THE UNITED STATES NAVY

INSTALLATION RESTORATION PROGRAM

FINAL

RECORD OF DECISION
FOR
SITES 29 and 35
MAIN BASE OPERABLE UNIT

ANDERSEN AIR FORCE BASE, GUAM

November 2010

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14. ABSTRACT
This Record of Decision (ROD) presents the rationale for selection of the preferred cleanup alternative for Installation Restoration Program (IRP) Sites 29 and 35, located in the Main Base Operable Unit at Andersen AFB, Guam. This ROD summarizes the history, environmental background, extent of contamination, associated human health and ecological risks, evaluation of remedial alternatives, public involvement, and rationale for selecting the preferred remedy for Sites 29 and 35.

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Acronyms and Abbreviations

AFB	Air Force Base
AR	Administrative Record
ARAR	Applicable or Relevant and Appropriate Requirement
Battelle	Battelle Columbus Division
bgs	below ground surface
BSL	Base Sanitary Landfill
BTV	Background Threshold Value
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
COC	contaminant of concern
COPC	contaminant of potential concern
CSM	conceptual site model
cy	cubic yard
DERP	Defense Environmental Restoration Program
DSI	detailed site inventory
EA	EA Engineering, Science, and Technology, Inc.
EPC	exposure point concentration
ESD	Explanation of Significant Differences
ESE	Environmental Science and Engineering, Inc.
°F	degrees Fahrenheit
FFA	Federal Facility Agreement
FS	Feasibility Study
GRA	general response action
Guam EPA	Guam Environmental Protection Agency
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Index
IC	Institutional Control
ICF	ICF Technology, Inc.
ID	identification
IRIS	Integrated Risk Information Systems
IRP	Installation Restoration Program
IT	IT Corporation
lcy	loose cubic yards

LTGM	Long-term Groundwater Monitoring
LUC	Land Use Control
LUCMP	Land Use Control Management Plan
µg/kg	micrograms per kilogram
MARBO	Marianas/Bonins Command
MEC	munitions and explosives of concern
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
MMRP	Military Munitions Response Program
msl	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan of 1990
NGL	Northern Guam Lens
NEPA	National Environmental Policy Act
O&M	Operation and Maintenanc
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethene
POL	petroleum, oil, and lubricants
PRG	Preliminary Remediation Goal
RAO	remedial action objective
RG	remedial goal
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROC	receptor of concern
ROD	Record of Decision
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act of 1986
SIM	selected ion monitoring
SLERA	Screening Level Ecological Risk Assessment
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCE	trichloroethene
TMV	toxicity, mobility, volume
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USN	United States Navy
VOC	volatile organic compound

1.0 Declaration

1.1 Site Name and Location

Facility Name: Andersen Air Force Base (AFB), Guam
Site Location: Yigo, Guam
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification (ID) Number: GU6571999519
Operable Unit/Site: Two Installation Restoration Program (IRP) sites located in the Main Base Operable Unit (OU):

- Site 29
- Site 35

1.2 Statement of Basis and Purpose

This decision document presents the selected remedies for IRP Sites 29 and 35, located at Andersen AFB, Yigo, Guam (Figures 1-1 and 1-2). The selected remedies were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan of 1990 (NCP). This decision is based on the Administrative Record (AR) for these sites, including pertinent IRP documents, correspondence, and material related to the CERCLA investigations and cleanups.

This document is issued by the United States Navy (USN)[1], as the lead agency. The USN is managing remediation of contamination at the Main Base OU Sites listed above in accordance with CERCLA as required by the Defense Environmental Restoration Program (DERP). The USN and the United States Environmental Protection Agency (USEPA) have jointly selected the remedies and the Guam Environmental Protection Agency (Guam EPA) has concurred with the

[1] The Department of Defense is in the process of realigning installation management functions at Andersen AFB. On October 1, 2009, pursuant to the 2005 Defense Base Closure and Realignment Commission Report, administrative custody of all real property on Andersen AFB and responsibility for installation support functions, including Environmental Restoration Program responsibilities, transferred within the Department of Defense from the Department of the Air Force to the Department of the Navy. Title to Andersen AFB real property will remain with the United States and the Air Force will continue to utilize the Base. The Navy will also utilize portions of the Base. In accordance with the April 15 2008, Department of Defense Environmental Supplemental Guidance for Implementing and Operating a Joint Base, at the time of property transfer the Navy, as the new property manager at the Base, assumed responsibility "for all existing and future environmental permits, requirements, plans, and agreements" at the Base (Ch. 1.1.2) and was required to "honor all existing, previously negotiated Federal Facility Agreements in place." (Ch. 2.17.5 of the Guidance).

In January 2009, the Navy and the Air Force entered into a separate Memorandum of Agreement, which delegated installation support and authority back to the Air Force General who is the Andersen Base Commanding Officer under the authority, control, and direction of the Joint Region Commander, who is a Navy Admiral. This delegation includes the authority to sign Records of Decision. The Andersen Base Commanding Officer and Andersen environmental staff continue to administer the FFA under Navy direction. Both the Air Force and the Navy notified USEPA of the change of administrative responsibility under the FFA (See Appendix A).

decision, under the guidelines established in the Federal Facility Agreement (FFA) signed in February 1993 by representatives of the USEPA Region 9, Guam EPA, and the United States Air Force (USAF) (USEPA et al., 1993).

1.3 Assessment of Sites

Site 29

The USN has determined that no action is necessary to protect public health or welfare or the environment at Site 29.

Site 35

The response action selected in this Record of Decision (ROD) is necessary to protect public health or welfare or the environment from actual or threatened releases of pollutants or contaminants from Site 35 which may present an imminent and substantial endangerment to public health or welfare.

Areas within Site 35 cannot support unrestricted use due to pollutants or contaminants remaining in place after implementation of the selected remedy. Land use restrictions are required as part of this response action and will be achieved through imposition of institutional controls (ICs), also known as land use controls (LUCs), that limit the use and/or exposure to those areas of the property that are contaminated.

The USN is committed to implementing, monitoring, maintaining, reporting on, and enforcing all components of the selected remedy to ensure that it remains protective of human health and the environment.

1.4 Description of Selected Remedy

Site 29

Based on the results of a previously conducted records search, Site Characterization Report, Asphalt Recovery Status Report, and a Remedial Investigation/Feasibility Study (RI/FS), the USN has determined that no further CERCLA remedial action is required at Site 29.

Site 35

Based on the results of a previously conducted records search, Site Characterization Report, Asphalt Recovery Status Report, and a Remedial Investigation/Feasibility Study (RI/FS), the USN has determined that remedial action is required for Site 35 in order to prevent potentially unacceptable risks to future residential receptors.

Remedial alternatives for Site 35 were developed and evaluated through a FS (EA Engineering, Science, and Technology, Inc. [EA], 2008). Based on the results of the FS, the USN selected *Institutional Controls* as the preferred alternative for Site 35. The major components of the selected response action are presented below.

Site	Selected Remedial Action	Performance Objectives
Site 35	Institutional Controls	• Prevent future residential exposures to aluminum, chromium, and vanadium in subsurface soil at concentrations greater than the RGs (173,500 mg/kg, 1,080 mg/kg, and 206 mg/kg, respectively). • Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds. • Limit and control any future excavation activities at the site (e.g., worker requirements, soil management, waste disposal).
BTV = background threshold value RG = remedial goal		

The contaminant of concern (COC) impacted soils at Site 35 do not constitute principal threat wastes as the COCs are metals that are relatively immobile in the highly alkaline limestone soils present at the site. Additionally, the COCs are present at the site in relatively low concentrations and are not of a highly toxic nature.

1.5 Statutory Determinations

This section describes how the selected remedy satisfies the statutory requirements of CERCLA, §121 and the regulatory requirements of the NCP.

Site 29

Because the soil sample analytical results for Site 29 indicate that there are no unacceptable risks to human health or the environment, the USN has determined that no CERCLA remedial action is necessary at the site.

Because there are currently no hazardous substances, pollutants, or contaminants remaining at the site above levels that would allow for unlimited use and unrestricted exposure, a five-year review is not required.

Site 35

The selected remedy for Site 35 is protective of human health and the environment, complies with promulgated requirements that are applicable or relevant and appropriate to the remedial action, and is cost effective.

The selected remedy represents the maximum extent to which permanent solutions can be used in a practicable manner at a site. It provides the best balance or trade-offs in terms of balancing criteria, while also considering the bias against offsite treatment and disposal and considering state and community acceptance.

The NCP establishes the expectation that treatment will be used to address the principal threats posed by a site whenever practicable (40 CFR 300.430[a] [1] [iii] [A]). The selected remedy of *Institutional Controls* does not satisfy the statutory preference for treatment as a principal element of the remedy because COC-impacted soil will remain on site untreated.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted for Site 35 within five years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 Data Certification Checklist

The information included in the Decision Summary section (Section 2) of this ROD is summarized in Table 1-1. Additional information can be found in the AR file for Andersen AFB, which is available for public review at two Information Repositories that are located at the Robert F. Kennedy Library, on the University of Guam campus, and the Nieves M. Flores Memorial Library in Hagåtña.

1.7 Authorizing Signatures

The following signature sheets document the decision by USN and USEPA Region 9 to select *No Action* as the remedy for Site 29 and *Institutional Controls* as the remedy for Site 35, Main Base OU, Andersen AFB, Guam, and the concurrence of Guam EPA in that decision.

This signature sheet documents the USN and Andersen AFB co-selection of *No Action* as the remedial action for Site 29 and *Institutional Controls* as the remedial action for Site 35, Main Base OU, Andersen AFB, Guam.

JOHN W. DOUCETTE
Brigadier General, USAF
Base Commanding Officer[2]

16 Nov 11
Date

[2] Under Delegation of Authority from Commander Joint Region Marianas. See Footnote 1.

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This signature sheet documents the USEPA Region 9 co-selection of *No Action* as the remedial action for Site 29 and *Institutional Controls* as the remedial action for Site 35, Main Base OU, Andersen AFB, Guam.

MICHAEL M. MONTGOMERY Date
Assistant Director, Federal Facilities and Site Cleanup Branch
U.S. Environmental Protection Agency, Region 9

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This signature sheet documents the Guam EPA concurrence in the selection of *No Action* as the remedial action for Site 29 and *Institutional Controls* as the remedial action for Site 35, Main Base OU, Andersen AFB, Guam.

ERIC M. PALACIOS
Acting Administrator
Guam Environmental Protection Agency

Date

2.0 Decision Summary

The Decision Summary identifies the selected remedies for Sites 29 and 35; explains how the selected remedies fulfill statutory and regulatory requirements; and provides a substantive summary of the AR file that supports the remedy selection decisions.

2.1 Site Names, Locations, and Descriptions

The following section presents descriptions of each of the two sites and their locations.

Site 29

Full Site Name:	Site 29
CERCLIS ID Number:	GU6571999519
Site Location:	Yigo, Guam
Site Type:	Former Waste Pile

Site 29 is located on the Main Base of Andersen AFB approximately 500 feet north of the active Base Sanitary Landfill (BSL) (Site 1/Landfill 1) and 1,400 feet north of Site 35 (Figures 2-1 and 2-2). The site is approximately 4 acres in size and is flat to gently sloping. Current site conditions were photographed in December 2008 and are presented in Photos 2-1 through 2-3.

Site 35

Full Site Name:	Site 35
CERCLIS ID Number:	GU6571999519
Site Location:	Yigo, Guam
Site Type:	Former Waste Pile

Site 35 is located on the Main Base of Andersen AFB approximately 400 feet south of the active BSL and 1,400 feet south of Site 29 (Figures 2-1 and 2-3). The site is approximately 7 acres in size and is flat to gently sloping. Current site conditions were photographed in December 2008 and are presented in Photos 2-4 through 2-6.

2.2 Site History and Enforcement Activities

This section provides background information and summarizes the series of investigations that led to the ROD. It describes the CERCLA response actions undertaken at the Main Base OU, Sites 29 and 35.

Due to its primary mission in national defense, the USAF has long been engaged in a wide variety of operations that involve the use, storage, and disposal of hazardous materials. On 14 October 1992, Andersen AFB was formally listed on the National Priorities List by the USEPA to investigate abandoned sites that may have been impacted by the use, storage, and disposal of hazardous materials.

The USN and USAF have conducted environmental investigations at the Main Base OU, Sites 29 and 35, in accordance with CERCLA under the DERP, which was established by Section 211 of SARA.

As the support agencies, the USEPA Region 9 and Guam EPA provide primary oversight of the environmental restoration actions, in accordance with the FFA. The enforcement activities for Andersen AFB were initiated when the USAF entered into an FFA with the USEPA Region 9 and Guam EPA. The FFA, finalized on 30 March 1993, established procedures for involving federal and territorial regulatory agencies, as well as the public, in the environmental restoration process at Andersen AFB. The FFA was based on applicable environmental laws including CERCLA, Hazardous and Solid Waste Act of 1982, SARA, and the NCP.

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

In accordance with USN policy, to the extent practicable, National Environmental Policy Act (NEPA) values have been incorporated throughout the CERCLA process culminating in this ROD. Separate NEPA documentation will not be issued.

Site 29

Site 29 has been evaluated in the following six environmental reports:

- *Installation Restoration Program Phase I: Records Search, Andersen Air Force Base, Guam* (Environmental Science and Engineering, Inc., and Reynolds, Smith and Hills, Inc. [ESE], 1985)
- *Installation Restoration Program Phase II, Stage 1—Confirmation/Quantification, Andersen AFB, Guam* (Battelle Columbus Division [Battelle], 1989)
- *Installation Restoration Program, Final Records Search for Andersen Air Force Base, Guam* (ICF Technology, Inc. [ICF], 1996a)
- *Installation Restoration Program, Final Site Characterization Report, Waste Piles 1, 2, and 3, Andersen Air Force Base, Guam* (ICF, 1998)
- *Final Asphalt Recovery Status Report, Installation Restoration Program Site 29, Waste Pile 2* (IT Corporation [IT], 2000a)
- *Final Remedial Investigation/Feasibility Study for Sites 29 and 35, Main Base Operable Unit, Andersen Air Force Base, Guam* (EA, 2008)

Site 29 was originally used as an asphalt tar storage area in the early 1950s. Andersen AFB's former asphalt plant reportedly used the asphalt tar during the post World War II expansion of the base (ICF, 1996a).

Site 35

Site 35 has been evaluated in the following six environmental reports:

- *Installation Restoration Program Phase II, Stage 1—Confirmation/Quantification, Andersen AFB, Guam* (Battelle, 1989)
- *IRP Phase 2, Remedial Investigation/Feasibility Study, Technical Report, Volume 1, Final, Andersen Air Force Base, Guam* (Science Applications International Corporation [SAIC], 1991)
- *Installation Restoration Program, Final Records Search for Andersen Air Force Base, Guam* (ICF, 1996a)
- *Installation Restoration Program, Final Site Characterization Report, Waste Piles 1, 2, and 3, Andersen Air Force Base, Guam* (ICF, 1998)
- *Final Asphalt Recovery Status Report, Installation Restoration Program Site 35, Waste Pile 1* (IT, 2000b)
- *Final Remedial Investigation/Feasibility Study for Sites 29 and 35, Main Base Operable Unit, Andersen Air Force Base, Guam* (EA, 2008)

Site 35 was initially identified by Battelle personnel during a field geophysical investigation in December 1986. Following discovery of the site, the Phase II, Stage 1 investigation was performed and found that Site 35 contained several thousand drums of asphaltic tar, with some drums leaking to the ground surface. The 1996 Records Search determined that Site 35 was originally used as an asphalt tar storage area in the 1970s for excess paving material (ICF, 1996a).

2.3 Community Participation

NCP Section 300.430(f)(3) establishes a number of public participation activities that the lead agency must conduct following preparation of the Proposed Plan and review by the support agency. Components of these items and documentation of how each component was satisfied for Sites 29 and 35, at Andersen AFB, Guam, are described in Tables 2-1 and 2-2.

Responses to comments received during the public comment period are included in the Responsiveness Summary, which is provided as Section 3 of the ROD.

2.4 Scope and Role of Operable Unit

As with many large sites, the environmental problems at Andersen AFB, Guam, are complex. As a result, the USN, with concurrence from USEPA Region 9 and Guam EPA, has organized the environmental restoration work at Andersen AFB into six OUs as described below.

Main Base OU (Sites 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 25, 26, 27, 28, 29, 34, and 35) – RODs addressing the Main Base OU are either completed or in the process of completion. The sites were proposed to be addressed in the following separate ROD documents:

- Sites 6, 9, and 12 (Group 1)
- Sites 5 and 8 (Group 2)
- Sites 4, 11, 25, 28, and 34 (Group 3)
- Sites 3, 10, 13, and 27 (Group 4)
- Sites 29 and 35
- Sites 2, 14, 15, and 26 (Grouping not yet assigned)

Final RODs for Groups 1, 2, and 3 were completed in September 2007, and the RODs for the remaining sites are currently under development.

Northwest Field OU (Sites 7, 16, 17, 21, 30, 31, and 36) – A Final ROD addressing Sites 7, 16, 17, 31, and 36 was completed in September 2007. The ROD for Site 21 is currently under development.

Due to presence of munitions and explosives of concern (MEC), Site 30 was transferred to the Andersen AFB's Military Munitions Response Program (MMRP). Under the MMRP, a ROD will be completed for Site 30 after a further investigation/feasibility study, with respect to the MEC, is completed.

Marianas/Bonins Command (MARBO) Annex OU (Sites 20, 22, 23, 24, 37, and 38) – A Final ROD addressing the MARBO Annex OU was completed in May 1998 and a Five-year ROD Review was completed in July 2004.

Harmon Annex OU (Sites 18, 19, and 39) – A Final ROD addressing the Harmon Annex OU was completed in July 2002.

Urunao OU (Site 40) – A Final ROD addressing the Urunao OU was completed in December 2003.

Site Wide OU (Sites 41 through 78) – The Site Wide OU consists of IRP sites that have been added to the program in recent years, and is distributed geographically across the Main Base, Northwest Field, MARBO Annex, and Tumon Tank Farm. The sites are proposed to be addressed in separate ROD documents as follows:

- Sites 45, 49, 59, 61, 67, 68, and 69 (Group A)
- Sites 48, 56, 58, 70, and 73 (Group B)
- Sites 47, 50, 51, 53, and 55 (Group C)
- Sites 63, 64, 65, 66, 72, and 77 (Group D)
- Sites 57, 71, 74, 75, 76, and 78 (Group E)
- Sites 44 and 46 (Group F)
- Sites 41, 42, 43 (Group G)
- Site 54

Final RODs for Groups A, B, C, and F were completed in November 2008, and the RODs for the remaining sites are currently under development. Due to presence of MEC, Sites 52, 60, and 62 were transferred to Andersen AFB's MMRP. Under the MMRP, RODs will be completed for these sites after further investigations/feasibility studies are completed with respect to the MEC.

2.5 Site Characteristics

This section describes the physical characteristics of the two sites addressed in this ROD. Brief descriptions are provided for each site. Guam is the largest, most populated, and southernmost island in the Mariana Islands, located in the western Pacific Ocean (Figure 1-1). Relative to Guam, Hawaii is located 3,700 miles to the east-northeast and Japan is located 1,560 miles to the north. Guam is approximately 30 miles long, varies in width from 4 to 12 miles, and has a total land area covering approximately 209 square miles.

2.5.1 Physiography and Climate

Physiographically, the island of Guam may be divided into northern and southern regions, which are separated by the Adelup Fault. The northern region is a limestone plateau consisting of rolling hills and cliff lines ranging from 200 to 600 feet above mean sea level (msl).

Andersen AFB consists of multiple parcels of land located on the northern half of Guam (Figure 1-2), and is situated on an undulating limestone plateau with surficial karst features. The Base property includes the Main Base (formerly North Field) and Northwest Field. Andersen AFB is approximately 8 miles wide by 2 to 4 miles long, and covers approximately 24.5 square miles.

Guam is located at 13° 27' north latitude (approximately 900 miles north of the equator), creating a year-round warm and humid climate. The mean annual temperature is 81 degrees Fahrenheit (°F). Daily temperatures range from the lower 70s to the upper 80s °F. Relative humidity ranges from 65 to 80 percent in the afternoon and 85 to 100 percent in the evening. Guam has two distinct seasons, a wet and a dry season. The dry season is typically from December to June, and the wet season occurs from July through November. Approximately 65 percent of the annual precipitation falls during these five rainy months, and the annual rainfall on northern Guam averages between 80 and 100 inches.

The dominant winds are the trade winds, blowing from the east or northeast with velocities between 4 and 12 miles per hour throughout the year. Storms may occur at any time during the year, although tropical storms and typhoons are more frequent during the rainy season. Large rainfall events associated with typhoons are common, with as much as 25 inches of rain in a 24-hour period (Ward et al., 1965).

These climatic conditions hold true for both sites covered by this ROD. Site-specific physiography is discussed in more detail in the sections below.

Site 29

Site 29 is located on the Main Base of Andersen AFB, approximately 500 feet north of the active BSL (Figure 2-1). The site is flat to gently sloping to the north and covers an area approximately 4 acres in size. During the RI field investigation, the site was primarily covered with low-growth vegetation, with the northern and eastern borders of the site heavily overgrown in jungle. The site elevation is approximately 490 feet above msl (Figure 2-2).

Site 35

Site 35 is also located on the Main Base of Andersen AFB, approximately 1,400 feet south of Site 29 and approximately 400 feet south of the active BSL (Figure 2-1). The site is flat to gently sloping to the southeast and covers an area approximately 7 acres in size. During the RI field investigation, the central portion of the site consisted of a shallow, former limestone quarry with exposed limestone bedrock and sparse, low-growth vegetation. The surrounding area was covered with jungle along the western and southern borders and a sharp topographic incline led up to Route 9 along the western border. The site elevation is approximately 490 feet above msl (Figure 2-3).

2.5.2 Geology and Hydrogeology

Sites 29 and 35 are underlain by the Mariana Limestone, which is underlain by the Barrigada Limestone. The Barrigada Limestone is underlain by the volcanic deposits of the Alutom Formation.

The soils on the Main Base consist predominately of the following three series of upland limestone soils: Guam, Guam-Urban land-Pulantat, and Ritidian Series. These soils are generally very shallow to shallow, well-drained, and range from flat to gently sloping on the interior to extremely steep along the cliff lines (Young, 1988).

The typical soil observed at Sites 29 and 35 consists of Guam cobbly clay loam. The Guam cobbly clay loam is derived from sediments overlying porous coralline limestone. Approximately 5 to 10 percent of the surface is covered by gravel and cobbles (Young, 1988). It is neutral to mildly alkaline with moderately rapid permeability. The surface layer is usually removed or mixed with underlying material during construction. The soil is typically characterized by a dusky red, gravelly clay loam, approximately 6 inches thick. The depth to limestone is usually 6 to 16 inches, unless landscaping has taken place.

Surface soils and bedrock are very porous and permeable and as a result, no rivers or streams are present in the northern portion of the island. Precipitation, except that portion lost to evapotranspiration, contributes to the groundwater lens.

Groundwater resources on northern Guam are encountered at approximately 400 to 600 feet bgs. The groundwater surface at the Main Base ranges between 3 to 4 feet above msl and the freshwater lens ranges between 100 to 160 feet thick. The important factors governing the volume of freshwater in the lens are: the effects of mixing freshwater and marine water, the permeability of the limestone formations, and the rate of recharge. The groundwater flow

direction of the Northern Guam Lens (NGL) near Sites 29 and 35 is from the limestone/volcanic contacts in the west-southwest towards the Pacific Ocean to the north. Faults, fractures, brecciated zones, joints, dissolution channels, or cavities can affect flow.

The aquifer located beneath Sites 29 and 35 is highly permeable and porous, has estimated hydraulic conductivities ranging from 2 to 20,000 feet per day, and porosities ranging from 15 to 20 percent (ICF, 1995). The aquifer beneath the sites occurs in basal conditions; however, fluctuations in depth to groundwater at Site 35 can be attributed to the site's close proximity to the parabasal contact to the south-southeast.

The following is a tabular summary of the geology and hydrogeology at Sites 29 and 35.

Site	Limestone Formation	Soil	Depth to Groundwater (approximate)	Proximity to Cliff Line
Site 29	Detrital facies of the Mariana Limestone	Guam cobbly clay loam	483 feet bgs	9,000 feet
Site 35	Barrigada Limestone	Guam cobbly clay loam	450 feet bgs	11,000 feet
bgs = below ground surface				

2.5.3 Surface Water Hydrology

No wetlands or surface water resources are located in the Northwest Field, the Main Base, or in the vicinity of Sites 29 and 35. The geology in the region is dominated by highly porous limestone bedrock underlying very thin soils with moderately rapid permeability. As a result precipitation readily infiltrates into the vadose zone, preventing the formation of surface streams, rivers, and lakes.

2.5.4 Ecology

Several potential receptors to contaminants may be present at both sites. Neither site is fenced; therefore, the sites can easily be accessed by potential receptors. Hunting is permitted near Site 29, and animals such as feral pigs and deer are occasionally hunted within surrounding designated areas. Currently, both sites lie within the designated foraging area for the endangered Mariana crow (*Corvus kubaryi*) and the Micronesian starling (*Aplonis opacus guami*). The *Tabernaemontana rotensis* is the only endangered tree identified in the area surrounding the two sites. This section provides site-specific information related to ecology at each of the individual sites. Ecological receptor populations for each site are discussed in Section 2.7.

Site 29

The ecological habitat at Site 29 primarily consists of mixed herbaceous vegetation with mixed or secondary growth vegetation covering the northern and eastern edges of the site. Approximately 90 percent of the site consists of mixed herbaceous vegetation and 10 percent consists of mixed or secondary growth vegetation. A mixture of grasses, vines, and herbs (up to

3 feet tall); shrubs and small trees (3 to 10 feet tall); and larger trees (10 to 30 feet tall) dominate the habitat.

Site 35

The ecological habitat at Site 35 primarily consists of mixed herbaceous vegetation with mixed or secondary growth vegetation covering the western and southern edges of the site. Approximately 75 percent of the site consists of mixed herbaceous vegetation and 25 percent consists of mixed or secondary growth vegetation. A mixture of grasses, vines, and herbs (up to 3 feet tall); herbs, shrubs, and small trees (3 to 10 feet tall); and larger trees (10 to 30 feet tall) dominate the habitat.

2.5.5 Previous Site Characterization Activities

Site 29

Site 29 was initially identified during the Phase I Records Search. Based on the results of the Phase I Records Search, the site was recommended for further field investigation and removal and disposal of the drums, and as a result was added to the Phase II, Stage 1 investigation (ESE, 1985).

During the Phase II, Stage 1 investigation in 1987, aerial infrared photographs of the landfill complex were taken and anomalies were investigated. Approximately 200 deteriorated asphalt-containing drums were identified at Site 29. Three samples were collected from material leaking from the drums and sent to a laboratory for analysis. Di-n-octylphthalate was detected in two samples at concentrations of 57 mg/kg and 53 mg/kg, well below the USEPA Region 9 residential PRG of 2,400 mg/kg. Additionally, the fieldwork and laboratory analyses were performed in the absence of approved quality assurance documents and standard operating procedures, which were subsequently established for the Andersen AFB IRP under the FFA. Data collected prior to the FFA do not meet the data quality objectives and cannot be used in performing a quantitative HHRA or a SLERA. The Phase II, Stage 1 investigation concluded with a recommendation of no further action due to the lack of evidence of chemical contamination found in the material and soils at Site 29. Additionally, no removal was conducted as the known waste materials at the site were not migrating (Battelle, 1989).

In 1995, a records search of past activities and a DSI were performed in support of a Site Characterization Report (ICF, 1998). The DSI identified approximately 930 55-gallon drums containing, or suspected of once containing, liquid asphalt at Site 29. Many of the drums had deteriorated to the point where the asphalt was pooling in surface depressions. The asphalt was estimated to cover approximately 28,250 square feet of surface area.

During the 1995 field investigation, seven test trenches were excavated, most of which did not reveal the presence of buried waste. Ordnance of an unspecified nature was identified while backfilling one trench (T7). This ordnance has since been removed and properly disposed of by Andersen AFB Explosive Ordnance Disposal personnel (ICF, 1998).

Twelve surface soil samples (including one duplicate) and two subsurface soil samples (including one duplicate) were collected during the 1995 field investigation and analyzed for semivolatile organic compounds (SVOCs) and Target Analyte List (TAL) metals (ICF, 1998). These results were screened against their respective industrial PRGs and BTVs. No SVOCs or TAL metals were detected in any of the surface or subsurface soil samples at concentrations exceeding industrial PRGs or BTVs.

Asphaltic-tar samples were collected from drums and the ground surface, and were analyzed to evaluate the quality of the material for potential reuse. The asphalts were determined to be grade AC-20 and AC-40 asphalt of acceptable quality for reuse. Remediation/recycling of the asphalt tar at Site 29 was scheduled as a result of the site characterization investigation (ICF, 1998).

Removal Actions Completed

In January 1998, excavation, removal, and recovery activities were conducted at Site 29 in conjunction with those at Site 35 (IT, 2000a; IT, 2000b). The remediation area included the entire area impacted by spilled and/or drummed asphalt. Site 29 was cleared and grubbed using an excavator equipped with a grappler. Cleared vegetation was piled along the edge of the cleared area and left to decompose naturally. The removal action included the following activities:

- Two trenches were excavated in the limestone bedrock and approximately 930 drums of asphalt and uncontained asphalt were placed on the slopes above these trenches. The asphalt was heated by the sun and flowed into the downgradient trenches. The asphalt that accumulated in the trenches was transported to Site 35 for recovery.

- Approximately 31,995 gallons, or 581 drums, of asphalt were recovered and placed in reconditioned drums. This asphalt was tested to evaluate its potential for use in pavement construction.

- Approximately 400 cy of asphalt debris, consisting of non-recoverable asphalt mixed with soil and organic material, were transported and stockpiled at Site 35, along with approximately 850 empty, asphalt-coated drums.

Following the completion of removal of asphalt and debris from Site 29, four confirmation surface soil samples (including one duplicate) were collected and analyzed for SVOCs, polycyclic aromatic hydrocarbons (PAHs), and TAL metals. These results were screened against their respective industrial PRGs and BTVs. No SVOCs, PAHs, or TAL metals were detected in the confirmation samples at concentrations exceeding respective residential PRGs or BTVs.

Post-Removal Action Characterization

Following the completion of the removal action, a field investigation was conducted at Site 29 in 2006 in support of a RI/FS document (EA, 2008). The RI included a visual site reconnaissance, DSI, geophysical survey, test trenching, surface and subsurface soil sampling, topographic survey, and an ecological survey. During the field investigation, the site was covered with low-

growth vegetation in the center and jungle along the northern and eastern borders. An underground petroleum, oil, and lubricants (POL) pipeline and associated electrical lines bisected the southern portion of the site.

A total of 23 surface soil samples (including two duplicates) were collected in June 2006 and analyzed for SVOCs, PAHs, and TAL metals.

- Aluminum was detected in three surface soil samples at concentrations (ranging from 174,000 to 186,000 mg/kg) exceeding the residential PRG (76,000 mg/kg) and BTV (173,500 mg/kg).
- Chromium was detected in two surface soil samples at concentrations (1,090 and 1,130 mg/kg) exceeding the residential PRG (210 mg/kg) and BTV (1,080 mg/kg).
- Lead was detected in one surface soil sample at a concentration (1,920 mg/kg) exceeding the residential PRG (400 mg/kg) and BTV (166 mg/kg).
- Manganese was detected in four surface soil samples at concentrations (ranging from 5,510 to 8,530 mg/kg) exceeding the residential PRG (1,800 mg/kg) and BTV (5,500 mg/kg).

Eleven additional surface soil samples (including three duplicates) were collected in September 2006 and analyzed for lead to delineate elevated concentrations. None of the delineation samples contained lead at concentrations exceeding the residential PRG or BTV.

The geophysical survey conducted during the RI field investigation identified several anomalies suspected to be buried waste disposal areas. In response, 14 test trenches were excavated and two subsurface soil samples were collected from the test trenches at 2 to 4 feet bgs. A majority of the materials observed in the excavations included chunks of black viscous tar and 55-gallon drum remnants.

A total of 10 subsurface soil samples (including one duplicate) were collected in July 2006 and analyzed for volatile organic compounds (VOCs), SVOCs, PAHs, and TAL metals.

- Benzo(a)pyrene was detected in one subsurface soil sample at a concentration (180 micrograms per kilogram [μg/kg]) exceeding the residential PRG (62 μg/kg).
- Aluminum was detected in two subsurface soil samples at concentrations (176,000 and 204,000 mg/kg) exceeding the residential PRG (76,000 mg/kg) and BTV (173,500 mg/kg).
- Chromium was detected in one subsurface soil sample at a concentration (1,210 mg/kg) exceeding the residential PRG (210 mg/kg) and BTV (1,080 mg/kg).
- Iron was detected in one subsurface soil sample at a concentration (125,000 mg/kg) exceeding the residential PRG (23,000 mg/kg) and BTV (116,495 mg/kg).

- Manganese was detected in one subsurface soil sample at a concentration (5,830 mg/kg) exceeding the residential PRG (1,800 mg/kg) and BTV (5,500 mg/kg).

- Vanadium was detected in one subsurface soil sample at a concentration (224 mg/kg) exceeding the residential PRG (78 mg/kg) and BTV (206 mg/kg).

Analytical results for the surface and subsurface soil samples collected during the RI were used to conduct a HHRA and a SLERA. The calculated site specific risk was below the calculated risk due to background. Therefore, no remediation is required at Site 29.

Site 35

Site 35 was included in the Phase II, Stage 1 investigation, which consisted of a site reconnaissance, detailed mapping, and shallow soil sampling (Battelle, 1989). At the time of the investigation, the site contained several thousand drums of asphaltic tar, with some drums leaking to the ground surface. The tar had flowed down slope and pooled in surface depressions. Animal remains were observed in several of these tar pools. The Phase II, Stage 1 investigation concluded with a recommendation for further investigation (Battelle, 1989).

In 1989, Site 35 was investigated in support of the Phase II, Stage 2 RI/FS (SAIC, 1991). The investigation included monitoring well installation, groundwater sampling, soil sampling, and a magnetometer survey. Shallow soil samples were collected and indicated the presence of petroleum hydrocarbons. Analytical results were used to perform a baseline risk assessment, which determined that the site may pose a potential threat to future human health and recommended additional investigation.

At the time of the Phase II, Stage 1 and Stage 2 investigations, fieldwork and laboratory analyses were performed in the absence of approved quality assurance documents and standard operating procedures established under the FFA. Data collected prior to approval of the FFA can be used for qualitative purposes, but do not meet the data quality objectives for the project and cannot be used in performing a quantitative HHRA or a SLERA.

In 1995, a records search of past activities and a DSI were performed at Site 35 (ICF, 1998). A review of previous reports and the DSI identified approximately 7,900 55-gallon drums containing, or suspected of once containing, asphaltic tar. Many of the drums had deteriorated to the point where the tar was collecting in pools ranging from 1 inch to 24 inches deep, and covering an estimated surface area of approximately 114,000 square feet.

During the 1995 field investigation, 23 test trenches were excavated, most of which did not encounter buried waste. However, buried drums containing asphaltic tar were observed in a mound of soil located in the northwest corner of the site (ICF, 1998).

A total of 15 surface soil samples (including two duplicates) were collected and analyzed for SVOCs and TAL metals (ICF, 1998).

- Aluminum was detected in five surface soil samples at concentrations (ranging from 178,000 to 207,000 mg/kg) exceeding the industrial PRG (100,000 mg/kg) and BTV (173,500 mg/kg).

- Chromium was detected in four surface soil samples at concentrations (ranging from 1,100 to 1,550 mg/kg) exceeding the industrial PRG (450 mg/kg) and BTV (1,080 mg/kg).

- Iron was detected in five surface soil samples at concentrations (ranging from 119,000 to 146,000 mg/kg) exceeding the industrial PRG (100,000 mg/kg) and BTV (116,495 mg/kg).

A total of four subsurface soil samples (including one duplicate and one resample) were collected and analyzed for SVOCs and TAL metals (ICF, 1998).

- Aluminum was detected in two subsurface soil samples at concentrations (182,000 and 226,000 mg/kg) exceeding the industrial PRG (100,000 mg/kg) and BTV (173,500 mg/kg).

- Chromium was detected in two subsurface soil samples at concentrations (1,100 and 1,220 mg/kg) exceeding the industrial PRG (450 mg/kg) and BTV (1,080 mg/kg).

- Iron was detected in two subsurface soil samples at concentrations (121,000 and 142,000 mg/kg) exceeding the industrial PRG (100,000 mg/kg) and BTV (116,495 mg/kg).

Asphaltic tar samples were collected from drums and the ground surface, and were analyzed to evaluate the quality of the material for potential reuse. The asphalts were determined to be grade AC-20 and AC-40 asphalt of acceptable quality for reuse for paving material (ICF, 1998).

Removal Actions Completed

Between November 1997 and July 1999, excavation, removal, and recovery activities were conducted at Site 35 (IT, 2000b). The remediation area included the entire area impacted by spilled and/or drummed asphalt. Site 35 was cleared and grubbed using an excavator equipped with a grappler. Cleared vegetation was piled along the edge of the cleared area and left to decompose naturally. The removal action included the following activities:

- Trenches were excavated into the limestone bedrock and approximately 8,000 drums of asphalt and uncontained asphalt were placed on the slopes above the trenches to eventually be heated by the sun and run off into the trenches to accumulate. Approximately 8,000 empty, asphalt-coated drums were subsequently transported to and disposed of at the active BSL.

- A total of 3,812 55-gallon drums (approximately 209,660 gallons) of asphalt was recovered from the asphalt recovery trenches and was tested to evaluate its suitability for use in paving material.

- Approximately 3,800 cy of asphaltic debris was stockpiled on site until it was eventually disposed of in trenches at Site 2/Landfill 2.

Ten confirmation surface soil samples (including one duplicate) were collected and analyzed for SVOCs, PAHs, and TAL metals following completion of the removal of the asphalt and debris from the site (IT, 2000b).

- Aluminum was detected in four surface soil samples (including one duplicate) at concentrations (ranging from 209,000 to 220,000 mg/kg) exceeding the industrial PRG (100,000 mg/kg) and BTV (173,500 mg/kg).

- Chromium was detected in four surface soil samples (including one duplicate) at concentrations (ranging from 1,080 to 1,340 mg/kg) exceeding the industrial PRG (450 mg/kg) and BTV (1,080 mg/kg).

In November 2000, approximately 850 soil-contaminated asphalt-containing drums, approximately 2,800 cy of uncontained asphalt-contaminated soil, and approximately 5,000 cy of asphalt contaminated with soil and other debris were excavated and removed from Site 6/Landfill 8 and moved to a bermed area at Site 35 (IT, 2001). In 2005, Andersen AFB reclaimed approximately 1,100 cy of the asphalt and asphalt-contaminated soil for use as an intermediate cover material for the adjacent consolidation unit to the south of the site (EA, 2008). The materials removed from Site 6 that were not reclaimed remain onsite in the bermed area at Site 35.

Post-Removal Action Characterization

Following the completion of the removal action, a field investigation was conducted at Site 35 in 2006 in support of a RI/FS document (EA, 2008). The RI included a visual site reconnaissance, DSI, geophysical survey, test trenching, surface and subsurface soil sampling, drum sampling and disposal, topographic survey, and an ecological survey. During the field investigation, the center portion of the site contained a limestone quarry with exposed limestone bedrock and very little low-growth vegetation. The site was covered with jungle along the western and southern borders and a sharp topographic incline led up to Route 9 along the western border. The site was accessed by the unpaved Landfill Access Road located to the north/northeast of the site.

A total of 29 surface soil samples (including two duplicates) were collected and analyzed for SVOCs, PAHs, and TAL metals.

- Benzo(b)fluoranthene was detected in one surface soil sample at a concentration (2,300 μg/kg) exceeding the residential PRG (620 μg/kg).

- Benzo(a)pyrene was detected in one surface soil sample at a concentration (940 μg/kg) exceeding the residential PRG (62 μg/kg).

- Dibenz(a,h)anthracene was detected in one surface soil sample at a concentration (280 μg/kg) exceeding the residential PRG (62 μg/kg).

- Indeno(1,2,3-cd)pyrene was detected in one surface soil sample at a concentration (1,200 μg/kg) exceeding the residential PRG (620 μg/kg).

- Chromium was detected in one surface soil sample at a concentration (1,120 mg/kg) exceeding the residential PRG (210 mg/kg) and BTV (1,080 mg/kg).

- Vanadium was detected in two surface soil samples at concentrations (218 and 232 mg/kg) exceeding the residential PRG (78 mg/kg) and BTV (206 mg/kg).

The geophysical survey conducted during the RI field investigation identified several anomalies suspected to be buried waste disposal areas. In response, 10 test trenches were excavated and five subsurface soil samples were collected from the test trenches at 2 to 6 feet bgs. A majority of the materials observed in the excavations included chunks of black viscous tar and metal debris.

A total of five subsurface soil samples were collected and analyzed for VOCs, SVOCs, PAHs, and TAL metals.

- Benzo(a)pyrene was detected in one subsurface soil sample at a concentration (180 μg/kg) exceeding the residential PRG (62 μg/kg).

- Aluminum was detected in one subsurface soil sample at a concentration (209,000 mg/kg) exceeding the residential PRG (76,000 mg/kg) and BTV (173,500 mg/kg).

- Chromium was detected in one subsurface soil sample at a concentration (1,610 mg/kg) exceeding the residential PRG (210 mg/kg) and BTV (1,080 mg/kg).

- Iron was detected in one subsurface soil sample at a concentration (129,000 mg/kg) exceeding the residential PRG (23,000 mg/kg) and BTV (116,495 mg/kg).

- Vanadium was detected in two subsurface soil samples at concentrations (211 and 220 mg/kg) exceeding the residential PRG (78 mg/kg) and BTV (206 mg/kg).

Analytical results for the surface and subsurface soil samples collected during the RI were used to conduct a HHRA and a SLERA. The SLERA concluded that there are no unacceptable risks to ecological receptors. The calculated risk for surface soil was below the calculated background risk. Therefore, no remediation is required for surface soil at Site 35.

For all subsurface soil COCs at Site 35, the EPCs were all above the site-specific PRGs. An FS was conducted to evaluate the aluminum, chromium, and vanadium found in subsurface soil (EA, 2008).

2.5.6 Nature and Extent of Contamination

Site 29

Analytical results indicated that four metals (aluminum, chromium, lead, and manganese) exceeded screening levels (residential PRGs and BTVs) in a few surface soil samples (Figure 2-4). One PAH (benzo[a]pyrene) and five metals (aluminum, chromium, iron, manganese, and vanadium) exceeded screening levels in a few subsurface soil samples. The risk assessment showed that the site risk is below the risk attributable to background, allowing for unlimited use of and unrestricted exposure to the land.

Site 35

Analytical results indicated that four PAHs (benzo[b]fluoranthene, benzo[a]pyrene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) and two metals (chromium and vanadium) exceeded screening levels (residential PRGs and BTVs) in a few surface soil samples (Figure 2-5). The risk assessment showed that the site risk for surface soils is below the risk attributable to background and that no remediation is required for surface soil at Site 35.

Analytical results indicated that PAHs (benzo[a]pyrene) and/or metals (aluminum, chromium, iron, and vanadium) exceeded screening levels in two subsurface soil samples (Figure 2-5). Results of the HHRA indicated that aluminum, chromium, and vanadium concentrations in subsurface soil pose potentially unacceptable risks to future residential receptors in two areas of the site (vicinity of samples AAFBMBS35S067 and AAFBMBS35S069). The SLERA concluded that there are no unacceptable risks to ecological receptors.

The estimated volume of subsurface soil with elevated aluminum, chromium, and vanadium concentrations is approximately 780 lcy. The estimated area of subsurface soil with elevated aluminum, chromium, and vanadium concentrations is approximately 3,930 square feet.

The source for the elevated metals in subsurface soil at Site 35 may be related to deteriorating drums; however, this is unlikely as drums or drum remnants were not found in the vicinity of sample AAFBMBS35S067. The exceedances may also be due to variability of background conditions. The results for these metals appear to be within the total range of background values, but exceed the calculated 95th percentile cut-off for background screening.

2.5.7 Conceptual Site Model

Conceptual site models (CSMs) were developed for Sites 29 and 35 to depict the potential relationship or exposure pathway between chemical sources and receptors. An exposure pathway describes the means by which a receptor can be exposed to contaminants in environmental media. These pathways are presented in Figures 2-6 and 2-7, and are based upon current and reasonably likely future land uses at Sites 29 and 35.

Although future residential land use is considered unlikely at any of the sites covered under this ROD, resident adult and child receptors were evaluated in the HHRA as a conservative measure

to determine whether the site would be suitable for unlimited use or unrestricted exposure, as described within this ROD.

2.6 Current and Potential Future Land and Resource Uses

2.6.1 Land Use

The following is a summary of current land use conditions at and around the two sites.

Site	Current Land Use	Surrounding Land Use
Site 29	Industrial/Open Space	Site 29 is located within the "Landfill Complex" of Andersen AFB, adjacent to the active BSL. The nearest residential area is located off Andersen AFB property, approximately 2,400 feet southwest of Site 29.
Site 35	Industrial/Open Space	Site 35 is located within the "Landfill Complex" of Andersen AFB, adjacent to the active BSL. The nearest residential area is located off Andersen AFB property, approximately 900 feet southwest of Site 35.
AFB = Air Force Base BSL = Base Sanitary Landfill		

Land use for the two sites, as well as adjacent and surrounding land, is expected to remain the same for the foreseeable future.

2.6.2 Ground and Surface Water Uses

All sites covered under this ROD are located above the NGL aquifer, which is designated by the USEPA as a sole source aquifer, and supplies Guam with approximately 80% of its drinking water (Barrett, 1982). Groundwater in the Main Base has been monitored regularly as part of the Long-term Groundwater Monitoring (LTGM) Program at Andersen AFB (EA, 2007). The initial round of groundwater sampling was collected for all the Main Base monitoring wells in November 1995 (Round 1) and on a semiannual basis (twice a year) thereafter.

The historical groundwater data set for the Main Base has established that there is no connection between the COCs observed in the surface and subsurface soils at Sites 29 and 35 and any groundwater contamination. Trichloroethene (TCE) and tetrachloroethene (PCE) have been observed in groundwater samples collected from Main Base monitoring wells at concentrations exceeding the Federal Safe Drinking Water Act's Maximum Contaminant Levels (MCLs). However, the groundwater contamination has been attributed to a likely TCE/PCE source(s) in the vicinity of Building 18006.

The LTGM data collected at Andersen AFB strongly support the CSM, which indicates that most of the contaminants observed in surface and subsurface soil samples (i.e., PAHs, pesticides, polychlorinated biphenyls, and TAL metals) are relatively immobile and are rarely observed in

groundwater at concentrations exceeding drinking water standards (MCLs) (EA, 2007). Groundwater and surface water were not identified as media of concern at any of the sites reviewed in this report; therefore, these media were not assessed in the HHRAs.

Groundwater north of the two sites is currently being developed for the Basewide potable drinking water system. The nearest production well is located less than 0.5 miles northwest of both sites.

Site 29

Two monitoring wells, LF1-2 and LF1-3, are located on or in close proximity to Site 29. Monitoring well LF1-2, located west of and across the road from the site, has been sampled on a semiannual basis since April 1996 and no COCs have been detected at concentrations exceeding MCLs. Monitoring well LF1-3, located near the electrical box in the northeast portion of the site, historically has had no COCs detected at concentrations exceeding MCLs (EA, 2007). Therefore, Site 29 should not have a negative impact on the aquifer.

Site 35

Two monitoring wells, LF1-1 and IRP-19, are located on or in close proximity to Site 35. Monitoring well LF1-1 is located within the boundaries of the active BSL, across the Landfill Access Road, and just north of the site. Historically, no COCs have been detected in groundwater from LF1-1 at concentrations exceeding MCLs (EA, 2007).

Monitoring well IRP-19 is located in the southeast corner of the site, just northeast of test trenches TT-023 and TT-024. Bis-2-ethylhexyl phthalate was detected once in one sample collected from IRP-19 (October 1998 at 21 micrograms per liter [µg/L]) at a concentration exceeding the Andersen AFB reporting limit of 10 µg/L (EA, 2007). An audit of laboratory procedures in 2000 corrected an organic extraction procedure, and bis-2-ethylhexyl phthalate has not been detected since. Therefore, Site 35 should not have a negative impact on the aquifer.

2.7 Summary of Site Risks

This section includes the basis for no action at Site 29 and the basis for remedial action at Site 35. Summaries of the HHRAs and SLERAs described in the RI, as well as the comparison of site-specific PRGs to EPCs for Site 29, are also presented. The CSMs developed for the HHRA and SLERA of these sites are presented in Figures 2-6 and 2-7, respectively.

During completion of the HHRA, risks for cancer COPCs and non-cancer COPCs were calculated separately and the risks for each were then summed to determine cumulative risks. For cumulative cancer risks, the USEPA has established an acceptable risk level of 10^{-6}, which represents a one-in-a-million increase in the lifetime cancer risk for the evaluated receptor (e.g., a resident or a site worker) if exposed to the site COPCs. The USEPA has determined increased cancer risk in excess of 10^{-4} (one-in-ten-thousand) is unacceptable. The risk range of 10^{-6} to 10^{-4} may be evaluated in the risk management context to determine whether risk is acceptable for

future site conditions (such as land use and potential users). For cumulative non-cancer risks, the USEPA has established a Hazard Index (HI) of less than 1.0 as acceptable.

For all COPCs, toxicity values for carcinogens and non-carcinogens are presented in Tables 2-3 through 2-7. When available, values were taken from the Integrated Risk Information Systems (IRIS) database (USEPA, 2006). IRIS chronic reference doses, reference concentrations, and Cancer slope factors are developed by USEPA and undergo an extensive process of scientific peer review. Therefore, IRIS values are judged as adequately verified.

If toxic potency concentrations for COPCs were not available from IRIS (USEPA, 2006), Health Effects Assessment Summary Tables (HEAST) (USEPA, 1999) were used as a secondary data source. As HEAST toxicity values are not scientifically peer-reviewed for quality or scientific acceptability, they may not be derived in strict accordance with USEPA-approved methodologies.

A more detailed description of the HHRA process is presented in the RI document (EA, 2008).

Uncertainties Assessment

Numerous uncertainties are involved in the HHRA process. These are discussed briefly below.

Sampling and Analysis Uncertainties

The sampling plan can have a significant impact on the results obtained in calculating human health risks at a site. To the extent that samples are collected in areas that are expected to be contaminated (biased sampling), the exposure point concentration (EPC) used in calculating risk exposures and risks is likely to overestimate the actual concentration encountered at the site from random exposure across the site. This sampling bias will generally result in an overestimate of exposures and risks at a site. The soil sampling at Andersen AFB incorporated a combination of random and biased samples. As the majority of soil samples collected at Andersen AFB are biased toward potentially contaminated areas, the detected concentrations and calculated health risks would tend to be overestimated.

Chemical Fate and Transport Modeling Uncertainties

The models used to estimate chemical concentrations associated with particulates in air at Andersen AFB are consistent with those recommended by USEPA (1996). However, due to uncertainties in modeling methodologies, USEPA-recommended models are likely to overestimate actual concentrations at the site. Thus, use of models is likely to result in overestimates of health risks at Andersen AFB.

Uncertainties of Toxicity Assessment

Numerous uncertainties are associated with the toxicity assessment. These are generally due to the unavailability of data to thoroughly calculate the toxicity of COPCs.

Uncertainties Analysis of Exposure Assessment

Soil Ingestion Rate

Soil ingestion rates for children are based on studies performed by Binder et al. (1986) and Clausing et al. (1987). Methods used in both studies involve the measurement of non-metabolized tracer elements in the feces of children and in the soil with which the child is in contact with. Both were short-term studies, and as they were not based on average long-term exposures, they represent an overestimate of exposure. More recent published data have shown that average soil ingestion rates for two-year-olds is less than 100 mg/day (Calabrese et al., 1989; Davis et al., 1990). Furthermore, USEPA soil ingestion rates for children ages 1 to 6 are based on ingestion rates for children at age 18 months and are applied through age 6 years (USEPA, 1989). This is very unlikely because children over 2 years old do not ingest at the same rate as an 18-month-old. Additionally, a conservative estimate was used for the fraction ingested (value of 1.0), which assumes that all soil ingested (for residential exposures) is ingested at the residence. This assumes that no activities take place elsewhere. Taken together, these suggest that intakes for this pathway are overestimated.

Exposure Duration

USEPA assumes residential exposure duration for adults is 30 years, which represents the USEPA-derived 90th percentile upper limit for time spent at one residence. The average (50th percentile) time spent at one residence is seven years. These values are recommended in the *Risk Assessment Guidance for Superfund* (USEPA, 1989). Soil ingestion for children age 1 to 6 is assumed to continue for the entire 6-year time frame.

Uncertainties in Risk Characterization

Uncertainties in the risk characterization can stem from the inherent uncertainties in the data evaluation, the exposure assessment process, including any modeling of EPCs in secondary media from primary media, and the toxicity assessment process. The individual uncertainties in these respective processes were addressed in the previous sections.

2.7.1 Site 29

This section summarizes the approach and findings of the HHRA and SLERA performed for Site 29, as described in the RI document (EA, 2008). The results of the comparison of site-specific PRGs to EPCs are also presented.

2.7.1.1 Summary of Human Health Risk Assessment for Site 29

An HHRA was performed for Site 29 as an element of the RI (EA, 2008). The HHRA identified surface and subsurface soil as the media of concern, and risks were estimated for the following receptors:

- Industrial worker exposures to surface soil
- Construction worker exposures to subsurface soil
- Residential (adult and child) exposures to surface and subsurface soil

The risk-based screening results for the receptors and media of concern at Site 29 are summarized as follows:

- Aluminum, cadmium, chromium, lead, manganese, nickel, and thallium were identified as COPCs for residential exposures to surface soil.

- Aluminum, chromium, lead, and manganese were identified as COPCs for industrial worker exposures to surface soil.

- Benzo(a)pyrene, aluminum, cadmium, chromium, manganese, nickel, thallium, and vanadium were identified as COPCs for residential exposures to subsurface soil.

- Aluminum, chromium, manganese, and vanadium were identified as COPCs for construction worker exposures to subsurface soil.

The maximum detected concentrations of potential contaminants are compared to their respective BTVs as part of the COPC screening and selection process. Antimony, arsenic, and vanadium were eliminated as COPCs in surface soil because their maximum detected concentrations (4.5 mg/kg, 43 mg/kg, and 206 mg/kg, respectively) were equal to or below their respective BTVs (63 mg/kg, 62 mg/kg, and 206 mg/kg). Arsenic was also eliminated as a COPC in subsurface soil because its maximum detected concentration (44 mg/kg) was below the BTV (62 mg/kg).

Medium-specific EPCs for aluminum, cadmium, chromium, lead, manganese, nickel, and thallium in surface soil, and benzo(a)pyrene, aluminum, cadmium, chromium, manganese, nickel, thallium, and vanadium in subsurface soil were calculated. The cumulative risks for the receptors and media of concern were assessed as follows (Tables 2-8 through 2-10):

- Surface Soil Cancer Risks - Excess cancer risk estimates for resident adult and child receptors (2.7×10^{-6} and 1.3×10^{-6}, respectively) were within the risk range of 10^{-6} to 10^{-4}. Based on the types and concentrations of contaminants present, as well as the current and expected future land use at the site, a risk management decision was made that determined these risks to be acceptable. Therefore, no unacceptable cancer risks were identified for residents exposed to surface soil. No unacceptable cancer risks were identified for industrial workers exposed to surface soil at the site.

- Surface Soil Non-Cancer Risks - The HI for resident children (9.1) exceeded USEPA's acceptable risk target (HI=1.0). As discussed below, the risk is driven by high background levels for metals. The HI for resident adults (1.1) marginally exceeded the USEPA's acceptable risk target (HI=1.0). However, HIs did not exceed 1.0 for individual target organs or for any individual COPC; therefore, risks for resident adults were determined to be acceptable. The HI for industrial workers did not exceed the

USEPA's acceptable risk target of 1.0. Aluminum, chromium, and manganese were identified as COCs for resident children exposed to surface soil at the site and site-specific PRGs were developed.

- Subsurface Soil Cancer Risks - Excess cancer risk estimates for resident adult, resident child, and adult construction worker receptors (3.7×10^{-6}, 3.3×10^{-6}, and 2.8×10^{-6}, respectively) were within the risk range of 10^{-6} to 10^{-4}. Based on the types and concentrations of contaminants present, as well as the current and expected future land use at the site, a risk management decision was made that determined these risks to be acceptable. Therefore, no unacceptable cancer risks were identified for residents or construction workers exposed to subsurface soil at the site.

- Subsurface Soil Non-Cancer Risks - The HI for resident children (12) exceeded USEPA's acceptable risk target (HI=1.0). As discussed below, the risk is driven by high background levels for metals. The HI for resident adults (1.4) exceeded the USEPA's acceptable risk target (HI=1.0). However, HIs did not exceed 1.0 for individual target organs or for any individual COPC; therefore, risks for resident adults were determined to be acceptable. The HI for construction workers (HI=1.9) exceeded the USEPA's acceptable risk target (HI=1.0). HIs did not exceed 1.0 for any individual COPC. The HI for the central nervous system target organ (1.1) was the only target organ HI to slightly exceed 1.0 and was attributed entirely to aluminum and manganese. The EPCs for aluminum and manganese (165,000 and 4,540 mg/kg, respectively) were below BTVs (173,000 and 5,500 mg/kg, respectively). Therefore, risks for construction workers were determined to be acceptable. Aluminum, chromium, manganese, and vanadium were identified as COCs for resident children exposed to subsurface soil at the site and site-specific PRGs were developed.

Comparison of Site-Specific PRGs and Background to EPCs

During preparation of this ROD, each COCs site-specific PRG was compared to the respective EPC (Table 2-11). In instances where the EPC was lower than the site-specific PRG, the risk associated with the COC was compared to the risk associated with background concentrations. An EPC and calculated site risk that are less than the BTV and risk associated with background indicate that COC concentrations are consistent with background levels at Andersen AFB and are not indicative of contamination.

Surface Soil

For all COCs identified in surface soil at Site 29, the EPCs were well below the site-specific PRGs. This indicates that concentrations are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, elevated metal concentrations do not pose an unacceptable risk to human health or the environment, and no remediation is required for surface soil at Site 29. A discussion of the comparison of site-specific PRGs to EPCs and risks associated with the COCs is presented below.

Aluminum – The calculated future resident child HI for aluminum (2.0) exceeded the risk threshold of 1.0. Aluminum was also identified as contributing (along with manganese) to the central nervous system target organ HI of 4.7. Therefore, aluminum was identified in the HHRA as a COC that posed potential unacceptable risk to the future resident child.

The site-specific PRGs developed for aluminum in the HHRA were calculated to reduce both single-contaminant and cumulative target organ risks to acceptable levels (75,000 mg/kg and 7,500 mg/kg, respectively). However, the BTV (173,500 mg/kg) for aluminum at Andersen AFB greatly exceeds the calculated resident site-specific PRG values, excluding them from practical implementation. Therefore, the BTV was identified as the site-specific PRG. The hazard quotient associated with background concentrations of aluminum is 2.3.

Out of 21 samples, only three sample concentrations (184,000 mg/kg, 177,000 mg/kg, and 174,000 mg/kg) exceeded the BTV, resulting in an EPC (150,000 mg/kg) for aluminum that was below the BTV. The distribution of sample concentrations across the site does not represent a distinct hot spot. Further, the calculated HI for aluminum (2.0) is less than the HQ associated with background concentrations (2.3). These factors indicate that concentrations of aluminum detected at the site are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, no remediation is required for aluminum concentrations in surface soil at Site 29.

Chromium – The calculated future resident child HI for chromium (4.1) exceeded the risk threshold of 1.0. Therefore, chromium was identified in the HHRA as a COC that posed potential unacceptable risk to the future resident child.

The site-specific PRG developed for chromium in the HHRA was calculated to reduce single-contaminant risks to acceptable levels (224 mg/kg); chromium does not have an identified target organ and therefore no cumulative target organ risks. However, the BTV (1,080 mg/kg) for chromium at Andersen AFB greatly exceeds the calculated resident site-specific PRG value, excluding it from practical implementation. Therefore, the BTV was identified as the site-specific PRG. The hazard quotient associated with background concentrations of chromium is 5.1.

Out of 21 samples, only two sample concentrations (1,130 mg/kg and 1,090 mg/kg) exceeded the BTV, resulting in an EPC (917 mg/kg) for chromium that was below the BTV. The distribution of sample concentrations across the site does not represent a distinct hot spot. Further, the calculated HI for chromium (4.1) is less than the HQ associated with background concentrations (5.1). These factors indicate that concentrations of chromium detected at the site are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, no remediation is required for chromium concentrations in surface soil at Site 29.

Manganese – The calculated future resident child HI for manganese (2.7) exceeded the risk threshold of 1.0. Manganese was also identified as contributing (along with aluminum) to the central nervous system target organ HI of 4.7. Therefore, manganese was identified in the HHRA as a COC that posed potential unacceptable risk to the future resident child.

The site-specific PRGs developed for manganese in the HHRA were calculated to reduce both single-contaminant and cumulative target organ risks to acceptable levels (1,757 mg/kg and 175.7 mg/kg, respectively). However, the BTV (5,500 mg/kg) for manganese at Andersen AFB greatly exceeds the calculated resident site-specific PRG values, excluding them from practical implementation. Therefore, the BTV was identified as the site-specific PRG. The hazard quotient associated with background concentrations of manganese is 3.0.

Out of 21 samples, only three sample concentrations (8,530 mg/kg, 7,550 mg/kg, and 5,510 mg/kg) exceeded the BTV, resulting in an EPC (4,920 mg/kg) for manganese that was below the BTV. The distribution of sample concentrations across the site does not represent a distinct hot spot. Further, the calculated HI for manganese (2.7) is less than the HQ associated with background concentrations (3.0). These factors indicate that concentrations of manganese detected at the site are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, no remediation is required for manganese concentrations in surface soil at Site 29.

Subsurface Soil

For all COCs identified in subsurface soil at Site 29, the EPCs were well below the site-specific PRGs. This indicates that concentrations are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, elevated metal concentrations do not pose an unacceptable risk to human health or the environment, and no remediation is required for subsurface soil at Site 29. A discussion of the comparison of site-specific PRGs to EPCs and risks associated with the COCs is presented below.

Aluminum – The calculated future resident child HI for aluminum (2.2) exceeded the risk threshold of 1.0. Aluminum was also identified as contributing (along with manganese) to the central nervous system target organ HI of 4.7. Therefore, aluminum was identified in the HHRA as a COC that posed potential unacceptable risk to the future resident child.

The site-specific PRGs developed for aluminum in the HHRA were calculated to reduce both single-contaminant and cumulative target organ risks to acceptable levels (75,000 mg/kg and 7,500 mg/kg, respectively). However, the BTV (173,500 mg/kg) for aluminum at Andersen AFB greatly exceeds the calculated resident site-specific PRG values, excluding them from practical implementation. Therefore, the BTV was identified as the site-specific PRG. The hazard quotient associated with background concentrations of aluminum is 2.3.

Out of nine samples, only two sample concentrations (204,000 mg/kg and 176,000 mg/kg) exceeded the BTV, resulting in an EPC (165,000 mg/kg) for aluminum that was below the BTV. The distribution of sample concentrations across the site does not represent a distinct hot spot. Further, the calculated HI for aluminum (2.2) is less than the HQ associated with background concentrations (2.3). These factors indicate that concentrations of aluminum detected at the site are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, no remediation is required for aluminum concentrations in subsurface soil at Site 29.

Chromium – The calculated future resident child HI for chromium (4.1) exceeded the risk threshold of 1.0. Therefore, chromium was identified in the HHRA as a COC that posed potential unacceptable risk to the future resident child.

The site-specific PRG developed for chromium in the HHRA was calculated to reduce single-contaminant risks to acceptable levels (227 mg/kg); chromium does not have an identified target organ and therefore no cumulative target organ risks. However, the BTV (1,080 mg/kg) for chromium at Andersen AFB greatly exceeds the calculated resident site-specific PRG value, excluding it from practical implementation. Therefore, the BTV was identified as the site-specific PRG. The hazard quotient associated with background concentrations of chromium is 5.1.

Out of nine samples, only one sample concentration (1,210 mg/kg) exceeded the BTV, resulting in an EPC (930 mg/kg) for chromium that was below the BTV. The distribution of sample concentrations across the site does not represent a distinct hot spot. Further, the calculated HI for chromium (4.1) is less than the HQ associated with background concentrations (5.1). These factors indicate that concentrations of chromium detected at the site are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, no remediation is required for chromium concentrations in subsurface soil at Site 29.

Manganese – The calculated future resident child HI for manganese (2.5) exceeded the risk threshold of 1.0. Manganese was also identified as contributing (along with aluminum) to the central nervous system target organ HI of 4.7. Therefore, manganese was identified in the HHRA as a COC that posed potential unacceptable risk to the future resident child.

The site-specific PRGs developed for manganese in the HHRA were calculated to reduce both single-contaminant and cumulative target organ risks to acceptable levels (1,816 mg/kg and 181.6 mg/kg, respectively). However, the BTV (5,500 mg/kg) for manganese at Andersen AFB greatly exceeds the calculated resident site-specific PRG values, excluding them from practical implementation. Therefore, the BTV was identified as the site-specific PRG. The hazard quotient associated with background concentrations of manganese is 3.0.

Out of nine samples, only one sample concentration (5,830 mg/kg) exceeded the BTV, resulting in an EPC (4,540 mg/kg) for manganese that was below the BTV. The distribution of sample concentrations across the site does not represent a distinct hot spot. Further, the calculated HI for manganese (2.5) is less than the HQ associated with background concentrations (3.0). These factors indicate that concentrations of manganese detected at the site are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, no remediation is required for manganese concentrations in subsurface soil at Site 29.

Vanadium – The calculated future resident child HI for vanadium (2.3) exceeded the risk threshold of 1.0. Vanadium was also identified as contributing to the kidney target organ HI of 2.3. Therefore, vanadium was identified in the HHRA as a COC that posed potential unacceptable risk to the future resident child.

The site-specific PRGs developed for vanadium in the HHRA were calculated to reduce both single-contaminant and cumulative target organ risks to acceptable levels (77 mg/kg and 7.7 mg/kg, respectively). However, the BTV (206 mg/kg) for vanadium at Andersen AFB greatly exceeds the calculated resident site-specific PRG values, excluding them from practical implementation. Therefore, the BTV was identified as the site-specific PRG. The hazard quotient associated with background concentrations of vanadium is 2.6.

Out of nine samples, only one sample concentration (224 mg/kg) exceeded the BTV, resulting in an EPC (178 mg/kg) for vanadium that was below the BTV. The distribution of sample concentrations across the site does not represent a distinct hot spot. Further, the calculated HI for vanadium (2.3) is less than the HQ associated with background concentrations (2.6). These factors indicate that concentrations of vanadium detected at the site are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, no remediation is required for vanadium concentrations in subsurface soil at Site 29.

2.7.1.2 Summary of Screening-Level Ecological Risk Assessment for Site 29

An extensive qualitative habitat and biota survey was conducted at Site 29 as part of the RI (EA, 2008). Based on results of the survey, the ecological receptors of concern (ROCs) were identified as terrestrial plants, terrestrial invertebrates (earthworms), and terrestrial avian species.

Based on the results of the SLERA, no unacceptable risks were identified for terrestrial plants, terrestrial invertebrates, or terrestrial avian species as a result of exposure to the COPCs present at Site 29. No ecological COCs were identified for Site 29.

2.7.1.3 Basis for No Action at Site 29

No unacceptable risks to public health or welfare or the environment were identified at Site 29; therefore, no action is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

2.7.2 Site 35

This section summarizes the approach and findings of the HHRA and SLERA performed for Site 35, as described in the RI document (EA, 2008).

2.7.2.1 Summary of Human Health Risk Assessment for Site 35

An HHRA was performed for Site 35 as an element of the RI (EA, 2008). The HHRA identified surface and subsurface soil as the media of concern at Site 35, and risks were estimated for the following receptors:

- Industrial worker exposures to surface soil
- Construction worker exposures to subsurface soil
- Residential (adult and child) exposures to surface and subsurface soil

The risk-based screening results for the receptors and media of concern at Site 35 are summarized as follows:

- Benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, cadmium, chromium, thallium, and vanadium were identified as COPCs for residential exposures to surface soil.

- Benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, chromium, and vanadium were identified as COPCs for industrial worker exposures to surface soil.

- Benzo(a)pyrene, aluminum, chromium, thallium, and vanadium were identified as COPCs for residential exposures to subsurface soil.

- Aluminum, chromium, and vanadium were identified as COPCs for construction worker exposures to subsurface soil.

The maximum detected concentrations of potential contaminants are compared to their respective BTVs as part of the COPC screening and selection process. Antimony, arsenic, and manganese were eliminated as COPCs in surface soil because their maximum detected concentrations (5.0 mg/kg, 45 mg/kg, and 4,520 mg/kg, respectively) were below their respective BTVs (63 mg/kg, 62 mg/kg, and 5,500 mg/kg).

Arsenic, cadmium, and manganese were eliminated as COPCs in subsurface soil because their maximum detected concentrations (46 mg/kg, 5.4 mg/kg, and 3,180 mg/kg, respectively) were below their respective BTVs (62 mg/kg, 6.5 mg/kg, and 5,500 mg/kg).

Medium-specific EPCs for benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, cadmium, chromium, thallium, and vanadium in surface soil, and benzo(a)pyrene, aluminum, chromium, thallium, and vanadium in subsurface soil were calculated. The cumulative risks for the receptors and media of concern were assessed as follows (Tables 2-12 through 2-14):

- Surface Soil Cancer Risks - Excess cancer risk estimates for resident adults and children (5.1×10^{-6} and 7.9×10^{-6}, respectively) were within the risk range of 10^{-6} to 10^{-4}. Based on the types and concentrations of contaminants present, as well as the current and expected future land use at the site, a risk management decision was made that determined these risks to be acceptable. Therefore, no unacceptable cancer risks were identified for residents exposed to surface soil. No unacceptable cancer risks were identified for industrial workers at the site.

- Surface Soil Non-Cancer Risks - The HI for resident children (4.4) exceeded USEPA's acceptable risk target (HI=1.0). As discussed below, the risk is driven by high background levels for metals. The HIs for resident adults and industrial workers did not exceed the USEPA's acceptable risk target of 1.0. Chromium and vanadium were identified as COCs for resident children exposed to surface soil at the site.

- Subsurface Soil Cancer Risks - Excess cancer risk estimates for resident adult, resident child, and adult construction worker receptors (4.6×10^{-6}, 3.0×10^{-6}, and 4.1×10^{-6}, respectively) were within the risk range of 10^{-6} to 10^{-4}. Based on the types and concentrations of contaminants present, as well as the current and expected future land use at the site, a risk management decision was made that determined these risks to be acceptable. Therefore, no unacceptable cancer risks were identified for construction workers or residents exposed to subsurface soil at the site.

- Subsurface Soil Non-Cancer Risks - The HI for resident children (12) exceeded USEPA's acceptable risk target (HI=1.0). The HI for resident adults (1.4) exceeded the USEPA's acceptable risk target (HI=1.0). However, HIs did not exceed 1.0 for individual target organs or for any individual COPC; therefore, risks for resident adults were determined to be acceptable. The HI for construction workers (2.0) exceeded the USEPA's acceptable risk target (HI=1.0). However, HIs did not exceed 1.0 for individual target organs or for any individual COPC; therefore, risks for construction workers were determined to be acceptable. Aluminum, chromium, and vanadium were identified as COCs for resident children exposed to subsurface soil at the site.

In summary, the HIs for aluminum, chromium, and vanadium exceeded the USEPA's risk target of 1.0 for resident children exposed to subsurface soil at Site 35, and were identified as COCs requiring remedial action.

Comparison of Site-Specific PRGs and Background to EPCs

During preparation of this ROD, each COCs site-specific PRG was compared to the respective EPC (Table 2-15). In instances where the EPC was lower than the site-specific PRG, the risk associated with the COC was compared to the risk associated with background concentrations. An EPC and calculated site risk that are less than the BTV and risk associated with background indicate that COC concentrations are consistent with background levels at Andersen AFB and are not indicative of contamination.

Surface Soil

For all COCs identified in surface soil at Site 35, the EPCs were well below the site-specific PRGs. This indicates that concentrations are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, elevated metal concentrations do not pose an unacceptable risk to human health or the environment, and no remediation is required for surface soil at Site 35. A discussion of the comparison of site-specific PRGs to EPCs and risks associated with the COCs is presented below.

Chromium – The calculated future resident child HI for chromium (2.6) exceeded the risk threshold of 1.0. Therefore, chromium was identified in the HHRA as a COC that posed potential unacceptable risk to the future resident child.

The site-specific PRG developed for chromium in the HHRA was calculated to reduce single-contaminant risks to acceptable levels (222 mg/kg); chromium does not have an identified target organ and therefore no cumulative target organ risks. However, the BTV (1,080 mg/kg) for

chromium at Andersen AFB greatly exceeds the calculated resident site-specific PRG value, excluding it from practical implementation. Therefore, the BTV was identified as the RG. The hazard quotient associated with background concentrations of chromium is 5.1.

Out of 27 samples, only one sample concentration (1,120 mg/kg) exceeded the BTV, resulting in an EPC (578 mg/kg) for chromium that was below the BTV. The distribution of sample concentrations across the site does not represent a distinct hot spot. Further, the calculated HI for chromium (2.6) is less than the HQ associated with background concentrations (5.1). These factors indicate that concentrations of chromium detected at the site are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, no remediation is required for chromium concentrations in surface soil at Site 35.

Vanadium – The calculated future resident child HI for vanadium (1.6) exceeded the risk threshold of 1.0. Vanadium was also identified as contributing to the kidney target organ HI of 1.6. Therefore, vanadium was identified in the HHRA as a COC that posed potential unacceptable risk to the future resident child.

The site-specific PRGs developed for vanadium in the HHRA were calculated to reduce both single-contaminant and cumulative target organ risks to acceptable levels (77 mg/kg and 7.7 mg/kg, respectively). However, the BTV (206 mg/kg) for vanadium at Andersen AFB greatly exceeds the calculated resident site-specific PRG values, excluding them from practical implementation. Therefore, the BTV was identified as the RG. The hazard quotient associated with background concentrations of vanadium is 2.6.

Out of 27 samples, only two sample concentrations (232 mg/kg and 218 mg/kg) exceeded the BTV, resulting in an EPC (123 mg/kg) for vanadium that was below the BTV. The distribution of sample concentrations across the site does not represent a distinct hot spot. Further, the calculated HI for vanadium (1.6) is less than the HQ associated with background concentrations (2.6). These factors indicate that concentrations of vanadium detected at the site are consistent with background levels at Andersen AFB and are not indicative of contamination. Therefore, no remediation is required for vanadium concentrations in surface soil at Site 35.

Subsurface Soil

For all COCs identified in subsurface soil at Site 35, the calculated EPCs were slightly above the BTVs. As degradation of drums is unlikely to be the source, it is possible that the COCs represent background conditions. The BTV for each inorganic was set at the concentration corresponding to the 95th percentile of data collected during the Andersen AFB background study (ICF, 1996b). The data from Site 35 appear to be within the range of the overall background data set, but are above the agreed upon upper threshold values. Since further background analysis was not conducted, subsurface soil will be addressed under a remedy.

2.7.2.2 Summary of Ecological Risk Assessment for Site 35

An extensive qualitative habitat and biota survey was conducted at Site 35 as part of the RI (EA, 2008). Based on results of the survey, the ROCs were identified as terrestrial plants, terrestrial

invertebrates (earthworms), and terrestrial avian species (Mariana crow and yellow bittern). Surface soil was identified as the only media of concern.

Based on the results of the SLERA, no unacceptable risks were identified for terrestrial plants, soil invertebrates, or terrestrial avian species as a result of exposure to the COPCs present at Site 35. No ecological COCs were identified for Site 35.

2.7.2.3 Basis for Action at Site 35

The response action selected in this ROD is necessary to protect public health or welfare or the environment from actual or threatened releases of pollutants or contaminants from subsurface soil at Site 35, which may present an imminent and substantial endangerment to public health or welfare.

A response action at Site 35 is warranted to mitigate unacceptable non-cancer risks present in subsurface soil at the site.

2.8 Remedial Action Objective for Site 35

RAOs provide a general description of what the cleanup will accomplish. These goals typically serve as the design basis for the remedial alternative. The following is the RAO for Site 35:

- Prevent future residential exposures to aluminum, chromium, and vanadium in subsurface soil at concentrations greater than the RGs (173,500 mg/kg, 1,080 mg/kg, and 206 mg/kg, respectively).

The RAO was developed based on the current and reasonably anticipated future land use as an industrial area/open space, as well as to address the unlikely future residential use. The above RAO addresses the identified unacceptable human health risks at Site 35 by prohibiting residential development on or adjacent to the site.

2.9 Description of Alternatives for Site 35

This section presents the remedial alternatives considered for Site 35 that were evaluated in the FS report (EA, 2008). The alternatives are summarized in the following table.

Alternative Designation	Alternative	Description
1	No Action	No remedial actions or institutional controls
2	Institutional Controls	LUCs and a LUCMP
3	Soil Removal	Excavation and offsite disposal of COC-impacted soil

COC = contaminant of concern
LUC = Land Use Controls
LUCMP = Land Use Control Management Plan

Each alternative evaluated is described in more detail, including remedy components, common elements and distinguishing features, and expected outcomes, in the following sections.

2.9.1 Description of Remedy Components

A total of three alternatives were developed to address remediation at Site 35. This section provides a summary overview of the components of these alternatives.

- Alternative 1: *No Action*
  - No treatment technologies
  - No containment or mitigation of contaminants at the site
  - No institutional controls
  - No operations, maintenance, or monitoring requirements
- Alternative 2: *Institutional Controls*
  - LUCs – The USN would enact LUCs through amendments to the Base General Plan to ensure the continued protection of human health and the environment. The full scope of the LUCs would be presented in a LUCMP to be developed by the USN in coordination with the USEPA and Guam EPA subsequent to approval of the ROD. The LUCMP would include (1) a prohibition on the redevelopment of the site (particularly for residential use) without prior approvals from the USN, the USEPA, and the Guam EPA; (2) limitations and controls on any future excavation activities at the site (e.g., worker requirements, soil management, waste disposal); and (3) a requirement that any intrusive activities be first approved by the 36 Civil Engineer Squadron/Civil Engineer Environmental Flight. The LUCMP would also include additional provisions such as (1) requirements for periodic (e.g., annual) inspections of the site to ensure compliance with the LUCs; (2) specification of periodic (e.g., annual) LUC-compliance reporting requirements; (3) protocols for property lease or transfer (note: currently, there are no plans for property lease or transfer); (4) protocols for posting and maintaining signage; and (5) protocols for notification and correction of any LUC non-compliance events. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.
  - Five-year reviews – Following successful implementation of the above actions, the site would be suitable for continued use by the USAF for industrial use/open space, but would not be suitable for unlimited use and unrestricted exposure (e.g., residential). Therefore, the USN, in conjunction with the USEPA and Guam EPA, would conduct five-year reviews to ensure that the *Institutional Controls* alternative is effective in the future in protecting human health and the environment. The reviews would focus on the site conditions, the current and planned future site use, the results of nearby monitoring programs (e.g., the Basewide LTGM Program), and the LUC-compliance reports. The five-year reviews would be conducted until the

concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

  - The *Institutional Controls* alternative would not result in any containment or mitigation of contaminants at the site.

- Alternative 3: *Soil Removal*

  - The *Soil Removal* alternative would include excavation and offsite disposal of approximately 780 lcy of COC-impacted subsurface soil from Site 35 (Figure 2-8).

  - Removal of all soil containing COCs above RGs would effectively mitigate all unacceptable risks to human receptors identified in the HHRA.

  - The *Soil Removal* alternative would render the site suitable for unlimited use and unrestricted exposure, allowing site closure under CERCLA.

  - No institutional controls would be needed and no five-year reviews would be necessary under the *Soil Removal* alternative.

2.9.2 Common Elements and Distinguishing Features of Each Alternative

Table 2-16 provides a summary of elements common to each alternative and features that distinguish one alternative from another.

2.9.3 Expected Outcome of Each Alternative

Table 2-17 provides a summary of the expected outcomes of each alternative.

2.10 Summary of Comparative Analysis of Alternatives for Site 35

In accordance with the NCP, the alternatives for Site 35 were evaluated using the nine criteria described in Section 121(b) of CERCLA and the NCP §300.430(f)(5)(i). These criteria are classified as threshold criteria, balancing criteria, and modifying criteria.

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

- Overall protection of human health and the environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

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

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

Modifying criteria are as follows:

- Community acceptance
- State/support agency acceptance

This section summarizes how well each alternative satisfies each evaluation criterion and indicates how it compares to the other alternatives under consideration.

2.10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

The *No Action* alternative would be protective of human health and the environment only under current site use conditions, as there are no risks associated with either ecological receptors or the industrial worker/construction worker scenario. The *No Action* alternative would not remove or reduce the volume of soil exceeding RGs.

The *Institutional Controls* alternative would be protective of human health and the environment as it would eliminate exposure to residential receptors by preventing residential development on or adjacent to the sites. Although soil containing COCs above RGs would remain, there are no unacceptable risks to industrial workers/construction workers at Site 35 and no unacceptable risks to ecological receptors were identified. The *Institutional Controls* alternative would not remove or reduce the volume of soil exceeding RGs.

The *Soil Removal* alternative would be protective of human health and the environment. The *Soil Removal* alternative would remove COC-impacted soil from the sites, thus eliminating the exposure medium.

The *Institutional Controls* and *Soil Removal* alternatives would be protective of human health and the environment by preventing residential development of the land and removing COC-impacted soil, respectively. The *No Action* alternative would not be protective of human health for residential receptors.

2.10.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State

requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

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

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility citing laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site (relevant) that their use is well-suited (appropriate) to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

There are not chemical-specific or action-specific ARARs for these remedial alternatives. The *Institutional Controls* and *Soil Removal* alternatives would be compliant with location-specific ARARs.

2.10.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that would remain on site following remediation and the adequacy and reliability of controls.

The *No Action* alternative would not be effective in the long-term because the identified unacceptable risks associated with COCs in soil under a residential scenario would persist at the site.

The *Institutional Controls* alternative would be effective in the long term for mitigating the identified risks for residential receptors. The LUCs would prohibit residential redevelopment of the site (i.e., eliminating the residential exposure pathway) and the LUCMP would contain provisions to ensure the proper implementation of LUCs in the event of property conditions or use changes. Although COC concentrations on site would remain above RGs, the annual inspections and reporting requirements and the five-year review process would ensure the long-term compliance with LUCs.

The *Soil Removal* alternative would be effective and permanent in the long term because COC-impacted soil (above RGs) would be removed from the site. Upon completion of the removal action, no restrictions on site exposure or future land use would be required.

2.10.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

The *No Action* alternative would not reduce the toxicity, mobility, or volume of waste through treatment.

The *Institutional Controls* alternative would not reduce the toxicity, mobility, or volume of waste through treatment.

The *Soil Removal* alternative would not reduce the toxicity, mobility, or volume of waste through treatment.

2.10.5 Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

The *No Action* alternative would not be effective in the short-term because the RAO would not be achieved; however, there are no risks associated with the potential receptors at Site 35. No new risks or environmental impacts would result from implementation of this alternative.

The *Institutional Controls* alternative would be effective in the short-term as LUCs would be quickly implemented (e.g., within 1 year) to achieve the RAO and no new risks to the community, site workers, or the environment would result.

The *Soil Removal* alternative would be effective in the short term as the excavations could be quickly implemented (e.g., within 1 year) to achieve the RAO. Potential risks to remediation/site workers during the disturbance of site soil would be mitigated through engineering controls (e.g., dust suppression, proper personal protective equipment). No new risks to the local community or environment would be anticipated.

2.10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

The *No Action* alternative would require no action, and therefore would require no implementation.

The *Institutional Controls* alternative is a proven and accepted remedial alternative under the appropriate site conditions. The administrative feasibility of implementing the alternative would be relatively simple, as there would be very little coordination of resources and materials. Annual inspections and periodic site reviews, to be conducted in conjunction with the five-year review process, would be implementable with the existing Andersen AFB personnel to ensure that *Institutional Controls* are protective of human health and the environment.

The *Soil Removal* alternative would be implementable as it would utilize standard excavation and disposal equipment and procedures. The required equipment and services would be readily available. However, because of the strong possibility that the metals are naturally occurring, the extent of the excavation may be much larger than the current estimate.

2.10.7 Cost

The estimated present worth costs for the *Institutional Controls* and *Soil Removal* alternatives and cost summaries are presented below. There would be no costs associated with the *No Action* alternative.

Alternative	Present Worth Cost	Short-Term and Long-Term Costs Considered
Institutional Controls	$94,200	This alternative includes $24,891 for total short-term costs and $94,200 in total costs including long-term and O&M costs.
Soil Removal	$290,900	This alternative includes no long-term costs. For a removal action with no ongoing monitoring, the present worth is equivalent to the estimated remedial action cost.
O&M = Operation and Maintenance		

2.10.8 State/Support Agency Acceptance

The Government of Guam has expressed its support for Alternative 3 – *Soil Removal* and Alternative 2 – *Institutional Controls* for Sites 29 and 35. The Government of Guam does not support Alternative 1 – *No Action* because the identified unacceptable risks to human health would not be mitigated.

2.10.9 Community Acceptance

During the public comment period, the community expressed its support for Alternative 3 – *Soil Removal* and Alternative 2 – *Institutional Controls* for Sites 29 and 35. The community did not support Alternative 1 – *No Action* because the identified unacceptable risks to human health would not be mitigated.

2.11 Principal Threat Wastes at Site 35

The NCP expects that treatment that reduces the toxicity, mobility, or volume of the principal threat wastes will be used to the extent practicable. The principal threat concept refers to the

source materials at a CERCLA site considered to be highly toxic or highly mobile that generally cannot be reliably controlled in place or present a significant risk to human health or the environment should exposure occur. A source material is material that contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater or air, or that acts as a source for direct exposure.

The COC-impacted subsurface soils at Site 35 do not constitute principal threat wastes based on the following:

- COCs are metals that are relatively immobile in the highly alkaline limestone environment at each of the sites.
- COCs are present at the sites in relatively low concentrations and are not of a highly toxic nature.

2.12 Selected Remedy for Site 35

The primary indicator of remedial action performance will be satisfying the RAO for Site 35 and protecting human health and the environment. Performance measures are defined herein as the RAO (see Section 2.8 – Remedial Action Objectives) plus the required actions to achieve the objectives, as defined in this section. It is anticipated that successful implementation, operation, maintenance, and completion of the performance measures will achieve a protective and legally compliant remedy for Site 35.

The remedy for Site 35, Alternative 2 – *Institutional Controls*, was selected based upon the ability to protect human health and the environment, and cost effectiveness. This section describes the selected remedy and also provides specific performance measures for the selected remedy.

Remedy selection is based on the detailed evaluation of remedial alternatives presented in the FS (EA, 2008). It is expected that the remedy will remain in effect and be protective of human health and the environment until such time as the concentrations of COCs decrease to, or below, applicable cleanup levels. LUCs will be maintained until the concentration of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

The USN is responsible for implementing, monitoring, maintaining, reporting on, and enforcing the remedial action identified herein for the duration of the remedy selected in this ROD. The USN will exercise this responsibility in accordance with CERCLA and the NCP. Concurrence by USEPA and Guam EPA is required for any modification of the remedy inconsistent with the objectives of this ROD.

2.12.1 Summary of the Rationale for the Selected Remedy

The selected remedy for Site 35 is Alternative 2 – *Institutional Controls*. The USN and USEPA believe that the selected remedy meets the threshold criteria and provides the best balance of

tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The remedy is expected to satisfy the following statutory requirements of CERCLA § 121(b):

- Threshold criteria
  - Protection of human health and the environment
  - Compliance with ARARs
- Balancing criteria
  - Long-term effectiveness and permanence
  - Toxicity, mobility or volume reduction through treatment
  - Short-term effectiveness
  - Implementability
  - Cost
- Modifying criteria
  - State agency acceptance
  - Community acceptance

The USN has selected Alternative 2 – *Institutional Controls* as the preferred alternative on the basis of the criteria above. As compared to other alternatives, the *Institutional Controls* alternative would control exposure to resident adults and children by prohibiting development of the land for residential use and would be easily implemented due to the location of the site adjacent to the active BSL. *Institutional Controls* provides the greatest potential return on investment when compared to the other alternatives.

Alternative 1 – *No Action* was not selected because it is not protective human health and the environment. Alternative 3 – *Soil Removal* was not selected because it is not as cost effective, given the site's current and expected future land use as industrial area / open space. *Soil Removal* is also not preferred because of uncertainty over whether the source of the metals is site-related or naturally occurring.

2.12.2 Description of the Selected Remedy

A detailed description of the actions that the USN will be required to perform to ensure proper implementation of the *Institutional Controls* alternative (i.e., LUCs) at Site 35, in accordance with this ROD, is provided in Appendix B. Appendix B provides a summary of (1) site risks relevant to the selected remedy; (2) a description of the property, including current and anticipated future property ownership, land use, and restrictions; (3) a description of onsite structures; (4) a description of LUC objectives; (5) a list of applicable institutional controls and other specific measures that are required to implement LUCs consistent with the selected remedy; (6) monitoring and reporting requirements; and (7) specific corrective actions to address non-compliant LUC events. The components necessary for implementation of the *Institutional Controls* alternative are as follows:

- Phase 1—Development of LUCMP and implementation of LUCs
- Phase 2—Periodic reviews (LUCs inspections and 5-year reviews).

2.12.3 Summary of Estimated Remedy Costs

A cost estimate for the *Institutional Controls* alternative at Site 35 is presented in Table 2-18. The information in the cost estimate tables is based on the available information regarding the anticipated scope of the remedial alternative.

Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the AR file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

2.12.4 Expected Outcomes of Selected Remedy

The selected remedy of *Institutional Controls* would effectively eliminate the potential for residential exposures to soil containing COCs above RGs by prohibiting residential development on or adjacent to the site through modification of the BGP. The site would remain suitable for continued use by the USAF as industrial/open space and industrial worker/occasional user exposures, but would not be suitable for unlimited use and unrestricted exposure (e.g., residential). The time frame to achieve this land use is immediate as the land is already appropriate for non-residential/undeveloped use. Groundwater is unaffected by contaminants on site and use of the groundwater would remain unchanged.

2.13 Statutory Determinations

2.13.1 Statutory Authority Finding for Site 29

Because the soil sample analytical results for Site 29 indicate that there are no unacceptable risks to human or the environment, the USN has determined that no further CERCLA remedial action is necessary at the sites. Therefore, no action is required for Site 29 to allow for unrestricted use of and unlimited exposure to the land.

Because there are currently no hazardous substances, pollutants, or contaminants remaining at the sites above levels that would allow for unlimited use and unrestricted access, a five-year review is not required.

2.13.2 Statutory Determination for Site 35

Under CERCLA §121 (as required by NCP §300.430(f)(5)(ii)), the lead agency must select a remedy that is protective of human health and the environment, complies with ARARs, is cost-effective, and uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes: 1) a preference for remedies that employ treatment which permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element; and 2) a bias against

offsite disposal of untreated wastes. The following sections discuss how the selected remedy meets these statutory requirements.

2.13.2.1 Protection of Human Health and the Environment

The selected remedy of *Institutional Controls* will protect human health by prohibiting residential development on and adjacent to the site, thus preventing potential exposure of residential receptors to COC-impacted soil at Site 35. The selected remedy will also protect the environment as no unacceptable ecological risks were identified onsite.

2.13.2.2 Compliance with ARARs

Remedial actions must comply with both Federal and State ARARs. ARARs are legally applicable or relevant and appropriate requirements, standards, criteria, or limitations of Federal and State environmental laws and regulations.

ARARs fall into three categories: chemical-specific, location-specific, and action-specific. Chemical-specific ARARs are health-based or risk-management-based numbers that provide concentration limits for the occurrence of a chemical in the environment. Location-specific ARARs restrict activities in certain sensitive environments. Action-specific ARARs are activity-based or technology-based, and typically control remedial activities that generate hazardous wastes (such as with those covered under the Resource Conservation and Recovery Act of 1976). Offsite shipment, treatment, and disposal of excavated contaminated soil invoke action-specific ARARs. Criteria to be considered, or TBCs, are non-promulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. However, in many circumstances, TBCs are considered along with ARARs.

Table 2-19 summarizes the ARARs and TBCs for the selected remedy at Site 35 and describes how the selected remedy addresses each one.

There are no chemical-specific or action-specific ARARs for the selected remedy. The selected remedy complies with the location-specific ARARs. The implementation of a remedy is required to meet the substantive portions of these requirements and is exempt from administrative requirements, such as permitting and notifications.

2.13.2.3 Cost Effectiveness

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

Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness. Overall effectiveness was then

compared to costs to determine cost-effectiveness. The overall effectiveness of the selected remedy for Site 35 was demonstrated in the comparative analysis of alternatives (Section 2.10 – Summary of Comparative Analysis of Alternatives) and is summarized in the following table.

Alternative	Present-Worth Cost	Incremental Cost (if applicable)	Long-Term Effectiveness and Permanence	Reduction of TMV Through Treatment	Short-Term Effectiveness
1. No Action	$0	$0	No	No	No
2. Institutional Controls	$94,200	$24,891*	Yes	No	Yes
3. Soil Removal	$290,900	$0	Yes	No	Yes
* Five-year ROD review TMV = toxicity, mobility, volume					

2.13.2.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The USN has determined that the selected remedy of *Institutional Controls* represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the USN has determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against offsite treatment and disposal and considering state and community acceptance.

The selected remedy manages the potential risks to human health and the environment by prohibiting residential development on or adjacent to the sites through modification of the BGP and therefore effectively eliminating residential exposures to subsurface soil containing COCs above RGs. No unacceptable risks were identified for current human receptors (industrial workers and construction workers) or ecological receptors.

2.13.2.5 Preference for Treatment as a Principal Element

Section 121(b) of CERCLA establishes the preference that treatment will be used to address the principal threats posed by a site wherever practicable. The selected remedy for Site 35 does not satisfy the statutory preference for treatment as a principal element of the remedy because COC-impacted soil will remain on site untreated.

2.13.2.6 Five-Year Review Requirements

Pursuant to CERCLA §121(c) and NCP §300.430(f)(5)(iii)(C), because the selected remedy will result in hazardous substances, pollutants, or contaminants remaining at Site 35 above levels that allow for unlimited use and unrestricted exposure, a statutory review will be required within five years after initiation of the remedial action to verify that the remedy is, or will be, protective of human health and the environment.

Five-year reviews will be conducted until concentrations of hazardous substances, pollutants, or contaminants remaining onsite are reduced to levels that allow for unlimited use and unrestricted exposure.

2.14 Documentation of Significant Changes

The Proposed Plan for Sites 29 and 35 was released for public comment on 4 May 2009. The Proposed Plan identified *No Action* as the preferred remedy for Site 29, and *Institutional Controls* as the preferred remedy for Site 35. The USN reviewed all verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

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3.0 Responsiveness Summary

This section provides a summary of the public comments regarding the Proposed Plan for remedial action at Sites 29 and 35, at Andersen AFB, Yigo, Guam. At the time of the public review period, the USAF had identified *No Action* as the preferred remedy for Site 29, and *Institutional Controls* as the preferred remedy for Site 35. Based upon the verbal comments received, the Proposed Plan was accepted by the public.

3.1 Stakeholder Comments and Lead Agency Responses

A public meeting was held on 27 May 2009 at the Guam Marriot Hotel in Tumon, Guam. The meeting officially began at 6:30 PM and concluded at 7:25 PM, according to the transcript. The meeting was attended by 6 members of the community. Mr. Gregg Ikehara, Andersen AFB 36 Civil Engineer Squadron/Civil Engineer Environmental Flight (36th CES/CEVR), provided an opening statement. Mr. Joe Vinch (36th CES/CEVR Environmental Engineer) gave a PowerPoint presentation discussing the proposed plan for the two IRP sites. Each presentation provided a brief site history, summary of past investigative studies and related analytical results, and when applicable a summary of the human health and ecological risk assessments. The preferred remedial alternative at each IRP site was also presented.

After the presentation, three members of the community spoke. The questions and comments received were primarily focused on clarifying details of the presented material and were adequately answered during the meeting. A brief summary of individual questions and comments are included on the following pages. The complete transcript is available in the AR file for Andersen AFB, which is available for public review at the Robert F. Kennedy Library at the University of Guam and the Nieves M. Flores Memorial Library in Hagåtña.

General

Mr. Kasperbauer asked whether there was a projected completion for the base restoration program. Mr. Ikehara explained that the Air Force goal is to have remedial actions in place for all of the sites by 2012; two years in advance of the Department of Defense goal of 2014.

Ms. Jones asked where sampling locations to determine background values are found. Mr. Ikehara explained that background concentrations are based on all sampling done within the program. These sites are limited to the northern portion of Guam.

Site 29

Mr. Kasperbauer asked why metals were detected in Waste Pile 2 (Site 29) despite tar/asphalt being the major contaminant identified at this site. Mr. Vinch explained that the detection of metals can be attributed to high background levels related to the geology of the northern portion of Guam. Mr. Ikehara also addressed Mr. Kasperbauer's follow-up questions, discussing why high background metals levels are found on base. He clarified that many of these metals are common constituents of weathered tropical soils and are not mobile enough to percolate into groundwater.

Mr. Kasperbauer expressed the opinion that the cleanup alternative for Site 29 was inexpensive enough to merit cleaning up the site. Mr. Ikehara responded by explaining that the Air Force does not generally clean up concentrations that are attributable to background concentrations because they are everywhere and it can be very difficult to identify the source or define the boundaries of the cleanup effort.

Mr. Kasperbauer asked why there was so much excess tar/asphalt stored at Site 29. Mr. Ikehara explained that the asphalt was likely brought in by ship following World War II, and that the base acquired more than it needed. Since it was not cost-effective to ship the drums back, they ended up being stored at sites around the base. He also mentioned that much of the asphalt previously found at Site 29 was recovered / recycled and donated to the Government of Guam for reuse.

Mr. Kasperbauer asked whether Site 29 was near the wildlife reserve for the Ko'ko. Mr. Ikehara replied that the refuge area, found in the Northwest field, was not adjacent to the site.

Site 35

Mr. Kasperbauer and Ms. Sian-Denten both asked whether Site 35 would be available for commercial, industrial, or other use in the future. Mr. Ikehara explained that because of the site's close proximity to the base sanitary landfill, other uses will be precluded by the potential for exposure if people were to dig or build in the area. The site will be in a controlled area, and will be monitored alongside the adjacent base landfill. Reuse of the site is unlikely to occur until long after the landfill is closed.

3.2 Technical and Legal Issues

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

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TABLES

Table 1-1
Data Certification Summary.

Decision Summary Sections	Site 29	Site 35
List of COCs and their respective concentrations	Section 2.5.5, Pages 2-8 to 2-10	Section 2.5.5, Pages 2-11 to 2-14
Baseline risk represented by the COCs	Section 2.7.1, Pages 2-19 to 2-24	Section 2.7.2, Pages 2-25 to 2-28
Cleanup levels established for COCs and the basis for these levels	NA	Section 2.8, Page 2-29
How source materials constituting principal threats will be addressed	NA	Section 2.11, Pages 2-35 to 2-36
Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD	Section 2.6, Pages 2-15 to 2-17	Section 2.6, Pages 2-15 to 2-17
Potential land and groundwater use that will be available at the site as a result of the selected remedies	Section 2.13.1, Page 2-38	Section 2.12.4, Page 2-38
Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected	NA	Section 2.12.3, Page 2-37 and Table 2-18
Key factor(s) that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision)	NA	Section 2.12.1, Pages 2-36 to 2-37

Notes:
NA = not applicable

Table 2-1
Public Notification of Document Availability.

Requirement:	Satisfied by:
Notice of availability of the Proposed Plan and RI/FS must be made in a widely-read section of a major local newspaper.	Notice of availability of the Proposed Plan was published in the *Guam Pacific Daily News* on 4 May 2009 and again on 26 May 2009.
Notice of availability should occur at least two weeks prior to the beginning of the public comment period.	The public comment period began on 18 May 2009.
Notice of availability must include a brief abstract of the proposed plan which describes the alternatives evaluated and identifies the preferred alternative (NCP Section 300.430(f)(3)(i)(A).	Notice of availability included all of these components and is included in Appendix C of this ROD.

Notice of availability should consist of the following information:
• Site name and location
• Date and location of public meeting
• Identification of lead and support agencies
• Alternatives evaluated in the detailed analysis
• Identification of preferred alternative
• Request for public comments
• Public participation opportunities including:
  o Location of information repositories and AR file
  o Methods by which the public may submit written and oral comments, including a contact person
  o Dates of public comment period
  o Contact person for the Restoration Advisory Board
	See notice in Appendix C.

Notes:
AR = Administrative Record
NCP = National Oil and Hazardous Substances Pollution Contingency Plan of 1990
RI = Remedial Investigation/Feasibility Study
ROD = Record of Decision

Table 2-2
Public Comment Period Requirements.

Requirement:	Satisfied by:
Lead agency (USN) should make document available to public for review on same date as newspaper notification.	Document was made available to the public on 4 May 2009. The notification of availability was made on 4 May 2009 and again on 26 May 2009.
Lead agency (USN) must ensure that all information that forms the basis for selecting the response action is included as part of the AR file and made available to the public during the public comment period.	The USN maintains information repositories for the Andersen AFB AR file at the Robert F. Kennedy Library at the University of Guam and the Nieves M. Flores Memorial Library in Hagåtña. Data and supporting CERCLA primary documents produced for Andersen AFB are maintained as part of these files and are available to the public.
CERCLA Section 177(a)(2) and NCP Section 300.430(f)(3)(i) requires the lead agency (USN) to provide the public with a reasonable opportunity (30 days) to submit written and oral comments on the Proposed Plan.	The USAF provided a public comment period for the Proposed Plan from 18 May 2009 to 17 June 2009.
The lead agency (USN) must extend the public comment period by at least 30 additional days upon timely request.	The USAF received no requests to extend the public comment period.
The lead agency (USN) must provide a public meeting to be held at or near the site during the public comment period. A transcript of this meeting must be made available to the public and be maintained in the AR for the site (pursuant to NCP Section 300.430(f)(3)(i)(E)).	A public meeting was held on 27 May 2009 at the Guam Marriott Resort and Spa in Tumon, Guam. A transcript of this meeting has been added to the AR file.

Notes:
AFB = Air Force Base
AR = Administrative Record
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
NCP = National Oil and Hazardous Substances Pollution Contingency Plan of 1990
RI = Remedial Investigation/Feasibility Study
USN = United States Navy

Table 2-3
Non-Cancer Toxicity Data – Oral/Dermal.

Contaminant of Potential Concern	Chronic/ Subchronic	Oral RfD Value (mg/kg-day)	Oral to Dermal Adjustment Factor (GI ABS) (1)	Adjusted Dermal RfD (2) (mg/kg bw-day)	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (mm/dd/yy)
Inorganics								
Aluminum	Chronic	1.00E+00	1	1.00E+00	Central Nervous System	100/3	EPA-NCEA	5/30/1997
Arsenic	Chronic	3.00E-04	1	3.00E-04	Skin	3/1	IRIS	11/28/2006
Cadmium	Chronic	2.40E-02	0.025	6.00E-04	Kidneys	10/1	IRIS	11/28/2006
Chromium, Total	Chronic	3.00E-03	0.025	7.50E-05	None	300/3	IRIS	11/28/2006
Manganese	Chronic	2.40E-02	0.04	9.60E-04	Central Nervous System	1/3	IRIS	11/28/2006
Nickel	Chronic	2.00E-02	0.04	8.00E-04	None	300/1	IRIS	11/28/2006
Thallium	Chronic	6.60E-05	1	6.60E-05	Liver, Blood	3000/1	IRIS	11/28/2006
Vanadium	Chronic	1.00E-03	0.026	2.60E-05	Kidneys	100/1	HEAST	8/25/1999
PAHs								
Benzo(b)fluoranthene	NA	NA	1	NA	NA	NA/NA	IRIS	11/28/2006
Benzo(a)pyrene	NA	NA	1	NA	NA	NA/NA	IRIS	11/28/2006
Dibenz(a,h)anthracene	NA	NA	1	NA	NA	NA/NA	IRIS	11/28/2006
Indeno(1,2,3-cd)pyrene	NA	NA	1	NA	NA	NA/NA	IRIS	11/28/2006

Notes:
1. U.S. Environmental Protection Agency (USEPA), 2004. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* (Part E, Supplemental Guidance for Dermal Risk Assessment). Final Guidance.
2. Dermal toxicological values adjusted from oral values using USEPA (2004) recommended chemical-specific GI ABS. RfDs are multiplied by the GI ABS.
3. For IRIS values, the date IRIS was searched is provided; for EPA-NCEA values, the date of the article provided by EPA-NCEA is provided; for HEAST values, the date of HEAST is provided.

bw-day = body weight per day
EPA-NCEA = National Center for Environmental Assessment
GI ABS = gastrointestinal absorption factors
HEAST = Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
mg/kg = milligram(s) per kilogram
NA = not applicable
PAH = polycyclic aromatic hydrocarbon
RfD = reference dose

Table 2-4
Non-Cancer Toxicity Data – Inhalation.

Contaminant of Potential Concern	Chronic/ Subchronic	Value Inhalation (RfC) (mg/m^3)	Adjusted Inhalation (RfD) (mg/kg-day)	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC:RfD: Target Organ	Dates [1] (mm/dd/yy)
Inorganics							
Aluminum	Chronic	5.00E-03	1.40E-03	Respiratory System	NA	EPA-NCEA	5/30/1997
Arsenic	NA	NA	NA	NA	NA	IRIS	11/28/2006
Cadmium	NA	NA	NA	NA	NA	IRIS	11/28/2006
Chromium, Total	Chronic	1.00E-04	2.20E-06	Lungs and Blood	300/1	IRIS	11/28/2006
Manganese	Chronic	5.00E-05	1.43E-05	Central Nervous System	1000/1	IRIS	11/28/2006
Nickel	NA	NA	NA	None	NA	IRIS	11/28/2006
Thallium	NA	NA	NA	NA	NA	IRIS	11/28/2006
Vanadium	NA	NA	NA	NA	NA	IRIS	11/28/2006
PAHs							
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	IRIS	11/28/2006
Benzo(a)pyrene	NA	NA	NA	NA	NA	IRIS	11/28/2006
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	EPA-NCEA	5/23/2001
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	EPA-NCEA	5/23/2001

Notes:
1. For IRIS values, the date IRIS was searched is provided; for EPA-NCEA values, the date of the article provided by EPA-NCEA is provided.

EPA-NCEA = National Center for Environmental Assessment
IRIS = Integrated Risk Information System
mg/kg = milligram(s) per kilogram
mg/m^3 = milligram(s) per square meter
NA = not applicable
PAH = polycyclic aromatic hydrocarbon
RfC = reference concentration
RfD = reference dose

Table 2-5
Chemical-Specific Parameters.

Contaminant of Potential Concern	Absorption Factor	Reference	GI ABS	Reference
Inorganics				
Aluminum	0	USEPA, 2004	1	USEPA, 2004
Arsenic	0.03	USEPA, 2004	1	USEPA, 2004
Cadmium	0.001	USEPA, 2004	0.025	USEPA, 2004
Chromium, Total	NA	USEPA, 2004	0.025	USEPA, 2004
Manganese	NA	USEPA, 2004	0.04	USEPA, 2004
Nickel	NA	USEPA, 2004	0.04	USEPA, 2004
Thallium	NA	USEPA, 2004	1	USEPA, 2004
Vanadium	NA	USEPA, 2004	0.026	USEPA, 2004
PAHs				
Benzo(b)fluoranthene	0.13	USEPA, 2004	1	USEPA, 2004
Benzo(a)pyrene	0.13	USEPA, 2004	1	USEPA, 2004
Dibenz(a,h)anthracene	0.13	USEPA, 2004	1	USEPA, 2004
Indeno(1,2,3-cd)pyrene	0.13	USEPA, 2004	1	USEPA, 2004

Notes:
GI ABS = gastrointestinal absorption factors
NA = data not available
PAH = polycyclic aromatic hydrocarbon
U.S. Environmental Protection Agency (USEPA), 2004. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* (Part E, Supplemental Guidance for Dermal Risk Assessment). Final Guidance.

Table 2-6
Cancer Toxicity Data – Oral/Dermal.

Contaminant of Potential Concern	Oral Cancer Slope Factor	Oral Absorption Efficiency for Dermal (GI ABS)[1]	Absorbed Cancer Slope Factor for Dermal [2]	Units	Weight of Evidence/Cancer Guideline Description	Source	Date [3] (mm/dd/yy)
Inorganics							
Aluminum	NA	1	NA	per (mg/kg-day)	NA	EPA-NCEA	5/30/1997
Arsenic	1.50E+00	1	1.50E+00	per (mg/kg-day)	A	IRIS	11/28/2006
Cadmium	NA	0.025	NA	per (mg/kg-day)	B1	IRIS	11/28/2006
Chromium, Total	NA	0.025	NA	per (mg/kg-day)	D	IRIS	11/28/2006
Manganese	NA	0.04	NA	per (mg/kg-day)	D	IRIS	11/28/2006
Nickel	NA	0.04	NA	per (mg/kg-day)	NA	IRIS	11/28/2006
Thallium	NA	1	NA	per (mg/kg-day)	D	IRIS	11/28/2006
Vanadium	NA	0.026	NA	per (mg/kg-day)	NA	IRIS	11/28/2006
PAHs							
Benzo(b)fluoranthene	7.30E-01	1	7.30E-01	per (mg/kg-day)	B2	IRIS	11/28/2006
Benzo(a)pyrene	7.30E+00	1	7.30E+00	per (mg/kg-day)	B2	IRIS	11/28/2006
Dibenz(a,h)anthracene	7.30E+00	1	7.30E+00	per (mg/kg-day)	B2	IRIS	11/28/2006
Indeno(1,2,3-cd)pyrene	7.30E-01	1	7.30E-01	per (mg/kg-day)	B2	IRIS	11/28/2006

Notes:
1. U.S. Environmental Protection Agency (USEPA), 2004. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* (Part E, Supplemental Guidance for Dermal Risk Assessment). Final Guidance.
2. Dermal Toxicological values adjusted from oral values using USEPA (2004) recommended chemical-specific GI ABS. Cancer slope factors are divided by the GI ABS.
3. For IRIS values, the date IRIS was searched is provided; for EPA-NCEA values, the date of the article provided by EPA-NCEA is provided.

EPA-NCEA = National Center for Environmental Assessment
GI ABS = gastrointestinal absorption factors
IRIS = Integrated Risk Information System
mg/kg = milligram(s) per kilogram
NA = not applicable
PAH = polycyclic aromatic hydrocarbon

Weight of Evidence:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
D - Not classifiable as a human carcinogen

Table 2-7
Cancer Toxicity Data – Inhalation.

Contaminant of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/Cancer Guideline Description	Unit Risk - Inhalation CSF	
	Value	Units	Value	Units		Source	Date [1]
Inorganics							
Aluminum	NA	$1/\mu g/m^3$	NA	per (mg/kg-day)	NA	EPA-NCEA	5/30/1997
Arsenic	4.30E-03	$1/\mu g/m^3$	1.51E+01	per (mg/kg-day)	A	IRIS	11/28/2006
Cadmium	1.80E-03	$1/\mu g/m^3$	6.30E+00	per (mg/kg-day)	B1	IRIS	11/28/2006
Chromium, Total	1.20E-02	$1/\mu g/m^3$	4.20E+01	per (mg/kg-day)	A	IRIS	11/28/2006
Manganese	NA	$1/\mu g/m^3$	NA	per (mg/kg-day)	D	IRIS	11/28/2006
Nickel	NA	$1/\mu g/m^3$	NA	per (mg/kg-day)	NA	IRIS	11/28/2006
Thallium	NA	$1/\mu g/m^3$	NA	per (mg/kg-day)	D	IRIS	11/28/2006
Vanadium	NA	$1/\mu g/m^3$	NA	per (mg/kg-day)	NA	IRIS	11/28/2006
PAHs							
Benzo(b)fluoranthene	8.00E-04	$1/\mu g/m^3$	3.10E-01	per (mg/kg-day)	B2	IRIS	11/28/2006
Benzo(a)pyrene	8.00E-03	$1/\mu g/m^3$	3.10E+00	per (mg/kg-day)	B2	IRIS	11/28/2006
Dibenz(a,h)anthracene	8.00E-03	$1/\mu g/m^3$	3.10E+00	per (mg/kg-day)	B2	IRIS	11/28/2006
Indeno(1,2,3-cd)pyrene	8.00E-04	$1/\mu g/m^3$	3.10E-01	per (mg/kg-day)	B2	IRIS	11/28/2006

Notes:
1. For IRIS values, the date IRIS was searched is provided; for EPA-NCEA values, the date of the article provided by EPA-NCEA is provided.

CSF = Cancer Slope Factor
EPA-NCEA = National Center for Environmental Assessment
IRIS = Integrated Risk Information System
mg/kg = milligram(s) per kilogram
NA = not applicable
PAH = polycyclic aromatic hydrocarbon
$\mu g/m^3$ = microgram(s) per cubic meter

Weight of Evidence:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
D - Not classifiable as a human carcinogen

Table 2-8
Summary of Contaminants of Potential Concern and Medium-Specific Exposure Point Concentrations for Site 29.

Media	Contaminant of Potential Concern	Concentration Detected		Units	BTV	2004 USEPA Region 9 PRG		Frequency Of Detection	Exposure Point Concentration	Statistical Measure
		Minimum	Maximum			Residential	Industrial			
Soil On-Site - Direct Contact - Surface Soil	Aluminum	55,900	186,000	mg/kg	173,500	76,000	100,000	21/21	150,000	Student's-t UCL(1)
	Cadmium	3	10.9	mg/kg	6.5	37	450	21/21	7.79	Student's-t UCL(1)
	Chromium	316	1,130	mg/kg	1,080	210	450	21/21	917	Approximate Gamma UCL(2)
	Lead	31.9	1,920	mg/kg	166	400	800	29/29	145	Mean(3)
	Manganese	1,570	8,530	mg/kg	5,500	1,800	19,000	21/21	4,920	Student's-t UCL(1)
	Nickel	73.1	314	mg/kg	243	1,600	20,000	21/21	229	Student's-t UCL(1)
	Thallium	0.82	1.6	mg/kg	1.42	5.2	67	6/21	0.750	Mod-t UCL (Adjusted for skewness) (4)
Soil On-Site - Direct Contact - Subsurface Soil	Aluminum	19,000	204,000	mg/kg	173,500	76,000	100,000	9/9	164,932	Student's-t UCL(1)
	Cadmium	1	8.6	mg/kg	6.5	37	450	9/9	7.70	Student's-t UCL(1)
	Chromium	100	1,210	mg/kg	1,080	210	450	9/9	930	Student's-t UCL(1)
	Manganese	669	5,830	mg/kg	5,500	1,800	19,000	9/9	4,542	Student's-t UCL(1)
	Nickel	26.5	272	mg/kg	243	1,600	20,000	9/9	243	Student's-t UCL(1)
	Thallium	2.7	2.7	mg/kg	1.42	5.2	67	1/9	1.61	Mod-t UCL (Adjusted for skewness) (4)
	Vanadium	21.1	224	mg/kg	206	78	1,000	9/9	178	Student's-t UCL(1)
	Benzo(a)pyrene	0.0036	0.18	mg/kg	NA	0.062	0.210	3/9	0.180	Max<95%UCLM(5)

Notes:
(1) ProUCL recommends using the Student's-t UCL for normally distributed data (ProUCL version 3.0).
(2) ProUCL recommends using the Adjusted Gamma UCL for gamma distributed data (ProUCL version 3.0).
(3) USEPA lead models require the use of the mean concentration.
(4) ProUCL recommends using the Modified Student's-t UCL for normally distributed data (ProUCL version 3.0).
(5) ProUCL recommends using the Hall's bootstrap UCL for nonparametric data (ProUCL version 3.0); however the Max is < the 95%UCLM.

BTV = Background Threshold Value
mg/kg = milligram(s) per kilogram
NA = not applicable
PRG = Preliminary Remediation Goal
UCL = Upper Confidence Limit
USEPA = United States Environmental Protection Agency
= Shading indicates contaminant of concern identified in the human health risk assessment

Table 2-9
Site 29 Risk Characterization Summary – Carcinogens.

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Surface Soil	Site 29	Aluminum	NA	NA	NA	--
	Site 29	Cadmium	NA	NA	3.49E-09	3.49E-09
	Site 29	Chromium	NA	NA	2.74E-06	2.74E-06
	Site 29	Manganese	NA	NA	NA	--
	Site 29	Nickel	NA	NA	NA	--
	Site 29	Thallium	NA	NA	NA	--
					Total Risk =	**2.74E-06**

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Surface Soil	Site 29	Aluminum	NA	NA	NA	--
	Site 29	Cadmium	NA	NA	1.71E-09	1.71E-09
	Site 29	Chromium	NA	NA	1.34E-06	1.34E-06
	Site 29	Manganese	NA	NA	NA	--
	Site 29	Nickel	NA	NA	NA	--
	Site 29	Thallium	NA	NA	NA	--
					Total Risk =	**1.34E-06**

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Surface Soil	Site 29	Aluminum	NA	NA	NA	--
	Site 29	Chromium	NA	NA	4.22E-08	4.22E-08
	Site 29	Manganese	NA	NA	NA	--
					Total Risk =	**4.22E-08**

Notes:
NA = not applicable
= Shading indicates unacceptable receptor risk

Table 2-9
Site 29 Risk Characterization Summary – Carcinogens.

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Subsurface Soil	Site 29	Aluminum	NA	NA	NA	--
	Site 29	Cadmium	NA	NA	3.45E-09	3.45E-09
	Site 29	Chromium	NA	NA	2.78E-06	2.78E-06
	Site 29	Manganese	NA	NA	NA	--
	Site 29	Nickel	NA	NA	NA	--
	Site 29	Thallium	NA	NA	NA	--
	Site 29	Vanadium	NA	NA	NA	--
	Site 29	Benzo(a)pyrene	6.17E-07	3.20E-07	3.97E-11	9.37E-07
					Total Risk =	**3.72E-06**

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Subsurface Soil	Site 29	Aluminum	NA	NA	NA	--
	Site 29	Cadmium	NA	NA	1.69E-09	1.69E-09
	Site 29	Chromium	NA	NA	1.36E-06	1.36E-06
	Site 29	Manganese	NA	NA	NA	--
	Site 29	Nickel	NA	NA	NA	--
	Site 29	Thallium	NA	NA	NA	--
	Site 29	Vanadium	NA	NA	NA	--
	Site 29	Benzo(a)pyrene	1.44E-06	5.24E-07	1.95E-11	1.96E-06
					Total Risk =	**3.33E-06**

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Subsurface Soil	Site 29	Aluminum	NA	NA	NA	--
	Site 29	Chromium	NA	NA	2.78E-06	2.78E-06
	Site 29	Manganese	NA	NA	NA	--
	Site 29	Vanadium	NA	NA	NA	--
					Total Risk =	**2.78E-06**

Notes:
NA = not applicable
= Shading indicates unacceptable receptor risk

Table 2-10
Site 29 Risk Characterization Summary – Non-Carcinogens.

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Dermal	Inhalation	Cumulative Hazard Quotient
Surface Soil	Site 29	Aluminum	Central Nervous System	2.05E-01	NA	2.22E-02	2.28E-01
	Site 29	Cadmium	Kidneys	4.45E-04	7.10E-05	NA	5.16E-04
	Site 29	Chromium	None	4.19E-01	NA	8.65E-02	5.05E-01
	Site 29	Manganese	Central Nervous System	2.81E-01	NA	7.14E-02	3.52E-01
	Site 29	Nickel	None	1.57E-02	NA	NA	1.57E-02
	Site 29	Thallium	Liver, Blood	1.56E-02	NA	NA	1.56E-02
						Receptor Hazard Index Total =	**1.12E+00**

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Dermal	Inhalation	Cumulative Hazard Quotient
Surface Soil	Site 29	Aluminum	Central Nervous System	1.92E+00	NA	4.36E-02	1.96E+00
	Site 29	Cadmium	Kidneys	4.15E-03	4.65E-04	NA	4.61E-03
	Site 29	Chromium	None	3.91E+00	NA	1.70E-01	4.08E+00
	Site 29	Manganese	Central Nervous System	2.62E+00	NA	1.40E-01	2.76E+00
	Site 29	Nickel	None	1.46E-01	NA	NA	1.46E-01
	Site 29	Thallium	Liver, Blood	1.45E-01	NA	NA	1.45E-01
						Receptor Hazard Index Total =	**9.10E+00**

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Dermal	Inhalation	Cumulative Hazard Quotient
Surface Soil	Site 29	Aluminum	Central Nervous System	1.53E-02	NA	2.74E-04	1.55E-02
	Site 29	Chromium	None	3.11E-02	NA	1.07E-03	3.22E-02
	Site 29	Manganese	Central Nervous System	2.09E-02	NA	8.81E-04	2.17E-02
						Receptor Hazard Index Total =	**6.95E-02**

Notes:
NA = not applicable
= Shading indicates unacceptable receptor risk

Table 2-10
Site 29 Risk Characterization Summary – Non-Carcinogens.

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Dermal	Inhalation	Cumulative Hazard Quotient
Subsurface Soil	Site 29	Aluminum	Central Nervous System	2.26E-01	NA	2.45E-02	2.50E-01
	Site 29	Cadmium	Kidneys	4.39E-04	7.01E-05	NA	5.10E-04
	Site 29	Chromium	None	4.25E-01	NA	8.77E-02	5.12E-01
	Site 29	Manganese	Central Nervous System	2.59E-01	NA	6.59E-02	3.25E-01
	Site 29	Nickel	None	1.66E-02	NA	NA	1.66E-02
	Site 29	Thallium	Liver, Blood	3.34E-02	NA	NA	3.34E-02
	Site 29	Vanadium	Kidneys	2.44E-01	NA	NA	2.44E-01
	Site 29	Benzo(a)pyrene	NA	NA	NA	NA	--
						Receptor Hazard Index Total =	**1.38E+00**

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Dermal	Inhalation	Cumulative Hazard Quotient
Subsurface Soil	Site 29	Aluminum	Central Nervous System	2.11E+00	NA	4.79E-02	2.16E+00
	Site 29	Cadmium	Kidneys	4.10E-03	4.59E-04	NA	4.56E-03
	Site 29	Chromium	None	3.96E+00	NA	1.72E-01	4.14E+00
	Site 29	Manganese	Central Nervous System	2.42E+00	NA	1.29E-01	2.55E+00
	Site 29	Nickel	None	1.55E-01	NA	NA	1.55E-01
	Site 29	Thallium	Liver, Blood	3.12E-01	NA	NA	3.12E-01
	Site 29	Vanadium	Kidneys	2.28E+00	NA	NA	2.28E+00
	Site 29	Benzo(a)pyrene	NA	NA	NA	NA	--
						Receptor Hazard Index Total =	**1.16E+01**

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Dermal	Inhalation	Cumulative Hazard Quotient
Subsurface Soil	Site 29	Aluminum	Central Nervous System	7.75E-01	NA	3.35E-02	8.08E-01
	Site 29	Chromium	None	4.25E-01	NA	8.77E-02	5.12E-01
	Site 29	Manganese	Central Nervous System	2.59E-01	NA	6.59E-02	3.25E-01
	Site 29	Vanadium	Kidneys	2.44E-01	NA	NA	2.44E-01
						Receptor Hazard Index Total =	**1.89E+00**

Notes:
NA = not applicable
= Shading indicates unacceptable receptor risk

Table 2-11
Comparison of Site-Specific PRGs and Background to EPCs for Site 29.

COC	Number of Exceedances / Number of Samples Analyzed	Values of Exceedances (mg/kg)	EPC (mg/kg)	Calculated HI	Calculated Site-Specific PRG for HI = 1.0 (mg/kg)	Calculated Site-Specific PRG for HI = 0.1 (mg/kg)	USEPA Region 9 Residential PRG (mg/kg)	BTV (mg/kg)	HQ Associated with Background	Site-Specific PRG (mg/kg)
Surface Soil										
Aluminum	3 / 21	184,000 177,000 174,000	**150,000**	2.0	75,000	7,500	76,000	173,500	2.3	**173,500**[a]
Chromium	2 / 21	1,130 1,090	**917**	4.1	224	NA	210	1,080	5.1	**1,080**[a]
Manganese	3 / 21	8,530 7,550 5,510	**4,920**	2.7	1,757	175.7	1,800	5,500	3.0	**5,500**[a]
Subsurface Soil										
Aluminum	2 / 9	204,000 176,000	**165,000**	2.2	75,000	7,500	76,000	173,500	2.3	**173,500**[a]
Chromium	1 / 9	1,210	**930**	4.1	227	NA	210	1,080	5.1	**1,080**[a]
Manganese	1 / 9	5,830	**4,540**	2.5	1,816	181.6	1,800	5,500	3.0	**5,500**[a]
Vanadium	1 / 9	224	**178**	2.3	77	7.7	78	206	2.6	**206**[a]

Notes:
(a) The BTV exceeded the calculated site-specific PRG; therefore, the BTV was used as the site-specific PRG (cleanup goal).

BTV = background threshold value
COC = contaminant of concern
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
PRG = preliminary remediation goal
USEPA = United States Environmental Protection Agency

Table 2-12
Summary of Contaminants of Potential Concern and Medium-Specific Exposure Point Concentrations for Site 35.

Media	Contaminant of Potential Concern	Concentration Detected		Units	BTV	2004 USEPA Region 9 PRG		Frequency Of Detection	Exposure Point Concentration	Statistical Measure
		Minimum	Maximum			Residential	Industrial			
Soil On-Site - Direct Contact - Surface Soil	Cadmium	0.28	7.1	mg/kg	6.5	37	450	24/27	3.82	Student's-t UCL[1]
	Chromium	10.9	1,120	mg/kg	1,080	210	450	27/27	578	Student's-t UCL[1]
	Thallium	1.1	4.4	mg/kg	1.42	5.2	67	7/27	1.49	Mod-t UCL (Adjusted for skewness)[2]
	Vanadium	2	232	mg/kg	206	78	1,000	27/27	123	Student's-t UCL[1]
	Benzo(a)pyrene	0.0011	0.94	mg/kg	NA	0.062	0.210	24/27	0.386	99% Chebyshev (Mean, Sd) UCL[3]
	Benzo(b)fluoranthene	0.0015	2.3	mg/kg	NA	0.620	2.10	24/27	0.939	99% Chebyshev (Mean, Sd) UCL[3]
	Dibenz(a,h)anthracene	0.00022	0.28	mg/kg	NA	0.062	0.210	14/27	0.115	99% Chebyshev (Mean, Sd) UCL[3]
	Indeno(1,2,3-cd)pyrene	0.0007	1.2	mg/kg	NA	0.620	2.10	17/27	0.490	99% Chebyshev (Mean, Sd) UCL[3]
Soil On-Site - Direct Contact - Subsurface Soil	Aluminum	24,600	209,000	mg/kg	173,500	76,000	100,000	5/5	196,085	Student's-t UCL[1]
	Chromium	133	1,610	mg/kg	1,080	210	450	5/5	1,361	Student's-t UCL[1]
	Thallium	1.8	4.6	mg/kg	1.42	5.2	67	4/5	3.84	Student's-t UCL[1]
	Vanadium	30.4	220	mg/kg	206	78	1,000	5/5	220	Max[4]
	Benzo(a)pyrene	0.0055	0.094	mg/kg	NA	0.062	0.210	2/5	0.0940	Adjusted Gamma UCL[5]

Notes:
(1) ProUCL recommends using the Student's-t UCL for normally distributed data (ProUCL version 3.0).
(2) ProUCL recommends using the Modified Student's-t UCL for normally distributed data (ProUCL version 3.0).
(3) ProUCL recommends using the 99% Chebyshev UCL for nonparametric data (ProUCL version 3.0).
(4) Maximum concentration exceeds 95UCLM; therefore maximum value is used as RME EPC.
(5) ProUCL recommends using the Adjusted Gamma UCL for gamma distributed data (ProUCL version 3.0).

BTV = Background Threshold Value
mg/kg = milligram(s) per kilogram
NA = not applicable
PRG = Preliminary Remediation Goal
UCL = Upper Confidence Limit
USEPA = United States Environmental Protection Agency
= Shading indicates contaminant of concern identified in the human health risk assessment

Table 2-13
Site 35 Risk Characterization Summary – Carcinogens.

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Surface Soil	Site 35	Cadmium	NA	NA	1.71E-09	1.71E-09
	Site 35	Chromium	NA	NA	1.73E-06	1.73E-06
	Site 35	Thallium	NA	NA	NA	--
	Site 35	Vanadium	NA	NA	NA	--
	Site 35	Benzo(a)pyrene	3.22E-07	1.67E-07	2.07E-11	4.89E-07
	Site 35	Benzo(b)fluoranthene	1.32E-06	6.86E-07	8.51E-11	2.01E-06
	Site 35	Dibenz(a,h)anthracene	3.94E-07	2.05E-07	2.54E-11	5.99E-07
	Site 35	Indeno(1,2,3-cd)pyrene	1.68E-07	8.71E-08	1.08E-11	2.55E-07
					Total Risk =	**5.08E-06**

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Surface Soil	Site 35	Cadmium	NA	NA	8.39E-10	8.39E-10
	Site 35	Chromium	NA	NA	8.46E-07	8.46E-07
	Site 35	Thallium	NA	NA	NA	--
	Site 35	Vanadium	NA	NA	NA	--
	Site 35	Benzo(a)pyrene	7.51E-07	2.73E-07	1.02E-11	1.02E-06
	Site 35	Benzo(b)fluoranthene	3.09E-06	1.12E-06	4.17E-11	4.21E-06
	Site 35	Dibenz(a,h)anthracene	9.20E-07	3.35E-07	1.24E-11	1.25E-06
	Site 35	Indeno(1,2,3-cd)pyrene	3.92E-07	1.43E-07	5.30E-12	5.35E-07
					Total Risk =	**7.87E-06**

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Surface Soil	Site 35	Chromium	NA	NA	2.66E-08	2.66E-08
	Site 35	Vanadium	NA	NA	NA	--
	Site 35	Benzo(a)pyrene	2.99E-08	5.13E-08	3.19E-13	8.12E-08
	Site 35	Benzo(b)fluoranthene	1.23E-07	2.11E-07	1.31E-12	3.34E-07
	Site 35	Dibenz(a,h)anthracene	3.66E-08	6.28E-08	3.91E-13	9.94E-08
					Total Risk =	**5.41E-07**

Notes:
NA = not applicable
= Shading indicates unacceptable receptor risk

Table 2-13
Site 35 Risk Characterization Summary – Carcinogens.

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Subsurface Soil	Site 35	Aluminum	NA	NA	NA	--
	Site 35	Chromium	NA	NA	4.06E-06	4.06E-06
	Site 35	Thallium	NA	NA	NA	--
	Site 35	Vanadium	NA	NA	NA	--
	Site 35	Benzo(a)pyrene	3.22E-07	1.67E-07	2.07E-11	4.89E-07
					Total Risk =	**4.55E-06**

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Subsurface Soil	Site 35	Aluminum	NA	NA	NA	--
	Site 35	Chromium	NA	NA	1.99E-06	1.99E-06
	Site 35	Thallium	NA	NA	NA	--
	Site 35	Vanadium	NA	NA	NA	--
	Site 35	Benzo(a)pyrene	7.52E-07	2.74E-07	1.02E-11	1.03E-06
					Total Risk =	**3.02E-06**

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Point	Contaminant of Potential Concern	Carcinogenic Risk			
			Ingestion	Dermal	Inhalation	Cumulative Risk
Subsurface Soil	Site 35	Aluminum	NA	NA	NA	--
	Site 35	Chromium	NA	NA	4.06E-06	4.06E-06
	Site 35	Vanadium	NA	NA	NA	--
					Total Risk =	**4.06E-06**

Notes:
NA = not applicable
= Shading indicates unacceptable receptor risk

Table 2-14
Site 35 Risk Characterization Summary – Non-Carcinogens.

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adults

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Cumulative Hazard Quotient
Surface Soil	Site 35	Cadmium	Kidneys	2.18E-04	3.48E-05	NA	2.53E-04
	Site 35	Chromium	None	2.64E-01	NA	5.45E-02	3.18E-01
	Site 35	Thallium	Liver, Blood	3.09E-02	NA	NA	3.09E-02
	Site 35	Vanadium	Kidneys	1.68E-01	NA	NA	1.68E-01
	Site 35	Benzo(a)pyrene	NA	NA	NA	NA	--
	Site 35	Benzo(b)fluoranthene	NA	NA	NA	NA	--
	Site 35	Dibenz(a,h)anthracene	NA	NA	NA	NA	--
	Site 35	Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	--
						Receptor Hazard Index Total =	**5.18E-01**

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Cumulative Hazard Quotient
Surface Soil	Site 35	Cadmium	Kidneys	2.04E-03	2.28E-04	NA	2.26E-03
	Site 35	Chromium	None	2.46E+00	NA	1.07E-01	2.57E+00
	Site 35	Thallium	Liver, Blood	2.89E-01	NA	NA	2.89E-01
	Site 35	Vanadium	Kidneys	1.57E+00	NA	NA	1.57E+00
	Site 35	Benzo(a)pyrene	NA	NA	NA	NA	--
	Site 35	Benzo(b)fluoranthene	NA	NA	NA	NA	--
	Site 35	Dibenz(a,h)anthracene	NA	NA	NA	NA	--
	Site 35	Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	--
						Receptor Hazard Index Total =	**4.43E+00**

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adults

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Cumulative Hazard Index
Surface Soil	Site 35	Chromium	None	1.96E-02	NA	6.72E-04	2.03E-02
	Site 35	Vanadium	Kidneys	1.25E-02	NA	NA	1.25E-02
	Site 35	Benzo(a)pyrene	NA	NA	NA	NA	--
	Site 35	Benzo(b)fluoranthene	NA	NA	NA	NA	--
	Site 35	Dibenz(a,h)anthracene	NA	NA	NA	NA	--
						Receptor Hazard Index Total =	**3.28E-02**

Notes:
NA = not applicable
= Shading indicates unacceptable receptor risk

Table 2-14
Site 35 Risk Characterization Summary – Non-Carcinogens.

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adults

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Cumulative Hazard Quotient
Subsurface Soil	Site 35	Aluminum	Central Nervous System	2.68E-01	NA	2.90E-02	2.98E-01
	Site 35	Chromium	None	6.21E-01	NA	1.28E-01	7.49E-01
	Site 35	Thallium	Liver, Blood	7.97E-02	NA	NA	7.97E-02
	Site 35	Vanadium	Kidneys	3.01E-01	NA	NA	3.01E-01
	Site 35	Benzo(a)pyrene	NA	NA	NA	NA	--
						Receptor Hazard Index Total =	**1.43E+00**

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Cumulative Hazard Index
Subsurface Soil	Site 35	Aluminum	Central Nervous System	2.51E+00	NA	5.70E-02	2.56E+00
	Site 35	Chromium	None	5.80E+00	NA	2.51E-01	6.05E+00
	Site 35	Thallium	Liver, Blood	7.44E-01	NA	NA	7.44E-01
	Site 35	Vanadium	Kidneys	2.81E+00	NA	NA	2.81E+00
	Site 35	Benzo(a)pyrene	NA	NA	NA	NA	--
						Receptor Hazard Index Total =	**1.22E+01**

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adults

Medium	Exposure Point	Contaminant of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Cumulative Hazard Index
Subsurface Soil	Site 35	Aluminum	Central Nervous System	9.21E-01	NA	3.99E-02	9.60E-01
	Site 35	Chromium	None	6.21E-01	NA	1.28E-01	7.49E-01
	Site 35	Vanadium	Kidneys	3.01E-01	NA	NA	3.01E-01
						Receptor Hazard Index Total =	**2.01E+00**

Notes:
NA = not applicable
= Shading indicates unacceptable receptor risk

Table 2-15
Comparison of Site-Specific PRGs and Background to EPCs for Site 35.

COC	Number of Exceedances / Number of Samples Analyzed	Values of Exceedances (mg/kg)	EPC (mg/kg)	Calculated HI	Calculated Site-Specific PRG for HI = 1.0 (mg/kg)	Calculated Site-Specific PRG for HI = 0.1 (mg/kg)	USEPA Region 9 Residential PRG (mg/kg)	BTV (mg/kg)	HQ Associated with Background	Site-Specific PRG (mg/kg)
Surface Soil										
Chromium	1 / 27	1,120	**578**	2.6	222	NA	210	1,080	5.1	**1,080**[a]
Vanadium	2 / 27	232 218	**123**	1.6	77	7.7	78	206	2.6	**206**[a]
Subsurface Soil										
Aluminum	1 / 5	209,000	**196,000**	2.6	75,000	7,500	76,100	173,500	2.3	**173,500**[a]
Chromium	1 / 5	1,610	**1,360**	6	227	NA	210	1,080	5.1	**1,080**[a]
Vanadium	2 / 5	220 211	**220**	2.8	79	7.9	78	206	2.6	**206**[a]

Notes:
(a) The BTV exceeded the calculated site-specific PRG; therefore, the BTV was used as the site-specific PRG (cleanup goal).

BTV = background threshold value
COC = contaminant of concern
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
PRG = preliminary remediation goal
USEPA = United States Environmental Protection Agency

Table 2-16
Common Elements and Distinguishing Features of Alternatives for Site 35.

	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Soil Removal
Summary of Key ARARs	Preliminary cleanup criteria (PRGs) would not be met.	There would be no adverse impacts to endangered species or historical objects.	Soil removal would protect against unacceptable risks to future residents. Would meet requirements for solid waste and RCRA hazardous waste management. Water resources would be protected. There would be no adverse impacts to endangered species or historical objects.
Long-term reliability of remedy	None	Moderate to High	High (Permanent)
Estimated time for design and construction	Immediate	Short. Requires development of LUCMP.	Short (within 1 year). Requires development of a work plan.
Estimated time to reach remediation goals	Indefinite	Indefinite	Immediate upon completion of removal action.
Estimated annual O&M cost	$0	$24,891 (every 5 years)	$0
Discount rate	5%	5%	5%
Number of years over which cost is projected	0	30	0
Use of presumptive remedies and/or innovative technologies	None	None	Non-time-critical removal action
Quantity of untreated waste and treatment residuals to be disposed of off-site and the degree of hazard remaining in such material	None	None	Approximately 780 lcy of aluminum-, chromium-, and vanadium-impacted subsurface soil with relatively low degree of hazard. Following characterization of waste, soil may be stabilized to meet requirements of the disposal facility.
Estimated capital cost	$0	$24,891	$290,900
Estimated total present worth	$0	$94,200	$290,900

Notes:
lcy – loose cubic yard
LUCMP – Land Use Controls Management Plan
O&M – Operations and Management

Table 2-17
Expected Outcome of Each Alternative for Site 35.

	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Soil Removal
Available uses of land upon achieving cleanup levels	Land would remain available for non-residential/undeveloped use.	Land would remain available for non-residential/undeveloped use.	Land would be available for unlimited and unrestricted use, including residential.
Time frame to achieve available land use	Land is already appropriate for non-residential/undeveloped use.	Land is already appropriate for non-residential/undeveloped use.	Land would be available for unrestricted use immediately upon completion of the removal action.
Available uses of groundwater upon achieving cleanup levels	Groundwater is unaffected by contaminants on site and use of groundwater would remain unchanged.	Groundwater is unaffected by contaminants on site and use of groundwater would remain unchanged.	Groundwater is unaffected by contaminants on site and use of groundwater would remain unchanged.
Time frame to achieve available groundwater use	NA	NA	NA
Other impacts or benefits associated with alternative	No mitigation of onsite contaminants or reduction in site exposure risks.	Exposures to residential receptors would be eliminated by prohibiting residential development on or adjacent to the site. No mitigation of onsite contaminants.	All exposure risks would be eliminated by removing contaminated soils from the site, resulting in unlimited and unrestricted access.

Notes:
NA = not applicable

Table 2-18
Cost Estimate for Institutional Controls Protective of Residential Receptors, Site 35, Andersen AFB, Guam.

Item	Reference	Quantity	Unit	Rate ($)	Year 1 Capital Costs ($)	Present Worth ($) at 5% for 30 years (rounded)
Long Term Cost. Site Periodic Review (shared costs for IRP Sites with ICs)						
List of Assumptions:						
Periodic Site Review & Public Education will be coordinated with Five-year ROD Review.						
Events will be performed at year 5, year 10, year 15, year 20, year 25, and year 30.						
Cost model assumes Periodic Site Review & Public Education costs shared with multiple IRP sites.						
Includes fact sheets.						
Cost model assumes Public Education costs shared with multiple IRP sites.						
Labor and Other ODC	**Rates**	**Hours**	**Labor Cost**	**Per Diem and Other ODCs**	**Total Labor and ODCs**	
Geologist-SR	$130	40	$5,200	$0	$5,200	
Engineer-SR	$135	40	$5,400	$500	$5,900	
Toxicologist-SR	$120	24	$2,880	$300	$3,180	
Geologist-MID	$80	24	$1,920	$300	$2,220	
CADD/GIS Operator-MID	$60	40	$2,400	$500	$2,900	
Other Direct Cost (ODC)					$5,491	
CADD/GIS Equipment				$600	$600	
Car Rental, airfare, travel & fuel				$500	$500	
Posting Signs (O&M)		1	event	$2,000	$2,000	
Press Release		1	event	$500	$500	
Cell Phone/Communications				$224	$224	
Copies, Postage, FedEx				$300	$300	
Guam Tax on Labor			$504		$504	
14.5% Markup on ODCs				$830	$830	
Guam Tax on ODCs				$33	$33	
TOTAL Site Periodic Review (shared by multiple sites with ICs)					**$24,891**	**$94,200**
					TOTAL Cost	**$94,200**
Notes:						
O&M = Operation & Maintenance; ODC = other direct costs; IC = Institutional Control						

Table 2-19
Description of ARARs and TBCs for the Selected Remedy for Site 35.

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
No chemical-specific ARARs or TBCs were identified.					
Location-Specific					
Federal Regulatory Requirement	Endangered Species and Habitats	Endangered Species Act, 16 USC 1531 and 50 CFR 200, 402	Relevant and Appropriate	Promotes actions to conserve endangered or threatened species or critical habitat.	The selected remedy will comply with this requirement by ensuring that signage is emplaced in such a way that does not impact nearby endangered species or their habitat. Listed species have not been observed on the site.
Territorial Regulatory Requirement	Endangered Species and Habitats	Endangered Species Act of Guam, 5 GCA, Chapter 63, Article 2	Relevant and Appropriate	Promotes actions to conserve endangered or threatened species or critical habitat.	The selected remedy will comply with this requirement by ensuring that signage is emplaced in such a way that does not impact nearby endangered species or their habitat. Listed species have not been observed on the site.
Federal Regulatory Requirement	Historical Objects and Sites	National Historic Preservation Act 16 USC Section 470; Archaeological and Historic Preservation Act 16 USC Section 469	Applicable	Provides for the historic preservation, restoration, and presentation of historic objects and sites.	The selected remedy will comply with this requirement by installing signage in such a way that avoids impacts to any historical objects at the sites.
No action-specific ARARs or TBCs were identified.					

Notes:
ARAR – Applicable or relevant and appropriate requirement
CFR – Code of Federal Regulation
GCA – Guam Code Annotated
PRG – Preliminary Remediation Goal
RG – Remedial Goal
USC – United States Code

PHOTOGRAPHS

Photo 2-1. Metallic debris in the southwestern portion of Site 29, Andersen AFB, Guam.

Photo 2-2. Asphalt debris in the southwestern portion of Site 29, Andersen AFB, Guam.

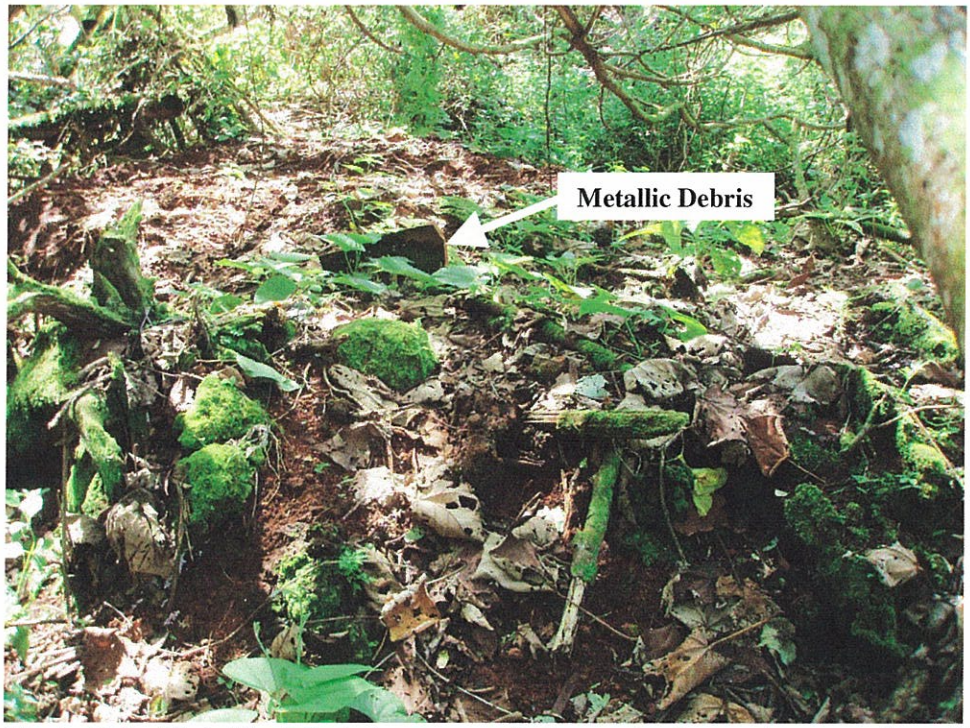

Photo 2-3. Metallic debris in a mounded area in the eastern portion of Site 29, Andersen AFB, Guam.

Photo 2-4. Metallic debris in the northwestern portion of Site 35, Andersen AFB, Guam.

Photo 2-5. Metallic debris in the southeastern portion of Site 35, Andersen AFB, Guam.

Photo 2-6. Close-up of metallic debris and ground surface in the southeastern portion of Site 35, Andersen AFB, Guam.

APPENDIX A

FEDERAL FACILITY AGREEMENT CHANGE LETTERS

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 36TH WING (PACAF)
UNIT 14007, APO AP 96543-4007

06 November 2009

36 CES/CEVR
Unit 14007
APO AP 96543-4007

Mr. Mark Ripperda
Project Manager
U.S. Environmental Protection Agency
75 Hawthorne St., H-9-4
San Francisco, CA 94105-3901

Dear Mr. Ripperda

This letter provides notice of a change in administrative responsibility pursuant to paragraph 28 of Federal Facility Agreement (FFA) Docket Number 93-117 (FFA).

As you are aware, Andersen Air Force Base is in the process of realigning installation management functions to a newly established Joint Region Marianas pursuant to the 2005 Defense Base Closure and Realignment Commission Final and Approved Recommendations. Title to Andersen Air Force Base real property will remain in the United States and the property will continue to be utilized by the Air Force. As of October 1, 2009, however, administrative custody and responsibility for managing real property assets will transfer from the Air Force to the Navy. The Air Force will become a supported component of the Joint Region Marianas and the Navy will become the supporting component.

In accordance with the April 2008 Department of Defense Environmental Supplemental Guidance for Implementing and Operating a Joint Base, the Navy, as the supporting component, *"will be responsible for all existing and future environmental permits, requirements, plans, and agreements at the installations to become the Joint Base."* (Ch. 1.1.2). As the supporting component, the Navy will be required to *"honor all existing, previously negotiated Federal Facility Agreements in place at the installations to become the Joint Base at the time of transfer."* (Ch. 2.17.5). The Navy is being supplied with an Environmental Condition of Property Report and with access to current environmental files including the FFA. No change to the FFA will be necessary in order for the Navy to assume responsibility for implementation of the FFA and the transfer of responsibility will not change the rights of the parties under the FFA or impede any action under the FFA. The Environmental staff will remain located at Andersen Air Force Base following 01 October 2009 and will be available to assist with any issues related to the FFA. However, the civilian environmental staff will become Navy employees and, likewise, funding responsibility will reside with the Navy.

Please contact Mr. Russell Littlejohn, Environmental Flight Chief, at (671) 366-2556 if you have any questions or concerns or would like to discuss possible changes/addendums to the FFA to further document the substitution of the United States Navy for the United States Air Force as the entity responsible for implementation of the FFA.

Sincerely

GREGG IKEHARA
Chief, Installation Restoration Program

cc:
Ms. Lorilee Crisostomo, GEPA
Mr. Rich Howard, Tech Law Inc.

DEPARTMENT OF THE NAVY
COMMANDER, JOINT REGION MARIANAS
PSC 455, BOX 152
FPO AP 96540-1000

IN REPLY REFER TO
9510
Ser J4/1235
November 23, 2009

Mr. Mark Ripperda
US Environmental Protection Agency
75 Hawthorne St. H-9-4
San Francisco, CA 94105-3901

Dear Mr. Ripperda,

SUBJECT: NOTIFICATION OF TRANSFER OF ENVIRONMENTAL RESTORATION PROGRAM RESPONSIBILITY

This letter serves as notification that all Environmental Restoration Program responsibilities for Andersen Air Force Base (AAFB), a property listed on the National Priorities List, will be officially transferred to the United States Navy under the Commander, Joint Region Marianas (CJRM), effective October 1, 2009, pursuant to chapter 2.17 of the April 2008 Department of Defense Environmental Supplemental Guidance (EVSG) for Implementing and Operating a Joint Base. This action is being taken to implement the 2005 Defense Base Realignment and Closure (BRAC) Act which requires the transfer of all installation support functions and administrative custody of real property from AAFB to the U.S. Navy.

In accordance with the EVSG, the Navy, as the supporting component, "will assume responsibility for environmental restoration data reporting, budgeting, record keeping, and financial liability" (Ch. 2.17.6), "will assume responsibility for all Restoration Advisory Boards" (Ch. 2.17.8), and will be required to "honor all existing, previously negotiated Federal Facility Agreements in place at the installations to become the Joint Base [Region] at the time of transfer." (Ch. 2.17.5).

If you have any questions, please contact Mr. Richard Raines, P.E., at telephone (671) 339-8420 or at richard.raines@fe.navy.mil.

Sincerely,

Peter S. Lynch

P. S. LYNCH
Captain, CEC, U.S. NAVY
Regional Engineer
By direction of the Commander

Copy to:
Guam Environmental Protection Agency
CNIC (N45)
NAVFAC Pacific (EV)
36CES

APPENDIX B

LAND USE CONTROLS FOR SITE 35

APPENDIX B. LAND USE CONTROLS (LUCs) FOR SITE 35

In support of the remedy selected in the Record of Decision (ROD) for Site 35, the United States Navy (USN) will implement the following actions to ensure that current and future land use activities remain compatible with the land use restrictions that are imposed by the ROD, and that they remain protective of human health and the environment. The following table provides a summary of the following: (1) site risks relevant to the selected remedy, (2) a description of the property including current and anticipated future property ownership, land use, and restrictions, (3) a description of on-site structures, (4) a description of LUC objectives, (5) a list of the institutional controls and other specific measures that are required to implement LUCs consistent with the selected remedy, (6) monitoring and reporting requirements, and (7) specific corrective actions to address non-compliant LUC events.

Risk Summary: There are no unacceptable risks to ecological receptors.
There are no unacceptable cancer or non-cancer risks to human health associated with exposure to surface soil. There are no unacceptable cancer risks associated with exposure to subsurface soil. Unacceptable non-cancer risks associated with exposure to subsurface soil were identified for resident children. No unacceptable non-cancer risks were identified for resident adults or construction workers exposed to subsurface soil.

Hazardous Substances: Aluminum, chromium, and vanadium in subsurface soil.

Selected Remedy: Institutional Controls (ICs), also known as Land Use Controls (LUCs).

Purpose of LUCs: Control direct exposure of future residents to contaminated subsurface soil within the site. The selected remedy does not include the removal of contaminated soil from the site. The selected remedy will result in contaminated subsurface soil remaining on site at concentrations that could pose potential unacceptable risks to future resident children. Institutional controls shall be required to control direct exposure to the contaminated subsurface soil and to eliminate unacceptable exposure pathways. The area designated for LUCs at Site 35 is presented in Figure B-1.

Property Ownership: The site is owned by the USN and is located within the Main Base portion of Andersen AFB, Guam.

Site Constraints: The site is located adjacent to the Base Sanitary Landfill and site access is limited to personnel with access to the Base. There is no fencing to restrict access to the site; however, there are no human health risks to current users of the site (industrial workers and construction workers). The LUCs will include prohibiting development of the site for residential use. The LUCs will be implemented through amendments to the BGP that will effectively act as deed restrictions. The BGP amendments will be completed within sixty (60) days of ROD approval. The USN will amend the BGP with one of the following sections: (1) a new section entitled "Prohibited and Permitted Uses at Environmental Restoration Sites" or (2) text to an existing section of the BGP that

addresses LUC restrictions at Andersen AFB. The USN will utilize its BGP as an administrative LUC to prevent uses that are inconsistent with the approved ROD.

Area Subject to Controls: Approximately seven acres. The area defining the "restricted" LUC areas will be posted with appropriate signage.

Current On-site Structures/Facilities: None.

Future Land Use Restrictions: The designated LUC area is prohibited from residential development as long as the site conditions are not suitable for unrestricted use and unlimited exposure. In addition, disturbance of soil within the designated LUC area is prohibited.

LUCs

The following are the LUC performance objectives for Site 35:

- Implement all LUCs.
- Prevent future residential exposures to aluminum, chromium, and vanadium in subsurface soil at concentrations greater than the RGs (173,500 mg/kg, 1,080 mg/kg, and 206 mg/kg, respectively).
- Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds.
- Limit and control any future excavation activities at the site (e.g., worker requirements, soil management, waste disposal).

The following are LUCs for Site 35:

- In the Base General Plan, identify the designated LUC area as prohibited from development and use for residential housing, elementary and secondary schools, child care facilities and playgrounds.
- Require Dig and Construction Permits prior to intrusive activities within the LUC area.

The LUCs will be enforced through the Land Use Control Management Plan (LUCMP) process. The LUCMP defines the institutional controls and other specific measures that are required to implement LUCs consistent with the selected remedy at each IRP Site.

Management of LUCs

Prepare and Maintain a LUCMP: The LUCMP shall serve as the operational "road map" for defining, implementing, and reporting on LUCs at Site 35. The USN is responsible for implementing, maintaining, reporting on, and enforcing the LUCs established in approved decision documents for IRP sites within Andersen AFB. The USN is responsible for maintaining the LUCMP to assure that activities within the designated

LUC area are in accordance with the remedies selected in the approved ROD and other pertinent decision documents.

The LUCMP includes protocols or a "process" for: (1) daily management of the LUCMP process; (2) annual inspections of Site 35 to ensure compliance with the LUCs; (3) specifications for annual LUC-compliance reporting requirements; (4) property lease or transfer (note: currently, there are no plans for property lease or transfer); (5) LUC modification or termination; and (6) notification process and relevant corrective actions for LUC non-compliant events.

Any activity that is inconsistent with the IC objectives or use restrictions, or any other action that may interfere with the effectiveness of the ICs will be addressed by the USN as soon as practicable, but in no case will the process be initiated later than 15 days after the USN becomes aware of the breach.

The USN will notify USEPA and Guam EPA as soon as practicable but no longer than ten days after discovery of any activity that is inconsistent with the IC objectives or use restrictions, or any other action that may interfere with the effectiveness of the ICs. The USN will notify USEPA and Guam EPA regarding how the USN has addressed or will address the breach within 10 days of sending USEPA and Guam EPA notification of the breach.

The USN shall notify USEPA and Guam EPA 45 days in advance of any proposed land use changes that are inconsistent with the land use control objectives or the selected remedy.

The LUCMP will be reviewed annually to assure that land use restrictions and controls are maintained as per the remedy selected in the ROD. The annual LUCMP monitoring reports will summarize (1) inspection activities performed in the prior year; (2) deficiencies or inconsistencies in maintaining the LUCs; (3) corrective actions taken; and (4) effectiveness of the corrective actions. The annual LUCMP monitoring reports will be used in preparation of the 5-year review to evaluate the effectiveness of the remedy.

Land Use Controls will be maintained until the concentration of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

The office on Andersen AFB responsible for implementing these actions is the 36th Civil Engineer Squadron (CES) Environmental Restoration Office (36 CES/CEVR).

Lease or Transfer of Property: Site 35 is located on the Main Base, and there are no current plans for the USN to lease or transfer the property. Although the USN may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the USN shall retain ultimate responsibility for remedy integrity.

The USN will provide notice to USEPA and Guam EPA at least six (6) months prior to any transfer or sale of Site 35 so that USEPA and Guam EPA can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective ICs. If it is not possible for the facility to notify USEPA and Guam EPA at least six months prior to any transfer or sale, then the facility will notify USEPA and Guam EPA as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to ICs. In addition to the land transfer notice and discussion provisions above, the USN further agrees to provide USEPA and Guam EPA with similar notice, within the same time frames, as to federal-to-federal transfer of property. The USN shall provide a copy of executed deed or transfer assembly to EPA and Guam EPA.

The office on Andersen AFB responsible for implementing these actions is the 36th CES Real Property Office (36 CES/CERR).

Dig and Construction Permits: No intrusive activities shall occur within the designated LUC area without prior approval of the USN. If intrusive activities are conducted within the designated LUC area, the work would require an approved health and safety plan and procedures for the proper handling and disposal of displaced wastes and/or soils. Dig and construction permits shall be maintained in the LUCMP for Site 35. This requirement shall be subject to an annual review (see above section for reporting requirements) and will remain in effect as long as hazardous substances in subsurface soil remain at concentrations that prevent unrestricted use and unlimited exposure.

The office on Andersen AFB responsible for implementing these actions is the 36th CES Customer Service (36 CES/CEOQC).

Base General Plan: The BGP will be amended within sixty (60) days of ROD approval to identify the designated LUC area as prohibited from further residential development as long as the site conditions are not suitable for unrestricted use and unlimited exposure. AFI 32-7062 (*Air Force Comprehensive Planning*) requires that installations develop and maintain a BGP as a central repository for information deemed essential for planning and managing the installation's physical assets, including environmental planning constraints such the LUCs. AFI 32-1021 (*Planning and Programming Military Construction Projects*) requires installations to comply with their BGP to ensure that there are no conflicts with land-use constraints stemming from the LUCs of the ERP that would impact facility planning and construction. Any requests for invasive activities (i.e., utility or construction work) through excavation permits, such as AF Form 103, or the construction review process, as per AFI 32-1001 (*Operations Management*), will be denied, unless the procedures for proposed land use changes described in the approved ROD, and amended to the BGP, are followed. The LUCs amended to the BGP will be monitored, maintained, enforced, and reported on through existing land-use management programs, such as the BCE Work Clearance Form (AF Form 103) (*Digging Permit*) and the construction review process (AFI 32-1001). The USN shall notify USEPA and Guam EPA in writing in advance of any changes to the internal procedures that would affect the LUCs.

The USN shall not modify or terminate Land Use Controls, implementation actions, or modify land use without approval by USEPA and the Guam EPA. The USN shall seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

This requirement shall be reviewed as part of the regular 5-year ROD review (2013) and remain in effect as long as hazardous substances in subsurface soil remain at concentrations that prevent unrestricted use and unlimited exposure.

The office on Andersen AFB responsible for implementing these actions is the 36th CES Engineering Flight (36 CES/CEC) and the GeoBase section within 36 CES/CEC (36 CES/CECB).

Monitoring and Reporting: Monitoring of the environmental use restrictions and controls will be conducted annually by the USN. The monitoring results will be included in a separate report or as a section of another environmental report, if appropriate, and provided to the USEPA and the Guam EPA. The annual monitoring reports will be used in preparation of the Five Year Review to evaluate the effectiveness of the remedy.

The annual monitoring report, submitted to the regulatory agencies by the USN, will evaluate the status of the ICs and how any IC deficiencies or inconsistent uses have been addressed. The annual evaluation will address whether the use restrictions and controls referenced above were communicated in the deed(s), whether the owners and state and local agencies were notified of the use restrictions and controls affecting the property, and whether use of the property has conformed with such restrictions and controls.

The office on Andersen AFB responsible for implementing these actions is the 36th CES Environmental Restoration Office (36 CES/CEVR).

Post Signage: Signs will be posted around the perimeter of the site and will meet the following requirements:

- Lettering shall be legible from a distance of at least 25 feet.
- Signs shall contain contact information for USAF personnel for long-term oversight.
- Signs shall be visible from surrounding areas and at potential routes of entry.
- The warning signs shall contain language similar to the following:

WARNING
Subsurface Soil Contains Potentially Hazardous Substances
Digging or Excavating is Prohibited
Contact Environmental Management at
(671) 366-0000, Ext 4692

These requirements shall be fulfilled as soon as practical, and shall be monitored annually as part of the O&M activities.

Operation and Maintenance: Warning signs shall be posted by the LUC restricted area to prevent intrusive activities without USN approval. Annual site inspections shall be conducted to: (1) confirm that signage is intact; (4) determine that no unapproved structures have been constructed or intrusive activities have been performed; and (5) ensure that the LUCMP is properly maintained and all activities relevant to the designated LUC area (i.e., proper documentation of digging permits, etc.) are properly documented. The USN will be responsible for summarizing the findings of the previous calendar year in an annual LUC Compliance Summary Report. The LUCs shall remain in effect as long as hazardous substances in subsurface soil remain at concentrations that prevent unrestricted use and unlimited exposure.

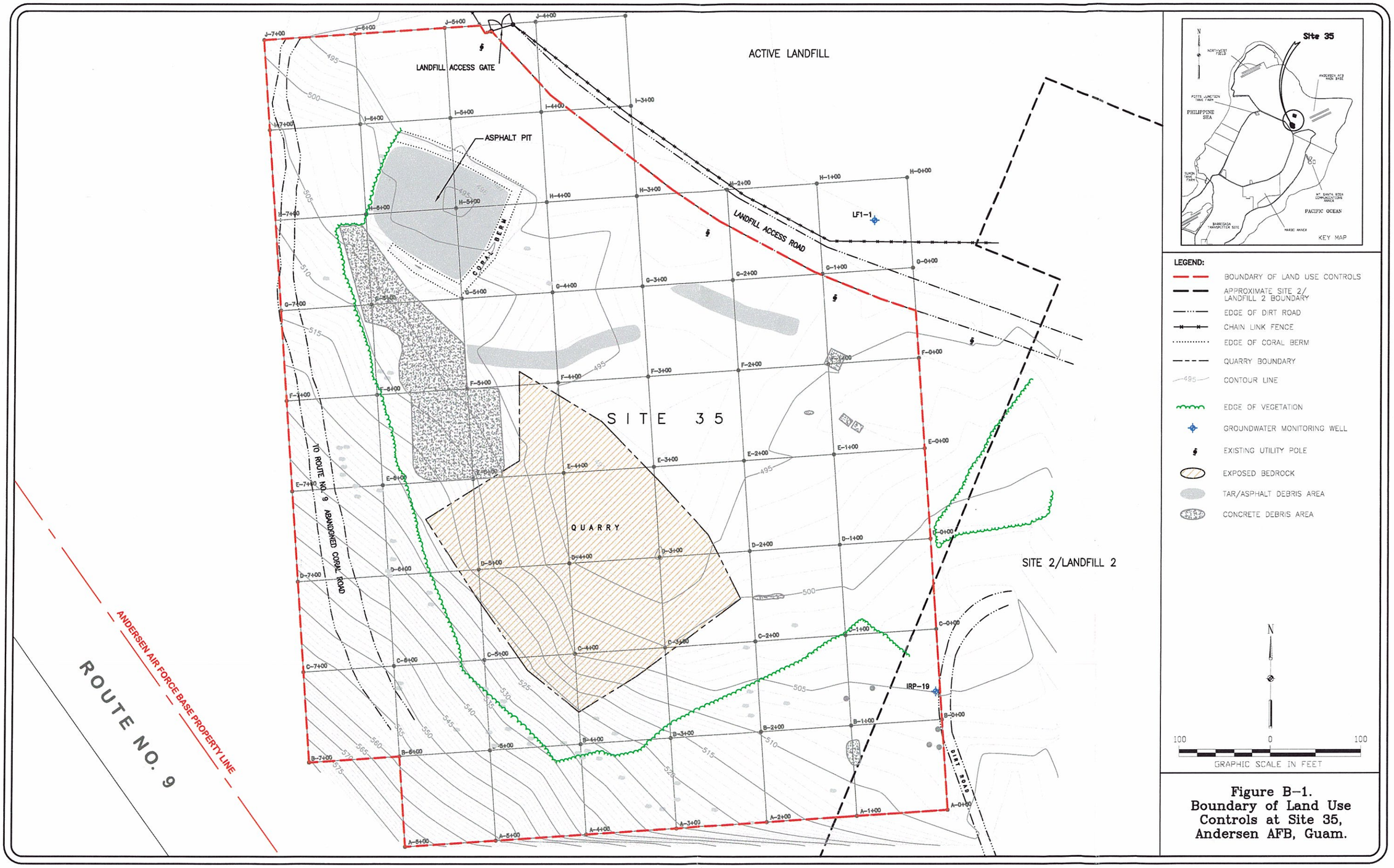

Figure B-1.
Boundary of Land Use Controls at Site 35, Andersen AFB, Guam.

APPENDIX C

NOTICE OF PUBLIC MEETING AND DOCUMENT AVAILABILITY

ANDERSEN AIR FORCE BASE
INSTALLATION RESTORATION PROGRAM

Public Meeting
May 27, 2009 at 6:30 p.m.
Guam Marriott Resort & Spa, The View
627B Pale San Vitores Rd., Tumon, Guam 96913

The Andersen Air Force Base Installation Restoration Program will hold a public meeting on May 27, 2009 to discuss the Proposed Plan for the remedial alternatives for Sites 29 and 35 of the Main Base Operable Unit.

The Proposed Plan discusses the potential risks posed by the sites and presents an evaluation of remedial alternatives. The preferred remedies presented in the plan include institutional controls at Site 35 and no action at Site 29. Soil removal was also considered as a potential remedy during the evaluation process. The final remedy will be selected after public comments are received.

The Proposed Plan and supporting documents are available for public review at the following locations

University of Guam (UOG)
Government Documents Department
Robert F. Kennedy Library, UOG Station
Mangilao, Guam 96923
(671) 735-2316 or -2315
Hours: Monday - Thursday
8:00 a.m. - 5:00 p.m.
Friday 9:00 a.m. - 5:00 p.m.
Contact: Walfrid Benavente

Nieves M. Flores Memorial Library
254 Martyr Street
Hagåtña, Guam 96910
(671) 475-4751, -4752, -4753, or -4754
Hours: Monday - Thursday
8:00 a.m. - 6:00 p.m.
Friday 1:00 p.m. - 5:00 p.m.
Saturday 8:00 a.m. - 5:00 p.m.
Contact: Teresita Kennimer

The 30-day public comment period will end on June 17, 2009. Written comments must be postmarked on or before June 17, 2009. For further information or to submit written comments, please contact the Remedial Project Manager:

Mr. Gregg Ikehara
Andersen AFB
36 CEV/CEVR, Unit 14007
APO AP 96543-4007
(671) 366-4692

ANDERSEN AIR FORCE BASE
INSTALLATION RESTORATION PROGRAM

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Mr. Gregg Ikehara
Andersen AFB
36 CEV/CEVR, Unit 14007
APO AP 96543-4007
(671) 366-4692

guampdn.com Pacific Daily News, Tuesday, May 26, 2009

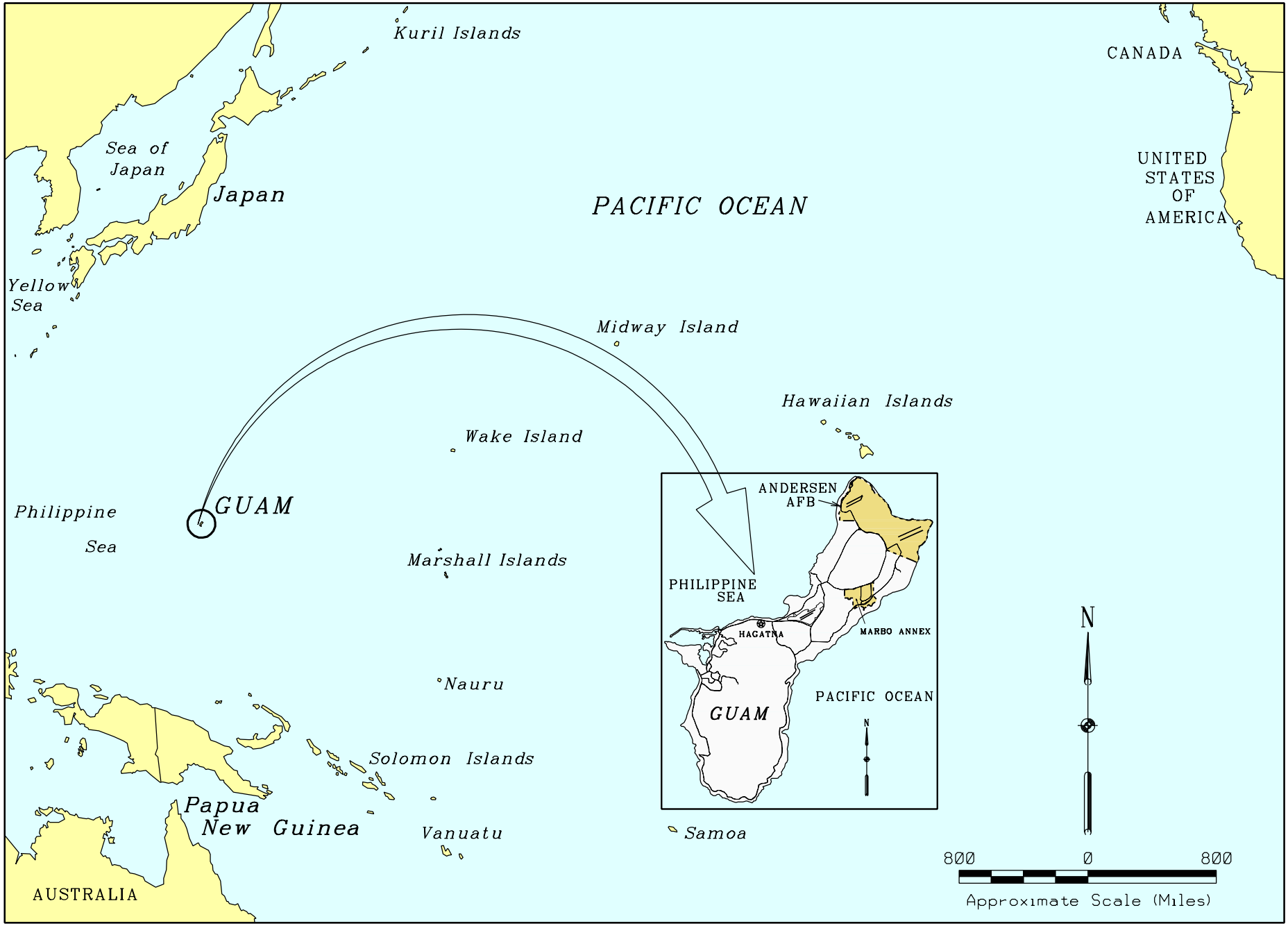
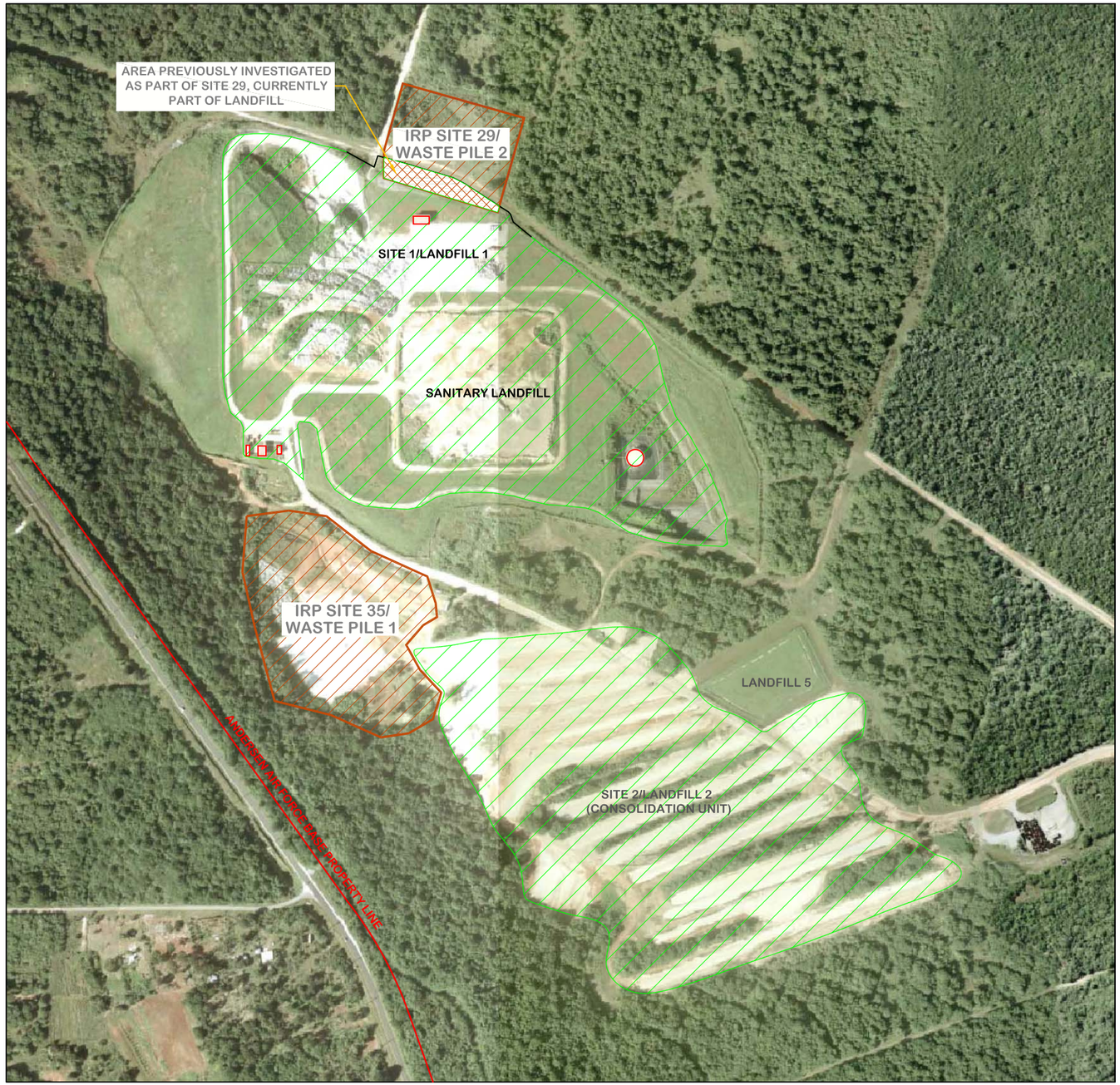
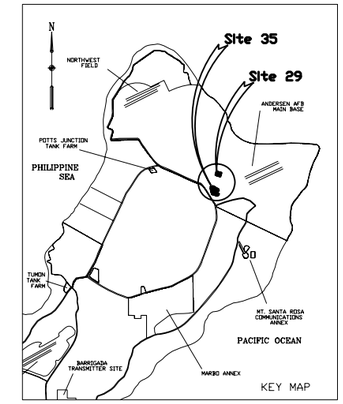


Figure 1-1. Location Map of Guam.

Figure 1–2. Location Map of Andersen Air Force Base on Guam.





LEGEND:

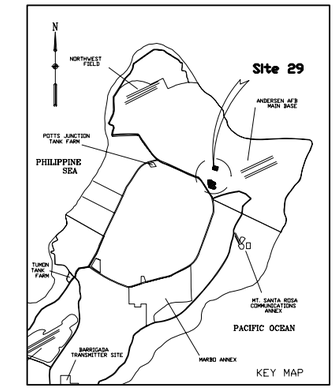
- AIR FORCE PROPERTY LINE
- SITE BOUNDARY
- LANDFILL/CONSOLIDATION UNIT BOUNDARY

N

450 0 450

GRAPHIC SCALE IN FEET

Figure 2−1.
Location of Site 29 and Site 35, Andersen AFB, Guam.



LEGEND:

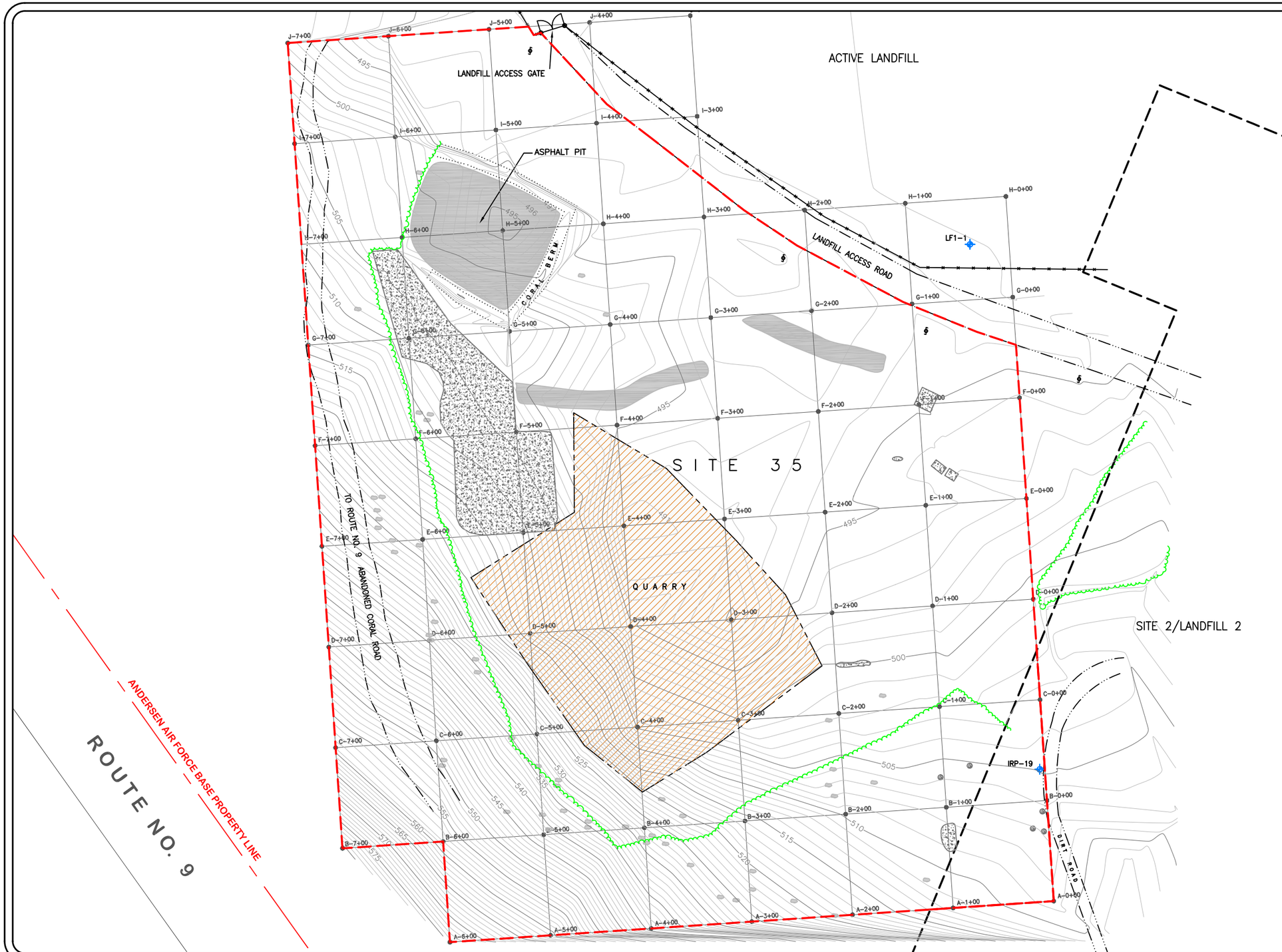
- APPROXIMATE SITE BOUNDARY
- EDGE OF DIRT ROAD
- CHAIN LINK FENCE (LANDFILL BOUNDARY)
- EDGE OF GREEN WASTE/BRUSH PILE
- EDGE ASPHALT PAVEMENT
- 486 CONTOUR LINE
- EDGE OF VEGETATION
- GROUNDWATER MONITORING WELL
- BOREHOLE LOCATION
- GREEN WASTE PILE
- ASPHALT PAVEMENT
- TAR/ASPHALT DEBRIS AREA
- FORMER ASPHALT TRENCH LOCATION
- SHALLOW TRENCH

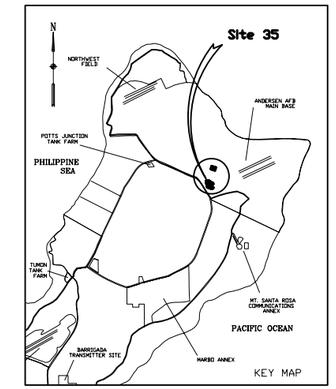
N

80 0 80

GRAPHIC SCALE IN FEET

Figure 2–2.
Topographic Survey
at Site 29,
Andersen AFB, Guam.





LEGEND:

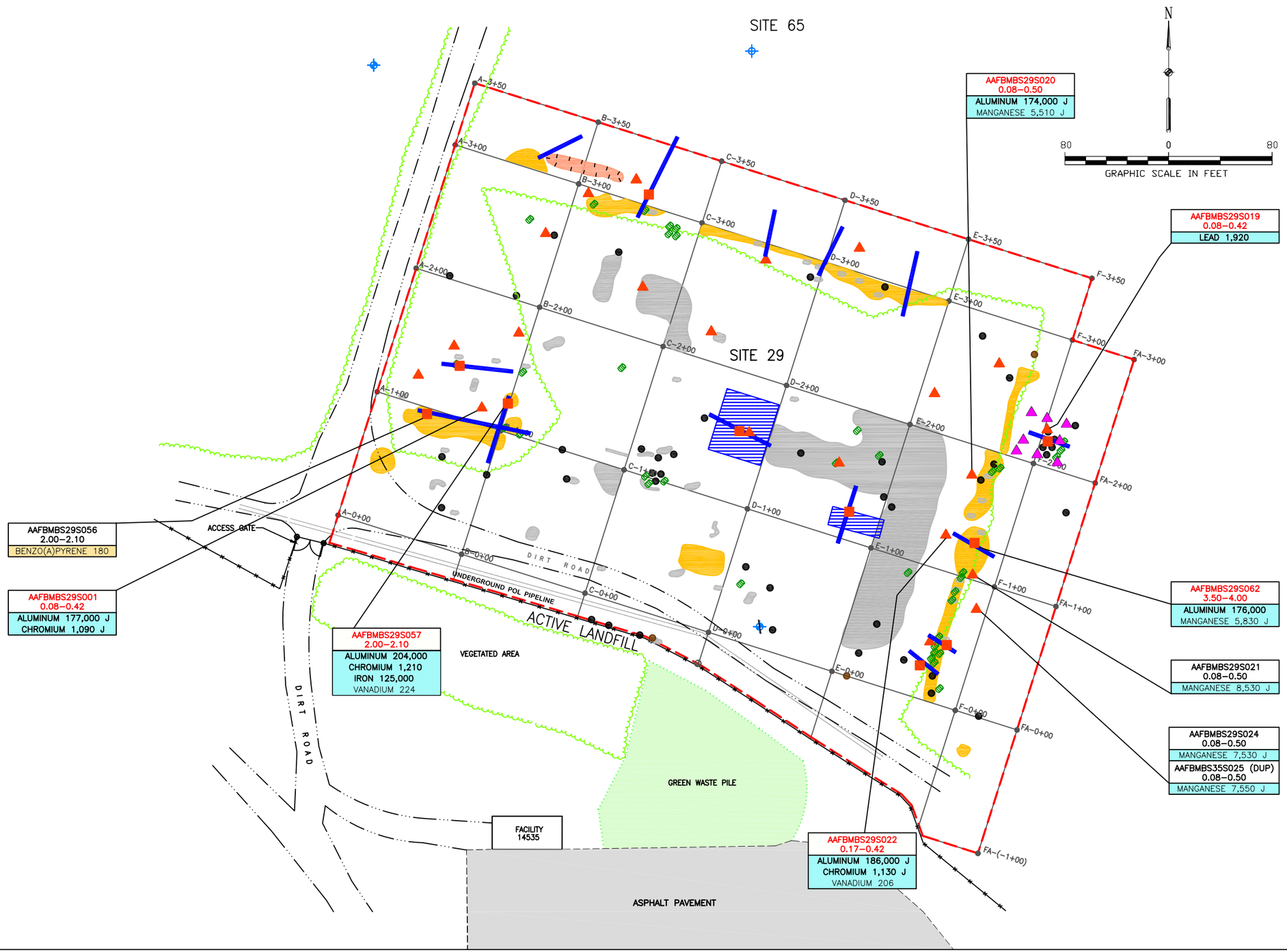
- APPROXIMATE SITE BOUNDARY
- APPROXIMATE SITE 2/ LANDFILL 2 BOUNDARY
- EDGE OF DIRT ROAD
- CHAIN LINK FENCE
- EDGE OF CORAL BERM
- QUARRY BOUNDARY
- 495 CONTOUR LINE
- EDGE OF VEGETATION
- GROUNDWATER MONITORING WELL
- EXISTING UTILITY POLE
- EXPOSED BEDROCK
- TAR/ASPHALT DEBRIS AREA
- CONCRETE DEBRIS AREA

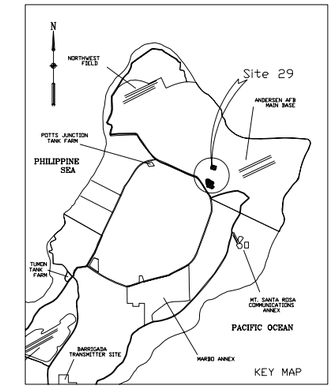
N

100 0 100

GRAPHIC SCALE IN FEET

Figure 2-3.
Topographic Survey at Site 35, Andersen AFB, Guam.





LEGEND:

- (SEPTEMBER 2006) DELINEATION SURFACE SOIL SAMPLE LOCATION
- (JUNE 2006) SURFACE SOIL SAMPLE LOCATION
- (JULY 2006) SUBSURFACE SOIL SAMPLE LOCATION
- EXPLORATORY TRENCH
- APPROXIMATE SITE BOUNDARY
- EDGE OF DIRT ROAD
- EDGE OF ASPHALT PAVEMENT
- CHAIN LINK FENCE (LANDFILL BOUNDARY)
- EDGE OF GREEN WASTE PILE/BRUSH PILE
- EDGE OF VEGETATION
- GROUNDWATER MONITORING WELL
- BOREHOLE LOCATION
- WOODEN UTILITY POLES ON THE GROUND
- METAL WASTE/DEBRIS
- DETERIORATED 55 GALLON DRUM OR SUSPECTED DRUM REMNANTS
- ASPHALT PAVEMENT
- GREEN WASTE PILE
- MOUNDED AREA
- TAR/ASPHALT DEBRIS AREA
- FORMER ASPHALT TRENCH LOCATION
- SHALLOW TRENCH

SAMPLE LOCATIONS IN RED EXCEED INDUSTRIAL PRGs AND/OR BTVs

AAFBMBS29S062 — SAMPLE ID
3.50–4.00 — SAMPLE DEPTH IN FEET
BENZO(A)PYRENE 180 — SVOCs/PAHs, UG/KG
ALUMINUM 176,000 — INORGANICS, MG/KG
MANGANESE 5,830 J

BOLDED VALUES EXCEED BTVs AND/OR INDUSTRIAL PRGs

NON–BOLDED VALUES EXCEED BTVs AND/OR RESIDENTIAL PRGs

BAL–BELOW ACTION LEVEL

ND–NOT DETECTED

J–CONCENTRATION VALUE IS ESTIMATED

Figure 2–4.
Surface and Subsurface Soil Sample Locations and Results Above BTVs at Site 29, Andersen AFB, Guam.

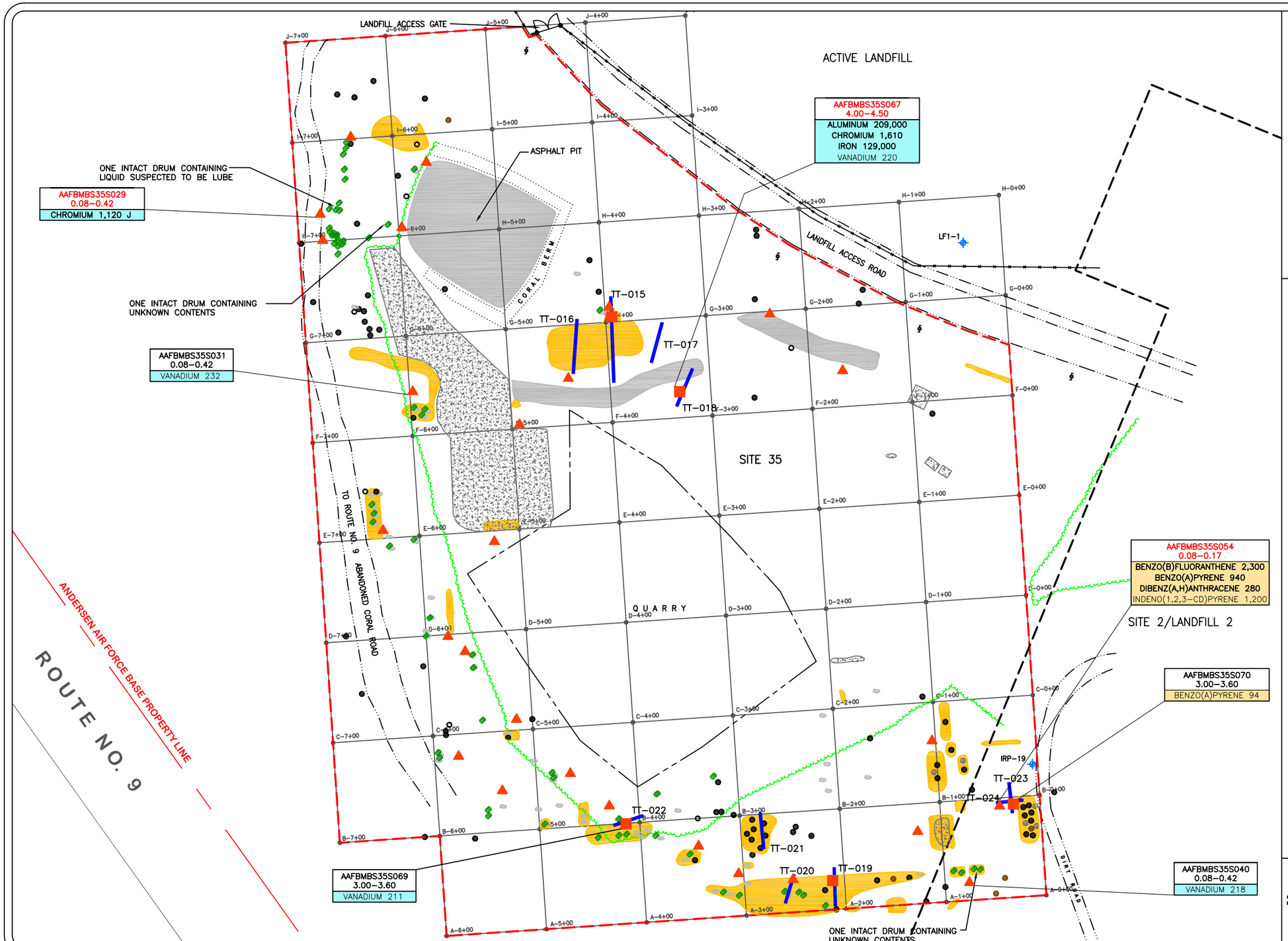


Figure 2–5.
Surface and Subsurface Soil Sample Locations and Results Above BTVs at Site 35, Andersen AFB, Guam.