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FEASIBILITY STUDY

DRIFTWOOD BAY RADIO RELAY STATION
UNALASKA ISLAND, ALASKA

FINAL
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APPENDIX A Applicable or Relevant and Appropriate Requirements
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ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ARAR	applicable or relevant and appropriate requirement
AST	aboveground storage tank
BBA	Burned Battery Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	contaminant of potential concern
cy	cubic yards
dBA	A-weighted decibels
DEW	Distant Early Warning
DRO	diesel-range organics
EPA	U.S. Environmental Protection Agency
FRTR	Federal Remediation Technologies Roundtable
FS	Feasibility Study
HAZWOPER	Hazardous Waste Operations and Emergency Response
HODS	Halogenated Organic Destruction System
ICs	institutional controls
LTM	long-term monitoring
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	monitored natural attenuation
NA	not applicable
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operations and maintenance
OSHA	Occupational Safety and Health Administration
PA/SI	Preliminary Assessment/Site Investigation
PCB	polychlorinated biphenyl
POL	petroleum, oil, and lubricants

ACRONYMS AND ABBREVIATIONS (Continued)

ppm	parts per million
RA	Risk Assessment
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RAO	remedial action objective
RRO	residual-range organics
RRS	Radio Relay Station
SARA	Superfund Amendments and Reauthorization Act
SC	site characterization
SWPPP	Storm Water Pollution Prevention Plan
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
USAF	U.S. Air Force
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
VOC	volatile organic compound
°C	degrees Celsius
°F	degrees Fahrenheit

EXECUTIVE SUMMARY

This Feasibility Study (FS) evaluates potential remedial technologies to address lead and polychlorinated biphenyl (PCB) contamination at the Driftwood Bay Radio Relay Station (RRS). Selected technologies were used as the building blocks to develop remedial alternatives for the areas of concern at the Driftwood Bay RRS, which include the following sites:

- BBA: Burned Battery Area (BBA)
- LF006: Old Disposal Site and Electronic Debris Area
- OT001: Former Composite Building

The alternatives were screened for effectiveness, implementability, and cost. Each alternative showing promise was subjected to detailed analysis based on the threshold and primary balancing criteria established under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (Code of Federal Regulations [CFR], Title 40, Chapter 300). The threshold criteria are:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARAR)

The primary balancing criteria are:

- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Each alternative was assigned a “pass” or “fail” rating for the threshold criteria. A rating of one to five was assigned for each primary balancing criteria (except cost), with five being the highest score. Following receipt of comments on the Proposed Plan, the alternatives will be further evaluated based on the modifying criteria:

- State acceptance
- Community acceptance

The evaluation of modifying criteria will then be documented in the Decision Documents for the Driftwood Bay RRS sites.

Table ES-1 summarizes the BBA alternatives presented for consideration. Costs provided assume work will be performed in 2011 and represent remediation of lead-contaminated soil from this site. Cost estimates presented in this document are strictly intended for comparison of alternatives.

Table ES-1
Summary of Retained Alternatives for Lead-Contaminated Soil at the BBA

Alternative	Description	Key Assumptions	Advantages	Disadvantages	Cost Estimate
1	No Action	-No Action Planned	-Easy to Implement -No Cost	-Not Protective	$0
2	Chemical Stabilization and Institutional Controls	-Administrative Controls Effective for Maintaining Current Land Use	-Easy to Implement -Low Cost	-Limited Effectiveness _-Institutional Controls Required	$356K
3	Removal and Offsite Disposal	-RCRA and Non-RCRA Lead Removed	-Highly Effective	-Difficult to Implement -Higher Cost	$872K
4	Chemical Stabilization and Offsite Disposal	-No lead is RCRA Waste After Treatment	-Highly Effective	-Difficult to Implement -Higher Cost	$898K
5	Chemical Stabilization and Onsite Disposal	-Soil Capped in Place	-Effective and Moderate Cost	-Requires Maintenance _-Institutional Controls Required	$766K

Notes: For definitions, see the Acronyms and Abbreviations section.

Because of simple implementation, low cost, and effectiveness, BBA Alternative 2, Chemical Stabilization and Institutional Controls, is recommended.

Table ES-2 summarizes the Site LF006 alternatives presented for consideration. Costs provided assume work will be performed in 2011 and represent remediation of lead-contaminated soil from this site.

Table ES-2
Summary of Retained Alternatives for Lead-Contaminated Soil at Site LF006

Alternative	Description	Key Assumptions	Advantages	Disadvantages	Cost Estimate
1	No Action	-No Action Planned	-Easy to Implement -No Cost	-Not Protective	$0
2	Chemical Stabilization and Institutional Controls	-Fence Needed to Restrict Access	-Easy to Implement -Low Cost	-Not Effective if Controls Do Not Work	$446K
3	Removal and Offsite Disposal	-RCRA and Non-RCRA Lead Removed	-Highly Effective	-Difficult to Implement -Higher Cost	$1.0 M
4	Chemical Stabilization and Offsite Disposal	-No lead is RCRA Waste After Treatment	-Highly Effective	-Difficult to Implement -Higher Cost	$1.1 M
5	Chemical Stabilization and Onsite Disposal	-Soil Capped in Place	-Effective and Moderate Cost	-Requires Maintenance and Institutional Controls	$719K

Note: For definitions, see the Acronyms and Abbreviations section.

Because of the high effectiveness and the ability to eventually relinquish the land, LF006 Alternative 4, Removal and Offsite Disposal, is recommended.

Table ES-3 summarizes the Site OT001 alternatives presented for consideration. Costs provided assume work will be performed in 2011 and represent remediation of PCB-contaminated soil from this site.

Table ES-3
Summary of Retained Alternatives for PCB-Contaminated Soil at Site OT001

Alternative	Description	Key Assumptions	Advantages	Disadvantages	Cost Estimate
1	No Action	-No Action Planned	-Easy to Implement -No Cost	-Not Protective	$0
2	Institutional Controls	-Administrative Controls Effective for Maintaining Current Land Use	-Easy to Implement -Low Cost	-Limited Effectiveness -Maintenance of Controls Required	$230K
3	Removal and Offsite Disposal	-All PCBs Removed	-Highly Effective	-Difficult to Implement -Higher Cost	$1.36M
4	Removal and Onsite Disposal	-PCBs Covered in Place	-Effective -Moderate Cost	-Requires Maintenance and Institutional Controls	$760K

Note: For definitions, see the Acronyms and Abbreviations section.

Because of relatively simple implementation, cost, and effectiveness, OT001 Alternative 2, Institutional Controls, is recommended.

The remedial action objective (RAO) developed for Sites BBA and LF006 is to prevent inhalation or direct contact of contaminants in soil containing lead in excess of 400 milligrams per kilogram (mg/kg). The following alternatives were developed to address lead-contaminated soil at Sites BBA and LF006:

- Alternative 1: No Action
- Alternative 2: Chemical Stabilization and Institutional Controls
- Alternative 3: Removal and Offsite Disposal
- Alternative 4: Chemical Stabilization and Offsite Disposal
- Alternative 5: Chemical Stabilization and Onsite Disposal

All alternatives were retained for detailed analysis. All were found to comply with threshold criteria, but had differing effectiveness, implementability, and cost limitations.

The RAO developed for Site OT001 is to prevent inhalation or direct contact of contaminants in soil containing PCBs in excess of 1 mg/kg. The following alternatives were developed to address PCB-contaminated soil at Site OT001:

- Alternative 1: No Action
- Alternative 2: Institutional Controls
- Alternative 3: Removal and Offsite Disposal
- Alternative 4: Onsite Disposal with Institutional Controls
- Alternative 5: Onsite Rotary Low-Temperature Thermal Desorption
- Alternative 6: Halogenated Organic Destruction System (HODS)

OT001 Alternatives 1, 2, 3 and 4 were retained for detailed analysis. OT001 Alternative 1 would not comply with ARARs or protect human health and the environment. OT001 Alternatives 2, 3, and 4 were found to comply with threshold criteria. OT001 Alternative 2 would be easiest to implement and cost the least, while OT001 Alternatives 3, 4, 5 and 6 had implementability and cost limitations.

State Regulated Sites/Areas

Based on results from previous investigations, the following sites are recommended to be designated "Cleanup Complete:"

- HESA: Heavy Equipment Storage Area
- SS004: Spill/Leak No. 4
- SS008: Spill/Leak No. 8
- SS005: Spill/Leak No. 5 MOGas at the runway
- SS011: Spill/Leak No. 11 at Runway Lighting Vault
- FL009: Spill/Leak No. 1 at the Septic Tank
- Quarry Area

The following sites are recommended to be designated "Cleanup Complete" once institutional controls are established:

- OT001: Antennas and Tanks
- WP003: Petroleum, oil, and lubricant (POL) Waste Pit at the Former Composite Building
- SS010: Spill Leak No. 2 at the Former Water Supply Pumphouse

Site SS007: Spill/Leak No. 7 is recommended for Monitored Natural Attenuation with institutional controls.

These sites will not be discussed in the FS because no hazardous substances regulated under CERCLA exist at levels hazardous to human health and the environment.

Additional Work

Following final approval of this FS, the U.S. Air Force (USAF) will issue a Proposed Plan for Driftwood Bay RRS. The alternatives included in the Proposed Plan will be based on the evaluation performed in this FS. Comments on the Proposed Plan will be solicited from the community and state, then remedies will be selected for each of the sites. The selected remedies will be recorded in the Decision Documents for each site.

1.0 INTRODUCTION

This draft Feasibility Study (FS) presents and evaluates remedial alternatives for the Driftwood Bay Radio Relay Station (RRS). This FS is part of continuing efforts by the U.S. Air Force (USAF) to address contamination at the facility.

Driftwood Bay RRS is divided into 14 sites, as detailed in the *2009 Site Characterization (SC) and Remedial Investigation (RI) Reports* (USAF 2009a,b). These include:

- OT001: Former Composite Building
- OT001: Antennas and Tanks
- WP003: Petroleum Oil and Lubricant (POL) Waste Pit at the Former Composite Building
- SS004: Spill/Leak No. 4
- SS005: Spill/Leak No. 5 MOGas at the runway.
- LF006: Old Disposal Site and Electronic Debris Area
- SS007: Spill/Leak No. 7
- SS008: Spill/Leak No. 8
- FL009: Spill/Leak No. 1 at the Septic Tank
- SS010: Spill Leak No. 2 at the Former Water Supply Pumphouse
- SS011: Spill/Leak No. 11 at Runway Lighting Vault
- BBA: Burned Battery Area (BBA)
- HESA: Heavy Equipment Storage Area
- Quarry Area

The following sites have no concentrations of hazardous substances in excess of risk-based cleanup levels, or contain only fuel contamination and are not considered in this FS.

- OT001: Antennas and Tanks
- WP003: POL Waste Pit at the Former Composite Building
- SS004: Spill/Leak No. 4
- SS005: Spill/Leak No. 5 MOGas at the runway
- SS007: Spill/Leak No. 7

- SS008: Spill/Leak No. 8
- FL009: Spill/Leak No. 1 at the Septic Tank
- SS010: Spill Leak No. 2 at the Former Water Supply Pumphouse
- SS011: Spill/Leak No. 11 at Runway Lighting Vault
- HESA: Heavy Equipment Storage Area
- Quarry Area

As outlined in the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) [Code of Federal Regulations (CFR Title 40, Part 300.430(e)], the objective of this FS is to develop and evaluate remedial alternatives so appropriate remedies can be selected for the sites. Specific goals of this document are to:

- Formulate site-specific remedial action objectives (RAOs);
- Identify applicable technologies based on contaminant distribution, concentration, and site conditions;
- Screen the identified technologies based on effectiveness, implementability, and cost;
- Use technologies that pass screening to develop alternatives that eliminate, control, and/or reduce risk; and
- Evaluate each alternative that passes screening against the following seven NCP criteria:
    - Protection of human health and the environment
    - Compliance with applicable or relevant and appropriate requirements (ARARs)
    - Long-term effectiveness and permanence
    - Reduction of toxicity, mobility, or volume through treatment
    - Short-term effectiveness
    - Implementability
    - Cost
- Present a comparative analysis to determine the relative performance of the alternatives.

This FS Report is organized as follows:

- Section 1.0 presents the introduction and summary of contaminants.
- Section 2.0 presents the technical approach and development and identification of remedial actions and technologies.
- Section 3.0 presents the development of remedial objectives and general response actions for each area.
- Section 4.0 presents identification and screening of remedial technologies.
- Section 5.0 presents the development, screening, and detailed analysis of remedial alternatives for the BBA.
- Section 6.0 presents the development, screening, and detailed analysis of remedial alternatives at Site LF006.
- Section 7.0 presents the development, screening, and detailed analysis of remedial alternatives at Site OT001.
- Section 8.0 summarizes the document and presents conclusions.
- Section 9.0 presents information on the documents referenced in this report.
- Appendix A presents ARARs.
- Appendix B contains cost estimates.

1.1 SITE HISTORY

Driftwood Bay RRS was initially one of 18 Distant Early Warning (DEW) Line stations constructed in Alaska between 1950 and 1959. Driftwood Bay RRS was made operational in 1961 to provide reliable communications for the DEW Line. Originally known as White Alice Communications Systems facilities, these facilities were redesignated by the Alaska Air Command as RRSs in 1969. In 1977, Driftwood Bay RRS was deactivated; in 1991, all facility buildings and structures, with the exception of concrete building foundations and portions of the fuel pipeline, were demolished or removed (USAF 1998). A 3,500-foot dirt runway is still present at the Lower Camp portion of the facility. As part of the demolition in 1991, a permitted landfill was developed to contain building debris and asbestos.

Dutch Harbor, the closest community to Driftwood Bay RRS, is located approximately 13.5 air miles to the southeast (Figure 1-1 and 1-2). No residents live within 4 miles of the former facility. USAF currently holds most of the land under a Public Land Order. Land surrounding the facility is part of the Alaska Maritime National Wildlife Refuge and is managed by the U.S Fish and Wildlife Service (USAF 2005). Land outside the Public Land Order includes Site LF006.

1.1.1 BBA Site History

The BBA was discovered in 2005 during an investigation of Site WP003 (POL Waste Pit). This area was estimated to be approximately 15 to 20 feet in diameter and contained evidence of more than 12 burned batteries (Figure 1-3). The size of the batteries could not be determined; however, field observations indicated that most were likely at least 12-volts in size. One soil sample was collected during this investigation and analyzed for diesel-range organics (DRO), residual-range organics (RRO), lead, arsenic, and polychlorinated biphenyls (PCBs). Only lead exceeded the cleanup levels (400 milligrams per kilogram [mg/kg]) with a sample result of 76,600 mg/kg (USAF 2005).

1.1.2 LF006 Site History

The electronic debris area at Site LF006 was discovered during 2007 site characterization activities (Figures 1-4 and 1-5). A pile of electronic debris (capacitors, transformers and batteries) was found in the southern portion of this area of concern. An area devoid of vegetation (previously called Lima Bean Area or Distressed Area) with several lead battery plates was found nearby. Contaminants of potential concern (COPCs) for this site include lead and PCBs. Niton field screening and analytical results for lead from this area indicated surficial lead contamination. PCB soil analytical results collected from the southern portion were below the Alaska Department of Conservation (ADEC) Method Two cleanup level of 1 mg/kg, with a maximum detected concentration of 0.167 mg/kg (USAF 2009b). Five batteries and more than 30 capacitors and audio transformers were removed from this site during the RI.

1.1.3 OT001 Site History

The Former Composite Building is located approximately 2 miles west of Driftwood Bay and connected to Lower Camp by a winding 4-mile road (Figure 1-6). This site included the composite building, antennas, two 20,000-gallon underground storage tanks (UST), and a 110-gallon aboveground storage tank (AST), among others structures. Foundations of the Former Composite Building and antenna arrays are currently in place though the primary structures have been removed. Site characterization work began in 1985 and initially indicated that PCBs were present in surface soil. All structures were demolished in 1991 along with the removal of one 20,000-gallon UST. A Preliminary Assessment/Site Investigation (PA/SI) was conducted in 1995 that indicated that PCBs and volatile organic compounds (VOCs) were present at the site.

1.2 SUMMARY OF ENVIRONMENTAL CONTAMINATION

This section summarizes types of contamination measured during the SC and RI at concentrations above regulatory cleanup level standards and presents estimated volumes of contaminated material. More detailed contaminant data can be found in the SC and RI Reports (USAF 2009a,b).

1.2.1 Soil Contamination

For the sites addressed in this FS, contaminants of concern (COC) in soil at Driftwood Bay RRS are lead and PCBs. Soil COCs and their applicable exposure pathways can be found in the conceptual site models and site-specific tables (USAF 2009, Section 2.0).

Table 1-1 presents estimated volumes of contaminated soil for development of remedial alternative cost estimates. The affected volume of soil was measured using ADEC Method Two cleanup criteria. Figure 1-1 presents the locations of these sites.

Table 1-1
Estimated Volume of Soil with COC Concentrations Above the Site Cleanup Level

Site ID	Site Name	COCs	Affected Volume of Soil
BBA	Burned Battery Area	Lead	93 CY
LF006	Former Disposal Area and Electronic Debris Area	Lead	230 CY
OT001	Former Composite Building	PCBs	320 CY

Note: For definitions, see the Acronyms and Abbreviations section.

At Site BBA, lead-contaminated soil is located in a single centralized area surrounding a former location of burned batteries. This area measures approximately 50 feet by 50 feet and extends an estimated 1 foot below ground surface (bgs) (Figure 1-3).

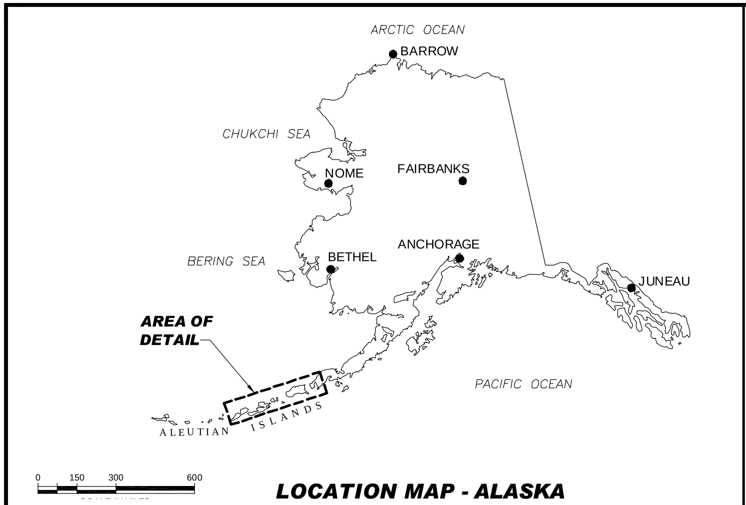
At Site LF006, two distinct lead-contaminated soil locations exist. To the north, a distressed area (previously called the lima bean area) is approximately 75 feet by 25 feet and extends an estimated 3 feet bgs (Figure 1-4). To the south, an area previously surrounding a large battery measures approximately 20 feet by 15 feet and extends an estimated 2 feet bgs (Figure 1-5).

At Site OT001, PCB-contaminated soil was found at the north-east and south edges of the Former Composite Building foundation. The northeast location measures approximately 90 feet by 65 feet and extends to a depth of approximately 1 foot bgs. The southern location is approximately 55 feet by 50 feet, and also extends to a depth of approximately 1 foot bgs (Figure 1-6).

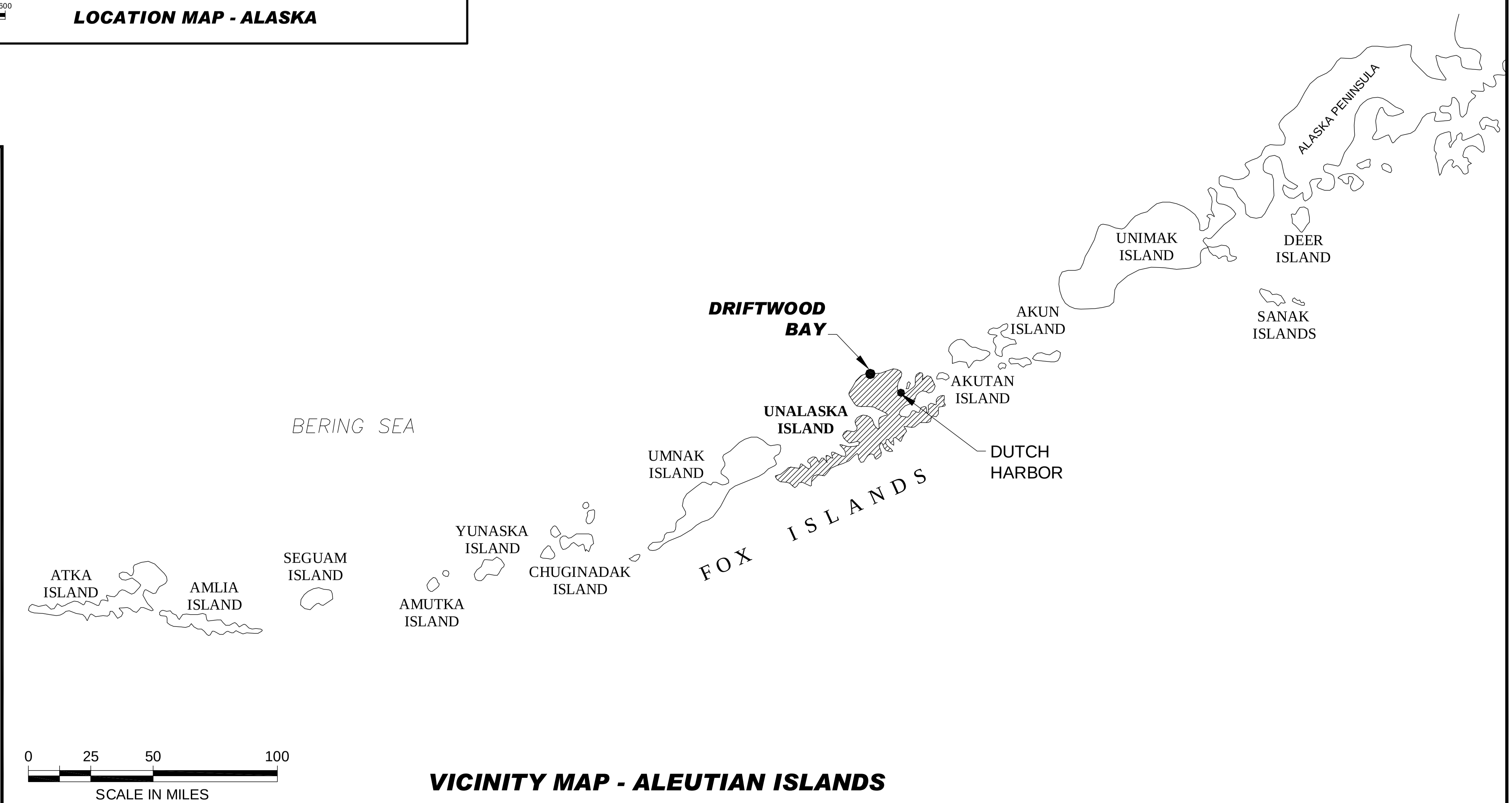
1.2.2 Groundwater Contamination

Groundwater was not encountered during SC at Sites BBA and OT001. Groundwater encountered at Site LF006 was not impacted by site contamination; therefore, groundwater contamination is not addressed in this FS.

G:\Autocad\Driftwood Bay\05PC8101\2010 Feasibility Study\Fig 1-1 AK Location.dwg Nov 12,2010 -tiedemam



LOCATION MAP - ALASKA



VICINITY MAP - ALEUTIAN ISLANDS

DRIFTWOOD BAY SITE LOCATION
AND VICINITY MAP

UNALASKA ISLAND, ALASKA

JACOBS	DATE: 12 November 2010	PROJECT MANAGER: D. Anderson	FIGURE NO.: 1-1

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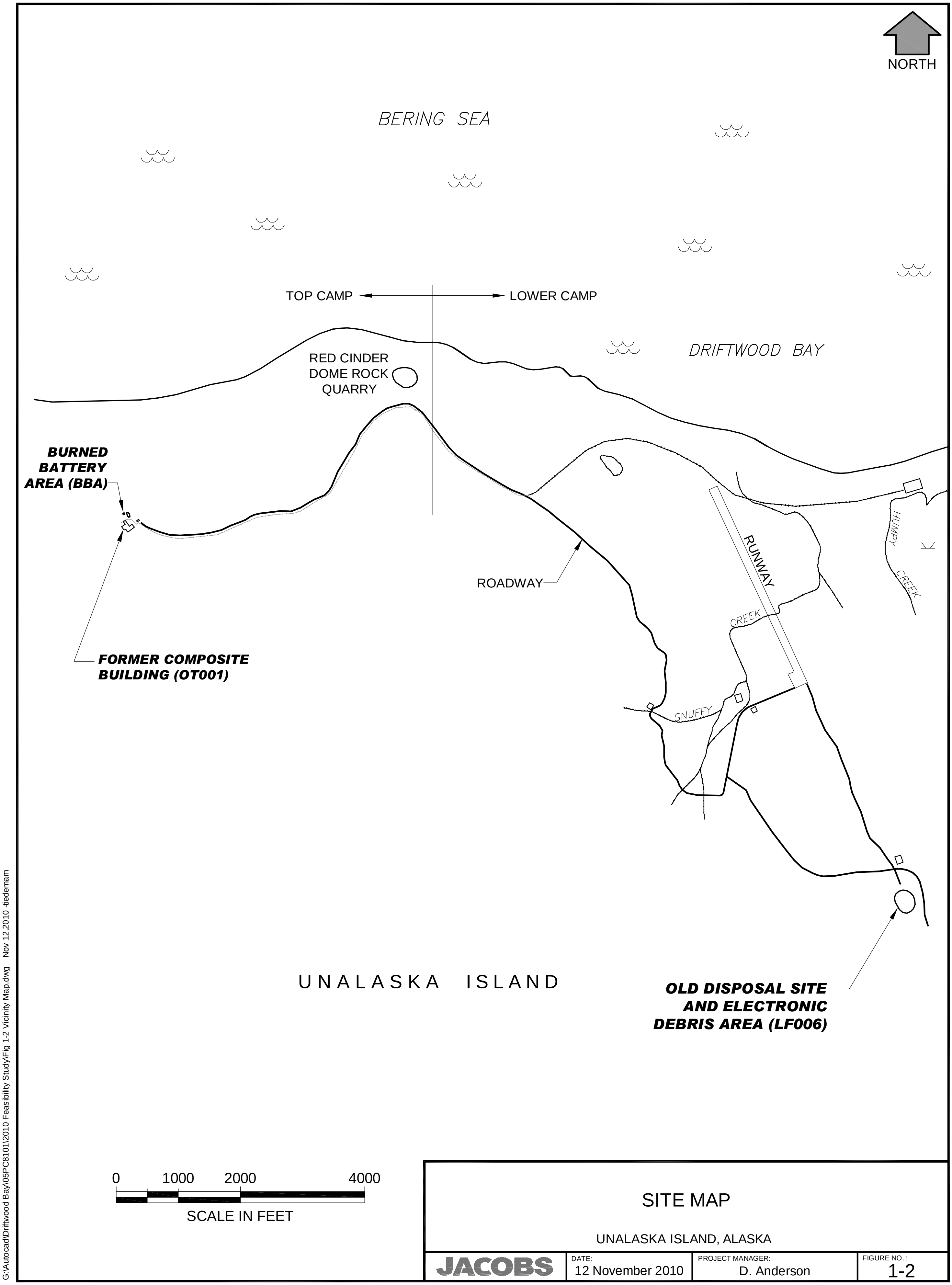
NORTH
BERING SEA
TOP CAMP
LOWER CAMP
DRIFTWOOD BAY
RED CINDER DOME ROCK QUARRY
BURNED BATTERY AREA (BBA)
ROADWAY
RUNWAY
CREEK
HUMPY CREEK
SNUFFY
FORMER COMPOSITE BUILDING (OT001)
UNALASKA ISLAND
OLD DISPOSAL SITE AND ELECTRONIC DEBRIS AREA (LF006)
0 1000 2000 4000
SCALE IN FEET
SITE MAP
UNALASKA ISLAND, ALASKA
JACOBS
DATE: 12 November 2010
PROJECT MANAGER: D. Anderson
FIGURE NO.: 1-2
G:\Autocad\Driftwood Bay\05PC8101\2010 Feasibility Study\Fig 1-2 Vicinity Map.dwg Nov 12,2010 -tiedemam

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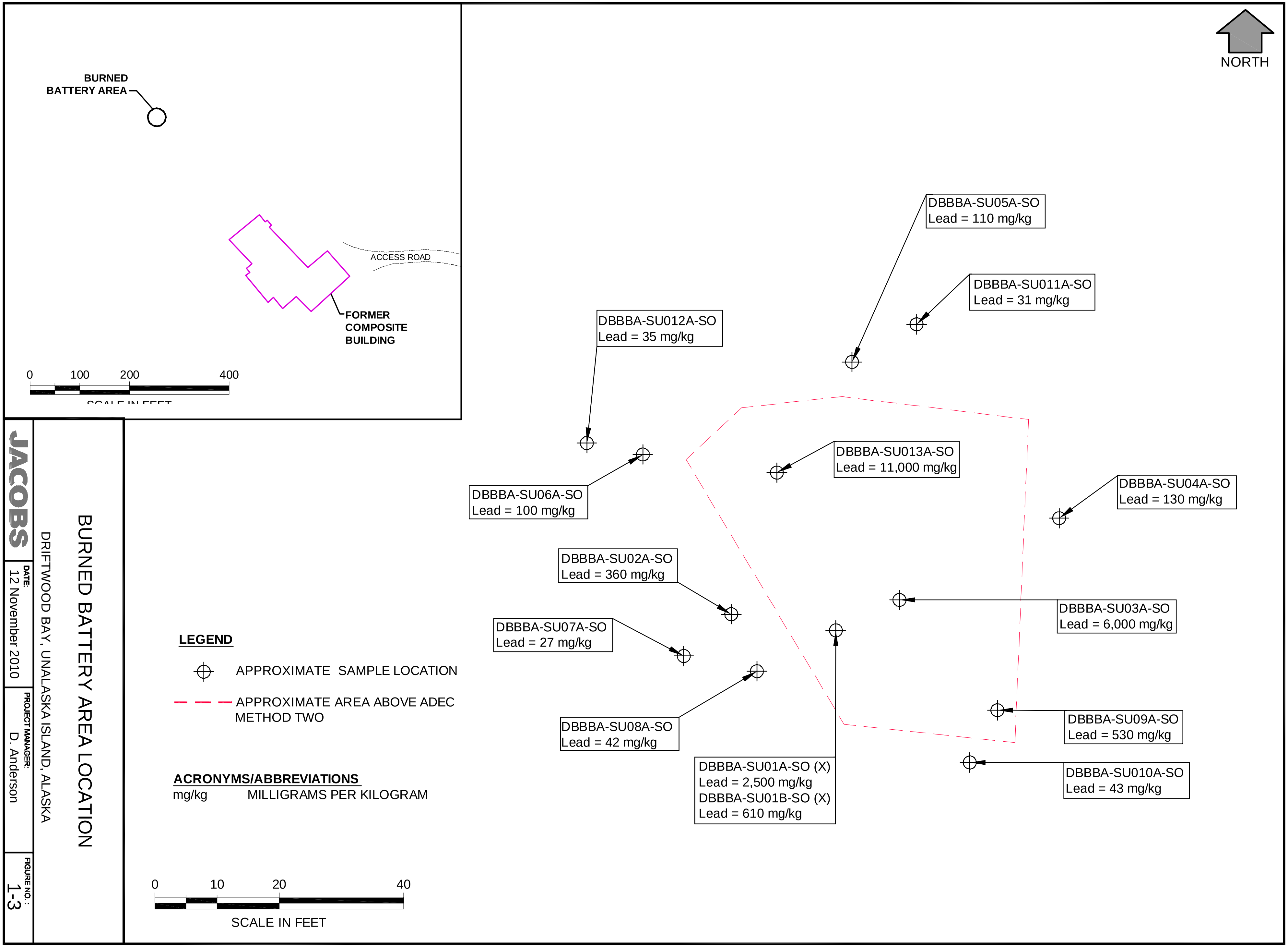
G:\Autocad\Driftwood Bay\05PC8101\2010 Feasibility Study\Fig 1-3 BBA Samples-Results.dwg Letter Landscape 12 Nov,2010 -tiedemam



BURNED BATTERY AREA LOCATION

DRIFTWOOD BAY, UNALASKA ISLAND, ALASKA

JACOBS	DATE: 12 November 2010	PROJECT MANAGER: D. Anderson	FIGURE NO.: 1-3

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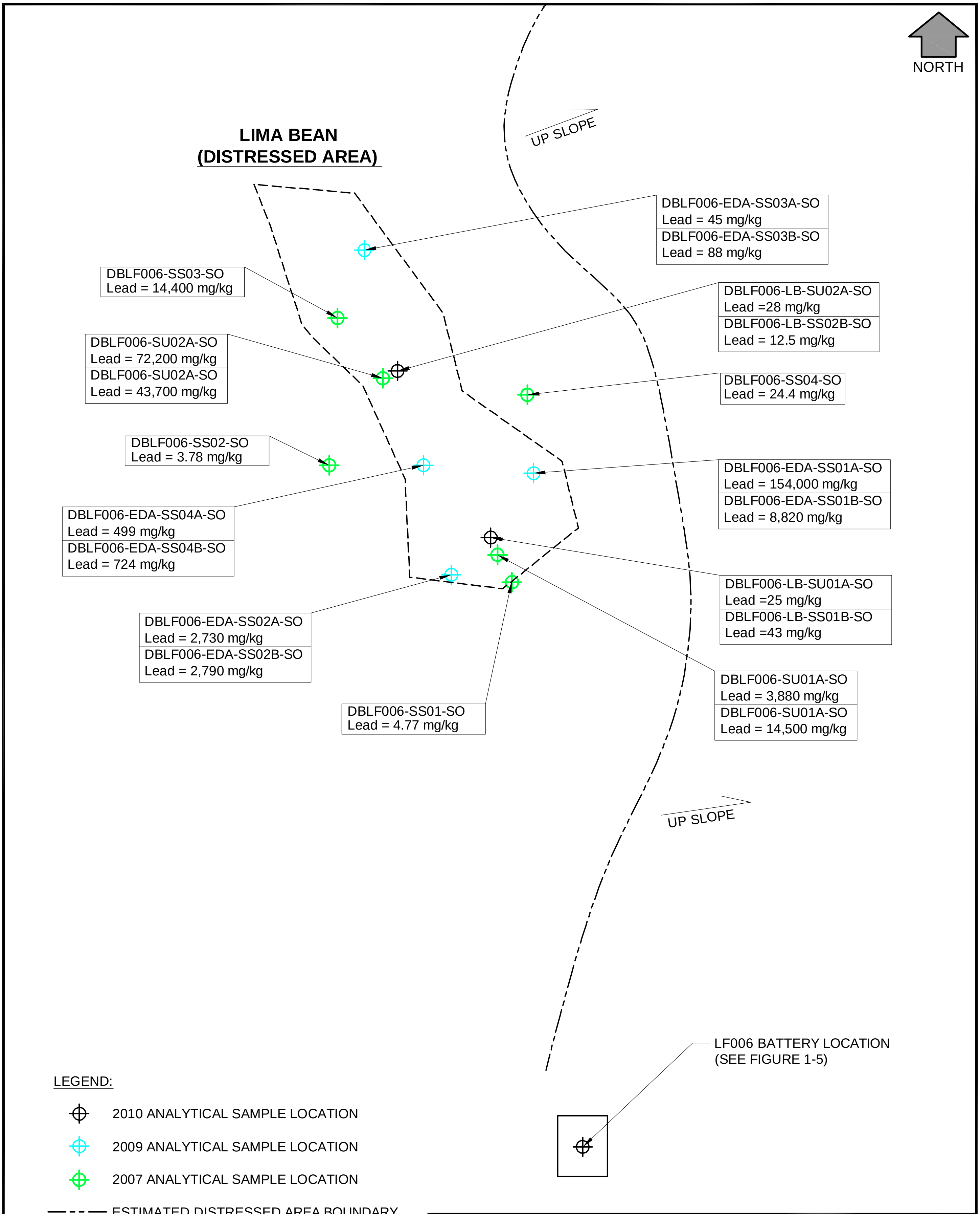

G:\Autocad\Driftwood Bay\05PC8101\2010 Feasibility Study\Fig 1-4 Electronic Debris Area.dwg Fig 2 Electronic Debris Area 12 Nov,2010 -tiedemam

SITE LF006 OLD DISPOSAL SITE AND ELECTRONIC DEBRIS AREA

DRIFTWOOD BAY, UNALASKA ISLAND, ALASKA

JACOBS	DATE: 12 November 2010	PROJECT MANAGER: D. Anderson	FIGURE NO.: 1-4

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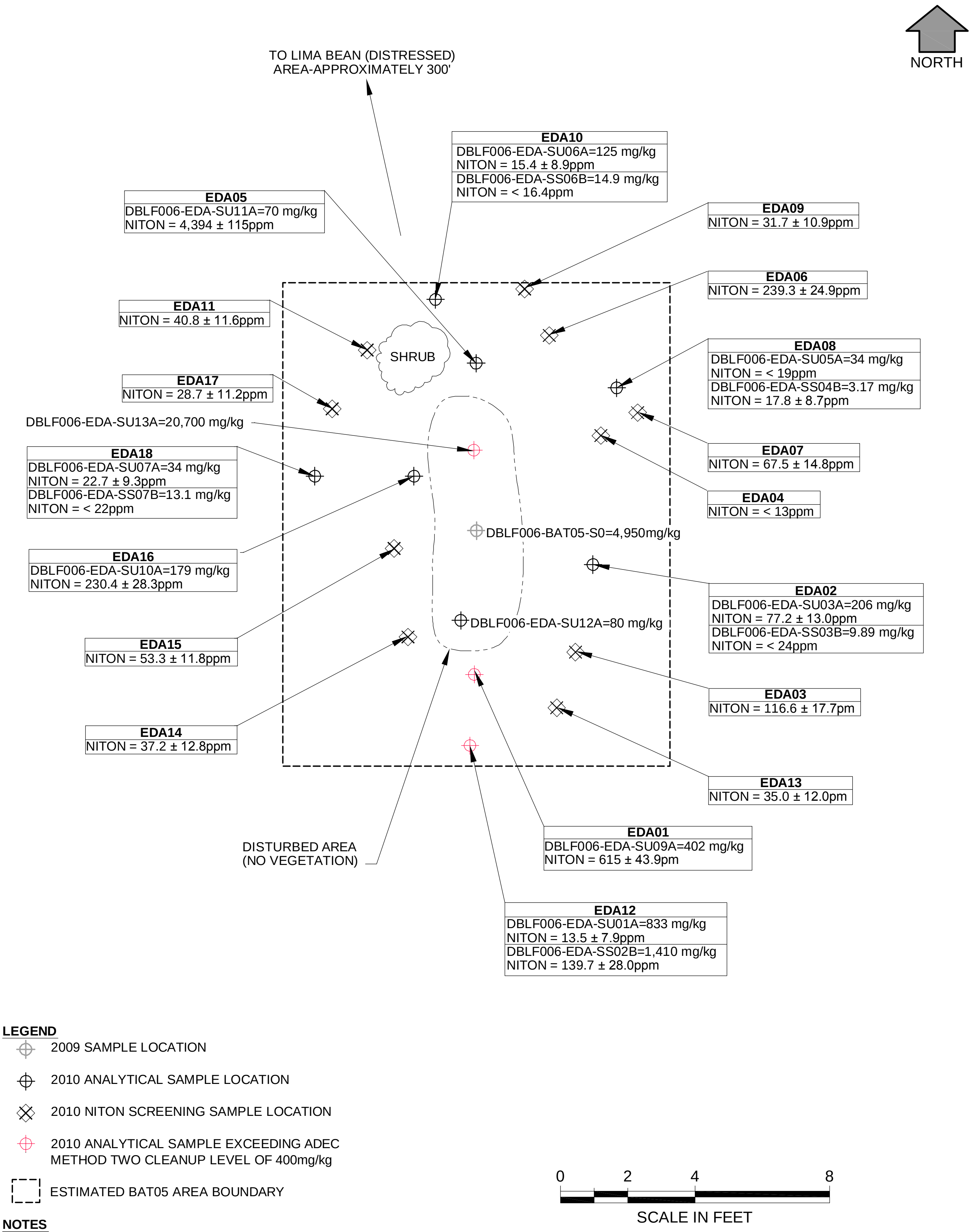

NOTES

1. THE HIGHER RESULT FROM EACH DUPLICATE PAIR IS PRESENTED.
2. mg/kg = MILLIGRAMS PER KILOGRAM
   ppm = PARTS PER MILLION
   SU = SURFACE SAMPLE COLLECTED AT 6" BELOW GROUND SURFACE
   SS = SUBSURFACE SAMPLE COLLECTED AT 1' BELOW GROUND SURFACE

SITE LF006 BATTERY LOCATION

DRIFTWOOD BAY, UNALASKA ISLAND, ALASKA

JACOBS

DATE:	PROJECT MANAGER:	FIGURE NO.:
12 November 2010	D. Anderson	1-5

G:\Autocad\Driftwood Bay\05PC8101\2010 Feasibility Study\Fig 1-5 BBA and Lead Results.dwg Fig 3-Heavy Equip Site 12 Nov.2010 -tiedemam

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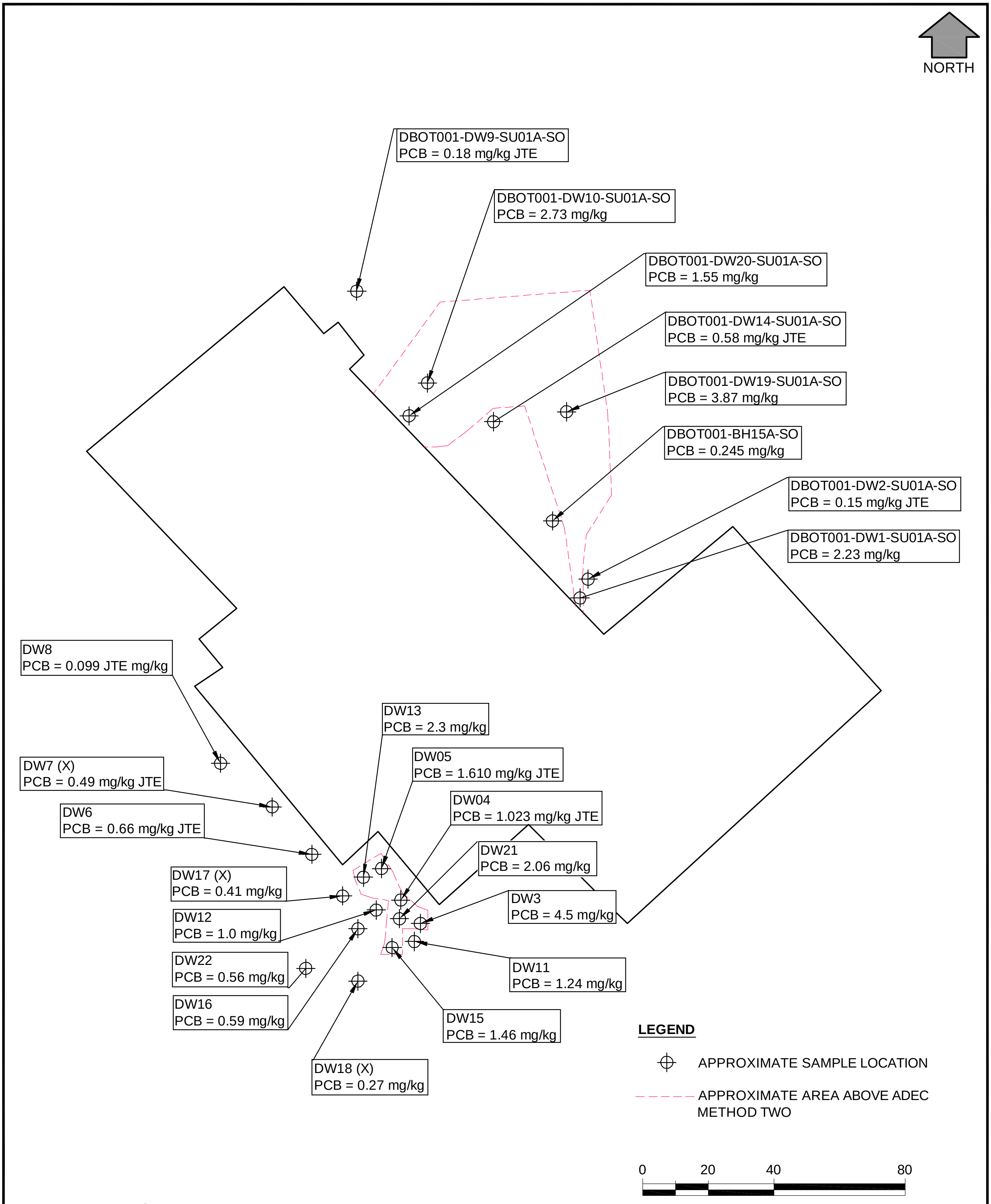

ACRONYMS/ABBREVIATIONS

JTE SAMPLE COOLER TEMPERATURE UPON RECEIPT AT THE LABORATORY HAD FROZEN SAMPLES OR THE TEMPERATURE EXCEEDED 6° CELSIUS

mg/kg MILLIGRAMS PER KILOGRAM

PCB POLYCHLORINATED BIPHENYL

FORMER COMPOSITE BUILDING (O1001) SITE LOCATIONS

DRIFTWOOD BAY, UNALASKA ISLAND, ALASKA

JACOBS	DATE: 12 November 2010	PROJECT MANAGER: D. Anderson	FIGURE NO.: 1-6

G:\Autocad\Driftwood Bay\05PC8101\2010 Feasibility Study\Fig 1-6 OT001 Site-comp.dwg Letter Portrait 15 Nov.2010 -tiedemam

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2.0 TECHNICAL APPROACH

In order to provide a clear understanding of remedial options available for the sites at Driftwood Bay RRS, the FS process presented in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) was followed (U.S. Environmental Protection Agency [EPA] 1988). This process entails the following steps:

- Development of RAOs and general response actions
- Identification and screening of remedial technologies capable of obtaining the RAOs
- Development of remedial alternatives
- Screening of remedial alternatives
- Detailed analysis of remedial alternatives

Sections 2.1 to 2.5 discuss these steps, which are implemented in the remaining sections of this document.

2.1 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES AND GENERAL RESPONSE ACTIONS

RAOs were developed based on contaminant concentration standards established under various chemical-specific ARARs. RAOs for soil contamination were set at the concentrations established under Method Two of the Alaska Administrative Code (AAC), Title 18, Chapter 75 (ADEC 2008a). General response actions are broad categories of actions that can be undertaken to satisfy RAOs. Section 3.0 addresses the development of RAOs and general response actions.

2.2 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

Remedial technologies were selected in accordance with *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). These technologies were screened based on effectiveness, implementability, and cost. Section 4.0 presents the technology identification and screening process for all sites and contaminants included in this FS.

2.2.1 Effectiveness

To evaluate effectiveness, each technology was screened against:

- Proven ability to achieve cleanup goals
- Potential effects on human health and the environment
- Reliability with respect to site contaminants

Innovative technologies that have not been proven in full-scale operations but offer potentially substantial advantages in other areas (such as simplified operations) have been considered for alternative development.

2.2.2 Implementability

This criterion evaluates the technical and administrative feasibility of implementing the technology at the site. Due to the remote location of Driftwood Bay RRS, technical and logistical aspects of implementability are particularly important. The need to mobilize large pieces of equipment to this remote site could affect implementability of an alternative. The extreme weather conditions found in the Aleutians could also affect various treatment alternatives, especially those that require biological reactions. The operations and maintenance (O&M) components of remedial projects taking place at remote locations in Alaska have frequently run into delays caused by weather and transportation issues. Difficulties also result from the small potential labor pool from which system operators must be recruited. Remedial technologies that are simple to implement and do not require extensive O&M are thus more desirable at remote sites.

2.2.3 Cost

This criterion qualitatively evaluates whether the capital and operating costs of implementing the technology are low, moderate, or high.

2.3 DEVELOPMENT OF REMEDIAL ALTERNATIVES

Remedial alternatives were developed based on the results of technology screening. In accordance with CERCLA guidance, a range of alternatives was developed to include a no-action alternative, alternatives that focus on reducing risk by preventing exposure, and alternatives that focus on treatment of contaminated soil. In this FS, a separate set of alternatives has been developed for each site because of the variation in contaminants and concentrations, landowners, and geographic distances. For the purposes of technology screening and detailed analysis of alternatives, the chosen alternatives would presumably address lead- and PCB- contaminated soil separately.

2.4 SCREENING OF REMEDIAL ALTERNATIVES

Following the identification of the remedial technologies appropriate for the Driftwood Bay RRS sites, technologies were screened based on their effectiveness, implementability, and cost.

Effectiveness is the ability of the technology to protect human health and the environment. It includes both short-term effectiveness, such as protection of workers during remedial actions, and long-term effectiveness, such as the magnitude of residual risk. Effectiveness also includes the ability of the technology to reduce the toxicity, mobility, and volume of contamination and the ability to meet RAOs and related ARARs. The effectiveness of these technologies used in similar projects in Alaska and the lower 48 states is taken into account in the screening process. Most importantly, the ability of the technology to meet USAF's overall remedial goal of site closure is considered.

Implementability is the technical and administrative feasibility of the technology as well as the availability of the various resources required. Technical feasibility generally refers to the ability to construct and reliably operate the process until the remedial goal is achieved. Administrative feasibility includes the ability to obtain agency and public approval and the availability of required facilities, specialists, and equipment. The implementability of technologies used in similar projects in Alaska and the lower 48 states was taken into account in the screening process.

Relative, rough order-of-magnitude costs for each technology are provided for comparative purposes during screening. Technologies were not eliminated from further consideration purely on the basis of cost factors, which are only rough estimates at this stage of the FS process. For purposes of better comparability of alternatives in the screening stage, nationally recognized cost estimates were used wherever available, even if actual costs were available. The reasoning behind this approach was to ensure an equal basis of comparison.

For the technologies evaluated, the Federal Remediation Technologies Roundtable (FRTR 2010) was used to obtain information on the effectiveness, implementability, and cost of technologies implemented in similar projects in Alaska and the lower 48 states.

2.5 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

The NCP (40 CFR 300) presents nine criteria for evaluating the acceptability of a given alternative. These nine criteria are categorized as threshold criteria, primary balancing criteria, and modifying criteria. A rating system based on the definitions, provided in 40 CFR 300.430(e)(9)(iii), has been developed for this document to evaluate and summarize the ability of the alternatives to meet the criteria (Table 2-1). A "pass" or "fail" determination is used for each threshold criterion. Except for cost, a number between 0 and 5 is assigned to each of the primary balancing criterion, as follows:

- Criterion is fully met (5).
- Criterion is partially met (1-4, depending on the degree to which the criterion is satisfied).
- Criterion is not met (0).

Numerical values were assigned subjectively according to professional judgment and used as a means of evaluating the options involved. The highest total numerical score does not indicate that an alternative is preferred.

Table 2-1
Remedial Alternative Evaluation System

Category	Standard	Evaluation Criteria	Value
Threshold Criteria	Overall Protection of Human Health and the Environment	Protective; provides adequate risk reduction.	Pass or Fail
	Compliance with ARARs	Complies with ARARs.	Pass or Fail
Primary Balancing Criteria	Long-Term Effectiveness and Permanence	Contaminants destroyed or removed; no recurrence is possible.	5
		Some contaminants destroyed, removed, or contained.	1-4
		Contaminants not removed or contained.	0
	Reduction of Toxicity, Mobility, or Volume Through Treatment	Significantly reduces toxicity, mobility, or volume through treatment; no residuals remaining after treatment.	5
		Somewhat reduces toxicity, mobility, or volume through treatment; some residuals remaining after treatment.	1-4
		Does not reduce toxicity, mobility, or volume through treatment; significant residuals remaining after treatment.	0
	Short-Term Effectiveness	Protective of community and workers during remediation; no environmental impacts; rapidly meets remedial action objectives.	5
		Somewhat protective of community and workers during remediation; limited environmental impacts; meets remedial action objectives over a period of years to decades.	1-4
		Not protective of community and workers during remediation; significant environmental impacts; will not meet remedial action objectives in the near future.	0
	Implementability	Proven, reliable technologies; little or no difficulty in obtaining needed approval, equipment, personnel, and materials. Technical difficulties are expected to be minimal.	5
		Somewhat unproven technologies; potentially more difficulty in obtaining needed approval, equipment, personnel, and materials. Technical difficulties may be significant.	1-4
		Unproven technologies; obtaining needed approval, equipment, personnel, and materials could be very difficult. Technical difficulties could prevent implementation.	0
	Cost	Estimated present-worth cost is listed for each alternative.	$
Modifying Criteria[1]	State Acceptance	To be determined	NA
	Community Acceptance	To be determined	NA

Notes:

[1] State and community acceptance will be evaluated following public comment on the Proposed Plan and addressed when the Decision Documents are prepared.

For definitions, see the Acronyms and Abbreviations section.

2.5.1 Threshold Criteria

The two threshold criteria are (1) overall protection of human health and the environment and (2) compliance with ARARs. Threshold criteria represent the minimum requirements that each alternative must meet to be eligible for selection.

Overall Protection of Human Health and the Environment

This criterion assesses the overall effectiveness of an alternative and focuses on whether that alternative achieves adequate protection and risk reduction, elimination, or control. The assessment of overall protection draws on assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Compliance with ARARs

Each alternative is assessed to determine whether it complies with ARARs. Appendix A presents ARARs for the Driftwood Bay RRS sites.

2.5.2 Primary Balancing Criteria

The five primary balancing criteria are (1) long-term effectiveness and permanence, (2) reduction of toxicity, mobility, or volume through treatment, (3) short-term effectiveness, (4) implementability, and (5) cost. Primary balancing criteria form the basis for comparing alternatives in light of site-specific conditions.

Long-Term Effectiveness and Permanence

This criterion assesses the destruction or removal of contaminants, the magnitude of residual risks remaining at the conclusion of remedial activities, and the adequacy and reliability of controls to be used to manage residual risk.

Reduction of Toxicity, Mobility, or Volume Through Treatment

CERCLA Section 9621 (Cleanup Standards) states a preference for remedial action treatments that permanently and significantly reduce the volume, toxicity, or mobility of contaminants as the primary element of the action. This criterion addresses the capacity of the alternative to reduce principal risks through destruction of contaminants, reduction in the total mass of contaminants, irreversible reduction in contaminant mobility, or reduction in the total volume of contaminated media.

Short-Term Effectiveness

This criterion addresses the effects of the alternative during construction and operation until remedial objectives are met. Each alternative is evaluated with respect to its (potentially negative) effects on community health, worker safety, and environmental quality during the course of remedial actions. This criterion also addresses the time required by each alternative until RAOs are achieved.

Implementability

This criterion is used to assess the technical and administrative feasibility of implementing an alternative. Technical issues include the reliability of the technology under consideration, potential construction difficulties, O&M, and the availability of required services, materials, and equipment (preferably from multiple sources). Administrative issues include permitting and access for construction and monitoring.

Cost

Cost estimates include both capital costs and O&M costs. Capital costs include costs for equipment, materials, construction-related labor, and site development. O&M costs include operating labor, maintenance and repair materials and associated labor, energy, process chemicals, disposal of treatment residues, operational sampling and analysis, data management, and administration. O&M costs have been included in life-cycle costs.

Cost estimates (Appendix B) were prepared using data available from the SC and RI reports and are intended to provide an accuracy of between +50 and –30 percent. These cost estimates are preliminary and were developed in accordance with *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA 2000). More detailed and accurate cost estimates will be developed as the CERCLA process progresses. Cost estimates included in this document are intended for comparative purposes only. They intentionally emphasize comparability (a key factor in the decision-making process) versus accuracy. Costs provided in this FS assume that work will be performed in 2011. Appendix B includes the cost for performance of this work and the detailed breakdown of the other costs.

2.5.3 Modifying Criteria

The two modifying criteria are state acceptance and community acceptance. State acceptance evaluates the technical and administrative issues and concerns of ADEC. Community acceptance evaluates the issues and concerns that the public may have regarding each of the alternatives. In accordance with EPA guidance (EPA 1988), modifying criteria will be evaluated following regulatory comment and public response to the Proposed Plan. State and community acceptance will be addressed when Decision Documents are prepared. Alternatives will not be evaluated against modifying criteria in this document.

3.0 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES AND GENERAL RESPONSE ACTIONS

This section describes the development of RAOs and general response actions for the FS sites at Driftwood Bay RRS.

3.1 REMEDIAL ACTION OBJECTIVES

RAOs consist of site-specific goals for protecting human health and the environment. In accordance with EPA guidance, the objectives are as specific as possible but not so specific that the range of alternatives is unduly limited (EPA 1988). RAOs specify the following:

- COCs
- Media (e.g., soil or groundwater)
- Exposure routes and receptors
- Acceptable contaminant concentrations, commonly referred to as preliminary remediation goals

RAOs to protect human health express an exposure route because protectiveness may be achieved by reducing exposure as well as contaminant concentrations.

Sections 3.1.1 to 3.1.3 present area-specific RAOs that were developed based on regulatory guidance and the findings of previous investigations, actions, and assessments.

3.1.1 BBA: Burned Battery Area

In 2007, an RI was conducted at the BBA using hand excavation and field screening techniques. The investigation revealed that the BBA was larger than anticipated. Field screening and analytical sampling were performed at 13 locations. Analytical lead results ranged from 27 mg/kg to 11,000 mg/kg. During this investigation, Ecobond™ was applied to the soil for the purposes of stabilizing the lead in soil to achieve a Toxicity Characteristic Leaching Procedure (TCLP) result of less than 5 milligrams per liter (mg/L). Three soil samples collected after the application of Ecobond™ were submitted for TCLP lead analysis; the resulting concentrations ranged from 0.023 mg/L to 0.86 mg/L (USAF 2009b).

Following the 2007 RI, a Risk Assessment (RA) was conducted that included the BBA. The results of the RA indicate that the only COC at the BBA is lead in soil. No groundwater has been encountered at the BBA. The RA also indicated that the risk of potential exposure to lead at the BBA does not pose an unacceptable hazard to adult recreational users under the current and anticipated land use (USAF 2009c). A conservative approach for conducting remedial actions at BBA would use the ADEC Method Two soil cleanup level for lead based on residential land use (400 mg/kg).

The RAO for the BBA is to:

- Prevent inhalation or direct contact of contaminants in soil containing lead in excess of 400 mg/kg.

3.1.2 LF006: Old Disposal Site and Electronic Debris Area

Following the 2007 RI, an RA was conducted that included electronic debris. The results of the RA indicate that the only COC at Site LF006 is lead in soil. The RA also indicated that the risk of potential exposure to lead at Site LF006 might pose an unacceptable hazard to adult recreational users under the current and anticipated land use (USAF 2009c). An acceptable approach for conducting remedial actions at Site LF006 would use the ADEC Method Two soil cleanup level for lead based on residential land use (400 mg/kg).

In 2009, Ecobond was applied to soils at the Distressed Area (Lima Bean Area) as a pilot test of the lead-stabilization technique. Post-treatment analytical samples were analyzed for total lead and TCLP lead. The results indicated that the bioavailability of lead was reduced, but the risk for adult exposure to lead was not eliminated. During 2009 fieldwork, a limited removal action was also conducted at a previous battery location (BAT05); however, it was determined that lead contamination extended further than expected and was not removed.

In 2010, a data gap investigation was conducted at the electronic debris area at Site LF006 in order to assess the effects of Ecobond™ nearly one year after its application as well as to perform field screening and analytical sampling to further define the lateral and vertical extents of lead contamination. The results of the data gap investigation indicated that soil treated with Ecobond™ contained lead at less than the Resource Conservation and Recovery Act (RCRA) hazardous lead limit of 5 mg/L. Analytical results and historical data indicate a high degree of variability in lead concentrations over short distances and suggest that lead contamination in this area is heterogeneous in nature. Under similar conditions, EcoBond™ has been used to treat lead-contaminated soil to render it nonhazardous for disposal.

The RAO for Site LF006 is to:

- Prevent inhalation or direct contact of contaminants in soil containing lead in excess of 400 mg/kg.

3.1.3 OT001: Composite Building Area Doorways

In 2007, nine samples were collected near the former doorways and analyzed for PCBs and VOCs. Analytical results and visual and olfactory observations indicated that VOC contamination was not present. The initial doorway characterization samples identified concentrations of PCBs greater than 1 mg/kg near the east doorway and the former garage doorways. Analytical samples were collected from step-out locations to further delineate the extent of PCB contamination. A total of 22 locations were sampled to delineate PCB contamination associated with the doorways. Analytical results from 8 of the 22 locations exceeded the ADEC cleanup level for PCBs (1 mg/kg).

Following the 2007 RI, an RA was conducted that included Site OT001. The results of the RA indicated that the only COC at Site OT001 is PCBs in soil. No groundwater was encountered at the Top Camp sites. The RA also indicated that the risk of potential exposure to PCBs at the Site OT001 doorways for adult recreational users under the current and anticipated land use was below threshold levels determined to be protective of human health and the environment (USAF 2009c). A conservative approach for conducting remedial actions at Site OT001 would use the ADEC Method Two soil cleanup level for PCBs based on unrestricted land use (1 mg/kg).

The RAO for Site OT001 (Composite Building Area Doorways) is to:

- Prevent inhalation or direct contact with soil containing PCBs in excess of 1 mg/kg.

3.2 GENERAL RESPONSE ACTIONS

General response actions are broad categories of actions that can be undertaken to satisfy RAOs. An evaluation of general actions that may be effective in meeting RAOs has led to the selection of the following general response actions:

- No action
- Limited action
- Containment
- Ex situ treatment
- In situ treatment
- Disposal

These actions can also be combined to form an effective remedy and are briefly described in Sections 3.2.1 to 3.2.6. Table 3-1 shows the general response actions and technologies that may be used.

3.2.1 No Action

The no-action general response action serves as a baseline against which other general response actions can be compared.

Table 3-1
Driftwood Bay General Response Actions and Potentially Applicable Technologies

General Response Actions	BBA	LF006	OT001	Potentially Applicable Technologies
No Action	X	X	X	No Action
Limited Action	X	X	X	Institutional Controls (ICs)
				Site Controls
				Monitored Natural Attenuation (MNA)
				Long-Term Monitoring
Containment	X	X	X	Permeable Cap/Onsite Disposal
				Impermeable Cap/Onsite Disposal
Ex Situ Treatment				Solvent Extraction/Soil Washing
				Dehalogenation by Base-Catalyzed Decomposition
				Mechanochemical Degradation
				Biopiles
				Land farming
				Onsite Incineration
				Hot-Air Vapor Extraction
			X	Onsite Rotary Low-Temperature Thermal Desorption
				Offsite Incineration
				Offsite Low-Temperature Thermal Desorption
			X	Halogenated Organic Destruction System (HODS)
In Situ Treatment				Soil Vapor Extraction
				Vitrification
				Bioventing
				Soil Heating
	X	X		Chemical Stabilization
Disposal	X	X	X	Offsite Disposal

Notes:

For definitions, see the Acronyms and Abbreviations section.

X - Indicates a technology that was retained for further analysis.

3.2.2 Limited Action

Limited action includes institutional controls (ICs), site controls, monitored natural attenuation (MNA), and long-term monitoring (LTM). ICs are legal or administrative measures taken to limit human exposure to contaminants by restricting access to and use of an area. Site controls include actions such as fencing and physically blocking access to the site. ICs and site controls are commonly used as temporary measures to ensure the protection of human health until remedial actions are complete. MNA is a limited action procedure used to document naturally occurring rates of contaminant degradation. Additionally, LTM can be used to ensure that assumptions made during remedy selection remain valid. When undertaken without other general response actions, limited actions attempt to protect human health and the environment without reducing the volume or toxicity of contaminants present.

3.2.3 Containment

Containment actions reduce risk to human health and environmental receptors by limiting exposure to contaminants. Containment can prevent both direct exposure (direct contact or inhalation) and indirect exposure (migration to groundwater). Containment technologies do not reduce the toxicity or volume of contaminants but can reduce contaminant mobility or prevent exposure. For example, placing an impermeable cap over a landfill may be used to protect the underlying groundwater.

3.2.4 Ex Situ Treatment

This general response action entails the removal and treatment of contaminated media. Treatment mechanisms may be physical, chemical, biological, or thermal processes. Removal of contaminated media can reduce long-term risks to human health and the environment but requires extra care to minimize short-term risks associated with handling the contaminated media.

3.2.5 In Situ Treatment

In situ treatment reduces long-term risks to human health and the environment by destroying or immobilizing contaminants in place through a variety of physical, chemical, biological, or thermal processes. Because the contaminants are not brought above the ground surface, short-term risks also are minimized. However, limited access to the contaminated media can reduce the effectiveness of in situ treatment options.

3.2.6 Disposal

Contaminated media can be removed and disposed of offsite at a Toxic Substances Control Act (TSCA) or RCRA landfill or an industrial waste landfill, depending on the nature of the contaminants and the acceptance criteria of the landfill.

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4.0 REMEDIAL TECHNOLOGIES IDENTIFICATION AND SCREENING

This section describes the identification and screening of remedial technologies for the FS sites at Drifwood Bay RRS. Remedial technologies were selected in accordance with *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). Section 4.1 describes remedial technologies potentially appropriate for contaminated soil. These technologies are screened based on effectiveness, implementability, and cost as described in Section 4.2. Table 4-2 summarizes the results of a preliminary evaluation of technologies based on these criteria. The remaining technologies are evaluated further in Sections 5.0 through 7.0.

4.1 IDENTIFICATION OF REMEDIAL TECHNOLOGIES TO TREAT CONTAMINATED SOIL

Potentially applicable remedial technologies were identified based on Jacobs' previous experience in treating contamination at remote sites in Alaska, professional judgment, FRTR databases (FRTR 2010), and input from USAF and ADEC. For each general response action, remedial technologies and associated technologies that were considered potentially appropriate for the sites were identified (Sections 4.1.1 to 4.1.5).

4.1.1 Limited Actions

The four types of limited actions considered to address site contaminants in soil are ICs, site controls, MNA, and LTM.

<u>Institutional Controls</u>

ICs are legal or administrative measures designed to prevent or reduce human or environmental exposure to contamination and to prevent activities that may result in increased exposure to or the spread of contamination. ADEC has provided informal guidance describing varying levels of ICs likely to be required, based on the cleanup standard used at any given site (ADEC 2008b). Table 4-1 summarizes this information.

Table 4-1
Institutional Controls Required Based on Cleanup Levels Used

Standard Used	Institutional Control
Most stringent Method Two cleanup levels	None
Method Three alternative cleanup levels based on site-specific total organic carbon data only	Informational: deed notice or other informational mechanism
Method Three alternative cleanup levels based on factors other than total organic carbon	Enforceable: equitable servitude, restrictive covenant, management right assignment, or compliance order by consent
Method Three changed land use	Enforceable: equitable servitude, restrictive covenant, management right assignment, or compliance order by consent
Method Four assumptions of limited usage	Enforceable: equitable servitude, restrictive covenant, management right assignment, or compliance order by consent
Groundwater Use Determination[1]	Enforceable: equitable servitude, restrictive covenant, management right assignment, or compliance order by consent
Groundwater Use Determination[1] - no viable groundwater exists	Informational: deed notice or other informational mechanism
Capping waste in place if contaminants may pose an unacceptable risk	Enforceable: equitable servitude, restrictive covenant, management right assignment, or compliance order by consent
Capping waste in place where solid wastes remain	Enforceable: equitable servitude, restrictive covenant, management right assignment, or compliance order by consent

Note:
[1] Under 18 AAC 75.350, groundwater is considered a drinking water source unless it is not a current or reasonably expected future source of drinking water; any contamination present will be transported to an area where no current or future drinking water source exists.

Site Controls

Site controls are physical measures taken to prevent access to sites that may pose an unacceptable risk to human health. Site controls can also be used to prevent actions that could cause the spread of contaminants, or to prevent vehicular access. Typical site controls include fences and barricades.

Monitored Natural Attenuation

EPA defines MNA as “the reliance on natural attenuation processes to achieve site-specific remedial objectives within a timeframe that is reasonable compared to that offered by more active methods” (EPA 1999). Natural processes that affect the fate and transport of contaminants include solution, dilution, dispersion, volatilization, biodegradation, abiotic degradation, and adsorption. MNA requires extensive site characterization because a longer time is generally required to reach cleanup levels, and LTM costs are generally higher than those for active remedial alternatives. Because MNA does not include a treatment component, overall costs are generally less than active remedial alternatives.

Long-Term Monitoring

LTM provides a continuous source of data concerning changing contaminant concentrations over time. It is commonly used as a component of a remedial alternative if contaminants are allowed to remain at the site at concentrations above RAOs or if treatment will require long periods of time. In comparison to MNA, LTM generally focuses on verifying the continued protectiveness of an alternative and not necessarily on documenting the fate and transport mechanisms of contaminant degradation.

4.1.2 Containment

Capping is a method of containment that minimizes the potential for exposure to contaminants. Caps generally fall into one of two categories: permeable or impermeable. In general, caps do not result in the destruction or removal of contaminants.

Permeable Cap/Onsite Disposal

A permeable cap following onsite disposal, which could be constructed using native soil, could be an effective method of preventing exposure due to direct contact or inhalation. A permeable cap would not prevent exposure due to migration of contaminants to groundwater; therefore, this method is only suitable for contaminants that have limited solubility in water. The placement of a permeable cap at the site would require ICs.

Impermeable Cap/Onsite Disposal

Impermeable caps can minimize direct contact, inhalation, and migration of soluble soil contaminants to groundwater. An impermeable cap would follow onsite disposal and can be constructed using bentonite, asphalt, concrete, or a synthetic liner. As noted above, it is not expected that placement of a cap will result in the destruction or removal of contaminants. The placement of an impermeable cap at the site would require ICs.

4.1.3 Ex Situ Treatment

A variety of ex situ processes are available for the treatment of excavated soil. These options assume prior excavation of soil and are discussed in the subsections below.

Solvent Extraction/Soil Washing

Solvent extraction uses an organic solvent to separate organic and metal contaminants from soil. The organic solvent is mixed with contaminated soil in an extraction unit. The extracted solution is passed through a separator, where contaminants and extractant (organic solvent) are separated from the soil.

Dehalogenation by Base-Catalyzed Decomposition

This technology is used for the dehalogenation of PCBs. Reagents are added to soil contaminated with halogenated organics. The dehalogenation process is achieved by either replacement of the halogen molecules or decomposition and partial volatilization of the contaminants.

Contaminated soil is screened, processed with a crusher and pug mill, and mixed with sodium bicarbonate. The mixture is heated to more than 330 degrees Celsius (°C) (630 degrees Fahrenheit [°F]) in a reactor to partially decompose and volatilize the contaminants. The volatilized contaminants are captured, condensed, and treated separately.

Glycolate Dehalogenation

This technology is used for the dehalogenation of PCBs. Glycolate is a technology that utilizes an alkaline polyethylene glycol reagent. Potassium polyethylene glycol is the most common reagent. Contaminated soils and reagent are mixed and heated in a treatment vessel.

The resulting reaction causes the polyethylene glycol to replace halogen molecules, and therefore renders the compound nonhazardous or less toxic. The reagent dehalogenates the pollutant to form a glycol ether and/or a hydroxylated compound and an alkali metal salt, which are water-soluble byproducts.

Onsite Incineration

Incineration may be used to address PCB-contaminated soil. First, contaminated soil is excavated to meet cleanup levels, and then soil is burned onsite in a direct-fire kiln, in the presence of oxygen, at temperatures of 1,482 to 1,760°C. This process volatilizes and combusts organic contaminants. Auxiliary fuels would be required to initiate and sustain combustion. Off-gasses and combustion residuals generally require additional treatment.

Offsite Incineration

Offsite Incineration utilizes the same processes described above; however, this technology also requires transport to an offsite incinerator.

Onsite Rotary Low-Temperature Thermal Desorption

Low-temperature thermal desorption may be used to address PCB-contaminated soil. Contaminated soil is excavated to meet cleanup levels, screened to remove rocks greater than 2 inches in particle size, and deposited into a mobile indirect-fire rotary treatment unit. For PCB-contaminated soil, the soil is heated to temperatures between 320 and 650°C, which volatilizes PCBs. Then vapors are treated, generally through the use of activated carbon.

Halogenated Organic Destruction System (HODS)

Contaminated soil is washed in a solvent that removes the PCBs from the soil particles. The solvent is then treated with a chemical agent to dechlorinate the PCB molecule and break the carbon-to-carbon bonds in the molecule. This process will generate solvents that contain PCBs.

4.1.4 In Situ Treatment

In situ treatment technologies avoid the need to excavate soil. By treating soil in place, in situ treatment technologies minimize costs and worker exposure to contaminated soil. However, because soil is left in place, uniform treatment can be more difficult to achieve, particularly when subsurface lithology is heterogeneous.

Solidification

Solidification is a process used to produce monolithic blocks of waste with high structural integrity containing contaminants. The contaminants do not necessarily interact chemically with the solidification reagents (typically cement/ash) but are mechanically locked within the solidified matrix. Stabilization methods usually involve the addition of chemical binders such as cement, silicates, or pozzolans, which limit the solubility or mobility of waste constituents even though the physical handling characteristics of the waste may not be changed or improved.

In Situ Vitrification

An electric current is used to melt soil or other earthen materials at extremely high temperatures (up to 2,000°C), thereby immobilizing most inorganic material and destroying organic pollutants by pyrolysis. Water vapor and organic pyrolysis combustion products are captured in a hood, which draws the contaminants into an off-gas treatment system to remove particulates and other pollutants. The vitrification product is a chemically stable, leach-resistant, glass and crystalline material similar to obsidian or basalt rock.

Chemical Stablization

Chemical stabilization can be performed in situ to reduce the leachability of heavy metals. The stabilizers form a chemical chain that binds with metal ions in the soil to form an insoluble compound. Though this technology does not remove the metal from the soil, it limits leachability, reduces the hazard to human health, and avoids a hazardous waste classification, if removed.

4.1.5 Disposal

This technology requires excavation and offsite shipment of contaminated soil. The soil would be shipped to a transportation, storage, and disposal facility (TSDF) for treatment or disposal. CERCLA includes a statutory preference for alternatives that treat contaminants rather than disposing of them offsite. Given the nature of the contaminants present at the Driftwood Bay RRS sites, offsite treatment and disposal offers a high degree of flexibility in treating soil. If contaminants are not destroyed and become mixed with other wastes, however, offsite disposal could create potential liability.

4.2 SCREENING OF REMEDIAL TECHNOLOGIES

Following identification of the remedial technologies and technologies appropriate for the Driftwood Bay RRS target sites, these technologies were screened based on their effectiveness, implementability, and cost.

Effectiveness is the ability of the technology to protect human health and the environment. It includes both short-term effectiveness, such as protection of workers during remedial actions, and long-term effectiveness, such as the magnitude of residual risk. Effectiveness also includes the ability of the technology to reduce the toxicity, mobility, volume of contamination and the ability to meet RAOs and related ARARs. The effectiveness of these technologies used in similar projects in Alaska and the lower 48 states was taken into account in the screening process. The ability of the technology to be consistent with the USAF's long-term transfer goals and/or management of the property was considered throughout the screening process.

Implementability is the technical and administrative feasibility of the technology as well as the availability of the various resources required. Technical feasibility generally refers to the ability to construct and reliably operate the process until the remedial goal is achieved. Administrative feasibility includes the ability to obtain agency and public approval and the availability of required facilities, specialists, and equipment. The implementability of technologies used in similar projects in Alaska and the lower 48 states is taken into account in the screening process.

Relative, rough order-of-magnitude costs for each technology were evaluated quantitatively, using FRTR values, and qualitatively in the evaluation (see Table 4-2). For newer technologies not found at the FRTR (FRTR 2010), similar technologies that were available at the FRTR were evaluated and supplemented with data from product vendors and previous testing.

For the technologies evaluated, the FRTR was used to obtain information on the effectiveness, implementability, and cost of technologies implemented in similar projects in Alaska and the lower 48 states.

Table 4-2
Driftwood Bay Radio Relay Station Technology Screening

General Response Action	Technology Process Option	Effectiveness	Implement-ablility	Cost	Retained for Site-Specific Screening
No Action	No Action	○	●	●	Yes
Limited Action	Institutional Controls	◐	●	●	Yes
	Site Controls	○	●	●	No
	Monitored Natural Attenuation	○	●	●	No
	Long-Term Monitoring	○	●	●	No
Containment	Permeable Cap/ Onsite Disposal	◐	◐	●	Yes
	Impermeable Cap/ Onsite Disposal	◐	◐	●	No
Ex Situ Treatment	Solvent Extraction/Soil Washing	○	◐	◐	No
	Dehalogenation by Base-Catalyzed Decomposition	◐	○	○	No
	Glycolate Dehalogenation	◐	○	○	No
	Onsite Incineration	●	◐	○	No
	Offsite Incineration	●	◐	○	No
	Onsite Low-Temperature Thermal Desorption	●	◐	○	Yes
	Halogenated Organic Destruction	○	◐	◐	Yes
In Situ Treatment	Solidification	◐	◐	◐	No
	Vitrification	◐	◐	◐	No
	Chemical Stabilization	◐	◐	●	Yes
Disposal	Offsite Disposal	●	◐	◐	Yes

Note:
For definitions, see the Acronyms and Abbreviations section.
● Highly effective, easy to implement, or low cost
◐ Somewhat effective, difficulty to implement, or moderate cost
○ Not effective, very difficult to implement, or high cost

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5.0 REMEDIAL ALTERNATIVES FOR THE BURNED BATTERY AREA

The BBA is located at Top Camp approximately 275 feet north of the northeast corner of the Former Composite Building; an area with melted plastic battery casings and scattered pieces of lead battery plates marks the site. The BBA is located on land withdrawn under public land order by the department of defense with USAF acting as the holding agency.

Remedial alternatives for lead-contaminated soil at the BBA were developed based on the RAOs described in Section 3.0 and the remedial technology described in Section 4.0.

The following alternatives were evaluated for treatment of lead-contaminated soil at the BBA:

- BBA Alternative 1: No Action
- BBA Alternative 2: Chemical Stabilization and Institutional Controls
- BBA Alternative 3: Removal and Offsite Disposal
- BBA Alternative 4: Chemical Stabilization and Offsite Disposal
- BBA Alternative 5: Chemical Stabilization and Onsite Disposal

Based on estimated soil volumes (Table 1-1), approximately 93 cubic yards (cy) of lead-contaminated soil at this site requires action under CERCLA.

5.1 DEVELOPMENT OF REMEDIAL ALTERNATIVES FOR THE BBA

To develop a remedial strategy for lead-contaminated soil at the BBA, a conceptual understanding of the volume and location of the contamination was needed. Approximately 93 cy of lead-contaminated soil remains at the site, which is approximately 140 tons of soil based on the estimate of 1.5 tons per cy. Estimates of contaminant mass and distribution were developed as follows:

- 2007 analytical data for lead were considered.
- Volumes of contaminated media were estimated (Section 1.1).
- An estimated density of the soil of 1.5 tons per cy was used to convert volume estimates to weight estimates.

5.1.1 BBA Alternative 1: No Action

Under the no-action alternative, no activities would be undertaken to treat the contamination present or to prevent exposure to the contamination. No monitoring would be conducted. A no-action alternative is required for consideration under the NCP and serves as a baseline against which other alternatives can be compared.

5.1.2 BBA Alternative 2: Chemical Stabilization and Institutional Controls

Under this alternative, soil contaminated with lead above the ADEC Method Two cleanup level (400 mg/kg) would be treated with a chemical stabilization product and ICs would be placed on the site. Calcium hydroxyapatite (or equivalent stabilizer) would be placed on the soil in situ to increase stabilization and prevent leaching of lead. This action would limit the migration of lead from the site. Method Four cleanup levels (from the RA [USAF 2009c]) indicate that potential exposures to lead at the BBA do not pose an unacceptable hazard to adult recreational receptors, including pregnant women, under current and reasonably anticipated land use. The ICs placed on the site would be used to maintain recreational use of the property and prevent soil from being moved from the site. The land would continue to be held by USAF, under Section 121 of CERCLA, as amended by Superfund Amendments and Reauthorization Act (SARA). The NCP requires that remedial actions that result in any hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every 5 years to ensure protection of human health and the environment. Therefore, 5-year reviews would be required until cleanup levels are met for the site (indefinitely).

5.1.3 BBA Alternative 3: Removal and Offsite Disposal

Under this alternative, soil contaminated with lead above the Method Two cleanup level (400 mg/kg) would be excavated, staged, manifested, and transported for disposal to a RCRA-permitted chemical waste landfill capable of managing RCRA-regulated lead-contaminated soil. Soil would be excavated and staged onsite prior to transport. Analytical samples would be collected from the staged soil for waste profiling.

The following logistical coordination and manifesting activities would be required for excavation, staging, transport, and disposal of lead-contaminated soil at a licensed TSDF:

- Staging, segregating into RCRA and non-RCRA waste streams, and containing excavated lead-contaminated soils in stockpiles.
- Loading lead-contaminated soil into Super Sacks® for transport from Top Camp to Lower Camp
- Chartering a barge from Driftwood Bay to Dutch Harbor with containers
- Staging containers at Dutch Harbor for barge transport to the TSDF
- Barging and trucking containers from Dutch Harbor to the TSDF
- Collecting and analyzing confirmation samples to ensure cleanup levels have been met

Confirmation sampling of the excavation would be required to ensure contaminants were no longer present at concentrations above the ADEC cleanup level. Once analytical results from confirmation samples indicate that all contaminated soil has been removed, the excavation would be backfilled.

5.1.4 BBA Alternative 4: Chemical Stabilization and Offsite Disposal

Under this alternative, soil contaminated with lead above the Method Two cleanup level (400 mg/kg) would be treated with a chemical stabilization product then excavated, staged, manifested, and transported for disposal to a chemical waste landfill capable of managing lead-contaminated soil. Calcium hydroxyapatite (or equivalent stabilizer) would be placed on the soil in situ to render the soil nonhazardous for disposal (or non-RCRA regulated). Soil would then be excavated and staged onsite prior to transport. Analytical samples would be collected from the staged soil for waste profiling.

The following logistical coordination and manifesting activities would be required for excavation, staging, transport, and disposal of lead-contaminated soil at a licensed TSDF:

- Loading lead-contaminated soil into Super Sacks® for transport from the Top Camp to Lower Camp
- Chartering a barge from Driftwood Bay to Dutch Harbor with containers

- Staging containers at Dutch Harbor for barge transport to the TSDF
- Barging and trucking containers from Dutch Harbor to the TSDF
- Collecting and analyzing confirmation samples to ensure cleanup levels have been met.

Confirmation sampling of the excavation would be required to ensure contaminants were no longer present in concentrations above the ADEC cleanup level. Once analytical results from confirmation samples indicate that all contaminated soil has been removed, the excavation would be backfilled.

5.1.5 BBA Alternative 5: Chemical Stabilization and Onsite Disposal with ICs

Under this alternative, soil contaminated with lead above the Method Two cleanup level (400 mg/kg) would be treated with a chemical stabilization product. Then a permeable soil cap would be placed over the site. Calcium hydroxyapatite (or equivalent stabilizer) would be placed on the soil in situ to increase stabilization and prevent leaching of lead. This action would limit the migration of lead from the site. After stabilization, a permeable cap including a geotextile layer and 2 feet of cover material would be placed over the lead-contaminated soil to prevent direct contact.

A permeable cap would be appropriate at this location because groundwater is not present at the site and migration offsite is not likely. Based on the approximate extent of contamination, the cap would need to cover approximately 2500 square feet.

The land would continue to be held by USAF under Section 121 of CERCLA, as amended by SARA. The NCP requires that remedial actions which result in any hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every 5 years to ensure protection of human health and the environment. Therefore, 5-year reviews would be required until cleanup levels are met for the site (indefinitely).

5.2 SCREENING OF REMEDIAL ALTERNATIVES FOR THE BBA

In this section, the alternatives presented in Section 5.1 are screened based on effectiveness, implementability, and cost.

5.2.1 BBA Alternative 1: No Action

This alternative would not be protective of human health or the environment. Lead is relatively immobile and the concentration is not expected to decrease at a rate that would achieve the RAOs within a reasonable timeframe. The potential for unacceptable human or environmental exposure to site contaminants under unrestricted land use would remain for as long as contaminant concentrations are above the cleanup levels.

No technical obstacles are involved with implementing the no-action alternative, but administrative approval is unlikely. No costs are associated with this alternative.

This alternative will receive detailed analysis for a baseline comparison to other alternatives in accordance with Section 300.430(e)(3) of the NCP.

5.2.2 BBA Alternative 2: Chemical Stabilization and Institutional Controls

This alternative would be moderately protective of human health and the environment. Though chemical stabilization limits the mobility of lead, it does not reduce the presence or concentration. The potential for unacceptable human or environmental exposure to site contaminants under unrestricted land use would remain for as long as contaminant concentrations are above cleanup levels. This alternative would call for restrictions on land use.

The technical obstacles to implementation of this alternative are limited to the logistical planning associated with the application of the chemical stabilizer. Administrative approval is more challenging for this alternative because it does not allow for unrestricted land use and requires administrative control to ensure protectiveness.

Costs associated with this alternative are relatively low. However, because this alternative allows a hazardous substance to remain onsite, USAF would likely have to maintain ownership of the site and perform 5-year reviews in perpetuity, increasing the long-term cost of the alternative. Cost evaluations in the FS are limited to 30 years for the purpose of detailed analysis; therefore, the actual long-term cost of this alternative might be underestimated.

This alternative has been retained for further consideration based on its implementability and cost.

5.2.3 BBA Alternative 3: Removal and Offsite Disposal

Removal and transport of lead-contaminated soil above the ADEC level to an approved TSDF would rapidly and effectively minimize exposure to soil contaminants. Thus, this alternative could effectively address soil contamination. Removal of the contaminants would not require maintenance or implementation of ICs. This alternative would require the excavation and shipment of all contaminated soil, as well as the backfilling of resulting excavations.

The primary challenge involved with implementing this alternative would be the transportation of contaminated soil from the site and clean backfill to the site, which would involve trucking containers between Top and Lower Camps site as well as barging the containers to the nearest shipping port in Dutch Harbor, AK. Trucks would require approximately 1 hour each round trip on a poorly-maintained, single-lane gravel road. Numerous trips would be necessary to remove all of the soil. Seasonality of barge service may also affect the barging logistics. The time needed to complete this alternative is primarily related to excavation of contaminated soil, and would be relatively fast. Administrative approval is likely for this alternative because the removal ensures protectiveness at the site.

The cost for offsite disposal is primarily related to transportation, which would include onsite trucking and offsite barging to the contiguous United States. Costs for transportation and disposal are dependent on the concentration of lead in the soil. Offsite disposal costs range from $85 to $275 per ton (for non-RCRA-regulated and RCRA-regulated soil, respectively) depending on lead concentrations, and do not include shipping costs, which can be upward of $1 million from a remote location such as Driftwood Bay RRS. Both RCRA and non-RCRA levels of lead have been found at the BBA and segregation of the soil would be required. Best management practices such as Storm Water Pollution Prevention Plans (SWPPP) would also be needed to prevent possible negative environmental impacts.

This alternative has been retained for further consideration because of its high level of effectiveness.

5.2.4 BBA Alternative 4: Chemical Stabilization and Offsite Disposal

Chemical stabilization, removal, and transport of soil with concentrations of lead above the ADEC cleanup level to an approved TSDF would rapidly and effectively minimize exposure to contaminated soil. Thus, this alternative could effectively address soil contamination. Removal of the contaminants would not require maintenance or implementation of ICs. This alternative would require the stabilization, excavation, and shipment of all contaminated soil, as well as backfilling the resulting excavations.

Implementation of this alternative is very similar to BBA Alternative 3: Removal and Offsite Disposal. The primary difference in implementation would be the need to transport chemical stabilizer to the site and apply it to the soil prior to removal. In exchange, soil would not need to be segregated into RCRA and non-RCRA waste.

The cost for offsite disposal is primarily related to transportation, which would include onsite trucking and offsite barging to the contiguous United States. Costs are similar to BBA Alternative 3: Removal and Offsite Disposal. However, the chemical stabilization should eliminate the cost associated with segregation and reduce the disposal cost to approximately $85 per ton for non-RCRA regulated waste. Shipping costs are still expected to be high, upward of $1 million from a remote location such as Driftwood Bay RRS. Best management practices such as SWPPPs would also be needed to prevent possible negative environmental impacts.

This alternative has been retained for further consideration because of its high level of effectiveness.

5.2.5 BBA Alternative 5: Chemical Stabilization and Onsite Disposal

This alternative would be protective of human health and the environment as long as the permeable cap remained intact. Though chemical stabilization limits the mobility of lead, it does not reduce the presence or concentration. The permeable cap would prevent human or environmental exposure to lead. The protectiveness of this alternative is limited because some control would be required to assure that the cap was not disturbed.

The technical obstacles to implementation of this alternative are limited to the logistical planning associated with the application of the chemical stabilizer and bringing soil from the quarry to the site for the cap. Administrative approval is likely for this alternative because it is protective of human health and the environment.

Costs associated with this alternative are moderate and are primarily associated with the cost of getting equipment to the site needed to install the soil cap. However, because this alternative allows a hazardous substance to remain onsite, USAF would likely have to maintain ownership of the site and perform 5-year reviews in perpetuity, thus increasing the long-term cost of this alternative. Cost evaluations in the FS are limited to 30 years for the purpose of detailed analysis; therefore the actual long-term cost of this alternative may be underestimated.

This alternative has been retained for further consideration because of its effectiveness, implementability, and cost.

5.2.6 Summary of Screening Results for the BBA

Table 5-1 compares the effectiveness, implementability, and cost of the screened alternatives. Figure 5-1 shows relative costs of the various technologies applied at this site. Figure 5-1 was developed strictly for screening purposes using the published unit costs presented previously and modified for site-specific factors. Appendix B contains detailed cost estimates performed for the alternatives.

Table 5-1
Screening of Alternatives for BBA Lead-Contaminated Soil

Alternative	Effectiveness	Implementability	Cost	Retained for Detailed Analysis?
1: No Action	○	●	●	Yes
2: Chemical Stabilization and Institutional Controls	◐	●	●	Yes
3: Removal and Offsite Disposal	●	◐	◐	Yes
4: Chemical Stabilization and Offsite Disposal	●	◐	◐	Yes
5. Chemical Stabilization and Onsite Disposal	◐	◐	◐	Yes

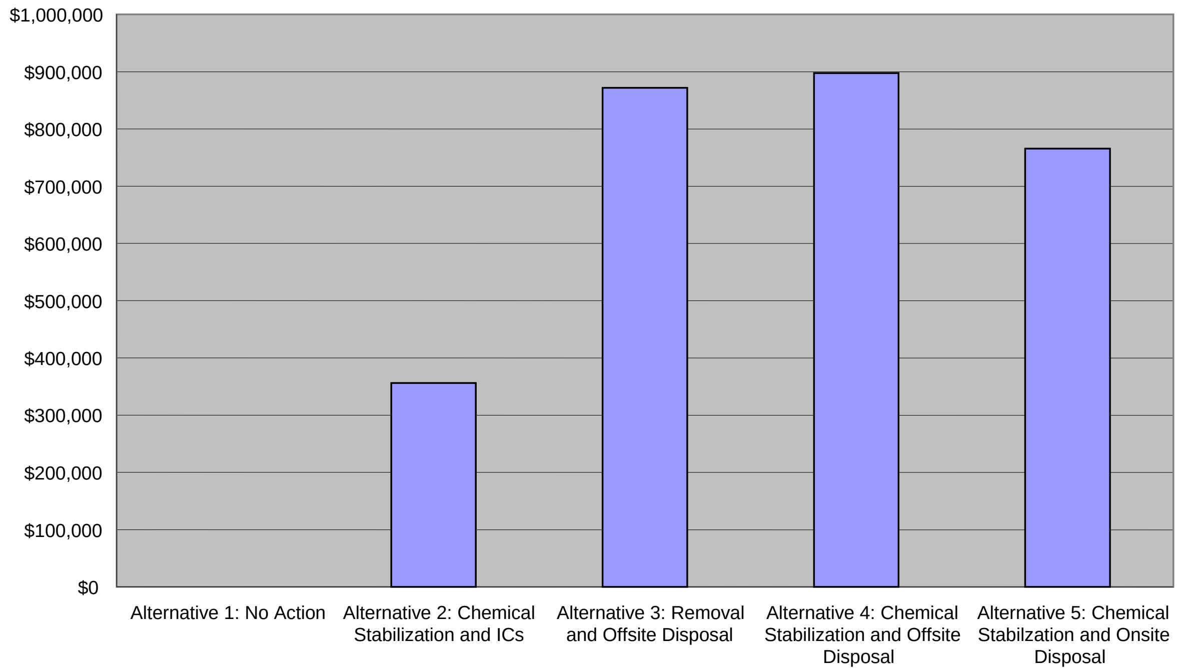
Notes:

● Highly effective, easy to implement, or low cost

◐ Somewhat effective, difficulty to implement, or moderate cost

○ Not effective, very difficult to implement, or high cost

Figure 5-1
Relative Costs of Alternatives for BBA Lead-Contaminated Soil



5.3 DETAILED ANALYSIS OF ALTERNATIVES FOR THE BBA

Remedial options in this section are evaluated assuming approximately 93 cy (140 tons) of lead-contaminated soil at the site. Based on the screening presented in Section 5.2, all alternatives screened were retained for detailed analysis. These include the following:

- BBA Alternative 1: No Action
- BBA Alternative 2: Chemical Stabilization and Institutional Controls
- BBA Alternative 3: Removal and Offsite Disposal
- BBA Alternative 4: Chemical Stabilization and Offsite Disposal
- BBA Alternative 5: Chemical Stabilization and Onsite Disposal

Sections 5.3.1 through 5.3.5 present detailed analysis for each selected alternative. Section 5.3.6 presents a comparison of the alternatives and their ability to achieve NCP criteria.

5.3.1 BBA Alternative 1: No Action

Under the no-action alternative, no activities would be undertaken to treat the contamination present or to prevent exposure to the contamination. No monitoring would be conducted. Table 5-2 summarizes the ability of this alternative to meet the NCP criteria. Values are based on the rating system described in Section 2.5, and their development is presented in the subsections below.

Table 5-2
Evaluation of BBA Alternative 1

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Fail
Compliance with ARARs	Fail
Long-Term Effectiveness and Permanence	0
Reduction in Toxicity, Mobility, and Volume through Treatment	0
Short-Term Effectiveness	2
Implementability	2
Cost	$0

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative would not be protective of human health or the environment. The potential for unacceptable human or environmental exposure to lead would remain for as long as concentrations are above the cleanup level. BBA Alternative 1 does not include ICs or site controls to prevent human contact with the contamination.

Compliance with ARARs

Because this alternative lacks ICs, people could be exposed to lead at concentrations above the ADEC Method Two cleanup level of 400 mg/kg. Thus, this alternative fails to comply with chemical-specific ARARs (Appendix A).

Long-Term Effectiveness and Permanence

Under the no-action alternative, lead-contaminated soil above the RAO cleanup level would remain onsite. Without action, the RAOs would not be achieved within a reasonable timeframe.

Lead is relatively immobile and the concentration would not be expected to decrease over time without some type of remedial action. This alternative would not be effective as a treatment for lead-contaminated soil.

Reduction of Toxicity, Mobility, or Volume Through Treatment

This alternative will not treat or immobilize contamination.

Short-Term Effectiveness

Implementation of this alternative would not involve intrusive activities. Implementation would have no negative impacts on community or worker health and safety or environmental quality; however, natural processes would not reduce lead concentrations below those presented in the RAOs within a reasonable timeframe.

No technical obstacles are involved with implementing the no-action alternative, but administrative approval is unlikely.

Cost

There are no costs associated with this alternative.

5.3.2 BBA Alternative 2: Chemical Stabilization and Institutional Controls

Table 5-3 summarizes the ability of BBA Alternative 2 to satisfy the objectives established by the NCP. Table 5-3 summarizes the ability of this alternative to meet NCP criteria. The rationale for the values listed in Table 5-3 is presented in the subsections below.

Table 5-3
Evaluation of BBA Alternative 2

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	3
Reduction in Toxicity, Mobility, and Volume Through Treatment	0
Short-Term Effectiveness	4
Implementability	4
Cost (in millions)	$0.35

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes to leave lead-contaminated soil at the site in place with the addition of a chemical stabilizer to limit migration. This effectively protects human health and the environment under a recreational land use scenario, but does not allow for unrestricted use of the site. RAOs would be only be achieved by limiting access and thus exposure to lead at the site.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

The long-term effectiveness of this alternative is highly dependent on maintenance of ICs. The site-specific risk assessment shows that concentrations of lead at the site are protective of human health and the environment under a recreational land use scenario. Because ICs are the primary means of preventing exposure to the contamination, they must be enforced and monitored to allow this alternative to be effective. If implemented, contamination at concentrations above the RAOs would remain onsite for more than 5 years, and 5-year reviews would be required.

Reduction of Toxicity, Mobility, or Volume Through Treatment

The goal of this alternative would be to prevent exposure to, rather than treat, lead-contaminated soil. This alternative would not satisfy the statutory preference for treatment as a principal element.

Short-Term Effectiveness

Implementation of this alternative would not involve intrusive activities. Implementation would have no negative impacts on community or worker health and safety or environmental quality. However, natural processes would not reduce lead to concentrations below those presented in the RAOs within a reasonable timeframe.

Implementability

Implementation of this alternative is relatively straightforward. The largest challenge is in the logistics of mobilizing the chemical stabilizer to the site. Chemical stabilizer is generally applied at a rate of 2.5 percent by weight. For the BBA, approximately 3.5 tons of stabilizer would be required.

Mobilization of stabilizer to the site would be most cost effective using a helicopter sling load from Dutch Harbor to the site, with the stabilizer contained in Super Sacks® (approximately 650 pounds each to allow for lift). This would avoid the need to mobilize heavy equipment to the site. A crew would also mobilize via helicopter directly to the site and would hand spread the chemical stabilizer. It is estimated that this action could be performed in one day. Administrative approval should be possible, though more challenging because contaminated soil would remain onsite.

Cost

Cost estimates for this alternative were based on the assumption that 93 cy (140 tons) of soil would require chemical stabilization. This alternative would cost approximately $350,000 to implement (Appendix B). Costs include the application of chemical stabilizer and the maintenance of ICs at the site. The costs for this alternative have been developed based on the following assumptions:

- This alternative would require an estimated one day of onsite work to apply chemical stabilizer to the volume of contaminated soil located at the BBA.
- An estimated 650 pounds per Super Sack® would be loaded for transport from Dutch Harbor to the site.
- Approximately 12 trips between the Dutch Harbor and the site would be required to transfer chemical stabilizer and personnel.
- Containers would be staged in Dutch Harbor (approximately 11 Super Sacks®, 650 pounds per Super Sack®).

5.3.3 BBA Alternative 3: Removal and Offsite Disposal

Table 5-4 summarizes the ability of BBA Alternative 3 to satisfy the objectives established by the NCP. The rationale for the values listed in Table 5-4 is presented in the subsections below.

Table 5-4
Evaluation of BBA Alternative 3

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	5
Reduction in Toxicity, Mobility, and Volume Through Treatment	0
Short-Term Effectiveness	3
Implementability	2
Cost (in millions)	$0.87

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes to remove lead-contaminated soil from the facility, effectively protecting human health and the environment. RAOs would be achieved at project completion.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative has the potential to be highly effective for addressing site contamination. Lead-contaminated soil would be removed from the site for a high degree of long-term effectiveness. Removal would be confirmed with analytical laboratory testing.

Reduction of Toxicity, Mobility, or Volume Through Treatment

No lead-contaminated soil would remain at the site, and the excavated soil would not be treated. Instead, excavated soil would be sent to a TSDF (RCRA-regulated, when necessary) for ultimate disposition. This alternative would not satisfy the statutory preference for treatment as a principal element.

Short-Term Effectiveness

Removal of lead-contaminated soil would be highly effective in a short time. Excavation of large volumes of soil could have negative environmental impacts. Because much of the site has previously been developed, anticipated impacts are not considered significant. The estimated 47 round trips between Top Camp and Lower Camp required to implement this alternative pose a significant risk due to dangers associated with the road condition between Top Camp and Lower Camp at the Driftwood Bay RRS. Soil excavation and containerization would expose site workers to the contamination as well as to hazards associated with working in and around excavations. These hazards would be addressed by instigating Occupational Safety and Health Administration (OSHA) / Hazardous Waste Operations and Emergency Response (HAZWOPER) requirements.

Implementability

Implementation of this alternative is logistically challenging. Equipment and personnel are not readily available in the area; therefore, mobilization to the installation would be required. Mobilization of equipment to the site would require transporting equipment via barge (likely from Anchorage due to the limited availability of equipment in Dutch Harbor). Once barged to Driftwood Bay, equipment would need to be transported along an unmaintained road. Upgrade of this road may be required prior to mobilization to the site.

Mobilization of other supplies and personnel could be achieved through air transport to Dutch Harbor, followed by small boat or air transport to the Driftwood Bay RRS. Again, road maintenance could be required for a safe and efficient mobilization. Demobilization of soil, equipment, and surplus supplies would be handled similarly to mobilization. Care would be taken to avoid spreading contamination during excavation and containerization activities. No additional activities would be required for lead-contaminated soil if this alternative were implemented. Administrative approval should be easily attained.

Cost

Cost estimates for this alternative were based on the assumption that 93 cy (140 tons) of soil would require excavation and offsite disposal. This alternative would cost approximately $870,000 to implement (Appendix B). Costs include excavation, containerization, shipment, and disposal of lead-contaminated soil. The costs for this alternative have been developed based on the following assumptions:

- This alternative would require an estimated two weeks of onsite work to set-up work areas, camp, and address the total volume of contaminated soil located at the site.
- Soil would be excavated and loaded into 1 cy Super Sacks®. An estimated $^{1}/_{2}$ ton per SuperSack would be loaded and 6 SuperSacks placed on a flatbed for transport to Lower Camp.
- Approximately 47 trips between the Top and Lower Camp would be made to transfer lead-contaminated soil (140 tons, 3 tons per outgoing trip).
- Super Sacks® staged at Lower Camp would be placed on a barge for transport to Dutch Harbor, AK.

- Approximately half of the soil generated during excavation will be regulated under RCRA.

5.3.4 BBA Alternative 4: Chemical Stabilization and Offsite Disposal

Table 5-5 summarizes the ability of BBA Alternative 4 to satisfy the objectives established by the NCP. The rationale for the values listed in Table 5-5 is presented in the subsections below.

Table 5-5
Evaluation of BBA Alternative 4

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	5
Reduction in Toxicity, Mobility, and Volume Through Treatment	1
Short-Term Effectiveness	3
Implementability	4
Cost (in millions)	$0.90

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes to remove lead-contaminated soil from the facility, effectively protecting human health and the environment. RAOs would be obtained at project completion.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative has the potential to be highly effective for addressing site contamination. Lead-contaminated soil would be removed from the site for a high degree of long-term effectiveness. Removal would be confirmed with analytical laboratory testing.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Though no lead-contaminated soil would remain at the site, chemical stabilization only limits mobility and leachability. The lead will remain in the soil, though it will be less available and thus less hazardous. Soil would be sent to a TSDF for ultimate disposition as lead-contaminated soil (non-RCRA). This alternative would not satisfy the statutory preference for treatment as a principal element.

Short-Term Effectiveness

Removal of lead-contaminated soil would be highly effective in a short time. Excavation of large volumes of soil could have negative environmental impacts. Because much of the site has previously been developed, anticipated impacts are not considered significant. The estimated 47 round trips between Top Camp and Lower Camp required to implement this alternative pose a significant risk due to dangers associated with the road condition between Top Camp and Lower Camp at the Driftwood Bay RRS. Soil excavation and containerization would expose site workers to the contamination as well as to hazards associated with working in and around excavations. These hazards would be addressed by instigating OSHA and HAZWOPER requirements.

Implementability

Implementation of this alternative is logistically challenging. Equipment and personnel are not readily available in the area; therefore, mobilization to the installation would be required. Mobilization of equipment to the site would require transporting equipment and chemical stabilizer via barge (likely from Anchorage due to the limited availability of equipment in Dutch Harbor). Once barged to Driftwood Bay, equipment would need to be transported along an unmaintained road. Improvement to this road could be required prior to mobilization to the site.

Mobilization of other supplies and personnel could be achieved through air transport to Dutch Harbor, followed by small boat or air transport to the Driftwood Bay RRS. Again, road maintenance could be required for a safe and efficient mobilization. Demobilization of soil, equipment, and surplus supplies would be handled similarly to mobilization. Care would be taken to avoid spreading contamination during excavation and containerization activities. No additional activities would be required for lead-contaminated soil if this alternative were implemented. Administrative approval should be easily attained.

Cost

Cost estimates for this alternative were based on the assumption that 93 cy (140 tons) of soil would require excavation and offsite disposal. This alternative would cost approximately $900,000 to implement (Appendix B). Costs include excavation, containerization, shipment, and disposal of lead-contaminated soil. The costs for this alternative have been developed based on the following assumptions:

- This alternative would require an estimated 2 weeks of onsite work to set-up work areas, camp, and address the total volume of contaminated soil located at the site.
- Soil would be excavated and loaded into 1 cy Super Sacks®. An estimated $^1/_2$ ton per Super Sack® would be loaded and six Super Sacks® placed on a flatbed for transport to Lower Camp.
- Approximately 47 trips between the Top and Lower Camp would be made to transfer lead-contaminated soil (140 tons, 3 tons per outgoing trip).
- Super Sacks® staged at Lower Camp would be placed on a barge for transport to Dutch Harbor, AK.
- No lead-contaminated soil generated would be regulated under RCRA.

5.3.5 BBA Alternative 5: Chemical Stabilization and Onsite Disposal

Table 5-6 summarizes the ability of BBA Alternative 5 to satisfy the objectives established by the NCP. The rationale for the values listed in Table 5-6 is presented in the subsections below.

Table 5-6
Evaluation of BBA Alternative 5

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	4
Reduction in Toxicity, Mobility, and Volume Through Treatment	0
Short-Term Effectiveness	2
Implementability	3
Cost (in millions)	$0.77

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes leaving lead-contaminated soil in place with the addition of a chemical stabilizer to limit migration, and a soil cover to prevent direct contact. If properly maintained this alternative effectively protects human health and the environment, but does restrict excavation at the site. RAOs would be only be achieved by limiting access and thus exposure to the site.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

The long-term effectiveness of this alternative is dependent on maintenance of the permeable cap and ICs. The soil cover may require periodic maintenance, especially in the windblown, unvegetated areas that exist at the site. Contamination at concentrations above the RAOs will remain onsite for more than 5 years, so 5-year reviews will be required.

Reduction of Toxicity, Mobility, or Volume Through Treatment

The goal of this alternative would be to prevent exposure to, rather than treat, lead-contaminated soil. This alternative would not satisfy the statutory preference for treatment as a principal element.

Short-Term Effectiveness

This alternative would be moderately protective of the community and site workers during the remedial action. Because of surface contamination, the possibility of short-term exposure risk to workers associated with construction of the cap exists. Short-term risk associated with cap maintenance may also present an exposure concern for future site workers. However, natural processes would not reduce lead to concentrations below the RAOs.

Implementability

Implementation of this alternative provides a moderate challenge. The greatest complexity is in the logistics of mobilizing the necessary equipment and chemical stabilizer to the site. Chemical stabilizer is generally applied at a rate of 2.5 percent by weight. For the BBA, approximately 3.5 tons of stabilizer would be required.

Mobilization of stabilizer and equipment to the site would require a barge (likely from Anchorage due to the limited availability of equipment in Dutch Harbor). Once barged to Driftwood Bay, equipment would need to be transported along an unmaintained road. Mobilization of other supplies and personnel could be achieved through air transport to Dutch Harbor, followed by small boat or air transport to the Driftwood Bay RRS. It is estimated that this action, including offload of equipment and mobilization to the site from Lower Camp, could be performed in 1 week. Administrative approval should be possible, though more challenging because lead-contaminated soil remains onsite.

Cost

Cost estimates for this alternative were based on the assumption that 93 cy (140 tons) of soil would require chemical stabilization and a 50- by 50-foot soil cover. This alternative would cost approximately $770,000 to implement (Appendix B). Costs include the application of chemical stabilizer, onsite disposal by addition of a 2-foot soil cover, and the maintenance of ICs at the site. The costs for this alternative have been developed based on the following assumptions:

- This alternative would require an estimated 1 week of onsite work to mobilize, apply chemical stabilizer, and install 2-feet of soil cover over the volume of contaminated soil located at the BBA.
- Stabilizer, equipment, and personnel would be transported to the site from Dutch Harbor, AK with a small landing craft.
- Daily air transport (helicopter) to and from Dutch Harbor, AK would be required for personnel during this activity.
- Equipment and personnel would return to Dutch Harbor, AK from the site on a small landing craft.

5.3.6 Comparison of Remedial Alternatives for the BBA

This section compares the five alternatives that received detailed analysis in Sections 5.3.1 to 5.3.5 according to their ability to comply with NCP criteria. Table 5-7 provides a summary.

Table 5-7
Comparison of Alternatives for the BBA Lead-Contaminated Soil

Evaluation Criteria	BBA Alternative 1: No Action	BBA Alternative 2: Chemical Stabilization and Institutional Controls	BBA Alternative 3: Removal and Offsite Disposal	BBA Alternative 4: Chemical Stabilization and Offsite Disposal	BBA Alternative 5: Chemical Stabilization and Onsite Disposal
Overall Protection of Human Health and the Environment	Fail	Pass	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass	Pass
Long-Term Effectiveness and Permanence	0	3	5	5	4
Reduction in Toxicity, Mobility, and Volume Through Treatment	0	0	0	1	0
Short-Term Effectiveness	2	4	3	3	2
Implementability	2	4	2	4	3
Cost (in millions)	$0	$0.35	$0.87	$0.90	$0.77

Threshold Criteria

BBA Alternative 1 fails to comply with the threshold criteria. Because this alternative lacks both ICs and active treatment, humans could be exposed to lead at concentrations above the ADEC Method Two cleanup level. The remaining alternatives are protective of human health and the environment and could be implemented in a manner that complies with all chemical-, location-, and action-specific ARARs.

Because Alternative 1 fails to attain the threshold criteria, it will not be considered further.

Primary Balancing Criteria

Alternatives 2-5 would be effective. BBA Alternatives 2 and 5 would require the maintenance of ICs indefinitely; however, ICs are already required in this area because of an onsite landfill. BBA Alternatives 3 and 4 are most effective, but have higher difficulties in implementability and cost. BBA Alternative 5 is also more difficult to implement and does not significantly lower risk compared to BBA Alternative 2. Because of simple implementation, low cost, and effectiveness, BBA Alternative 2, Chemical Stabilization and Institutional Controls, is recommended by USAF.

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6.0 REMEDIAL ALTERNATIVE FOR SITE LF006: OLD DISPOSAL SITE

Site LF006 is located at Lower Camp approximately 3,500 feet south of the south end of the runway. In 2007, characterization activities were conducted at several sites at the former Driftwood Bay RRS, including Site LF006. Investigation activities at Site LF006 identified additional electronic debris (batteries and transformers) not previously investigated and indicated several areas of lead-contaminated soil within the site. Site LF006 landownership is not well defined at this time. The site may be on property currently owned by the U.S. Fish and Wildlife Service (USFWS).

Remedial alternatives for lead-contaminated soil at Site LF006 were developed based on the RAOs described in Section 3.0 and the remedial technology described in Section 4.0.

The following alternatives were evaluated for treatment of lead-contaminated soil at Site LF006:

- LF006 Alternative 1: No Action
- LF006 Alternative 2: Chemical Stabilization and Institutional Controls
- LF006 Alternative 3: Removal and Offsite Disposal
- LF006 Alternative 4: Chemical Stabilization and Offsite Disposal
- LF006 Alternative 5: Chemical Stabilization and Onsite Disposal

Based on estimated soil volumes (Table 1-1), approximately 230 cy of lead-contaminated soil at this site requires action under CERCLA.

6.1 DEVELOPMENT OF REMEDIAL ALTERNATIVES FOR SITE LF006

To develop a remedial strategy for lead-contaminated soil at Site LF006, a conceptual understanding of the volume and location of the contamination was needed. Approximately 230 cy of lead-contaminated soil remains at the site, which is approximately 345 tons of soil based on the estimate of 1.5 tons per cy. Estimates of contaminant mass and distribution were developed as follows:

- 2007, 2009, and 2010 analytical data for lead were considered.
- Volumes of contaminated media were estimated (Section 1.1).
- An estimated density of the soil of 1.5 tons per cy was used to convert volume estimates to weight estimates.

6.1.1 LF006 Alternative 1: No Action

Under the no-action alternative, no activities would be undertaken to treat the contamination present or to prevent exposure to the contamination. No monitoring would be conducted. A no-action alternative is required for consideration under the NCP and serves as a baseline against which other alternatives can be compared.

6.1.2 LF006 Alternative 2: Chemical Stabilization and Institutional Controls

Under this alternative, soil contaminated with lead above the ADEC Method Two cleanup level (400 mg/kg) would be treated with a chemical stabilization product and ICs would be placed on the site. Calcium hydroxyapatite (or equivalent stabilizer) would be placed on the soil in situ to increase stabilization and prevent leaching of lead. This action would limit the migration of lead from the site. Method Four cleanup levels indicate that potential exposures to lead at Site LF006 could pose an unacceptable hazard to adult recreational receptors, including pregnant women, under current and reasonably anticipated land use; therefore, ICs restricting site access would be required. The ICs would be used to prohibit access to lead-contaminated soil at the site. Section 121 of CERCLA, as amended by SARA, and the NCP require that remedial actions resulting in any hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every 5 years to ensure protection of human health and the environment. Therefore, 5-year reviews would be required until cleanup levels are met for the site (indefinitely).

6.1.3 LF006 Alternative 3: Removal and Offsite Disposal

Under this alternative, soil contaminated with lead above the Method Two cleanup level (400 mg/kg) would be excavated, staged, manifested, and transported for disposal to a

RCRA-permitted chemical waste landfill capable of managing RCRA-regulated lead-contaminated soil. Soil would be excavated and staged onsite prior to transport. Analytical samples would be collected from the staged soil for waste profiling purposes.

The following logistical coordination and manifesting activities would be required for excavation, staging, transport, and disposal of lead-contaminated soil at a licensed TSDF:

- Staging, segregating into RCRA and non-RCRA waste streams, and containing excavated lead-contaminated soils
- Loading lead-contaminated soil into Super Sacks® for transport from the site to the beach
- Chartering a barge from Driftwood Bay to Dutch Harbor with containers
- Staging containers at Dutch Harbor for barge transport to the TSDF
- Barging and trucking containers from Dutch Harbor to the TSDF
- Collecting and analyzing confirmation samples to ensure that soil containing concentrations of lead over the ADEC cleanup level has been removed.

Confirmation sampling of the excavation would be required to ensure that contaminants were no longer present at concentrations above the ADEC cleanup levels. Once analytical results from confirmation samples indicate that all contaminated soil has been removed, the excavation would be backfilled.

6.1.4 LF006 Alternative 4: Chemical Stabilization and Offsite Disposal

Under this alternative, soil contaminated with lead above the Method Two cleanup level (400 mg/kg) would be treated with a chemical stabilization product then excavated, staged, manifested, and transported for disposal to a chemical waste landfill capable of managing lead-contaminated soil. Calcium hydroxyapatite (or equivalent stabilizer) would be placed on the soil in situ to limit leaching of lead and reduce the likelihood of a RCRA waste stream being generated. Soil would then be excavated and staged onsite prior to transport. Samples would be collected from the staged soil for waste profiling.

The following logistical coordination and manifesting activities would be required for excavation, staging, transport, and disposal of lead-contaminated soil at a licensed TSDF:

- Loading lead-contaminated soil into Super Sacks® for transport from the site to the beach
- Chartering a barge from Driftwood Bay to Dutch Harbor with containers
- Staging containers at Dutch Harbor for barge transport to the TSDF
- Barging and trucking containers from Dutch Harbor to the TSDF
- Collecting and analyzing confirmation samples to ensure cleanup levels have been met

Confirmation sampling would be required post-treatment to ensure contaminants were present at levels below ADEC cleanup criteria. Once confirmation is received that all contaminated soil has been removed, the excavation would be backfilled.

6.1.5 LF006 Alternative 5: Chemical Stabilization and Onsite Disposal with Institutional Controls

Under this alternative, soil contaminated with lead above Method Two cleanup levels (400 mg/kg) would be treated with a chemical stabilization product, Then a 2-foot soil cap would be placed over the site. Calcium hydroxyapatite (or equivalent stabilizer) would be placed on the soil in situ to increase stabilization and prevent leaching of lead. This action would limit the migration of lead from the site. After stabilization, the onsite disposal would consist of a geotextile layer and 2 feet of cover material placed over the lead-contaminated soil to prevent direct contact.

Onsite disposal would be appropriate for this site because lead migration offsite is not likely. Based on the approximate extent of contamination, the cap would need to cover approximately 2,175 square feet.

The land would also need to be acquired by USAF. Section 121 of CERCLA, as amended by SARA, and the NCP require that remedial actions resulting in any hazardous substances, pollutants, or contaminants that remain at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every 5 years to ensure protection of human health and the environment. Therefore, 5-year reviews would be required until cleanup levels are met for the site (indefinitely).

6.2 SCREENING OF REMEDIAL ALTERNATIVES FOR SITE LF006

In this section, the alternatives presented in Section 5.1 are screened based on effectiveness, implementability, and cost.

6.2.1 LF006 Alternative 1: No Action

This alternative would not be protective of human health or the environment. Lead is relatively immobile and the concentration is not expected to decrease at a rate that would achieve the RAOs within a reasonable timeframe. The potential for unacceptable human or environmental exposure to lead under unrestricted land use would remain for as long as contaminant concentrations are above cleanup levels.

No technical obstacles are involved with implementing the no-action alternative, but administrative approval is unlikely. No costs are associated with this alternative.

This alternative will receive detailed analysis for a baseline comparison to other alternatives, in accordance with Section 300.430(e)(3) of the NCP.

6.2.2 LF006 Alternative 2: Chemical Stabilization and Institutional Controls

This alternative would be moderately protective of human health and the environment. Though chemical stabilization limits the mobility of lead, it does not reduce the presence or concentration. The potential for unacceptable human or environmental exposure to lead under any land use would remain for as long as contaminant concentrations are above cleanup levels. This alternative would require restricted access to the site.

The technical obstacles to implementation of this alternative are limited to the logistical planning associated with the application of the chemical stabilizer and fencing necessary to restrict site access. Administrative approval is very challenging for this alternative because it does not allow for unrestricted land use and therefore requires restriction of physical access to the site to ensure protectiveness.

Costs associated with this alternative are relatively low. However, because this alternative allows a hazardous substance to remain onsite, USAF would likely have to maintain ownership of the site and perform 5-year reviews in perpetuity, which increase the long-term cost of the alternative. Cost evaluations in the Feasibility Study are limited to 30 years for the purpose of detailed analysis; therefore, the actual long-term cost of this alternative may be underestimated.

This alternative has been retained for further consideration because of its implementability and cost.

6.2.3 LF006 Alternative 3: Removal and Offsite Disposal

Removal of lead-contaminated soil above ADEC cleanup criteria to an approved TSDF would rapidly and effectively minimize exposure to soil contaminants. Thus, this alternative could effectively address soil contamination. Removal of the contaminants would not require maintenance or implementation of ICs. This alternative would require the excavation and shipment of all contaminated soil, as well as the backfilling of resulting excavations.

The primary challenge involved with implementing this alternative would be the transportation of contaminated soil from the site and clean backfill to the site, which would involve containers and trucking between the site and the beach as well as barging the containers to the nearest shipping port in Dutch Harbor, AK. Seasonality of barge service may also affect the barging logistics. The time required to complete this alternative is primarily related to excavation of contaminated soil, and would be relatively quick. Administrative approval is likely for this alternative because the removal would ensure protectiveness at the site.

The cost for offsite disposal is primarily related to transportation, which would include onsite trucking and offsite barging to the contiguous United States. Transportation and disposal costs are dependent upon the concentration of lead in soil. Offsite disposal costs range from $85 to $275 per ton (for non-RCRA-regulated and RCRA-regulated soil, respectively), depending on lead concentrations, and do not include shipping costs, which can be upward of $1 million from a remote location such as Driftwood Bay RRS. Both RCRA and non-RCRA levels of lead have been found at Site LF006. Segregation of this soil would be required. Best management practices such as SWPPPs would also be needed to prevent possible negative environmental impacts.

This alternative has been retained for further consideration because of its high level of effectiveness.

6.2.4 LF006 Alternative 4: Chemical Stabilization and Offsite Disposal

Chemical stabilization and removal of lead-contaminated soil above ADEC cleanup criteria to an approved TSDF would rapidly and effectively minimize exposure to soil contaminants. Thus, this alternative could effectively address soil contamination. Removal of the contaminants would not require maintenance or implementation of ICs. This alternative would require stabilization, excavation and shipment of all contaminated soil, as well as backfilling the resulting excavations.

Implementation of this alternative is very similar to Site LF006 Alternative 3: Removal and Offsite Disposal. The primary differences in implementation would be the need to transport chemical stabilizer to the site and apply it to the soil prior to removal. In exchange, soil would not need to be segregated into RCRA and non-RCRA waste.

The cost for offsite disposal is primarily related to transportation, which would include onsite trucking and offsite barging to the contiguous United States. Costs are similar to Site LF006 Alternative 3: Removal and Offsite Disposal. However, the chemical stabilization should eliminate the cost associated with segregation and reduce the disposal cost to approximately $85 per ton. Shipping costs are still expected to be high, upward of $1 million from a remote location such as Driftwood Bay RRS. Best management practices such as SWPPPs would also be needed to prevent possible negative environmental impacts.

This alternative has been retained for further consideration because of its high level of effectiveness.

6.2.5 LF006 Alternative 5: Chemical Stabilization and Onsite Disposal

This alternative would be protective of human health and the environment as long as the permeable cap cover remained intact. Though chemical stabilization limits the mobility of lead, it does not reduce the presence or concentration. The soil cover would prevent human or environmental exposure to site contaminants. The protectiveness of this alternative is limited because some control would be required to assure that the cover was not disturbed.

The technical obstacles to implementation of this alternative are limited to logistical planning associated with the application of the chemical stabilizer and transportation of soil to the site for the cap. Administrative approval is likely for this alternative because it is protective of human health and the environment.

Costs associated with this alternative are moderate and are primarily associated with the cost of transporting equipment to the site required to install the soil cap. However, because this alternative allows a hazardous substance to remain onsite, USAF would like have to maintain ownership of the site and would need to perform 5-year reviews in perpetuity, which increases the long-term cost of the alternative. Because cost evaluations in the FS are limited to 30 years for the purpose of detailed analysis, the actual long-term cost of this alternative may be underestimated.

This alternative has been retained for further consideration because of its effectiveness, implementability, and cost.

6.2.6 Summary of Screening Results for Site LF006

Table 6-1 compares the effectiveness, implementability, and cost of the screened alternatives. Figure 6-1 shows relative costs of the various technologies applied at this site. Figure 6-1 was developed strictly for screening purposes using the published unit costs previously presented, which have been modified for site-specific factors. Appendix B contains detailed cost estimates performed for the alternatives.

Table 6-1
Screening of Alternatives for Site LF006 Lead-Contaminated Soil

Alternative	Effectiveness	Implementability	Cost	Retained for Detailed Analysis?
1: No Action	○	●	●	Yes
2: Chemical Stabilization and Institutional Controls	○	●	●	Yes
3: Removal and Offsite Disposal	●	◐	◐	Yes
4: Chemical Stabilization and Offsite Disposal	●	◐	◐	Yes
5. Chemical Stabilization and Onsite Disposal	◐	◐	◐	Yes

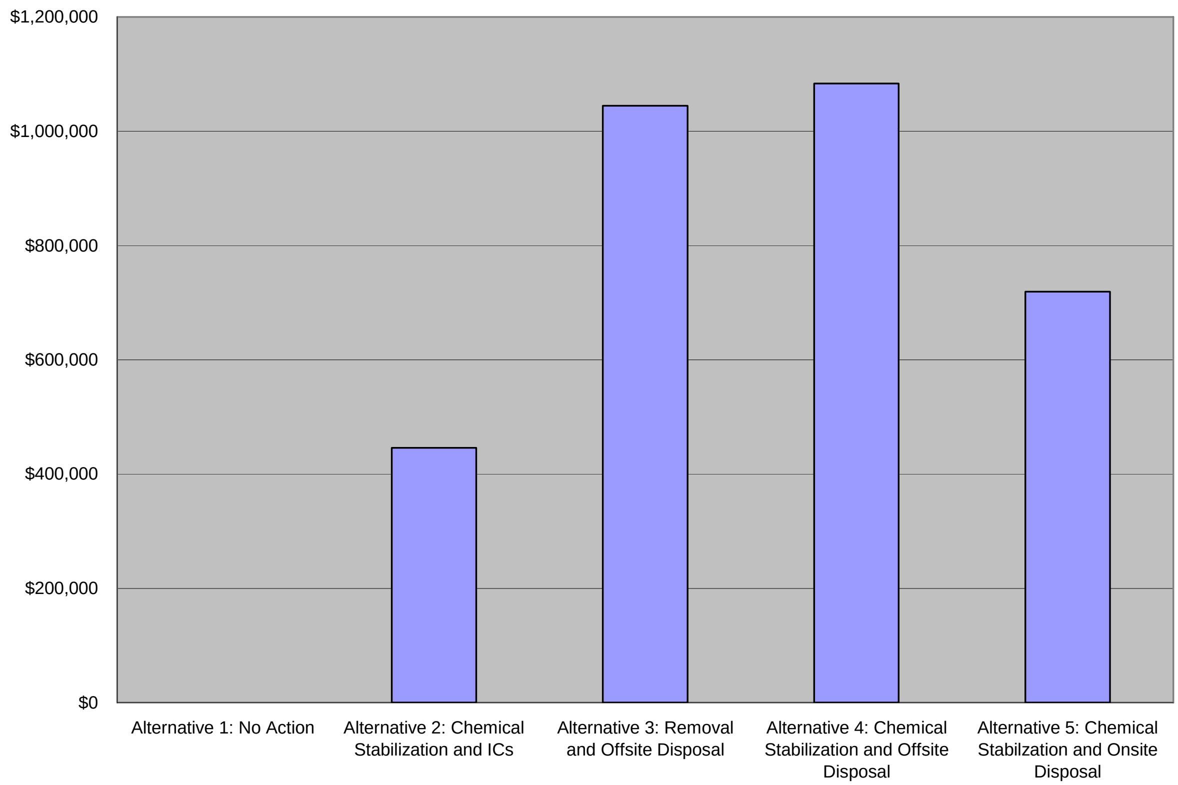
Notes:

● Highly effective, easy to implement, or low cost

◐ Somewhat effective, difficulty to implement, or moderate cost

○ Not effective, very difficult to implement, or high cost

Figure 6-1
Relative Costs of Alternatives for Site LF006 Lead-Contaminated Soil



6.3 DETAILED ANALYSIS OF ALTERNATIVES FOR SITE LF006

Remedial options in this section are evaluated assuming approximately 230 cy (345 tons) of lead-contaminated soil at the site. Based on the screening presented in Section 6.2, all alternatives screened were retained for detailed analysis. These include the following:

- LF006 Alternative 1: No Action
- LF006 Alternative 2: Chemical Stabilization and Institutional Controls
- LF006 Alternative 3: Removal and Offsite Disposal
- LF006 Alternative 4: Chemical Stabilization and Offsite Disposal
- LF006 Alternative 5: Chemical Stabilization and Onsite Disposal

Sections 6.3.1 through 6.3.5 present detailed analysis for each selected alternative. Section 6.3.6 presents a comparison of the alternatives and their ability to achieve NCP criteria.

6.3.1 LF006 Alternative 1: No Action

Under the no-action alternative, no activities would be undertaken to treat the contamination present or to prevent exposure to the contamination. No monitoring would be conducted. Table 6-2 summarizes the ability of this alternative to meet the NCP criteria. Values are based on the rating system described in Section 2.5, and their development is presented in the subsections below.

Table 6-2
Evaluation of LF006 Alternative 1

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Fail
Compliance with ARARs	Fail
Long-Term Effectiveness and Permanence	0
Reduction in Toxicity, Mobility, and Volume Through Treatment	0
Short-Term Effectiveness	2
Implementability	2
Cost	$0

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative would not be protective of human health or the environment. The potential for unacceptable human or environmental exposure to site contaminants would remain for as long as contaminant concentrations are above cleanup levels. This alternative does not include ICs or site controls to prevent human contact with the contamination.

Compliance with ARARs

Because this alternative lacks ICs, people could be exposed to site contaminants at concentrations above regulatory limits. Thus, this alternative fails to comply with chemical-specific ARARs (Appendix A).

Long-Term Effectiveness and Permanence

Under the no-action alternative, lead-contaminated soil above human-health cleanup levels would remain onsite. Concentrations of fuel contaminants would decrease slowly over time through biodegradation. Without action, the RAOs would not be achieved within a reasonable timeframe.

Lead is relatively immobile and the concentration is not expected to decrease over time without some type of remedial action. This alternative would not be effective as a treatment for lead-contaminated soil.

Reduction of Toxicity, Mobility, or Volume Through Treatment

This alternative will not treat or immobilize contamination.

Short-Term Effectiveness

Implementation of this alternative would not involve intrusive activities. Implementation would have no negative impacts on community or worker health and safety or environmental quality; however, natural processes would not reduce contaminants to concentrations below those presented in the RAOs within a reasonable timeframe.

No technical obstacles are involved with implementing the no-action alternative, but administrative approval is unlikely.

Cost

There are no costs associated with this alternative.

6.3.2 LF006 Alternative 2: Chemical Stabilization and Institutional Controls

Table 6-3 summarizes the ability of Site LF006 Alternative 2 to satisfy the objectives established by the NCP. The rationale for the values listed in Table 6-3 is presented in the subsections below.

Table 6-3
Evaluation of LF006 Alternative 2

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	3
Reduction in Toxicity, Mobility, and Volume Through Treatment	0
Short-Term Effectiveness	4
Implementability	4
Cost (in millions)	$0.45

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes to leave lead-contaminated soil in place with the addition of a chemical stabilizer to limit migration. This alternative requires the restriction of access to the site to effectively protect human health and the environment under any land use scenario. RAOs would only be achieved by prohibiting access and thus exposure to the site.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs if ICs are properly maintained.

Long-Term Effectiveness and Permanence

The long-term effectiveness of this alternative is highly dependent on maintenance of ICs. The site-specific risk assessment shows that concentrations of lead at the site are not protective of human health and the environment under any land use scenario. Because ICs are the primary means of preventing exposure to the contamination, physical barriers must be installed and maintained as well as administrative control enforced and monitored to allow this alternative to be effective. Contamination at concentrations above the RAOs will remain onsite for more than 5 years, so 5-year reviews will be required.

Reduction of Toxicity, Mobility, or Volume Through Treatment

The goal of this alternative would be to prevent exposure to, rather than treat, lead-contaminated soil. Therefore, this alternative would not satisfy the statutory preference for treatment as a principal element.

Short-Term Effectiveness

Implementation of this alternative would not involve intrusive activities. Impacts on community or worker health and safety or environmental quality would be limited to the installation of a fence around the lead-contaminated areas. Natural processes would not reduce contaminants to concentrations below those presented in the RAOs within a reasonable timeframe.

Implementability

Implementation of this alternative is relatively straightforward. The greatest challenge is in the logistics of mobilizing the chemical stabilizer and fencing materials to the site. Chemical stabilizer is generally applied at a rate of 2.5% by weight. For Site LF006, approximately 9 tons of stabilizer would be required.

Mobilization of stabilizer and fencing to the site would be most cost effective using a helicopter sling load from Dutch Harbor to the site in Super Sacks® or bundles (approximately 650 lbs. each to allow for lift). This would avoid the need to mobilize heavy equipment to the site. A crew would also mobilize via helicopter directly to the site and would hand-spread the chemical stabilizer. It is estimated that this action could be performed in 5 days.

Administrative approval would be very difficult because contaminated soil with the associated potential risk to human-health or the environment remains onsite.

Cost

Cost estimates for this alternative were based on the assumption that 230 cy (345 tons) of soil would require chemical stabilization. This alternative would cost approximately $446,000 to implement (Appendix B). Costs include the application of chemical stabilizer and the maintenance of ICs at the site. The costs for this alternative have been developed based on the following assumptions:

- This alternative would require an estimated 5 days of onsite work to apply chemical stabilizer to the volume of contaminated soil located at Site LF006 and install fencing around the site.
- An estimated 650 pounds per load would be loaded for transport from Dutch Harbor to the site.
- Approximately 14 trips between the Dutch Harbor and the site would be made to transfer chemical stabilizer, fencing, and personnel.
- Materials would be staged in Dutch Harbor (approximately 11 Super Sacks® and 2 fence bundles).

6.3.3 LF006 Alternative 3: Removal and Offsite Disposal

Table 6-4 summarizes the ability of Site LF006 Alternative 3 to satisfy the objectives established by the NCP. The rationale for the values listed in Table 6-4 is presented in the subsections below.

Table 6-4
Evaluation of LF006 Alternative 3

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	5
Reduction in Toxicity, Mobility, and Volume Through Treatment	0
Short-Term Effectiveness	3
Implementability	2
Cost (in millions)	$1.0

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes to remove lead-contaminated soil from the facility, effectively protecting human health and the environment. RAOs would be obtained at project completion.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative has the potential to be highly effective for addressing site contamination. Lead-contaminated soil would be removed from the site for a high degree of long-term effectiveness. Removal would be confirmed with analytical laboratory testing.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Though no lead-contaminated soil would remain at the site, the soil would not be treated. Instead, soil would be sent to a TSDF (RCRA-regulated, when necessary) for ultimate disposition. This alternative would not satisfy the statutory preference for treatment as a principal element.

Short-Term Effectiveness

Removal of lead-contaminated soil would be highly effective in a short time. Excavation of large volumes of soil could have negative environmental impacts. Because much of the site has previously been developed, anticipated impacts are not considered significant. Soil excavation and containerization would expose site workers to the contamination as well as to hazards associated with working in and around excavations. These hazards would be addressed by instigating OSHA and HAZWOPER requirements.

Implementability

Implementation of this alternative is logistically challenging. Equipment and personnel are not readily available in the area; therefore, mobilization to the installation would be required. Mobilization of equipment to the site would require transporting equipment via barge (likely from Anchorage due to the limited availability of equipment in Dutch Harbor). Once barged to Driftwood Bay, equipment would need to be transported to the site along an unmaintained road.

Mobilization of other supplies, and personnel could be achieved through air transport to Dutch Harbor, followed by small boat or air transport to the Driftwood Bay RRS. Demobilization of soil, equipment, and surplus supplies would be handled similarly to mobilization. Care would be taken to avoid spreading contamination during excavation and containerization activities. No additional activities would be required for lead-contaminated soil if this alternative were implemented. Administrative approval should be easily attained.

Cost

Cost estimates for this alternative were based on the assumption that 230 cy (345 tons) of soil would require excavation and offsite disposal. This alternative would cost approximately $1 million to implement (Appendix B). Costs include excavation, containerization, shipment, and disposal of lead-contaminated soil. The costs for this alternative have been developed based on the following assumptions:

- This alternative would require an estimated 2 weeks of onsite work to set-up work areas and address the total volume of contaminated soil located at the site.
- Soil would be excavated and loaded into 1 cy Super Sacks®. An estimated $^{1}/_{2}$ ton per Super Sack® would be loaded and six Super Sacks® placed on a flatbed for transport to the beach.
- Approximately 115 trips between the site and the beach would be made to transfer lead-contaminated soil (345 tons, 3 tons per outgoing trip).
- Super Sacks® staged at the beach would be placed on a barge for transport to Dutch Harbor, AK.
- Approximately 25 percent of the soil generated during excavation would be regulated under RCRA.

6.3.4 LF006 Alternative 4: Chemical Stabilization and Offsite Disposal

Table 6-5 summarizes the ability of Site LF006 Alternative 4 to satisfy the objectives established by the NCP. The rationale for the values listed in Table 6-5 is presented in the subsections below.

Table 6-5
Evaluation of LF006 Alternative 4

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	5
Reduction in Toxicity, Mobility, and Volume Through Treatment	1
Short-Term Effectiveness	3
Implementability	4
Cost (in millions)	$1.1

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes to remove lead-contaminated soil from the facility, effectively protecting human health and the environment. RAOs would be obtained at project completion.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative has the potential to be highly effective for addressing site contamination. Lead-contaminated soil would be removed from the site for a high degree of long-term effectiveness. Removal of contamination to below acceptable cleanup levels would be confirmed through laboratory analysis.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Though no lead-contaminated soil would remain at the site above acceptable cleanup levels, the chemical stabilization performed on soil in situ does not reduce the toxicity of lead in the soil, only limits mobility and leachability. The soil will be rendered nonhazardous, and be sent to a TSDF for ultimate disposition as lead-contaminated soil (non-RCRA). This alternative would not satisfy the statutory preference for treatment as a principal element.

Short-Term Effectiveness

Removal of lead-contaminated soil would be highly effective in a short time. Excavation of large volumes of soil could have negative environmental impacts. Because much of the site has previously been developed, anticipated impacts are not considered significant. Soil excavation and containerization would expose site workers to the contamination as well as to hazards associated with working in and around excavations. These hazards would be addressed by enforcing OSHA and HAZWOPER requirements.

Implementability

Implementation of this alternative would be moderately challenging. The greatest complexity is in the logistics of mobilizing the necessary equipment and chemical stabilizer to the site. Chemical stabilizer is generally applied at a rate of 2.5 percent by weight. For Site LF006, approximately 9 tons of stabilizer would be required. Mobilization of equipment to the site would require transporting equipment and chemical stabilizer via barge (likely from Anchorage due to the limited availability of equipment in Dutch Harbor). Once barged to Driftwood Bay, equipment would need to be transported along an unmaintained road.

Mobilization of other supplies, and personnel could be achieved through air transport to Dutch Harbor, followed by small boat or air transport to the Driftwood Bay RRS. Demobilization of soil, equipment, and surplus supplies would be handled similarly. Care would be taken to avoid spreading contamination during excavation and containerization activities. No additional activities would be required for lead-contaminated soil if this alternative were implemented. Administrative approval should be easily attained.

Cost

Cost estimates for this alternative were based on the assumption that 230 cy (345 tons) of soil would require excavation and offsite disposal. This alternative would cost approximately $1.1 million to implement (Appendix B). Costs include excavation, containerization, shipment, and disposal of lead-contaminated soil. The costs for this alternative have been developed based on the following assumptions:

- This alternative would require an estimated two weeks of onsite work to set-up work areas and address the total volume of contaminated soil located at the site.
- Soil would be excavated and loaded into 1 cy Super Sacks®. An estimated $^{1}/_{2}$ ton per Super Sack® would be loaded and six SuperSacks placed on a flatbed for transport to the beach.
- Approximately 115 trips between the Top and Lower Camp would be made to transfer lead-contaminated soil (230 tons, 3 tons per outgoing trip).
- Super Sacks® would be placed on a barge for transport to Dutch Harbor, AK.
- No lead-contaminated soil generated as waste would be regulated under RCRA.

6.3.5 LF006 Alternative 5: Chemical Stabilization and Onsite Disposal

Table 6-6 summarizes the ability of Site LF006 Alternative 5 to satisfy the objectives established by the NCP. The rationale for the values listed in Table 6-6 is presented in the subsections below.

Table 6-6
Evaluation of LF006 Alternative 5

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	4
Reduction in Toxicity, Mobility, and Volume Through Treatment	0
Short-Term Effectiveness	2
Implementability	3
Cost (in millions)	$0.72

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes to leave lead-contaminated soil in place with the addition of a chemical stabilizer to limit migration and a permeable cap to prevent direct contact. If properly maintained, this alternative effectively protects human health and the environment, but does restrict excavation at the site. RAOs would be only be achieved by limiting access and thus exposure to the site.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

The long-term effectiveness of this alternative is dependent on maintenance of the soil cover and ICs. The soil cover may require periodic maintenance, especially in the windblown, unvegetated areas that exist at the site. Contamination at concentrations above RAOs would remain onsite for more than 5 years, so 5-year reviews will be required.

Reduction of Toxicity, Mobility, or Volume Through Treatment

The goal of this alternative would be to prevent exposure to, rather than treat, lead-contaminated soil. This alternative would not satisfy the statutory preference for treatment as a principal element.

Short-Term Effectiveness

This alternative would be mostly protective of the community and site workers during the remedial action. Because of surface contamination, the possibility of short-term exposure risk to workers associated with construction of the cap exists. Short-term risks associated with cap maintenance may also present an exposure concern for future site workers. However, natural processes would not reduce contaminants to concentrations below those presented in the RAOs.

Implementability

Implementation of this alternative would be moderately challenging. The greatest complexity is in the logistics of mobilizing the necessary equipment and chemical stabilizer to the site. Chemical stabilizer is generally applied at a rate of 2.5% by weight. For Site LF006, approximately 9 tons of stabilizer would be required. Mobilization of stabilizer and equipment to the site would require a barge (likely from Anchorage due to the limited availability of equipment in Dutch Harbor). Once barged to Driftwood Bay, equipment would need to be transported along an unmaintained road. Mobilization of other supplies and personnel could be achieved through air transport to Dutch Harbor, followed by small boat or air transport to the Driftwood Bay RRS.

Clean soil is available at the site and may be used to construct the soil cover. It is estimated that this action could be performed in one week including offload of equipment and mobilization to the site. Administrative approval should be possible, though more challenging because contaminated soil remains onsite.

Cost

Cost estimates for this alternative were based on the assumption that 230 cy (345 tons) of soil would require chemical stabilization and two permeable caps (75- by 25-foot and a 20- by 15-foot) are required. This alternative would cost approximately $719,000 to implement (Appendix B). Costs include the application of chemical stabilizer, onsite disposal by addition of a 2-foot soil cover, and the maintenance of ICs at the site. The costs for this alternative have been developed based on the following assumptions:

- This alternative would require an estimated 1 week of onsite work for mobilization, application of the chemical stabilizer, and installation of 2 feet of soil cover over the volume of contaminated soil located at Site LF006.
- Stabilizer, equipment, and personnel would barge to the site from Dutch Harbor, AK with a small landing craft (with state rooms for lodging).
- Equipment and personnel would return to Dutch Harbor, AK from the site on a small landing craft.

6.3.6 Comparison of Remedial Alternatives for Site LF006

This section compares the five alternatives that received detailed analysis in Sections 6.3.1 to 6.3.5 according to their ability to comply with NCP criteria. Table 6-7 provides a summary.

Table 6-7
Comparison of Alternatives for the Lead-Contaminated Soil at Site LF006

Evaluation Criteria	LF006 Alternative 1: No Action	LF006 Alternative 2: Chemical Stabilization and Institutional Controls	LF006 Alternative 3: Removal and Offsite Disposal	LF006 Alternative 4: Chemical Stabilization and Offsite Disposal	LF006 Alternative 5: Chemical Stabilization and Onsite Disposal
Overall Protection of Human Health and the Environment	Fail	Pass	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass	Pass
Long-Term Effectiveness and Permanence	0	3	5	5	4
Reduction in Toxicity, Mobility, and Volume Through Treatment	0	0	0	1	0
Short-Term Effectiveness	2	4	3	3	2
Implementability	2	4	2	4	3
Cost (in millions)	$0	$0.45	$1.0	$1.1	$0.72

Threshold Criteria

LF006 Alternative 1 fails to comply with the threshold criteria. Because this alternative lacks both ICs and active treatment, humans could be exposed to site contaminants at concentrations above regulatory (health-based) limits. The remaining alternatives are protective of human health and the environment and could be implemented in a manner that complies with all chemical-, location-, and action-specific ARARs.

Because LF006 Alternative 1 fails to attain the threshold criteria, it will not be considered further.

Primary Balancing Criteria

LF006 Alternatives 3 and 4 are most effective but have higher difficulties in implementability and cost. LF006 Alternative 2 cannot assure protectiveness of the site. LF006 Alternatives 2 and 5 require ICs, which may be difficult and burdensome to maintain, especially on property not currently owned by USAF.

Because of the high effectiveness and the ability to eventually relinquish the land, LF006 Alternative 3, Removal and Offsite Disposal, is recommended by USAF.

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7.0 REMEDIAL ALTERNATIVE FOR PCB-CONTAMINATED SOIL AT SITE OT001

Site OT001, the Former Composite Building, is located approximately 2 miles west of Driftwood Bay and connected to Lower Camp by a winding 4-mile road. This site is owned by USAF. Remedial alternatives for PCB-contaminated soil at Site OT001 were developed based on the RAOs described in Section 3.0 and the remedial technology described in Section 4.0.

The following alternatives were evaluated for treatment of PCB-contaminated soil:

- OT001 Alternative 1: No Action
- OT001 Alternative 2: Institutional Controls
- OT001 Alternative 3: Removal and Offsite Disposal
- OT001 Alternative 4: Onsite Disposal with ICs
- OT001 Alternative 5: On Site Rotary Low-Temperature Thermal Desorption
- OT001 Alternative 6: Halogenated Organic Deconstruction System (HODS)

Based on estimated soil volumes (Table 1-1), approximately 483 tons of PCB-contaminated soil at this site requires action under CERCLA.

7.1 DEVELOPMENT OF REMEDIAL ALTERNATIVES FOR SITE OT001

To develop a remedial strategy for PCB-contaminated soil, a conceptual understanding of the volume and location of the contamination was needed. Approximately 320 cy of PCB-contaminated soil remains at the site, which is approximately 480 tons of soil based on the estimate of 1.5 tons per cy. Estimates of contaminant mass and distribution were developed as follows:

- 2007 analytical data for PCBs were considered.
- Volumes of contaminated media were estimated (Section 1.2.1).
- An estimated density of the soil of 1.5 tons per cy was used to convert volume estimates to weight estimates.

7.1.1 OT001 Alternative 1: No Action

Under the no-action alternative, no activities would be undertaken to treat the contamination present or to prevent exposure to the contamination. No monitoring would be conducted. A no-action alternative is required for consideration under the NCP and serves as a baseline against which other alternatives can be compared.

7.1.2 OT001 Alternative 2: Institutional Controls

Under this alternative, ICs would be placed on the site. The ICs would prevent the disposition and use of any soil excavated from the site, and would be maintained until the concentrations of PCBs in the soil are at such levels to allow for unlimited land use and unrestricted exposure. Method Four cleanup levels indicate potential exposures to PCBs at Site OT001 do not pose an unacceptable hazard to adult recreational receptors, including pregnant women, under current and reasonably anticipated land use; therefore ICs would be placed on the site to maintain recreational use of the property and prevent soil from being moved from the site. The land would continue to be held by USAF. Section 121 of CERCLA, as amended by SARA and the NCP, require that remedial actions which result in any hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every 5 years to ensure protection of human health and the environment. Therefore, 5-year reviews would be required until cleanup levels are met for the site (indefinitely).

7.1.3 OT001 Alternative 3: Removal and Offsite Disposal

Soil contaminated with PCBs above the ADEC cleanup level (1 mg/kg) would be excavated, staged, manifested, and transported for disposal to a TSCA-permitted chemical waste landfill capable of managing bulk PCB remediation waste with concentrations greater than 50 parts per million (ppm). Soil would be excavated, staged, and segregated into TSCA (> 50 mg/kg) and non-TSCA (< 50 mg/kg) waste streams prior to transport. Samples would be collected from the staged soil for waste profiling.

The following logistical coordination and manifesting activities would be required for excavation, staging, transport, and disposal of PCB-contaminated soil at a licensed TSDF:

- Staging, segregating into TSCA and non-TSCA waste streams and containing excavated PCB-contaminated soils in stockpile(s)
- Loading PCB-contaminated soil into containers for chartered barge transport to Dutch Harbor
- Transferring containers from chartered barge to the barge that will travel to the TSDF
- Barging containers from Dutch Harbor to the TSDF
- Collecting and analyzing confirmation samples to ensure cleanup levels have been met

Once analytical results indicate that all contaminated soil has been removed, the excavation would be backfilled.

7.1.4 OT001 Alternative 4: Onsite Disposal with Institutional Controls

Under this alternative, a permeable soil cap would be placed over the PCB-contaminated soil at Site OT001. The permeable cap would consist of a geotextile layer, and 2 feet of cover material would be placed over the PCB-impacted soil to prevent direct contact.

A permeable cap would be appropriate at this location because groundwater is not present at the site and migration offsite is not likely. Based on the approximate extent of contamination, the cap would need to cover approximately 8,600 square feet.

The land would continue to be held by USAF. Section 121 of CERCLA, as amended by SARA and the NCP, require that remedial actions which result in any hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every 5 years to ensure protection of human health and the environment. Therefore, 5-year reviews would be required until cleanup levels are met for the site (indefinitely).

7.1.5 OT001 Alternative 5: On-Site Rotary Low-Temperature Thermal Desorption

Under this alternative, PCB-contaminated soil would be treated onsite using a mobile thermal desorption system.

All power, equipment, and supplies would be transported to Dutch Harbor by plane or barge and then all equipment would be barged to Driftwood Bay RRS. Soil with PCB concentrations above the cleanup level would be excavated and stockpiled prior to thermal desorption treatment. Confirmation samples would be collected during field activities to ensure that soil containing PCBs above the cleanup level was removed.

In the thermal desorption process, soil is heated to volatilize the PCBs, and the exhaust is treated to prevent emissions of volatile contaminants. To address PCBs (with a boiling point greater than 320°C), high-temperature thermal desorption would be used.

A State of Alaska air quality permit may be required, and the system outfitted with appropriate worker safety controls and air pollution controls to prevent short-term risks to human health and the environment during treatment activities.

Mobilization and demobilization would involve air and barge transport of the treatment system to Driftwood Bay RRS. Design, packing, assembly, disassembly, decontamination, and re-packaging of the treatment system would be required before and after use.

Confirmation sampling would be required post-treatment to ensure contaminants were present at levels below the ADEC cleanup level.

7.1.6 Alternative 6: Halogenated Organic Destruction System (HODS)

Under this alternative, PCB-contaminated soil would be treated onsite using HODS. The HODS process breaks PCBs down into a less hazardous substance. The process utilizes a solvent to extract the PCBs from the soil, followed by a chemical agent that dechlorinates the PCB molecule by breaking the carbon-to-carbon bonds within the PCB molecule, and results in the formation of VOCs. A nutrient containing a microbe that is attracted to both the nutrient and the hydrocarbon molecules is then added to the soil, and the microbe consumes the hydrocarbon molecules. A chemical called pentanonic is also added to aid the reduction of PCBs in the soil. It possesses an extreme electric charge that breaks the hydrocarbon molecules into smaller chains, which become fatty acids. pentanonic degrades into the soil after approximately 7 days.

Mobilization and demobilization of the system would involve barge transport of the system to the Driftwood Bay RRS. Confirmation sampling and analysis would be conducted post-treatment to ensure that contaminants were reduced to levels below the ADEC Method Two cleanup level of 1 mg/kg.

7.2 SCREENING OF REMEDIAL ALTERNATIVES FOR SITE OT001

In this section, the alternatives presented in Section 5.1 are screened based on effectiveness, implementability, and cost.

7.2.1 OT001 Alternative 1: No Action

This alternative would not be protective of human health or the environment. PCBs are recalcitrant and relatively immobile, and their concentrations are not expected to decrease at a rate that would achieve the RAOs within a reasonable timeframe. The potential for unacceptable human or environmental exposure to site contaminants would remain for as long as contaminant concentrations are above cleanup levels. PCBs are a persistent contaminant and would likely not be effectively remediated if no action were taken.

No technical obstacles are involved with implementing the no-action alternative, but administrative approval is unlikely. No costs are associated with this alternative.

This alternative will receive detailed analysis for a baseline comparison to other alternatives, in accordance with Section 300.430(e)(3) of the NCP.

7.2.2 OT001 Alternative 2: Institutional Controls

This alternative would be moderately protective of human health and the environment, though it does not reduce the presence or concentration of PCB-contamination. The potential for unacceptable human or environmental exposure to site contaminants under unrestricted land use would remain for as long as contaminant concentrations are above cleanup levels. This alternative would call for restrictions of land use.

There are no technical obstacles involved with implementation of this alternative. However, the administrative approval is challenging for this alternative because it does not allow for unrestricted land use and requires administrative control to ensure protectiveness.

Costs associated with this alternative are relatively low. However, because this alternative allows a hazardous substance to remain onsite USAF would likely have to maintain ownership of the site and would need to perform 5-year reviews in perpetuity, which increases the long-term cost of the alternative. Because cost evaluations in the FS are limited to 30 years for the purpose of detailed analysis, the actual long-term cost of this alternative may be underestimated.

This alternative has been retained for further consideration because of its implementability and cost.

7.2.3 OT001 Alternative 3: Removal and Offsite Disposal

Removal of soil containing concentrations of PCBs greater than 1 mg/kg and transport to an approved TSDF would rapidly and effectively minimize direct contact to PCBs. Thus, OT001 Alternative 3 could effectively address soil contamination. Removal of the contaminants would not require maintenance or implementation of ICs. This alternative would require excavation and shipment of all contaminated soil, as well as backfilling of resulting excavations.

The primary challenge involved with implementing this alternative would be the transportation of contaminated soil from the site and clean backfill to the site, which would involve barging between the Driftwood Bay RRS and the TSDF. The seasonality of barge service may also affect the barging logistics. Logistically, stockpiling excavated soil prior to removal into containers may be considered based on the distance between PCB-contaminated soil areas at the site. Any stockpile may be required to conform with 40 CFR 761.65 regulations for short-term storage of PCBs. The time required to complete this alternative is primarily related to excavation of contaminated soil, and would be quick.

The cost for offsite disposal is primarily related to transportation, which would include barge transportation from Driftwood Bay RRS to the contiguous United States. Transportation and disposal costs are dependent upon the level of PCB contamination. Offsite disposal costs range from $200 to $350 per ton (for bulk PCB remediation waste with concentrations less than 50 ppm and concentrations greater than 50 ppm, respectively), and do not include shipping costs, which can be upward of $1 million from a remote location such as Driftwood Bay RRS. All the soil identified at OT001 is below the bulk PCB remediation waste threshold of 50 mg/kg. Best management practices such as a SWPPP would also be needed to prevent possible negative environmental impacts.

This alternative has been retained for further consideration because of its high level of effectiveness.

7.2.4 OT001 Alternative 4: Onsite Disposal and Institutional Controls

This alternative would be protective of human health and the environment as long as the permeable cap remained intact. A permeable cap would prevent human or environmental exposure to PCB-contaminated soil; it would not reduce the presence or concentration of contamination. The protectiveness of this alternative is limited because some control would be required to assure that the cap was not disturbed.

The technical obstacles to implementation of this alternative are limited to the logistical planning of transporting the soil from a quarry to the site for the cap. Administrative approval is likely for this alternative because it is protective of human health and the environment.

Costs associated with this alternative are moderate and are primarily associated with getting the equipment needed to install the permeable cap to the site. However, because this alternative allows a hazardous substance to remain onsite, USAF would likely be required to maintain ownership of the site and would need to perform 5-year reviews in perpetuity, thus increasing the long-term cost of the alternative. Cost evaluations in the FS are limited to 30 years for the purpose of detailed analysis; therefore, the actual long-term cost of this alternative may be underestimated.

7.2.5 OT001 Alternative 5: Onsite Rotary Low-Temperature Thermal Desorption

Under this alternative, contaminated soil would be excavated and thermally treated using a mobile thermal desorption unit. Thermal desorption has been proven effective in treating PCB-contaminated soil; thus, the direct contact and inhalation exposure pathways would be effectively addressed. Removal of the contaminants would not require maintenance or implementation of ICs. Onsite thermal desorption for PCBs has only been executed at a handful of sites, none as remote as Driftwood Bay RRS.

In order to effectively implement this alternative, air pollution permits would be required, and all applicable air pollution control requirements would need to be met. Dioxins are a known breakdown product of PCBs during this process and present a higher human health risk than PCBs. Because this is an ex situ treatment alternative, excavation of contaminated soil would be required, and best management practices (i.e., SWPPP) would be needed to prevent possible negative environmental impacts. Prior to treatment in an onsite thermal treatment unit, PCB-contaminated soil would be stockpiled. The stockpile would conform to 40 CFR 761.65 regulations for short-term storage of PCBs. Transportation of the treatment unit to the Driftwood Bay RRS site would be challenging but possible.

Mobilization costs for thermal treatment would be relatively high. Costs involved include those of equipment mobilization to the site (approximately 20 containers would be required), excavation, supplemental fuel to operate the treatment unit, and confirmatory sampling and analysis. Generic costs for thermal desorption of contaminated soil in the contiguous United States range from $40 to $300 per cy (FRTR 2010).

Mobilization of a thermal treatment unit into a remote location, high fuel costs, and costs associated with transporting the fuel add significantly to the cost of this alternative. This alternative has been eliminated from further consideration because of challenges associated with implementability and cost.

7.2.6 OT001 Alternative 6: Halogenated Organic Destruction System (HODS)

Under this alternative, PCB-contaminated soil would be treated onsite using HODS technology. HODS includes the use of a chemical agent that breaks down the PCB molecule into VOCs, which are then treated using a bio-enhancement technique and the chemical pentanonic. The treatment would not result in any hazardous waste and would reduce the PCB concentration in the soil to below the ADEC Method Two cleanup level. Confirmation sampling would be required to confirm that all soil containing PCBs greater than 1 mg/kg has been removed.

The biggest obstacle to implementability of HODS at the Driftwood Bay RRS is the remoteness of the site. Personnel and equipment (the system itself, a generator, loaders, and trucks) would be transported by air and/or barge to Dutch Harbor then barged to Driftwood Bay RRS. All of the equipment would require mobilization prior to traveling and would require demobilization after treatment is complete. The cost of utilizing this technology at the Driftwood Bay RRS has been estimated to be approximately $1,000 per cy of contaminated soil. This amount includes the treatment of the contaminated soil, the transport of the system, and the generator needed to power the system.

HODS is an innovative technology. A treatability study was performed in Port Heiden, Alaska during the summer of 2009. Results from the treatability study indicated that the alternative was not effective in treating the contaminated soil; therefore, this alternative has been eliminated for further consideration.

7.2.7 Summary of Screening Results for Site OT001

Table 7-1 compares the effectiveness, implementability, and cost of the screened alternatives. Appendix B contains detailed cost estimates performed for the alternatives.

Table 7-1
Screening of Alternatives for Site OT001

Alternative	Effectiveness	Implementability	Cost	Retained for Detailed Analysis?
1: No Action	○	●	●	Yes
2: Institutional Controls	◐	●	●	Yes
3: Removal and Offsite Disposal	●	◐	◐	Yes
4: Onsite Disposal	◐	◐	○	Yes
5: Onsite Rotary Low-Temperature Thermal Desorption	◐	○	○	No
6: Halogenated Organic Destruction System	◐	○	○	No

Notes:

● Highly effective, easy to implement, or low cost

◐ Somewhat effective, difficulty to implement, or moderate cost

○ Not effective, very difficult to implement, or high cost

7.3 DETAILED ANALYSIS OF ALTERNATIVES FOR SITE OT001

Remedial options in this section are evaluated assuming approximately 320 cy (480 tons) of contaminated soil, which accounts for all contaminated soil known to exist at Site OT001 of Driftwood Bay RRS. Based on the screening presented in Section 5.2, the following alternatives were selected for detailed analysis:

- OT001 Alternative 1: No Action
- OT001 Alternative 2: Institutional Controls
- OT001 Alternative 3: Removal and Offsite Disposal
- OT001 Alternative 4: Onsite Disposal with ICs

Sections 7.3.1 through 7.3.4 present detailed analysis for each selected alternative. Section 7.3.5 presents a comparison of the alternatives and their ability to achieve NCP criteria.

7.3.1 OT001 Alternative 1: No Action

Under the no-action alternative, no activities would be undertaken to treat the contamination present or to prevent exposure to the contamination. No monitoring would be conducted. Table 7-2 summarizes the ability of this alternative to meet the NCP criteria. Values are based on the rating system described in Section 2.5, and their development is presented in the subsections below.

Table 7-2
Evaluation of OT001 Alternative 1

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Fail
Compliance with ARARs	Fail
Long-Term Effectiveness and Permanence	0
Reduction in Toxicity, Mobility, and Volume through Treatment	0
Short-Term Effectiveness	2
Implementability	2
Cost	$0

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative would not be protective of human health or the environment. The potential for unacceptable human or environmental exposure to site contaminants would remain for as long as contaminant concentrations remain above cleanup levels. This alternative does not include ICs or site controls to prevent human contact with the contamination.

Compliance with ARARs

Because this alternative lacks ICs, people could be exposed to site contaminants at concentrations above the ADEC cleanup level (1 mg/kg). Thus, this alternative fails to comply with chemical-specific ARARs (Appendix A).

Long-Term Effectiveness and Permanence

Under the no-action alternative, PCB-contaminated soil above human-health cleanup levels would remain onsite. PCBs are recalcitrant and relatively immobile, and their concentrations are not expected to decrease over time without some type of remedial action. This alternative would not be effective as a treatment for PCB-contaminated soil.

Reduction of Toxicity, Mobility, or Volume Through Treatment

This alternative will not treat or immobilize contamination.

Short-Term Effectiveness

Implementation of this alternative would not involve intrusive activities. Implementation would have no negative impacts on community or worker health and safety or environmental quality; however, natural processes would not reduce contaminants to concentrations below those presented in the RAOs within a reasonable timeframe.

Implementability

No technical obstacles are involved with implementing the no-action alternative, but administrative approval is unlikely.

Cost

There are no costs associated with this alternative.

7.3.2 OT001 Alternative 2: Institutional Controls

Table 7-3 summarizes the ability of OT001 Alternative 2 to satisfy the objectives established by the NCP. The rationale for the values listed in Table 7-3 is presented in the subsections below.

Table 7-3
Evaluation of OT001 Alternative 2

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	3
Reduction in Toxicity, Mobility, and Volume Through Treatment	0
Short-Term Effectiveness	5
Implementability	5
Cost (in millions)	$0.23

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes to leave PCB-contaminated soil in place, but restrict access by use of ICs. This effectively protects human health and the environment under a recreational land use scenario, but does not allow for unrestricted use of the site. RAOs would only be achieved by limiting access and thus exposure to PCBs at the site.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs if properly maintained.

Long-Term Effectiveness and Permanence

The long-term effectiveness of this alternative is highly dependent on maintenance of the ICs. The site-specific risk assessment shows that the concentrations of PCBs at the site are protective of human health and the environment under a recreational land use scenario. Because ICs are the primary means of preventing exposure to the contamination, they must be enforced and monitored to allow this alternative to be effective. Contamination at concentrations above the RAO will remain onsite for more than 5 years; therefore 5-year reviews will be required.

Reduction of Toxicity, Mobility, or Volume Through Treatment

The goal of this alternative would be to prevent exposure to, rather than treat, PCB-contaminated soil. This alternative would not satisfy the statutory preference for treatment as a principal element.

Short-Term Effectiveness

Implementation of this alternative would not involve intrusive activities. Implementation would not have negative impacts on community or worker health and safety or environmental quality. However, natural processes would not reduce contaminants to concentrations below those presented in the RAOs within a reasonable timeframe.

Implementability

There are no technical obstacles involved with implementation of this alternative. However, the administrative approval is challenging for this alternative because it does not allow for unrestricted land use and requires administrative control to ensure protectiveness.

Cost

Cost estimates for this alternative include planning, coordination, site visit, and preparation of land use maps involved with implementing ICs. This alternative would cost approximately $0.23 million to implement (Appendix B).

7.3.3 OT001 Alternative 3: Removal and Offsite Disposal

Table 7-4 summarizes the ability of OT001 Alternative 3 to satisfy the objectives established by the NCP. The subsections below present the rationale for the values in Table 7-4.

Table 7-4
Evaluation of OT001 Alternative 3

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	5
Reduction in Toxicity, Mobility, and Volume Through Treatment	0
Short-Term Effectiveness	3
Implementability	2
Cost (in millions)	$1.36

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes to remove PCB-contaminated soil from the facility, thereby effectively protecting human health and the environment. Contaminated soil would be removed, and RAOs would be attained at project completion. Removal would be confirmed with analytical samples.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

This alternative has the potential to be highly effective for addressing site contamination. PCB-contaminated soil would be removed from the facility for a high degree of long-term effectiveness.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Although no PCB-contaminated soil would remain at the facility, the soil would not be treated but sent to a TSDF for ultimate disposition. This alternative would not satisfy the statutory preference for treatment as a principal element.

Short-Term Effectiveness

Removal of PCB-contaminated soil would be highly effective within a short time. Excavation of large volumes of soil could have negative environmental impacts, but because much of the site has previously been developed, the anticipated impacts are not considered significant. The estimated 33 round trips between Site OT001 and the Driftwood Bay landing area required to implement this alternative pose a significant risk due to dangers associated with the road conditions between Top and Lower Camp at the Driftwood Bay RRS. Soil excavation and containerization would expose site workers to the contamination as well as to hazards associated with working in and around excavations. These hazards would be addressed by instigating OSHA and HAZWOPER requirements.

Implementability

Implementation of this alternative is logistically challenging. Equipment and personnel are not readily available in the area; therefore, mobilization to the installation would be required. Mobilization of equipment to the site would require transporting equipment via barge (likely from Anchorage due to the limited availability of equipment in Dutch Harbor). Once barged to Driftwood Bay, equipment would need to be transported along an unmaintained road. An upgrade of this road will be required prior to mobilization to the site.

Mobilization of other supplies, and personnel could be achieved through air transport to Dutch Harbor, followed by small boat or air transport to the Driftwood Bay RRS. Again, road maintenance could be required for a safe and efficient mobilization. Demobilization of soil, equipment, and surplus supplies would be handled similarly. Care would be taken to avoid spreading contamination during excavation and containerization. No additional activities would be required for PCB-contaminated soil if this alternative were implemented. Administrative approval should be easily attained.

Cost

Cost estimates for this alternative were based on the assumption that 320 cy (483 tons) of soil would require offsite disposal. This alternative would cost approximately $1.36 million to implement (Appendix B). Costs include excavation, containerization, shipment, and disposal of PCB-contaminated soil. The costs for this alternative have been developed based on the following assumptions:

- This alternative would require an estimated 12 days of onsite work when accounting for the total volume of contaminated soil located at Site OT001.
- An estimated 15 tons per container would be loaded for barge transport to the TSDF.
- Approximately 33 containers would be used to transport the PCB-contaminated soil to the TSDF.

7.3.4 OT001 Alternative 4: Onsite Disposal and Institutional Controls

Table 7-5 summarizes the ability of OT001 Alternative 4 to satisfy the objectives established by the NCP. The rationale for the values listed in Table 7-5 is presented in the subsections below.

Table 7-5
Evaluation of OT001 Alternative 4

Evaluation Criteria	Value
Overall Protection of Human Health and the Environment	Pass
Compliance with ARARs	Pass
Long-Term Effectiveness and Permanence	4
Reduction in Toxicity, Mobility, and Volume Through Treatment	0
Short-Term Effectiveness	4
Implementability	3
Cost (in millions)	$0.76

Note: For definitions, see the Acronyms and Abbreviations section.

Overall Protection of Human Health and the Environment

This alternative proposes a permeable cap be placed over PCB-contaminated soil, effectively protecting human health and the environment as long as the cap remained intact. RAOs would be obtained at project completion.

Compliance with ARARs

This alternative would comply with all chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

The long term effectiveness of this alternative is relatively high, but is dependent upon the permeable cap remaining intact, as PCB-contaminated soil will remain onsite. Some control would be required to assure that the cap were not disturbed.

Reduction of Toxicity, Mobility, or Volume Through Treatment

This alternative will not treat or immobilize contamination.

Short-Term Effectiveness

Implementation of this alternative would not involve intrusive activities. Implementation would not have negative impacts on community or worker health and safety, or environmental quality; however, natural processes would not reduce contaminants to concentrations below those presented in the RAOs within a reasonable timeframe.

Implementability

Implementation of this alternative is moderately challenging due to logistics involved with transporting the soil to the site for the permeable cap. Equipment and personnel are not readily available in the area; therefore, mobilization to the installation would be required. Mobilization of equipment to the site would require transporting equipment via barge (likely from Anchorage due to the limited availability of equipment in Dutch Harbor). Once barged to Driftwood Bay, equipment would need to be transported along an un-maintained road. Upgrade of this road will be required prior to mobilization to the site.

Mobilization of other supplies, and personnel could be achieved through air transport to Dutch Harbor, followed by small boat or air transport to the Driftwood Bay RRS. Again, road maintenance could be required for a safe and efficient mobilization. Demobilization of equipment, and surplus supplies would be handled similarly to mobilization.

Cost

Costs associated with this alternative are based on the assumption that 320 cy of cover material will be required to implement the permeable cap. This alternative would cost approximately $0.76 million to implement (Appendix B). Costs include containerization and shipment of cover material. The costs for this alternative have been developed based on the following assumptions:

- This alternative would require an estimated 3 days of onsite work.
- An estimated 15 tons of soil per container would be loaded for barge transport to Driftwood Bay.
- Approximately 33 containers would be used to transport the soil for the permeable cap.

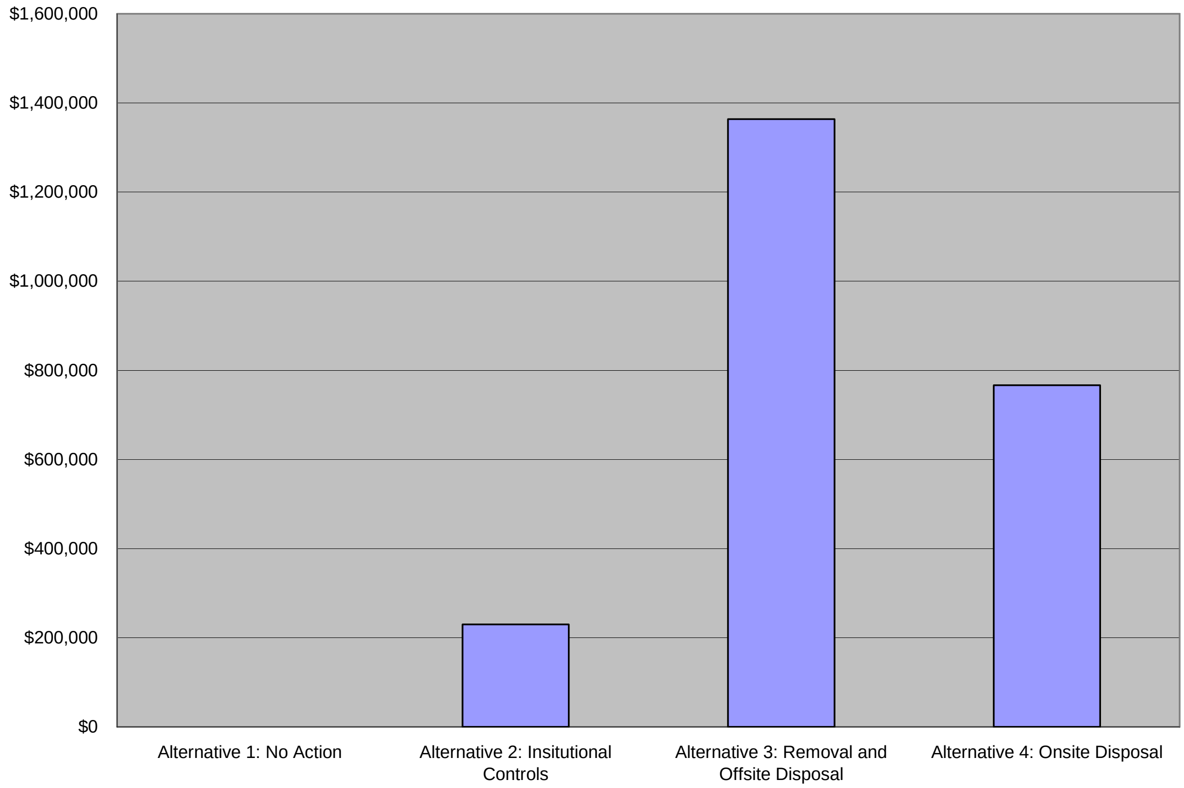
7.3.5 Comparison of Remedial Alternatives for Site OT001

This section compares the four alternatives that received detailed analysis in Sections 7.3.1 to 7.3.4 according to their ability to comply with NCP criteria. Table 7-6 provides a summary and Figure 7-1 shows relative costs of the various technologies applied at this site. Figure 7-1 was developed strictly for screening purposes using the published unit costs presented above modified for site-specific factors.

Table 7-6
Comparison of Alternatives for Site OT001

Evaluation Criteria	OT001 Alternative 1: No Action	OT001 Alternative 2: Institutional Controls	OT001 Alternative 3: Offsite Disposal	OT001 Alternative 4: Onsite Disposal
Overall Protection of Human Health and the Environment	Fail	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass
Long-Term Effectiveness and Permanence	0	3	5	4
Reduction in Toxicity, Mobility, and Volume Through Treatment	0	0	0	0
Short-Term Effectiveness	2	5	3	4
Implementability	2	5	2	3
Cost (in millions)	$0	$0.23	$1.36	$0.76

Figure 7-1
Relative Costs of Alternatives for PCB-Contaminated Soil



Threshold Criteria

OT001 Alternative 1 fails to comply with the threshold criteria. Because this alternative lacks both ICs and active treatment, humans could be exposed to site contaminants at concentrations above regulatory (health-based) limits. The remaining alternatives are protective of human health and the environment and could be implemented in a manner that complies with all chemical-, location-, and action-specific ARARs.

Because OT001 Alternative 1 fails to attain the threshold criteria, it will not be considered further.

Primary Balancing Criteria

OT001 Alternatives 3 and 4 are most effective, but have higher difficulties in implementability and cost. OT001 Alternative 1 cannot ensure protectiveness of the site. OT001 Alternatives 2 and 4 would require the maintenance of ICs indefinitely; however, ICs are already required in this area because of an onsite landfill.

Because of relatively simple implementation, cost, and effectiveness, OT001 Alternative 2, Institutional Controls, is recommended by USAF.

8.0 SUMMARY AND CONCLUSIONS

Based on results from previous investigations, the following sites are recommended to be designated "Cleanup Complete:"

- HESA: Heavy Equipment Storage Area
- SS004: Spill/Leak No. 4
- SS008: Spill/Leak No. 8
- SS005: Spill/Leak No. 5 MOGas at the Runway
- SS011: Spill/Leak No. 11 at Runway Lighting Vault
- FL009: Spill/Leak No. 1 at the Septic Tank
- Quarry Area

The following sites are recommended to be designated "Cleanup Complete" once ICs are established:

- OT001: Antennas and Tanks
- WP003: POL Waste Pit at the Former Composite Building
- SS010: Spill Leak No. 2 at the Former Water Supply Pumphouse

Site SS007: Spill/Leak No. 7 is recommended for MNA with ICs.

The remedial alternatives developed through this FS considered the following areas of concern at the Driftwood Bay RRS:

- BBA: Burned Battery Area
- LF006: Electronic Debris Area
- OT001: Former Composite Building

The following site-specific remedial alternatives were developed:

BBA: Burned Battery Area:

- Alternative 1: No Action
- Alternative 2: Chemical Stabilization and Institutional Controls
- Alternative 3: Removal and Offsite Disposal
- Alternative 4: Chemical Stabilization and Offsite Disposal
- Alternative 5: Chemical Stabilization and Onsite Disposal

LF006: Electronic Debris Area

- Alternative 1: No Action
- Alternative 2: Chemical Stabilization and Institutional Controls
- Alternative 3: Removal and Offsite Disposal
- Alternative 4: Chemical Stabilization and Offsite Disposal
- Alternative 5: Chemical Stabilization and Onsite Disposal

OT001: Former Composite Building

- Alternative 1: No Action
- Alternative 2: Institutional Controls
- Alternative 3: Removal and Offsite Disposal
- Alternative 4: Onsite Disposal and Institutional Controls
- Alternative 5: Onsite Rotary Low-Temperature Thermal Desorption
- Alternative 6: Halogenated Organic Deconstruction System (HODS)

The site specific preferred alternatives developed in this FS are as follows:

- BBA – Alternative 2, Chemical Stabilization with Institutional Controls
- LF006 – Alternative 3, Removal and Offsite Disposal
- OT001 – Alternative 2, Institutional Controls

9.0 REFERENCES

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APPENDIX A
Applicable or Relevant and Appropriate Requirements

UNITED STATES AIR FORCE
611TH AIR SUPPORT GROUP
611TH CIVIL ENGINEER SQUADRON

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

APPENDIX A: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

DRIFTWOOD BAY RADIO RELAY STATION UNALASKA ISLAND, ALASKA

FINAL
JULY 2011

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ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ARAR	applicable or relevant and appropriate requirement
ARCS	assessment and remediation of contaminated sediments
AS	Alaska Statute
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DRO	diesel-range organics
EPA	U.S. Environmental Protection Agency
EqP	equilibrium partitioning
ERL	effects range-low
ERM	effects range-median
GRO	gasoline-range organics
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NAWQC	National Ambient Water Quality Criteria
NOAA	National Oceanic and Atmospheric Administration
ORNL	Oak Ridge National Laboratories
PAH	polycyclic aromatic hydrocarbon
PCBs	polychlorinated biphenyls
PRG	preliminary remediation goal
RI	remedial investigation
RRO	residual-range organics
RRS	Radio Relay Station
SQuiRTs	Screening Quick Reference Tables
SVOC	semivolatile organic compounds

ACRONYMS AND ABBREVIATIONS (Continued)

TAH	total aromatic hydrocarbons
TAqH	total aqueous hydrocarbons
TBC	to be considered
TEC	threshold effects concentration
USC	United States Code
VOC	volatile organic compounds
μg/L	micrograms per liter

1.0 INTRODUCTION

Remedial actions must be designed to comply with federal, state, and local environmental laws, regulations, standards, criteria, and requirements that are legally applicable or relevant and appropriate to the situation. Identification of potential applicable or relevant and appropriate requirements (ARARs) is required for site activities conducted in accordance with the Installation Restoration Program and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) programs at U.S. Department of Defense installations. This appendix defines the concept of ARARs and summarizes some of the draft ARARs that may apply to the remedial alternatives developed for the Driftwood Bay Radio Relay Station (RRS). Final ARARs will be established during the preparation of Decision Documents for the installation. Based on the Code of Federal Regulations (CFR), Title 40, Section 300.5, the following definitions apply:

- **Applicable requirements** are those preliminary remediation goals (PRG), standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at Driftwood Bay RRS.
- **Relevant and appropriate requirements** are PRGs, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at Driftwood Bay RRS, address problems or situations sufficiently similar to those found at Driftwood Bay RRS that their use is well-suited.

ARARs can be in the form of regulations enforceable by federal, state, or local laws, or by regulatory guidance. U.S. Environmental Protection Agency (EPA) guidance (1988) divides ARARs into three categories:

- **Chemical-specific ARARs** define PRGs in the ambient environment.
- **Action-specific ARARs** define performance and design standards for actions to be taken.
- **Location-specific ARARs** modify chemical- and/or action-specific ARARs to reflect the unique requirements of the location.

ARARs are not the only factors that determine what happens at a contaminated site; they represent the minimum requirements for which an action must be taken. In some instances, because of multiple contaminants or pathways, compliance with ARARs will not achieve an acceptable degree of protection. In other cases, nonpromulgated criteria, advisories, and other forms of guidance need to be considered. Therefore, health-based risk levels, ARARs, environmental impacts, and possibly to-be-considered (TBC) criteria or guidelines, are used to set PRGs. The health-based risk levels developed for PRGs must also consider the potential future uses of the site.

2.0 CHEMICAL-SPECIFIC ARARS

Table 2-1 presents exposure media at each site. Identified chemical-specific ARARs are summarized in Table 2-2 and explained in the following sections.

Table 2-1
Exposure Media for Driftwood Bay Radio Relay Station

Media	Exposure Media Present at:	
	Top Camp: Burned Battery Area and OTOO1 Doorways	Lower Camp: Electronic Debris Area
Soil	Y	Y
	Y	Y
Groundwater	N	Y
	N	Y
Surface Water	N	Y
	N	Y
	N	Y
	N	Y
Freshwater Sediment	N	Y
	N	Y

Notes: Y = yes, N = no

2.1 SOIL ARARS

Soil at the site is regulated under Alaska Administrative Code (AAC), Title 18, Chapter 75, Article 3, *Oil and Hazardous Substances Pollution Control Regulations – Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances*. These regulations provide four methods of establishing PRGs for soils: two methods (Methods One and Two) that derive PRGs from standard tables and two methods (Methods Three and Four) that derive site-specific PRGs. Sections 2.1.1 through 2.1.4 discuss these methods. Table 2-2 shows which methods are prepared for use at each site.

Table 2-2
Summary of Chemical-Specific ARARs and To-Be-Considered Guidance for Driftwood Bay Radio Relay Station

Media	Standard	ARAR Assessment	Function
Soil	18 AAC 75.341 – Tables B1 and B2	Applicable	Provides PRGs for specific contaminants
	40 CFR 761	Applicable	Provides federal regulations on sampling and analytical protocols and PRGs for PCBs
Groundwater	18 AAC 75.345 – Table C	Applicable	Provides PRGs for specific contaminants in groundwater
	18 AAC 70	Relevant and Appropriate	Establishes water quality standards for protection of surface water in Alaska
Surface Water	18 AAC 70	Applicable	Establishes water quality standards for protection of surface water in Alaska
	18 AAC 80	Relevant and Appropriate	Applies preliminary MCLs to water that is or may be used for drinking water
	Safe Drinking Water Act	Relevant and Appropriate	Applies drinking water MCLs and nonzero MCLGs to water that is or may be used for drinking water
	NAWQC from the Clean Water Act	Relevant and Appropriate	Applies to surface water
Freshwater Sediment	EqP values based on NAWQC	Applicable	Applies to fresh water sediment
	EPA SQGs	TBC	ARCS TEC values will be used for screening when EqP values are not available. Secondary chronic values will be used for screening when EqP and ARCS TEC values are not available.

Notes: For definitions, see the Acronyms and Abbreviations section.

2.1.1 Method One

Method One soil PRGs [18 AAC 75.341(a) – Table A1 for nonarctic zones, such as Driftwood Bay RRS] apply to soil contaminated with only petroleum products. These standards are not considered risk-based. Because contaminants other than petroleum products are present at the Driftwood Bay RRS, Method One soil PRGs will not be used for the sites presented in this report.

2.1.2 Method Two

Method Two soil PRGs [18 AAC 75.341(c) and (d) – Tables B1 and B2] apply to soils contaminated with petroleum hydrocarbons or other chemicals. The regulation tabulates soil PRGs for gasoline-, diesel-, and residual-range organics as well as organic and inorganic chemicals. The standards applicable at the Driftwood Bay RRS are those for sites located in a nonarctic zone with annual precipitation of greater than or equal to 40 inches. Different PRGs are presented for each of three exposure routes: direct contact, inhalation, and migration to groundwater. Table 2-3 presents these standards for all potential contaminants of concern analyzed during the remedial investigation (RI). In addition, the following technical memorandum has been published, and the associated PRGs are also included in Table 2-3:

- *Environmental Laboratory Data and Quality Assurance Requirements*, Technical Memorandum 06-002 (Alaska Department of Environmental Conservation [ADEC] 2009)

The standards listed in Table 2-3 provide Method Two standards applicable to the Driftwood Bay RRS. Human exposure can occur directly (by direct contact or inhalation) or indirectly (via migration from contaminated soil to groundwater). Table 2-4 presents applicable exposure routes for each site. At sites where all three exposure pathways may exist, the most stringent of the three pathway-specific levels is applicable. At Top Camp, a usable aquifer does not exist beneath the site; site groundwater is temporal and cannot reasonably be expected to act as a transport mechanism for site contaminants. Thus, human health risk caused by contaminants migrating to groundwater cannot reasonably be anticipated for Top Camp. At these sites, specifically the Composite Building and Burned Battery Area, only the more stringent of the standards for the ingestion and inhalation exposure pathways are applicable.

Table 2-3
Regulatory Limits for a Nonarctic Zone with Precipitation Greater Than or Equal to 40 Inches

Analyte	Regulatory Action Limits for Soil[1]			Groundwater[2] (mg/L)	Surface Water Screening Criteria	
	Direct Contact (mg/kg)	Outdoor Inhalation (mg/kg)	Migration to Groundwater (mg/kg)		Freshwater (mg/L)	Marine (mg/L)
Petroleum Hydrocarbons						
GRO	1,400	1,400	260	1.3		
DRO	8,250	12,500	230	1.5		
RRO	8,300	22,000	9,700	1.1		
VOCs by SW8260B						
1,1,1-Trichloroethane	16,600	360	0.82	0.2	0.011	0.011
1,1,2,2-Tetrachloroethane	34	4.1	0.017	0.0043	0.0017	0.0017
1,1,2-Trichloroethane	120	8.6	0.82	0.005	0.00059	1.2
1,1-Dichloroethane	16,600	900	25	7.3	0.047	0.047
1,1-Dichloroethene	75	3.6	0.016	7.3	0.00057	0.00057
1,2,3-Trichloropropane	0.97	0.13	0.00053	0.0004		
1,2,4-Trichlorobenzene	830	41	0.85	0.07	0.26	0.26
1,2,4-Trimethylbenzene	4,100	37	23	1.8		
1,2-Dibromoethane	0.6	3.4	0.00016	0.00005		
1,2-Dichlorobenzene	7,500	45	5.1	0.6	2.7	2.7
1,2-Dichloroethane	75	3.6	0.016	0.005	0.0038	0.0038
1,2-Dichloropropane	100	4	0.018	0.005	0.0005	
1,3,5-Trimethylbenzene	4,100	32	23	1.8		
1,3-Dichlorobenzene	7500	69	28	3.3	0.4	0.4
1,3-Dichloropropane						
1,4-Dichlorobenzene	280	22	0.64	0.075	0.4	0.4
2-Butanone	49,800	23,300	59	22	14	14
Acetone	74,700	51,100	88	33	1.5	1.5
Benzene	120	8.4	0.025	0.005	0.012	0.012

Table 2-3
Regulatory Limits for a Non-Arctic Zone with Precipitation Greater Than or Equal to 40 Inches (Continued)

Analyte	Regulatory Action Limits for Soil[1]			Groundwater[2] (mg/L)	Surface Water Screening Criteria	
	Direct Contact (mg/kg)	Outdoor Inhalation (mg/kg)	Migration to Groundwater (mg/kg)		Freshwater (mg/L)	Marine (mg/L)
Bromobenzene			73	0.023		
Bromochloromethane						
Bromodichloromethane	110	7.3	0.044	0.014		
Bromoform	860	320	0.34	0.11	0.043	0.043
Carbon disulfide	3,900	250	12	3.7	0.00092	0.00092
Carbon tetrachloride	52	2.6	0.023	0.005	0.0025	0.0025
Chlorobenzene	1,700	200	0.63	0.1	0.68	0.68
Chlorodibromomethane	81	11	0.032	0.01	0.0041	0.0041
Chloroform	830	2.4	0.46	0.14	0.057	0.057
cis-1,2-Dichloroethene	830	95	0.24	0.07		
Dichlorodifluoromethane	16,600	280	140	7.3		
Ethylbenzene	8,300	81	6.9	0.7	3.1	3.1
Hexachloro-1,3-butadiene	11	3.8	0.12	0.0073	0.0044	0.0044
Isopropylbenzene	8,300	62	51	3.7		
Methyl bromide	120	11	0.16	0.051	0.047	
Methylene bromide	830	280	1.1	0.37		
Methylene chloride	910	120	0.016	0.005	0.008	0.008
Naphthalene	1,100	21	20	0.73	0.012	0.012
n-Butylbenzene	830	42	15	0.061		
sec-Butylbenzene	830	41	12	0.061		
Styrene	16,600	200	96	0.1		
tert-Butylbenzene	830	70	12	0.061		

Table 2-3
Regulatory Limits for a Non-Arctic Zone with Precipitation Greater Than or Equal to 40 Inches (Continued)

Analyte	Regulatory Action Limits for Soil[1]			Groundwater[2] (mg/L)	Surface Water Screening Criteria	
	Direct Contact (mg/kg)	Outdoor Inhalation (mg/kg)	Migration to Groundwater (mg/kg)		Freshwater (mg/L)	Marine (mg/L)
Tetrachloroethene	13	7.3	0.024	0.005	0.008	0.008
Toluene	6,600	220	6.5	1	6.8	6.8
trans-1,2-Dichloroethene	1,700	120	0.37	0.1	0.14	
Trichloroethene	17	0.42	0.018	0.005	0.027	0.027
Trichlorofluoromethane	24,900	920	86	1.3		
Vinyl acetate	83,000	1,100	100	37	0.016	0.016
Vinyl chloride (chloroethene)	4.5	3.2	0.0085	0.002	0.02	0.02
Xylenes (total)[3]	16,600	63	63	10	0.013	0.013
PAHs by SW8270CSIM[4]						
Acenaphthene	2,300		180	2.2	0.67	0.023
Acenaphthylene	2,300		180	2.2		
Anthracene	16,800		3,000	11	8.3	0.00073
Benzo(a)anthracene	4		3.6	0.0012	0.000028	0.000028
Benzo(a)pyrene	0.4		2.1	0.0002	0.000028	0.000028
Benzo(b)fluoranthene	4		12	0.0012	0.000028	0.000028
Benzo(g,h,i)perylene	1,100		38,700	1.1		
Benzo(k)fluoranthene	40		120	0.012	0.000028	0.000028
Chrysene	400		360	0.12	0.000028	0.000028
Dibenzo(a,h)anthracene	0.4		4	0.00012	0.000028	0.000028
Indeno(1,2,3-c,d)pyrene	4		41	0.0012	0.000028	0.000028
Fluoranthene	1,500		1,400	1.5	0.3	0.3
Fluorene	1,900		220	1.5	1.1	0.0039

Table 2-3
Regulatory Limits for a Non-Arctic Zone with Precipitation Greater Than or Equal to 40 Inches (Continued)

Analyte	Regulatory Action Limits for Soil[1]			Groundwater[2] (mg/L)	Surface Water Screening Criteria	
	Direct Contact (mg/kg)	Outdoor Inhalation (mg/kg)	Migration to Groundwater (mg/kg)		Freshwater (mg/L)	Marine (mg/L)
Naphthalene	1,100	21	20	0.73	0.012	0.012
Phenol	16,800		3,000	11	21	21
Pyrene	1,100		1,100	1.1	0.83	
SVOCs by SW8270C						
1,2,4-Trichlorobenzene	830	41	0.85	0.07	0.26	0.26
1,2-Dichlorobenzene	7,500	45	5.1	0.6	2.7	2.7
1,3-Dichlorobenzene	7500	69	28	3.3	0.4	0.4
1,4-Dichlorobenzene	280	22	0.64	0.075	0.4	0.4
1-Methylnaphthalene	230	560	6.2	1.5		
2,4,5-Trichlorophenol	5,300		67	3.7		
2,4,6-Trichlorophenol	380	3,000	1.4	0.077	0.021	0.021
2,4-Dichlorophenol	190		1.3	0.11	0.07	0.07
2,4-Dimethylphenol	1,100		8.8	0.7	0.38	
2,4-Dinitrophenol	130		0.54	0.073	0.069	
2,4-Dinitrotoluene	7.2		0.0093	0.0013	0.00011	
2,6-Dinitrotoluene	7.2		0.0094	0.0013		
2-Chloronaphthalene	3,800		120	2.9	1	
2-Chlorophenol	410	1900	1.5	0.18	0.081	
2-Methyl-4,6-dinitrophenol					0.013	
2-Methylnaphthalene	230	560	6.1	1.5		
2-Methylphenol (o-cresol)	2,700		15	1.8	0.013	0.013
2-Nitroaniline			180	0.001		

Table 2-3
Regulatory Limits for a Non-Arctic Zone with Precipitation Greater Than or Equal to 40 Inches (Continued)

Analyte	Regulatory Action Limits for Soil[1]			Groundwater[2] (mg/L)	Surface Water Screening Criteria	
	Direct Contact (mg/kg)	Outdoor Inhalation (mg/kg)	Migration to Groundwater (mg/kg)		Freshwater (mg/L)	Marine (mg/L)
2-Nitrophenol						
3,3-Dichlorobenzidine	9.2		0.19	0.0019	0.0004	0.0004
3-Nitroaniline						
4-Bromophenyl phenyl ether						
4-Chloroaniline	80		0.057	0.15		
4-Chloro-3-methyl phenol						
4-Chlorophenyl phenyl ether						
4-Methylphenol (p-cresol)			310	0.18		
4-Nitroaniline						
4-Nitrophenol						
Acenaphthene	2,300		180	2.2	0.67	0.023
Acenaphthylene	2,300		180	2.2		
Aniline			85	0.012		
Anthracene	16,800		3,000	11	8.3	0.00073
Azobenzene			4.4	0.00061		
Benzo(a)anthracene	4		3.6	0.0012	0.000028	0.000028
Benzo(a)pyrene	0.4		2.1	0.0002	0.000028	0.000028
Benzo(b)fluoranthene	4		12	0.0012	0.000028	0.000028
Benzo(g,h,i)perylene	1,100		38,700	1.1		
Benzo(k)fluoranthene	40		120	0.012	0.000028	0.000028
Benzoic acid	259,000		410	150	0.042	0.042
Benzyl alcohol			18,000	11	0.0086	0.0086

Table 2-3
Regulatory Limits for a Non-Arctic Zone with Precipitation Greater Than or Equal to 40 Inches (Continued)

Analyte	Regulatory Action Limits for Soil[1]			Groundwater[2] (mg/L)	Surface Water Screening Criteria	
	Direct Contact (mg/kg)	Outdoor Inhalation (mg/kg)	Migration to Groundwater (mg/kg)		Freshwater (mg/L)	Marine (mg/L)
Bis(2-chloroethoxy)methane						
Bis(2-chloroethyl)ether	6.2	2.5	0.0022	0.00077	0.00031	0.00031
Bis(2-chloroisopropyl)ether			2.9	0.00027	1.4	1.4
Bis(2-ethylhexyl)phthalate	180		13	0.006	0.018	0.018
Butyl benzyl phthalate	2,400		920	7.3	1.5	0.019
Carbazole	230		6.5	0.043		
Chrysene	400		360	0.12	0.000028	0.000028
Dibenzo(a,h)anthracene	0.4		4	0.00012	0.000028	0.000028
Dibenzofuran	170		11	0.073	0.0037	0.0037
Diethyl phthalate	50,600		130	29	23	23
Dimethyl phthalate	633,000		1,100		313	313
Di-n-butyl phthalate	6,500		80	3.7	2.7	2.7
Di-n-octyl phthalate	2,500		3,800	1.5		
Fluoranthene	1,900		220	1.5	0.3	0.3
Fluorene	1,900		220	1.5	1.1	0.0039
Hexachlorobenzene	2.6	1.1	0.047	0.001	0.0000075	0.0000075
Hexachloroethane	53	130	0.21	0.04	0.019	0.019
Indeno(1,2,3-c,d)pyrene	4		41	0.0012	0.000028	0.000028
Isophorone	4,400		3.1	0.9	0.084	0.084
Naphthalene	1,100	21	20	0.73	0.012	0.012
Nitrobenzene	41	90	0.094	0.018	0.017	0.017
n-Nitrosodimethylamine			0.0095	0.0000096	0.0000069	0.0000069

Table 2-3
Regulatory Limits for a Non-Arctic Zone with Precipitation Greater Than or Equal to 40 Inches (Continued)

Analyte	Regulatory Action Limits for Soil[1]			Groundwater[2] (mg/L)	Surface Water Screening Criteria	
	Direct Contact (mg/kg)	Outdoor Inhalation (mg/kg)	Migration to Groundwater (mg/kg)		Freshwater (mg/L)	Marine (mg/L)
n-Nitrosodi-n-propylamine	0.43		0.0011	0.00012	0.000005	
n-Nitrosodiphenylamine	610		15	0.17	0.05	0.05
Pentachlorophenol	32		0.047	0.001	0.0028	0.0028
Phenanthrene	16,800		3,000	11	0.0063	0.0063
Phenol	19,000		68	11	21	21
Pyrene	1,100		1,000	1.1	0.83	
Pyridine			61	0.036		
PCBs						
PCB-1016 (Aroclor 1016)	1	1		0.0005	0.000014	0.00003
PCB-1221 (Aroclor 1221)	1	1		0.0005	0.000014	0.00003
PCB-1232 (Aroclor 1232)	1	1		0.0005	0.000014	0.00003
PCB-1242 (Aroclor 1242)	1	1		0.0005	0.000014	0.00003
PCB-1248 (Aroclor 1248)	1	1		0.0005	0.000014	0.00003
PCB-1256 (Aroclor 1256)	1	1		0.0005	0.000014	0.00003
PCB-1260 (Aroclor 1260)	1	1		0.0005	0.000014	0.00003
Total PCBs	1	1		0.0005	0.000014	0.00003
Total Metals by SW6020						
Chromium	250		25	0.1	0.011	0.05
Lead	400			0.015	0.0032	0.0081

Table 2-3
Regulatory Limits for a Non-Arctic Zone with Precipitation Greater Than or Equal to 40 Inches (Continued)

Analyte	Regulatory Action Limits for Soil[1]			Groundwater[2] (mg/L)	Surface Water Screening Criteria	
	Direct Contact (mg/kg)	Outdoor Inhalation (mg/kg)	Migration to Groundwater (mg/kg)		Freshwater (mg/L)	Marine (mg/L)
Total Mercury by SW7470A/SW7471A						
Mercury	25	13	1.4	0.002	0.00077	0.00094
Hexavalent Chromium by SW7196A						
Chromium VI	250		25	0.1	0.011	0.05

(grey)	No applicable regulatory limit or screening criteria available.
(blue)	EPA Region 6 PRGs Table (EPA 2007), "residential soils" value for soils and "tap water" value for groundwater
(light cyan)	18 AAC 70, *Alaska Water Quality Criteria Manual* (ADEC 2003), freshwater aquatic life criteria
(yellow)	18 AAC 70, *Alaska Water Quality Criteria Manual* (ADEC 2003), saltwater aquatic life criteria (chronic)
(green)	18 AAC 70, *Alaska Water Quality Criteria Manual* (ADEC 2003), human health criteria for noncarcinogens "water + organism"
(pink)	EPA *National Recommended Water Quality Criteria* (EPA 2002), human health criteria for consumption of water and organisms
(orange)	ORNL *Preliminary Remediation Goals for Ecological Endpoints* (ORNL 1997)
(purple)	40 CFR 131.36, 1992 National Toxics Rule, human health risk for consumption of water and organisms, 10^{-5} risk

Notes:
[1] ADEC 18 AAC 75, Tables B1 and B2 (over 40-inch)
[2] ADEC 18 AAC 75, Table C; ADEC Technical Memorandum 01-007
[3] Total xylenes = sum of o-, m-, and p-xylenes
[4] PAH MDLs and PQLs must also meet respective TAH/TAqH action limits of 0.010 and 0.015 mg/L and respective maximum PQLs of 0.0010 and 0.0015 mg/L
For definitions, see Acronyms and Abbreviations section.

Table 2-4
Exposure Routes Applicable to Soil at Each Site

Site	Direct Contact	Inhalation	Migration to Groundwater
OT001: Former Composite Building	X	X	Not applicable
Burned Battery Area	X	X	Not applicable
LF006: Electronic Debris Area	X	X	X

Note: X = Applicable exposure routes for each site

2.1.3 Method Three

Method Three allows for modification of selected default soil PRGs to account for site-specific soil and aquifer data. The applicable PRG is the most stringent of the site-specific calculated PRGs for a particular pathway or pathways and the Method Two level for the remaining exposure pathways. Site-specific PRGs can be developed as follows:

- Inhalation or migration-to-groundwater PRGs can be modified using site-specific soil data and standard equations referenced in the ADEC *Guidance of Cleanup Levels Equations and Input Parameters* (ADEC 2004).
- Inhalation or migration-to-groundwater PRGs can be modified using site-specific data and/or a fate-and-transport model prepared in accordance with the ADEC *Guidance on Fate and Transport Modeling* (ADEC 1998).
- Direct contact or inhalation levels can be modified using acceptable commercial/industrial exposure parameters and standard equations referenced in the ADEC *Guidance of Cleanup Standards Equations and Input Parameters* (ADEC 2004) if ADEC has determined that a commercial/industrial use of the site is appropriate.

2.1.4 Method Four

Method Four provides for establishing site-specific alternative cleanup levels based on the results of a risk assessment. The results of the risk assessment provide a basis for determining whether, and to what extent, cleanup of affected media is warranted. All sites in the 2007 RI were evaluated under the Method Four risk assessment.

Table 2-5 presents potential methods for obtaining PRGs, based on information presented in the RI.

Table 2-5
Source of Soil Standards Used at Each Site

Site	Portion of Site	Method Two	Method Three	Method Four
OT001: Former Composite Building	Doorways	X	X	
Burned Battery Area	All	X		X
LF006: Electronic Debris Area	All	X		X

Note: X = The predicted method for obtaining PRGs.

2.1.5 Polychlorinated Biphenyls

Because soil containing polychlorinated biphenyls (PCBs) was detected at the Driftwood Bay RRS, 40 CFR 761 is considered applicable. These regulations provide standards for the storage, treatment, disposal, and management of wastes containing PCBs. All PCB data will be compared to applicable standards in 40 CFR 761.

2.2 GROUNDWATER ARARS

The groundwater PRGs in 18 AAC 75.345, Table C, are applicable to the Driftwood Bay RRS. For water that is closely connected hydrologically to nearby surface water, these regulations incorporate ADEC Water Quality Standards (18 AAC 70). If ADEC determines that groundwater is not a current or reasonably anticipated future source of drinking water and that contamination will not migrate to a source of drinking water, a concentration equal to 10 times the PRGs in Table C may be appropriate. The regulations in effect at the time of Decision Document signing will be used. As discussed in the site characterization, a number of sites at the Driftwood Bay RRS facility do not contain groundwater. Table 2-3 presents regulatory limits for groundwater.

40 CFR 761 provides standards for the storage, treatment, disposal, and management of wastes containing PCBs. Although groundwater containing PCBs was a potential concern at the Driftwood Bay RRS, based on data gathered during the 2007 RI, groundwater is not an

exposure mechanism nor a contaminant migration mechanism at Top Camp, and PCBs were not detected at Lower Camp.

2.3 SURFACE WATER ARARS

Under 18 AAC 70, ADEC Water Quality Standards are applicable to surface waters at the facility for the protection of human health: "substances may not exceed Alaska Drinking Water Standards (18 AAC 80)." In those cases where no standards are listed in 18 AAC 80, analytical data will be compared to the more stringent of federal maximum contaminant levels (MCL) and nonzero maximum contaminant level goals (MCLG). Federal MCLs and MCLGs are established by the Safe Drinking Water Act [United States Code, Title 40, Part 300(G)] and may apply to surface water that is or may be used for drinking water (EPA 2007). Values for ambient water quality criteria were obtained from National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRTs) (NOAA 2008). The standards set forth in 18 AAC 70 also prohibit total aqueous hydrocarbons (TAqH) in the water column at or above 15 micrograms per liter (μg/L) and prohibit total aromatic hydrocarbons (TAH) in the water column at or above 10 μg/L. TAH is defined as the sum of the results for all benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds detected. TAqH is defined as the sum of the results for all polycyclic aromatic hydrocarbons (PAH) and BTEX compounds detected. Table 2-3 shows these standards. For the compounds analyzed during the 2007 site characterization, the standards set forth in 18 AAC 80 (state MCLs) are a subset of the federal drinking water standards (federal MCLs), and no attempt has been made to differentiate between the two. Standards presented in 18 AAC 80, the Safe Drinking Water Act, and National Ambient Water Quality Criteria are relevant and appropriate to remedial action at the facility.

2.4 SEDIMENT STANDARDS

Samples collected at or below the water table in places where sediments are being moved on a relatively rapid time scale are considered sediment samples. No ARARs have been identified for sediments, and Sections 2.4.1 and 2.4.2 present TBC guidance to be used as screening values for freshwater and marine sediments. Table 2-6 presents numerical values.

Table 2-6
Freshwater and Marine Sediment Screening Values

Analyte	Freshwater		Marine
	ORNL TEC	ORNL PRGs	NOAA ERL
Petroleum Hydrocarbons			
GRO			
DRO			
RRO			
VOCs by SW8260B			
1,1,1-Trichloroethane		9.6	
1,1,2,2-Tetrachloroethane		5.4	
1,1,2-Trichloroethane		9.8	
1,1-Dichloroethane		0.027	
1,1-Dichloroethene		3.5	
1,2,3-Trichloropropane			
1,2,4-Trichlorobenzene		9.7	
1,2,4-Trimethylbenzene			
1,2-Dibromoethane			
1,2-Dichlorobenzene		0.33	
1,2-Dichloroethane		4.3	
1,2-Dichloropropane			
1,3,5-Trimethylbenzene			
1,3-Dichlorobenzene		1.7	
1,3-Dichloropropane			
1,4-Dichlorobenzene		0.35	
2-Butanone		0.27	
Acetone		0.0091	
Benzene		0.16	
Bromobenzene			
Bromochloromethane			
Bromodichloromethane			
Bromoform			
Carbon disulfide		0.00086	
Carbon tetrachloride		2	
Chlorobenzene		0.417	
Chlorodibromomethane			
Chloroform		0.96	

Table 2-6
Freshwater and Marine Sediment Screening Values (Continued)

Analyte	Freshwater		Marine
	ORNL TEC	ORNL PRGs	NOAA ERL
cis-1,2-Dichloroethene			
Dichlorodifluoromethane			
Ethylbenzene		5.4	
Hexachloro-1,3-butadiene			
Isopropylbenzene			
Methyl bromide			
Methylene bromide			
Methylene chloride		18	
Naphthalene	0.03275	0.39	
n-Butylbenzene			
sec-Butylbenzene			
Styrene			
tert-Butylbenzene			
Tetrachloroethene		3.2	
Toluene		0.05	
trans-1,2-Dichloroethene			
Trichloroethene		52	
Trichlorofluoromethane			
Vinyl acetate		0.00084	
Vinyl chloride (chloroethene)			
Xylenes (total)		0.16	
PAHs by SW8270CSIM			
Acenaphthene		0.089	0.016
Acenaphthylene		0.13	0.044
Anthracene	0.03162	0.25	0.0853
Benzo(a)anthracene	0.26	0.69	0.261
Benzo(a)pyrene	0.35	0.394	0.43
Benzo(b)fluoranthene	0.027	4	
Benzo(g,h,i)perylene	0.29	6.3	
Benzo(k)fluoranthene		4	
Chrysene	0.5	0.85	0.384
Dibenzo(a,h)anthracene		0.0282	0.0634
Indeno(1,2,3-c,d)pyrene	0.078	0.837	

Table 2-6
Freshwater and Marine Sediment Screening Values (Continued)

Analyte	Freshwater		Marine
	ORNL TEC	ORNL PRGs	NOAA ERL
Fluoranthene	0.06423	0.834	0.6
Fluorene	0.03464	0.14	0.019
Naphthalene	0.03275	0.39	0.16
Phenol		0.032	
Pyrene	0.57	1.4	0.665
SVOCs by SW8270C			
1-Chloronaphthalene			
2,4,5-Trichlorophenol			
2,4,6-Trichlorophenol			
2,4-Dichlorophenol			
2,4-Dimethylphenol			
2,4-Dinitrophenol			
2,4-Dinitrotoluene			
2,6-Dinitrotoluene			
2-Chloronaphthalene			
2-Chlorophenol			
2-Methyl-4,6-dinitrophenol			
2-Methylnaphthalene			0.07
2-Methylphenol (o-cresol)		0.012	
2-Nitroaniline			
2-Nitrophenol			
3,3-Dichlorobenzidine			
3-Nitroaniline			
4-Bromophenyl phenyl ether		1.2	
4-Chloro-3-methyl phenol			
4-Chlorophenyl phenyl ether			
4-Methylphenol (p-cresol)			
4-Nitroaniline			
4-Nitrophenol			
Acenaphthene		0.089	0.016
Acenaphthylene		0.13	0.044
Aniline			
Anthracene	0.03162	0.25	0.0853

Table 2-6
Freshwater and Marine Sediment Screening Values (Continued)

Analyte	Freshwater		Marine
	ORNL TEC	ORNL PRGs	NOAA ERL
Azobenzene			
Benzidene		0.0017	
Benzo(a)anthracene	0.26	0.69	0.261
Benzo(a)pyrene	0.35	0.394	0.43
Benzo(b)fluoranthene	0.027	4	
Benzo(g,h,i)perylene	0.29	6.3	
Benzo(k)fluoranthene		4	
Benzoic acid			
Benzyl alcohol		0.0011	
Bis(2-chloroethoxy)methane			
Bis(2-chloroethyl)ether			
Bis(2-chloroisopropyl)ether			
Bis(2-ethylhexyl)phthalate		2.7	
Butyl benzyl phthalate			
Carbazole			
Chrysene	0.5	0.85	0.384
Dibenzo(a,h)anthracene		0.0282	0.0634
Dibenzofuran		0.42	
Diethyl phthalate		0.61	
Dimethyl phthalate			
Di-n-butyl phthalate		240	
Di-n-octyl phthalate			
Fluoranthene	0.06423	0.834	0.6
Fluorene	0.03464	0.14	0.019
Hexachloro-1,3-butadiene			
Hexachlorobenzene			
Hexachlorocyclopentadiene			
Hexachloroethane		1	
Indeno(1,2,3-c,d)pyrene	0.078	0.837	
Isophorone			
Naphthalene	0.03275	0.39	0.16
Nitrobenzene			
N-Nitrosodimethylamine			

Table 2-6
Freshwater and Marine Sediment Screening Values (Continued)

Analyte	Freshwater		Marine
	ORNL TEC	ORNL PRGs	NOAA ERL
n-Nitrosodi-n-propylamine			
n-Nitrosodiphenylamine			
p-Chloroaniline			
Pentachlorophenol			
Phenanthrene		0.54	0.24
Phenol		0.032	
Pyrene	0.57	1.4	0.665
Pyridine			
PCBs by SW8082			
PCB-1016 (Aroclor 1016)		0.53	0.0227
PCB-1221 (Aroclor 1221)		0.12	0.0227
PCB-1232 (Aroclor 1232)		0.6	0.0227
PCB-1242 (Aroclor 1242)		29	0.0227
PCB-1248 (Aroclor 1248)		1	0.0227
PCB-1256 (Aroclor 1256)		72	0.0227
PCB-1260 (Aroclor 1260)		63	0.0227
Total PCBs	0.03162	0.18	0.0227
Total Metals by SW6020			
Lead	34.2	110	46.7

Notes:

No applicable regulatory limit or screening criteria available.

All units in mg/kg

ORNL TEC and PRG values from Jones et. al, 1997; NOAA ERL values from NOAA, 2008

For definitions, see the Acronyms and Abbreviations section.

2.4.1 Freshwater Sediments

Freshwater sediment data are based on ecologically-based benchmark values protective of sediment-dwelling organisms in freshwater aquatic environments. Specifically, sediment quality guidelines from *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota* (Jones et al. 1997) will be considered.

Per ecological risk assessment guidance and Oak Ridge National Laboratories (ORNL) (1997), detections of inorganic analytes at concentrations above toxicological benchmark values (e.g., threshold effects concentration [TECs]) do not indicate the presence of contamination. Additionally, remedial or risk management decisions should not be made based solely on exceedances of benchmark values. Per these documents, areas with TEC exceedances warrant further evaluation, such as toxicity testing, site-specific evaluations, or biological assessments.

2.4.2 Marine Sediments

Marine sediment data are based on ecologically-based benchmark values protective of sediment-dwelling organisms established for marine aquatic environments. Specifically, marine sediment criteria from the NOAA SQuiRTs (NOAA 2008) will be considered. In most instances, the effects range-low (ERL) published in the NOAA SQuiRTs will be used for the screening of marine sediments associated with the site.

The NOAA sediment quality guidelines are based on the incidence of adverse biological effects associated with chemical concentrations in marine and estuarine sediments (Long et al. 1995) and on two guideline values: ERL and effects range-median (ERM). The two guideline values delineate three concentration ranges for a particular chemical. Concentrations below the ERL values represent a minimal-effects range, a range intended to estimate conditions in which effects would be rarely observed. Concentrations equal to and above the ERL, but below the ERM, represent a possible-effects range within which effects would only occasionally occur. Finally, the concentrations equivalent to and above the ERM value represent a probable-effects range within which effects would frequently occur. Analytical results for sediment samples were obtained from NOAA SQuiRTs and will be screened against ERL values (Table 2-5).

Per ecological risk assessment guidance and ORNL and NOAA documents, detections of inorganic analytes above toxicological benchmark values (ERLs) do not indicate the presence of contamination. Remedial or risk management decisions should not be made based solely on exceedances of benchmark values. Per these documents, areas with ERL exceedances warrant further evaluation such as toxicity testing, site-specific evaluations, or biological assessments.

3.0 LOCATION-SPECIFIC ARARS

Location-specific ARARs are restrictions developed on the basis of the conduct of activities in specific locations. These ARARs may restrict or preclude certain remedial actions, or they may apply only to certain portions of an installation. Location-specific factors that may trigger ARARs include sensitive habitats, floodplains, wetlands, endangered species habitat, and historic or archeological resources.

Table 3-1 lists potential location-specific ARARs identified for the Driftwood Bay RRS and their general applicability for the remedial alternatives proposed in this report.

Table 3-1
Potential Location-Specific ARARs

Requirement	Citation	ARAR Assessment	Description
Protect wetlands[1]	Clean Water Act Section 404; 40 CFR 230, 33 CFR 320-330 40 CFR 6, Appendix A	Applicable	Requires consideration of impacts to wetlands in order to minimize their destruction or degradation and to preserve/enhance wetland values. Applicable to activities that would affect wetlands.
Protect floodplains	Fish and Wildlife Coordination Act (16 USC 661, et seq.); 40 CFR 6.302 40 CFR 6, Appendix A	Applicable	Potentially applicable to activities occurring within the 100-year floodplain.
Coordinate fish and wildlife	Fish and Wildlife Coordination Act (16 USC 661, et seq.); 40 CFR 6.302 Fish and Wildlife Conservation Act (PL 99-645) Rivers and Harbors Act of 1899, Section 10 (33 USC 403) Protection of Fish and Game Alaska Stature (AS) 16.05.870; 5 AAC 95.010	TBC	Applies to fish or wildlife resources that may be affected by actions resulting in control or modification of any natural stream or water body that should be protected. Federal agencies taking such actions must consult with the U.S. Fish and Wildlife Service.
Do not cause irreparable harm, loss, or destruction of significant artifacts	National Historic Preservation Act (16 USC 470); 36 CFR 800 Archaeological and Historic Preservation Act 16 USC 469, 40 CFR 6.301(c) Historic Sites, Buildings, and Antiquities Act 16 USC 461	TBC	The National Historic Preservation Act identifies procedures for the protection of historically and culturally significant properties. 16 USC 469 prohibits alteration of terrain that threatens significant scientific, prehistoric, historic, or archaeological data. The Archeological and Historic Preservation Act of 1974 requires that a federal agency notify the Secretary of Interior regarding any agency project that will destroy a significant archeological site.
Protect the coastal zone	Coastal Zone Management Act (16 USC 1451-1564, 15 CFR 921) Alaska Coastal Management Act (AS 46.40) and Alaska Coastal Zone Management Program	TBC	Establishes goals and a mechanism for states to control use and development of their coastal zone. Authorizes states to administer approved coastal nonpoint pollution programs.
Protect endangered species	Endangered Species Act 16 USC 1531, 50 CFR 402	TBC	Established requirements for the protection of federally listed threatened and endangered species. Potentially applicable to activities which could affect threatened or endangered species or their habitat.

Table 3-1
Potential Location-Specific ARARs (Continued)

Requirement	Citation	ARAR Assessment	Description
Protect Marine Mammals	Marine Mammal Protection Act of 1972. 50 CFR 216	Applicable	Prohibits, with certain exceptions, the harvesting of marine mammals in U.S. waters and by U.S. citizens on the high seas as well as the importation of marine mammals and marine mammal products into the U.S. Acknowledges that some marine mammal species or stocks may be in danger of extinction or depletion as a result of human activities.
Protect bird migratory routes	Migratory Bird Treaty Act of 1972 (16 USC 703-712) 50 CFR, Parts 10, 20, and 21 Bald Eagle and Golden Eagle Protection Act (16 USC 668-668d)	TBC	Requires that federal agencies examine proposed actions relative to habitat loses or losses of individual birds. Requires protection of most species of native birds in the U.S. from unregulated "take," which can include poisoning at waste sites.

Notes:
[1] 40 CFR 6, Appendix A, sets forth EPA policy for carrying out the provisions of Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands). Executive orders are binding on the level of government (federal or state) for which they are issued.
For definitions, see the Acronyms and Abbreviations section.

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4.0 ACTION-SPECIFIC ARARS

Action-specific ARARs are additional requirements that apply to a specific investigative or remedial action (Table 4-1). Action-specific requirements do not in themselves determine the remedial alternatives; they indicate how a selected alternative must be implemented. Action-specific ARARs were developed during evaluation of alternatives as part of the feasibility study. Action-specific ARARs are refined during remedial design as specific information becomes available.

Table 4-1
Action-Specific ARARs

Regulation	Description	A or RA	Rationale
Alaska Spill Reporting and Notification (18 AAC 75)	ADEC has authority for specifying soil, surface water, and groundwater cleanup levels resulting from the discharge of an oil or a hazardous substance.	Applicable	18 AAC 75.360 lists requirements for cleanup work plans.
Alaska Air Quality Control Regulations (18 AAC 50, 15) and the Clean Air Act (40 CFR 230, 33 CFR 320-330)	Regulations governing identification, prevention, abatement, and control of air pollution	Applicable	Cleanup methods may require the use of heavy machinery and trucks for transporting soil. Onsite remedial activities may also require air monitoring.
U.S. Department of Transportation Regulations (49 CFR 170-199; 40 CFR 263)	Governs the packaging, marking, labeling, recordkeeping, transportation, and transporters of hazardous materials.	Applicable	Monitoring samples or contaminated media are transported from the project area.
Alaska Hazardous Waste Regulations (18 AAC 62)			
Toxic Substances Control Act (40 CFR 761)	Regulates storage and disposal requirements, including onsite storage limitations for PCB wastes. Specifies notification and recordkeeping requirements for PCB disposal.	Applicable	PCBs are present at OT001.
Resource Conservation and Recovery Act (40 CFR 260)	Regulates hazardous waste identification, classification, generation, management and disposal.	Applicable	Hazardous waste could be generated at the BBA or LF006.

Table 4-1
Action-Specific ARARs (Continued)

Regulation	Description	A or RA	Rationale
Clean Water Act [33 USC 1251(404); 33 CFR 323; 40 CFR 230; 33 USC 1341(401); 33 CFR 320-330; AS 46.03; 18 AAC 15; 18 AAC 70; 18 AAC 72]	Prohibits discharge of dredged or fill material into wetlands without a permit. Obtain certification for any discharge into a waterway that may be considered a pollutant.	TBC	Although no wetlands are near the subject sites, tundra and marshy areas exist that need to be considered.
Occupational Safety and Health Act of 1970 (29 CFR 1910)	Sets standards for safety in the work environment.	Applicable	40-hour HAZWOPER training and annual 8-hour refreshers are required for site workers.
Alaska Occupational Safety and Health (Subchapter 10, Hazardous waste operations and Emergency Response Code; 8 AAC 61)			
Solid Waste Management Regulations (40 CFR 257, 40 CFR 264, 49 CFR 265, 40 CFR 266, 40 CFR268, 40 CFR 270, 40 CFR 261, 40 CFR 262)	Governs the management of solid wastes generated during remedial activity. Specifies restrictions on land disposal of specific types of hazardous waste based on levels achievable by current technology.	Applicable	Excavated soils and monitoring samples may be generated from the project area. Remedial alternatives may create contaminated media to be removed from the site.
Alaska Solid Waste Management Regulations (18 AAC 60, 18 AAC 75, 18 AAC 62)			

5.0 WAIVERS OF ARARS

Section 40 CFR 300.430(f)(1)(ii)(C) of the National Oil and Hazardous Substances Pollution Contingency Plan provides that under certain circumstances, ARARs may be waived. These waivers apply only to meeting ARARs with respect to remedial actions at the contaminated area; other statutes requiring remedies that protect human health and the environment cannot be waived. A waiver must be invoked for each ARAR that will not be attained or achieved. Waivers of state environmental, federal environmental, or facility siting ARARs may include the following:

- **Interim measures**
  The remedial action selected is only part of a total remedial action that will meet the ARAR when completed; it may apply to sites where a final remedy is divided into several smaller actions.
- **Greater risk**
  Compliance with the ARAR will result in greater risk to human health or the environment. Magnitude, duration, and reversibility of adverse impacts are considered.
- **Technically impracticable**
  Compliance is technically impracticable from an engineering perspective. Engineering feasibility and reliability are considered.
- **Equivalent to other standard**
  The selected action would attain a standard of performance equivalent to the standard required by the ARAR. It may be used where the ARAR specifies design or operating standards but equivalent or better results are available from an alternative design or method of operation.
- **Inconsistent application**
  The standard has not been applied consistently in similar circumstances.

- **Fund balancing**

  This waiver is primarily applicable to sites undergoing action under CERCLA Section 104 and does not affect the Driftwood Bay RRS sites.

Currently no ARAR waivers are being sought for the Driftwood Bay RRS.

6.0 REFERENCES

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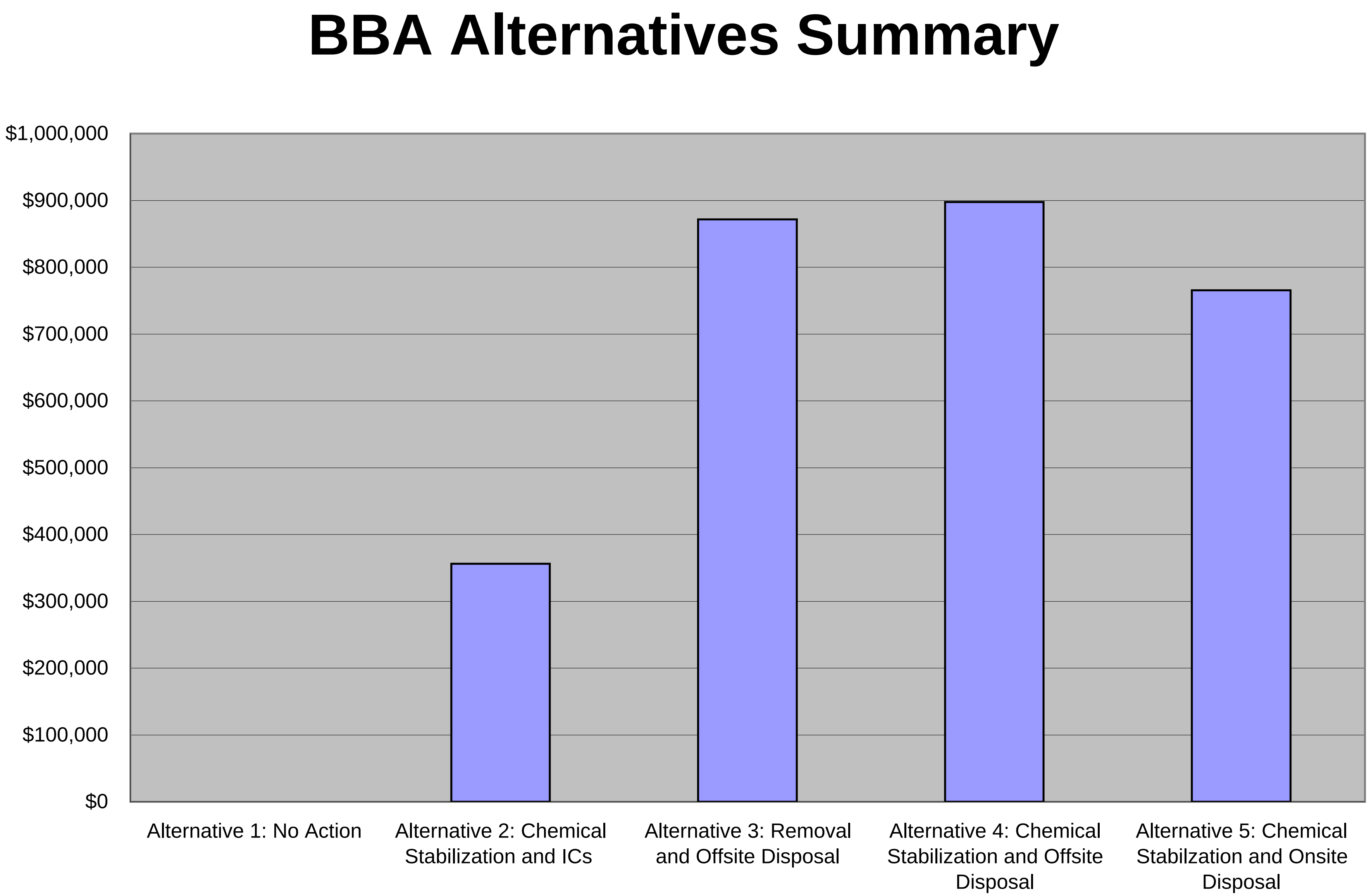
APPENDIX B
Cost Estimates

Total Costs for the Burned Battery Area (BBA)

Alternative 1: No Action	$0.00
Alternative 2: Chemical Stabilization and ICs	$356,097.94
Alternative 3: Removal and Offsite Disposal	$871,784.00
Alternative 4: Chemical Stabilization and Offsite Disposal	$897,529.00
Alternative 5: Chemical Stabilzation and Onsite Disposal	$765,586.76



BBA Alternatives Summary
$1,000,000
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
Alternative 1: No Action
Alternative 2: Chemical Stabilization and ICs
Alternative 3: Removal and Offsite Disposal
Alternative 4: Chemical Stabilization and Offsite Disposal
Alternative 5: Chemical Stabilzation and Onsite Disposal

Chemical Stabilization and ICs - BBA

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Pre-Mobilization/Mobilization/Demobilization							
Planning	$75	hr	240	2	$36,000		Work plan prep, meetings, & coordination
Procurements/Purchasing Labor	$75	hr	80	2	$12,000		Secure equipment & supplies, contractural
Helicopter	$7,500	trip	2	1	$15,000		Based on historic pricing, 1 day each for mobilization and demobilization
Mobilization Labor	$75	hr	24	2	$3,600		2 people, 2 12 hour days
Ecobond (delivered)	$6,000	ton	4	1	$24,000		Based on historic pricing, 2.5% by weight applied Ecobond
Airfare	$1,200	trip	1	2	$2,400		Based on Pen Air 2-week advance purchase
Per Diem	$57	man-day	2	2	$228	*$93,228*	JTR rates
Site Work							
Chemical Stabilization							
Collect Pretreatment Samples	$75	hr	2	2	$300		2 people, 2 hours
Apply Ecobond	$75	hr	8	2	$1,200		2 people, 8 hours
Collect Posttreatment Samples	$75	hr	2	2	$300		2 people, 2 hours
Lodging and Per Diem	$178	man-day	1	2	$356		JTR rates
Equipment							
Helicopter	$7,500	day	1	1	$7,500	*$7,500*	Based on historic pricing
Reporting							
Ecobond Application Technical Memorandum	$75	hr	100	2	$15,000	*$15,000*	Technical memorandum preparation, review, and submittal
Institutional Controls							
Planning	$75	hr	60	2	$9,000		Planning, meetings, and coordination
Map Design	$75	hr	40	2	$6,000		Preparation of land use maps and controls
Documentation	$75	hr	40	2	$6,000	*$21,000*	Based on historic data
Management and Support							
Professional Services	$75	hr	90	2	$13,500	*$13,500*	Assumes management and support will be 15% of professional services hours
5-Year Review							
Community Involvment and Notification	$75	hr	30	2	$4,500		Preparing and issuing public notices
Document Review	$75	hr	80	2	$12,000		Reviewing historical documents and current laws and regulations
Data Review and Analysis	$75	hr	40	1	$3,000		Reviewing data from previous site work
Site Inspection							Visiting the site to view and asssess current condistions
Mobilization Costs	$20,000	trip	1	1	$20,000		Assumes 2 people flying from Anchorage to Dutch Harbor and chartering a boat to Driftwood Bay
Labor	$75	hr	30	2	$4,500		Assume 2 people, 3 10hr days
Interviews	$75	hr	20	2	$3,000		Conducting intervies with relevant personnel
Protectiveness Determination	$75	hr	180	2	$27,000		Prepare 5-year review report
Subtotal 5-Year Review					**$74,000**		
Present Value						*$205,870*	Assumes i=5%,; P=F(A/F,5%,5)(P/A,5%,30); F=subtotal
Total, Capital Costs						***$356,098***	

Removal and Offsite Disposal - BBA

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Mobilization							
Planning	$75	hr	320	2	$48,000		Work plan prep, meetings, & coordination
Procurements/Purchasing Labor	$75	hr	120	2	$18,000		Secure equipment & supplies, contractural
Landing Craft with state rooms Mob/Demob	$105,000	trip	2	1	$210,000		Based on historic pricing, 7 days each for mobilization and demobilization
Mobilization Labor	$75	hr	24	6	$10,800		6 people, 2 12 hour days
Airfare	$1,200	trip	1	6	$7,200		Based on Pen Air 2-week advance purchase
Per Diem	$57	man-day	2	6	$684		JTR rates
Equipment							
Track Excavator	$750	day	14	1	$10,500		Based on historic data
Flatbed Truck	$55	day	14	1	$770		Based on historic data
Forklift/Loader	$1,700	day	14	1	$23,800		Based on historic data
GPS	$115	day	14	1	$1,610		Based on historic data
Misc. Tools and Supplies (EPL)	$30,000	LS	1	1	$30,000	*$361,364*	Based on historic pricing for similar efforts
Site Work							
Duration = 1 day for site setup, 2 days for Top Camp Road Repair, 7 days for excavation, containerization, and transportation, 2 days for site restoration, 2 days for waste transfer to Dutch Harbor = 14 days total							
Site Manager	$95	hr	168	1	$15,960		14 days at 12 hours per day
Safety Officer/CQC	$75	hr	168	1	$12,600		14 days at 12 hours per day
Sampler	$75	hr	168	1	$12,600		14 days at 12 hours per day
Operator	$100	hr	168	1	$16,800		14 days at 12 hours per day
Driver	$100	hr	168	1	$16,800		14 days at 12 hours per day
Laborer	$80	hr	168	1	$13,440		14 days at 12 hours per day
Equipment							
Landing Craft with state rooms	$15,000	day	14	1	$210,000		14 working days
Track Excavator	$750	day	14	1	$10,500		14 working days
Flatbed Truck	$550	day	14	1	$7,700		14 working days
Forklift/Loader	$1,700	day	14	1	$23,800		14 working days
GPS	$115	day	14	1	$1,610	*$341,810*	14 working days
Waste							
Pre-shipment Preparation and Submittals	$650	LS	1	1	$650		Based on historic data
Prepare and Submit Complete Manifest Packages	$95	ea	8	1	$760		Based on historic data
Waste Container Management and Tracking	$375	LS	1	1	$375		Based on historic data
Non-hazardous Lead-Contaminated Soil Disposal	$85	ton	70	1	$5,950		Quantity estimate
RCRA hazardous Lead-Contaminated Soil Disposal	$275	ton	70	1	$19,250		Quantity estimate
Open top container rental - non-hazardous	$15	day	40	4	$2,400		Assumes 20 tons per container
Open top container rental - RCRA hazardous	$15	day	40	4	$2,400		Assumes 20 tons per container
Non-hazardous Origination Charge - Dutch Harbor	$ 9,500	container	4	1	$38,000		Based on historic data
RCRA hazardous Origination Charge - Dutch Harbor	$ 9,500	container	4	1	$38,000	*$107,785*	Based on historic data
Laboratory							
Lead (total) - 6020	$17	ea	20	1	$340		Based on average from ID/IQ pricing
Lead (TCLP) - 1311/6020	$110	ea	7	1	$770		Based on average from ID/IQ pricing
Cooler shipments	$100	ea	2	1	$200		Based on historic data; assumes 20 samples per cooler
Reporting							
Draft and Final Report	$75	hr	220	2	$33,000	*$33,000*	Draft and Final Removal Action Report
Management and Support							
Professional Services	$75	hr	371	1	$27,825	*$27,825*	Assumes management and support will be 15% of professional services hours
Total, Capital Costs						***$871,784***	

Chemical Stabilization and Offsite Disposal - BBA

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Mobilization							
Planning	$75	hr	320	2	$48,000		Work plan prep, meetings, & coordination
Procurements/Purchasing Labor	$75	hr	120	2	$18,000		Secure equipment & supplies, contractural
Landing Craft with state rooms Mob/Demob	$105,000	trip	2	1	$210,000		Based on historic pricing, 7 days each for mobilization and demobilization
Mobilization Labor	$75	hr	24	6	$10,800		6 people, 2 12 hour days
Ecobond (delivered)	$6,000	ton	4	1	$24,000		Based on historic pricing, 2.5% by weight applied Ecobond (partial application in 2009)
Airfare	$1,200	trip	1	6	$7,200		Based on Pen Air 2-week advance purchase
Per Diem	$57	man-day	2	6	$684		JTR rates
Equipment							
Track Excavator	$750	day	14	1	$10,500		Based on historic data
Flatbed Truck	$55	day	14	1	$770		Based on historic data
Forklift/Loader	$1,700	day	14	1	$23,800		Based on historic data
GPS	$115	day	14	1	$1,610		Based on historic data
Misc. Tools and Supplies (EPL)	$30,000	LS	1	1	$30,000	*$385,364*	Based on historic pricing for similar efforts
Site Work							
Duration = 1 day for site setup, 2 days for Top Camp Road Repair, 1 day for Ecobond application, 7 days for excavation, containerization, and transportation, 2 days for site restoration, 2 days for waste transfer to Dutch Harbor = 15 days total							
Site Manager	$95	hr	180	1	$17,100		15 days at 12 hours per day
Safety Officer/CQC	$75	hr	180	1	$13,500		15 days at 12 hours per day
Sampler	$75	hr	180	1	$13,500		15 days at 12 hours per day
Operator	$100	hr	180	1	$18,000		15 days at 12 hours per day
Driver	$100	hr	180	1	$18,000		15 days at 12 hours per day
Laborer	$80	hr	180	1	$14,400		15 days at 12 hours per day
Equipment							
Landing Craft with state rooms	$15,000	day	15	1	$225,000		15 working days
Track Excavator	$750	day	15	1	$11,250		15 working days
Flatbed Truck	$550	day	15	1	$8,250		15 working days
Forklift/Loader	$1,700	day	15	1	$25,500		15 working days
GPS	$115	day	15	1	$1,725	*$366,225*	15 working days
Waste							
Pre-shipment Preparation and Submittals	$650	LS	1	1	$650		Based on historic data
Prepare and Submit Complete Manifest Packages	$95	ea	7	1	$665		Based on historic data
Waste Container Management and Tracking	$375	LS	1	1	$375		Based on historic data
Non-hazardous Lead-Contaminated Soil Disposal	$85	ton	140	1	$11,900		Quantity estimate
RCRA hazardous Lead-Contaminated Soil Disposal	$275	ton	0	1	$0		Quantity estimate
Open top container rental - non-hazardous	$15	day	40	7	$4,200		Assumes 20 tons per container
Open top container rental - RCRA hazardous	$15	day	40	0	$0		Assumes 20 tons per container
Non-hazardous Origination Charge - Dutch Harbor	$ 9,500	container	7	1	$66,500		Based on historic data
RCRA hazardous Origination Charge - Dutch Harbor	$ 9,500	container	0	1	$0	*$84,290*	Based on historic data
Laboratory							
Lead (total) - 6020	$17	ea	20	1	$340		Based on average from ID/IQ pricing
Lead (TCLP) - 1311/6020	$110	ea	7	1	$770		Based on average from ID/IQ pricing
Cooler shipments	$100	ea	2	1	$200		Based on historic data; assumes 20 samples per cooler
Reporting							
Draft and Final Report	$75	hr	220	2	$33,000	*$33,000*	Draft and Final Removal Action Report
Management and Support							
Professional Services	$75	hr	382	1	$28,650	*$28,650*	Assumes management and support will be 15% of professional services hours
Total, Capital Costs						***$897,529***	

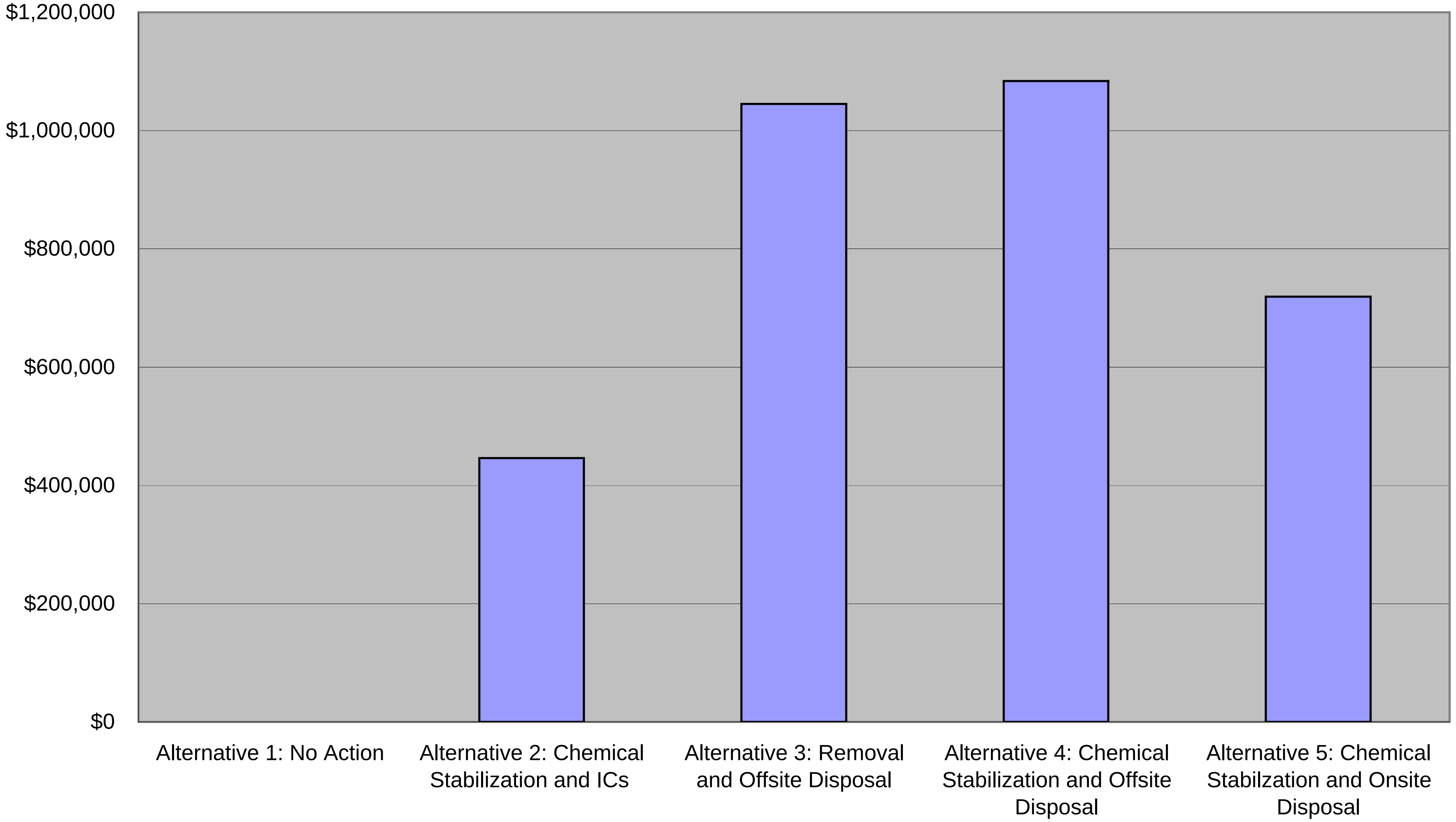
Chemical Stabilization and Onsite Disposal - BBA

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Mobilization							
Planning	$75	hr	280	2	$42,000		Work plan prep, meetings, & coordination
Procurements/Purchasing Labor	$75	hr	100	2	$15,000		Secure equipment & supplies, contractural
Landing Craft with state rooms Mob/Demob	$105,000	trip	2	1	$210,000		Based on historic pricing, 7 days each for mobilization and demobilization
Mobilization Labor	$75	hr	24	5	$9,000		5 people, 2 12 hour days
Ecobond (delivered)	$6,000	ton	4	1	$24,000		Based on historic pricing, 2.5% by weight applied Ecobond (partial application in 2009)
Airfare	$1,200	trip	1	5	$6,000		Based on Pen Air 2-week advance purchase
Per Diem	$57	man-day	2	5	$570		JTR rates
Equipment							
Track Excavator	$750	day	14	1	$10,500		Based on historic data
End Dump Truck	$950	day	14	1	$13,300		Based on historic data
Forklift/Loader	$1,700	day	14	1	$23,800		Based on historic data
GPS	$115	day	14	1	$1,610		Based on historic data
Misc. Tools and Supplies (EPL)	$30,000	LS	1	1	$30,000	*$385,780*	Based on historic pricing for similar efforts
Site Work							
Duration = 0.25 day for site setup, 1.5 days for landfill constructon, and 0.25 day for site restoration = 2 days total							
Site Manager	$95	hr	24	1	$2,280		2 days at 12 hours per day
Safety Officer/CQC	$75	hr	24	1	$1,800		2 days at 12 hours per day
Operator	$100	hr	24	1	$2,400		2 days at 12 hours per day
Driver	$100	hr	24	1	$2,400		2 days at 12 hours per day
Laborer	$80	hr	24	1	$1,920		2 days at 12 hours per day
Equipment							
Landing Craft with state rooms	$15,000	day	2	1	$30,000		2 working days
Track Excavator	$750	day	2	1	$1,500		2 working days
End Dump Truck	$950	day	2	1	$1,900		2 working days
Forklift/Loader	$1,700	day	2	1	$3,400		2 working days
GPS	$115	day	2	1	$230	*$47,830*	2 working days
Reporting							
Draft and Final Report	$75	hr	220	2	$33,000	*$33,000*	Draft and Final Remedial Action Report
Institutional Controls							
Planning	$75	hr	60	2	$9,000		Planning, meetings, and coordination
Map Design	$75	hr	40	2	$6,000		Preparation of land use maps and controls
Documentation	$75	hr	40	2	$6,000	*$21,000*	Based on historic data
Management and Support							
Professional Services	$75	hr	258	1	$19,350	*$19,350*	Assumes management and support will be 15% of professional services hours
Biannual Cap Inspection							
Site Inspection							Visiting the site to view and asssess current condistions
Planning and Procurements	$75	hr	40	2	$6,000		Planning and procuring vendors, subcontractors, and materials
Mobilization Costs	$20,000	trip	1	1	$20,000		Assumes 2 people flying from Anchorage to Dutch Harbor and chartering a boat to Driftwood Bay
Labor	$75	hr	30	2	$4,500		Assume 2 people, 3 10hr days
Subtotal 5-Year Review					**$30,500**		
Present Value						*$52,757*	Assumes i=5%,; P=F(A/F,5%,2)(P/A,5%,4); F=subtotal
5-Year Review							
Community Involvment and Notification	$75	hr	30	2	$4,500		Preparing and issuing public notices
Document Review	$75	hr	80	2	$12,000		Reviewing historical documents and current laws and regulations
Data Review and Analysis	$75	hr	40	1	$3,000		Reviewing data from previous site work
Site Inspection							Visiting the site to view and asssess current condistions
Mobilization Costs	$20,000	trip	1	1	$20,000		Assumes 2 people flying from Anchorage to Dutch Harbor and chartering a boat to Driftwood Bay
Labor	$75	hr	30	2	$4,500		Assume 2 people, 3 10hr days
Interviews	$75	hr	20	2	$3,000		Conducting intervies with relevant personnel
Protectiveness Determination	$75	hr	180	2	$27,000		Prepare 5-year review report
Subtotal 5-Year Review					**$74,000**		
Present Value						*$205,870*	Assumes i=5%,; P=F(A/F,5%,5)(P/A,5%,30); F=subtotal
Total, Capital Costs						***$765,587***	

Total Costs for Site LF006

Alternative 1: No Action	$0.00
Alternative 2: Chemical Stabilization and ICs	$445,997.94
Alternative 3: Removal and Offsite Disposal	$1,044,869.00
Alternative 4: Chemical Stabilization and Offsite Disposal	$1,083,579.00
Alternative 5: Chemical Stabilzation and Onsite Disposal	$719,129.94

LF006 Alternatives Summary



Chemical Stabilization and ICs - LF006

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Pre-Mobilization/Mobilization/Demobilization							
Planning	$75	hr	240	2	$36,000		Work plan prep, meetings, & coordination
Procurements/Purchasing Labor	$75	hr	80	2	$12,000		Secure equipment & supplies, contractural
Helicopter	$7,500	trip	2	1	$15,000		Based on historic pricing, 1 day each for mobilization and demobilization
Fencing Materials and Installation Equipment	$19,000	trip	2	1	$38,000		Engineering Estimate
Mobilization Labor	$75	hr	24	2	$3,600		2 people, 2 12 hour days
Ecobond (delivered)	$6,000	ton	5	1	$30,000		Based on historic pricing, 2.5% by weight applied Ecobond (partial application in 2009)
Airfare	$1,200	trip	1	2	$2,400		Based on Pen Air 2-week advance purchase
Per Diem	$57	man-day	2	2	$228	*$137,228*	JTR rates
Site Work							
Chemical Stabilization							
Collect Pretreatment Samples	$75	hr	6	2	$900		2 people, 1/2 12 hour day
Apply Ecobond	$75	hr	12	2	$1,800		2 people, 1 12 hour day
Collect Posttreatment Samples	$75	hr	6	2	$900		2 pepole, 1/2 12 hour day
Lodging and Per Diem	$178	man-day	2	2	$712		JTR rates
Fence and Sign Installation							
Fence Installation	$45	LF	270	1	$12,150		Based on historic pricing/quantity estimate
Provide oversight	$75	hr	60	1	$4,500		1 person, 5 12-hour days
Sign Installation	$1,500	LS	1	1	$1,500		Engineering Estimate
Lodging and Per Diem	$178	man-day	5	1	$890		JTR rates
Equipment							
Helicopter	$7,500	day	7	1	$52,500	*$52,500*	Based on historic pricing
Reporting							
Ecobond Application Technical Memorandum	$75	hr	100	2	$15,000	*$15,000*	Technical memorandum preparation, review, and submittal
Institutional Controls							
Planning	$75	hr	60	2	$9,000		Planning, meetings, and coordination
Map Design	$75	hr	40	2	$6,000		Preparation of land use maps and controls
Documentation	$75	hr	40	2	$6,000	*$21,000*	Based on historic data
Management and Support							
Professional Services	$75	hr	96	2	$14,400	*$14,400*	Assumes management and support will be 15% of professional services hours
5-Year Review							
Community Involvment and Notification	$75	hr	30	2	$4,500		Preparing and issuing public notices
Document Review	$75	hr	80	2	$12,000		Reviewing historical documents and current laws and regulations
Data Review and Analysis	$75	hr	40	1	$3,000		Reviewing data from previous site work
Site Inspection							Visiting the site to view and asssess current condistions
Mobilization Costs	$20,000	trip	1	1	$20,000		Assumes 2 people flying from Anchorage to Dutch Harbor and chartering a boat to Driftwood Bay
Labor	$75	hr	30	2	$4,500		Assume 2 people, 3 10hr days
Interviews	$75	hr	20	2	$3,000		Conducting intervies with relevant personnel
Protectiveness Determination	$75	hr	180	2	$27,000		Prepare 5-year review report
Subtotal 5-Year Review					**$74,000**		
Present Value						*$205,870*	Assumes i=5%,; P=F(A/F,5%,5)(P/A,5%,30); F=subtotal
Total, Capital Costs						***$445,998***	

Removal and Offsite Disposal - LF006

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Mobilization							
Planning	$75	hr	320	2	$48,000		Work plan prep, meetings, & coordination
Procurements/Purchasing Labor	$75	hr	120	2	$18,000		Secure equipment & supplies, contractural
Landing Craft with state rooms Mob/Demob	$105,000	trip	2	1	$210,000		Based on historic pricing, 7 days each for mobilization and demobilization
Mobilization Labor	$75	hr	24	6	$10,800		2 people, 2 12 hour days
Airfare	$1,200	trip	1	6	$7,200		Based on Pen Air 2-week advance purchase
Per Diem	$57	man-day	2	6	$684		JTR rates
Equipment							
Track Excavator	$750	day	14	1	$10,500		Based on historic data
Flatbed Truck	$55	day	14	1	$770		Based on historic data
Forklift/Loader	$1,700	day	14	1	$23,800		Based on historic data
GPS	$115	day	14	1	$1,610		Based on historic data
Misc. Tools and Supplies (EPL)	$30,000	LS	1	1	$30,000	*$361,364*	Based on historic pricing for similar efforts
Site Work							
Duration = 1 day for site setup, 9 days for excavation, containerization, and transportation, 2 days for site restoration, 4 days for waste transfer to Dutch Harbor = 16 days total							
Site Manager	$95	hr	192	1	$18,240		16 days at 12 hours per day
Safety Officer/CQC	$75	hr	192	1	$14,400		16 days at 12 hours per day
Sampler	$75	hr	192	1	$14,400		16 days at 12 hours per day
Operator	$100	hr	192	1	$19,200		16 days at 12 hours per day
Driver	$100	hr	192	1	$19,200		16 days at 12 hours per day
Laborer	$80	hr	192	1	$15,360		16 days at 12 hours per day
Equipment							
Landing Craft with state rooms	$15,000	day	16	1	$240,000		16 working days
Track Excavator	$750	day	16	1	$12,000		16 working days
Flatbed Truck	$550	day	16	1	$8,800		16 working days
Forklift/Loader	$1,700	day	16	1	$27,200		16 working days
GPS	$115	day	16	1	$1,840	*$390,640*	16 working days
Waste							
Pre-shipment Preparation and Submittals	$650	LS	1	1	$650		Based on historic data
Prepare and Submit Complete Manifest Packages	$95	ea	18	1	$1,710		Based on historic data
Waste Container Management and Tracking	$375	LS	1	1	$375		Based on historic data
Non-hazardous Lead-Contaminated Soil Disposal	$85	ton	258	1	$21,930		Quantity estimate
RCRA hazardous Lead-Contaminated Soil Disposal	$275	ton	87	1	$23,925		Quantity estimate
Open top container rental - non-hazardous	$15	day	40	13	$7,800		Assumes 20 tons per container
Open top container rental - RCRA hazardous	$15	day	40	5	$3,000		Assumes 20 tons per container
Non-hazardous Origination Charge - Dutch Harbor	$ 9,500	container	13	1	$123,500		Based on historic data
RCRA hazardous Origination Charge - Dutch Harbor	$ 9,500	container	5	1	$47,500	*$230,390*	Based on historic data
Laboratory							
Lead (total) - 6020	$17	ea	30	1	$510		Based on average from ID/IQ pricing
Lead (TCLP) - 1311/6020	$110	ea	18	1	$1,980		Based on average from ID/IQ pricing
Cooler shipments	$100	ea	3	1	$300		Based on historic data; assumes 20 samples per cooler
Reporting							
Draft and Final Report	$75	hr	220	2	$33,000	*$33,000*	Draft and Final Removal Action Report
Management and Support							
Professional Services	$75	hr	393	1	$29,475	*$29,475*	Assumes management and support will be 15% of professional services hours
Total, Capital Costs						***$1,044,869***	

Chemical Stabilization and Offsite Disposal - LF006

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Mobilization							
Planning	$75	hr	320	2	$48,000		Work plan prep, meetings, & coordination
Procurements/Purchasing Labor	$75	hr	120	2	$18,000		Secure equipment & supplies, contractural
Landing Craft with state rooms Mob/Demob	$105,000	trip	2	1	$210,000		Based on historic pricing, 7 days each for mobilization and demobilization
Mobilization Labor	$75	hr	24	6	$10,800		2 people, 2 12 hour days
Ecobond (delivered)	$6,000	ton	5	1	$30,000		Based on historic pricing, 2.5% by weight applied Ecobond (partial application in 2009)
Airfare	$1,200	trip	1	6	$7,200		Based on Pen Air 2-week advance purchase
Per Diem	$57	man-day	2	6	$684		JTR rates
Equipment							
Track Excavator	$750	day	14	1	$10,500		Based on historic data
Flatbed Truck	$55	day	14	1	$770		Based on historic data
Forklift/Loader	$1,700	day	14	1	$23,800		Based on historic data
GPS	$115	day	14	1	$1,610		Based on historic data
Misc. Tools and Supplies (EPL)	$30,000	LS	1	1	$30,000	*$391,364*	Based on historic pricing for similar efforts
Site Work							
Duration = 1 day for site setup, 1 day for Ecobond application, 9 days for excavation, containerization, and transportation, 2 days for site restoration, 4 days for waste transfer to Dutch Harbor = 17 days total							
Site Manager	$95	hr	204	1	$19,380		17 days at 12 hours per day
Safety Officer/CQC	$75	hr	204	1	$15,300		17 days at 12 hours per day
Sampler	$75	hr	204	1	$15,300		17 days at 12 hours per day
Operator	$100	hr	204	1	$20,400		17 days at 12 hours per day
Driver	$100	hr	204	1	$20,400		17 days at 12 hours per day
Laborer	$80	hr	204	1	$16,320		17 days at 12 hours per day
Equipment							
Landing Craft with state rooms	$15,000	day	17	1	$255,000		17 working days
Track Excavator	$750	day	17	1	$12,750		17 working days
Flatbed Truck	$550	day	17	1	$9,350		17 working days
Forklift/Loader	$1,700	day	17	1	$28,900		17 working days
GPS	$115	day	17	1	$1,955	*$415,055*	17 working days
Waste							
Pre-shipment Preparation and Submittals	$650	LS	1	1	$650		Based on historic data
Prepare and Submit Complete Manifest Packages	$95	ea	18	1	$1,710		Based on historic data
Waste Container Management and Tracking	$375	LS	1	1	$375		Based on historic data
Non-hazardous Lead-Contaminated Soil Disposal	$85	ton	345	1	$29,325		Quantity estimate
RCRA hazardous Lead-Contaminated Soil Disposal	$275	ton	0	1	$0		Quantity estimate
Open top container rental - non-hazardous	$15	day	40	18	$10,800		Assumes 20 tons per container
Open top container rental - RCRA hazardous	$15	day	40	0	$0		Assumes 20 tons per container
Non-hazardous Origination Charge - Dutch Harbor	$ 9,500	container	18	1	$171,000		Based on historic data
RCRA hazardous Origination Charge - Dutch Harbor	$ 9,500	container	0	1	$0	*$213,860*	Based on historic data
Laboratory							
Lead (total) - 6020	$17	ea	30	1	$510		Based on average from ID/IQ pricing
Lead (TCLP) - 1311/6020	$110	ea	18	1	$1,980		Based on average from ID/IQ pricing
Cooler shipments	$100	ea	3	1	$300		Based on historic data; assumes 20 samples per cooler
Reporting							
Draft and Final Report	$75	hr	220	2	$33,000	*$33,000*	Draft and Final Removal Action Report
Management and Support							
Professional Services	$75	hr	404	1	$30,300	*$30,300*	Assumes management and support will be 15% of professional services hours
Total, Capital Costs						***$1,083,579***	

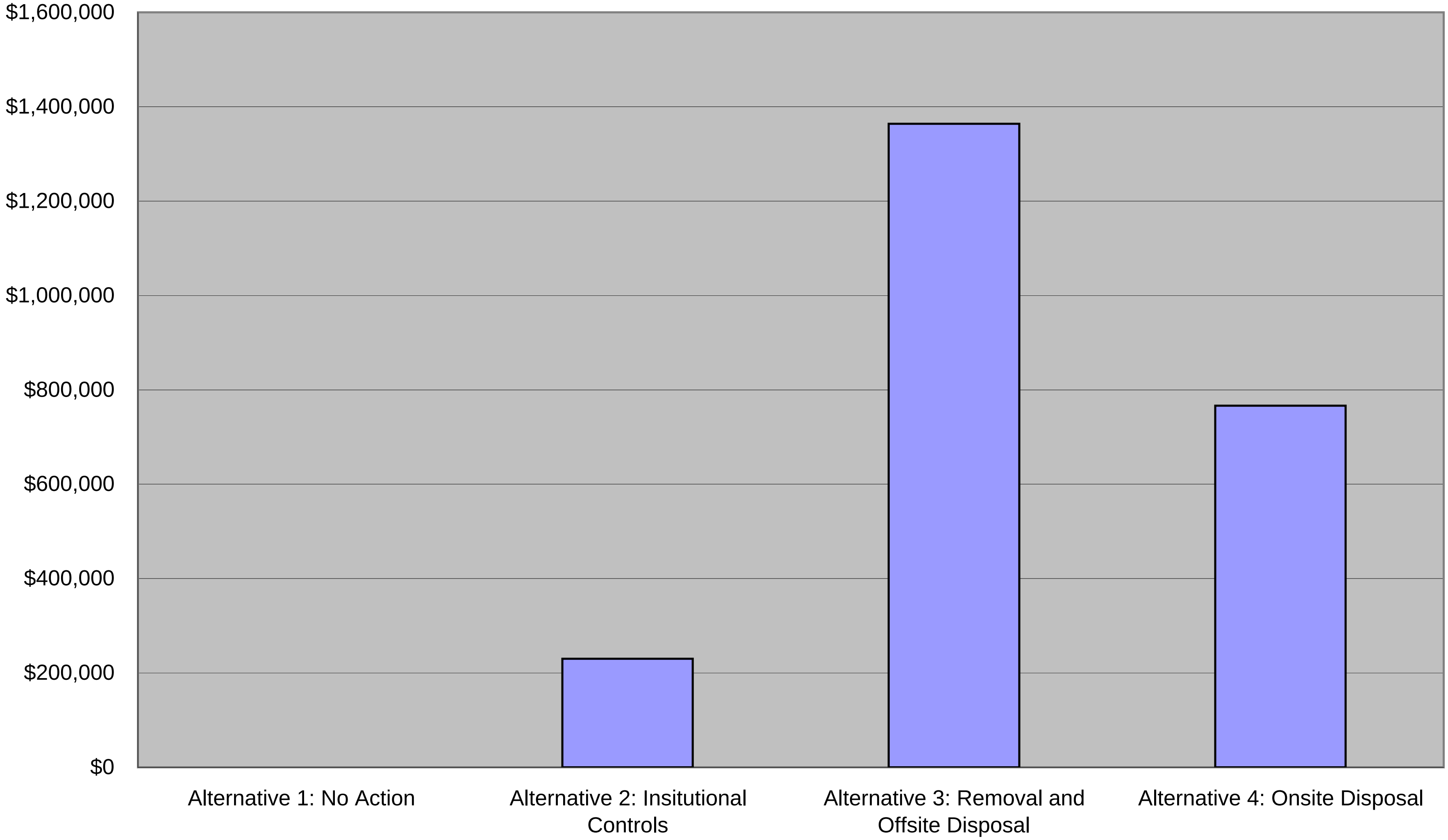
Chemical Stabilization and Onsite Disposal - LF006

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Mobilization							
Planning	$75	hr	280	2	$42,000		Work plan prep, meetings, & coordination
Procurements/Purchasing Labor	$75	hr	100	2	$15,000		Secure equipment & supplies, contractural
Landing Craft with state rooms Mob/Demob	$105,000	trip	2	1	$210,000		Based on historic pricing, 7 days each for mobilization and demobilization
Mobilization Labor	$75	hr	24	5	$9,000		5 people, 2 12 hour days
Ecobond (delivered)	$6,000	ton	5	1	$30,000		Based on historic pricing, 2.5% by weight applied Ecobond (partial application in 2009)
Airfare	$1,200	trip	1	5	$6,000		Based on Pen Air 2-week advance purchase
Per Diem	$57	man-day	2	5	$570		JTR rates
Equipment							
Track Excavator	$750	day	14	1	$10,500		Based on historic data
End Dump Truck	$950	day	14	1	$13,300		Based on historic data
Forklift/Loader	$1,700	day	14	1	$23,800		Based on historic data
GPS	$115	day	14	1	$1,610		Based on historic data
Misc. Tools and Supplies (EPL)	$30,000	LS	1	1	$30,000	*$391,780*	Based on historic pricing for similar efforts
Site Work							
Duration = 0.25 day for site setup, 1.5 days for landfill constructon, and 0.25 day for site restoration = 2 days total							
Site Manager	$95	hr	24	1	$2,280		2 days at 12 hours per day
Safety Officer/CQC	$75	hr	24	1	$1,800		2 days at 12 hours per day
Operator	$100	hr	24	1	$2,400		2 days at 12 hours per day
Driver	$100	hr	24	1	$2,400		2 days at 12 hours per day
Laborer	$80	hr	24	1	$1,920		2 days at 12 hours per day
Equipment							
Landing Craft with state rooms	$15,000	day	2	1	$30,000		2 working days
Track Excavator	$750	day	2	1	$1,500		2 working days
End Dump Truck	$950	day	2	1	$1,900		2 working days
Forklift/Loader	$1,700	day	2	1	$3,400		2 working days
GPS	$115	day	2	1	$230	*$47,830*	2 working days
Reporting							
Draft and Final Report	$75	hr	220	2	$33,000	*$33,000*	Draft and Final Remedial Action Report
Institutional Controls							
Planning	$75	hr	60	2	$9,000		Planning, meetings, and coordination
Map Design	$75	hr	40	2	$6,000		Preparation of land use maps and controls
Documentation	$75	hr	40	2	$6,000	*$21,000*	Based on historic data
Management and Support							
Professional Services	$75	hr	262	1	$19,650	*$19,650*	Assumes management and support will be 15% of professional services hours
5-Year Review							
Community Involvment and Notification	$75	hr	30	2	$4,500		Preparing and issuing public notices
Document Review	$75	hr	80	2	$12,000		Reviewing historical documents and current laws and regulations
Data Review and Analysis	$75	hr	40	1	$3,000		Reviewing data from previous site work
Site Inspection							Visiting the site to view and asssess current condistions
Mobilization Costs	$20,000	trip	1	1	$20,000		Assumes 2 people flying from Anchorage to Dutch Harbor and chartering a boat to Driftwood Bay
Labor	$75	hr	30	2	$4,500		Assume 2 people, 3 10hr days
Interviews	$75	hr	20	2	$3,000		Conducting intervies with relevant personnel
Protectiveness Determination	$75	hr	180	2	$27,000		Prepare 5-year review report
Subtotal 5-Year Review					**$74,000**		
Present Value						*$205,870*	Assumes i=5%,; P=F(A/F,5%,5)(P/A,5%,30); F=subtotal
Total, Capital Costs						***$719,130***	

Total Costs for Site OT001

Alternative 1: No Action	$0.00
Alternative 2: Insitutional Controls	$230,020
Alternative 3: Removal and Offsite Disposal	$1,363,684
Alternative 4: Onsite Disposal	$766,627

OT001 Alternatives Summary



Institutional Controls - OT001

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Institutional Controls							
Planning	$75	hr	60	2	$9,000		Planning, meetings, and coordination
Map Design	$75	hr	40	2	$6,000		Preparation of land use maps and controls
Documentation	$75	hr	40	2	$6,000	*$21,000*	Based on historic data
Management and Support							
Professional Services	$75	hr	21	2	$3,150	*$3,150*	Assumes management and support will be 15% of professional services hours
5-Year Review							
Community Involvment and Notification	$75	hr	30	2	$4,500		Preparing and issuing public notices
Document Review	$75	hr	80	2	$12,000		Reviewing historical documents and current laws and regulations
Data Review and Analysis	$75	hr	40	1	$3,000		Reviewing data from previous site work
Site Inspection							Visiting the site to view and asssess current condistions
Mobilization Costs	$20,000	trip	1	1	$20,000		Assumes 2 people flying from Anchorage to Dutch Harbor and chartering a boat to Driftwood Bay
Labor	$75	hr	30	2	$4,500		Assume 2 people, 3 10hr days
Interviews	$75	hr	20	2	$3,000		Conducting intervies with relevant personnel
Protectiveness Determination	$75	hr	180	2	$27,000		Prepare 5-year review report
Subtotal 5-Year Review					**$74,000**		
Present Value						*$205,870*	Assumes i=5%,; P=F(A/F,5%,5)(P/A,5%,30); F=subtotal
Total, Capital Costs						***$230,020***	

Removal and Offsite Disposal - OT001

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Mobilization							
Planning	$75	hr	320	2	$48,000		Work plan prep, meetings, & coordination
Procurements/Purchasing Labor	$75	hr	120	2	$18,000		Secure equipment & supplies, contractural
Landing Craft with state rooms Mob/Demob	$105,000	trip	2	1	$210,000		Based on historic pricing, 7 days each for mobilization and demobilization
Mobilization Labor	$75	hr	24	6	$10,800		2 people, 2 12 hour days
Airfare	$1,200	trip	1	6	$7,200		Based on Pen Air 2-week advance purchase
Per Diem	$57	man-day	2	6	$684		JTR rates
Equipment							
Track Excavator	$750	day	14	1	$10,500		Based on historic data
Flatbed Truck	$55	day	14	1	$770		Based on historic data
Forklift/Loader	$1,700	day	14	1	$23,800		Based on historic data
GPS	$115	day	14	1	$1,610		Based on historic data
Misc. Tools and Supplies (EPL)	$30,000	LS	1	1	$30,000	*$361,364*	Based on historic pricing for similar efforts
Site Work							
Duration = 1 day for site setup, 2 days for Top Camp Road Repair, 17 days for excavation, containerization, and transportation, 2 days for site restoration, 4 days for waste transfer to Dutch Harbor = 26 days total							
Site Manager	$95	hr	312	1	$29,640		26 days at 12 hours per day
Safety Officer/CQC	$75	hr	312	1	$23,400		26 days at 12 hours per day
Sampler	$75	hr	312	1	$23,400		26 days at 12 hours per day
Operator	$100	hr	312	1	$31,200		26 days at 12 hours per day
Driver	$100	hr	312	1	$31,200		26 days at 12 hours per day
Laborer	$80	hr	312	1	$24,960		26 days at 12 hours per day
Equipment							
Landing Craft with state rooms	$15,000	day	26	1	$390,000		26 working days
Track Excavator	$750	day	26	1	$19,500		26 working days
Flatbed Truck	$550	day	26	1	$14,300		26 working days
Forklift/Loader	$1,700	day	26	1	$44,200		26 working days
GPS	$115	day	26	1	$2,990	*$634,790*	26 working days
Waste							
Pre-shipment Preparation and Submittals	$650	LS	1	1	$650		Based on historic data
Prepare and Submit Complete Manifest Packages	$95	ea	25	1	$2,375		Based on historic data
Waste Container Management and Tracking	$375	LS	1	1	$375		Based on historic data
Non-hazardous PCB-Contaminated Soil Disposal	$85	ton	483	1	$41,055		Quantity estimate
TSCA PCB-Contaminated Soil Disposal	$250	ton	0	1	$0		Quantity estimate
Open top container rental - non-hazardous	$15	day	40	25	$15,000		Assumes 20 tons per container
Open top container rental - RCRA hazardous	$15	day	40	0	$0		Assumes 20 tons per container
Non-hazardous Origination Charge - Dutch Harbor	$ 9,500	container	25	1	$237,500		Based on historic data
TSCA hazardous Origination Charge - Dutch Harbor	$ 13,400	container	0	1	$0	*$296,955*	Based on historic data
Laboratory							
PCBs - 8082	$115	ea	30	1	$3,450		Based on average from ID/IQ pricing
Cooler shipments	$100	ea	2	1	$200		Based on historic data; assumes 20 samples per cooler
Reporting							
Draft and Final Report	$75	hr	220	2	$33,000	*$33,000*	Draft and Final Removal Action Report
Management and Support							
Professional Services	$75	hr	501	1	$37,575	*$37,575*	Assumes management and support will be 15% of professional services hours
Total, Capital Costs						***$1,363,684***	

Onsite Disposal - OT001

Item	Unit Rate	Units	Quantity	Number of Resources	Cost	2011 Cost Subtotal	Basis of Estimate
Mobilization							
Planning	$75	hr	280	2	$42,000		Work plan prep, meetings, & coordination
Procurements/Purchasing Labor	$75	hr	100	2	$15,000		Secure equipment & supplies, contractural
Landing Craft with state rooms Mob/Demob	$105,000	trip	2	1	$210,000		Based on historic pricing, 7 days each for mobilization and demobilization
Mobilization Labor	$75	hr	24	5	$9,000		5 people, 2 12 hour days
Airfare	$1,200	trip	1	5	$6,000		Based on Pen Air 2-week advance purchase
Per Diem	$57	man-day	2	5	$570		JTR rates
Equipment							
Track Excavator	$750	day	14	1	$10,500		Based on historic data
End Dump Truck	$950	day	14	1	$13,300		Based on historic data
Forklift/Loader	$1,700	day	14	1	$23,800		Based on historic data
GPS	$115	day	14	1	$1,610		Based on historic data
Misc. Tools and Supplies (EPL)	$30,000	LS	1	1	$30,000	*$361,780*	Based on historic pricing for similar efforts
Site Work							
Duration = 0.5 day for site setup, 2 days for landfill construction, and 0.5 day for site restoration = 3 days total							
Site Manager	$95	hr	36	1	$3,420		3 days at 12 hours per day
Safety Officer/CQC	$75	hr	36	1	$2,700		3 days at 12 hours per day
Operator	$100	hr	36	1	$3,600		3 days at 12 hours per day
Driver	$100	hr	36	1	$3,600		3 days at 12 hours per day
Laborer	$80	hr	36	1	$2,880		3 days at 12 hours per day
Equipment							
Landing Craft with state rooms	$15,000	day	3	1	$45,000		3 working days
Track Excavator	$750	day	3	1	$2,250		3 working days
End Dump Truck	$950	day	3	1	$2,850		3 working days
Forklift/Loader	$1,700	day	3	1	$5,100		3 working days
GPS	$115	day	3	1	$345	*$71,745*	3 working days
Reporting							
Draft and Final Report	$75	hr	220	2	$33,000	*$33,000*	Draft and Final Remedial Action Report
Institutional Controls							
Planning	$75	hr	60	2	$9,000		Planning, meetings, and coordination
Map Design	$75	hr	40	2	$6,000		Preparation of land use maps and controls
Documentation	$75	hr	40	2	$6,000	*$21,000*	Based on historic data
Management and Support							
Professional Services	$75	hr	273	1	$20,475	*$20,475*	Assumes management and support will be 15% of professional services hours
Biannual Cap Inspection							
Site Inspection							Visiting the site to view and asssess current condistions
Planning and Procurements	$75	hr	40	2	$6,000		Planning and procuring vendors, subcontractors, and materials
Mobilization Costs	$20,000	trip	1	1	$20,000		Assumes 2 people flying from Anchorage to Dutch Harbor and chartering a boat to Driftwood Bay
Labor	$75	hr	30	2	$4,500		Assume 2 people, 3 10hr days
Subtotal 5-Year Review					**$30,500**		
Present Value						*$52,757*	Assumes i=5%,; P=F(A/F,5%,2)(P/A,5%,4); F=subtotal
5-Year Review							
Community Involvment and Notification	$75	hr	30	2	$4,500		Preparing and issuing public notices
Document Review	$75	hr	80	2	$12,000		Reviewing historical documents and current laws and regulations
Data Review and Analysis	$75	hr	40	1	$3,000		Reviewing data from previous site work
Site Inspection							Visiting the site to view and asssess current condistions
Mobilization Costs	$20,000	trip	1	1	$20,000		Assumes 2 people flying from Anchorage to Dutch Harbor and chartering a boat to Driftwood Bay
Labor	$75	hr	30	2	$4,500		Assume 2 people, 3 10hr days
Interviews	$75	hr	20	2	$3,000		Conducting intervies with relevant personnel
Protectiveness Determination	$75	hr	180	2	$27,000		Prepare 5-year review report
Subtotal 5-Year Review					**$74,000**		
Present Value						*$205,870*	Assumes i=5%,; P=F(A/F,5%,5)(P/A,5%,30); F=subtotal
Total, Capital Costs						***$766,627***	

APPENDIX C
Response to Comments

REVIEW COMMENTS **PROJECT: Driftwood Bay RRS Feasibility Study** **LOCATION: Driftwood Bay, AK**
DOCUMENT: Feasibility Study Driftwood Bay Radio Relay Station Draft Report, November 2010

COMPANY: ADEC	**DATE:** 02/04/2011 **REVIEWER:** Curtis Dunkin **PHONE:** (907) 269-3053	**Action taken on comment by: Jacobs**

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - accepted W - withdrawn (if neither, explain)	JACOBS RESPONSE	RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1	Pg 1-5 to 1-6 (Section 1.2)	This section needs to include information from previous investigations that summarizes the vertical extent and intervals of both characterization sampling conducted and the contaminant concentrations observed at each of the three sites. As discussed in comments 2 and 3 below, i.e. for site LF006, 230 cu yards of contaminated soil seems to be an excessive estimate given soil lead contamination is shallow and the proposed area necessary for capping is only 120 sq feet.	A	Additional information describing the extent of contamination will be added to Section 1.2.1 Soil Contamination. This information will include the nature of soil contamination at each site, the vertical extent estimated, and references to the figures depicting horizontal extent.	
2	Pg 5-1 to 5-4 (Section 5.1/5.1.5) Pg 6-1 to 6-4 (Section 6.1/6.1.5) Pg 7-1 to 7-3 (Section 7.1/7.1.4)	There appears to be a discrepancy between the square footage of the proposed cap in each of the onsite disposal alternatives and the stated estimated volume of contaminated soil that is proposed for removal in other alternatives (i.e. for the BBA, removal alternatives involve 93 cu yards and capping only involves an area of 50 sq ft).	A	This discrepancy appears to be attributed to a poor estimate of square footage for capping at BBA. The site is circular with an approximately 50-foot diameter. More than a 50-square-foot area would require capping. The volume and area calculations will be rechecked for all sites.	
3	Pg 5-4 (Section 5.1.5) Pg 6-4 (Section 6.1.5) Pg 7-3 (Section 7.1.4)	These three alternatives should also have 'With Institutional Controls' stated in the title and the IC's should be discussed. Likewise, w/ IC's should be included whenever referring to these alternatives in other sections throughout the document.		As used in this FS, the term "Institutional Controls" refers to USAF guidance regarding land use controls. In these three alternatives, the land use controls may be managed differently. For example, onsite disposal may be permitted through ADEC Solid Waste or may be treated as a contaminant cap and addressed by institutional controls regulated under ADEC Contaminated Sites. If added as requested, the term "Institutional	

REVIEW COMMENTS

PROJECT: Driftwood Bay RRS Feasibility Study **LOCATION: Driftwood Bay, AK**

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Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - accepted W - withdrawn (if neither, explain)	JACOBS RESPONSE	RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
				Controls" may be interpreted to mean different management practices based on which alternative they are associated with and were omitted from these alternatives to avoid future confusion. Please advise on the desired approach.	
4	Pg 5-25 (Section 5.3.6)	First sentence under 'primary balancing criteria' omit the word 'all alternatives' and reword: i.e. Alternatives #2-5 would be effective.	A	'All alternatives' at the beginning of the first sentence will be replaced by 'Alternatives 2-5…'	
5	Pg 5-27 (Section 6.0)	The last sentence of the first paragraph of this section states 'the site may be on property currently owned by the USFWS'. Has the land ownership status not yet been determined for this site and will previous and/or future site work be an issue regarding a right of entry?	A	At the time that this document was issued, land ownership was not yet determined. Maps reviewed in the interim indicate that site LF006 is on USFWS land. Additional efforts will be required to provide the USAF ownership or access to these lands.	
6	Pg 6-3 (Section 6.1.3)	Last sentence of this section: this sentence should be similar if not identical to the last sentence in section 5.1.3. Please change or reword (i.e. post-removal not post treatment).	A	The last paragraph of Section 6.1.3 will be modified to state, 'Confirmation sampling of the excavation would be required to ensure contaminants were no longer present at concentrations above the ADEC cleanup level. Once analytical results from confirmation samples indicate that all contaminated soil has been removed, the excavation would be backfilled.'	
7	Pg 5-9 (Table 5-1) Pg 6-9 (Table 6-1) Pg 7-10 (Table 7-1)	Alternative #1 'no action' is listed as having no effectiveness for all three sites because no action does not achieve overall protection of human health and the environment; why is this alternative considered further instead of excluding it at the screening stage?		The 'No Action' alternative is retained as a baseline for comparing other alternatives. The intent is to adequately show the range of potential remedies available. This process is described in limited detail throughout the EPA *Guidance for*	

REVIEW COMMENTS **PROJECT: Driftwood Bay RRS Feasibility Study** **LOCATION: Driftwood Bay, AK**
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COMPANY: ADEC	**DATE:** 02/04/2011 **REVIEWER:** Curtis Dunkin **PHONE:** (907) 269-3053	**Action taken on comment by: Jacobs**

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - accepted W - withdrawn (if neither, explain)	JACOBS RESPONSE	RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
				Conducting Remedial Investigations and Feasibility Studies Under CERCLA (HTTP://RAIS.ORNL.GOV/DOCUMENTS/GUIDANCE.PDF). Ref. pages 92, 155, etc.	
8	Pg 7-3 (Section 7.1.4)	Omit repeated 'over the' in first sentence.	A	The suggested change will be made.	
9	Pg 7-8 (Section 7.2.4)	Omit 'of' in the first sentence of last paragraph 'Costs associated with…'	A	The suggested change will be made.	
10	Pg 7-10 (Table 7-1)	The effectiveness rating for alternative #4 'Onsite Disposal' should be changed to half-shaded as it is for the other two sites in Tables 5-1 and 6-1.	A	The effectiveness for Onsite Disposal will be depicted with a half-shaded circle indicating that the alternative is somewhat effective.	
11	General OT001 (Access to Top Camp)	Do cost and implementability evaluations factor the potential necessity to reconstruct and improve roads – especially for work at the Top Camp? The current status and improvability of the road to the Top Camp should be discussed since this appears to be the most potentially limiting factor for working at Top Camp.		Implementability and cost evaluations included road repair for alternatives requiring motor vehicle passage along the road to Top Camp (i.e. OT001 Alternatives 3 and 4). The road repair is discussed in Sections 7.3.3 and 7.3.4 (Implementability), but will be clarified to state, 'An upgrade of this road ~~could~~ *will* be required prior to mobilization to the site.'	
12	Pg 5-27, 6-25 (Primary Balancing Criteria)	When a recommended or preferred action is discussed, please state '…is recommended by the Air Force…'	A	The last sentence on pages 5-27, 6-25, and 7-22 will be modified to state, '…is recommended by the USAF.'	
13	Pg A-4-1-2 (Table 4-1)	Please include a footnote that defines A or RA – action specific and remedial alternative?	A	The terms Applicable or Relevant and Appropriate will be spelled out in Table 4-1 to match formatting for other tables.	