frequency of less than 20%, the EPC is equal to the maximum detected concentration.
COC – chemical of concern
EPC – exposure point concentration
HQ – hazard quotient
LSS – Lower Site Summit
mg/kg – milligrams per kilogram
USS – Upper Site Summit
Values in **bold/red** exceed the project acceptable HQ of 1.

Chemical- and medium-specific RBCLs were calculated for applicable human and ecological risk drivers identified in the HHERA, in accordance with ADEC Method Four procedures described in 18 AAC 75.340, 18 AAC 75.345, and ADEC's *Cleanup Levels Guidance, June 2008*. Briefly, chemical- and medium-specific RBCLs for the protection of ecological receptors (ERBCLs) were derived by back-calculating concentrations of chemical risk drivers in site media equivalent to a chemical-specific HQ of 1. Additional details on how the ERBCLs were calculated are provided in the SFS.

The estimated ecological risk at USS, calculated based on the Masked Shrew, exceeds the HQ criterion of 1, driven by the following contaminants in surface soil:

- Cadmium – An ERBCL for cadmium was calculated at 1.49 mg/kg.
- Lead – An ERBCL of 204 mg/kg was calculated for lead.

The estimated ecological risk at LSS, calculated based on the American Robin and Masked Shrew, exceeds the HI criterion of 1, driven by concentrations of the following contaminants in surface soil at LSS:

- bis(2-ethylhexyl) phthalate – An ERBCL for this chemical was calculated at 0.549 mg/kg.
- Cadmium – An ERBCL for this chemical was calculated at 1.49 mg/kg.
- Pentachlorophenol – An ERBCL for this chemical was calculated as 7.67 mg/kg.

The results of the risk characterization in the SS047 ERA and follow-on risk assessment presented in the SFS indicate that exposures to contaminants in surface soil at USS and LSS may pose an unacceptable risk to ecological receptors.

There are many uncertainties in assessing ecological risks from chemicals occurring in the environment, including the selection of COPECs and evaluation of exposure pathways. These uncertainties are discussed in Section 7.1.4 and are detailed in the RI HHERA.

7.3 Basis for Action

Based on the results of the HHERA, as summarized above, the response actions selected in this ROD are necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances from USS and LSS into the environment.

PALs for individual analytes were established during the Triad process prior to the RI and were revised through the informal dispute resolution. PALs are based on the ADEC 18 AAC 75 Method Two under-40-inch zone direct contact values (based on the potential exposure pathways). COPCs and COPECs were established during the HHERA and were based on the analytical results, along with the PALs, and the associated risk criteria factors specific to potential routes of exposure. The COPCs and COPECs identified as presenting an unacceptable level of risk to human health or the environment were carried forward as COCs; however, the COC list presented in the RI was updated as part of the SFS to reflect the agreements of the informal dispute resolution. The SFS took the analytes designated as COCs and identified the remedial action objectives (RAOs) to address their presence. The RAOs were then presented in the Revised Proposed Plan (October 2016) for comment and review and then the selected remedy will be agreed upon during the ROD.

Table 7-7 summarizes the CERCLA COCs at USS and LSS. COCs were identified in surface soil at USS and in surface and subsurface soil at LSS. No COCs were identified in groundwater at either USS or LSS, because groundwater is not a viable exposure pathway at these sites. There is no groundwater at USS and groundwater at LSS is classified as EPA Class IIIA groundwater – insufficient yield.

Table 7-7 CERCLA COCs by Media – USS and LSS

COC by Media	Minimum Detection	Maximum Detection	Detection Frequency	Exposure Point Concentration
USS				
Surface Soil (0 to 2 feet bgs) (mg/kg)				
Metals				
Cadmium	0.12	23.9	15 of 15	9.62
Lead	8.85	950	15 of 15	386
Semi-Volatile Organic Compounds				
Benzo(a)anthracene	0.09	8.61	10 of 23	1.78
Benzo(a)pyrene	0.08	5.75	8 of 23	1.37
Benzo(b)fluoranthene	0.21	10.6	8 of 23	2.37
LSS				
Surface Soil (0 to 2 feet bgs) (mg/kg)				
Metals				
Cadmium	0.08	15.6	34 of 34	2.82
Semi-Volatile Organic Compounds				
Benzo(a)pyrene	0.08	2.83	12 of 37	7.74
Benzo(b)fluoranthene	0.13	6.15	11 of 37	8.66
bis(2-ethylhexyl) phthalate	0.13	5.44	3 of 37	5.44
Pentachlorophenol	0.64	46.5	1 of 37	46.5
Subsurface Soil (greater than 2 feet bgs) (mg/kg)				
Volatile Organic Compounds (mg/kg)				
1,1,2-Trichloroethane	0.003	1.65	1 of 36	1.65
1,2,3-Trichloropropane	0.003	0.491	1 of 36	0.491
1,2-Dibromo-3-chloropropane	0.012	3.04	1 of 36	3.04
Semi-Volatile Organic Compounds				
Benzo(a)anthracene	0.091	37	2 of 36	37
Benzo(a)pyrene	0.079	35.7	2 of 36	35.7
Benzo(b)fluoranthene	0.124	40.1	2 of 36	40.1
Dibenz(a,h)anthracene	0.079	6.12	2 of 36	6.12
Indeno(1,2,3-c,d)pyrene	0.192	16.1	2 of 36	16.1

Table 7-7 (Cont.) CERCLA COCs by Media – USS and LSS

Key:
bgs – below ground surface
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COC – chemical of concern
LSS – Lower Site Summit
mg/kg – milligrams per kilogram
USS – Upper Site Summit

8.0 REMEDIAL ACTION OBJECTIVES

RAOs provide a general description of what the cleanup will accomplish. These goals typically serve as the design basis for the remedial alternatives that will be presented in the next section.

The RAOs for USS are as follows:

- Prevent future resident direct contact (ingestion or dermal absorption) with surface soil that has contaminant concentrations exceeding cleanup levels. The following contaminants exceed these levels in surface soil at USS:
  - Benzo(a)anthracene exceeding 2.0 mg/kg
  - Benzo(a)pyrene exceeding 0.20 mg/kg.
  - Benzo(b)fluoranthene exceeding 2.0 mg/kg.
  - Lead exceeding 204 mg/kg.
- Prevent exposure of ecological receptors (Masked Shrew) to USS surface soil that has contaminant concentrations exceeding cleanup levels. The following contaminants exceeds these levels in USS surface soil:
  - Cadmium exceeding 1.49 mg/kg.
  - Lead exceeding 204 mg/kg.

The RAOs for LSS are:

- Prevent site worker, site visitor, or future resident direct contact with surface and subsurface soil that has contaminant concentrations exceeding cleanup levels. The following CERCLA COCs exceed their cleanup levels and contribute to LSS human health risks:

  Surface soil:
  - Benzo(a)pyrene exceeding 0.20 mg/kg.
  - Benzo(b)fluoranthene exceeding 2.0 mg/kg.
  - Pentachlorophenol exceeding 7.67 mg/kg.

  Subsurface soil:
  - 1,1,2-Trichloroethane exceeding 0.831 mg/kg.
  - 1,2,3-Trichloropropane exceeding 0.066 mg/kg.
  - 1,2-dibromo-3-chloropropane exceeding 0.104 mg/kg.
  - Benzo(a)anthracene exceeding 2.0 mg/kg.
  - Benzo(a)pyrene exceeding 0.20 mg/kg.
  - Benzo(b)fluoranthene exceeding 2.0 mg/kg.
  - Dibenz(a,h)anthracene exceeding 0.20 mg/kg.
  - Indeno(1,2,3-c,d)pyrene exceeding 2.0 mg/kg.
- Prevent exposure of ecological receptors (Masked Shrew and American Robin) to LSS surface soil with contaminant concentrations exceeding cleanup levels. The following

CERCLA COCs exceed their cleanup levels and contribute to LSS ecological receptor health risks are:

Surface soil:

- bis(2-ethylhexyl) phthalate exceeding 0.549 mg/kg.
- Cadmium exceeding 1.49 mg/kg.
- Pentachlorophenol exceeding 7.67 mg/kg.

These RAOs were developed based on the current and reasonably anticipated land use. The land use at SS047 is designated currently and in the future in the Base Master Plan as training use only; however, the RAOs are based on UU/UE, including residential use. These RAOs address the risks identified in the risk assessment by applying limited actions that will reduce human and ecological exposure to contamination and prevent activities that may result in increased exposure or spread the extent of contamination.

Table 8-1 summarizes the CERCLA COCs at USS and LSS and provides the cleanup level and basis for the cleanup level for each COC. COCs were identified in surface soil at USS and in surface and subsurface soil at LSS.

Table 8-1 CERCLA COC Cleanup Levels – USS and LSS

COC by Media	Maximum Detection	Cleanup Level	Basis for Cleanup Level
USS			
Surface Soil (0 to 2 feet bgs) (mg/kg)			
Metals			
Cadmium	23.9	1.49	ERBCL
Lead	950	204	ERBCL
Semi-Volatile Organic Compounds (mg/kg)			
Benzo(a)anthracene	8.61	2.0	ADEC
Benzo(a)pyrene	5.75	0.20	ADEC
Benzo(b)fluoranthene	10.6	2.0	ADEC
LSS			
Surface Soil (0 to 2 feet bgs) (mg/kg)			
Metals			
Cadmium	15.6	1.49	ERBCL
Semi-Volatile Organic Compounds (mg/kg)			
Benzo(a)pyrene	2.83	0.20	ADEC
Benzo(b)fluoranthene	6.15	2.0	ADEC
bis(2-ethylhexyl) phthalate	5.44	0.549	ERBCL
Pentachlorophenol	46.5	7.67	ERBCL

Table 8-1 (Cont.) CERCLA COC Cleanup Levels – USS and LSS

COC by Media	Maximum Detection	Cleanup Level	Basis for Cleanup Level
Subsurface Soil (greater than 2 feet bgs) (mg/kg)			
Volatile Organic Compounds (mg/kg)			
1,1,2-Trichloroethane	1.65	0.831	RBCL
1,2,3-Trichloropropane	0.491	0.066	ADEC
1,2-Dibromo-3-chloropropane	3.04	0.104	RBCL
Semi-Volatile Organic Compounds			
Benzo(a)anthracene	37	2.0	ADEC
Benzo(a)pyrene	35.7	0.20	ADEC
Benzo(b)fluoranthene	40.1	2.0	ADEC
Dibenz(a,h)anthracene	6.12	0.20	ADEC
Indeno(1,2,3-c,d)pyrene	16.1	2.0	ADEC

Key:
ADEC – Alaska Department of Environmental Conservation, 18 Alaska Administrative Code 75.341, Table B1 Method Two, Human Health, Under 40-inch Zone (March 23, 2017)
bgs – below ground surface
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COC – chemical of concern
ERBCL – Ecological risk-based cleanup level (calculated in the RI HHERA)
HHERA – Human Health and Ecological Risk Assessment
LSS – Lower Site Summit
mg/kg – milligrams per kilogram
RBCL – Risk-based cleanup level (calculated in the RI HHERA)
RI – Remedial Investigation
USS – Upper Site Summit

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9.0 DESCRIPTION OF ALTERNATIVES

A remedial action (cleanup) strategy has been developed to address the contaminants associated with the COCs at SS047. The strategy places a priority on excavating contaminated surface soils that exceed cleanup levels for metals and SVOCs at SS047. The strategy places a priority on excavation of metals and SVOCs from the surface soils first for the following reasons:

- Metals and SVOCs pose a higher ecological risk to burrowing animals in the surface soils when compared to subsurface soils.
- Metals and SVOCs pose a higher risk to human health and the environment when compared to PHCs.
- Metals, VOCs, and SVOCs pose a lower risk to human health and the environment in subsurface soils when compared to surface soils.

Contaminated subsurface soil has been documented at one Action Area at SS047 (LSS-Q, Figure 5-3) and the selected remedy includes its removal via excavation. Although the priority is on the removal of surface soil, the contaminated subsurface soil is co-located with contaminated surface soil and, therefore, will be addressed at the same time as the surface soil removal at that Action Area. This response action is anticipated to lower concentrations of metals and SVOCs in the soil at SS047 to below chemical-specific ARARs.

Remedial alternatives for USS and LSS were evaluated in the SFS. The following sections describes the alternatives evaluated for USS and LSS.

9.1 Remedial Alternatives for USS

The remedial alternatives considered for surface soil at USS were evaluated in the SFS, as summarized in **Table 9-1**.

After screening of the technologies and process options, the following remedial alternatives for USS were eliminated from further analysis for reasons detailed in the SFS:

- Soil cover – moderate effectiveness; difficult implementability; and high cost.
- RCRA cap – moderate effectiveness; difficult implementability; and high cost.
- Natural attenuation – low effectiveness; easy implementability; and low cost.
- Soil vapor extraction – low effectiveness; moderate implementability; and high cost.
- Chemical oxidation – high effectiveness; difficult implementability; and moderate cost.
- Thermal desorption – high effectiveness; moderate implementability; and moderate cost.
- Bioremediation – high effectiveness; difficult implementability; and high cost.

The results of the technologies and process options screening identified three response actions to be retained for evaluation as part of the USS remedial alternatives. However, LUCs were subsequently eliminated because they would not prevent potential exposures of ecological receptors to impacted surface soil at USS.

Table 9-1 Summary of Remedial Alternatives Evaluated for USS

Remedial Alternative	USS
No Action	**X**
Land Use Controls	o
Containment	
– Soil Cover	o
– Resource Conservation Recovery Act Cap	o
In-Situ Treatment – Soil	
– Natural Attenuation	o
– Soil Vapor Extraction	o
– Chemical Oxidation	o
Ex-Situ Treatment – Soil	
– Thermal Desorption	o
– Bioremediation	o
– Excavation and off-site disposal	**X**

Key:
X – Detailed analysis has been carried out for this option.
o – Not considered suitable for this application.
USS – Upper Site Summit

The two response actions presented in the Revised Proposed Plan for USS are as follows:

- **No Action.** This response action consists of leaving the impacted soil in its current condition, with no further investigation or remedial action. Evaluation of this response action is required by the NCP.
- **Excavation and Off-Site Disposal.** For soil, excavation refers to removing contaminated soil, backfilling with clean material, and disposal of the excavated soil at a permitted disposal facility. All CERCLA-excavated waste will be required to be transported to an EPA-approved disposal facility in the Lower 48, because there are none in the State of Alaska. Excavation and disposal will be achieved in a single construction season.

9.1.1 Description of Remedy Components for USS

The following remedial alternatives were evaluated for USS:

- **Alternative USS-1: No Action**. The No Action alternative serves as a baseline against which other alternatives are compared, as required by the NCP. Under this alternative, no remedial actions would be taken, monitoring would not be conducted, and LUCs would not be implemented to prevent exposures. No cost is associated with this alternative. Abandonment of existing USS groundwater monitoring wells would need to be considered if no remedial actions are taken, although this is not assumed in the Alternative USS-1 cost estimate.

- **Alternative USS-2: Surface Soil Excavation with Off-site Disposal**. Alternative USS-2 includes excavation of impacted surface soil (0 to 2 feet bgs) from locations exceeding cleanup levels in surface soil samples. There is no subsurface contamination at USS. This alternative would directly address contaminated surface soil at Action Areas USS-F and USS-K and would meet the key ARARs identified in Section 10.2. This alternative is reliable in the long-term, because the contaminated surface soil would be removed and remedial excavations have little potential for failure. The estimated timeframe for design and construction is 1 year.

  Approximately 44 cubic yards of soil would be removed from the two Action Areas. The soil would be excavated and transported off-site to an EPA-approved disposal facility in the Lower 48. The estimated time to reach the remediation goals is 1 year. Excavation backfill material would be obtained from an approved borrow source located on JBER. Material from the JBER borrow pit is used broadly at JBER and has been an acceptable source for previous environmental restoration projects where clean backfill is required. Following excavation, disposal, and backfilling, no further contamination would remain on-site above cleanup levels and annual operations and maintenance (O&M) would not be required. The estimated cost for this alternative is $147,000 over a 2-year period. Five-Year Reviews would not need to be conducted.

9.1.2 Expected Outcome of Each Alternative for USS

Alternative USS-1: No Action. There are no site changes at USS expected from selecting this alternative.

Alternative USS-2: Surface Soil Excavation with Off-site Disposal. All CERCLA contamination associated with USS surface soil would be removed by excavation, thus eliminating potential impacts to human health and ecological receptors. After implementation of this alternative, USS would meet the criteria for UU/UE.

9.2 Remedial Alternatives for LSS

The remedial alternatives considered for LSS were evaluated in the SFS, as summarized in **Table 9-2**.

Following screening of the technologies and process options, the following remedial alternatives for LSS were eliminated from further analysis for reasons detailed in the SFS:

- Soil cover – moderate effectiveness; difficult implementability; and high cost.
- RCRA cap – moderate effectiveness; difficult implementability; and high cost.
- Natural attenuation – low effectiveness; easy implementability; and low cost.
- Soil vapor extraction – low effectiveness; moderate implementability; and high cost.
- Chemical oxidation – high effectiveness; difficult implementability; and moderate cost.
- Thermal desorption – high effectiveness; moderate implementability; and moderate cost.
- Bioremediation – high effectiveness; difficult implementability; and high cost.

Table 9-2 Summary of Remedial Alternatives Evaluated for LSS

Remedial Alternative	LSS
No Action	**X**
Land Use Controls	**X**
Containment	
– Soil Cover	o
– Resource Conservation Recovery Act Cap	o
In-Situ Treatment – Soil	
– Natural Attenuation	o
– Soil Vapor Extraction	o
– Chemical Oxidation	o
Ex-Situ Treatment – Soil	
– Thermal Desorption	o
– Bioremediation	o
– Excavation and off-site disposal	**X**

Key:
X – Detailed analysis has been carried out for this option.
o – Not considered suitable for this application.
LSS – Lower Site Summit

The results of the technologies and process options screening identified three response actions to be retained for evaluation as part of the LSS remedial alternatives. The following response actions were presented in the Revised Proposed Plan:

- **No Action.** This response action consists of leaving the impacted soil in its current condition, with no further investigation or remedial action. Evaluation of this response action is required by the NCP.
- **Land Use Controls.** A LUC is any type of physical, legal, proprietary or administrative mechanism that restricts the use of, or limits access to, real property to prevent or reduce risks to human health and the environment. Physical mechanisms (i.e., engineering controls) encompass a variety of engineered remedies to contain or reduce contamination and physical barriers to limit access to property, such as landfill caps, fences, or signs. The legal, proprietary, or administrative mechanisms used for LUCs are generally the same as those used for institutional controls (ICs), as discussed in the NCP. Examples of ICs include: deed notices; IC registries, property easements, and covenants; installation administrative controls, such as construction and work request review and approval processes; and administrative orders and cleanup agreements.
- **Excavation and Off-Site Disposal.** For soil, excavation refers to removing contaminated soil, backfilling with clean material, and disposal of the excavated soil at a permitted disposal facility. All CERCLA-excavated waste will be required to be transported to an EPA-approved disposal facility in the Lower 48, because there are none in the State of Alaska. Excavation and disposal will be achieved in a single construction season.

9.2.1 Description of Remedy Components for LSS

The following remedial alternatives were evaluated for LSS:

- **Alternative LSS-1: No Action.** The No Action alternative serves as a baseline against which other alternatives are compared, as required by the NCP. Under this alternative, no remedial actions would be taken, no monitoring would be conducted, and LUCs would not be implemented to prevent exposures. Although natural attenuation may occur, contaminant reductions would not be verified with monitoring. No costs are associated with this alternative. Abandonment of existing LSS groundwater monitoring wells would need to be considered if no remedial actions are taken, although this is not assumed in the Alternative LSS-1 cost estimate.
- **Alternative LSS-2: Surface and Subsurface Soil Excavation with Off-Site Disposal.** Alternative LSS-2 would excavate all surface and subsurface soil with contamination exceeding cleanup levels. Excavations would be completed to bedrock, or to the depth at which the deepest soil contamination has been detected. This alternative would rapidly remove contaminated soil from Action Areas LSS-B, LSS-H, LLS-Q, and LLS-U and would meet the key ARARs identified in Section 10.2. This alternative is reliable in the long-term because all contaminated soil would be removed and remedial excavations have little potential for failure. The estimated timeframe for design and construction is 1 year.

  An estimated total of about 263 cubic yards of impacted soil would be excavated from the four action areas. The estimated soil excavation volume for this alternative is based on available analytical data and is, therefore, uncertain. Due to the uncertainties in the lateral and vertical extents of LSS soil contamination, the actual volume of soil that must be removed from LSS under this alternative is also uncertain. The actual volume of soil that must be excavated to meet soil cleanup levels could potentially be substantially greater than the volume estimate provided above. Before soil is excavated, the lateral and vertical extents of soil contamination would be better delineated with a sampling program. During implementation, confirmation samples would be taken to verify removal of all soil with concentrations exceeding cleanup levels.

  Excavated soil would be transported off-site to an EPA-approved landfill. The estimated time to reach the remediation goals is 1 year. Following excavation, disposal, and backfilling, no further surface or subsurface soil contamination would remain on-site above cleanup levels and annual O&M would not be required. The estimated cost for this alternative is $371,000 over a 2-year period. Five-Year Reviews would not need to be conducted.
- **Alternative LSS-3: Surface Soil Excavation with Off-site Disposal and LUCs.** Alternative LSS-3 incorporates many components of Alternative LSS-2, except for subsurface soil excavation. At Action Area LSS-Q, only the surface soil (0 to 2 feet bgs) would be excavated, with clean fill being used to cover the remaining contaminated subsurface soil. This alternative would implement LUCs to restrict exposure to any remaining contaminated soils and would meet the key ARARs identified in Section 10.2. This alternative is reliable in the long-term because all contaminated surface soil would be removed and remedial excavations have little potential for failure. The estimated timeframe for design and construction is 1 year.

Surface soil with contamination exceeding cleanup levels would be excavated and disposed of off-site. Approximately 163 cubic yards of impacted surface soil would be excavated and transported off-site for disposal. Contaminated subsurface soil would remain in place at LSS-Q under this alternative, and LUCs would restrict excavation and removal of subsurface soils to prevent human exposure to contamination and to prevent contaminated soils from being placed in sensitive environmental locations where ecological damage may occur. Subsurface soil contamination is expected to breakdown naturally over time. Based on available site-specific information, there is no estimate of time for these contaminants to achieve cleanup levels. For the purposes of cost estimation, a 30-year time frame is being used to reach cleanup levels.

The estimated soil excavation volume for this alternative is based on available analytical data and is, therefore, uncertain. Due to the uncertainties in the lateral and vertical extents of LSS soil contamination, the actual volume of soil that must be removed from LSS under this alternative is also uncertain. The actual volume of soil that must be excavated to meet soil cleanup levels could potentially be substantially greater than the volume estimate provided above. Before soil is excavated, the lateral and vertical extents of soil contamination would be better delineated with a sampling program. During implementation, confirmation samples would be taken to verify removal of all soil with concentrations exceeding cleanup levels.

Excavated soil would be transported off-site to an EPA-approved landfill. Following excavation, disposal, and backfilling, no further surface soil contamination would remain on-site above cleanup levels. Because subsurface soil contamination would remain on-site above cleanup levels, Five-Year Reviews would need to be conducted. In addition, O&M would be required to maintain the integrity of the soil cover. The estimated capital cost for this alternative is $321,000, with costs ranging from $451,000 to $518,000 over the 30-year period estimated to reach cleanup levels.

9.2.2 Expected Outcome of Each Alternative for LSS

Alternative LSS-1: No Action. There are no site changes expected at LSS from selecting this alternative.

Alternative LSS-2: Surface and Subsurface Soil Excavation with Off-Site Disposal. All CERCLA contamination associated with LSS soil would be removed by excavation, thus eliminating potential impacts to human health and ecological receptors. After implementation of this alternative, LSS would meet the criteria for UU/UE.

Alternative LSS-3: Surface Soil Excavation with Offsite Disposal and LUCs. All CERCLA contamination associated with LSS surface soil would be removed by excavation. Subsurface soil would remain in place at Action Area LSS-Q under this alternative and would be addressed by natural attenuation. Based on available site-specific information, the time required for natural attenuation to achieve cleanup levels for subsurface soil at LSS cannot be estimated. However, for the purposes of cost estimation, a 30-year year time frame is being used.
To prevent potential future human exposures to subsurface soil that would remain on site at LSS, JBER would implement and maintain LUCs to prevent human access and exposure to this

contamination. Such controls would include the site access restrictions that are already in place and a dig permit process for any intrusive work in areas of LSS with subsurface contamination. Five-Year Reviews would need to be conducted, because contaminants would remain on site above levels that allow for unrestricted land use.

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10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

In accordance with the NCP, the alternatives for SS047 were evaluated using the nine criteria described in Section 121(a) & (b) of CERCLA and 40 CFR 300.430(e)(9)(i), as cited in NCP Section 300.430(f)(5)(i). These criteria are classified as threshold criteria, balancing criteria, and modifying criteria. In the final balancing of trade-offs among alternatives upon which the final remedy selection is based, modifying criteria are of equal importance to the balancing criteria.

Threshold criteria are standards that an alternative must meet to be eligible for selection as a remedial action. There is little flexibility in meeting the threshold criteria – the alternative must meet them or it is unacceptable. The following are classified as threshold criteria:

- Overall protection of human health and the environment.
- Compliance with or an applicable waiver of ARARs.

Balancing criteria weigh the tradeoffs among alternatives. These criteria represent the standards upon which the detailed evaluation and comparative analysis of alternatives are based. In general, a high rating on one criterion can offset a low rating on another balancing criterion. The following five of the nine criteria are considered balancing criteria:

- Long-term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, and Volume (TMV) Through Treatment
- Short-term Effectiveness
- Implementability
- Cost

Modifying criteria may be considered to the extent that information is available during the FS or SFS. However, the following modifying criteria can be fully considered only after public and regulator comments are received:

- Community Acceptance
- State/Support Agency Acceptance

For the two threshold criteria (protection of human health and the environment and compliance with ARARs), the alternatives are rated either pass or fail. The evaluation of the alternatives based on four of the balancing criteria (long-term effectiveness and permanence, reduction of TMV through treatment, short-term effectiveness, and implementability) results in a rating of high, medium, or low, depending on the degree to which the remedy satisfies the criterion. Costs are evaluated based on estimated capital costs and annual O&M costs.

In accordance with the NCP, the alternatives for USS and LSS were evaluated using the nine criteria described above. **Tables 10-1** and **10-2** compare the cleanup alternatives at USS and LSS, respectively, using the threshold and balancing evaluation criteria described in CERCLA.

Table 10-1 Remedial Alternative Comparison – Upper Site Summit

Evaluation Criteria	Alternative USS-1	Alternative USS-2
	No Action	Excavation and off-site disposal of surface soil
Estimated Volume (cubic yards)	NA	44
Evaluation Criteria		
Overall Protection of Human Health and the Environment	Fail	Pass
Compliance with ARARs	Fail	Pass
Long-Term Effectiveness and Permanence	Low	High
Reduction of TMV through Treatment	Low	Low
Short-Term Effectiveness	Medium	High
Implementability	High	High
Estimated Costs		
Capital Costs	$0	$147,000
NPV at 2.0%	$0	$147,000
NPV at 5%	$0	$147,000
Estimated Construction Timeframe	0 years	1 year
Estimated Time to Achieve Remedial Action Objectives	NA	1 year

Key:
% – percent
ARARs – applicable or relevant and appropriate requirements
NA – not applicable
NPV – net present value; *Guidelines for Preparing Economic Analyses*, co-authored by National Center for Environmental Economics Office of Policy, and U.S. Environmental Protection Agency, updated May 2014.
TMV – toxicity, mobility, and volume
USS – Upper Site Summit

Scoring:
Pass = meets threshold criterion
Fail = does not meet threshold criterion
High, Medium, and Low indicate the degree to which the alternative satisfies the criterion.

Table 10-2 Remedial Alternative Comparison – Lower Site Summit

Evaluation Criteria	Alternative LSS-1	Alternative LSS-2	Alternative LSS-3
	No Action	Surface and subsurface soil excavation with off-site disposal	Surface soil excavation with off-site disposal and LUCs
Estimated Volume (cubic yards)	NA	263	163
Evaluation Criteria			
Overall Protection of Human Health and the Environment	Fail	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass
Long-Term Effectiveness and Permanence	Low	High	Medium
Reduction of TMV through Treatment	Low	Low	Low
Short-Term Effectiveness	Medium	High	High
Implementability	High	High	Medium
Estimated Costs			
Capital Costs	$0	$371,000	$321,000
NPV at 2.0%	$0	$371,000	$518,000
NPV at 5%	$0	$371,000	$451,000
Estimated Construction Timeframe	0 years	1 year	1 year
Estimated Time to Achieve Remedial Action Objectives	NA	1 year	30 years

Key:
% – percent
ARAR – applicable or relevant and appropriate requirement
LSS – Lower Site Summit
LUCs – land use controls
NA – not applicable
NPV – net present value; *Guidelines for Preparing Economic Analyses*, co-authored by National Center for Environmental Economics Office of Policy, and U.S. Environmental Protection Agency, updated May 2014.
TMV – toxicity, mobility, and volume

Scoring:
Pass – meets threshold criterion
Fail – does not meet threshold criterion
High, Medium, and Low indicate the degree to which the alternative satisfies the criterion.

The following subsections detail how well each alternative satisfies each evaluation criterion and indicates how each alternative compares to the others under consideration for USS and LSS.

10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is the first threshold criterion, and alternatives are rated as follows (Tables 10-1 and 10-2):

- **Alternative USS-1 (No Action):** This alternative would not be protective of human health and the environment and would not mitigate any risks posed by surface soil to ecological receptors. Therefore, the No Action alternative **fails** this criterion.
- **Alternative USS-2 (Excavation and Off-site Disposal of Surface Soil):** This alternative would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through removal. Excavation would eliminate soil COCs above cleanup levels. Alternative USS-2 **passes** this criterion.
- **Alternative LSS-1 (No Action)**: This alternative would not be protective of human health and the environment and would not mitigate any risks to human and ecological receptors. Therefore, the No Action alternative **fails** this criterion.
- **Alternatives LSS-2 (Surface and Subsurface Soil Excavation with Off-Site Disposal) and LSS-3 (Surface Soil Excavation with Off-Site Disposal and LUCs):** Alternatives LSS-2 and LSS-3 provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through removal and/or LUCs. For all both of these alternatives, surface soil COCs above cleanup levels would be eliminated by excavation. Alternative LSS-3 would utilize LUCs to prevent exposures to subsurface soil. Therefore, Alternatives LSS-2 and LSS-3 **pass** this criterion.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and NCP Section 300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites must attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations that are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA Section 121(d)(4). Criteria to be considered (TBC) are non-promulgated advisories or guidance issued by Federal or State government that are not legally binding and do not have the status of potential ARARs. However, in many circumstances, TBCs are considered along with ARARs.

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. State standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site (relevant) that

their use is well-suited (appropriate) to the particular site. State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

ARARs fall into three categories: chemical-specific, location-specific, and action-specific. *Chemical-specific* ARARs are health-based or risk-management-based numbers that provide concentration limits for the occurrence of a chemical in the environment at agreed-upon points of compliance. *Location-specific* ARARs restrict activities in certain sensitive environments. *Action-specific* ARARs are activity-based or technology-based, and typically control remedial activities that generate hazardous wastes (such as with those covered under RCRA). Offsite shipment, treatment, and disposal of excavated contaminated soil invoke action-specific ARARs.

Table 10-3 summarizes the ARARs for the selected remedy at SS047, as defined in the SFS, and describes how the selected remedy addresses each one at agreed-upon points of compliance.

Compliance with ARARs addresses whether an alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified. Compliance with ARARs is the second threshold criterion, and alternatives are rated as follows (Tables 10-1 and 10-2):

- **Alternative USS-1 (No Action):** This alternative does not address the chemical-specific ARAR 18 AAC 75.340-341, Table B-1, which establishes cleanup goals for soil. Therefore, the No Action alternative **fails** this criterion.
- **Alternative USS-2 (Excavation and Off-site Disposal of Surface Soil):** This alternative prevents unacceptable human and ecological exposures to surface soil by complete excavation of soil exceeding cleanup levels. Alternative USS-2 would be implemented to comply with all action-, chemical-, and location-specific ARARs. Therefore, Alternative USS-2 **passes** this criterion.
- **Alternative LSS-1 (No Action)**: This alternative does not address the chemical-specific ARAR 18 AAC 75.340-341, Table B-1, which establishes cleanup goals for soil. Therefore, the No Action alternative **fails** this criterion.
- **Alternative LSS-2 (Surface and Subsurface Soil Excavation with Off-Site Disposal):** This alternative prevents unacceptable human and ecological exposures to soil COCs by complete excavation of soil exceeding cleanup levels. Alternative LSS-2 would be implemented to comply with all action-, chemical-, and location-specific ARARs. Therefore, Alternative LSS-2 **passes** this criterion.
- **Alternative LSS-3 (Surface Soil Excavation with Off-Site Disposal and LUCs):** This alternative prevents unacceptable human and ecological exposures to surface soil COCs by excavation of surface soil exceeding cleanup levels. Exposures to subsurface soil contamination would be managed through LUCs. Alternative LSS-3 would be implemented to comply with all action-, chemical-, and location-specific ARARs. Therefore, Alternative LSS-3 **passes** this criterion.

Table 10-3 Description of ARARs for the Selected Remedy

Source	Standard, Requirement, Criterion, Limitation	Description of Standard	Status	Selected Remedy[1] Points of Compliance
Chemical-Specific ARAR				
ADEC, Oil and Other Hazardous Substances Pollution Control	18 AAC 75.340-341, Table B-1	Establishes cleanup goals for soil.	Applicable	Selected remedy will remove soil with contaminant concentrations exceeding cleanup levels for soil (18 AAC 75.340-341).
	18 AAC 75.370	Establishes requirements for storage and disposal of contaminated soils.	Applicable	Storage and disposal of excavated soils will be managed to ensure protectiveness of human health, safety, and welfare of the environment.
Title 40 – Protection of Environment	40 CFR 261.20, 261.30, 262.11, and 264 Subpart L	Requirements for the safe management of hazardous waste.	Relevant and Appropriate	Selected remedy will comply with the RCRA, Subtitle C, Hazardous Waste Management regulations to prevent adverse impacts associated with handling hazardous waste.
Action-Specific ARAR				
Title 40 – Protection of Environment	40 CFR 261.20, 261.30, 262.11, and 264 Subpart L	Requirements for the safe management of hazardous waste and actions generating hazardous waste.	Relevant and Appropriate	Selected remedy will comply with the RCRA, Subtitle C, Hazardous Waste Management regulations to prevent adverse impacts associated with handling hazardous waste.
ADEC, Oil and Other Hazardous Substances Pollution Control	18 AAC 75.355	Establishes sampling and analysis requirements.	Applicable	Confirmation sampling will comply with soil sampling and analysis specifications.
	18 AAC 75.360	Establishes cleanup operation requirements.	Applicable	Selected remedy will comply with cleanup operation requirements for soil.
	18 AAC 75.375 (c)	Establishes requirements for ICs to be transferred with the land if contamination is left in place above cleanup levels.	Applicable	ICs are not anticipated and will only be required if the site does not meet unrestricted use after implementation of the selected remedy.

Table 10-3 (Cont.) Description of ARARs for the Selected Remedy

Source	Standard, Requirement, Criterion, Limitation	Description of Standard	Status	Selected Remedy[1] Points of Compliance
Location-Specific ARAR				
Title 36 – Parks, Forests, and Public Property	36 CFR 800 16 USC 470, et. seq.	Requirements to minimize adverse effects of remedial activities on historic properties (cultural resources). Historic sites or structures are those included on or eligible for the National Register of Historic Places.	Applicable	Remediation activities must not adversely affect archeological sites and historic properties. These regulations are applicable, because Site SS047 is part of Nike Site Summit Historic District.
Title 40 – Protection of Environment	40 CFR 264 Subpart L	Requirements to protect waste piles in order to prevent the generation of run-off or leachate.	Applicable	If excavated soils are stockpiled onsite prior to offsite disposal, the waste piles will be protected from precipitation and surface water run-on.
Executive Order 13186 - Responsibilities of Federal Agencies to Protect Migratory Birds	66 Federal Register 3853	Directs federal agencies that take actions that either directly or indirectly affect migratory birds to work with the U.S. Fish & Wildlife Service and other federal agencies to promote the conservation of migratory bird populations.	TBC	Remediation activities will be conducted with consideration of potential impacts to migratory birds.
Bald and Gold Eagle Protection Act	16 USC 661; 40 CFR 6.302(g)	Prohibits taking eagles, including their parts, nests, or eggs. Includes impacts that result from human-induced alterations initiated around a previously-used nest site.	Applicable	Remediation activities must not impact, harm, or disturb eagles, their eggs, or their nest sites.

Key:

1 – The selected remedy is as follows: at USS, excavation and offsite disposal of contaminated surface soil (0 to 2 feet bgs) at Action Areas USS-F and USS-K; at LSS, the excavation and offsite disposal of contaminated surface soil (0 to 2 feet bgs) at Action Areas LSS-B, LSS-H, LSS-Q, and LSS-U and of contaminated subsurface soil (2 to 3 feet bgs) at Action Area LSS-Q.

AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
ARAR – applicable or relevant and appropriate requirement
bgs – below ground surface
CFR – Code of Federal Regulations
ICs – institutional controls
RCRA – Resource Conservation and Recovery Act
TBC – to be considered
USC – United States Code

10.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This balancing criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls. Alternatives are rated as follows (Tables 10-1 and 10-2):

- **Alternative USS-1 (No Action):** The No Action alternative is not effective in providing protectiveness to humans or the environment and, therefore, is rated **low** for this criterion.
- **Alternative USS-2 (Excavation and Off-site Disposal of Surface Soil):** This alternative would permanently remove all CERCLA COCs in the soil at concentrations above their cleanup levels by excavation. Therefore, Alternative USS-2 is rated **high** for this criterion.
- **Alternative LSS-1 (No Action)**: The No Action alternative is not effective in providing protectiveness to humans or the environment and, therefore, is rated **low** for this criterion.
- **Alternative LSS-2 (Surface and Subsurface Soil Excavation with Off-Site Disposal):** This alternative would permanently remove all CERCLA COCs in soil at concentrations above their cleanup levels. Therefore, Alternative LSS-2 is rated **high** for this criterion.
- **Alternative LSS-3 (Surface Soil Excavation with Off-Site Disposal and LUCs):** This alternative would remove surface soil contamination, which presents the greatest risk for human health or ecological exposure, but would leave subsurface COCs in place and would require LUCs to maintain protectiveness. Therefore, Alternative LSS-3 is rated **medium** for this criterion.

10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of TMV through treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present. This is a primary balancing criterion, and alternatives are rated as follows (Tables 10-1 and 10-2):

- **Alternative USS-1 (No Action):** This alternative does not reduce or contain harmful effects from COCs. Therefore, Alternative USS-1 is rated **low** for this criterion.
- **Alternative USS-2 (Excavation and Off-site Disposal of Surface Soil):** This alternative would remove contaminants in the surface soil from the site, but only by relocating them. This alternative does not reduce or contain harmful effects from COCs. This alternative is rated **low** for this criterion.
- **Alternative LSS-1 (No Action):** This alternative does not reduce or contain harmful effects from COCs. Therefore, Alternative LSS-1 is rated **low** for this criterion.
- **Alternative LSS-2 (Surface and Subsurface Soil Excavation with Off-Site Disposal):** Alternative LSS-2 would remove all contaminants in the surface and subsurface soil from the site, but by relocating them. This alternative does not reduce or contain harmful effects from COCs. This alternative is rated **low** for this criterion.

- **Alternative LSS-3 (Surface Soil Excavation with Off-Site Disposal and LUCs):** This alternative would remove contaminants in the surface soil from the site by relocating them, but contamination would remain in place in subsurface soil. This alternative does not reduce or contain harmful effects from COCs. This alternative is rated **low** for this criterion.

10.5 Short-Term Effectiveness

Short-term effectiveness addresses the length of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved. This criterion is one of the primary balancing criteria, and alternatives are rated as follows (Tables 10-1 and 10-2):

- **Alternative USS-1 (No Action):** This alternative is not effective in reducing harmful effects from the COCs at USS. However, during implementation, the No Action Alternative would have no negative impacts on site workers or the environment. This alternative is rated **medium** for this criterion.
- **Alternative USS-2 (Excavation and Off-site Disposal of Surface Soil):** This alternative can be readily implemented and completed over a relatively short time frame (a single construction season). This alternative would use methodology that minimizes risk to human health and the environment during remedial activities. Therefore, this alternative is rated **high** for this criterion.
- **Alternative LSS-1 (No Action):** This alternative is not effective in reducing harmful effects from the COCs at LSS. However, during implementation, no action has no negative impacts on site workers or the environment. Therefore, Alternative LSS-1 is rated **medium** for this criterion.
- **Alternative LSS-2 (Surface and Subsurface Soil Excavation and Off-Site Disposal):** Alternative LSS-2 can be readily implemented and completed over a relatively short time frame (single construction season). This alternative would use methodology that prevents risk to human health and the environment during remedial activities. This alternative is rated **high** for this criterion.
- **Alternative LSS-3 (Surface Soil Excavation with Off-Site Disposal and LUCs):** This alternative can be readily implemented and completed over a relatively short time frame (single construction season). Alternative LSS-3 would use methodology that prevents risk to human health and the environment during remedial activities. This alternative is rated **high** for this criterion.

10.6 Implementability

Implementability addresses the technical and administrative feasibility of implementing a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are considered as part of this evaluation. This is the fourth primary balancing criterion, and alternatives are rated as follows (Tables 10-1 and 10-2):

- **Alternative USS-1 (No Action):** This alternative requires no site work or administrative action and thus can be readily implemented. Alternative USS-1 is rated **high** for this criterion.
- **Alternative USS-2 (Excavation and Off-site Disposal of Surface Soil):** Alternative USS-2 can be readily implemented, access is good, and excavation equipment and disposal facilities are available. This alternative is rated **high** for this criterion.
- **Alternative LSS-1 (No Action):** This alternative can be readily implemented. Alternative LSS-1 is rated **high** for this criterion.
- **Alternative LSS-2 (Excavation and Off-Site Disposal of Surface and Subsurface Soil):** Alternative LSS-2 can be readily implemented, access is good, and excavation equipment and disposal facilities are available. This alternative is rated **high** for this criterion.
- **Alternative LSS-3 (Surface Soil Excavation with Off-Site Disposal and LUCs):** Alternative LSS-3 can be readily implemented, access is good, and excavation equipment and disposal facilities are available. However, subsurface soil contamination would remain in place, requiring monitoring and Five-Year Reviews. Therefore, this alternative is rated **medium** for this criterion.

10.7 Cost

The cost criterion includes the estimated capital and annual operations and maintenance costs, as well as net present value (NPV). NPV is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent. Cost is the final primary balancing criterion.

Costs for all alternatives at USS are presented in Table 10-1. Alternative USS-1 has the lowest estimated NPV, while Alternative USS-2 has the highest estimated NPV. Neither alternative has recurring, annual O&M costs.

Costs for all alternatives at LSS are presented in Table 10-2. Alternative LSS-1 has the lowest estimated NPV, while Alternative LSS-3 has the highest estimated NPV. Of the active remedial alternatives considered, Alternative LSS-2 has the lowest estimated costs over a 30-year period.

10.8 State/Support Agency Acceptance

The EPA and ADEC concur that, if implemented properly, the following remedies, as presented in this ROD, will comply with State and Federal environmental laws:

- USS-2: Excavation and Off-site Disposal of Surface Soil
- LSS-2: Surface and Subsurface Soil Excavation with Off-site Disposal.

10.9 Community Acceptance

Written and verbal comments were received during the public comment period and are summarized and addressed in Section 15. There were no major concerns raised by the public regarding the proposed remedy.

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11.0 PRINCIPAL THREAT WASTES

The NCP expects that treatment that reduces the TMV of the principal threat wastes will be used to the extent practicable. The principal threat concept refers to the source materials at a CERCLA site considered to be highly toxic or highly mobile that generally cannot be reliably controlled in place, or present a significant risk to human health or the environment should exposure occur. A source material is material that contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air or that acts as a source for direct exposure. There are no principal threat wastes at USS or LSS. The metals, VOCs, and SVOCs detected in soil at USS or LSS are neither highly toxic nor highly mobile and do not present a significant risk to human health or the environment should exposure occur.

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12.0 SELECTED REMEDY

The following subsections identify the selected remedies for USS and LSS.

12.1 Selected Remedy for USS

The selected remedy for USS (Alternative USS-2) involves excavation and off-site disposal of surface soil with CERCLA contaminants at concentrations above cleanup levels. This remedial action was selected based upon the ability to protect human health and the environment and compliance with ARARs. This remedy provides the best balance among the balancing criteria and appears consistent with comments received from the public and ADEC. The USAF has determined that the selected remedy provides the best balance of trade-offs among the alternatives with respect to the five balancing criteria set out in NCP Section 300.430(f)(1)(i)(B).

Remedy selections are based on the detailed evaluation of remedial alternatives presented in the SFS and Revised Proposed Plan, EPA and ADEC concurrence, and community preference for off-site disposal. The USAF is responsible for implementing, maintaining, and monitoring the remedial actions identified herein for the duration of the remedies selected in this ROD. The USAF will exercise this responsibility in accordance with CERCLA and the NCP.

12.1.1 Summary of the Rationale for the Selected Remedy for USS

The selected remedial alternative for USS is Alternative USS-2. The USAF and EPA believe that the selected remedy for USS meets the threshold criteria and provides the best balance of tradeoffs compared to the other alternative with respect to the balancing and modifying criteria. The remedy is expected to satisfy the nine selection criteria, as defined by CERCLA Section 300.430(e)(9)(iii)

Alternative USS-2 meets the threshold criteria, is the most effective when ranked against the balancing criteria, and has received concurrence from the EPA and ADEC, and acceptance from the community under the modifying criteria.

12.1.2 Description of the Selected Remedy for USS

The selected remedy for USS is Alternative USS-2: the excavation of all surface soil at USS with CERCLA contamination exceeding cleanup levels. This alternative will permanently remove contaminated soil in Action Areas USS-F and USS-K (Figure 5-2). The primary soil contaminants that will be removed from the site are the COCs listed in Table 7-7. Approximately 44 cubic yards of soil will be removed from Action Areas USS-F and USS-K, as summarized in **Table 12-1**. The estimated areas, depths, and volumes included in Table 12-1 are based on available sampling information for USS.

Table 12-1 USS – Soil Excavation Estimates by Area

Action Area	Area (square feet)	Depth (feet)	Volume (cubic yards)	Sample Identification	Contaminant(s)
USS-F	100	2	7.4	SS10USS	Cd

USS-K	500	2	37	SS11USS, SS12USS	Cd, Pb, B(a)A, B(a)P, B(b)F

Key:
B(a)A – benzo(a)anthracene
B(a)P – benzo(a)pyrene
B(b)F – benzo(b)fluoranthene
Cd – cadmium
Pb – lead
USS – Upper Site Summit

Excavated soil will be transported off-site to a disposal facility located in the Lower 48, as there are none in Alaska. The excavated material will be placed into Supersacks for transport off-site. Removal of the contaminated soil will be confirmed by post-excavation sampling of the bottom and sidewalls of the excavation. Excavation backfill material will be obtained from an approved borrow source located on JBER. Material from the JBER borrow pit is used broadly at JBER and has been an acceptable source for previous environmental restoration projects where clean backfill is required.

The major components of the selected remedy for USS are as follows:

- Excavate contaminated surface soil (0 to 2 feet bgs) from Action Areas USS-F and USS-K.
- Collect post-excavation soil samples to confirm that cleanup levels have been achieved.
- Transport contaminated soil offsite for disposal.

12.1.3 Summary of Estimated Remedy Costs for USS

The estimated remedy costs of Alternative USS-2 are summarized in **Table 12-2**. The information provided in Table 12-2 is based on the best available information regarding the anticipated scope of the selected remedy (USS-2). Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedy. Major changes may be documented in the form an Explanation of Significant Differences or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. Costs for implementing USS-2 at SS047 were provided in the SFS.

Table 12-2 Summary of Estimated Remedy Costs – USS

			Alternative USS-2	
Total Excavation Volume (in-place) (CERCLA)		cubic yards	44	
Total Mass Excavated (CERCLA)		tons	67	
Excavation Duration		days	2	
Assumed time to meet all cleanup goals		years	1	
Remedy Component	**Unit Cost**	**Units**	**Quantity**	**Cost**
Remedial Design Stage Actions				
Additional Pre-Excavation Delineation	$2,300	per sample	10	$23,000
Capital Costs -- Excavation				
Pre-survey: permitting, staking, utility clearance	$1,200	per day	4	$4,800
Excavation, Disposal, and Site Restoration Tasks CERCLA [1]	$527	per ton	67	$35,098
Waste profiling -- sampling and analysis	$5,000	lump sum	5	$25,000
Confirmation sampling [2]	$2,300	per sample	10	$23,000
Backfill Material [3]	$15	per ton	67	$1,005
Field oversight (2 personnel/day)	$2,400	per day	1	$4,800
Operation, Maintenance, and Reporting				
Remedial Action Report	$30,000	per report	1	$30,000
Annual Sampling & Analysis	$13,800	per year	0	$0
Annual data review and reporting	$10,000	per year	0	$0
Five-Year Reviews	$30,000	per report	0	$0
Replacement of warning signs (once at 25 years)	$500	per sign	0	$0
Annual LUC Enforcement, Monitoring, Reporting	$3,000	per year	0	$0
NPV of Recurring Costs	2.0%			$0
NPV of Recurring Costs	5.0%			$0
Capital				**$147,000**
NPV (2.0%)				**$147,000**
NPV (5.0%)				**$147,000**

Key:

1 – Unit costs of $527 per ton are based on $473 per ton for off-site treatment, plus estimated costs for excavation, loading, hauling and replacement in excavations of CERCLA material.

2 – No abandonment of existing USS groundwater wells during the 30-year period of analysis.

3 – Granular fill is available on site, transport and placement estimated at $15/ ton placed.

% – percent

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act

NPV – net present value; *Guidelines for Preparing Economic Analyses*, co-authored by National Center for Environmental Economics Office of Policy, and U.S. Environmental Protection Agency, updated May 2014.

USS – Upper Site Summit

12.1.4 Expected Outcomes of the Selected Remedy for USS

Upon completion of the selected remedy, USS will be in compliance with CERCLA and the State of Alaska environmental statutes. No known CERCLA contamination above site-specific cleanup levels will remain at USS after the selected remedy (excavation) has been completed. Refer to Table 7-7 for COCs, cleanup levels, and the basis for the cleanup level. The selected remedy will limit human and ecological exposure to contaminants at USS. All soil with contaminants exceeding cleanup levels would be excavated and removed from the site, resulting in no remaining

soil risks or hazards to human or ecological receptors. Although land use is not expected to change, USS would meet the criteria for UU/UE after the cleanup levels are achieved, which is expected to occur within 1 year of implementation.

12.2 Selected Remedy for LSS

The selected remedy for LSS (Alternative LSS-2) includes surface and subsurface soil excavation and off-site disposal. This remedial action was selected based upon the ability to protect human health and the environment and compliance with ARARs. This remedy provides the best balance among the balancing criteria and appears consistent with comments received from the public and ADEC. The USAF has determined that the selected remedy provides the best balance of trade-offs among the alternatives with respect to the five balancing criteria set out in NCP Section 300.430(f)(1)(i)(B).

Remedy selections are based on the detailed evaluation of remedial alternatives presented in the SFS and Revised Proposed Plan, EPA and ADEC concurrence, and community preference for offsite disposal. The USAF is responsible for implementing, maintaining, and monitoring the remedial actions identified herein for the duration of the remedies selected in this ROD. The USAF will exercise this responsibility in accordance with CERCLA and the NCP.

12.2.1 Summary of the Rationale for the Selected Remedy for LSS

The selected remedial alternative for LSS is Alternative LSS-2. The USAF and EPA believe that the selected remedy for LSS meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The remedy is expected to satisfy the nine selection criteria as defined by CERCLA Section 121(b).

Alternative LSS-2 meets the threshold criteria, is the most effective alternative when ranked against the balancing criteria, and has received concurrence from the EPA and ADEC and acceptance from the community under the modifying criteria.

12.2.2 Description of the Selected Remedy for LSS

The selected remedy for LSS is Alternative LSS-2: the excavation of all surface and subsurface soil at LSS with CERCLA contamination exceeding cleanup levels. This alternative will rapidly remove contaminated soil in Action Areas LSS-B, LSS-H, LSS-Q, and LSS-U. The primary soil contaminants that will be removed from the site are the COCs listed in Table 7-7. Surface soil contamination at LSS is associated primarily with localized releases at Action Areas LSS-B, LSS-H, LSS-Q, and LSS-U (Figure 5-3). Subsurface contamination is present in the vicinity of Action Area LSS-Q, the Launch Control Building.

Approximately 263 cubic yards of soil will be removed from Action Areas LSS-B, LSS-H, LSS-Q, and LSS-U, as summarized in **Table 12-3**. The estimated areas, depths, and volumes included in Table 12-3 are based on available sampling information for LSS. Although there are uncertainties on the lateral and vertical extents at the LSS Action Areas, additional sampling may be performed either as a stand-alone remedial action sampling program, or in conjunction with the

remedial action to verify that removal of all soil with concentrations exceeding cleanup levels is achieved.

Table 12-3 LSS – Soil Excavation Estimates by Area

Action Area	Area (square feet)	Depth (feet)	Volume (cubic yards)	Sample Identification	Contaminant(s)
LSS-B	1,000	2	74.1	SS12LSS, SS13LSS	B(a)P, B(b)F, Cd
LSS-H	100	2	7.4	SS19LSS	Cd
LSS-Q	900	5	166.7	TP06LSS, TP07LSS, BH07LSS	1,1,2-Tce, 1,2,3-Tcp, 1,2-Db 3-Cp, B(a)A, B(a)P, B(b)F, D(a,h)A, I(1,2,3-c,d)P
LSS-U	200	2	14.8	SS60LSS	B(a)P, B(b)F, B(2-e)P, PCIP, Cd

Key:
1,1,2-Tce – 1,1,2-trichloroethane
1,2,3-Tcp – 1,2,3-trichloropropane
1,2-Db 3-Cp – 1,2-dibromo-3-chloropropane
B(a)A – benzo(a)anthracene
B(a)P – benzo(a)pyrene
B(b)F – benzo(b)fluoranthene
B(2-e)P – bis(2-ethylhexyl) phthalate
Cd – cadmium
D(a,h)A – dibenz(a,h)anthracene
I(1,2,3-c,d)P – indeno(1,2,3-c,d)pyrene
LSS – Lower Site Summit
PCIP – pentachlorophenol

Excavated soil will be transported off-site to a disposal facility located in the Lower 48, as there are none in Alaska. The excavated material will be placed into Supersacks for transport off-site. Removal of the contaminated soil will be confirmed by post-excavation sampling of the bottom and sidewalls of the excavations. Excavation backfill material will be obtained from an approved borrow source located on JBER. Material from the JBER borrow pit is used broadly at JBER and has been an acceptable source for previous environmental restoration projects where clean backfill is required.

The major components of the selected remedy for LSS are as follows:

- Excavate contaminated surface soil (0 to 2 feet bgs) from Action Areas LSS-B, LSS-H, and LSS-U.
- Excavate contaminated surface (0 to 2 feet bgs) and subsurface soil (deeper than 2 feet bgs) from Action Area LSS-Q.
- Collect post-excavation samples to confirm that cleanup levels have been achieved.
- Transport contaminated soil offsite for disposal.

12.2.3 Summary of Estimated Remedy Costs for LSS

A summary of the estimated remedy costs for Alternative LSS-2 is provided in **Table 12-4**. The information provided in Table 12-4 is based on the best available information regarding the anticipated scope of the selected remedy (LSS-2). Changes in the cost elements are likely to occur

as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form an Explanation of Significant Differences or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. Costs for implementing LSS-2 were provided in the SFS.

Table 12-4 Summary of Estimated Remedy Costs – LSS

			Alternative LSS-2	
Total Excavation Volume (in-place) (CERCLA)		cubic yards	263	
Total Mass Excavated (CERCLA)		tons	345	
Excavation Duration		days	3	
Assumed time to meet all cleanup goals		years	1	
Remedy Component	**Unit Cost**	**Units**	**Quantity**	**Cost**
Remedial Design Stage Actions				
Additional Pre-Excavation Delineation	$2,300	per sample	20	$46,000
Capital Costs -- Excavation				
Pre-survey: permitting, staking, utility clearance	$1,200	per day	4	$4,800
Excavation, Disposal, and Site Restoration Tasks CERCLA [1]	$527	per ton	345	$181,499
Waste profiling -- sampling and analysis	$5,000	lump sum	10	$50,000
Confirmation sampling	$2,300	per sample	20	$46,000
Backfill Material [2]	$15	ton	344	$5,166
Field oversight (2 personnel/day)	$2,400	per day	3	$7,200
Capital Costs -- LUCs				
Installation of warning signs (materials and labor)	$500	per sign	0	$0
Administrative costs (legal, GIS, procurement & invoicing)	$2,000	Estimated	0	$0
Operation, Maintenance, and Reporting				
Remedial Action Report	$30,000	per report	1	$30,000
Five-Year Reviews	$30,000	per report	0	$0
Replacement of warning signs (once at 25 years)	$500	per sign	0	$0
Annual LUC Enforcement, Monitoring, Reporting	$3,000	per year	0	$0
NPV of Recurring Costs	2.0%			$0
NPV of Recurring Costs	5.0%			$0
Capital				**$371,000**
NPV (2.0%)				**$371,000**
NPV (5.0%)				**$371,000**

Key:

1 – Unit costs of $527 per ton are based on $473 per ton for off-site treatment, plus estimated costs for excavation, loading, hauling and replacement in excavations of CERCLA material.

2 – Granular fill is available on site, and can be transported and placed for approx. $15/ ton.

% – percent

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act

GIS – geographical information systems

LSS – Lower Site Summit

LUC – land use control

NPV – net present value; *Guidelines for Preparing Economic Analyses*, co-authored by National Center for Environmental Economics Office of Policy, and U.S. Environmental Protection Agency, updated May 2014.

12.2.4 Expected Outcomes of the Selected Remedy for LSS

Upon completion of the selected remedy, LSS will be in compliance with CERCLA and the State of Alaska environmental statutes. No known CERCLA contamination above site-specific cleanup levels will remain at LSS after the selected remedy (excavation) has been completed. Refer to Table 7-7 for COCs, cleanup levels, and the basis for the cleanup level at LSS. All soil with contaminants exceeding cleanup levels would be excavated and removed from the site, resulting in no remaining soil risks or hazards to human or ecological receptors. Although land use is not expected to change, LSS would meet the criteria for UU/UE after the cleanup levels are achieved, which is expected to occur within 1 year of implementation.

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13.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121 (as required by NCP Section 300.430(f)(5)(ii)), the lead agency must select a remedy that is protective of human health and the environment, complies with ARARs, is cost-effective, and uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, periodic Five-Year reviews are required if hazardous substances will remain in place above levels allowing for UU/UE after implementing the selected remedy. Because the remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for UU/UE, a Five-Year review will not be required for this remedial action. CERCLA also includes: 1) a preference for remedies that employ treatment which permanently and significantly reduces the TMV of hazardous wastes as a principal element; and 2) a bias against offsite disposal of untreated wastes. The following sections discuss the selected remedy in relation to these statutory requirements.

13.1 Protection of Human Health and the Environment

USS. Excavation of CERCLA hazardous materials in soil at USS would serve to protect human health and the environment by reducing COC concentrations from the designated action areas and relocating the contaminated soil to an off-site, permitted facility. No remaining soil risks or hazards to human or ecological receptors will exist after cleanup levels are achieved. Exposure concentrations will be reduced to protective ARAR levels or to levels below the 1×10^{-5} risk criterion for carcinogenic risk or the HI of 1 for non-carcinogenic risk. Implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts. Because the remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for UU/UE, a Five-Year review will not be required for this remedial action.

LSS. Excavation of CERCLA hazardous substances in soil at LSS would serve to protect human health and the environment by reducing COC concentrations from the designated action areas at LSS and relocating the contaminated soil to an off-site, permitted facility. No remaining soil risks or hazards to human or ecological receptors will exist after cleanup levels are achieved. Exposure concentrations will be reduced to protective ARAR levels or to levels below the 1×10^{-5} risk criterion for carcinogenic risk or the HI of 1 for non-carcinogenic risk. Implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts.

13.2 Compliance with ARARs

Remedial actions must comply with both Federal and State ARARs. ARARs are legally applicable or relevant and appropriate requirements, standards, criteria, or limitations of Federal and State environmental laws and regulations. Criteria TBCs are non-promulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. However, in many circumstances, TBCs are considered along with ARARs. Table 10-3 summarizes the ARARs for the selected remedy at SS047, including USS and LSS, and describes how the selected remedy addresses each one at agreed-upon points of compliance.

USS. The selected remedy for USS complies with the chemical-specific, location-specific, and action-specific ARARs. The implementation of the remedy is required to meet the substantive portions of these requirements at agreed-upon points of compliance and is exempt from administrative requirements such as permitting and notifications. Removal of the contaminated soil will be confirmed by post-excavation sampling of the bottom and sidewalls of the excavation.

LSS. The selected remedy for LSS complies with the chemical-specific, location-specific, and action-specific ARARs. The implementation of the remedy is required to meet the substantive portions of these requirements at agreed-upon points of compliance and is exempt from administrative requirements such as permitting and notifications. Removal of the contaminated soil will be confirmed by post-excavation sampling of the bottom and sidewalls of the excavations.

13.3 Cost Effectiveness

The selected remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" (40 CFR 300.430(f)(1)(ii)(D)). This determination was accomplished by evaluating the "overall effectiveness" of the alternative that satisfies the threshold criteria (that is, is protective of human health and the environment and ARAR-compliant).

Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination: long-term effectiveness and permanence, reduction in TMV through treatment, and short-term effectiveness. Overall effectiveness was then compared to costs to determine cost-effectiveness. The overall effectiveness of the selected remedy for USS and LSS was demonstrated in the comparative analysis of alternatives (Section 10). The estimated NPV of the selected remedy (in 2015 dollars) for USS is $147,000 (Table 12-2) and for LSS is $371,000 (Table 12-4).

It is important to note that more than one cleanup alternative can be cost-effective, and the Superfund program does not mandate the selection of the most cost-effective cleanup alternative. In addition, the most cost-effective remedy is not necessarily the remedy that provides the best balance of tradeoffs with respect to the remedy selection criteria, nor is it necessarily the least-costly alternative that is both protective of human health and the environment and ARAR-compliant. Rather, cost-effectiveness is concerned with the reasonableness of the relationship between the effectiveness afforded by each alternative and its costs compared to other available options.

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected remedy for USS and LSS provides the best balance of trade-offs among the alternatives with respect to the five balancing criteria set out in NCP Section 300.430(f)(l)(i)(B). Although no treatment is being utilized for CERCLA hazardous materials at USS or LSS, the selected remedy of excavation provides the most effective, long-term solution given the conditions at the site. Excavation with off-site disposal of CERCLA hazardous materials is protective of

human health and the environment by permanently removing contaminated soil from the site. In addition, this remedy is readily implementable and cost-effective.

13.5 Preference for Treatment as a Principal Element

The NCP establishes the expectation that treatment will be used to address the principal threats posed by a site wherever practicable (40 CFR 300.430(a)(1)(iii)(A)). The selected remedy of excavation and off-site disposal of surface soil at USS and for surface and subsurface soil at LSS for CERCLA COCs does not satisfy the statutory preference for treatment as a principal element of the remedy. However, this remedy is preferred because of its significant and rapid reduction in risk and cost-effectiveness and because it is readily implementable.

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14.0 DOCUMENTATION OF SIGNIFICANT CHANGES

After the Revised Proposed Plan was issued in October 2016, ADEC promulgated new cleanup standards. These cleanup standards were incorporated into this ROD and are identified as the human health cleanup levels specified for USS and LSS. Cleanup levels identified in revised Proposed Plan were based on those specified in the SFS; therefore, the cleanup levels have changed. The newly promulgated cleanup standards included in this ROD are lower than those previously identified in the revised Proposed Plan.

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PART III – RESPONSIVENESS SUMMARY

This section provides a summary of the public comments regarding the 2013 Proposed Plan and the 2016 Revised Proposed Plan for remedial action at SS047 at JBER, and the USAF response to comments. At the time of the public comment period for the 2016 Proposed Plan, the proposed remedies were:

- Excavation and off-site disposal of surface soil at USS.
- Surface and subsurface soil excavation and off-site disposal at LSS.
- No Action under CERCLA for Areas A and C. Petroleum-contaminated areas will be addressed under ADEC cleanup regulations and remedies will be determined in a separate decision document.
- No Further Action for Areas B and D.

15.0 STAKEHOLDER COMMENTS AND LEAD AGENCY RESPONSES

JULY 2013 PROPOSED PLAN WRITTEN COMMENTS

Stakeholder comments were received by the USAF during the public review period of the Proposed Plan from FONSS and Arctic Valley Ski Association. No additional written comments were received during the public comment period.

Public Comment 1: FONSS expressed appreciation that the planned excavations will not impact structures, foundations, or concrete pads at USS or LSS. FONSS also requested that they be advised and allowed to comment if further investigations reveal the need to excavate under any of the structures, foundations, or concrete pads, or would otherwise significantly affect the landscape and the defining and characteristic features of Nike Site Summit. FONSS expressed concern that the group tours to LSS will be allowed to continue during the 30-year estimated completion timeframe associated with the selected remedy, and questioned if LSS-4 (soil excavation and off-site treatment/disposal; ISCO (in situ chemical oxidation) for deep soil and groundwater) would be a better remedy due to the shorter duration to completion.

USAF Response: The USAF will continue to collaborate with FONSS to make sure Nike Site Summit remains accessible for scheduled group tours and site restoration work. LSS-4 was not chosen as the selected remedy because of uncertainties with the effectiveness of ISCO. The detailed analysis explains that the 3-year estimate to completion assumes only one application of ISCO, but at times this process requires multiple applications of ISCO to prove effective at reducing contaminant levels. LSS-2 is the least invasive remedy that is protective of human and ecological receptors.

JULY 2013 PROPOSED PLAN PUBLIC MEETING

The following questions were received at the Public Meeting held on 1 August 2013, at the Fairview Community Recreation Center in Anchorage, Alaska.

Public Comment 1: How many people are going to be up there, and what is going to be left for people to be working up there? Who is going to be up there to be bothered?

USAF Response: We will only be removing soil from these areas. The areas are fairly small, and will be backfilled with clean soil, which will not impact any of the site structures. This process is not just about people being bothered, it also has to do with environmental impact. We realize the likelihood of people actually inhabiting the area is slim. There will be site workers there continually, because there are commercial communication systems at USS, and at both USS and LSS there are mission activities that occur with troop mobilizations and training.

Public Comment 2: I have a related question on the risks. Previously we heard there's a risk category for visitors, and in Area C (which happens to be a backcountry access point), can you define what a visitor is and what the risk assessment is for a visitor? Is the contamination at Area C purely within the boundaries of JBER, or could a visitor, for example, be a full-time employee of the Anchorage Ski Club?

USAF Response: Site visitors were assessed, but they were deemed to not have an associated risk. Area C is located closest to the ski area, but all areas are within JBER boundaries and are shown on the site maps. Area C has just a small pocket of one contaminant that needs to be addressed.

Public Comment 3: My question is related to the proposed work and to what extent you'll be entering the lease of Arctic Valley and the Anchorage Ski Club, and if you'll be having any heavy equipment entering that area on the privately maintained road or on that parking area that's also privately maintained?

USAF Response: The only excavation that would be done is a very small amount of soil, approximately 1 cubic yard. It would require a small backhoe and Supersacks (a 1 cubic yard poly container). It would be a very minimal, 1-day project. All other access to the remaining SS047 areas would not use the privately maintained road.

Public Comment 4: I'd like to put in a plug for Friends of Site Summit. If you get in touch with them, they're having tours up there. They had some last year to start with, and it was a really wonderful trip. I was assigned up there in '69 and '70, so it had been 40 years since I was up there. It is really just a beautiful place to go.

OCTOBER 2016 REVISED PROPOSED PLAN WRITTEN COMMENTS

Stakeholder comments were received by the USAF during the public review period of the Revised Proposed Plan from Knik Tribal Council. No additional written comments were received during the public comment period.

Public Comment 1: The Knik Tribe concurs that the Preferred Alternatives Outline as Alternative USS-2 and Alternative LSS-2 in the Proposed Plan for Remedial Action are expected to achieve substantial and long-term risk reduction through excavation and off-site disposal of all material above cleanup levels, at a reasonable cost. And that, the alternatives provide active remediation to the area that has the highest risk and is relatively simple to implement.

It is our understanding that contaminated soils from the above facilities will be transported for off-site disposal outside of Alaska.

USAF Response: All CERCLA-related contamination will be disposed of outside Alaska at an appropriate facility.

OCTOBER 2016 PROPOSED PLAN PUBLIC MEETING

Public Comment 1: When was the site placed on the EPA Priorities List?

USAF Response: Fort Richardson was placed on the EPA Priority List in 1994.

Public Comment 2: The informal dispute resolution, so that was something that was triggered by EPA?

USAF Response: Yes, the EPA disagreed with the use of the term "groundwater" at Upper and Lower Site Summit, and the language that was used to describe land use controls (LUCs). During the informal dispute resolution process, we agreed that groundwater does not exist at Upper Site Summit; subsurface water at Lower Site Summit was of "insufficient yield" to be considered a drinking water source and would be reclassified as EPA Class IIIA groundwater; and if LUCs were part of the selected remedy, the USAF would use the LUC language contained in the EPA's *LUC Checklist* per OSWER Directive 9355.6-12.

Public Comment 3: The Propose Plan doesn't include anything about asbestos or other contaminants that may be in the buildings. So the Air Force just leaves those alone and the Friends of Nike Site Summit take care of that? What happens?

USAF Response. Asbestos is being managed at the Nike Site Summit under a separate program and, as buildings are worked on or demolished, the asbestos is remediated or encapsulated by specialty contractors as buildings are being restored. This work continues within the programmatic agreement with the Friends of Nike Site Summit until 2029.

Public Comment 4: I have one question in regard to the groundwater. So by EPA saying that there wasn't any groundwater there, will that reduce the costs for cleaning or treating?

USAF Response. Yes, the groundwater determination reduces the amount of contaminated material that will need to be treated; reducing the overall cost to clean up the site.

Public Comment 5: When was the public meeting advertised, and was it only advertised on the day of the meeting?

USAF Response: The public meeting was advertised several times in the following five local newspapers:

- Mat-Su Valley Frontiersman on 5 and 19 October 2016.
- Anchorage Press on 6 and 20 October 2016.
- Arctic Warrior on 7 and 21 October 2016.
- Chugiak-Eagle River Star on 6, 13, and 20 October 2016.
- Alaska Dispatch News on 2 and 19 October 2016.

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16.0 TECHNICAL AND LEGAL ISSUES

No technical or legal issues were identified during the public review period of the 2016 Proposed Plan.

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APPENDIX A

Index to SS047 Documents in the Administrative Record

Appendix A
SS047 Nike Site Summit
Administrative Record Index
As of: June 9, 2017

Date	Title	Document ID
08-Aug-95	ADEC Letter to US Army Concerning Concurrence for Site Summit Leaking UST Request for Transfer	SS04700001 - SS04700001
01-Oct-96	Preliminary Assessment/Site Investigation Addendum	SS04700002 - SS04700021
01-Oct-96	Preliminary Assessment/Site Investigation Addendum, App A, Confined Space Entry Documentation	SS04700022 - SS04700027
01-Oct-96	Preliminary Assessment/Site Investigation Addendum, App B, Chain of Custody's	SS04700028 - SS04700031
01-Oct-96	Preliminary Assessment/Site Investigation Addendum, App C, Analytical Laboratory Results	SS04700032 - SS04700084
01-Oct-96	Preliminary Assessment/Site Investigation Addendum, App D, Chemical Quality Assurance Report	SS04700085 - SS04700097
01-Jul-96	Preliminary Assessment/Site Investigation	SS04700098 - SS04700238
01-Jul-96	Preliminary Assessment/Site Investigation, App A, Analytical Laboratory Result	SS04700239 - SS04700408
01-Jul-96	Preliminary Assessment/Site Investigation, App B, Chemical Quality Assurance	SS04700409 - SS04700496
01-Jul-96	Preliminary Assessment/Site Investigation, App C, Soil Boring Logs	SS04700497 - SS04700501
01-Jul-96	Preliminary Assessment/Site Investigation, App D, Chain of Custody's	SS04700502 - SS04700550
01-Oct-98	Conceptual Site Model, Draft	SS04700551 - SS04700596
01-Oct-98	Conceptual Site Model, Draft, App A, Copies of 1996 PA/SI Soil Sample Results Table	SS04700597 - SS04700605
01-Oct-98	Conceptual Site Model, Draft, App B, Matrix Score Sheet Determinations, Buildings 39225/39600	SS04700606 - SS04700610
01-Oct-98	Conceptual Site Model, Draft, App C, Copies 1996 PA/SI Water Sample Results Table	SS04700611 - SS04700613
27-Oct-98	US Army Review Comments on the Draft Conceptual Site Model	SS04700614 - SS04700616
01-Sep-00	Risk Assessment Work Plan	SS04700617 - SS04700742
01-Sep-00	Risk Assessment Work Plan, App A, ADEC Ecological Checklist	SS04700743 - SS04700751
22-May-00	US Army Corps of Engineers Review Comments on Draft Risk Assessment Work Plan,	SS04700752 - SS04700754
01-Sep-00	Sampling and Analysis Plan	SS04700755 - SS04700758
01-Sep-00	Sampling and Analysis Plan, Field Sampling Plan	SS04700759 - SS04700875
01-Sep-00	Sampling and Analysis Plan, Field Sampling Plan, App A, Solid-Stem Auger SOP	SS04700876 - SS04700890
01-Sep-00	Sampling and Analysis Plan, Quality Assurance Project Plan	SS04700891 - SS04700928
01-Sep-00	Sampling and Analysis Plan, Quality Assurance Project Plan, App A, Parameters	SS04700929 - SS04700939
01-Sep-00	Sampling and Analysis Plan, Quality Assurance Project Plan, App B, Corrective Action	SS04700940 - SS04700942
01-Sep-00	Sampling and Analysis Plan, Site Health and Safety Plan	SS04700943 - SS04700968
19-Apr-00	US Army Corps of Engineers Review Comments on Sampling and Analysis Plan	SS04700969 - SS04700980
01-Nov-99	E&E Memorandum US Army ED Concerning Risk Assessment	SS04700981 - SS04700992
12-Nov-99	US Army ED Risk Assessment Transmittal Memorandum	SS04700993 - SS04700993

Date	Title	Document ID
12-Nov-99	US Army ED Transmittal Memorandum, Attachment, E & E Memorandum to USAED concerning Risk Assessment	SS04700994 - SS04701005
01-Aug-10	Baseline Risk Assessment Work Plan	SS04701006 - SS04701079
01-Aug-10	Baseline Risk Assessment Work Plan, App A, Field Forms	SS04701080 - SS04701086
01-Aug-10	Baseline Risk Assessment Work Plan, App B, Standard Operating Procedures	SS04701087 - SS04701326
01-Aug-10	Baseline Risk Assessment Work Plan, App C, Responses to Comments	SS04701327 - SS04701364
01-Aug-10	Baseline Risk Assessment Work Plan, App D, TRIAD Meeting Uncertainty Tables	SS04701365 - SS04701370
01-Aug-10	Baseline Risk Assessment Work Plan, Atch 1, Health and Safety Plan	SS04701371 - SS04701388
01-Aug-10	Baseline Risk Assessment Work Plan, Atch 1, Health and Safety Plan, App A, Field Forms	SS04701389 - SS04701392
01-Aug-10	Baseline Risk Assessment Work Plan, Atch 1, Health and Safety Plan, App B, Material Safety Data	SS04701393 - SS04701465
01-Aug-10	Baseline Risk Assessment Work Plan, Atch 2, Quality Assurance Project Plan	SS04701466 - SS04701572
01-Aug-10	Baseline Risk Assessment Work Plan, Atch 3, Human Health & Ecological Risk Assessment Work Plan	SS04701573 - SS04701652
01-Aug-10	Baseline Risk Assessment Work Plan, Atch 3, Human Health & Ecological Risk Assessment, App A Scoping	SS04701653 - SS04701661
01-Aug-10	Baseline Risk Assessment Work Plan, Atch 3, Human Health & Ecological Risk Assessment, App B Eco sco	SS04701662 - SS04701666
01-Aug-10	Baseline Risk Assessment Work Plan, Atch 3, Human Health & Ecological Risk Assessment, App C Exposur	SS04701667 - SS04701683
31-May-11	Incorporation of Nike Site Summit into US Army Federal Facility Agreement	SS04701684 - SS04701685
01-May-12	Remedial Investigation, Vol 1 of 3, Analytical Data Report	SS04701686 - SS04701736
01-May-12	Remedial Investigation, Vol 1 of 3, Analytical Data, App A, Data Verification & Validation Report	SS04701737 - SS04702153
01-May-12	Remedial Investigation, Vol 1 of 3, Analytical Data, App B, ADEC Laboratory Data Review Checklist	SS04702154 - SS04702322
01-May-12	Remedial Investigation, Vol 1 of 3, Analytical Data, App C, Laboratory Level III/IV Data Reports	SS04702323 - SS04702323
28-Jul-12	ADEC Comments on the Draft Remedial Investigation - Remedial Field Investigation	SS04702324 - SS04702331
15-Jul-11	Army/Air Force Review Comments on the Draft Remedial Investigation Report.	SS04702332 - SS04702333
24-Aug-11	EPA Comments on the Draft Remedial Investigation - Remedial Field Investigation Report	SS04702334 - SS04702337
01-May-12	Remedial Investigation, Vol 2 of 3, Remedial Field Investigation Report	SS04702338 - SS04702531
01-May-12	Remedial Investigation, Vol 2 of 3, Remedial Field Investigation, App A Triad Documents	SS04702532 - SS04702557
01-May-12	Remedial Investigation, Vol 2 of 3, Remedial Field Investigation, App B, Stakeholder Comments & Resp	SS04702558 - SS04702558
01-May-12	Remedial Investigation, Vol 2 of 3, Remedial Field Investigation, App C, Summary Tables of Analytica	SS04702559 - SS04702627
01-May-12	Remedial Investigation, Vol 2 of 3, Remedial Field Investigation, App D, Site Photos	SS04702628 - SS04702670
01-May-12	Remedial Investigation, Vol 2 of 3, Remedial Field Investigation, App E, Field Forms	SS04702671 - SS04702764

Date	Title	Document ID
01-May-12	Remedial Investigation, Vol 2 of 3, Remedial Field Investigation, App F, Sample Location Coordinates	SS04702765 - SS04702769
01-May-12	Remedial Investigation, Vol 2 of 3, Remedial Field Investigation, App G, Waste Disposal Summary	SS04702770 - SS04702772
28-Jul-11	ADEC Comments on the Draft Remedial Investigation Analytical Data Report	SS04702773 - SS04702774
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment	SS04702775 - SS04702978
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App A, Scoping Form	SS04702979 - SS04702987
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App B, Esoscoping	SS04702988 - SS04702992
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App C, PtoUCL Output	SS04702993 - SS04703006
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App D, COPC & COPEC	SS04703007 - SS04703035
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App E, ProUCL Output	SS04703036 - SS04703165
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App Summary Statist	SS04703166 - SS04703176
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App G, Exposure Dose	SS04703177 - SS04703181
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App H, Johnson Model	SS04703182 - SS04703227
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App I, Hazard Calcula	SS04703228 - SS04703288
01-May-12	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App J, Ecological Exp	SS04703289 - SS04703294
01-May-13	Remedial Investigation, Vol 3 of 3, Human Health & Ecological Risk Assessment, App K, Ecological Cal	SS04703295 - SS04703336
01-Aug-11	Response to EPA Comments on Draft Remedial Investigation Human Health & Ecological Risk Assessment	SS04703337 - SS04703352
17-Nov-11	Response to ADEC Comments on Draft Remedial Investigation - Human Health Ecological Risk Assessment	SS04703353 - SS04703362
21-May-12	USAF Memorandum requesting Revision of Federal Facility Agreement Document Schedule	SS04703363 - SS04703364
03-Jan-13	ADEC Letter Approving the Draft Final Feasibility Study	SS04703365 - SS04703365
23-Jan-13	USEPA Letter Approving the Draft Final Feasibility Study	SS04703366 - SS04703366
01-Feb-13	Feasibility Study	SS04703367 - SS04703570
01-Feb-13	Feasibility Study, App A, Assessment of Analytical Results	SS04703571 - SS04703596
01-Feb-13	Feasibility Study, App B, Project Cleanup Level Criteria	SS04703597 - SS04703615
01-Feb-13	Feasibility Study, App C, Agency Review Comments	SS04703616 - SS04703656
17-Apr-95	US Army Memorandum Concerning Legacy Project Status Report for Nike Site Summit	SS04703657 - SS04703658
01-Oct-95	NFRAP DD for USTs 113 & T39-225 at Bldg 39-225 (Lower Site Summit)	SS04703659 - SS04703663
01-Oct-95	NFRAP DD for UST 58 at Bldg 39-600 (Upper Site Summit)	SS04703664 - SS04703667
01-Apr-96	Background Data Analysis Report, Fort Richardson, AK	SS04703668 - SS04703759
01-Apr-96	Background Data Analysis Report, Appendix A, Output from ANOVA on Unedited Data Sets	SS04703760 - SS04703764

Date	Title	Document ID
01-Apr-96	Background Data Analysis Report, Appendix B, Output from ANOVA on Final Background Data Sets	SS04703765 - SS04703771
01-Apr-96	Background Data Analysis Report, Appendix C, Probability Plots of Non-Log Transformed Soil Data	SS04703772 - SS04703787
12-Jul-96	US Army Memorandum to State of Alaska Department of Natural Resources	SS04703788 - SS04703791
16-Jul-96	ADNR Letter to Base Concurring with Nike Site Summit Environmental Clean-up	SS04703792 - SS04703792
26-Sep-97	Photos of Nike Site Summit Taken By Dowl Engineers (KJK)	SS04703793 - SS04703817
07-Oct-97	Photos of Nike Site Summit with Some Handwritten Notes from Dowl Engineers (KJK)	SS04703818 - SS04703827
01-Oct-98	Conceptual Site Model Draft, Former Nike Missile Site & Former "Opportunity Strikes" Site Summit	SS04703828 - SS04703885
12-Nov-99	US Army Memorandum Concerning Conceptual Site Model/Site Summit Risk Assessment	SS04703886 - SS04703898
01-Feb-00	Site Summit Sampling and Analysis Plan	SS04703899 - SS04704076
01-Feb-00	Site Summit SAP, Appendix A Parameters and Associatesd Quantitation/Detection Limits	SS04704077 - SS04704117
30-May-10	Response to ADEC's Comments on Pre-draft RI/FS and Baseline Risk Assessment Work Plan	SS04704118 - SS04704147
11-Jun-10	MWH Email to Base Concerning Lead Scavenger Laboratory Results	SS04704148 - SS04704149
21-Jun-10	ADEC Letter to USAF Concerning Comments on Pre-draft RI/FS and Baseline Risk Assessment Work Plan	SS04704150 - SS04704169
27-Jul-10	ADEC Email to USAF Concerning Unacceptable Response to Comments on Pre-draft RI/FS Work Plan	SS04704170 - SS04704173
17-Aug-10	ADEC Memorandum Approving Nike Site Summit RI/FS Work Plan (Aug 2010)	SS04704174 - SS04704174
16-Feb-11	MWH Technical Memorandum to US Army Concerning Groundwater Use Determination for Nike Site Summit	SS04704175 - SS04704179
01-Jul-11	USEPA Comments on Draft Nike Site Summit RFI	SS04704180 - SS04704182
28-Jul-11	ADEC Letter to USAF Concerning Comments on Draft Nike Site Summit Remedial Field Investigation	SS04704183 - SS04704187
28-Jul-11	USAF Email to ADEC Concerning Nike Site Summit Draft Analytical Data Report Errors	SS04704188 - SS04704189
03-Jan-13	ADEC letter to USAF Approving the Nike Site Summit Feasibility Study (FS)	SS04704190 - SS04704190
09-May-13	USEPA Letter to USAF Comments on Draft Nike Site Summit Proposed Plan	SS04704191 - SS04704194
10-May-13	ADEC Letter to USAF Concerning Comments on Draft Nike Summit Proposed Plan	SS04704195 - SS04704198
27-Jun-13	Proposed Cleanup Levels Set to Limit of Quantitation for Selected Analytes, SS047	SS04704199 - SS04704201
01-Jul-13	Proposed Plan Nike Site Summit	SS04704202 - SS04704223
17-Jul-13	Public Comment Period on Proposed Plan	SS04704224 - SS04704224
16-Aug-13	Friends of Nikes Site Summit Letter to USAF Concerning Comments on Proposed Plan	SS04704225 - SS04704226
06-Jan-14	ADEC Letter to USAF Concerning Comments on Draft SS047 ROD	SS04704227 - SS04704252
11-Feb-14	MWH Letter to USAF Concerning Revised Cost Estimates for SS047 ROD	SS04704253 - SS04704256
15-Feb-14	UFP-QAPP Worksheet #15 for RI/FS and Baseline Risk Assessment Work Plan	SS04704257 - SS04704257
19-Mar-14	USAF Response to EPA Comments on Draft SS047 ROD	SS04704258 - SS04704306

Date	Title	Document ID
19-Mar-14	USAF Responses to ADEC Comments on Draft SS047 ROD	SS04704307 - SS04704332
23-Apr-14	JBER Telephone Meeting Minutes Concerning Nike Site Summit,(SS047) ROD Changes Follow-up Discussion	SS04704333 - SS04704334
23-May-14	MWH Groundwater Determination at Lower Site Summit Technical Memorandum	SS04704335 - SS04704345
06-Jan-13	ADEC Comments on Draft Record of Decision, SS047, Nov 2013	SS04704346 - SS04704371
23-Jan-13	EPA Approval of Draft Final Feasibilty Study, Dec 2012	SS04704372 - SS04704372
01-Aug-13	Nike Site Summit Proposed Plan Public Meeting Transcript	SS04704373 - SS04704419
03-Apr-14	E-mail RE: RTCs Draft Record of Decision, EPA Draft List of Issues	SS04704420 - SS04704424
03-Apr-14	EPA Initial Issues and Comments on the RTCs for Draft ROD, Nov 2013	SS04704425 - SS04704427
14-Apr-14	E-mail RE: ADEC List of Issues on RTCs for Nike Site Summit Record of Decision	SS04704428 - SS04704441
16-Apr-14	E-mail RE: EPA Comments on the LUCs for Nike Summit Draft Final Record of Decision	SS04704442 - SS04704447
16-May-14	E-mail RE: EPA's Groundwater Policy for Superfund Program	SS04704448 - SS04704451
20-May-14	Informal Dispute Meeting Agenda, Tables and Figures, May 20, 2014	SS04704452 - SS04704468
23-May-14	Groundwater Detemination at Lower Site Summit, SS047	SS04704469 - SS04704479
16-Jun-14	Support for Groundwater Insufficiency Determination at Lower Site Summit	SS04704480 - SS04704481
29-Jul-15	Informal Dispute Resolution Memorandum	SS04704482 - SS04704484
09-Dec-14	Scoping Meeting with EPA & ADEC to Discuss the Proposed Format of the Supplemental Feasibility Study	SS04704485 - SS04704486
05-Mar-15	ADEC Comments on Draft Supplement Feasibity Study, Dated Feb 2015	SS04704487 - SS04704493
27-Apr-15	Response to ADEC Comments on Draft Supplemental Feasiblity Study, Feb 2015	SS04704494 - SS04704498
27-Apr-15	Responses to EPA Comments on Draft Supplemental Feasibility Study, Feb 2015	SS04704499 - SS04704517
01-May-15	Supplemental Feasibility Study	SS04704518 - SS04704639
12-May-15	Supplemental Feasibility Study, App A: Groundwater Determination at Lower Site Summit	SS04704640 - SS04704655
01-May-15	Supplemental Feasibility Study, App B: EPA Memo, Support for Groundwater Insufficiency Determination	SS04704656 - SS04704658
01-May-15	Supplemental Feasibility Study, App C, Assessment of Analytical Results at SS047	SS04704659 - SS04704677
01-May-15	Supplemental Feasibility Study, App D: Analytes Evaluated by Media and Location	SS04704678 - SS04704685
01-Oct-16	Proposed Plan for Remedial Action	SS04704686 - SS04704706
02-Oct-16	Alaska Dispatch News Notice of Public Meeting	SS04704707 - SS04704708
03-Oct-16	Chugiak Eagle River Star Notice of Public Meeting	SS04704709 - SS04704710
03-Oct-16	Anchorage Press Newspaper Notice of Public Meeting	SS04704711 - SS04704712
19-Oct-16	Proposed Plan Public Meeting Transcript	SS04704713 - SS04704757