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George Air Force Base, California

Installation Restoration Program

Prepared for
Air Force Center for Environmental Excellence
Brooks Air Force Base, Texas

Contract F41624-92-D-8038

Final
Operable Unit 3 Record of Decision

November 1998

MONTGOMERY WATSON

File:
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INSTALLATION RESTORATION PROGRAM

FINAL

RECORD OF DECISION
OPERABLE UNIT 3

GEORGE AIR FORCE BASE, CALIFORNIA

Prepared For:

U. S. Air Force Center for Environmental Excellence
Brooks Air Force Base

Contract No. F41624-92-D-8038
Delivery Order 004
Montgomery Watson Project No. 1212009.04090074

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November 1998

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ACRONYMS AND ABBREVIATIONS

AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CDWR	California Department of Water Resources
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
cfs	cubic feet per second
COPC	compound of potential concern
COPEC	compound of potential ecological concern
CRP	Community Relations Plan
DCA	dichloroethane
DCE	dichloroethene
DHS	Department of Health Services
DTSC	Department of Toxic Substances Control
EM	electromagnetic terrain conductivity
ET	evapotranspiration
FFA	Federal Facilities Agreement
FML	flexible membrane liner
FS	Feasibility Study
FSRA	Full Service Remedial Action
ft/day	feet per day
ft^2/day	square feet per day
ft/ft	feet per foot
GAC	granular activated carbon
GAFB	George Air Force Base
gpd	gallons per day
gpm	gallons per minute
GPR	ground penetrating radar
HVOC	halogenated volatile organic compound
IRP	Installation Restoration Program
IT	International Technologies Corporation
JMM	James M. Montgomery Consulting Engineers, Inc.
LRA	Local Reuse Agency
LSA	LSA Associates, Inc.
LUFT	Leaking Underground Fuel Tank
M&E	Metcalf & Eddy, Inc.
MAG	magnetometry
MAP	Management Action Plan
MCL	Maximum Contaminant Level
µg/kg	microgram per kilogram
µg/L	micrograms per liter
mg/kg	milligram per kilogram
mg/L	milligrams per liter

ACRONYMS AND ABBREVIATIONS
(Continued)

mph	miles per hour
msl	mean sea level
MWA	Mojave Water Agency
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEDA	Northeast Disposal Area
NFA	No Further Action
NPL	National Priorities List
O&M	operations and maintenance
ORC	Oxygen Release Compound
OU	Operable Unit
OVA	organic vapor analyzer
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
POL	petroleum, oil, and lubricant
ppm	parts per million
PRG	Preliminary Remediation Goal
RAB	Restoration Advisory Board
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RSA	Regional Statistical Area
RWQCB	Regional Water Quality Control Board
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act of 1986
SCIA	Southern California International Airport
SEDA	Southeast Disposal Area
STP	sewage treatment plant
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TBC	to-be-considered
TCA	trichloroethane
TCE	trichloroethene
TE	toxicity equivalent
TMV	toxicity, mobility, and volume
TPH	total petroleum hydrocarbons
TRC	Technical Review Committee
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank

ACRONYMS AND ABBREVIATIONS
(Continued)

UV	ultraviolet
VOC	volatile organic compound
VVEDA	Victor Valley Economic Development Agency
VVWRA	Victor Valley Wastewater Reclamation Authority
WPA	Work Plan Addendum
WQPS	Water Quality Protection Standards

TAB

Section 1

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

George Air Force Base
Operable Unit 3
San Bernardino County, California

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document, a Record of Decision (ROD), presents the selected remedies for Operable Unit (OU) 3 sites at George Air Force Base (GAFB), which were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for these sites and complies with 40 Code of Federal Regulations (CFR), Part 300. The format of this ROD is consistent with the guidance provided in the U.S. Environmental Protection Agency's (USEPA's) "A Guide to Developing Superfund Records of Decision" (USEPA, 1990).

OU 3 consists of 60 Installation Restoration Program (IRP) sites. Each of the OU 3 sites and any proposed remedies are listed on Table 1. These sites are distributed throughout the base and range in size from a few hundred square feet to over 90 acres. The purpose of this ROD is to set forth the remedial actions to be conducted to remediate OU 3 IRP sites that were presented in the OU 3 Feasibility Study (FS) Report (Montgomery Watson, 1997a) and to document the selection of no further action (NFA) as final closure for the remaining OU 3 IRP sites.

The sites addressed in the OU 3 FS are presented in this ROD in two groups: 1) landfill sites (DP-03, DP-04, LF-12, LF-14, LF-35, LF-44, and the Southeast Disposal Area [SEDA][the SEDA remediation boundary includes nine separate sites]) (referred to as "landfill sites" in this ROD); and 2) sites affected by total petroleum hydrocarbons (TPH) and/or volatile organic

compounds (VOCs) (WP-17, FT-19a, FT-19b, FT-19c, FT-20 [soil], OT-51, SS-59, and OT-69) (referred to as "TPH/VOC sites" in this ROD). The TCE detected in groundwater in monitoring wells in the vicinity of Site FT-20 (groundwater) is currently associated with the groundwater contamination at OU 2. Therefore, final decisions regarding potential actions at Site FT-20 (groundwater) will be determined in the OU 2 ROD. The remaining OU 3 sites are recommended for NFA (see Table 1).

The U.S. Air Force (USAF), USEPA Region IX, and the State of California concur with the selected remedies.

1.3 ASSESSMENT OF THE SITE

Actual or threatened releases of pollutants and contaminants from the landfill sites and TPH/VOC sites, if not addressed by implementing the remedial actions presented in this ROD, may present a risk to public health, welfare, or the environment. The remaining sites are recommended for NFA (see Table 1).

1.4 DESCRIPTION OF THE SELECTED REMEDIES

Based on remedial investigations and alternatives evaluated in the OU 3 FS (Montgomery Watson, 1997a), the USAF determined the final action for the 60 OU 3 IRP sites addressed in this ROD as summarized in Table 1. The determination of these final actions was achieved with the concurrence of the USEPA and the State of California. Section 2.0 provides further details describing the remedies for sites requiring action. Risk assessment and remedy selection considered reuse. As a result, selected remedies are compatible with intended property reuse. The selected remedy for the affected specific parcel will be reviewed with the local reuse agency, prior to a transfer, to ensure that it remains compatible with reuse.

1.5 STATUTORY DETERMINATIONS

The selected remedies (Table 1) are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial actions, and are cost-effective. The remedies utilize permanent solutions and alternative treatment technology to the maximum extent practicable for these sites. The remedies for the TPH/VOC sites satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, and volume (TMV) as a principal element. However, because treatment of the principal threats of the landfill sites was not found to be practicable, the remedies for the landfills do not satisfy the statutory preference for treatment as a principal element. A review of this ROD will be conducted every 5 years to ensure that the remedies continue to provide adequate protection of human health and the environment.

1.6 APPROVED

ALBERT F. LOWAS, JR
Director
Air Force Base Conversion Agency

16 September 1998
Date

Concurrence

DANIEL D. OPALSKI
Chief, Federal Facilities Cleanup ;Branch
Environmental Protection Agency
Region IX

10/5/98
Date

JOHN E. SCANDURA
Chief, Southern California Operations
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Department of Toxic Substances Control

9/30/98
Date

HAROLD SINGER
Executive Officer
California Regional Water Quality Control Board
Lahontan Region

Sep 29, 1998
Date

TAB

Section 2

2.0 DECISION SUMMARY

This decision summary provides a description of OU 3 including the regional setting, physiography, meteorology, demography and land use, hydrology, hydrogeology, and water use. This section also summarizes the problems posed by the conditions at OU 3, the remedial alternatives, and the rationale for the selection and how the selected remedy satisfies statutory requirements.

2.1 SITE NAME, LOCATION, AND DESCRIPTION

GAFB encompasses an area of approximately 5,347 acres and is located in San Bernardino County in the western Mojave Desert near the cities of Victorville and Adelanto, California. Victorville is located on Interstate 15, approximately 70 miles northeast of the City of Los Angeles, 35 miles north of San Bernardino, and 31 miles south of Barstow (Figure 1). In evaluating environmental conditions at GAFB, all identified sites have been combined into three OUs based on the type of waste present and the geographical location (Figure 2).

2.1.1 Description of Operable Units

OU 1 consists of three sites: (1) Site SD-25 (S-20), an Industrial/Storm Drain which in the past received industrial waste; (2) Site WP-26 (S-21), the former sewage treatment plant (STP) percolation ponds; and (3) the dissolved TCE plume detected in the groundwater beneath the northeast portion of the base and adjacent off-base areas. A ROD has been finalized for OU 1 (Montgomery Watson, 1994).

OU 2 consists of six sites: (1) Site SS-30, a free-phase JP-4 jet fuel plume identified beneath the Operational Apron; (2) Site ST-54, a pipeline leak near Building 708; (3) Site ST-57, Fuel Pit No. 1; (4) Site SS-58, the underground storage tank (UST) complex at Building 690; and (5) Site ST-67, the entire Liquid Fuel Distribution System, including five aboveground tanks, two major pipelines (8-inch and 10-inch), and all hydrants (Fuel Pits 1 through 7) and associated piping,

and (6) FT-20 (groundwater), TCE detected in the groundwater in the vicinity of the old sewage treatment plant percolation ponds.

OU 3 consists of the 60 remaining IRP sites located throughout GAFB. The OU 3 sites consist of a variety of potential contaminant source areas including landfills, other waste disposal and storage sites, fire training areas, spill sites, and leachfields. Table 1 presents a summary of all OU 3 IRP sites. These sites are distributed throughout the base and range in size from a few hundred square feet to over 90 acres. These sites have been designated as disposal pit (DP), fire training area (FT), landfill (LF), radiological waste (RW), spill site (SS), waste pit (WP), or "other" (OT). The remedial investigations and site characterizations for the OU 3 sites are detailed in the OU 3 Remedial Investigation (RI) Report (Montgomery Watson, 1996a). This ROD presents the final decision for closure of all OU 3 IRP sites.

The pesticide dieldrin has been detected in monitoring wells in the eastern portion of the base in the vicinity of the former residential housing area (i.e., monitoring wells NZ-63, NZ-64, and NZ-66) (Montgomery Watson, 1996a and 1997d). These detections are not currently associated with OU 3 and will be addressed as part of another OU; therefore, the are not addressed as part of this OU 3 ROD. The manner in which these detections are addressed is to be determined based on discussions between the Remedial Project Managers (RPMs) for the USEPA, the California Department of Toxic Substances Control (DTSC) (formerly the California Department of Health Services [DHS]), the Lahontan Regional Water Quality Control Board (RWQCB), and the USAF.

Based on the OU 3 remedial investigations, the "landfill sites" and the "TPH/VOC sites" were assessed for remedial actions as detailed in the OU 3 FS Report (Montgomery Watson, 1997a); the remaining sites were recommended for NFA. Table 1 lists all OU 3 sites and documents the sites for which NFA is recommended. The discussions that follow regarding OU 3 sites refer to the sites that require some form of remedial action (i.e., the landfill sites and TPH/VOC sites).

2.1.2 Physical Characteristics of OU 3

The 60 OU 3 IRP sites are located throughout GAFB. The area immediately surrounding the base is the Victor Valley portion of the Upper Mojave River Basin. The regional geomorphology, surface water hydrology, geology, hydrogeology, regional planning, and ecology of GAFB and the surrounding area are discussed in detail in the OU 3 RI Report (Montgomery Watson, 1996a) and are summarized below.

2.1.2.1 Regional Physiography. GAFB is located in the Mojave Desert physiographic province of California. Locally, the base lies within a wedge-shaped tectonic block in the south-central portion of the Mojave Desert, flanked by the Sierra Nevada Mountains to the northwest, the Radman and Cady Mountains to the northeast, the San Gabriel Mountains to the southwest, and the San Bernardino Mountains to the southeast (Figure 3). The local region is comprised predominantly of northward sloping alluvial fan deposits derived from the surrounding mountains, and recent deposits associated with the Mojave River. Regional elevations reach as high as 8,500 feet (near Crestline), where annual precipitation typically is more than 40 inches. In contrast, the terminus of the Mojave River at Soda Dry Lake (elevation 923 feet) south of Baker receives 3 inches of precipitation annually. Elevations in the vicinity of GAFB range from 2,650 feet at the northeast corner of the study area, to 2,920 feet at the southwest corner of the base, south of Air Base Road. The average elevation at GAFB is approximately 2,750 feet, with average slopes of approximately 2 to 4 percent to the northeast. The base is relatively flat except at the eastern edge, where the surface elevation drops approximately 200 feet to the Mojave River. The average elevation of the Mojave River flood plain immediately east of the base is approximately 2,580 feet (Montgomery Watson, 1996a).

The Mojave River flows along the east side of GAFB in a northwesterly direction. Communities within the Victor Valley area include the city of Adelanto, directly west and adjacent to GAFB, the city of Victorville directly southeast, and Oro Grande, Silver Lakes, Apple Valley, and Hesperia. The Victor Valley Wastewater Reclamation Authority (VVWRA) treatment plant is located approximately one-half mile north of the northern border of GAFB.

2.1.2.2 Meteorology. The climate in the GAFB area is typical of the high desert region of California and Nevada. The summers are hot and dry, with maximum daily temperatures often exceeding 100°F in July and August. Winters are cool and dry and nighttime temperatures often fall below freezing in December and January (SAIC, 1987). The annual average temperature is 62°F.

Based on Air Force records from 1942 to 1992, annual precipitation at GAFB ranges from 0.77 inch to 11.22 inches, with an average annual precipitation of 5.72 inches (Montgomery Watson, 1996a). Monthly precipitation typically ranges from 0.25 inch to 4.47 inches, with the period from January through March being the wettest. During storm events, daily precipitation may reach as much as 2.93 inches. Snowfall is infrequent, but may total a few inches per year and was recorded to be as high as 17 inches in 1974. The average annual potential evapotranspiration (ET) rate is about 83 inches (SAIC, 1987), far exceeding average annual precipitation.

Prevailing winds in the area of GAFB are from the south; however, the strongest gusts are typically from the west. Westerly gusts of 50 miles per hour (mph) or more usually occur in the spring. In the summer, strong southerlies blow over the San Bernardino Mountains (Cajon Pass) in the evenings. Northerly winds occur more frequently in the fall and winter months (SAIC, 1987).

2.1.2.3 Demography and Land Use. GAFB is located within Census Tract 91.02, and Regional Statistical Area (RSA) 32B of San Bernardino County (US Census Bureau). RSA 32B also includes the cities of Adelanto, Hesperia, and Victorville and the unincorporated communities of Phelan, Apple Valley, and Lucerne Valley. According to the closure documents for GAFB, the estimated combined GAFB military and civilian work force on base in mid-1992 was 3,725. However, because the base closure in December 1992, there no longer are permanent residents on base. The following are 1994 estimated populations of the surrounding cities and communities, according to their respective city offices or San Bernardino County (Montgomery Watson, 1996a):

Adelanto	13,000
Apple Valley	53,450

Hesperia	58,050
Lucerne Valley	10,000
Oro Grande	430
Phelan	15,000
Silver Lakes	3,000
Victorville	57,830
TOTAL	210,760

The Victor Valley area has experienced significant population growth in the past two decades. Between 1970 and 1980, the number of residents in RSA 32B increased approximately 70 percent (SAIC, 1987). Population growth in the area is projected to be approximately 5 percent annually until 2010 (USAF, 1992). The projected annual growth figures may be greater than 5 percent depending on the ultimate reuse of GAFB.

The major land use activities of the Victor Valley area include residential development, government and commercial services, cement manufacturing, railroad and highway transportation, localized agricultural activities along the Mojave River, and industrial mining in the outlying areas. The California Aqueduct carries water across the high desert approximately 5 miles south of the base and may impact long-term land use planning. A major fuels distribution pipeline parallels Air Base Road for half the length of the base, and a high-voltage transmission utility corridor crosses the southeast corner of the base.

GAFB was established during World War II and provided the foundation for a steady economic base for the Victorville, Adelanto, and Apple Valley areas. Until 1992, GAFB was the largest employer in the Victorville area. Residential and commercial development and growth of community services was, in large part, due to the presence of the base. Despite the recent base closure, the climate and recreational attractions within the region continue to contribute to the development of vacation and/or second homes as well as the expansion of retirement communities. Growth in the Victor Valley also has been impacted as increasing numbers of people move to the area seeking to avoid the congestion and high cost of living in the Los Angeles Basin.

The proposed action for reuse of GAFB is development of an international airport and a commercial, industrial, and business park development. The Local Reuse Agency (LRA) and the Victor Valley Economic Development Agency (VVEDA) has designated the airport as the Southern California International Airport (SCIA). There are currently light industry and commercial companies using the facilities. There are no current plans for residential development on former base property (CRSS Constructors, Inc., 1996). The above reuse was considered during the development of risk assessments and remedy selection. As a result, the selected remedies are compatible with reuse. The selected remedy for the affected specific parcel will be reviewed with the local reuse agency, prior to a transfer, to ensure that it remains compatible with reuse.

2.1.2.4 Hydrogeology. GAFB is located in the George Groundwater Sub-Basin which is a sub-basin of the Upper Mojave River Basin. The George Sub-Basin reportedly is a structural trough containing up to 3,000 feet of alluvial sediments in the deepest parts of the basin. The depth to bedrock is estimated to be approximately 1,350 feet below ground surface (bgs). Water level and lithology data have been used to identify two distinct water-bearing zones in the GAFB area: a shallow "Upper Aquifer" and a deeper "Lower Aquifer," separated by the "Aquitard."

The Upper Aquifer is a zone of saturated, highly to moderately permeable, interbedded silty sands, poorly sorted sands, silts, and clays. Pumping test data indicate that the Upper Aquifer has transmissivities ranging from 7 square feet per day (ft^2/day) to 2,400 ft^2/day and hydraulic conductivities ranging from less than 0.01 feet per day (ft/day) to 35 ft/day. Groundwater elevations within the area range from approximately 2,680 feet above mean sea level (msl) in the northeastern portion of the base to 2,760 feet above msl in the southwest. The general groundwater flow direction typically varies from the north to northeast with a hydraulic gradient of approximately 0.003 feet/foot (ft/ft). North of the base, the groundwater gradient increases to 0.01 towards the northeast. The Upper Aquifer exists beneath GAFB; however, it terminates to the north and eastern portion of the base. The saturated zone is up to approximately 80 feet thick and thins to a thickness of zero where the aquifer terminates.

The Aquitard, consisting of interbedded very low to low permeability clays and silts, is present from approximately 2,650 feet above msl to 2,740 feet above msl and is approximately 20 to 40 feet thick. The Aquitard is believed to have been deposited in a lake-filled basin which historically occupied the vicinity of GAFB. The Aquitard hydraulically separates the Upper and Lower aquifers but is not continuous north of the base and east of the area along the Mojave

River bluffs. However, the Aquitard is continuous to the west and southwest as determined by investigation activities performed for OU 1 (Montgomery Watson, 1995b), OU 2 (IT, 1992), and OU 3 (Montgomery Watson, 1996a). The lack of hydraulic communication between the aquifers through the Aquitard is supported by a zone of unsaturated moderately permeable materials encountered below the Aquitard and above the Lower Aquifer and dry clays within the Aquitard encountered in well borings during investigations for OU 1, OU 2, and OU 3. Geotechnical testing has indicated hydraulic conductivities of Aquitard silts and clays ranging from 3.1E-4 ft/day to 1.7E-3 ft/day (Montgomery Watson, 1995b). Where the Upper Aquifer terminates to the north and east of the area, the lateral edge of the Aquitard has been inferred.

The Lower Aquifer is present beneath the entire base and generally consists of interbedded sands, gravelly sands, and silts with minor caliche beds. Groundwater elevations in the Lower Aquifer within the area range from 2,590 to 2,584 feet above msl. The gradient in the central portion of the base is 0.0002 ft/ft and increases to 0.001 ft/ft toward the east. Pumping test data indicate that the Lower Aquifer has transmissivities ranging from 170 ft^2/day to 6,000 ft^2/day and hydraulic conductivities that may exceed 80 ft/day based on an assumed aquifer thickness of 100 feet. The Lower Aquifer is geographically extensive and is hydraulically associated with the Mojave River Aquifer. The Mojave River Aquifer occupies the river channel sediments east of the base. The Mojave River deposits overlie and are interbedded with older Lower Aquifer soils. This unit is relatively transmissive and provides good quality water to regional wells. Potentiometric contours of the Lower Aquifer are perpendicular to the directions of flow in the Mojave River. Therefore, groundwater flow in the Mojave River and Lower aquifers are parallel.

2.1.2.5 Surface Water Hydrology. The Mojave River is the major surface drainage in the Victor Valley. The Mojave extends for approximately 125 miles from its headwaters at the Mojave Forks in the San Bernardino Mountains to its terminus at Soda Dry Lake south of Baker (Figure 4). The river drains an area over 3,000 square miles (USAF, 1992). East of GAFB, the river flows northward, coming as close as approximately 1,500 feet from the northeast corner of the base. Surface flow in the Mojave River through most of the Victor Valley typically occurs only during heavy rainstorms. In the Upper Mojave River Basin, however, perennial flow occurs

for approximately 1 mile below the Mojave Forks because of the perennial flow of Deep Creek (which merges with the Mojave at its headwaters), and again near Victorville through the Upper Narrows and the Lower Narrows. The Narrows are formed by a bedrock ridge that creates a subsurface flow barrier, causing river underflow to rise to the ground surface. U.S. Geological Survey (USGS) topographic maps and aerial photographs indicate that, historically, surface flow continued downstream as far as Bryman, 8 miles north of GAFB. Today, surface flow persists only approximately 1 mile below the Lower Narrows, except during and shortly after heavy rainfall. Regional withdrawal of groundwater apparently has lowered the Mojave River underflow in the vicinity of GAFB.

Daily mean discharge values of the Mojave River through the Lower Narrows during 1993 ranged from 3 to 13,800 cubic feet per second (cfs), with an average daily discharge of 394 cfs. Daily discharge in 1993, a very wet year, averaged nearly 28 times greater than 1990 values (Montgomery Watson, 1996a). Discharge records maintained since 1899 indicate an average discharge of 75.2 cfs, with a maximum discharge of 70,600 cfs recorded March 2, 1938 (USGS, 1992).

East of GAFB, the Mojave River has cut a channel approximately 1 mile wide and 200 feet deep. No perennial streams are located within the boundaries of GAFB. Rainfall generally percolates into the topsoil, collects in low areas and evaporates, or discharges through small natural channels. Surface water from GAFB drains predominantly to the northeast and east. Runoff from the flight line and the industrial and office areas is directed through roadways, storm drains, culverts, and ditches to the Outfall Ditch on the northeast side of the base. Flow from this drainage ditch reaches the Mojave River only during heavy storms. Runoff from the eastern residential areas discharges through small natural gullies located to the north and east. This runoff travels north and east toward the Mojave River wash. Much of the southern part of the base drains northward into the industrial and flight line runoff system. Intermittent surface flow on the western half of the base discharges north-northwestward into tributaries that discharge to the Mojave River near Helendale.

A large, north-trending arroyo dissects the northeast section of the base. The arroyo channel is approximately 15 feet wide near the northern base fence line and 100 feet wide where the arroyo discharges into the Mojave River wash. It was formerly fed by the Outfall Ditch from the base, numerous gullies, and a smaller drainage ditch that originates from the Fire Training Area. The arroyo intermittently receives treated effluent from the OU 1 groundwater extraction and treatment system. This water percolates into the subsurface just north of the base boundary and before the arroyo discharges to the Mojave River wash.

Discharge sources into the Mojave River upstream of GAFB are limited to agricultural and recreational uses and several fish hatcheries. East of GAFB, the Riverside Cement Plant discharges cooling water into the Mojave River Channel. The VVWRA sewage treatment facility northeast of GAFB discharges treated water directly into the Mojave River wash east of the plant. Although annual discharge volumes vary, they have been steadily increasing. Data supplied by the VVWRA indicate that during 1993, the treatment plant discharged an average of approximately 5 million gallons per day (gpd) into the Mojave River, and another 1 million gpd through its percolation ponds (Montgomery Watson, 1996a).

2.1.2.6 Water Use. Water usage includes domestic, industrial, and agricultural. The per capita rate of water demand has been estimated to be 200 to 285 gpd (SAIC, 1987). Because of arid conditions and lack of surface water bodies in the Upper Mojave River Valley Groundwater Basin, groundwater has been the principal source of water used in the Victor Valley desert communities. The Mojave Water Agency (MWA) oversees the adjudication of groundwater within the Mojave River Groundwater Basin. Consumptive groundwater usage in the Upper Mojave River Groundwater Basin (the MWA's "Alto" portion of the basin) in 1990 was estimated to be 89,400 acre-feet. The projected annual consumption for the year 1995 was 94,500 acre-feet.

Population increases in the study area caused domestic water demand to almost double during the period between 1973 and 1983 (SAIC, 1987), and double again between 1983 and 1994 (Montgomery Watson, 1996a). The increase in demand has led to overdraft conditions (water removed from the basin but not replenished) within the Mojave River Groundwater Basin.

Groundwater overdraft in the Upper Mojave River Basin for the years 1990 and 1995 is estimated to be 19,900 and 25,000 acre-feet, respectively (Montgomery Watson, 1996a). Groundwater consumption in the George Groundwater Sub-basin has not been specifically tracked by the MWA; however, tracking by smaller use areas is being pursued as groundwater overdraft in the region continues to be a concern.

As of 1990, the MWA has been entitled to 50,800 acre-feet per year of water from the California Water Project. However, due to recent statewide drought conditions, the MWA has not yet been allotted their full entitlement. Once allotted, the MWA plans to begin utilizing their water entitlement to directly recharge groundwater in the Mojave River Basin (Montgomery Watson, 1996a).

Limited information is available concerning supply wells on and in the vicinity of GAFB. Available data indicate the existence of off-base wells beyond the northeast corner of the base, below the southeast corner of the base, and along the Mojave River beyond the eastern base boundary (Figure 5).

Two supply wells owned by the VVWRA are located northeast of the base. These two wells are reported to be screened at depths of 65 to 75 feet bgs with pumping capacities of 500 gallons per minute (gpm) each. Based on the location and approximate elevations of the wellheads, these wells are believed to be screened in the Mojave River Aquifer. The groundwater table was measured at 36 feet bgs. Groundwater from these VVWRA wells is used only for non-potable and industrial applications, while bottled drinking water is supplied for workers at the plant (Montgomery Watson, 1996a).

According to the records maintained by the California Department of Water Resources (CDWR), four production wells exist southeast of the base (Figure 5). The production capacities of these wells range from 100 to 1,200 gpm. The wells are screened to depths ranging from 500 to 610 feet bgs, and may be screened in a deeper and possibly different aquifer system than the monitoring wells installed at GAFB in the Lower Aquifer.

Currently, seven production wells supply water to both GAFB and the adjacent city of Adelanto. An eighth well was closed when production rates declined. Water elevations indicate that these wells are screened below or in the deeper portions of the Lower Aquifer (Boyle, 1987). All of the production wells are located near the Mojave River beyond the eastern base boundary, on the west side of the Mojave River in Section 30 T6N, R4W, just north of the Lower Narrows (Figure 5). Five of the seven water supply wells near GAFB operated while the base was active; however, production rates since base closure are not known. These wells will likely be used to service the future uses of the base property.

Three additional wells are located northeast of GAFB production wells along the eastern bank of the Mojave River (Figure 5), and supply water to the town of Oro Grande.

It is suspected that privately owned wells and smaller capacity domestic and irrigation wells in the vicinity draw from the Upper Aquifer.

2.1.2.7 Vegetation. The most predominant type of vegetation is the creosote bush scrub community, which includes creosote bush, cheesebush, burroweed, ricegrass, and Mormon tea. This type of vegetation is typically found in the undeveloped areas of the base. Russian Thistle, or tumbleweed, is often found in the disturbed areas. Riparian (associated with water) vegetation communities including cottonwoods, willows, cattail rushes, and sedges are found along the Mojave River channel, near the base golf course and the former GAFB STP percolation ponds (Montgomery Watson, 1996a).

A biological assessment was conducted in 1989 in the northern portion of the base and in an off-base section just north of the northern base boundary. This assessment was done as part of the initial FS for the Northeast Disposal Area (NEDA) (JMM, 1988). The dominant plant species found were creosote bush, sweetbush, cheesebush, paperbag bush, and indigo bush, all Mojave Desert creosote bush scrub. Golden cholla cactus, beavertail cactus, and pencil cholla were also found scattered throughout the site. Herbaceous plants included introduced grasses such as abu-mashi and red brome, as well as native grasses and herbs such as Indian ricegrass,

spurge, chia, and fiddleneck. Joshua trees occur along the base of the steep slopes in the area (LSA, 1989).

Several sensitive plant species may occur in the area of GAFB. Good habitat exists for several of the plant species; however, only Joshua trees were actually observed during the survey of the area (LSA, 1989). Additionally, the U.S. Fish and Wildlife Service (USFWS) lists three Category-2 species that may be present on GAFB. These are the alkali mariposa lily, Barstow woody sunflower, and the desert cymoperus. Category-2 species are those for which existing information is insufficient to warrant listing as endangered or threatened species (USAF, 1989).

2.1.2.8 Animal Life. Animal life in the vicinity of GAFB includes both desert and riparian species such as black-tail jackrabbit, cottontail rabbit, and antelope ground squirrel (Montgomery Watson, 1996a). Seventy-five bird species have been identified in the area, including ravens, hawks, owls, quail, flycatchers, larks, warblers, sparrows, and blackbirds. Other wildlife includes lizards, snakes, pocket mice, raccoons, and coyotes. Generally, animal activity is highest in the northern and southern portions of the base where native plants are least disturbed. Animal activity typically has been lowest in the high traffic areas of the base, such as the housing and industrial complex, the recreation areas, and the runways (USAF, 1989); however, it is likely that some activity and reinhabitation has occurred since base closure.

The desert tortoise is the only animal species found on the base that is listed by the USFWS as a threatened or endangered species. Two Category-2 animal species that may be present on GAFB are the ferruginous hawk, and Mojave ground squirrel (USAF, 1989).

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 Base History

GAFB is a 5,347-acre facility constructed between 1941 and 1943. GAFB was commissioned as a flight training school. With flight training as primary activity at GAFB throughout its history, bombardier and glider, single- and twin-engine, and jet flight training schools were all

accommodated on the base at various times. Over the years, a wide variety of aircraft has been stationed at GAFB.

To effectively carry out the primary mission of pilot training, GAFB engaged in a variety of support operations such as aircraft maintenance and fire fighting training, that required the handling, use, and disposal of hazardous and non-hazardous materials.

Since 1980, the USAF has had an active environmental cleanup program which is currently known as the IRP. The purpose of the IRP at GAFB is to protect human health and the environment by identifying and cleaning up environmental contamination resulting from past disposal practices. The cleanup at GAFB is being conducted under the requirements of CERCLA. Section 120 of CERCLA states that the facilities must investigate and remediate, if necessary, past releases of hazardous waste.

In December 1988, GAFB was informed that it would be decommissioned as an Air Force base in December 1992. In February 1990, the USEPA added GAFB to the Superfund National Priorities List (NPL).

In October 1990, GAFB signed a Federal Facilities Agreement (FFA) with USEPA Region IX, the DTSC, and the Lahontan RWQCB. The three OUs were created with the signing of the FFA. The base was formally closed on December 15, 1992.

2.2.2 OU 3 Site Investigations

RI/FS activities at GAFB began in 1981 when the USAF performed a records search to identify possible contaminated sites and potential problems that may result from contaminant migration from these sites (CH2M Hill, 1982). Since 1981, the USAF has performed investigations in an effort to confirm the presence of potential contamination at sites identified during the records search and to define the extent of contamination at these sites.

The first preliminary study conducted under the IRP at GAFB was completed in January 1982. This study was a Phase I records search and was based on a review of available records pertaining to chemical handling and disposal practices, interviews with site personnel, and a site survey of activities at many sites within GAFB. The 1982 report indicated that potentially hazardous waste from past activities was stored and disposed at GAFB (CH2M Hill, 1982).

In 1992, a work plan was prepared for OU 3 (JMM, 1992). This work plan summarized the historical information for all known OU 3 sites including the results of any prior investigations. The OU 3 Work Plan Addendum (WPA) assessed historical information, the Phase 1 records search (CH2M Hill, 1982), and subsequent site inspections. Based on this assessment, the WPA recommended NFA for 20 sites determined not to pose a threat to human health or the environment and presented the recommended remedial investigation activities for the remaining OU 3 sites.

The OU 3 remedial investigation activities began in 1992. Of the 60 OU 3 IRP sites that make up OU 3, no further investigation was required at the 20 sites designated as NFA in the OU 3 WPA (JMM, 1992), land use restrictions were recommended for Site LF-35 in the WPA, and the remaining sites were investigated. Of the sites investigated, Montgomery Watson investigated 27 IRP sites; Metcalf & Eddy (M&E) investigated eight sites; Montgomery Watson and M&E investigated two sites, and International Technologies Corporation (IT) investigated two sites. Table 1 summarizes this information. The 20 sites recommended as NFA in the WPA included one site located in the SEDA (LF-11) and three sites (DP-02, LF-43, and LF-45) associated with OU 3 sites that were investigated by Montgomery Watson. The OU 3 RI Report presented results from the OU 3 remedial investigations including cumulative basewide human health and ecological risk assessments.

The primary objective of the OU 3 RI was to obtain sufficient information to support an informed decision regarding the most appropriate future action at each site. Specific objectives of the RI report included identification of the extent of contamination, analysis of the fate and transport of contaminants, and development of a baseline risk assessment.

Specific field investigation activities included aerial ground penetrating radar (GPR) surveys, surface GPR surveys, boundary confirmation borings, soil-gas surveys, surface and subsurface soil sampling, test pit excavations, soil borings, monitoring well installation, downhole geophysics, aquifer testing, monitoring well sampling, geotechnical sampling, HydroPunch® sampling, record searches, biological testing, dioxin testing, surface mapping, and a radiological survey.

To help identify compounds of potential concern (COPCs), background concentrations were established for inorganics in soil and groundwater. Detected organic compounds were not considered to be naturally occurring and, therefore, were considered to be above background.

Vadose zone contaminant migration modeling (SESOIL) was performed under hypothetical worst case conditions to estimate potential impacts to groundwater. For most sites modeled, results suggested that the most mobile constituents detected in soils would migrate less than 20 feet below the bottom of the site within 100 years. Therefore, utilizing the known data in a conservative fashion, impacts to groundwater from the landfills are unlikely. However, modeling suggested that groundwater will be impacted by vadose zone contamination at Sites FT-19c and OT-51.

Human health and ecological risk assessments were performed for the COPCs at each site as appropriate. The risk assessment addressed public health impacts from ingestion, inhalation, and dermal exposure to the COPCs in the soil. Specific receptors and exposure scenarios were identified for each site. The exposure scenarios used to evaluate the potential risk for a particular site were dependent on the proposed reuse of land parcel in which a site was located, the COPCs identified at the site, and the potential completed exposure pathways. At the time of the remedial investigation and performance of the risk assessment, the proposed reuse of land parcels at GAFB were identified in the base Management Action Plan (MAP) (USAF, 1993). Exposure scenarios that were used for each site-specific risk assessment included: industrial/commercial, trespasser/visitor, construction worker (potential surface soil exposure), construction worker (potential subsurface soil exposure), and future resident. Additional details describing the risk assessment methodology are presented in the OU 3 RI Report (Montgomery Watson, 1996a).

Based on the results of the RI activities and results of the risk assessment, sites that posed a potential threat to human health and the environment were analyzed in detail in the OU 3 FS. The sites assessed in the OU 3 FS Report were grouped in "landfill sites" and "TPH/VOC sites" because of the similarity between the sites in each group with respect to contaminant type, distribution, site characteristics, and potential cleanup activities. The "landfill sites" included: Sites DP-03, DP-04, LF-12, LF-14, LF-44, and the SEDA (remediation boundary includes nine sites; see Table 1). The "TPH/VOC sites" included: WP-17, FT-19a, FT-19b, FT-19c, FT-20 (soil), OT-51, SS-59, and OT-69. A separate detailed FS analysis of Site OT-69 was presented in the RI/FS for the TCE/tetrachloroethene (PCE) Study Area (IT, 1995a).

Table 1 summarizes the 60 OU 3 IRP sites and the proposed remedy (i.e., NFA or the remedial alternative selected through the FS process). The findings and conclusions of this ROD are based on the analysis of OU 3 presented in the final FS Report (Montgomery Watson, 1997a) and the accompanying Proposed Plan (Montgomery Watson, 1997b). The technical information supporting each alternative is included in these reports and the OU 3 RI Report (Montgomery Watson, 1996a).

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Community Relations Plan (CRP) was completed in 1991 for GAFB by IT following USEPA guidance (IT, 1991). Consistent with the CRP, the USAF established a Technical Review Committee (TRC) which was composed of the USEPA, DTSC, Lahontan RWQCB, and representatives from adjacent communities. The TRC met on a quarterly basis to provide community representatives with up-to-date information on recent milestone events. In January 1994, GAFB established the Restoration Advisory Board (RAB) which replaced the TRC. The RAB met on a quarterly basis until 1997 when it voted to move to an annual meeting. The meetings are open to the public. The RAB is designed to act as a focal point for environmental exchange between GAFB and the public.

The OU 3 RI Report (Montgomery Watson, 1996a), OU 3 FS Report (Montgomery Watson, 1997a), and OU 3 Proposed Plan (Montgomery Watson, 1997b) were released to the public and were made available in both the Administrative Record File and in information repositories maintained at the following locations:

- The Air Force Base Conversion Agency (AFBCA) Office at GAFB
- The Victorville Branch of the San Bernardino County Library
- The Adelanto Branch of the San Bernardino County Library

The availability of these documents and announcement of the public meeting and public comment period were published in the Daily Press in Victorville, the Desert Dispatch in Barstow, and the Sun in San Bernardino in September 1997. A press release was sent to five other local newspaper and radio organizations announcing the public meeting and public comment period.

The Proposed Plan was mailed in September 1997 to all parties identified in the CRP, including government officials, media, private organizations, and interested members of the community.

A public comment period was held from September 22, 1997 to October 22, 1997. A public meeting was held on October 8, 1997 at the Green Tree Inn, Victorville, California. Representatives from the USAF, USEPA, DTSC, and Lahontan RWQCB were present at the meeting. The Responsiveness Summary (Section 3.0 of this ROD) contains responses to questions from the meeting and comments submitted by mail.

2.4 SCOPE AND ROLE OF OPERABLE UNIT WITHIN THE SITE STRATEGY

As summarized in Section 2.1, the suspected hazardous waste sites present at GAFB were grouped into three OUs based on the type of waste present and the geographical location (Figure 2). This ROD deals specifically with OU 3. Chemicals found at 60 OU 3 IRP sites potentially relate to activities associated with equipment maintenance; fire training; fuel use and storage; pest control; laboratory, shop, and hospital operations; and landfill and solid waste disposal.

As summarized in Table 1, 40 OU 3 sites were recommended for NFA based on the results of the WPA (JMM, 1992) and the OU 3 RI investigation (Montgomery Watson, 1996a). Land use restrictions were recommended for Site LF-35 in the OU 3 WPA (JMM, 1992). Final decisions regarding the groundwater in the vicinity of Site FT-20 will be determined in the OU 2 ROD because it is currently associated with the groundwater contamination at OU 2 (this affected groundwater is now referred to as FT-20 [groundwater]). The remaining role for OU 3 is to set forth the remedial action to be conducted to remediate the remaining sites that were presented in the OU 3 FS Report (Montgomery Watson, 1997a). These remaining sites (Figure 6) are presented in two groups: the landfill sites (DP-03, DP-04, LF-12, LF-14, LF-44, and the SEDA [remediation boundary includes nine sites]); and the TPH/VOC sites (WP-17, FT-19a, FT-19b, FT-19c, FT-20 [soil], OT-51, SS-59, and OT-69) and are discussed in detail below.

2.5 LANDFILL SITE SUMMARY

This section summarizes the site characteristics, risk assessment results, descriptions of the alternatives evaluated, alternatives comparison, and the selection of the final remedies for the OU 3 landfill sites requiring action (Sites DP-03, DP-04, LF-12, LF-14, LF-35, LF-44, and the SEDA).

Site characterization activities were not performed for Site LF-35 as part of the OU 3 investigations. Site LF-35 is a reported landfill for asbestos and fiberglass located in Parcel A. These constituents are not expected to be mobile in soils. Unless mobilized via excavation activities, any asbestos or fiber glass present should not pose a threat to human health or the environment. Therefore, land use restrictions are recommended in the OU 3 WPA (JMM, 1992). By placing land use and deed restrictions on the site forbidding disturbance of buried materials, the potential exposure pathways for asbestos or fiberglass will not be completed and protection of human health would be assured.

The site characterization activities for the remaining landfill sites are discussed below.

2.5.1 Summary of Landfill Site Characteristics and Risk Assessments

The OU 3 landfill sites presented in this ROD were investigated and evaluated using the same rationale and investigative techniques, including geophysics, soil gas, test pits, and soil and groundwater sampling. Table 2 presents a summary of the OU 3 landfill site characterizations on a site-specific basis. The results of the each of the landfill site investigations were similar; various inorganics were detected as were hydrocarbons, semivolatile organic compounds (SVOCs), and dioxins. The results of the baseline risk assessments indicated that although there were some sites with a maximum excess lifetime cancer risk above the California benchmark of 1E-06, all were within or below the USEPA guidelines of 1E-04 to 1E-06. The site-specific ecological risk assessments indicated that a potential risk to ecological receptors was present at Sites DP-03, DP-04, LF-12, LF-14, and the SEDA. Ecological risks were considered insignificant at Site LF-44.

The site characterizations and risk assessments for the landfill sites requiring remedial action are summarized below. Additional details regarding the site characterizations and risk assessments are presented in the OU 3 RI/FS reports (Montgomery Watson, 1996a and 1997a).

2.5.1.1 Site DP-03. Site DP-03 is a suspected acid and oil burial site located approximately 400 feet north of the northeast end of the Crosswind/Secondary Runway. The following subsections summarize the site characterization and risk assessment for Site DP-03.

Site Characterization. To characterize Site DP-03, aerial GPR and surface geophysics including GPR, electromagnetic terrain conductivity (EM), and magnetometry (MAG) were performed. Additionally, an extensive soil-gas program was conducted, surface and subsurface (test pit) samples were collected and analyzed, and physical site conditions were evaluated. Data gathered were used to perform fate and transport modeling and were also incorporated into the baseline risk assessment.

Geophysical anomalies suggested the presence of buried material concentrated near the center of the site. VOCs in shallow soil-gas were detected sporadically throughout the site. Three test pits

were excavated to depths up to 10 feet to investigate geophysical and soil-gas anomalies. In general, geophysical anomalies corresponded to construction debris such as rebar, concrete, and asphalt, and fill materials were encountered to depths greater than 9 feet bgs. No evidence of buried drums were found, and no soil staining or visual indications of contamination was noted in the test pits. Lead, 10 SVOCs, and hydrocarbons were detected sporadically in surface and subsurface samples above background. Although benzene, toluene, ethylbenzene, and xylene (BTEX) was detected in the soil gas, no VOC contamination was found in the surface or subsurface soil samples. Vadose zone modeling results showed that even under the most conservative conditions, the most mobile constituent detected at any OU 3 landfill site will not migrate deeper than 20 feet below the bottom of the disturbed areas within 100 years. Therefore, the less mobile contaminants detected at this site would not be expected to migrate deeper than 20 feet below the bottom of the disturbed areas. Because the depth to groundwater beneath Site DP-03 is greater than 100 feet, modeling results indicate that there is no potential for contaminant leaching to groundwater.

Risk Assessment. As described in Section 2.2.2, a baseline risk assessment was performed for Site DP-03 for which risk assessment scenarios were evaluated based on the proposed reuse of the land parcel in which the site is located (USAF, 1993). Using the likely future land use of an airfield and related facilities, the baseline human health risk assessment evaluated risk for the following scenarios: industrial/commercial, trespasser/visitor, construction worker (potential surface soil exposure), and construction worker (potential subsurface soil exposure). This baseline risk assessment estimated the highest excess lifetime cancer risk of 1.9E-05, primarily because of polynuclear aromatic hydrocarbons (PAHs) under an industrial/commercial scenario.

The qualitative ecological benchmark screening indicated that there are potential risks to ecological receptors because of the localized presence of PAHs. However, the results of subsequent quantitative food chain modeling specifically for bioaccumulative compounds indicated that bioaccumulative compounds of potential ecological concern (COPECs) pose no significant risks to vegetation and wildlife at the site. Human activities associated with the proposed land use for this parcel are expected to limit the selection of Site DP-03 as a primary habitat for many ecological receptors.

2.5.1.2 Site DP-04. Site DP-04 is a reported pesticide and oil drum burial site located between Sites DP-03 and LF-14. The following subsections summarize the site characterization and risk assessment for Site DP-04.

Site Characterization. To characterize Site DP-04, aerial GPR and surface geophysics including GPR, EM, and MAG were performed. Additionally, an extensive soil-gas program was conducted, surface and subsurface (test pit) samples were collected and analyzed, and physical site conditions were evaluated. Data gathered were used to perform fate and transport modeling and were also incorporated into the baseline risk assessment.

Geophysical anomalies suggested the presence of buried material concentrated near the center of the site. VOCs in shallow soil-gas were detected sporadically throughout the site. Six test pits were excavated to depths up to 15 feet to investigate geophysical and soil-gas anomalies. In general, geophysical anomalies corresponded to construction debris such as concrete, metal, wood, and plastic, and fill materials were encountered to depths greater than 15 feet bgs. No evidence of buried drums were found, and no soil staining or visual indications of contamination were noted in the test pits. Lead, nickel, mercury, zinc, two pesticides, one polychlorinated biphenyl (PCB) and hydrocarbons were detected sporadically in surface and subsurface samples above background. Although benzene and total BTEX were detected in the soil gas, no VOC contamination was found in the surface or subsurface soil samples. Vadose zone modeling results showed that even under the most conservative conditions, the most mobile constituent detected at any OU 3 landfill site will not migrate deeper than 20 feet below the bottom of the disturbed areas within 100 years. Therefore, the less mobile contaminants detected at this site would not be expected to migrate deeper than 20 feet below the bottom of the disturbed areas. Because the depth to groundwater beneath Site DP-04 is greater than 100 feet, modeling results indicate that there is no potential for contaminant leaching to groundwater.

Risk Assessment. As described in Section 2.2.2, a baseline risk assessment was performed for Site DP-04 for which risk assessment scenarios were evaluated based on the proposed reuse of the land parcel in which the site is located (USAF, 1993). The scenarios evaluated for this site

included: industrial/commercial, trespasser/visitor, construction worker (potential surface soil exposure), and construction worker (potential subsurface soil exposure). This baseline human health risk assessment estimated the highest excess lifetime cancer risk of 6.7E-05, primarily because of Aroclor 1260 (a PCB) under the industrial/commercial scenario.

The results of the ecological risk assessment indicated a potential risk to burrowing mammals and their predators (e.g., barn owl), primarily because of the highly localized presence of Aroclor 1260. However, human activities associated with the proposed land use for this parcel along with the disturbed nature of the site are expected to limit the selection of Site DP-04 as a primary habitat for many ecological receptors.

2.5.1.3 Site LF-12. Site LF-12 is an abandoned landfill site located in an unpaved, relatively undeveloped area north of the base residential area and east of Phantom Street. The following subsections summarize the site characterization and risk assessment for Site LF-12.

Site Characterization. To characterize Site LF-12, aerial GPR and surface geophysics including GPR, EM, and MAG were performed. Additionally, an extensive soil-gas program was conducted, surface and subsurface (test pit) samples were collected and analyzed, up- and downgradient monitoring wells were installed and sampled, and physical site conditions were evaluated. Data gathered were used to perform fate and transport modeling and were also incorporated into the baseline risk assessment.

Geophysical anomalies suggested the presence of buried material concentrated near the center of the site. VOCs in shallow soil gas were detected sporadically throughout the site. Five test pits were excavated to depths up to 15 feet to investigate geophysical and soil-gas anomalies. In general, geophysical anomalies corresponded to construction debris such as metal, plastic, concrete, glass and plaster board, and fill materials were encountered to depths greater than 10 feet bgs. No evidence of buried drums were found, and no soil staining or visual indications of contamination was noted in the test pits. Barium, lead, mercury, zinc, three dioxins, and hydrocarbons were detected sporadically in surface and subsurface samples above background. Although benzene, total BTEX, and TCE were detected in the soil gas, no VOC contamination

was found in the surface or subsurface soil samples. One monitoring well was installed upgradient of the site, and three monitoring wells were installed downgradient of the site. Analysis of the soil samples collected from the borings and the groundwater samples collected from the wells indicate that no leaching of contaminants has occurred at the site. Vadose zone modeling results showed that even under the most conservative conditions, the most mobile constituent detected at any OU 3 landfill site will not migrate deeper than 20 feet below the bottom of the disturbed areas within 100 years. Therefore, the less mobile contaminants detected at this site would not be expected to migrate deeper than 20 feet below the bottom of the disturbed areas. Because the depth to groundwater beneath Site LF-12 is greater than 100 feet, modeling results indicate that there is no potential for contaminant leaching to groundwater.

Risk Assessment. As described in Section 2.2.2, a baseline risk assessment was performed for Site LF-12 for which risk assessment scenarios were evaluated based on the proposed reuse of the land parcel in which the site is located (USAF, 1993). The scenarios evaluated for this site included: industrial/commercial, trespasser/visitor, construction worker (potential surface soil exposure), construction worker (potential subsurface soil exposure), and future resident. This baseline human health risk assessment estimated the highest excess lifetime cancer risk of 7.7E-07, primarily because of dioxins under the future resident scenario. This is below the benchmark values for risk assessment.

The results of the ecological risk assessment indicated a potential risk to burrowing mammals and their predators (e.g., barn owl), primarily because of the highly localized presence of dioxins, lead, zinc, and barium. However, human activities associated with the proposed land use for this parcel are expected to limit the selection of Site LF-12 as a primary habitat for many ecological receptors.

Although the calculated risk to human health was below the benchmark, because the site was an abandoned landfill and there is a potential risk to ecological receptors, closure actions were considered in the OU 3 FS.

2.5.1.4 Site LF-14. Site LF-14 is an abandoned landfill site located in an unpaved, relatively undeveloped area east of the Alert Hangar. The following subsections summarize the site characterization and risk assessment for Site LF-14.

Site Characterization. To characterize Site LF-14, aerial GPR, and surface geophysics including GPR, EM, and MAG were performed. Additionally, an extensive soil-gas program was conducted, surface and subsurface (test pit) samples were collected and analyzed, up- and downgradient monitoring wells were installed and sampled, and physical site conditions were evaluated. Data gathered were used to perform fate and transport modeling and were also incorporated into the baseline risk assessment.

Geophysical anomalies suggested the presence of buried materials at the site. VOCs in shallow soil-gas were detected sporadically throughout the site. Seven test pits were excavated to depths up to 15 feet to investigate geophysical and soil-gas anomalies. In general, geophysical anomalies corresponding to construction debris such as metal, wood, glass, plastic, asphalt, concrete, gravel, trash, and fill materials were encountered to depths greater than 15 feet bgs. Two of the test pits were located near crushed drums on the surface of the site. Empty and crushed drums were also located in these test pits, but no evidence of soil staining was noted on the surface of the site or in the test pits. Lead, cadmium, copper, mercury, manganese, zinc, four SVOCs, three pesticides, toluene, and hydrocarbons were detected sporadically in surface and subsurface samples above background. Although benzene, toluene, PCE, TCE, trichloroethane (TCA), freon-11 (F-11), and total BTEX were detected in the soil gas, no widespread VOC contamination was found in the surface or subsurface soil samples. Toluene was the only VOC detected at the site, and it was detected in two of the subsurface samples. Two monitoring wells were installed downgradient of the site to assess the water quality. Analysis of the soil samples collected from one boring and the groundwater samples collected from the wells indicate that no leaching of contaminants has occurred at the site. Vadose zone modeling results showed that even under the most conservative conditions, the most mobile constituent detected at any OU 3 landfill site will not migrate deeper than 20 feet below the bottom of the disturbed areas within 100 years. Therefore, the less mobile contaminants detected at this site would not be expected to migrate deeper than 20 feet below the bottom of the disturbed areas. Because the depth to

groundwater beneath Site LF-14 is greater than 100 feet, modeling results indicate that there is no potential for contaminant leaching to groundwater.

Risk Assessment. As described in Section 2.2.2, a baseline risk assessment was performed for Site LF-14 for which risk assessment scenarios were evaluated based on the proposed reuse of the land parcel in which the site is located (USAF, 1993). The scenarios evaluated for this site included: industrial/commercial, trespasser/visitor, construction worker (potential surface soil exposure), and construction worker (potential subsurface soil exposure). This baseline human health risk assessment estimated the highest excess lifetime cancer risk of 1.0E-05 primarily because of cadmium under an industrial/commercial scenario. Although this is above the benchmark values for risk assessment, the cadmium at the site is considered naturally occurring and within background ranges.

The results of the ecological risk assessment indicate a potential risk to burrowing mammals and their predators (e.g., barn owl), because of the localized presence of cadmium, lead, and pesticides. However, human activities associated with the proposed land use for this parcel are expected to limit the selection of Site LF-14 as a primary habitat for many ecological receptors.

Although the calculated risk to human health was due to constituents that are considered naturally occurring, because the site was an abandoned landfill and there was a potential risk to ecological receptors, closure actions were considered in the OU 3 FS.

2.5.1.5 Site LF-44. Site LF-44 is an abandoned landfill site located about 1,000 feet south of Site LF-14. The following subsections summarize the site characterization and risk assessment for Site LF-44.

Site Characterization. To characterize Site LF-44 aerial GPR and surface geophysics including GPR, EM, and MAG were performed. Surface and subsurface (test pit) samples were collected and analyzed, and physical site conditions were evaluated. Data gathered were used to perform the fate and transport modeling and were also incorporated into the baseline risk assessment.

Geophysical anomalies suggested the presence of buried material concentrated near the center of the site. VOCs in shallow soil gas were detected sporadically throughout the site. Four test pits were excavated to depths up to 15 feet to investigate geophysical and soil-gas anomalies. In general, geophysical anomalies corresponded to construction debris such as concrete and trash, and fill materials were encountered to depths greater than 8 feet bgs. No evidence of buried drums were found, and no soil staining or visual indications of contamination was noted in the test pits. Antimony, lead, and hydrocarbons were detected sporadically in surface and subsurface samples above background. No VOC contamination was found in the surface or subsurface soil samples. Vadose zone modeling results showed that even under the most conservative conditions, the most mobile constituent detected at any OU 3 landfill site will not migrate deeper than 20 feet below the bottom of the disturbed areas within 100 years. Therefore, the less mobile contaminants detected at this site would not be expected to migrate deeper than 20 feet below the bottom of the disturbed areas. Because the depth to groundwater beneath Site LF-44 is greater than 100 feet, modeling results indicate that there is no potential for contaminant leaching to groundwater.

Risk Assessment. As part of the screening for the baseline human health risk assessment, no COPCs were identified, therefore, no human health risk assessment was completed.

The results of the ecological risk assessment suggest some potential ecological impacts at Site LF-44 from physical disturbances. Some stress on vegetation exists at the site as a result of physical disturbance related to former site activities. However, significant chemical risks to vegetation or wildlife were not indicated by the site characterization data. Nevertheless, because this site was an abandoned landfill with exposed debris, in order to restore the natural surface at the site, closure actions were considered in the OU 3 FS.

2.5.1.6 Site SEDA. The geographic area known as the SEDA historically included 10 OU 3 sites: five landfill sites (Sites LF-07, LF-08, RW-09, DP-10, and LF-11), one burial site (WP-40), one spill site (SS-52), and three munitions disposal areas (DP-15, DP-33, and DP-34). The location of the SEDA relative to GAFB is presented in Figure 2. Site LF-11 is located generally to the east of the other sites and was recommended for NFA in the OU 3 WPA (JMM,

1992). Because of the geographical proximity of the remaining nine sites and the generally indeterminable boundaries between them, the entire area has been handled as a unit. The following subsections summarize the SEDA site characterization and risk assessment.

Site Characterization. To characterize the SEDA, aerial GPR and surface geophysics including GPR, EM, and MAG were performed. Additionally, an extensive soil-gas program was conducted, surface and subsurface (test pit and soil borings) samples were collected and analyzed, up- and downgradient monitoring wells were installed and sampled, and physical site conditions were evaluated. Data gathered were used to perform fate and transport modeling using SESOIL and were also incorporated into the baseline risk assessment.

Geophysical anomalies suggested the presence of buried materials at the site. VOCs in shallow soil-gas were detected sporadically throughout the site. Twenty-two test pits were excavated to depths up to 15 feet to investigate geophysical and soil-gas anomalies. In general, geophysical anomalies corresponded to construction debris such as concrete, asphalt, metal, paper, glass, wood, rubber, and plaster board. This construction debris, burned debris, and fill material was encountered to depths greater than 13.5 feet bgs. A few crushed and empty drums were noted as surface debris at the site; however, no evidence of buried drums was found and no soil staining or visual indications of contamination was noted in the test pits. Although total benzene, BTEX, PCE, TCE, dichloroethene (DCE), TCA, Freon-11 (F-11), and carbon tetrachloride were detected in the soil gas, no widespread VOC contamination was found in the surface or subsurface soil samples. Toluene was the only VOC detected at the site, and it was detected in two subsurface samples. Two monitoring wells were installed upgradient of the site, and seven monitoring wells were installed downgradient of the site. Analysis of the soil samples collected from the borings and the groundwater samples collected from the wells indicates that no leaching of contaminants has occurred at the site. Vadose zone modeling results (SESOIL) showed that even under the most conservative conditions, the most mobile constituent detected at any OU 3 landfill site will not migrate deeper than 20 feet below the bottom of the disturbed areas within 100 years. Therefore, the less mobile contaminants detected at this site would not be expected to migrate deeper than 20 feet below the bottom of the disturbed areas. Because the depth to groundwater

beneath the SEDA is greater than 100 feet, modeling results indicate that there is no potential for contaminant leaching to groundwater.

Risk Assessment. As described in Section 2.2.2, a baseline risk assessment was performed for the SEDA for which risk assessment scenarios were evaluated based on the proposed reuse of the land parcel in which the site is located (USAF, 1993). The scenarios evaluated for this site included: industrial/commercial, trespasser/visitor, construction worker (potential surface soil exposure), construction worker (potential subsurface soil exposure), and future resident. This baseline human health risk assessment estimated the highest excess lifetime cancer risk of 8.4E-05 primarily because of arsenic and chromium under the future resident scenario. Although this is above the benchmark values for risk assessment, the arsenic and chromium values detected at the SEDA are considered within background and naturally occurring.

The results of the ecological risk assessment indicated a potential risk to burrowing mammals and their predators (e.g., barn owl), because of the localized presence of several metals and dioxin/furan congeners.

Although the calculated risk to human health was due to constituents that are considered naturally occurring, because the site was an abandoned landfill and there is a potential risk to ecological receptors, closure actions were considered in the OU 3 FS.

2.5.2 Description of Landfill Site Alternatives

Based on the results of remedial investigations, it was determined that remedial action was potentially necessary at the OU 3 landfill sites (DP-03, DP-04, LF-12, LF-14, LF-44, and the SEDA). An FS analysis was performed in which (1) remedial action objectives (RAOs) were identified; (2) potentially applicable technologies were identified and screened based on effectiveness, implementability, and cost; (3) the technologies retained after the initial screening were combined into potential alternatives for each site; and (4) the alternatives were then subjected to a detailed analysis with respect to the nine criteria defined by the USEPA for CERCLA sites (USEPA, 1988).

Alternatives were developed and evaluated for the landfill sites as a group because of the similarity between the sites with respect to contaminant type, distribution, site characteristics, and potential actions. The RAOs established for the OU 3 landfill sites are summarized below:

- prevent direct contact with landfill contents;
- minimize infiltration that may result in waste constituents leaching to groundwater;
- control surface water runoff and run-on, and erosion; and
- monitor groundwater quality to determine if landfill contaminants are leaching to the groundwater.

Five remedial alternatives were developed for the OU 3 landfill sites from an analysis of remedial technologies as part of the OU 3 FS (Montgomery Watson, 1997a). The five alternatives, with their components, are as follows:

Alternative 1 (No Action with Monitoring)
1) Groundwater Monitoring
2) 5-Year Site Review

Alternative 2 (Institutional Controls)
1) Surface Restoration
2) Access Restrictions
3) Land Use Restrictions
4) Groundwater Monitoring
5) 5-Year Site Review

Alternative 3 (Surface Controls/Existing Cover Rehabilitation)
1) Surface Controls
2) Surface Restoration
3) Access Restrictions
4) Land Use Restrictions
5) Groundwater Monitoring
6) 5-Year Site Review

Alternative 4 (Soil Cover)
1) Native Soil Cover
2) Surface Controls
3) Surface Restoration

4) Access Restrictions
5) Land Use Restrictions
6) Groundwater Monitoring
7) 5-Year Site Review

Alternative 5 (Synthetic Cap)
1) Synthetic Cap
2) Native Soil Cover
3) Surface Controls
4) Surface Restoration
5) Access Restrictions
6) Land Use Restrictions
7) Groundwater Monitoring
8) 5-Year Site Review

These alternatives are presented in detail in the OU 3 FS and are summarized in the sections below.

2.5.2.1 Alternative 1: No Action with Monitoring. As required by the NCP, the no action alternative serves as a baseline against which other landfill site alternatives are compared. Its components include groundwater monitoring and the 5-year site review.

Groundwater monitoring at the OU 3 landfill sites would be part of the an approved basewide long-term monitoring plan for GAFB. Selected monitoring wells at each site would be sampled annually, semi-annually, or quarterly, to determine if landfill contaminants are leaching to the groundwater.

The no action alternative would leave the landfill contents in place with no closure activities undertaken. Because contaminants would remain on site, a site review would be conducted every 5 years as required by CERCLA. This would include a review of annual environmental monitoring results to determine if landfill contaminants have migrated to the environment (i.e., moved beyond the known boundaries of the landfill sites). The purpose of the 5-year site review and long-term monitoring would be to assess the effectiveness of an alternative.

2.5.2.2 Alternative 2: Institutional Controls. Alternative 2 includes access and land use restrictions, surface restoration, groundwater monitoring, and the 5-year site review.

Access restrictions would involve the installation of 8-foot-high chain-link fences with barbed wire and/or posting of warning signs posted along the perimeter of the site. The locations of the fences at each landfill would be determined as part of the design and would minimize access to people, vehicular traffic, and terrestrial animals.

The implementation of land use restrictions at the OU 3 landfill sites would assure the protectiveness of the remedy and human health. Deed restrictions would be recorded to restrict use of the sites for the following purposes: 1) a residence, including any mobile home or factory-built housing, constructed or installed for use as permanently occupied residential human habitation, 2) a long-term care hospital for humans, 3) a traditional public or private school for persons under 21 years of age, and 4) a day care center. In addition, the deed would prohibit the disturbance of the landfill cover, subsurface soils, and fencing without prior approval from the USAF and appropriate state and local agencies.

Surface restoration would involve the removal of municipal wastes and debris, such as plastics, tires, paper products, rubble, etc., from the landfill surface. Use of backhoes and dump trucks to remove wastes would be combined with manual collection, following the proper health and safety procedures. Collected wastes would be disposed of at an off-site Class III landfill facility, or may be consolidated with other wastes under an OU 3 landfill cap.

The definitions of the other components of this alternative (e.g., groundwater monitoring and the 5-year site review) are the same as for Alternative 1.

2.5.2.3 Alternative 3: Surface Controls/Existing Cover Rehabilitation. Alternative 3 has the same components as Alternative 2 with the addition of surface controls. In addition, the existing cover conditions would be evaluated and rehabilitated to functional parameters as discussed below.

Surface controls include general site grading, drainage, and revegetation. General site grading would be accomplished by using cut-and-fill techniques which involve excavation of clean soils

from outside the landfill boundary and from elevated mounds of clean soils within the landfill and consolidation of these soils in the "potholes" within the landfill. In order to minimize intrusive activities at the OU 3 landfill sites, the remedial design for this alternative would ensure that the fill volume is greater than the cut volume and the difference would be imported from and off-site borrow source. This design would effectively produce a soil cover on the landfill with an estimated thickness of 12 to 18 inches. The final grade for each site would have a minimum slope of 1.5 percent, with the actual slope designed to fit the natural topography of the site. Site drainage would be implemented by constructing drainage channels around the landfill boundary to divert surface water away from the landfill site. A conceptual diagram of the implementation of surface controls/existing cover rehabilitation is shown on Figure 7.

The land use restrictions for sites where surface controls would be implemented would include the prohibition of subsurface development (e.g., excavation, pile-driving) and excessive vehicular traffic (e.g., off-road vehicles, dirt bikes), in addition to the more general types of land use restrictions which may be applied.

2.5.2.4 Alternative 4: Soil Cover. Alternative 4 has the same components as Alternative 3 with the addition of a 24-inch-thick native soil cover installed over the graded landfill surface. The soil cover would be compacted only for structural purposes because the native soil at GAFB is expected to be difficult to compact to low permeability levels. The primary purpose of the native soil cover is to provide a separation layer that would prevent direct contact with landfill contents. A conceptual diagram of a native soil cover is shown on Figure 8.

2.5.2.5 Alternative 5: Synthetic Cap. Alternative 5 has the same components as Alternative 4 with the addition of a synthetic flexible membrane liner (FML), 30-mil thick, installed over the graded landfill surface. A native soil cover would then be installed over the synthetic liner, as described for Alternative 4. In addition to preventing direct contact with landfill contents, the synthetic cap also prevents surface water infiltration that could lead to the leaching of landfill contaminants to the groundwater and/or storm water. A conceptual diagram of a synthetic cap is shown on Figure 8.

2.5.3 Summary of Comparative Analysis of Alternatives for the Landfill Sites

The remedial alternatives developed were analyzed in detail using the nine evaluation criteria required by the NCP. These criteria are classified as threshold criteria, primary balancing criteria, and modifying criteria. Threshold criteria are:

1) Overall protection of human health and the environment
2) Compliance with applicable or relevant and appropriate requirements (ARARs)

Primary balancing criteria are:

3) Long-term effectiveness and permanence
4) Reduction of TMV through treatment
5) Short-term effectiveness
6) Implementability
7) Cost

Modifying criteria are:

8) State/support agency acceptance
9) Community acceptance

The resulting strengths and weaknesses of the alternatives were then weighed to identify the alternative providing the best balance among the nine criteria. Table 3 summarizes this comparison.

2.5.3.1 Overall Protection of Human Health and the Environment. This criterion is an overall assessment of whether each alternative provides adequate protection of human health and the environment. The evaluation focuses on a determination of the degree to which a specific alternative achieves adequate protection and describes the manner in which site risks are eliminated, reduced, or controlled through treatment, engineering, or institutional measures. The potential for cross-media impacts is also assessed.

Alternative 1: Does not provide any direct protection of human health and the environment because no landfill closure activities are undertaken. This alternative would not change the risks currently associated with a site.

Alternative 2: Provides the minimum requirements necessary to protect human health by reducing the potential for direct contact with landfill contents through access and land use restrictions and the removal of municipal wastes from the surface. However, Alternative 2 does not satisfy the RAOs for minimizing infiltration and controlling runoff and soil erosion and current risks associated with the site are only slightly reduced.

Alternative 3: Provides better protection of human health and the environment than Alternative 2 by providing a final cover with the proper grade and protected slopes. The potential for direct contact with landfill contents is substantially reduced and the potential for contaminant leaching is reduced. By eliminating potential exposure pathways to landfill contaminants, the initially low risks associated with the site are additionally minimized.

Alternative 4: Provides better protection of human health and the environment than Alternative 3 by providing a thicker soil cover. The potential for direct contact with landfill contents is practically eliminated and the potential for contaminant leaching is further reduced. Alternative 4 provides additional confidence that the risks associated with the site are minimized.

Alternative 5: Provides the same protection of human health and better protection of the environment than Alternative 4 by providing a final cover that is more effective in reducing infiltration. The potential for contaminant leaching is practically eliminated.

2.5.3.2 **Compliance with ARARs.** Pursuant to Section 121 (d) CERCLA, as amended, the remedial actions must attain a degree of cleanup which assures protection of human health and the environment. In addition CERCLA requires that remedial actions meet standards, requirements, limitations, or criteria that are ARARs. ARARs are of three types: chemical-, action-, and location-specific. The three types of ARARs are defined as follows:

- **Chemical-Specific ARARs.** Chemical-specific ARARs include those environmental laws and regulations that regulate the release to the environment of materials possessing certain chemical or physical characteristics or containing specified chemical compounds. These requirements generally set health- or risk-

based concentration limits or discharge limits for specific hazardous substances (USEPA, 1989).

- **Location-Specific ARARs.** As defined in the USEPA draft guidance (USEPA, 1988): "Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats."

- **Action-Specific ARARs.** Action-specific ARARs are restrictions that define acceptable treatment and disposal procedures for hazardous substances. These ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants, such as Resource Conservation and Recovery Act of 1976 (RCRA) regulations for waste treatment, storage, and disposal. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. The type and nature of these requirements is dependent upon the particular remedial or removal action taken at a site. Therefore, different actions or technologies are often subject to different action-specific ARARs.

Identification and consideration of potential ARARs associated with a site and its remedial action is an ongoing process throughout site characterization and remediation.

An ARAR may be either "applicable" or "relevant and appropriate," but not both. The NCP (contained in Title 40 of the CFR Part 300) defines "applicable" and "relevant and appropriate requirements" as follows:

> "Applicable requirements means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those 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 means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not

'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable."

In other words, a requirement is "applicable" when the remedial action or the circumstances at the site satisfy all of the jurisdictional prerequisites of that requirement. Relevant and appropriate requirements must be complied with to the same degree as if they were applicable, but there is more discretion in this determination and it is possible for only part of a requirement to be considered relevant and appropriate in a given case.

Where no promulgated standards exist for a given chemical or situation, nonpromulgated advisories and guidance ("to-be-considered" [TBC] materials) issued by federal or state government may be used in determining the necessary level of cleanup for protection of human health or the environment. TBCs do not have the status of potential ARARs; however, in many circumstances they will be considered along with ARARs as part of the site risk assessment and may be used in determining the necessary level of cleanup.

Identification of ARARs and TBCs must be done on a site-specific basis. Neither CERCLA nor the NCP provides across-the-board standards for determining whether a particular remedy will effect an adequate cleanup at a particular site. Rather, the process recognizes that each site will have unique characteristics that must be evaluated and compared to those requirements that apply under the given circumstances.

Final ARARs for the OU 3 landfill sites were established through discussions between the Lahontan RWQCB, DTSC, USEPA, and USAF. A listing of agreed upon federal and state laws and regulations that are ARARs for the OU 3 landfill sites is provided in Table 4. Based on the ARARs identified: Alternative 1 will not comply with all ARARs for the landfill sites; Alternative 2 may not comply with all federal and state ARARs on landfill closure at all sites;

and Alternatives 3, 4, and 5 are expected to comply with the pertinent federal and state ARARs on landfill closure such as grading, drainage, slope protection through revegetation, etc.

2.5.3.3 Long-Term Effectiveness and Permanence. The purpose of this criterion is to assess the residual risk and the adequacy and reliability of controls associated with a particular alternative. The magnitude of risk resulting from the presence of untreated waste or treatment residuals is assessed with respect to the volume or concentration of residual contaminants.

The second component, adequacy and reliability of controls, assesses the containment systems and institutional controls in place to determine if they are sufficient to ensure that both human and environmental exposure is within protective levels. The long-term reliability of management controls to provide continued protection from residuals is also addressed with regard to (1) the potential need to replace technical components of the alternative, and (2) the potential exposure pathway and resulting risks should the remedial action need replacement.

Alternative 1: This alternative does not satisfy the RAOs for preventing direct contact with landfill contents, minimizing infiltration, and controlling runoff and soil erosion. Therefore, the risks from direct contact and the potential for contaminant leaching remains unchanged.

Alternative 2: This alternative partially satisfies the RAO for preventing direct contact with landfill contents (through surface restoration and access and land use restriction), thereby slightly reducing the risks. However, the long-term reliability of access restrictions and surface restoration would not be as reliable as the soil cover rehabilitation and/or installation described for Alternatives 3 through 5. In addition, land use restrictions may be difficult to enforce in the long term. Alternative 2 does not satisfy the RAOs for minimizing infiltration and controlling runoff and soil erosion. Therefore, the potential for contaminant leaching remains unchanged.

Alternative 3: This alternative satisfies the RAO for preventing direct contact with landfill contents (through surface controls and cover rehabilitation), thereby effectively minimizing potential risks. The alternative effectively meets the RAOs for reducing infiltration and controlling runoff and soil erosion, thereby reducing the potential for contaminant leaching.

However, surface controls require comprehensive long-term maintenance to prolong their effectiveness.

Alternative 4: This alternative effectively satisfies the RAOs for preventing direct contact with landfill contents, minimizing infiltration, and controlling runoff and soil erosion, thereby eliminating the risks and the potential for contaminant leaching. However, a soil cover requires comprehensive long-term maintenance to prolong its effectiveness.

Alternative 5: This alternative effectively satisfies the RAOs for preventing direct contact with landfill contents, minimizing infiltration, and controlling runoff and soil erosion, thereby eliminating the risks and the potential for contaminant leaching. However, a soil cover and a synthetic cap both require comprehensive long-term maintenance to prolong their effectiveness.

2.5.3.4 Reduction of Toxicity, Mobility, and Volume through Treatment. Alternatives are assessed to determine the extent to which they permanently reduce TMV of the contaminants posing the principal threats at a site. The specific factors considered in this assessment include:

- treatment or recycling process(es) of associated target contaminants and the amount of contaminants to be destroyed or treated;
- degree of expected reduction in the TMV and the degree to which treatment or recycling will be irreversible;
- type and quantity of treatment residuals expected to remain following treatment; and
- whether or not the alternative satisfies the statutory preference for treatment as a principal element.

Alternative 1: This alternative does not provide any reduction of TMV of contaminants in the landfill sites.

Alternative 2: The removal of municipal wastes from the surface reduces the amount of wastes at the landfill sites.

Alternative 3: The removal of municipal wastes from the surface reduces the amount of wastes at the landfill sites. This alternative does not provide any reduction of toxicity or volume of contaminants in the landfill sites. However, the surface controls/existing cover rehabilitation minimizes surface water infiltration and runoff, thereby reducing the mobility of contaminants through leaching.

Alternative 4: The removal of municipal wastes from the surface reduces the amount of wastes at the landfill sites. This alternative does not provide any reduction of toxicity or volume of contaminants in the landfill sites. However, the surface controls, existing cover rehabilitation, and soil cover, minimize surface water infiltration and runoff, thereby reducing the mobility of contaminants through leaching.

Alternative 5: The removal of municipal wastes from the surface reduces the amount of wastes at the landfill sites. This alternative does not provide any reduction of toxicity or volume of contaminants in the landfill sites. However, the surface controls, existing cover rehabilitation, soil cover, and synthetic cap all minimize surface water infiltration and runoff, thereby reducing the mobility of contaminants through leaching.

2.5.3.5 Short-Term Effectiveness. Alternatives are evaluated with respect to their effects on human health and the environment during implementation of the remedial action. This evaluation addresses protection of site workers and the community during remedial actions, potential environmental impacts, and the time until remedial action objectives are achieved.

Alternative 1: This alternative results in no risks to construction workers because no closure activities are undertaken.

Alternative 2: This alternative results in minimal risks to construction workers during surface restoration activities.

Alternative 3: This alternative results in minimal risks to construction workers during surface restoration, surface controls, and existing cover rehabilitation activities.

Alternative 4: This alternative results in minimal risks to construction workers during surface restoration, surface controls, existing cover rehabilitation, and soil cover installation activities.

Alternative 5: This alternative results in minimal risks to construction workers during surface restoration, surface controls, existing cover rehabilitation, and soil cover and synthetic cap installation activities.

2.5.3.6 Implementability. This criterion has three components: (1) technical feasibility, (2) administrative feasibility, and (3) availability of services and materials. Each alternative is assessed on the basis of factors within these three categories.

The assessment of the administrative feasibility of a particular remedial alternative is based on the number and complexity of activities needed to coordinate with other offices and regulatory agencies during preparation and implementation of the alternative. Factors that are considered in the assessment of technical feasibility include:

- potential for problems associated with construction and operation of an alternative;
- reliability of an alternative and its components;
- ease of undertaking additional remedial action, if needed; and
- ability to monitor the effectiveness of the remedy and evaluate the risks of exposure should monitoring be insufficient to detect a failure.

The availability of services and materials is to be considered. This includes such items as off-site treatment, storage or disposal capacity, equipment, and specialists.

The implementability of each remedy becomes progressively more difficult from Alternative 1 to Alternative 5 because of the consecutive addition of components as described below.

Alternative 1: This alternative is easily implemented because no closure activities are undertaken. Groundwater monitoring is easy to implement and the materials required are readily available. There are no administrative difficulties associated with this alternative.

Alternative 2: Although more difficult to implement than Alternative 1, surface restoration is easy to implement, using standard equipment and technologies and readily available services and materials. Some administrative difficulties may be encountered for land use restrictions depending on property disposal and reuse plans.

Alternative 3: This alternative is more difficult to implement than Alternative 2 with the addition of surface controls and existing cover rehabilitation. Additional components are feasible, using standard equipment and technologies and readily available services and materials. Some difficulties in site grading may occur because of uneven topography in some areas. Some administrative difficulties may be encountered for land use restrictions depending on property disposal and reuse plans.

Alternative 4: This alternative is more difficult to implement than Alternative 3 with the addition of the soil cover component. Additional components are feasible, using standard equipment and technologies and readily available services and materials. Some administrative difficulties may be encountered for land use restrictions depending on property disposal and reuse plans.

Alternative 5: This is the most difficult to implement with the addition of the synthetic cap component. Implementation of the synthetic cap is feasible, using standard equipment and technologies and readily available services and materials. Installation of the synthetic cap can be difficult and care must be taken so that punctures or tears to not develop during placement. Some administrative difficulties may be encountered for land use restrictions depending on property disposal and reuse plans.

2.5.3.7 **Cost.** Both capital costs and operation and maintenance costs are considered for each alternative, with a target accuracy of -30 to +50 percent. Capital costs include both direct (e.g., equipment) and indirect (e.g., contingency allowances) costs. Costs are presented on a present-worth basis over a period of 30 years, with a discount rate of 7 percent. Table 5 presents a summary of the remedial alternative costs for the landfill sites for each of the five alternatives. Detailed cost analysis is presented in the OU 3 FS Report (Montgomery Watson, 1997a).

2.5.3.8 **State Acceptance.** This assessment considers the technical and administrative issues and concerns the state or support agency may have regarding each of the alternatives. Final application of this criterion will occur in the approval of this ROD.

Alternative 1: It is likely the state would not accept this alternative because it does not include components to achieve the RAOs, in particular, it does not actively prevent contact with landfill contents or minimize infiltration.

Alternative 2: It is unlikely the state would accept this alternative for sites with COPCs resulting in calculated human health or COPECs resulting in calculated ecological risk because it does not actively minimize infiltration. However, this site is likely to be satisfactory for sites with exposed debris but not having COPCs or COPECs (i.e., Site LF-44).

Alternative 3: This alternative would be considered more acceptable than Alternatives 1 and 2 because it eliminates the potential for direct contact with landfill contents and reduces the potential for contaminant leaching through the rehabilitated existing landfill cover with the use of surface controls.

Alternative 4: This alternative may be perceived as preferable to Alternative 3 because of the additional protection from contact with landfill contents and reduction of infiltration provided by the native soil cover.

Alternative 5: This alternative may be perceived as preferable to Alternative 4 because of the additional protection from infiltration provided by the synthetic liner.

2.5.3.9 Community Acceptance. Community acceptance indicates the public support for a given alternative. Section 3.0 of this ROD documents the community acceptance of the selected remedies, as presented in the Proposed Plan (Montgomery Watson, 1997b). Section 3.0 includes a responsiveness summary that addresses the comments received during the public comment period. The community did not express any significant objections to the selected remedies during the public meeting or public comment period.

2.5.4 The Selected Remedies for the Landfill Sites

This section provides a description of the preferred alternatives for remediation of the OU 3 landfill sites based on the detailed evaluation of alternatives presented in the OU 3 FS Report (Montgomery Watson, 1997a). This section includes the basis for selection of a preferred alternative, a description of the preferred alternative, and cost analyses.

2.5.4.1 Selection of the Preferred Alternatives. The RAOs established for the landfill sites in the OU 3 FS are summarized in Section 2.5.2. An evaluation of the five alternatives with respect to the nine CERCLA criteria resulted in the selection of the following preferred alternatives to meet the RAOs for the OU 3 landfill sites.

Site DP-03. Under the industrial/commercial scenario, the baseline human health risk assessment estimated the highest cancer risk of 1.9E-05 for this landfill site, primarily because of the presence of PAHs. This risk value is above the California and USEPA acceptable benchmark value of 1.0E-06.

The ecological risk assessment indicated that there were potential risks to ecological receptors because of the localized presence of PAHs. However, the results of subsequent quantitative food chain modeling specifically for bioaccumulative compounds indicated that bioaccumulative constituents pose no significant risks to vegetation and wildlife at the site. Human activities associated with the proposed land use for this parcel are expected to limit the selection of Site DP-03 as a primary habitat for many ecological receptors.

Because the benchmark for human health risk is exceeded and to expedite reuse, the RAO for preventing direct contact with landfill contents must be satisfied by recommending either Alternative 4 or Alternative 5 for Site DP-03 in the OU 3 FS. Both of these alternatives also satisfy the RAOs for minimizing infiltration and controlling runoff and soil erosion. Alternative 4 is less expensive but equally effective in satisfying the RAOs as Alternative 5. The implementation of surface controls and the installation of a soil cover at Site DP-03 would constitute landfill closure and therefore make the site a potential candidate for delisting in the future.

Therefore, Alternative 4 was the selected remedy for Site DP-03. This alternative was implemented as described in Section 2.9. Actions at the OU 3 landfill sites were completed in April 1997.

Site DP-04. Under the industrial/commercial scenario, the baseline human health risk assessment estimated the highest cancer risk of 6.7E-05 for this landfill site, primarily because of the presence of Aroclor-1260. This risk value is above the California and USEPA acceptable benchmark value of 1.0E-06.

The results of the ecological risk assessment indicated a potential risk to burrowing mammals and their predators (e.g., barn owl), primarily because of the highly localized presence of Aroclor 1260. However, human activities associated with the proposed land use for this parcel along with the disturbed nature of the site are expected to limit the selection of Site DP-04 as a primary habitat for many ecological receptors.

Because the benchmark for human health risk was exceeded and to expedite reuse, the RAO for preventing direct contact with landfill contents must be satisfied by recommending either Alternative 4 or Alternative 5 for Site DP-04 in the OU 3 FS. Both of these alternatives also satisfy the RAOs for minimizing infiltration and controlling runoff and soil erosion. Alternative 4 is less expensive but equally effective in satisfying the RAOs as Alternative 5. Therefore, Alternative 4 was the recommended selected remedy for Site DP-04 in the OU 3 FS. The implementation of surface controls and the installation of a soil cover at Site DP-04 would

constitute landfill closure and therefore make the site a potential candidate for delisting in the future.

Therefore, Alternative 4 was the selected remedy for Site DP-04. This alternative was implemented as described in Section 2.9. Actions at the OU 3 landfill sites were completed in April 1997.

Site LF-12. Under the future resident scenario, the baseline human health risk assessment estimated the highest cancer risk of 7.7E-07 for this landfill site, primarily because of the presence of dioxins found in some burn pits. This risk value is below the California and USEPA benchmark value of acceptable risk (i.e., risks calculated below this value would not require attention).

The results of the ecological risk assessment indicated a potential risk to burrowing mammals and their predators (e.g., barn owl), primarily because of the highly localized presence of dioxins, lead, zinc, and barium. However, human activities associated with the proposed land use for this parcel are expected to limit the selection of Site LF-12 as a primary habitat for many ecological receptors.

In order to satisfy the RAOs for minimizing infiltration and controlling runoff and soil erosion, Alternative 3 was the recommended remedy for Site LF-12 in the OU 3 FS. Alternatives 1 and 2 are not capable of satisfying these RAOs. In addition, the implementation of surface controls and cover rehabilitation at Site LF-12 would constitute landfill closure and therefore make the site a potential candidate for delisting in the future.

Therefore, Alternative 3 was the selected remedy for Site LF-12. This alternative was implemented as described in Section 2.9. Actions at the OU 3 landfill sites were completed in April 1997.

Site LF-14. Under the industrial/commercial scenario, the baseline human health risk assessment estimated the highest cancer risk of 1.0E-05 for this landfill site, primarily because of

the presence of cadmium values that are considered naturally occurring. Therefore, the probable health risks at Site LF-14 are expected to be lower, thereby reducing the importance of the RAO for preventing direct contact with landfill contents.

The results of the ecological risk assessment indicated a potential risk to burrowing mammals and their predators (e.g., barn owl), because of the localized presence of cadmium, lead, and pesticides. However, human activities associated with the proposed land use for this parcel are expected to limit the selection of Site LF-14 as a primary habitat for many ecological receptors.

In order to satisfy the RAOs for minimizing infiltration and controlling runoff and soil erosion, Alternative 3 was the recommended remedy for Site LF-14 in the OU 3 FS. Alternatives 1 and 2 are not capable of satisfying these RAOs. In addition, the implementation of surface controls and cover rehabilitation at Site LF-14 would constitute landfill closure and therefore make the site a potential candidate for delisting in the future.

Therefore, Alternative 3 was the selected remedy for Site LF-14. This alternative was implemented as described in Section 2.9. Actions at the OU 3 landfill sites were completed in April 1997.

Site LF-44. The screening risk assessment identified no COPCs for this landfill site. Therefore, there are no human health risks for direct contact with landfill contents and there is no potential for contaminant leaching. This practically eliminates the need to satisfy any of the RAOs for Site LF-44.

The results of the ecological risk assessment suggested some potential ecological impacts at Site LF-44 from physical disturbances. Some stress on vegetation exists at the site as a result of physical disturbance related to former site activities. However, significant chemical risks to vegetation or wildlife were not indicated by the site characterization data.

However, in order to restore the natural surface of the site, Alternative 2 was recommended for Site LF-44 in the OU 3 FS. The implementation of surface restoration and institutional controls

at Site LF-44 would constitute landfill closure and therefore make the site a potential candidate for delisting in the future.

Therefore, Alternative 2 was the selected remedy for Site LF-44. This alternative was implemented as described in Section 2.9. Actions at the OU 3 landfill sites were completed in April 1997.

SEDA. Under the future resident scenario, the baseline human health risk assessment estimated the highest cancer risk of 8.4E-05 for this landfill site, primarily because of arsenic and chromium values that are considered naturally occurring. Therefore, the probable health risks at the SEDA are expected to be lower, thereby reducing the importance of the RAO for preventing direct contact with landfill contents.

The results of the ecological risk assessment indicated a potential risk to burrowing mammals and their predators (e.g., barn owl), because of the localized presence of several metals and dioxin/furan congeners.

In order to satisfy the RAOs for minimizing infiltration and controlling runoff and soil erosion, Alternative 3 was selected for the SEDA in the OU 3 FS. Alternatives 1 and 2 are not capable of satisfying these RAOs. In addition, the implementation of surface controls and cover rehabilitation at the SEDA would effectively produce a soil cover on the landfill with an average thickness of 1.6 feet based on preliminary grading plans. Therefore, Alternative 3 would constitute landfill closure and make the site a potential candidate for delisting in the future.

Therefore, Alternative 3 was the selected remedy for the SEDA. This alternative was implemented as described in Section 2.9. Actions at the OU 3 landfill sites were completed in April 1997.

2.5.4.2 Detailed Description of the Landfill Site Preferred Alternatives. The selected alternatives from the OU 3 FS for the landfill sites (identified in Section 2.5.4.1) are described in detail below.

Sites DP-03 and DP-04. Installation of Alternative 4 for Sites DP-03 and DP-04 includes the following specific activities:

- grading the existing soil cover to promote surface runoff and decrease infiltration of surface water into landfill wastes;
- restoration of existing soil cover;
- installation of drainage ditches to prevent surface water from running onto the sites;
- installation of a 2-foot-thick native soil cover to reduce the potential of exposure to contaminants;
- re-establishment of native plant species on the graded surface;
- implementation of long-term groundwater monitoring in accordance with an approved basewide long-term groundwater monitoring plan;
- installation and maintenance of site perimeter fencing to control site access including signage warning against unauthorized vehicular traffic;
- implementation of land use restrictions such as preventing construction activities that would impair the integrity of the existing cover and preventing installation of monitoring or injection wells in the site area (except where required for environmental purposes); and
- 5-year site review to assess the effectiveness of the remedy.

Sites LF-12, LF-14, and the SEDA. Installation of Alternative 3 for Sites LF-12 and LF-14 includes the following specific activities:

- removal of surface debris;
- grading or cutting of the surface to promote surface runoff and decrease infiltration of surface water into landfill wastes;
- restoration of existing soil cover;
- installation of drainage ditches to prevent surface water from running onto the sites;

- re-establishment of native plant species on the graded surface;
- implementation of long-term groundwater monitoring in accordance with an approved basewide long-term groundwater monitoring plan;
- installation and maintenance of site perimeter fencing to control site access including signage warning against unauthorized vehicular traffic;
- implementation of land use restrictions such as preventing construction activities that would impair the integrity of the existing cover and preventing installation of monitoring or injection wells in the site area (except where required for environmental purposes); and
- 5-year site review to assess the effectiveness of the remedy.

Site LF-44. Contaminants of potential concern were not detected in soil samples at LF-44. Installation of Alternative 2 for Site LF-44 includes the following specific activities:

- removal of surface debris and disposal at an off-site disposal facility;
- implementation of long-term groundwater monitoring in accordance with an approved basewide long-term groundwater monitoring plan;
- implementation of land use notifications identifying the area as an NFA site; and
- 5-year site review to assess the effectiveness of the remedy.

Additional detail regarding the preferred action for the landfill sites has been presented in the Closure and Post-Closure Technical Plans for the landfill sites (Montgomery Watson, 1996b). A contingency plan would be implemented should it be determined that the remedy is no longer protective of human health and the environment. Contingency plans will be described as necessary as part of the operations and maintenance (O&M) documentation.

2.5.4.3 Cost Analysis. A preliminary cost estimate was prepared for the selected alternatives for each landfill site as part of the OU 3 FS process. Tables 6 through 11 summarize the cost analysis for the preferred alternative for each site.

2.5.4.4 System Implementation. In an effort to accelerate the remedial process, to minimize present and future environmental risks, reduce potential impacts to groundwater, and

facilitate timely transfer of property to the community, cleanup activities have been initiated under the direction of the USAF, at some of the sites presented in this ROD. These accelerated actions were performed in agreement with the RPMs including the USEPA, DTSC, Lahontan RWQCB, and USAF. The accelerated actions were performed at landfill Sites DP-03, DP-04, LF-12, LF-14, LF-44, and the SEDA as detailed in the Technical Plans for the landfill sites (Montgomery Watson, 1996b) and the Site Closeout Report for the landfill sites (Montgomery Watson, 1997c). The actions at the landfill sites began in June 1996 and were completed in April 1997. These actions are summarized in Section 2.9 (Current Site Status). The effectiveness of these remedies will be assessed as part of the ongoing O&M and long-term monitoring and will be the focus of the 5-year site review.

2.5.5 Statutory Determinations for the Landfill Sites

The selected remedies satisfy the statutory requirements of Section 121 of CERCLA, as amended by SARA, in that the following four mandates are attained:

- The selected remedies are protective of human health and the environment, will decrease site risks, and will not create short-term risk nor have cross-media consequences.
- The selected remedies comply with federal and state requirements that are applicable or relevant and appropriate to the remedial action such as chemical-specific ARARs, chemical-specific clean-up standards, and action-specific ARARs.
- The selected remedies are cost-effective in its fulfillment of the nine CERCLA evaluation criteria through remediation of the landfill sites in a reasonable period of time.
- The selected remedies utilize permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practicable.

2.5.5.1 Protection of Human Health and the Environment. Protection of human health and the environment at the OU 3 landfill sites is achieved by the selected remedy for each site by reducing or eliminating the potential for direct contact with landfill contents and minimizing infiltration.

2.5.5.2 **Compliance with ARARs.** All pertinent ARARs identified for the OU 3 landfill sites (Table 4) will be met by the selected remedies.

2.5.5.3 **Cost Effectiveness.** The USEPA, the USAF, and the State of California believe that the selected remedies fulfill the nine criteria of the NCP and provide overall effectiveness with respect to their costs.

2.5.5.4 **Utilization of Permanent Solution and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Possible.** The selected remedy represents, to the maximum extent to which permanent solutions and treatment technologies can be used, a cost-effective manner for remediating the OU 3 landfill sites. The remedies selected provide the best balance of long-term effectiveness and permanence; reduction of TMV through treatment; short-term effectiveness; implementability and cost effectiveness.

2.5.5.5 **Preference for Treatment as a Principle Element.** The selected remedies will leave contaminants in place at the OU 3 landfill sites. The size of the landfill sites and the heterogeneous nature of the wastes present, preclude a remedy in which contaminants could be excavated and treated effectively. Therefore, the selected remedies do not satisfy the preference for treatment as a principle element. However, the selected remedies provide a cost-effective method to reduce the mobility of contaminants.

2.6 TPH/VOC SITE SUMMARY

This section summarizes the site characteristics, risk assessment results, descriptions of the alternatives evaluated, alternatives comparison, and the selection of the final remedies for the OU 3 TPH/VOC sites potentially requiring action (Sites WP-17, FT-19a, FT-19b, FT-19c, FT-20 [soil], OT-51, and SS-59). Because potential remedial alternatives for Site OT-69 were evaluated separately (IT, 1995a), this site is discussed separately in Section 2.7.

2.6.1 Summary of TPH/VOC Site Characteristics and Risk Assessments

The OU 3 TPH/VOC sites presented in this ROD were investigated and evaluated using the same rationale and investigative techniques, which included a combination of soil-gas and soil sampling (soil borings, HydroPunch®, and monitoring wells). Table 12 presents a summary of the OU 3 TPH/VOC site characterizations on a site-specific basis.

Because of the similarities between these sites, they were initially investigated separately from the other OU 3 sites. The data was presented in the Remedial Investigation Summary Report for Soil Removal at Miscellaneous OU 3 Sites (M&E, 1994). Detected concentrations were compared to "initial evaluation criteria" to determine whether FS analysis to assess potential remedial action was required. The initial evaluation criteria were based on the Leaking Underground Fuel Tank (LUFT) Manual (LUFT Task Force, 1989) and were presented in the M&E RI Report as follows for soils less than 30 feet bgs (M&E, 1994):

TPH	1,000	milligram per kilogram (mg/kg)
benzene	1,000	micrograms per kilogram (µg/kg)
toluene	50,000	µg/kg
ethylbenzene	50,000	µg/kg
total xylenes	50,000	µg/kg

The results of the M&E investigation of the TPH/VOC sites were summarized in the subsequent OU 3 RI Report (Montgomery Watson, 1996a) in which a risk assessment was performed for each site.

Six of these sites (WP-17, FT-19a, FT-19b, FT-19c, OT-51, and SS-59) had TPH and BTEX constituents detected in soil at concentrations exceeding the initial evaluation criteria for these constituents.

The risk assessments performed for the TPH/VOC sites indicated that Sites FT-19a, FT-19b, FT-19c, and FT-20 [soil] had risks exceeding the California benchmark value of 1E-06; however, the

risks were primarily a result of the presence of inorganics which were considered naturally occurring.

Two sites had groundwater affected by COPCs (Sites OT-51 and OT-69). Site OT-51 had detectable concentrations of TPH (extractable as JP-4) and BTEX in the area of contaminated soil. A detailed risk assessment was not performed for groundwater at Site OT-51 because there is no completed exposure pathway to receptors (i.e., groundwater is at approximately 120 feet bgs and is not used as a source for potable water, irrigation, etc., in the vicinity of Site OT-51). Site OT-69 is defined as the TCE and PCE detected in groundwater in monitoring wells in the flightline and operations support facilities area. Site OT-69 has been addressed separately in Section 2.7. The groundwater beneath Sites FT-19a, b, and c is affected by TCE; however, this contamination is addressed in the final ROD for OU 1 (Montgomery Watson, 1994).

The site characterizations and risk assessments for the TPH/VOC sites requiring remedial action are summarized below. Additional details regarding the site characterizations and risk assessments are presented in the OU 3 RI/FS reports (Montgomery Watson, 1996a and 1997a).

2.6.1.1 Site WP-17. Site WP-17 is located near Buildings 551 and 552 in the central portion of the base. The site consists of a petroleum, oil, and lubricant (POL) leachfield used for disposal of waste POLs from vehicle maintenance and a fuels laboratory. The following subsections summarize the site characterization and risk assessment for Site WP-17.

Site Characterization. To characterize Site WP-17, M&E performed investigation activities including a historical records review, a soil-gas survey, and soil boring installation. Subsurface samples from the soil borings were collected and analyzed. Data gathered were used by Montgomery Watson to perform the fate and transport modeling and were also incorporated into the baseline risk assessment.

Elevated organic vapor analyzer (OVA) readings observed during the soil-gas survey were used to locate the four initial soil borings. Soil-gas survey results indicated pronounced O_2-CO_2 inversions at Site WP-17. The pronounced O_2-CO_2 inversions could indicate that aerobic

degradation has occurred and may be occurring. Localized elevated (>200 parts per million [ppm]) methane levels in locations with strong O_2-CO_2 inversion suggested that anaerobic degradation of constituents may be occurring in some areas (M&E, 1994).

Eleven soil borings were advanced to further investigate the soil-gas results and to assess the presence of POL and fuel constituents at the site. TPH and VOCs were detected in surface and subsurface samples collected from borings throughout the site. Based on the soil boring analytical results, it was concluded that detected concentrations exceeded the initial evaluation criteria (see Section 2.6.1) for TPH and BTEX in the boring adjacent to the oil-water separator at WP-17 (SBS-06). Concentrations exceeding these criteria were not detected deeper than 25 feet bgs at this boring. Several of the other borings in the vicinity of the former leachfield showed detectable concentrations of hydrocarbons and VOCs; however, these were lower than the evaluation criteria. Based on an assumed depth to groundwater of 120 feet bgs, vadose zone modeling results indicated that under the base case scenario (best estimate of site conditions for calibrated model), benzene in the soil water (i.e., the water distributed between the soil particles in the vadose zone) will not reach the water table and the soil water concentrations will reduce to less than 1.0 micrograms per liter (µg/L) in 100 years. The TPH constituents detected at Site WP-17 are less mobile than benzene; therefore, petroleum hydrocarbons constituents detected at Site WP-17 are not expected to adversely impact groundwater.

Risk Assessment. As described in Section 2.2.2, a baseline risk assessment was performed for Site WP-17 for which risk assessment scenarios were evaluated based on the proposed reuse of the land parcel in which the site is located (USAF, 1993). The scenario evaluated for this site was the construction worker (potential subsurface soil exposure). This baseline human health risk assessment estimated the highest excess lifetime cancer risk of 9.7E-07, primarily because of total chromium. Although this is below the benchmark values for risk assessment, because the initial evaluation criteria (based on the LUFT Manual; see Section 2.6.1) for TPH and BTEX were exceeded in soils at the site, the site was assessed in the OU 3 FS.

The results of the ecological risk assessment indicated that Site WP-17 was not an area of potential ecological concern because of the lack of suitable habitat for environmental receptors.

2.6.1.2 Sites FT-19a and FT-19c. Sites FT-19a and FT-19c are fire training areas located north of the Crosswind/Secondary Runway (Figure 2). Site FT-19a is an older training area located underneath a formerly concrete-lined training area. In addition to the main area, smaller areas, also used for fire training, are located south and east of the main training area. The smaller areas make up Site FT-19c. The following subsections summarize the site characterization and risk assessment for Sites FT-19a and FT-19c. Groundwater beneath Site FT-19 is considered part of OU 1.

Site Characterization. To characterize Sites FT-19a and FT-19c, M&E performed investigation activities including a soil-gas survey, soil boring installation, composite sample dioxin testing (with a risk assessment), biological testing, and removal activities (with associated confirmation sampling). Samples from the soil borings and confirmation samples were collected and analyzed. Data gathered were used by Montgomery Watson to perform the fate and transport modeling and were also incorporated into the baseline risk assessment.

Concentrations of VOCs in shallow (7 feet bgs) soil-gas points were identified throughout the site. Thirty-eight soil borings were advanced to investigate the fire training rings and to further investigate the soil-gas results. Four composite samples from surface soil samples throughout the site showed detectable concentrations of some dioxin constituents. Based on the application of total equivalence factors to the dioxin results, M&E reported that the toxicity equivalents (TEs) were below action levels (M&E, 1994). TPH, VOCs, and SVOCs were detected in surface and subsurface samples in borings throughout the site. Based on the soil boring analytical results, it was concluded that petroleum concentrations exceeded the initial evaluation criteria for TPH and BTEX (based on the LUFT Manual; see Section 2.6.1) in several locations at the sites. Biological testing suggests that, although some aerobic biological activity may be occurring at the site, very little anaerobic biological activity was occurring (M&E, 1994). Vadose zone modeling results indicated that under the base case scenario (best estimate of site conditions for calibrated model), benzene in the soils at Sites FT-19a and FT-19c will not adversely affect groundwater quality. However, under the base case scenario, model results predicted that TCE present in the vadose zone at Site FT-19c would reach the water table within 75 years with

concentrations increasing to greater than 400 milligrams per liter (mg/L) within 100 years. Because FT-19 overlies the OU 1 TCE plume and is considered a potential source for this contamination, the modeling of the groundwater beneath this area has been considered separately as part of OU 1. The proposed OU 1 treatment system design, including modeling scenarios and results, is presented in detail in the OU 1 Pre-Design Study (Montgomery Watson, 1995b).

Risk Assessment. As described in Section 2.2.2, a baseline risk assessment was performed for Sites FT-19a and FT-19c for which risk assessment scenarios were evaluated based on the proposed reuse of the land parcel in which the site is located (USAF, 1993). The scenarios evaluated for these sites included: industrial/commercial, trespasser/visitor, construction worker (potential surface soil exposure), and construction worker (potential subsurface soil exposure) This baseline human health risk assessment estimated the highest lifetime cancer risk of 4.0E-06 for Site FT-19a, primarily because of arsenic under a construction worker (subsurface soils) scenario. Although this is above the benchmark values for risk assessment, the arsenic at the site is considered naturally occurring. However, because the initial evaluation criteria (based on the LUFT Manual; see Section 2.6.1) for TPH and BTEX were exceeded in soils at the site, the site was assessed in the OU 3 FS.

The baseline human health risk assessment estimated the highest lifetime cancer risk of 3.1E-06 for Site FT-19c, primarily because of chromium under an industrial/commercial scenario. Although this is above the benchmark values for risk assessment, the chromium at the site is considered naturally occurring and within background ranges. However, because the initial evaluation criteria (based on the LUFT Manual; see Section 2.6.1) for TPH and BTEX were exceeded in soils at this site and vadose zone modeling indicated TCE in soils may adversely affect groundwater quality, the site was assessed in the OU 3 FS.

The results of the ecological risk assessment indicated that Sites FT-19a and FT-19c are not areas of potential ecological concern because of the lack of suitable habitat for environmental receptors.

2.6.1.3 Site FT-19b. Site FT-19b is the Medical Waste Disposal Area adjacent to Site FT-19c (Figure 2). The site is located approximately 800 feet south of the main fire training area (Site FT-19a). Medical waste was discovered at the site during soil-gas investigations conducted in the Site FT-19 area in 1987 (Montgomery Watson, 1996a). Because of the unique nature of Site FT-19b, it was investigated separately from Sites FT-19a and FT-19c. The following subsections summarize the site characterization and risk assessment for Site FT-19b.

Site Characterization. To characterize Site FT-19b, M&E performed investigation activities including a soil-gas survey, soil boring installation, composite sample dioxin testing (with a risk assessment), biological testing, and disposal area assessment with shallow test pits. Samples from the soil borings and confirmation samples were collected and analyzed. Biological testing and composite dioxin sampling was performed over the Site FT-19 area as a whole (sites a, b, and c). Data gathered were used by Montgomery Watson to perform the fate and transport modeling and were also incorporated into the baseline risk assessment. It was found that the soil beneath the medical wastes was affected by hydrocarbons and VOCs similar to Sites FT-19a and FT-19c as detailed below.

Concentrations of VOCs in shallow (7 feet bgs) soil-gas points were identified throughout the site. Eleven soil borings were advanced to further investigate the soil-gas results and assess the presence of fuel and VOC constituents at the site. TPH, VOC, and SVOCs were detected in surface and subsurface samples in borings throughout the site. Based on the soil boring analytical results, is was concluded that petroleum concentrations exceeded the initial evaluation criteria (based on the LUFT Manual; see Section 2.6.1) for TPH and BTEX in two borings at the site. TPH was detected to a maximum depth of 25 feet bgs. Vadose zone modeling results indicated that under the base case scenario (best estimate of site conditions for calibrated model), the most mobile constituents in the soils at Site FT-19b will not adversely affect groundwater quality. The disposal area assessment and test pits revealed that medical wastes were present primarily in the surface soil.

It is believed that the TPH and VOC constituents detected at the site are related to activities at Sites FT-19a and FT-19c. However, the summary of the site characterization at Site FT-19b

have been presented separately from Sites FT-19a and FT-19c to be consistent with the original data presentation in the M&E RI Report (M&E, 1994) and because of the unique site characteristic of the medical waste being present. The approximate area where medical wastes were observed was mapped by M&E (M&E, 1994) and is presented in the OU 3 RI Report (Montgomery Watson, 1996a). The medical wastes at this site have been removed and disposed of at an off-site disposal facility under the Full Service Remedial Action (FSRA) activities.

Risk Assessment. As described in Section 2.2.2, a baseline risk assessment was performed for Site FT-19b for which risk assessment scenarios were evaluated based on the proposed reuse of the land parcel in which the site is located (USAF, 1993). The scenarios evaluated for this site included: industrial/commercial, trespasser/visitor, construction worker (potential surface soil exposure), and construction worker (potential subsurface soil exposure). This baseline human health risk assessment estimated the highest excess lifetime cancer risk of 5.2E-06, primarily because of incidental ingestion of beryllium and nickel in soils under the industrial/commercial worker scenario. Although this is above the benchmark value for risk assessment, the beryllium and nickel detected at the site were considered naturally occurring and within background ranges. However, because the initial evaluation criteria (based on the LUFT Manual; see Section 2.6.1) for TPH and BTEX were exceeded in soils at the site, remedial actions were considered in the OU 3 FS for the TPH and VOCs detected at Site FT-19b.

The results of the ecological risk assessment indicated that Site FT-19b was not an area of potential ecological concern because of the lack of suitable habitat for environmental receptors.

2.6.1.4 Site FT-20 (Soil)

Site FT-20 (soil) is the reported location of an abandoned fire training area (Figure 2). The site is located in an unpaved area south of the STP percolation ponds (Site WP-26). Site FT-20 (soil) is the designation for the soil in this area. The affected groundwater in this vicinity is designated as FT-20 (groundwater) which is currently an OU 2 site; therefore, it is not addressed further in this ROD. The following subsections summarize the site characterization and risk assessment for Site FT-20 (soil).

Site Characterization. To characterize Site FT-20 (soil), an active soil-gas program was conducted, five borings were installed, and surface and subsurface (soil boring) samples were collected and analyzed. Compiled data were used to perform fate and transport modeling and were also incorporated into a baseline risk assessment.

TCE in shallow soil-gas was detected sporadically throughout the site. Five soil borings were installed to depths of 15 feet to investigate soil-gas anomalies and reported burn areas. Arsenic, barium, lead, mercury, zinc, and hydrocarbons were detected sporadically in surface and subsurface samples above background. Although TCE was detected in the soil-gas, no VOC contamination was found in the surface or subsurface soil samples. Hydrocarbons were detected in two surface soil samples at concentrations of 4,200 mg/kg and 8,900 mg/kg. Vadose zone modeling results showed that even under the most conservative conditions, the most mobile constituent will not migrate deeper than 20 feet below the bottom of the disturbed areas within 100 years. Therefore, the less mobile contaminants detected at this site are not expected to migrate significantly below the bottom of the disturbed areas and would pose no threat to the groundwater.

Risk Assessment. As described in Section 2.2.2, a baseline risk assessment was performed for Site FT-20 for which risk assessment scenarios were evaluated based on the proposed reuse of the land parcel in which the site is located (USAF, 1993). The scenarios evaluated for this site included: industrial/commercial, trespasser/visitor, construction worker (potential surface soil exposure), and construction worker (potential subsurface soil exposure). This baseline human health risk assessment estimated a highest excess lifetime cancer risk of 4.0E-05, primarily because of arsenic under an industrial/commercial scenario. Although this is above the benchmark value for risk assessment, the arsenic at the site is considered naturally occurring and within the background range. However, because elevated concentrations of petroleum hydrocarbons were detected in surface samples, the site was assessed in the OU 3 FS.

The results of the ecological risk assessment indicated that Site FT-20 (soil) is not an area of potential ecological concern because of the lack of suitable habitat for environmental receptors.

2.6.1.5 Site OT-51/SS-59. The location of Site OT-51 is shown on Figure 2. The site consists of five engine test cells. The section of the site designated as OT-51 is located near engine test cell Facilities 799 and 807. Periodic jet fuel spills have reportedly occurred at the site during testing. The section of the site designated as SS-59 is located near Facility 819. Site SS-59 is the reported location of an 8,000-gallon jet fuel spill. The two remaining test cells are located in revetments south of Site SS-59. Because the sites are closely related, they were combined for investigation activities. The following subsections summarize the site characterization and risk assessment for Site OT-51/SS-59.

Site Characterization. To characterize Site OT-51/SS-59, M&E performed investigation and removal activities including soil boring and monitoring well installation, and UST and septic system removal. Surface and subsurface samples from the soil borings were collected and analyzed. Based on preliminary analytical data collected by M&E, Montgomery Watson performed subsequent investigations at a "hot spot" identified at Site OT-51. The additional investigation activities at Site OT-51 included: subsurface soil sampling during installation of HydroPunch® borings, soil borings, and monitoring wells; downhole geophysics; aquifer testing; and groundwater sampling. Data gathered from the M&E and Montgomery Watson investigations were used by Montgomery Watson to perform the fate and transport modeling and were also incorporated into the baseline risk assessment.

The results of the M&E investigations at Site OT-51/SS-59 are presented in detail in the M&E RI Report (M&E, 1994) and are summarized in the OU 3 RI Report (Montgomery Watson, 1996a). Based on the initial evaluation criteria presented in the M&E RI Report (based on the LUFT Manual; see Section 2.6.1), it was concluded that no further action was warranted at the soil berm at Facility 807 or the two revetment engine test cells south of SS-59. However, consideration of potential remedial action warranted at Facility 819 (Site SS-59) and further investigation was required at the soil berm at Facility 799 (Site OT-51) to define the extent of constituent concentrations exceeding the initial evaluation criteria for TPH and BTEX.

Subsequent investigations at Site OT-51, performed by Montgomery Watson to fill general data needs, included collection of subsurface soil samples and groundwater sampling. Results of this investigation showed that detectable concentrations of TPH and BTEX are present in the groundwater in the area of the hot spot identified during the M&E investigations. Monitoring wells installed upgradient (WZ-05) and downgradient (MW-1) showed no detectable concentrations of TPH (extractable as JP-4) or BTEX during the September 1994 sampling event. However, TPH (extractable as JP-4) and BTEX were detected in monitoring wells WZ-04 and WZ-06 (installed in the area of the hot spot), and in crossgradient HydroPunch® borings SBS-25 and SBS-27. Soil sampling confirmed the elevated hydrocarbon constituent concentrations reported by M&E with the highest concentrations of TPH (extractable as JP-4) and BTEX occurring in samples collected from WZ-04. Soil sampling from the M&E and Montgomery Watson investigations confirmed that the elevated TPH and VOC concentrations in the soil are primarily limited to the area of the hot spot. Occasional hits of TPH and BTEX compounds are present in some surrounding borings, with the highest detected concentrations occurring at depths of approximately 100 feet bgs. Vadose zone modeling results indicated that under the base case scenario (best estimate of site conditions for calibrated model), benzene in the soil will continue to reach the water table over the 100 years modeled. Based on the fact that groundwater is affected by TPH and VOCs beneath Site OT-51, and vadose zone modeling results, the affected groundwater was also modeled for the site using benzene as an indicator compound. Results of this modeling indicated that over 50 years, the migration of benzene leaching from the vadose zone will be limited. The base case scenario indicated that the leading edge of a 0.5 μg/L benzene plume boundary would migrate approximately 400 feet from the source area.

After the completion of the remedial investigations at the site in September 1994, subsequent sampling rounds were performed as part of the basewide long-term monitoring plan in September 1995, January 1996, May 1996, October 1996, February 1997, and July 1997 (Montgomery Watson, 1996c,d,e,f; Montgomery Watson, 1997d,e,f). All four monitoring wells had detectable concentrations of TPH and BTEX in the September 1995 sampling event. Concentrations of most of these compounds increased in subsequent sampling rounds, with peak values in January and May 1996, after which concentrations generally decreased. BTEX

compounds were near or below detection limits during the last sampling event (July 1997), and TPH values ranged from <50 mg/L (non-detect) to 120 mg/L.

Risk Assessment. Preliminary Remediation Goal (PRG) screening in accordance with the methodology presented in the OU 3 RI indicated that further human health risk analysis was not required because confirmed contamination was at depths that would not affect receptors in the risk assessment scenarios. However, because the initial evaluation criteria (based on the LUFT Manual as presented in the M&E RI Report [M&E, 1994]) for TPH and BTEX were exceeded in soils at the site and because groundwater quality is affected, the site was assessed in the OU 3 FS.

The results of the ecological risk assessment indicated that Site OT-51/SS-59 is not an area of potential ecological concern because of the lack of suitable habitat for environmental receptors.

2.6.2 Description of TPH/VOC Site Alternatives

Based on the results of remedial investigations, it was determined that remedial action was potentially necessary at OU 3 TPH/VOC Sites WP-17, FT-19a, FT-19b, FT-19c, OT-51, and SS-59 to protect groundwater quality. An FS analysis was performed for these sites as described for the landfill sites in Section 2.5.2. Alternatives were developed and evaluated for the TPH/VOC sites as a group because of the similarity between the sites with respect to contaminant type, distribution, site characteristics, and potential actions. The RAOs established for the OU 3 TPH/VOC sites are summarized below:

Soil Sites. The RAOs developed for the soils at the TPH/VOC sites are summarized below.

Protection of Human Health

- Prevent human exposure to soil having 1E-04 to 1E-06 excess cancer risk from all carcinogens.
- Prevent human exposure to soil having noncarcinogens in excess of reference doses (RfDs).

Protection of the Environment

- Reduce the TMV of the contamination in unsaturated soil to reduce the potential migration of contaminants to groundwater.
- Remove, to the extent practical, the COPCs detected in unsaturated soils to meet or exceed the remediation goals discussed below.

To protect groundwater quality, remediation goals for the BTEX and TPH in soils were determined in the FS based on the LUFT Field Manual (LUFT Task Force, 1989) by completing the scoring system presented in the LUFT manual for a general site at GAFB. Figure 9 presents the remediation goals for TPH and BTEX in the form of depth-specific levels relative to the groundwater table. The depth to groundwater for the TPH/VOC sites is approximately 120 feet bgs.

The LUFT manual does not provide a method for determining remediation goals for TCE (the primary constituent of concern for Site FT-19c); therefore, remediation goals were determined using SESOIL modeling as detailed in the OU 3 FS Report (Montgomery Watson, 1997a). A graphical presentation of the levels of TCE that must be obtained are presented on Figure 10.

Based on these remediation goals, a remedy would be implemented and operated until the mass of contaminants remaining was such that no impact to groundwater was anticipated. Prior to closure of a TPH/VOC site for which a remedy has been implemented, confirmation samples (soil and vapor) would be collected as necessary to demonstrate that soil cleanup levels presented on Figures 9 and 10 are achieved. If contamination remaining in soil can be demonstrated to have no impact to groundwater quality, concentrations remaining in soil may exceed the numerical values presented in Figures 9 and 10, and the site may be considered for closure.

Groundwater Sites. There are currently no complete exposure pathways for the contaminated groundwater at Site OT-51. Groundwater in the site area is not used as a source of domestic, industrial, or agricultural supply. Therefore, there is currently no danger of adverse exposure to either base personnel or residents. In addition, the groundwater does not reach the ground

surface within the base boundaries; therefore, there is no known current exposure pathway to ecological receptors.

However, in accordance with ARARs which call for protection of groundwater resources, groundwater at Site OT-51 should be protected. Therefore, the RAO for groundwater is as follows:

- Reduce the dissolved concentrations for identified COPCs in the groundwater beneath Site OT-51 so that the most stringent concentrations identified in the ARARs are not exceeded (maximum contaminant levels [MCLs], secondary MCLs, or quantifiable taste or odor criteria).

The groundwater numerical cleanup standards for Site OT-51 are presented on Table 13.

Remedial alternatives were developed for the TPH/VOC sites from an analysis of remedial technologies as part of the OU 3 FS (Montgomery Watson, 1997a). The alternatives, with their components, are presented in the following sections as applicable for soil and groundwater.

Soil Alternatives. Four remedial alternatives were developed for the TPH/VOC-affected soils from an analysis of remedial technologies as part of the OU 3 FS (Montgomery Watson, 1997a). The four alternatives, with their components, are as follows:

Alternative 6 (No Action for Soil)
1) Groundwater Monitoring
2) 5-Year Site Review

Alternative 7 (Removal/Disposal)
1) Removal of Contaminated Soils
2) Transport of Soils to Off-Site Treatment/Disposal Facility
3) Surface Restoration

Alternative 8 (Soil Vapor Extraction [SVE])
1) Installation of SVE System to Remediate Soils
2) Groundwater Monitoring
3) Access Restrictions
4) Land Use Restrictions
5) 5-Year Site Review

Alternative 9 (Bioventing)

1) Installation of Bioventing System to Remediate Soils
2) Groundwater Monitoring
3) Access Restrictions
4) Land Use Restrictions
5) 5-Year Site Review

Groundwater Alternatives. Two remedial alternatives were developed for TPH/VOC-affected groundwater at Site OT-51 from an analysis of remedial technologies as part of the OU 3 FS (Montgomery Watson, 1997a). The alternatives, with their components, are as follows:

Alternative 10 (No Action for Groundwater)

1) Groundwater Monitoring
2) 5-Year Site Review

Alternative 11 (Oxygen Enhanced Bioremediation)

1) Land Use Restrictions
2) Use of an oxygen-releasing chemical (i.e., Oxygen Release Compound [ORC]® or hydrogen peroxide [H_2O_2]) in existing wells if COPCs in downgradient monitoring wells do not meet groundwater numerical cleanup standards (Table 13) within a sufficient time frame
3) Groundwater Monitoring
4) 5-Year Site Review

2.6.2.1 Alternative 6: No Action for Soil. As required by the NCP, the no action alternative serves as a baseline against which other TPH/VOC soil alternatives are compared. Its components include groundwater monitoring and the 5-year site review.

Groundwater monitoring at the OU 3 TPH/VOC sites would be part of an approved basewide long-term monitoring plan for GAFB. Selected monitoring wells at each site would be sampled annually, semi-annually, or quarterly, to determine if TPH/VOC contaminants are leaching to the groundwater. Additional monitoring wells may be required to satisfy this monitoring component (i.e., at Site OT-51).

The no-action alternative would leave TPH/VOC-affected soils in place with no closure activities undertaken; however, natural degradation of the TPH and VOCs would occur. Because contaminants would remain on site, a site review would be conducted every 5 years as required

by CERCLA. The purpose of the 5-year site review and long-term monitoring would be to assess the effectiveness of the alternative.

2.6.2.2 Alternative 7: Removal/Disposal. Alternative 7 includes removal of contaminated soils, transport to an off-site treatment/disposal facility, and surface restoration.

For this alternative, backhoes and dump trucks would be used to remove affected soils. Surface restoration would involve importing clean fill and restoring the excavated area to a level, compacted surface. Affected soils would be transported to the off-site treatment/disposal facility and clean fill would be imported with dump trucks. Some demolition and/or cutting of existing concrete pads would be required (i.e., at Site SS-59).

It is assumed that, after the contaminated soils are removed from the site, there would be closure on the site and continued groundwater monitoring would not be conducted and the 5-year site review would not be required.

2.6.2.3 Alternative 8: Soil Vapor Extraction. Alternative 8 consists of using SVE to remediate soil with confirmation sampling, groundwater monitoring, land use and access restrictions, and 5-year site review.

SVE is a soil remediation technology that uses vacuum blowers to pull large volumes of air through contaminated soil. The air flow sweeps out the soil gas, causing desorption of volatile contaminants from the soil into the vapor phase. A schematic of a typical SVE system design is presented in Figure 11.

SVE for soil would be achieved using a series of extraction vents. Monitoring points would be installed for soil vapor sampling to facilitate a pilot test study at the site and for subsequent system evaluation. A schematic for a typical monitoring point and vapor sampling apparatus is presented on Figure 12.

To evaluate system performance for this alternative, confirmation samples would be collected and groundwater monitoring would be performed. Confirmation sampling to determine completion of the remediation could include soil and vapor.

In addition, land use and access restrictions would be employed until the remediation is confirmed to be complete. Land use restrictions would prohibit disturbance of affected soils and restrict installation of wells for use other than groundwater monitoring. Access restrictions would protect the remedy while in place and would be achieved through fencing and/or standard security procedures minimizing access from unauthorized personnel. When the remediation is complete, the restrictions described above would be reassessed by the appropriate regulatory agencies as part of the 5-year site review. The purpose of the 5-year site review and monitoring would be to assess the effectiveness of the alternative.

2.6.2.4 Alternative 9: Bioventing. Alternative 9 consists of using in situ bioventing to remediate soil with confirmation sampling, groundwater monitoring, land use and access restrictions, and 5-year site review.

Bioventing uses forced aeration to stimulate soil-indigenous microorganisms to aerobically metabolize organic compounds in unsaturated soils. Depending on air flow rates, VOCs may be simultaneously removed through volatilization. A schematic of a typical bioventing system is presented in Figure 13.

To evaluate system performance for this alternative, confirmation samples would be collected and groundwater monitoring would be performed. Confirmation sampling to determine completion of the remediation could include soil samples and vapor samples.

In addition, land use and access restrictions (as described in Section 2.6.2.3), and 5-year site review would be employed until remediation is confirmed complete as described for Alternative 8.

2.6.2.5 Alternative 10: No Action for Groundwater. As required by the NCP, the no action alternative serves as a baseline against which other TPH/VOC groundwater alternatives are compared. Its components include groundwater monitoring and the 5-year site review.

Selected monitoring wells would be sampled annually, semi-annually, or quarterly, to monitor constituents present in the groundwater. Additional monitoring wells may be required to satisfy groundwater monitoring requirements.

The no-action alternative would leave TPH/VOC-affected groundwater in place with no closure activities undertaken. Because contaminants would remain on site, a site review would be conducted every 5 years as required by CERCLA. The groundwater monitoring and 5-year site review would be used to assess the effectiveness of the alternative.

2.6.2.6 Alternative 11: Oxygen Enhanced Bioremediation. Alternative 11 consists of land use restrictions, use of oxygen-releasing chemicals (i.e., ORC® or H_2O_2) in existing monitoring wells if COPCs in downgradient monitoring wells do not meet groundwater numerical cleanup standards (Table 13) within a sufficient time frame, groundwater monitoring, and 5-year site review.

With this alternative, the implementation of land use restrictions at the site would restrict access to the affected groundwater and prohibit disturbance of existing monitoring wells and appurtenances. Administrative measures would be taken to ensure that groundwater is not used for domestic uses (i.e., drinking or irrigation).

The top portion of the groundwater would be oxygenated through the use of oxygen-releasing chemicals (i.e., ORC® or H_2O_2) in the existing monitoring wells to accelerate natural biodegradation. ORC® is a fine, insoluble magnesium peroxide compound that slowly releases oxygen when it is activated by moisture. The oxygenation would enhance the degradation of fuels and VOCs by naturally occurring aerobic microorganisms. ORC® is a passive process which does not disturb the hydraulics of the plume. Installation would consist of installing an appropriate number of inert filter socks containing the ORC® compound into the groundwater

via the existing monitoring wells. The ORC® socks would require replacement every 6 to 12 months, depending on the concentrations of constituents in the groundwater.

Similarly, H_2O_2 can be used to oxygenate the groundwater by injecting a dilute solution into the contaminated groundwater zone. For comparison purposes, the discussion that follows, including the cost analysis, assumes the use of ORC®.

The groundwater monitoring and 5-year site review would be used to assess the effectiveness of the alternative.

Subsequent to the remedial investigations at Site OT-51, groundwater at the site has been routinely monitored as part of the Basewide Long-Term Groundwater Monitoring Plan (Montgomery Watson, 1995c and 1996c). The groundwater data collected since September 1995 at Site OT-51 as part of the long-term groundwater monitoring effort (Montgomery Watson, 1996d,e,f; 1997d,e,f) have indicated that the COPCs in groundwater increased slightly and then began decreasing. It is expected that the plume will be below detectable levels of benzene in 5 years. Under this alternative, if subsequent rounds of long-term monitoring do not continue to show the trend of decreasing levels of COPCs, the contingent task of installation of the oxygen-releasing chemicals described above would be implemented.

2.6.3 Summary of Comparative Analysis of Alternatives for the TPH/VOC Sites

The remedial alternatives developed were analyzed in detail using the nine evaluation criteria required by the NCP as detailed in Section 2.5.3 for the landfill sites.

The resulting strengths and weaknesses of the alternatives were then weighed to identify the alternative providing the best balance among the nine criteria. Table 14 summarizes this comparison.

2.6.3.1 Overall Protection of Human Health and the Environment. This criterion was defined in Section 2.5.3.1 for the landfill sites. The comparative analysis for this criterion for the TPH/VOC sites is presented below.

Soil:

Alternative 6: This alternative does not provide any direct protection of human health and the environment at any of the TPH/VOC soil sites because no cleanup activities are undertaken.

Alternative 7: The overall protection of human health and the environment is high at the applicable sites (FT-20 [soil] and SS-59). This alternative removes the potential for direct contact with TPH/VOC-affected soils through removal, treatment, and disposal, and reduces the potential for further leaching to the groundwater.

Alternative 8: The overall protection of human health and the environment is high at the applicable site (FT-19c). This alternative would reduce the levels of TPH/VOC constituents in soils to below remediation goals.

Alternative 9: The overall protection of human health and the environment is high at the applicable sites (WP-17, FT-19a, FT-19b, and OT-51). This alternative would reduce the levels of TPH constituents in soils to below remediation goals.

Groundwater (Site OT-51):

Alternative 10: This alternative does not provide any additional direct protection of human health and the environment because no enhanced remedial activities are undertaken and access to the affected groundwater is not restricted. The process of natural attenuation would occur.

Alternative 11: This alternative provides overall protection of human health and the environment through land use and deed restrictions prohibiting installation of domestic supply wells until remediation can be demonstrated. This alternative enhances natural degradation of contaminants.

2.6.3.2 Compliance with ARARs. The definition of ARARs and this criterion was presented in Section 2.5.3.2 for the landfill sites. Final ARARs for the OU 3 landfill sites were established through discussions between the Lahontan RWQCB, DTSC, USEPA, and USAF. A listing of agreed upon federal and state laws and regulations that are ARARs for the OU 3 TPH/VOC sites is provided in Table 15.

Soil:

Alternative 6: May not comply with all ARARs at all TPH/VOC sites because the existing contamination remains in place with no active remediation to achieve cleanup goals.

Alternative 7: The active removal of contaminated soils and subsequent appropriate disposal is expected to comply with the ARARs for TPH/VOC sites.

Alternative 8: The active remediation of contaminated soils through SVE is expected to comply with the ARARs for TPH/VOC sites.

Alternative 9: The active remediation of contaminated soils through bioventing is expected to comply with the ARARs for TPH/VOC sites.

Groundwater (Site OT-51):

Alternative 10: May not comply with all ARARs for groundwater because no enhanced remediation of the groundwater plume is undertaken. Although natural attenuation processed would occur, the state considers movement of the plume as a discharge which violates State Water Resources Control Board Resolution 68-16; an ARAR for this site.

Alternative 11: This alternative is expected to comply with ARARs. Specifically, the proposed action is expected to enhance biodegradation and address threatened impacts to waters of the state.

2.6.3.3 Long-Term Effectiveness and Permanence. This criterion was defined in Section 2.5.3.3 for the landfill sites. The comparative analysis for this criterion for the

TPH/VOC sites is presented below. All of the TPH/VOC alternatives satisfy the RAO on groundwater monitoring to assess potential migration of constituents to groundwater.

Soil:

Alternative 6: This alternative does not provide an active method to satisfy the RAOs for preventing human exposure to soils having excess risk, to reduce concentrations of contaminants to meet remediation goals, and to reduce the TMV of contaminants. However, the natural degradation of fuel constituents would occur. Therefore, the risks from direct contact with the TPH/VOC-affected soils remains unchanged.

Alternative 7: This alternative satisfies all of the RAOs at the applicable sites (FT-20 [soil] and SS-59); therefore, long-term effectiveness of this alternative is expected to be high.

Alternative 8: This alternative satisfies all of the RAOs at the applicable site (FT-19c); therefore, long-term effectiveness of this alternative is expected to be high. SVE has proven to be effective in remediating soil contaminated with VOCs to below target remediation goals. In addition, the aeration of the soil via vapor extraction may encourage biological degradation of TPH constituents.

Alternative 9: This alternative satisfies all of the RAOs at the applicable sites (WP-17, FT-19a, FT-19b, and OT-51); therefore, long-term effectiveness of this alternative is expected to be high. Bioventing has proven to be effective in remediating soil contaminated with hydrocarbons to below target remediation goals.

Groundwater (Site OT-51):

Alternative 10: This alternative does not satisfy the RAOs for preventing human exposure to contaminated groundwater having excess risk. Therefore, the risks from direct contact with the affected groundwater remain unchanged.

Alternative 11: For this alternative, restriction of access to the affected groundwater provides a permanent solution. Biodegradation would ultimately reduce the contaminant concentrations.

2.6.3.4 Reduction of Toxicity, Mobility, and Volume through Treatment. This criterion was defined in Section 2.5.3.4 for the landfill sites. The comparative analysis for this criterion for the TPH/VOC sites is presented below.

Soil:

Alternative 6: This alternative provides no active reduction of TMV of TPH/VOC-affected soils at any of the sites.

Alternative 7: This alternative would reduce the TMV of soil contaminants at the applicable sites (FT-20 [soil] and SS-59) by physically removing, treating, and ultimately disposing of the affected soils.

Alternative 8: SVE would reduce the TMV of soil contaminants at the applicable site (FT-19c).

Alternative 9: Bioventing would reduce the TMV of soil contaminants at the applicable sites (WP-17, FT-19a, FT-19b, and OT-51).

Groundwater (Site OT-51):

Alternative 10: This alternative provides no enhanced reduction of TMV of TPH/VOC-affected groundwater at Site OT-51. The total mass of contaminants is reduced by degradation and the concentrations are reduced by natural attenuation to below groundwater numerical cleanup standards. The volume of affected groundwater is not reduced; however, the volume of water that contains constituents above numerical cleanup standards would be reduced. Mobility is not actively reduced; however, results of groundwater modeling for the site indicated that over 50 years, the benzene leaching from the vadose zone would not migrate far from the source areas. The base case model scenario indicated that the leading edge of a 0.5 µg/L benzene plume boundary would migrate approximately 400 feet from the source area.

Alternative 11: This alternative provides enhancement of the naturally occurring reduction of TMV of TPH/VOC-affected groundwater at Site OT-51. The total mass of contaminants is

reduced by degradation and the concentrations are reduced to below groundwater numerical cleanup standards. The volume of affected groundwater is not reduced; however, the volume of water that contains constituents above numerical cleanup standards would be reduced. Mobility is not actively reduced; however, results of groundwater modeling for the site indicated that over 50 years, the benzene leaching from the vadose zone would not migrate far from the source areas. The base case model scenario indicated that, left untreated, the leading edge of a 0.5 µg/L benzene plume boundary would migrate approximately 400 feet from the source area. Additional groundwater monitoring beyond Alternative 10 would provide data to allow efficient evaluation of the natural degradation and potential migration of contaminants at the site. Oxygenation of top portion of the groundwater with oxygen-releasing chemicals would accelerate natural degradation of constituents.

2.6.3.5 Short-Term Effectiveness. This criterion was defined in Section 2.5.3.5 for the landfill sites. The comparative analysis for this criterion for the TPH/VOC sites is presented below.

Soil:

Alternative 6: This alternative entails no risks to construction workers because no cleanup activities are undertaken at any site. In addition, no short-term public health and environmental impacts would be expected from this alternative.

Alternative 7: Short-term public health and environmental impacts associated with this alternative at the applicable sites (FT-20 [soil] and SS-59) are expected to be minimal. Site remediation workers would need to take appropriate precautions during removal and transport of affected soils.

Alternative 8: Short-term public health and environmental impacts associated with this alternative at the applicable site (FT-19c) are expected to be minimal. Site remediation workers would need to take appropriate precautions during installation and operation of the SVE system.

Alternative 9: Short-term public health and environmental impacts associated with this alternative at the applicable sites (WP-17, FT-19a, FT-19b, and OT-51) are expected to be minimal. Site remediation workers would need to take appropriate precautions during installation and operation of the bioventing systems.

Groundwater (Site OT-51):

Alternative 10: This alternative entails no risks to construction workers because no cleanup activities are undertaken at the site. In addition, no short-term public health and environmental impacts would be expected from this alternative.

Alternative 11: Short-term public health and environmental impacts associated with this alternative are expected to be minimal. Site remediation workers would need to take appropriate precautions during installation of the selected soil remediation system and use of oxygen-releasing chemicals in the existing monitoring wells.

2.6.3.6 Implementability. This criterion was defined in Section 2.5.3.6 for the landfill sites. The comparative analysis for this criterion for the TPH/VOC sites is presented below.

Soil:

Alternative 6: This alternative is easily implemented because no closure activities are under taken. Groundwater monitoring is easy to implement and the materials required are readily available. There are no administrative difficulties associated with this alternative.

Alternative 7: Removal and disposal of soils is a feasible technology and is easily implemented for shallow contamination (i.e., Sites FT-20 [soil] and SS-59). Materials and services required are readily available.

Alternative 8: SVE is a demonstrated technology that is readily implemented. Materials and services required are readily available. There are no administrative difficulties associated with this alternative.

Alternative 9: Similar to Alternative 8, bioventing is a demonstrated technology that is readily implemented. Materials and services required are readily available. There are no administrative difficulties associated with this alternative.

Groundwater (Site OT-51):

Alternative 10: This alternative is easily implemented because no closure activities are under taken. Groundwater monitoring is easy to implement and the materials required are readily available. There are no administrative difficulties associated with this alternative.

Alternative 11: Use of oxygen-releasing chemicals (i.e., ORC®) in the existing monitoring wells is relatively easy. All services and materials required are readily available.

2.6.3.7 Cost. This criterion was defined in Section 2.5.3.7 for the landfill sites. Table 16 presents a summary of the remedial alternative costs for the TPH/VOC sites. Costs are presented on a present-worth basis over a period of 30 years, with a discount rate of 7 percent. Detailed cost analysis is presented in the FS (Montgomery Watson, 1997a).

2.6.3.8 State Acceptance. This criterion was defined in Section 2.5.3.8 for the landfill sites. Final application of this criterion will occur in the approval of this ROD. The comparative analysis for this criterion for the TPH/VOC sites is presented below.

Soil:

Alternative 6: It is likely the state would not accept this alternative for most TPH/VOC sites because no active steps are taken to achieve the RAOs. However, this alternative may be acceptable for shallow contamination at levels near or below the remediation goals (i.e., FT-19b, FT-20 [soil], and SS-59).

Alternative 7: It is likely the state would accept this alternative for shallow TPH/VOC contamination because the affected soils are completely removed.

Alternative 8: It is likely the state would accept this alternative for the applicable site (Site FT-19c) because the contaminants are actively removed from the site.

Alternative 9: It is likely the state would accept this alternative for the applicable sites (Site WP-17 and FT-19a) because the contaminants are actively degraded during the bioventing process.

Groundwater (Site OT-51):

Alternative 10: The state may not accept this alternative because no steps are taken to enhance the natural processes that would ultimately achieve the RAOs.

Alternative 11: The state is likely to accept this alternative because the remedy would reduce the contaminants in the state's waters with enhanced biodegradation.

2.6.3.9 Community Acceptance. As defined in Section 2.5.3.9 for the landfill sites, Community acceptance indicates the public support for a given alternative. Section 3.0 of this ROD documents the community acceptance of the selected remedies, as presented in the Proposed Plan (Montgomery Watson, 1997b). Section 3.0 includes a responsiveness summary that addresses the comments received during the public comment period. The community did not express any significant objections to the selected remedies during the public meeting or public comment period.

2.6.4 The Selected Remedies for the TPH/VOC Sites

This section provides a description of the preferred alternatives for remediation of the OU 3 TPH/VOC sites based on the detailed evaluation of alternatives presented in the OU 3 FS (Montgomery Watson, 1997a). This section includes the basis for selection of a preferred alternative, a description of the preferred alternative, and cost analyses.

2.6.4.1 Selection of the Preferred Alternatives. The RAOs established for the TPH/VOC sites in the OU 3 FS are summarized in Section 2.6.2. An evaluation of the

alternatives with respect to the nine CERCLA criteria resulted in the selection of the following preferred alternatives to meet the RAOs for the TPH/VOC sites.

Site WP-17. Under the construction worker scenario (subsurface soils), the baseline human health risk assessment estimated the highest cancer risk of 9.7E-07 for this TPH/VOC-affected soil site, primarily because of the presence of total chromium found in subsurface soils. This risk value is below the California and USEPA acceptable benchmark value of 1.0E-06. However, the initial evaluation criteria (based on the LUFT Manual; see Section 2.6.1) for TPH and BTEX were exceeded in the soils at the site.

The results of the ecological risk assessment indicated that Site WP-17 was not an area of potential ecological concern because of the lack of suitable habitat for environmental receptors.

In order to satisfy the RAOs for preventing human exposure to contaminated soils, to reduce concentrations of contaminants to meet remediation goals, and to reduce the TMV of contaminants, Alternative 9 (Bioventing) was recommended for Site WP-17 in the OU 3 FS. Alternative 6 (No Action) is not capable of satisfying these RAOs. The technologies incorporated in Alternative 7 (Removal/Disposal) were screened out as not applicable for Site WP-17 because of the prohibitive costs associated with the volumes of soil that would be required to be removed. The technologies incorporated for Alternative 8 (SVE) were screened out as not applicable for Site WP-17 because, although SVE encourages biodegradation of TPH constituents, it is less effective and more costly than bioventing.

Therefore, Alternative 9 (Bioventing) was the selected remedy for Site WP-17. The bioventing system has been installed as discussed in Section 2.9. The system became operational in February 1996 and it is anticipated that remedy completion will be achieved within 5 years.

Site FT-19a. Under the construction worker (subsurface soils) scenario, the baseline human health risk assessment estimated the highest lifetime cancer risk of 2.8E-06 for Site FT-19a, primarily because of the presence of arsenic. Although this is above the benchmark values for risk assessment, the arsenic at the site is considered naturally occurring. However, the initial

evaluation criteria (based on the LUFT Manual; see Section 2.6.1) for TPH and BTEX were exceeded in soils at the site.

The results of the ecological risk assessment indicated that Site FT-19a was not an area of potential ecological concern because of the lack of suitable habitat for environmental receptors.

In order to satisfy the RAOs for preventing human exposure to contaminated soils potentially posing excess risk, to reduce concentrations of contaminants to meet remediation goals, and to reduce the TMV of contaminants, Alternative 9 (Bioventing) was recommended for Site FT-19a in the OU 3 FS. Alternative 6 (No Action) is not capable of satisfying these RAOs. The technologies incorporated in Alternative 7 (Removal/Disposal) were screened out as not applicable for Site FT-19a because of the prohibitive costs associated with the volumes of soil that would be required to be removed. The technologies incorporated for Alternative 8 (SVE) were screened out as not applicable for Site FT-19a because, although SVE encourages biodegradation of TPH constituents, it less effective and more costly than bioventing.

Therefore, Alternative 9 (Bioventing) was the selected remedy for Site FT-19a. The bioventing system has been installed as discussed in Section 2.9. The system became operational in April 1996 and it is anticipated that remedy completion will be achieved within 5 years.

Site FT-19b. The initial evaluation criteria (based on the LUFT Manual; see Section 2.6.1) for TPH and BTEX were exceeded in soils at the site; therefore, the site was evaluated in the OU 3 FS. However, the contamination at the site appears to be limited in distribution with concentrations of TPH not detected below 25 feet bgs (M&E, 1994). Vadose zone modeling results indicated that under the base case scenario (best estimate of site conditions for calibrated model), the most mobile constituents in the soils at Site FT-19b will not adversely affect groundwater quality. A subsequent risk assessment indicated that under the industrial/commercial worker scenario, the baseline human health risk assessment estimated the highest lifetime risk of 5.2E-06 for the site, primarily because of the presence of beryllium and nickel. Although this is above the benchmark value for risk assessment, the beryllium and nickel detected at the site is considered naturally occurring and within background range. The results of

the ecological risk assessment indicated that Site FT-19b is not an area of potential ecological concern because of the lack of suitable habitat for environmental receptors. The medical wastes at this site have been removed and disposed at an off-site disposal facility under the FSRA activities ongoing at the base.

Based on the detailed analysis of alternatives, Alternative 6 (No Action) was recommended for Site FT-19b in the OU 3 FS. The technologies incorporated in Alternative 7 (Removal/Disposal) were screened out as not applicable for Site FT-19b because of the prohibitive costs associated with the volumes of soil that would be required to be removed. The technologies incorporated for Alternative 8 (SVE) were screened out as not applicable for Site FT-19b because, although SVE encourages biodegradation of TPH constituents, this technology is used primarily to encourage volatilization of VOC contamination. Alternative 9 (Bioventing), is less costly than SVE and more effective for treating TPH contamination. However, given the limited distribution of detected TPH and VOCs, vadose zone model results indicating that groundwater quality will not be adversely affected, and risk assessment results indicating excess risk are the result of metals considered naturally occurring, remedial action at the associated costs are not believed to be warranted. Therefore, the no action alternative is the selected remedy at this site. Groundwater monitoring will be performed for this area as part of the remedial actions to be performed for Sites FT-19a and FT-19c; therefore, there would be no costs associated with the no action alternative for this site.

Site FT-19c. Under the construction worker (subsurface soils) scenario, the baseline human health risk assessment estimated the highest lifetime cancer risk of 3.1E-06 for Site FT-19c, primarily because of chromium under a construction worker (subsurface soils) scenario. Although this is above the benchmark values for risk assessment, the chromium at the site is considered naturally occurring and within background ranges. However, the initial evaluation criteria (based on the LUFT Manual; see Section 2.6.1) for TPH and BTEX were exceeded in soils at the site. In addition, vadose zone modeling results indicate that TCE present in soils will adversely affect groundwater beneath the site.

The results of the ecological risk assessment indicated that Site FT-19c was not an area of potential ecological concern because of the lack of suitable habitat for environmental receptors.

In order to satisfy the RAOs for preventing human exposure to contaminated soils, to reduce concentrations of contaminants to meet remediation goals, and to reduce the TMV of contaminants, Alternative 8 (SVE) was recommended for Site FT-19c in the OU 3 FS. Alternative 6 (No Action) is not capable of satisfying these RAOs. The technologies incorporated in Alternative 7 (Removal/Disposal) were screened out as not applicable for Site FT-19c because of the prohibitive costs associated with the volumes of soil that would be required to be removed. The technologies incorporated in Alternative 9 (Bioventing) were screened out as not applicable for Site FT-19c because bioventing would not be effective at removing the TCE detected in the subsurface soils at the site.

Therefore, Alternative 8 (SVE) was the selected remedy for Site FT-19c. The SVE system has been installed as discussed in Section 2.9. The system became operational in March 1996 and it is anticipated that remedy completion will be achieved within 5 years.

Site FT-20 (Soil). The baseline human health risk assessment estimates the highest excess lifetime cancer risk of 4.0E-06, primarily because of arsenic under an industrial worker, construction worker, and trespasser scenario. Although this is above the benchmark values for risk assessment, the arsenic at the site is considered naturally occurring and within the background ranges. The results of the ecological risk assessment indicated that Site FT-20 (soil) is not an area of potential ecological concern because of the lack of suitable habitat for environmental receptors. However, petroleum hydrocarbons were detected in surface samples at this site.

Site FT-20 (soil) was recommended for NFA in the OU 3 FS. The technologies incorporated in Alternatives 8 (SVE) and 9 (Bioventing) were screened out as not applicable at Site FT-20 (soil) because they are not considered effective for shallow soils. Based on an evaluation of the concentrations of petroleum hydrocarbons and metals detected at the site, the RPMs have determined that the constituents would not pose a threat to groundwater. The detected levels of

hydrocarbons are less than the remediation goals for TPH/VOC sites (Figure 9). Therefore, the implementation of Alternative 6 (No Action with Monitoring) or Alternative 7 (Removal/Disposal) are not considered cost-effective for Site FT-20 (soil), and NFA was the selected remedy.

Site OT-51. PRG screening in accordance with the methodology presented in the OU 3 RI indicated that detailed human health risk analysis was not required. The results of the ecological risk assessment indicated that Site OT-51/SS-59 is not an area of potential ecological concern because of the lack of suitable habitat for environmental receptors. However, the initial evaluation criteria (based on the LUFT Manual; see Section 2.6.1) for TPH and BTEX were exceeded in soils at the site. Because this site is unique among the TPH/VOC sites in that TPH and VOC constituents were detected in both soil and groundwater, potential remediation in the soil and groundwater are addressed separately as discussed in the sections below.

Soil. Site SS-59 was recommended for NFA in the OU 3 FS. The technologies incorporated in Alternatives 8 (SVE) and 9 (Bioventing) were screened out as not applicable at Site SS-59 because they are not considered effective for shallow soils. Based on an evaluation of the limited distribution of detected petroleum hydrocarbons at the site, the RPMs have determined that the constituents would not pose a threat to groundwater. Therefore, the implementation of Alternative 6 (No Action with Monitoring) or Alternative 7 (Removal/Disposal) are not considered cost-effective for Site SS-59, and NFA was recommended.

In order to satisfy the RAOs for preventing human exposure to contaminated soils, to reduce concentrations of contaminants to meet remediation goals, and to reduce the TMV of contaminants, Alternative 9 (Bioventing) is recommended for Site OT-51. Alternative 6 (No Action) is not capable of satisfying the RAOs. The technologies incorporated in Alternative 7 (Removal/Disposal) were screened out as not applicable for this site because of the prohibitive costs associated with the volumes of deep soil that would be required to be removed. The technologies incorporated for Alternative 8 (SVE) were

screened out as not applicable for Site OT-51 because, although SVE encourages biodegradation of TPH constituents, it is less effective and more costly than bioventing.

Therefore, Alternative 9 (Bioventing) was the selected remedy for Site OT-51. The bioventing system has been installed as discussed in Section 2.9. The system became operational in April 1996 and it is anticipated that remedy completion will be achieved within 5 years.

Groundwater. In order to satisfy the RAOs for reducing dissolved contaminants in groundwater to below MCLs, natural attenuation is the selected remedy for the groundwater at Site OT-51. Although Alternative 10 (No Action) will ultimately satisfy the RAOs, it does not ensure that groundwater will not be used for domestic purposes in the future. As part of natural attenuation institutional controls, continued groundwater monitoring would be performed to assess potential future migration and degradation of COPCs in the groundwater. Land use restrictions would prohibit domestic use of the groundwater and ensure protection of human health and the environment. If the levels of COPCs observed in the downgradient monitoring wells do not decrease to meet groundwater numerical cleanup standards (Table 13) within a sufficient time frame, oxygenation of the top portion of the groundwater using oxygen-releasing chemicals (Alternative 11) would be implemented to accelerate natural degradation.

2.6.4.2 Detailed Description of the TPH/VOC Site Preferred Alternatives. The selected alternatives from the OU 3 FS for the TPH/VOC sites (identified in Section 2.6.4.1) are described in detail below.

Site FT-19c. Alternative 8 has been selected for this site and soil will be treated with SVE. This includes the following specific activities:

- installation of an SVE system including extraction vents, monitoring points, air blower, aboveground piping, equipment pad, and associated appurtenances;
- implementation of a soil vapor off-gas monitoring program to assess system performance;

- implementation of access restrictions to prevent unauthorized access to installed equipment;

- implementation of land use restrictions which will restrict construction activities that would impair the integrity of the existing system (i.e., SVE and monitoring wells) while it is in place and prevent installation of monitoring or injection wells in the site area (except where required for environmental purposes); these would be enforced until the soil remedy is completed (groundwater restrictions are covered under the OU 1 ROD [Montgomery Watson, 1994]);

- collection of confirmation samples (soil and vapor) to assess remedy completion; and

- 5-year site review to assess the effectiveness of the remedy.

Sites WP-17, FT-19a, and OT-51 (soil). Alternative 9 has been selected for these sites and soils will be treated with bioventing. This includes the following specific activities:

- installation of bioventing systems including injection vents, monitoring points, air blower, aboveground piping, equipment pad, and associated appurtenances;

- implementation of a soil vapor monitoring program to assess system performance;

- implementation of long-term groundwater monitoring in accordance with an approved basewide long-term groundwater monitoring plan;

- implementation of access restrictions to prevent unauthorized access to installed equipment;

- implementation of land use restrictions which will restrict construction activities that would impair the integrity of the existing system (i.e., bioventing, SVE, and monitoring wells) while it is in place and prevent installation of monitoring or injection wells in the site area (except where required for environmental purposes); these would be enforced until the soil remedy is completed;

- collection of confirmation samples (soil and vapor) to assess remedy completion; and

- 5-year site review to assess the effectiveness of the remedy.

Site OT-51 (groundwater). Natural attenuation has been selected as the remedy for this site. As a contingency, Alternative 11 would be implemented such that groundwater would be treated

with oxygenation of the groundwater using oxygen-releasing chemicals if COPCs observed in downgradient monitoring wells do not decrease to meet groundwater numerical cleanup standards (Table 13) within a sufficient time frame. This remedy includes the following specific activities:

- decommissioning the abandoned well casing downgradient of Site OT-51;
- implementation of long-term groundwater monitoring in accordance with an approved basewide long-term groundwater monitoring plan;
- implementation of use restrictions which would prohibit domestic use of the groundwater;
- installation of one or two downgradient monitoring wells to satisfy long-term monitoring requirement (the OU 3 FS cost estimate included well installation for the soils alternative presented on Table 20);
- implementation of oxygen-releasing chemicals (Alternative 11) as a contingency if COPCs in groundwater do not decrease to groundwater numerical cleanup standards within a sufficient time frame (see Section 2.6.2.5); and
- 5-year site review to assess the effectiveness of the remedy.

2.6.4.3 Cost Analysis. A preliminary cost estimate was prepared for the selected alternatives for each TPH/VOC site as part of the OU 3 FS process. Tables 17 through 21 summarize the cost analysis for the selected alternative for sites WP-17, FT-19a, FT-19c, OT-51 (soil and groundwater [assuming the use of ORC®]). With the selection of NFA for Sites FT-19b, FT-20 (soil), and SS-59, there would be no additional costs incurred for these sites.

2.6.4.4 System Implementation. In an effort to accelerate the remedial process, early remedial actions have been initiated, under the direction of the USAF, at the TPH/VOC sites presented in this ROD. These accelerated actions were conducted to minimize present and future environmental risks and were performed in agreement with the RPMs including the USEPA, DTSC, Lahontan RWQCB, and USAF. The accelerated actions were performed at TPH/VOC Sites WP-17, FT-19a, FT-19c, and OT-51 as summarized in Section 2.6.4.3 and detailed in the Work Plan for Remedial Activities at the TPH/VOC sites (Montgomery Watson, 1995a).

Bioventing systems were installed at WP-17, FT-19a, and OT-51 from December 1995 through April 1996. These systems are currently in operation. An SVE system was installed at Site FT-19c from December 1995 through March 1996 and is currently in operation. These actions are summarized in Section 2.9 (Current Site Status).

2.6.5 Statutory Determinations for the TPH/VOC Sites

The selected remedies satisfy the statutory requirements of Section 121 of CERCLA, as amended by SARA, in that the following five mandates are attained:

- The selected remedies are protective of human health and the environment, will decrease site risks, and will not create short-term risk nor have cross-media consequences.
- The selected remedies comply with federal and state requirements that are applicable or relevant and appropriate to the remedial action such as chemical-specific ARARs, chemical-specific clean-up standards, and action-specific ARARs.
- The selected remedies are cost-effective in their fulfillment of the nine CERCLA evaluation criteria through remediation of the TPH/VOC sites in a reasonable period of time.
- The selected remedies utilize permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practical.
- The selected remedies satisfy the preference for treatment as a principle element.

2.6.5.1 Protection of Human Health and the Environment. Protection of human health and the environment at the OU 3 TPH/VOC sites is achieved by the selected remedies for each site by removal of the contamination through treatment (i.e., biodegradation and SVE).

2.6.5.2 Compliance with ARARs. All pertinent ARARs identified for the TPH/VOC sites (Table 15) will be met by the selected remedies.

2.6.5.3 Cost Effectiveness. The USEPA, the USAF, and the State of California believe that the selected remedies fulfill the nine criteria of the NCP and provide overall effectiveness in relation to their costs.

2.6.5.4 Utilization of Permanent Solution and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Possible. The selected remedy represents, to the maximum extent to which permanent solutions and treatment technologies can be used, a cost-effective manner for remediating the OU 3 TPH/VOC sites. The remedies selected provide the best balance of long-term effectiveness and permanence; reduction of TMV through treatment; short-term effectiveness; implementability and cost-effectiveness.

2.6.5.5 Preference for Treatment as a Principle Element. The preference for treatment as the principle elements is satisfied to the extent practicable by the selected remedies. Alternative 9 (Bioventing) at Sites WP-17, FT-19b, and OT-51 will remove and treat contaminants in soils to below acceptable levels through biodegradation. Alternative 8 (SVE) at FT-19c will remove the primary COPC (TCE) from soils by physical transfer from soil to air and discharging the TCE. The expected concentrations of TCE discharged to the air (less than 1 pound/day) do not require treatment. By selection of natural attenuation for groundwater at Site OT-51, the COPCs will be treated through natural attenuation with contingent implementation of oxygen-releasing chemicals (Alternative 11) if the levels of COPCs observed in the downgradient monitoring wells do not decrease to meet groundwater numerical cleanup standards (Table 13) within a sufficient time frame.

2.7 SITE OT-69 SUMMARY

This section summarizes the site characteristics, risk assessment results, descriptions of the alternatives evaluated, alternatives comparison, and the selection of the final remedy for Site OT-69.

2.7.1 Summary of Site OT-69 Characteristics and Risk Assessment

Site OT-69 consists of the TCE and PCE groundwater contamination that was detected in the flightline and operations support facilities area. The site was investigated independently by IT and results of the investigations are discussed in detail in the RI/FS for the OU 3 TCE/PCE Study Area (IT, 1995a). Additional modeling for the groundwater in the northeast portion of the flightline area was performed by Montgomery Watson (Montgomery Watson, 1996a). Figure 14 presents select affected wells that identify the five plumes that make up Site OT-69. The results of the investigations are summarized below.

The TCE/PCE contamination in this area was first identified during the 1992 investigation of aviation jet fuel (JP-4) contamination within OU 2. In 1993, the extent of the TCE/PCE groundwater contamination in the vicinity of the flight line and operational support facilities was investigated by IT. The 1993 investigations determined that the Aquitard under the Upper Aquifer would prevent contaminants from migrating to greater depths, and wells completed to the base of the Upper Aquifer, or to the top of the Aquitard, contained no contaminants. The soil and groundwater TCE/PCE contamination at well MW-49 was further delineated by IT in 1995. The additional investigations performed to further characterize the extent of TCE and PCE contamination in the vicinity of MW-49 included soil-gas, soil and groundwater sampling and analysis, and installation of cluster monitoring wells (IT, 1995a).

The 1993 Site OT-69 RI performed by IT resulted in the following principal findings and conclusions (IT, 1995a):

- The highest concentration of TCE in groundwater (37.0 μg/L) was detected in well MW-49 on the southern edge of the study area. TCE was detected above the MCL of 5 μg/L in seven samples.
- The TCE groundwater contamination in OU 3 occurs in several, small, isolated plumes. The new wells placed limits on the extent of contamination detected during the OU 2 investigation.
- TCE and PCE were not detected in any of the 613 soil samples analyzed during the JP-4 OU 2 RI, or the 115 soil samples analyzed during the 1993 TCE/PCE RI

investigation. TCE was detected in only 4 of the 29 soil samples collected during the MW-49 TCE investigation.

- Contaminant fate and transport indicated that the highest levels of TCE in OU 3 will attenuate to 5 µg/L in approximately 40 to 45 years by physical mechanisms.

- PCE groundwater contamination (highest concentration was 7.8 µg/L) occurs in one area near the southwest end of the flight line.

- Analysis of groundwater samples from cluster wells indicated that the TCE groundwater contamination was limited to the upper 30 feet of the aquifer. In the middle and bottom portions of the aquifer, no TCE was detected.

- The total volume of TCE and PCE dissolved within the groundwater was calculated in the OU 3 TCE/PCE draft RI/FS to be approximately 0.8 gallons of TCE and 0.006 gallons of PCE.

Subsequent to the 1992 OU 2 RI and 1993 RI (for Site OT-69), it was determined that additional data was required to evaluate the extent of TCE/PCE at Site OT-69. The primary objective was to further characterize the extent of TCE/PCE in the vicinity of well MW-49. The 1995 RI/FS for the TCE/PCE study area (Site OT-69) resulted in the following principal findings and conclusions (IT, 1995a):

- The highest concentrations of TCE contamination (78 µg/L) occur in the top 6 feet of the water table. The TCE concentrations drop to 4 µg/L, 6 feet below the water table, and are non-detect 30 feet and deeper below the water table.

- TCE contamination in the vadose zone soils is lower than the level in the groundwater. The concentration of TCE in soil-gas is below the equilibrium concentration for the associated groundwater contaminant level. Therefore, the vadose zone contamination does not pose a source for further groundwater contamination.

- The TCE concentrations have declined in well MW-49 and increased in MW-60, suggesting the plume has moved downgradient during the previous 2 years.

- Soil-gas and soil sample analysis indicated that MW-49/MW-72 are closer to the source than the wash rack (see IT, 1995a).

- Fate and transport modeling indicates that the TCE contaminant plume in MW-49 area will reduce to 5 µg/L within 46 years and move approximately 1,000 feet north from the original location. The other plumes will attenuate to the MCL in much less time.

- Contaminant dispersion modeling suggest that the TCE plume will degrade to the detection level and before being intercepted by the OU 1 groundwater treatment system.

Groundwater sampling of wells NZ-51, NZ-52, NZ-54, and NZ-68 near the STP percolation ponds has indicated the presence of TCE in the groundwater in the northeast flightline area. This area is now considered part of Site OT-69; however, it was not specifically addressed in the RI/FS for the TCE/PCE Study Area (IT, 1995a). Therefore, Montgomery Watson performed additional solute-transport modeling of this area to assess the natural attenuation of the "northeast" OT-69 plume.

The results of the additional modeling for the northeast OT-69 plume showed the current northeastward migration of TCE at the northeast OT-69 plume will be changed significantly by percolation resulting from the OU 1 treatment system. Modeling suggests the plume will move south and east after commencement of effluent percolation from this system, and concentrations are predicted to drop below the current MCL for TCE (5 μg/L) in less than two years.

There are currently no complete exposure pathways for the contaminated groundwater at Site OT-69. Groundwater in the site areas is not used as a source of domestic, industrial, or agricultural supply. Therefore, there is currently no danger of adverse exposure to either base personnel or residents. In addition, the groundwater does not reach the ground surface within the base boundaries; therefore, there is no known exposure pathway to ecological receptors. However, a risk assessment was performed that considered the possibility that the groundwater within the study area would migrate beyond the boundaries of the base or that the base would be used for residential development in the future (IT, 1995a). The risk assessment found there were no likely exposure pathways and consequently no risks to the on-base workers and off-base residents from TCE/PCE contamination. The total carcinogenic risk from dichloroethane (DCA), TCE, and PCE based on three groundwater exposure pathways (drinking water, dermal contact, and inhalation) is 2E-05 for a basewide residential development case and 3E-08 for a limited residential development case.

2.7.2 Description of Site OT-69 Alternatives

Based on the results of remedial investigations, it was determined that remedial action alternatives be assessed at Site OT-69. An FS analysis was performed for this site as described for the landfill sites in Section 2.5.2. Part of the FS process included development of RAOs as described below.

There are currently no complete exposure pathways for the contaminated groundwater at Site OT-69. Groundwater in the site areas is not used as a source of domestic, industrial, or agricultural supply. Therefore, there is currently no danger of adverse exposure to either base personnel or residents. In addition, the groundwater does not reach the ground surface within the base boundaries; therefore, there is no known exposure pathway to ecological receptors. However, in accordance with ARARs that call for protection of groundwater resources, groundwater at Site OT-51 should be protected. Therefore, the RAO for groundwater is as follows:

- Reduce the dissolved concentrations for identified COPCs in the groundwater at Site OT-69 so that the most stringent concentrations identified in the ARARs are not exceeded (MCLs, secondary MCLs, or quantifiable taste or odor criteria).

The groundwater numerical cleanup standards for Site OT-69 are presented on Table 13.

Six alternatives were developed for Site OT-69 as detailed in the RI/FS for the TCE/PCE Study Area (IT, 1995a). The alternatives, with their components, are as follows:

Alternative G-1
1) No Action

Alternative G-2
1) Land Use Restrictions
2) Deed Restrictions
3) Natural Attenuation with Groundwater Monitoring

Alternative G-3
1) In Situ Air Sparging
2) SVE Recovery/Abatement

3) Groundwater Monitoring
4) Institutional Controls

Alternative G-4
1) Groundwater Extraction
2) Surface Groundwater Treatment with Ultraviolet (UV) Oxidation
3) Reinjection of Treated Groundwater
4) Institutional Controls

Alternative G-5
1) Groundwater Extraction
2) Surface Groundwater Treatment with granular activated carbon (GAC)
3) Reinjection of Treated Groundwater
4) Institutional Controls

Alternative G-6
1) Groundwater Extraction
2) Surface Groundwater Treatment with Thermally Abated Air Stripping
3) Reinjection of Treated Groundwater
4) Institutional Controls

2.7.2.1 Alternative G-1: No Action. Alternative G-1 serves as a baseline against which other soil alternatives are compared. No institutional controls or remedial action would be undertaken. Natural attenuation of groundwater contamination would be allowed to continue. All monitoring would be discontinued.

2.7.2.2 Alternative G-2: Natural Attenuation/Institutional Controls. Alternative G-2 consists of natural attenuation with institutional controls which include land use restrictions prohibiting installation of wells for domestic purposes in the affected aquifer and deed restrictions prohibiting use of contaminated water. In addition, continued monitoring of the natural attenuation of the plume would be achieved through annual groundwater monitoring of approximately 10 wells.

2.7.2.3 Alternative G-3: In Situ Air Sparging, SVE Recovery/Abatement in Vadose Zone, Groundwater Monitoring. Alternative G-3 includes installation of approximate 58 sparge wells at isolated detection points. Air injection at each well would occur at 25 cubic feet per minute (cfm) into the bottom 10 feet of the Upper Aquifer. Approximately 183 SVE vents would be used to capture VOCs transferred from the liquid to vapor phase (assuming a radius of

influence of 50 feet). Vapor abatement from SVE system would be accomplished using a catalytic thermal oxidation system or an internal combustion engine (to be determined based on the results of pilot tests).

2.7.2.4 Alternative G-4: Groundwater Extraction, Surface Groundwater Treatment with UV-Oxidation, Reinjection of Treated Groundwater. Alternative G-4 includes installation of approximately 21 extraction wells at isolated detection points. Extraction wells would be pumped at an average rate of 25 gpm (totaling 525 gpm). Extracted groundwater would be pumped to a central surface treatment plant where contaminants would be removed using aqueous enhanced UV-oxidation. Approximately 225 gpm of treated groundwater would be reinjected directly to the Upper Aquifer using nine injection wells located around the perimeter of isolated detection points. Because of hydraulic limitations, the remaining 300 gpm of treated groundwater would be discharged to the surface.

2.7.2.5 Alternative G-5: Groundwater Extraction, Surface Groundwater Treatment with GAC, Reinjection of Treated Groundwater. Alternative G-5 is the same as G-4 with the exception that contaminants would be removed from the groundwater with GAC (rather than UV-oxidation).

2.7.2.6 Alternative G-6: Groundwater Extraction, Surface Groundwater Treatment with Thermally Abated Air Stripping, Reinjection of Treated Groundwater. Alternative G-6 is the same as Alternatives G-4 and G-5 with the exception that contaminants would be removed from the groundwater with an air stripper with a thermal fuel-assisted combustor for vapor abatement (rather than UV-oxidation or GAC).

2.7.3 Summary of Comparative Analysis of Alternatives for Site OT-69

The remedial alternatives developed for Site OT-69 were analyzed in detail using the nine evaluation criteria required by the NCP as detailed in Section 2.5.3 for the landfill sites.

The resulting strengths and weaknesses of the alternatives were then weighed to identify the alternative providing the best balance among the nine criteria. Table 22 summarizes this comparison.

2.7.3.1 Overall Protection of Human Health and the Environment. This criterion was defined in Section 2.5.3.1 for the landfill sites. The comparative analysis for this criterion for Site OT-69 is presented below.

Alternative G-1: Would reduce concentrations of contamination to levels affording acceptable risk levels in approximately 46 years. There are currently no exposure pathways that would result in a threat to human health. Given future land use plans, completed exposure pathways are not anticipated in this time frame.

Alternative G-2: Would reduce concentrations of contamination to levels affording acceptable risk levels in approximately 46 years. There are currently no exposure pathways that would result in a threat to human health. Given future land use plans, completed exposure pathways are not anticipated in this time frame. In addition, land use and deed restrictions provide protection of human health.

Alternative G-3: Would reduce concentrations of contamination to acceptable levels in approximately 1 year. Potential additional risk introduced through the transfer of COPCs to the air would be reduced to acceptable levels through treatment via catalytic thermal oxidation system. A potential residual risk remains associated with off-site disposal of SVE condensate; therefore, proper disposal is required.

Alternative G-4: Would reduce contaminated groundwater to acceptable levels in approximately 10 years.

Alternative G-5: Would reduce contaminated groundwater to acceptable levels in approximately 10 years. Potential residual risk remains associated with off-site disposal of spent GAC; therefore, proper disposal is required.

Alternative G-6: Would reduce contaminated groundwater to acceptable levels in approximately 10 years. Potential additional risk introduced through the transfer of COPCs to the air would be reduced to acceptable levels through treatment via a thermal fuel-assisted combustor. Potential residual risk remains associated with off-site disposal of spent acid from stripping tower wash down; therefore, proper disposal is required.

2.7.3.2 Compliance with ARARs. The definition of ARARs and this criterion was presented in Section 2.5.3.2 for the landfill sites. A listing of federal and state laws and regulations that are ARARs for the OU 3 TPH/VOC sites is provided in Table 15. These are also the ARARs for Site OT-69. ARARs are expected to be met with all alternatives. Chemical-specific ARARs will be met by ultimately achieving the cleanup standards. Action-specific ARARs will be met by appropriate design and implementation of remedial alternatives.

2.7.3.3 Long-Term Effectiveness and Permanence. This criterion was defined in Section 2.5.3.3 for the landfill sites. The comparative analysis for this criterion for Site OT-69 is presented below.

Alternative G-1: Natural attenuation is expected to reduce risk to acceptable levels. Controls for on-site residuals are not required.

Alternative G-2: Natural attenuation is expected to reduce risk to acceptable levels. Controls for on-site residuals are not required.

Alternative G-3: Remediation through air sparging and SVE is expected to reduce risk to acceptable levels. Potential residual risk remains associated with off-site disposal of SVE condensate; therefore, proper disposal is required. Controls for on-site residuals are not required.

Alternative G-4: Remediation groundwater extraction and surface treatment is expected to reduce risk to acceptable levels. Controls for on-site residuals are not required.

Alternative G-5: Remediation groundwater extraction and surface treatment is expected to reduce risk to acceptable levels. Potential residual risk remains associated with off-site disposal of spent GAC; therefore, proper disposal is required. Controls for on-site residuals are not required.

Alternative G-6: Remediation groundwater extraction and surface treatment is expected to reduce risk to acceptable levels. Potential residual risk remains associated with off-site disposal of spent acid from stripping tower wash down; therefore, proper disposal is required. Controls for on-site residuals are not required.

2.7.3.4 Reduction of Toxicity, Mobility, and Volume through Treatment. This criterion was defined in Section 2.5.3.4 for the landfill sites. The comparative analysis for this criterion for Site OT-69 is presented below.

Alternative G-1: Toxicity and mobility is not reduced. However, concentrations of contaminants are reduced to levels determined to be protective of human health. In addition, the volume of affected groundwater is not reduced; however, the volume of groundwater with concentrations of contaminants resulting in excess risk is ultimately reduced to zero.

Alternative G-2: Same as Alternative G-1.

Alternative G-3: A high degree of TMV reduction is achieved because contaminants are destroyed on site through SVE abatement (catalytic thermal oxidation system or an internal combustion engine).

Alternative G-4: A high degree of TMV reduction is achieved because contaminants are destroyed on site through UV-oxidation.

Alternative G-5: A high degree of TMV reduction is achieved locally because contaminants are removed from groundwater with GAC. Some chemical toxicity is transferred to an off-site location with spent GAC.

Alternative G-6: A high degree of TMV reduction is achieved locally because contaminants are destroyed on site through thermal abatement. Some chemical toxicity is transferred to an off-site location with spent acid wash.

2.7.3.5 Short-Term Effectiveness. This criterion was defined in Section 2.5.3.5 for the landfill sites. The comparative analysis for this criterion for Site OT-69 is presented below.

Alternative G-1: Under current or expected base land use, there are no completed exposure pathways. However, in the event land use changes such that exposure pathways are completed, this alternative would not eliminate exposure pathway reduction of concentrations to below MCLs for 46 years. Because there is no remedial action taken, there is not potential exposure to remedial workers.

Alternative G-2: Under current or expected base land use, there are no completed exposure pathways. In addition, this alternative prevents the completion of exposure pathways in the future by implementing institutional controls. There is possible exposure to remedial workers during groundwater sampling which can be mitigated by following appropriate health and safety procedures.

Alternative G-3: This alternative prevents the completion of exposure pathways in the future by implementing institutional controls. A small potential risk to the community is generated by transfer of contaminants to the vapor phase which is partially mitigated through SVE vapor abatement/recovery. A relatively small short-term risk exists with the transport and disposal of SVE condensate. There is possible exposure to remedial workers during monitoring activities which can be mitigated by following appropriate health and safety procedures.

Alternative G-4: In addition, this alternative prevents the completion of exposure pathways in the future by implementing institutional controls. There is possible exposure to remedial workers during monitoring activities which can be mitigated by following appropriate health and safety procedures.

Alternative G-5: In addition, this alternative prevents the completion of exposure pathways in the future by implementing institutional controls. A relatively small short-term risk exists with the transport and disposal of spent GAC. There is possible exposure to remedial workers during monitoring activities which can be mitigated by following appropriate health and safety procedures.

Alternative G-6: In addition, this alternative prevents the completion of exposure pathways in the future by implementing institutional controls. A small potential risk the community is generated by transfer of contaminants to the vapor phase which is partially mitigated through vapor abatement. A relatively small short-term risk exists with the transport and disposal of spent acid wash water. There is possible exposure to remedial workers during monitoring activities which can be mitigated by following appropriate health and safety procedures.

2.7.3.6 Implementability. This criterion was defined in Section 2.5.3.6 for the landfill sites. The comparative analysis for this criterion for Site OT-69 is presented below.

Alternative G-1: No remedial action is undertaken for this alternative; therefore, there are no technical or administrative limitations and no services or materials are required.

Alternative G-2: There are no technical or administrative limitations for this alternative. Services and materials required for groundwater monitoring are readily available.

Alternative G-3: The technologies that make up this alternative are technically implementable, proven, and available. Permitting may be required for off-site disposal of SVE condensate. Services and materials required are readily available; however, significant amounts of supplemental fuel would be required for SVE abatement system.

Alternative G-4: The technologies that make up this alternative are technically implementable, proven, and available. Services and materials required are readily available.

Alternative G-5: The technologies that make up this alternative are technically implementable, proven, and available. Permitting may be required for off-site disposal of spent GAC. Services and materials required are readily available.

Alternative G-6: The technologies that make up this alternative are technically implementable, proven, and available. Permitting may be required for off-site disposal of spent acid wash water. Services and materials required are readily available; however, significant amounts of supplemental fuel would be required for vapor abatement system.

2.7.3.7 Cost. This criterion was defined in Section 2.5.3.7 for the landfill sites. The comparative analysis for this criterion for Site OT-69 is summarized in Table 23. Costs are presented on a present-worth basis over a period of 30 years, with a discount rate of 7 percent. A detailed cost analysis is presented in the RI/FS for the TCE/PCE Study Area (IT, 1995a).

2.7.3.8 State Acceptance. This criterion was defined in Section 2.5.3.8 for the landfill sites. The comparative analysis for this criterion for Site OT-69 is presented below.

Alternative G-1: It is not likely the state would accept this alternative because it does not assure prevention of exposure in the event future land use plans change.

Alternative G-2: It is likely the state would accept this alternative because it assures protection of human health through periodic monitoring and deed restrictions. The Lahontan RWQCB has accepted this alternative provided the assessment of other more active remedies is considered as a contingency if the natural attenuation remedy is not restoring water quality in a timely manner.

Alternative G-3: It is likely that this alternative would be perceived favorably because of the short duration of the remedial action (approximately 1 year). There may be objections to the perception that there would be air emissions caused by this alternative; however, these would be mitigated by proper abatement. There may also be objection to the production of residual waste (SVE condensate).

Alternative G-4: It is likely the state would accept this alternative because it assures protection of human health through periodic monitoring, deed restrictions, and ultimate reduction of contaminants to acceptable levels (in approximately 10 years).

Alternative G-5: It is likely the state would accept this alternative because it assures protection of human health through periodic monitoring, deed restrictions, and ultimate reduction of contaminants to acceptable levels (in approximately 10 years). There may be objection to the production of residual waste (spent GAC).

Alternative G-6: It is likely the state would look favorably at this alternative because it assures protection of human health through periodic monitoring, deed restrictions, and ultimate reduction of contaminants to acceptable levels (in approximately 10 years). There may be objections to the perception that there would be air emissions caused by this alternative; however, these would be mitigated by proper abatement. There may also be objection to the production of residual waste (spent acid wash).

2.7.3.9 Community Acceptance. As defined in Section 2.5.3.9 for the landfill sites, Community acceptance indicates the public support for a given alternative. Section 3.0 of this ROD documents the community acceptance of the selected remedies, as presented in the Proposed Plan (Montgomery Watson, 1997b). Section 3.0 includes a responsiveness summary that addresses the comments received during the public comment period. The community did not express any significant objections to the selected remedies during the public meeting or public comment period.

2.7.4 The Selected Remedy for Site OT-69

This section provides a description of the preferred alternative for Site OT-69 based on the detailed evaluation of alternatives presented in the RI/FS for the TCE/PCE Study Area (IT, 1995a). This section includes the basis for selection of a preferred alternative, a description of the preferred alternative, and cost analyses.

2.7.4.1 Selection of the Preferred Alternative. The RAOs established for Site OT-69 are presented in Section 2.7.2. The preferred alternative that best meets these objectives for Site OT-69 based on the comparative analysis of the alternatives with respect to the nine CERCLA criteria is Alternative G-2 (Institutional Controls/Natural Attenuation). This alternative assures protection of human health and the environment through institutional controls, is effective at ultimately reducing contaminant concentrations to acceptable levels though natural attenuation, is very easy to implement, and is cost effective.

2.7.4.2 Detailed Description of the Site OT-69 Preferred Alternative. Alternative G-2 consists of natural attenuation with institutional controls which include land use restrictions prohibiting installation of wells for domestic purposes in the affected aquifer and deed restrictions prohibiting use of contaminated water. Continued monitoring of the natural attenuation of the plume will be achieved through an approved long term groundwater monitoring plan. More active remedies would be considered as a contingency if the natural attenuation remedy is not restoring water quality in a timely manner. The criteria under which active remediation would be initiated at Site OT-69 were detailed in a memorandum prepared by IT which is included as Appendix B to this ROD (IT, 1995b). Details regarding the criteria established in this memorandum are summarized in Section 2.9.2.5. If it is determined that natural attenuation is not restoring water quality, more active remedies would be assessed as part of the 5-year review process and may include alternatives assessed as part of this ROD or additional new technologies that may become available.

2.7.4.3 Cost Analysis. A preliminary cost estimate was prepared for the selected alternative for Site OT-69 as part of the OU 3 FS process. Table 24 summarizes the cost analysis for Site OT-69.

2.7.5 Statutory Determinations for Site OT-69

The selected remedy satisfies the statutory requirements of Section 121 of CERCLA, as amended by SARA, in that the following mandates are attained:

- The selected remedy is protective of human health and the environment, will decrease site risks, and will not create short-term risk nor have cross-media consequences;

- The selected remedy complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action such as chemical-specific ARARs, chemical-specific clean-up standards, and action-specific ARARs;

- The selected remedy is cost-effective in its fulfillment of the nine CERCLA evaluation criteria through remediation of Site OT-69 in a reasonable period of time;

- The selected remedy utilizes permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practical;

The distribution of contaminants at Site OT-69 and prohibitive costs associated with treatment alternatives, preclude a remedy in which contaminants could be treated effectively. Therefore, the selected remedy does not satisfy the preference for treatment as a principle element.

2.7.5.1 Protection of Human Health and the Environment. There are currently no complete exposure pathways for the contaminated groundwater at Site OT-69. Groundwater in the site areas is not used as a source of domestic, industrial, or agricultural supply. Therefore, there is currently no danger of adverse exposure to either base personnel or residents. In addition, the groundwater does not reach the ground surface within the base boundaries; therefore, there is no known exposure pathway to ecological receptors. Protection of human health and the environment at Site OT-69 is achieved through the selected remedy by ultimately achieving acceptable concentrations through natural attenuation.

2.7.5.2 Compliance with ARARs. All pertinent ARARs identified for Site OT-69 (Table 15) will be met by the selected remedy.

2.7.5.3 Cost Effectiveness. The USEPA, the USAF, and the State of California believe that the selected remedy for Site OT-69 fulfills the nine criteria of the NCP and provides overall effectiveness in relation to their costs.

2.7.5.4 Utilization of Permanent Solution and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Possible. The selected remedy represents, to the maximum extent to which permanent solutions and treatment technologies can be used, a cost-effective manner for addressing Site OT-69. The alternative selected provides the best balance of long-term effectiveness and permanence; reduction of TMV through natural attenuation; short-term effectiveness; implementability; and cost-effectiveness.

2.7.5.5 Preference for Treatment as a Principle Element

The preferred alternative does not incorporate active treatment. However, concentrations of contaminants are reduced to levels determined to be protective of human health. The volume of affected groundwater is not reduced; however, the volume of groundwater with concentrations of contaminants resulting in excess risk is ultimately reduced to zero.

2.8 DOCUMENTATION OF SIGNIFICANT CHANGES

There are no significant changes in this ROD from the OU 3 Proposed Plan.

2.9 CURRENT SITE STATUS

The preferred alternatives described in this ROD are based on meeting the RAOs identified during the OU 3 FS process (Montgomery Watson, 1997a and IT, 1995a). The findings of the final OU 3 FS Report and the accompanying OU 3 Proposed Plan (Montgomery Watson, 1997b) were used to develop this ROD. The technical information supporting each alternative is included in these reports and the OU 3 RI Report (Montgomery Watson, 1996a).

In an effort to accelerate the remedial process, to minimize present and future environmental risks, to reduce potential impacts to groundwater, and to facilitate timely transfer of property to the community, cleanup activities have been initiated under the direction of the USAF, at some of the sites presented in this ROD. These accelerated actions were performed in agreement with the RPMs including the USEPA, DTSC, Lahontan RWQCB, and USAF. This work has been

performed under the FSRA contract with the Air Force Center for Environmental Excellence (AFCEE). Accelerated actions performed to date have implemented the proposed cleanup activities.

The detailed alternatives evaluation for these sites presented in the OU 3 FS was performed prior to the initiation of the accelerated action; therefore, the FS alternatives comparison and cost analysis are presented in the previous sections of this ROD in its original form. Table 25 presents the current estimates of present worth costs for the selected remedial alternatives incorporating the actual construction costs incurred to date for sites where accelerated actions were performed.

The accelerated actions performed to date are summarized in the sections below. The effectiveness of these remedies will be assessed as part of the ongoing O&M and long-term groundwater monitoring and will be the focus of the 5-year site review. As part of the 5-year review, the status of compliance with ARARs will be evaluated and reported. The specific action items to meet the requirements of this ROD are presented in Appendix A.

2.9.1 Landfill Sites

Accelerated actions were performed at landfill sites DP-03, DP-04, LF-12, LF-14, LF-44, and the SEDA (nine sites). The actions at the landfill sites began in June 1996 and were completed in April 1997. The preferred alternatives implemented for the landfills minimizes or mitigates the human health and ecological risks presented on Table 2 by providing a physical barrier to potential contamination. A description of the barrier and the accelerated activities performed at the landfill sites are discussed below.

2.9.1.1 Sites DP-03 and DP-04. Grading the existing soil cover to promote surface runoff and decrease infiltration of surface water into the refuse; installation of a 2-foot-thick native soil cover to reduce the potential of exposure to contaminants; installation of site perimeter fencing to control site access; installation of drainage ditches above the landfill to prevent surface water from running onto the landfill sites; and re-establishment of native plant

species on the graded surface. Prior to construction of the soil cover at Site DP-04, hot spot removal was performed by removing approximately 10 cubic yards of soil to reduce potential risk to burrowing animals. This soil was disposed off site.

2.9.1.2 Sites LF-12, LF-14, and the SEDA (Nine Sites). Removal of surface debris; rehabilitation of the existing soil cover to produce a cover with an estimated thickness of 12 to 18 inches; grading or cutting of the surface to promote surface runoff and decrease infiltration of surface water into the refuse; installation of drainage ditches above the landfill to prevent surface water from running onto the landfill sites; installation of site perimeter fencing to control site access; and re-establishment of native plant species on the graded surface.

2.9.1.3 Site LF-44. Contaminants of potential concern were not detected in soil samples. Activities performed at this site included the removal of surface debris in September and October 1995. This debris was disposed of off site.

2.9.1.4 Groundwater Monitoring For the Landfill Areas. Regulations require groundwater monitoring for each landfill site. Groundwater monitoring at the landfill sites is being performed as presented in the Basewide Long-Term Groundwater Monitoring Plan for GAFB and the Site Closeout Report for DP-03, DP-04, LF-12, LF-14, and the Southeast Disposal Area (Montgomery Watson, 1996c, 1997c). Several rounds of groundwater monitoring have been completed under this plan (Montgomery Watson, 1996d,e; 1997d).

As part of the monitoring program, monitoring wells associated with the landfills are sampled and analyzed for halogenated volatile organic compounds (HVOCs) (EPA method 8260 suggested), and landfill indicator parameters (pH, total dissolved solids, chloride, sulfate, and nitrate). The sampling frequency and analyte selection may be modified as the program progresses.

Monitoring is used to assess whether contaminants have migrated into the environment. Water Quality Protection Standards (WQPS) will be developed to assess whether there has been a release from the landfills. The WQPS will be developed within 6 months of the signing of this

ROD and will be based on the available groundwater data to establish baseline values for which future sampling results will be compared.

2.9.1.5 Ecological Monitoring For the Landfill Areas. The landfill remediation consisted of activities that would minimize exposure of landfill wastes to ecological receptors. For example, landfill remediation consisted of the installation of a 12- to 24-inch native soil cover as described above. During construction of the remedy, the native soil was compacted by grading. Site access is controlled by fencing. The fence was installed to a depth of 1 foot bgs. The sites were revegetated with native plants.

Although the soil was compacted during construction, the sites provide potential habitat for burrowing animals that can burrow under or move through small openings in the fence. Burrowing animals could potentially compromise the effectiveness of the cap as a barrier between the waste and the surrounding ecosystem. Burrowing animals that could potentially enter the area include special-status species such as the Mojave ground squirrel, Mojave vole, desert tortoise, San Diego horned lizard, and burrowing owl. Other species that may impact the soil cover include the coyote, badger, and kangaroo rat.

The soil covers at each site will be maintained by surveying for animal burrows. The Air Force will consult with the State Department of Fish and Game to develop a burrows management protocol for the O&M document. A contingency plan for recurring burrow problems and the specific details of the ecological monitoring plan will be presented in the subsequent O&M document.

The maintenance activity schedule is presented in the Site Closeout Report for DP-03, DP-04, LF-12, LF-14, and the Southeast Disposal Area (Montgomery Watson, 1997c). The schedule to implement any recommended repairs noted during the routine maintenance inspections will vary depending on the type of repair. Minor repairs may be implemented in 30 days, but more difficult or more costly repairs may require more time to implement. Implementation of revegetative repairs will be limited by seasonal conditions relating to the plant's life cycle. An effort will be made to make revegetative repairs as soon as it is practical based on seasonal

timing. The subsequent routine maintenance inspection will note if the recommended repairs were made.

2.9.2 TPH/VOC Sites

Accelerated actions at petroleum TPH/VOC sites were conducted to minimize present and future environmental risks, reduce potential impacts to groundwater, and facilitate reuse as described below. Access and land use will be restricted at all sites. These restrictions on site use will be subject to re-evaluation as remediation efforts progress. It is anticipated that this land will be used only for industrial purposes.

2.9.2.1 Sites WP-17, FT-19a, and OT-51 (Soil). Soil at these sites is currently being treated with bioventing. The bioventing systems were installed from December 1995 through April 1996 and are currently in operation.

2.9.2.2 Site FT-19b. Petroleum contamination at this site was evaluated in the OU 3 FS Report and the site is recommended for NFA (Montgomery Watson, 1997a). Medical waste found on the surface was removed and disposed off site. Downgradient monitoring will continue to assess groundwater quality.

2.9.2.3 Site FT-19c. Soil at this site is currently being treated with SVE. The SVE system was installed from December 1995 through March 1996 and is currently in operation.

2.9.2.4 Site OT-51 (Groundwater). The groundwater data collected since September 1995 at Site OT-51 as part of the long-term groundwater monitoring effort (Montgomery Watson, 1996d,e,f; 1997d,e,f) have indicated that the COPCs in groundwater increased slightly and then began decreasing. It is expected that the plume will be below detectable levels of benzene in 5 years. If subsequent rounds of long-term monitoring do not continue to show the trend of decreasing levels of COPCs, the contingent remedy of installation of oxygen-releasing chemicals described for Alternative 11 (Section 2.6.2.6) will be implemented.

2.9.2.5 Site OT-69. The Lahontan RWQCB has accepted Alternative G-2 (Institutional Controls/Natural Attenuation) provided the assessment of other more active remedies is considered as a contingency if the natural attenuation remedy is not restoring water quality in a timely manner. The criteria under which active remediation would be initiated at Site OT-69 were detailed in a memorandum prepared by IT which is included as Appendix B to this ROD (IT, 1995b). The contents of this memorandum are summarized below.

The monitoring and response plan proposed by the USAF was developed based on computer modeling simulations that estimate specific future concentrations in particular wells projecting that water quality objectives will be restored in approximately 50 years. If the expected reductions do not occur in the projected time frame, plus or minus 15% of the projected concentration, then the data will be evaluated. If the data are less than two standard deviations of the projected concentrations, then monitoring may continue. If the data are greater than two standard deviations, then the wells will be resampled and the data reevaluated. If the data are still greater than two standard deviations of the original projected concentrations, then an active remedy consisting of air sparging with soil vapor extraction will be implemented or the agencies will reach consensus regarding a technical decision for implementing some other appropriate active remedy. The ROD will be amended at that time to specify the ARARs for the contingent remedy.

As part of the remedy for Site OT-69, groundwater will be monitored and the data will be evaluated. If measured TCE concentrations exceed the predicted ranges presented in Appendix B, the following steps will be taken:

1) Determine the variability of the analytical method employed at the time of the analysis.
2) Consider the analytical standard deviation and calculate the possible contaminant concentration range.
3) Determine if the calculated range in concentration is two standard deviations above the predicted concentration range.

4) If the concentration is two standard deviations above the predicted concentration range, initiate verification measures.

5) If the concentration is less than two standard deviations above the predicted concentration range, maintain routine sampling schedule.

If it is determined that natural attenuation is not restoring water quality, more active remedies would be assessed as part of the 5-year review process. If a more active remedy is determined to be warranted, the USAF will make a timely request for funds by identifying to the Department of the Air Force the funding needed to complete the activities in accordance with Executive Order 12088 and OMB circular A-106 (which is updated bi-monthly and for which funding requests are made at least two years in advance when possible), or any pertinent amendments to these requirements.

In the event that Congress fails to appropriate necessary funding for OU 3 ROD activities at GAFB, the following will occur:

- the USAF will so advise all FFA signatories within 90 days of such failure; and
- the USAF will provide to all FFA signatories documentation of all measures it will undertake to ensure that ROD activities are completed. These measures may include, but are not limited to, continuing to seek funding for implementing the contingent remedy.

2.9.2.6 System Monitoring of the TPH/VOC Sites. A vapor monitoring program for the bioventing and SVE systems was developed based on field observations and on the results of pilot testing before system startup. Field monitoring at the bioventing and SVE sites includes routine system maintenance and monitoring of soil vapor to document reductions in petroleum TPH/VOC concentrations and to determine the effectiveness of cleanup. At the bioventing sites, soil gases (oxygen and carbon dioxide) are monitored because they can indicate changes in biological activity. Increased biological activity is an indicator of biodegradation of the hydrocarbon compounds. Soil vapor monitoring is conducted by collecting soil vapor from monitoring points installed at various locations at the sites. Confirmation samples (soil and

vapor) will be collected as necessary from the TPH/VOC sites to confirm completion of the remedy prior to closure of the sites.

2.9.2.7 Groundwater Monitoring For the TPH/VOC Sites. Groundwater monitoring at applicable sites will be performed as presented in an approved long-term groundwater monitoring plan for GAFB. Several rounds of groundwater monitoring have been completed under this plan (Montgomery Watson, 1996d,e,f and 1997d,e,f). The sampling frequency and analyte selection may be modified as the program progresses. The rationale for system shut down will be provided in subsequent RD/RA documents.

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TAB

Section 3

3.0 RESPONSIVENESS SUMMARY

3.1 OVERVIEW

The public comment period for the proposed plan began on September 22, 1997 and ended on October 22, 1997. A public notice summarizing the OU 3 Proposed Plan, and announcing the public comment period and public meeting was printed in the Daily Press in Victorville, the Desert Dispatch in Barstow, and the Sun in San Bernardino at the start of the public comment period. A press release was sent to five other local newspaper and radio organizations also summarizing the OU 3 Proposed Plan and announcing the public comment period and the public meeting.

The public meeting was held on October 8, 1997 at the Green Tree Inn, Victorville, California. Representatives from USAF, DTSC, USEPA, and Lahontan RWQCB were present at the meeting. No members of the community attended. During the public comment period, written comments were received from the SCIA and the City of Victorville in a letter dated October 3, 1997.

Judging from the comments received, the community accepts the USAF's preferred remedial alternatives for the 60 OU 3 IRP sites.

3.2 BACKGROUND ON COMMUNITY INVOLVEMENT

The USAF values public input and has endeavored to maintain public involvement since the beginning of the environmental investigation and cleanup activities at GAFB. A chronological history of the community involvement with environmental issues at the GAFB is summarized below.

In November 1987, GAFB provided information about environmental concerns at the base as part of the "GAFB Community Days" activities. In 1988, a repository of information for public review was established at the GAFB library. In early 1990, similar repositories were established

at the Adelanto and Victorville public libraries. Administrative files for the project are maintained at the GAFB AFBCA located in Building 321. In October 1992, GAFB held an informational open house to discuss the environmental cleanup program and visit the potentially contaminated sites.

In July 1991, GAFB established a TRC that consisted of members of the community and local agencies and govemments. The TRC met on a quarterly basis. In January 1994, GAFB established the RAB which replaced the TRC. The RAB is designed to act as a focal point for environmental information exchange between GAFB and the public. The RAB met quarterly until 1997 when it voted to meet annually. The meetings are open to the public. An RAB and community update meeting was held June 4, 1997, in Victorville, California.

3.3 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

Comments received during the GAFB OU 3 public comment period on the final FS and Proposed Plan are summarized below. The comment period was held from September 22, 1997 to October 22, 1997. The comments are presented in the order in which they were received and copies of comments are included as part of the administrative record (Appendix C).

Public Meeting: No comments were received during the public meeting.

Written Comments:

1. The SCIA and the City of Victorville issued a letter dated October 3, 1997 containing comments as summarized below:

    a) Concerned was expressed that the implementation of Alternative 4 (Soil Cover) to Sites DP-03 and DP-04 would restrict future reuse of the land in this area. Additionally, the question was asked as to what would be the cost associated with remediating the sites such that future reuse would not be limited.

b) The SCIA inquired as to whether the preferred alternative constituted cleanup for Sites DP-03 and DP-04.

c) A request for clarification was made as to what is meant by the "preferred alternative," what alternatives were evaluated other than the "preferred alternative," and whether the preferred alternative is permanent.

Air Force Response: The response to these comments is as follows:

a) As part of the FS process (Montgomery Watson, 1997a), technologies were evaluated and screened as to whether they would be appropriate for the landfill sites. The only technology that would allow unrestricted reuse of Sites DP-03 and DP-04 would be removal of all wastes and disposal at an off-site facility. Removal and disposal of was "screened out" as a potential technology largely because of the impracticality of the technology given the heterogeneity and volume of the wastes. The general CERCLA experience has led to the establishment of containment as the appropriate response for landfill sites. This issue is discussed in additional detail in Sections 4.2 and 5.4 of the OU 3 FS Report (Montgomery Watson, 1997a). Because removal and disposal was screened out as a technology, it was not considered in the alternatives evaluation phase of the FS process. Therefore, a detailed cost analysis was not performed for this option. However, it is anticipated that removal and disposal of all wastes at these sites would be cost prohibitive.

b) The preferred alternative would constitute cleanup of the sites and its selection would be documented with the signing of this OU 3 ROD.

c) The term "preferred alternative" refers to the remedial option that is determined to best meets the nine CERCLA criteria of 1) overall protection of human health and the environment, 2) compliance with ARARs, 3) long-term effectiveness and

permanence, 4) reduction of TMV through treatment, 5) short-term effectiveness, 6) implementability, 7) cost, 8) state/support agency acceptance, and 9) community acceptance.

The preferred alternative selected for Sites DP-03 and DP-04 is Alternative 4 (Soil Cover). However, five separate alternatives were evaluated for these sites. The alternatives evaluated for these sites were as follows:

Alternative 1 (No Action with Monitoring)
Alternative 2 (Institutional Controls)
Alternative 3 (Surface Controls/Existing Cover Rehabilitation)
Alternative 4 (Soil Cover)
Alternative 5 (Synthetic Cap)

The selection of the Alternative 4 for Sites DP-03 and DP-04 is considered to be the most effective to minimize present and future environmental risks, reduce potential impacts to groundwater, and facilitate timely transfer of the surrounding property to the community. The implementation of the preferred alternative would be the permanent solution pending 5-year review of monitoring activities as required by CERCLA.

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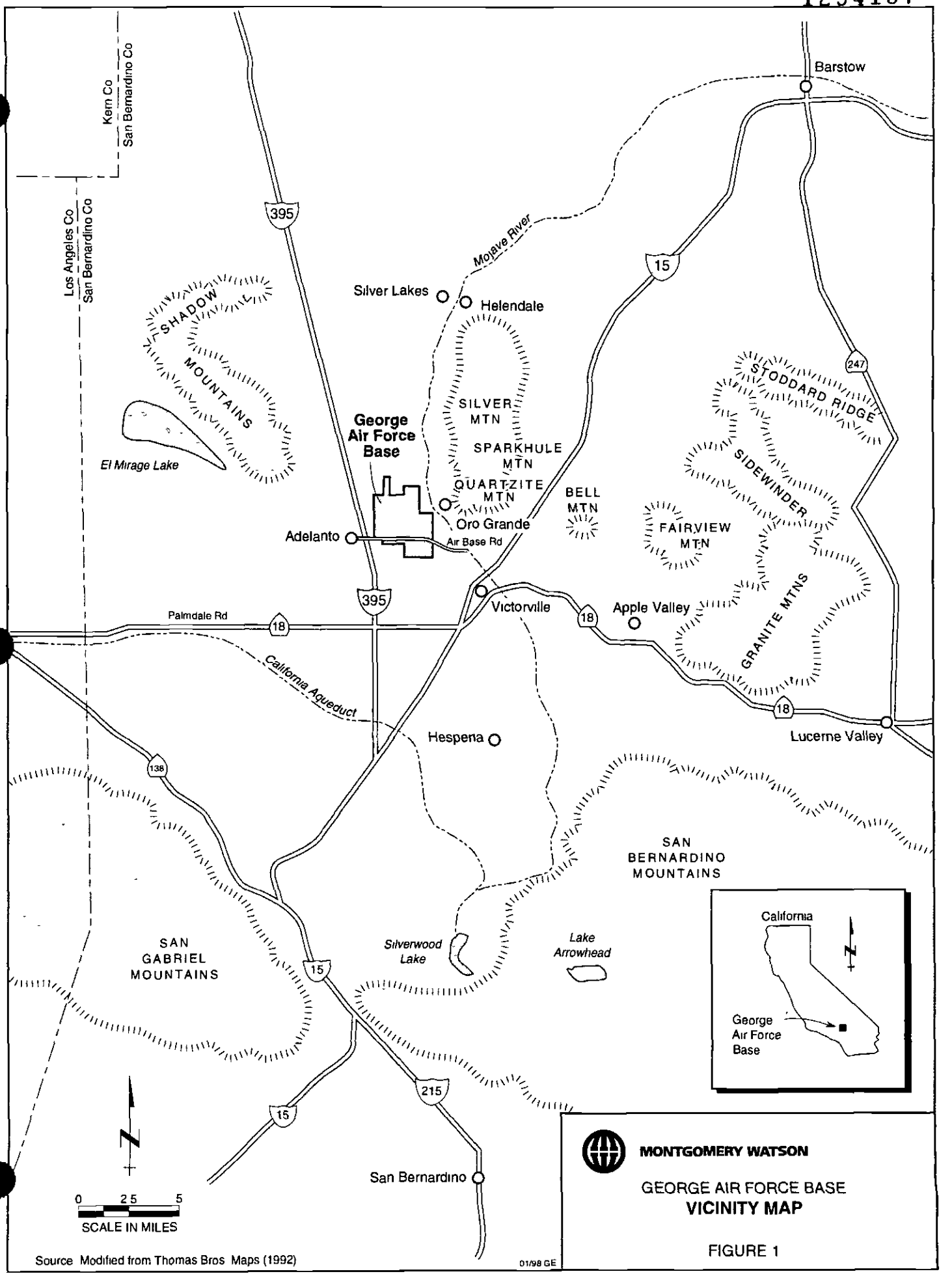
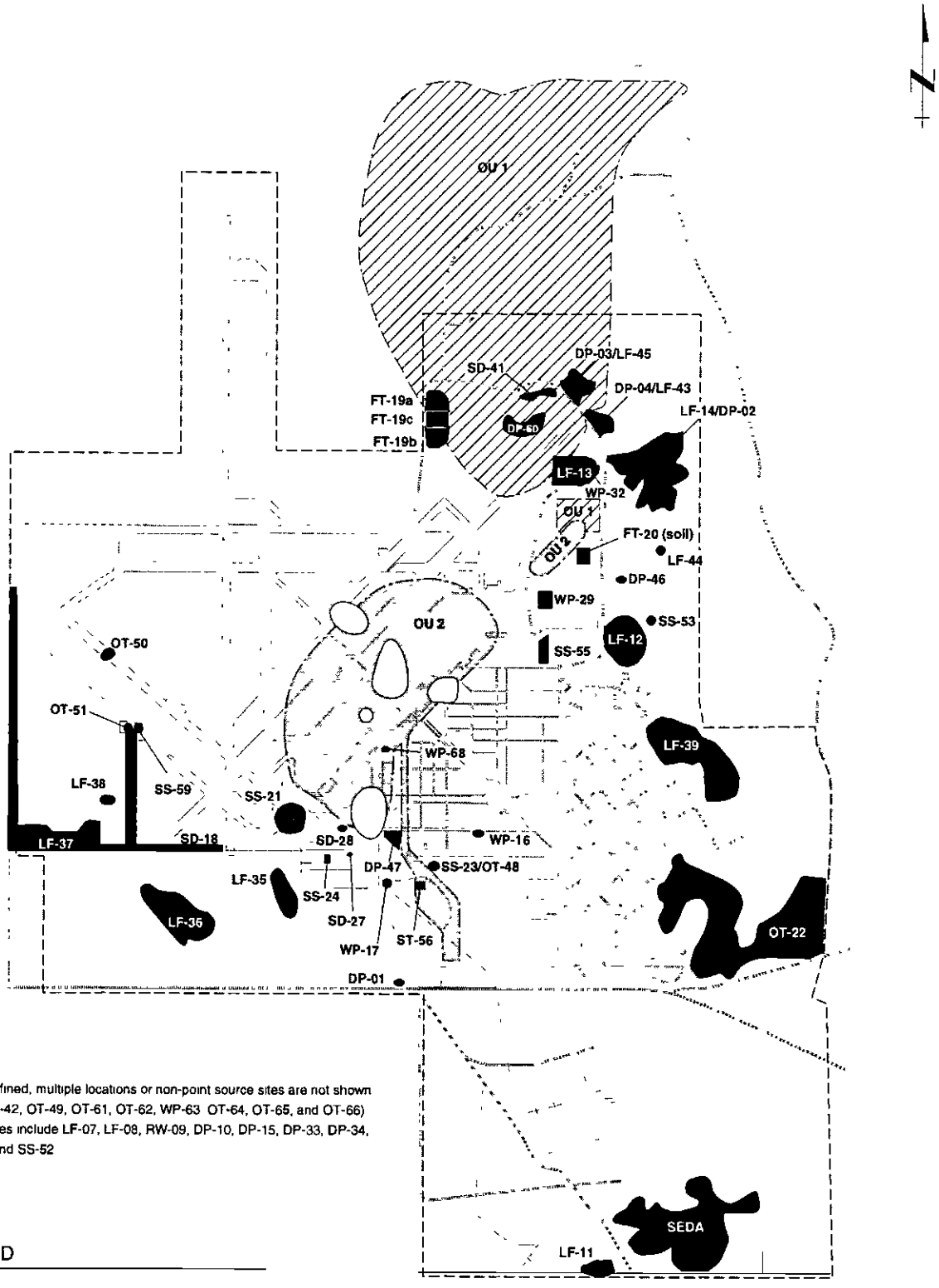
TAB

Figures

1294137


Kern Co
San Bernardino Co
Los Angeles Co
San Bernardino Co
Barstow
395
Mojave River
15
Silver Lakes
Helendale
SHADOW MOUNTAINS
El Mirage Lake
SILVER MTN
SPARKHULE MTN
QUARTZITE MTN
George Air Force Base
Oro Grande
Adelanto
Air Base Rd
BELL MTN
STODDARD RIDGE
247
SIDEWINDER
FAIRVIEW MTN
GRANITE MTNS
Victorville
Apple Valley
Palmdale Rd
18
California Aqueduct
Hespena
Lucerne Valley
138
SAN BERNARDINO MOUNTAINS
SAN GABRIEL MOUNTAINS
Silverwood Lake
Lake Arrowhead
California
George Air Force Base
215
San Bernardino
0 2.5 5
SCALE IN MILES
Source Modified from Thomas Bros Maps (1992)
01/98 GE
MONTGOMERY WATSON
GEORGE AIR FORCE BASE
VICINITY MAP
FIGURE 1



Notes

1) Poorly defined, multiple locations or non-point source sites are not shown (Sites SD-42, OT-49, OT-61, OT-62, WP-63 OT-64, OT-65, and OT-66)

2) SEDA Sites include LF-07, LF-08, RW-09, DP-10, DP-15, DP-33, DP-34, WP-40, and SS-52

LEGEND

- OU 1
- OU 2
- OU 3
- OT-69 TCE PLUMES (OU 3)

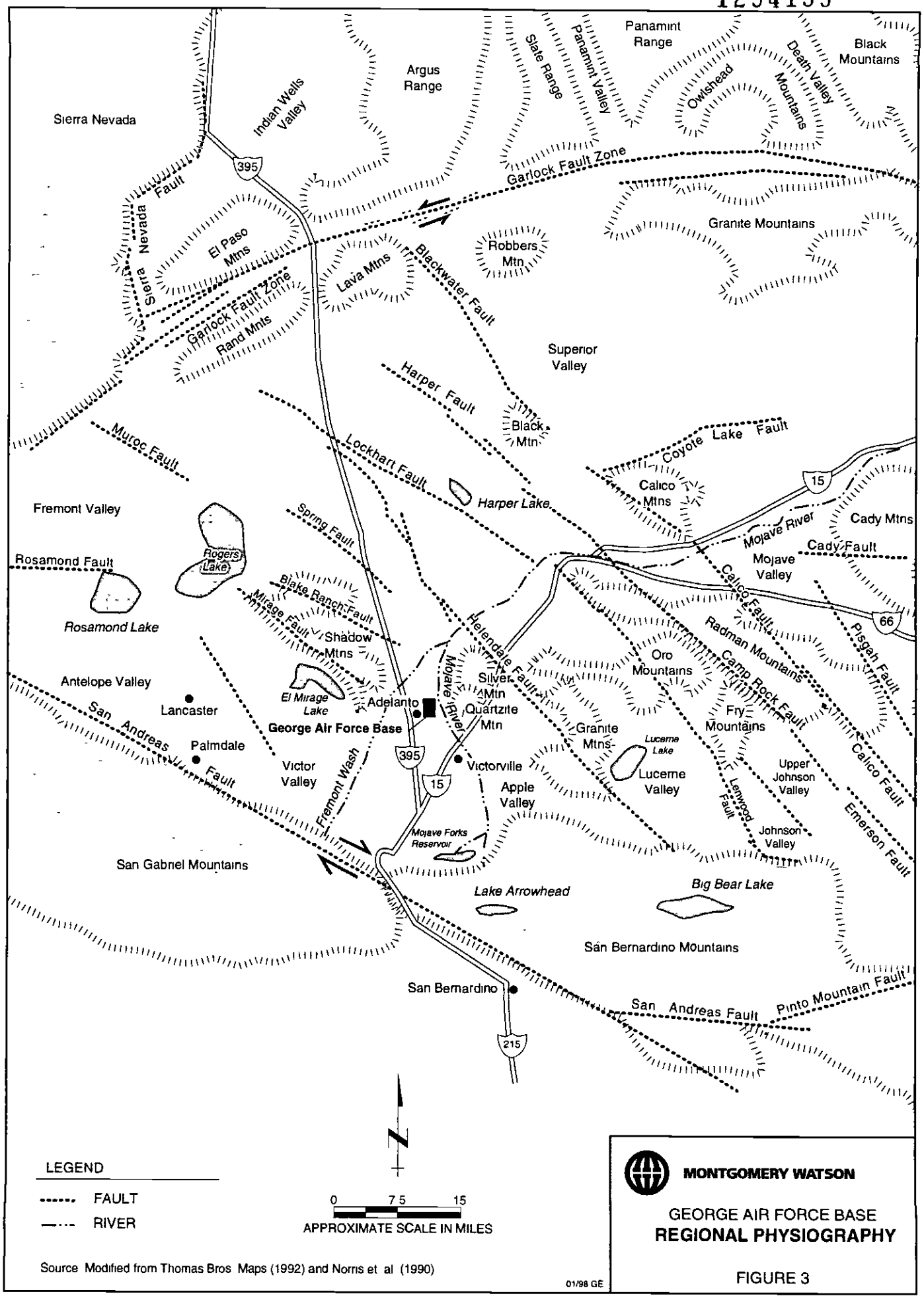
0 1500 3000
SCALE IN FEET

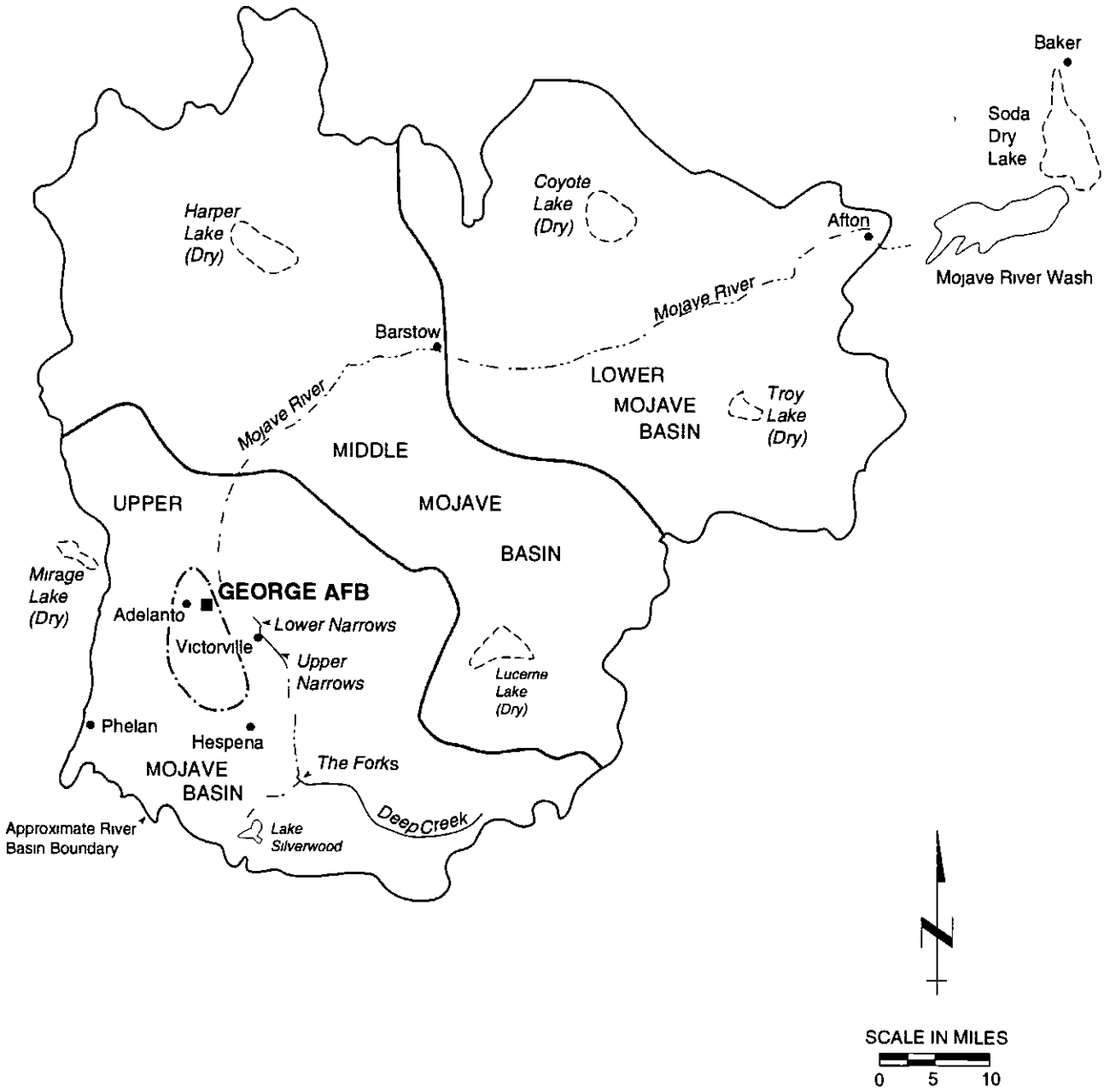
GEORGE AIR FORCE BASE
OPERABLE UNIT SITE LOCATIONS

Figure 2

10/97 GE

1294139


Sierra Nevada
Indian Wells Valley
Argus Range
Slate Range
Panamint Valley
Panamint Range
Owlshead Mountains
Death Valley
Black Mountains
395
Garlock Fault Zone
Sierra Nevada Fault
El Paso Mtns
Granite Mountains
Robbers Mtn
Lava Mtns
Blackwater Fault
Garlock Fault Zone
Rand Mnts
Superior Valley
Harper Fault
Black Mtn
Muroc Fault
Lockhart Fault
Coyote Lake Fault
Calico Mtns
15
Harper Lake
Fremont Valley
Spring Fault
Mojave River
Cady Mtns
Cady Fault
Rogers Lake
Rosamond Fault
Mojave Valley
Calico Fault
Blake Ranch Fault
Mirage Fault
Rosamond Lake
Shadow Mtns
Helendale Fault
Radman Mountains
Pisgah Fault
66
Oro Mountains
Camp Rock Fault
Antelope Valley
Silver Mtn
Quartzite Mtn
Lancaster
El Mirage Lake
Adelanto
Mojave River
Fry Mountains
George Air Force Base
Granite Mtns
Lucerne Lake
San Andreas Fault
Palmdale
395
Victorville
Lucerne Valley
Upper Johnson Valley
Calico Fault
Victor Valley
Fremont Wash
15
Apple Valley
Lenwood Fault
Emerson Fault
Mojave Forks Reservoir
Johnson Valley
San Gabriel Mountains
Lake Arrowhead
Big Bear Lake
San Bernardino Mountains
San Bernardino
San Andreas Fault
Pinto Mountain Fault
215
LEGEND
FAULT
RIVER
0 7.5 15
APPROXIMATE SCALE IN MILES
Source Modified from Thomas Bros Maps (1992) and Norris et al (1990)
01/98 GE
MONTGOMERY WATSON
GEORGE AIR FORCE BASE
REGIONAL PHYSIOGRAPHY
FIGURE 3



LEGEND

- Perennial Flowing Stream
- Intermittent Flowing Stream
- Approximate Location of George Groundwater Sub-Basin (Subsurface Surveys, 1990)

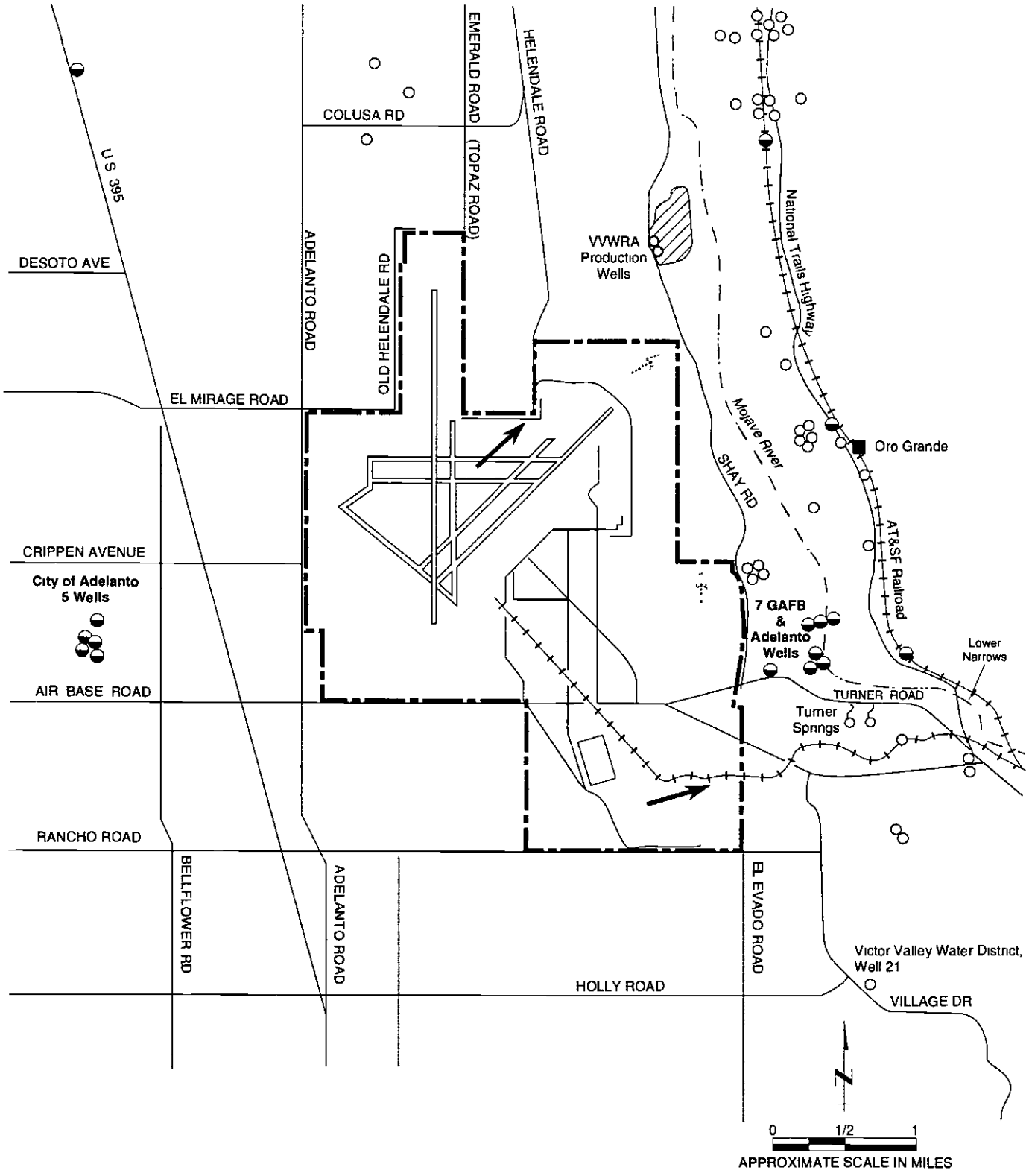
SOURCE SAIC, 1987

03/97 GE

MONTGOMERY WATSON

MAJOR HYDROGEOLOGIC FEATURES IN THE MOJAVE RIVER BASIN

FIGURE 4



LEGEND

- Municipal Water Supply Well
- Domestic Water Supply Well
- Surface Spring
- Approximate Direction of Groundwater Flow in Upper Aquifer
- Approximate Direction of Groundwater Flow in Lower Aquifer

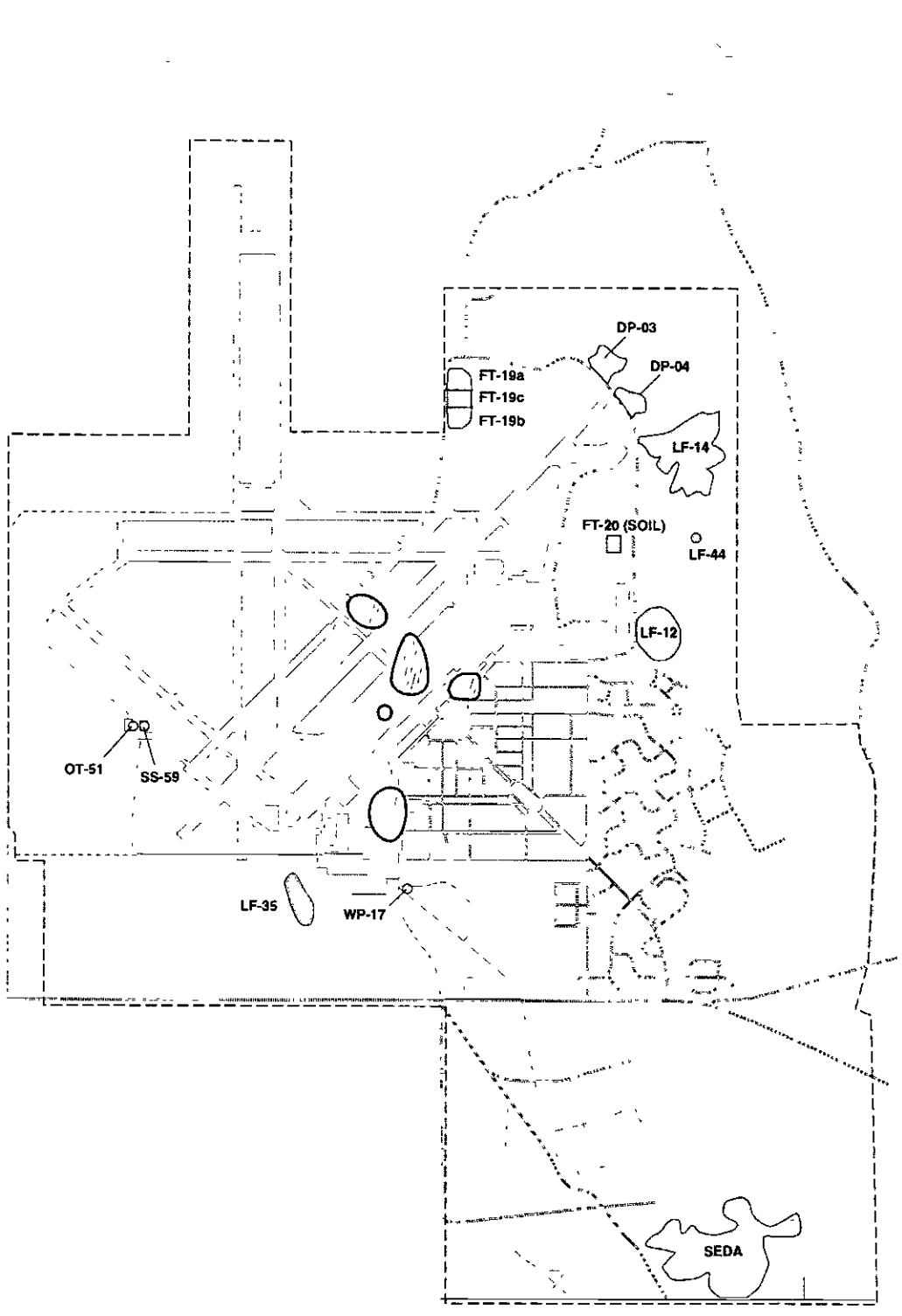
Wells are approximately located based on California Department Water Resources records

07/95 GE

MONTGOMERY WATSON

APPROXIMATE LOCATIONS OF KNOWN MUNICIPAL AND DOMESTIC WATER-SUPPLY WELLS, GAFB VICINITY

FIGURE 5



LEGEND

OU 3 SITE

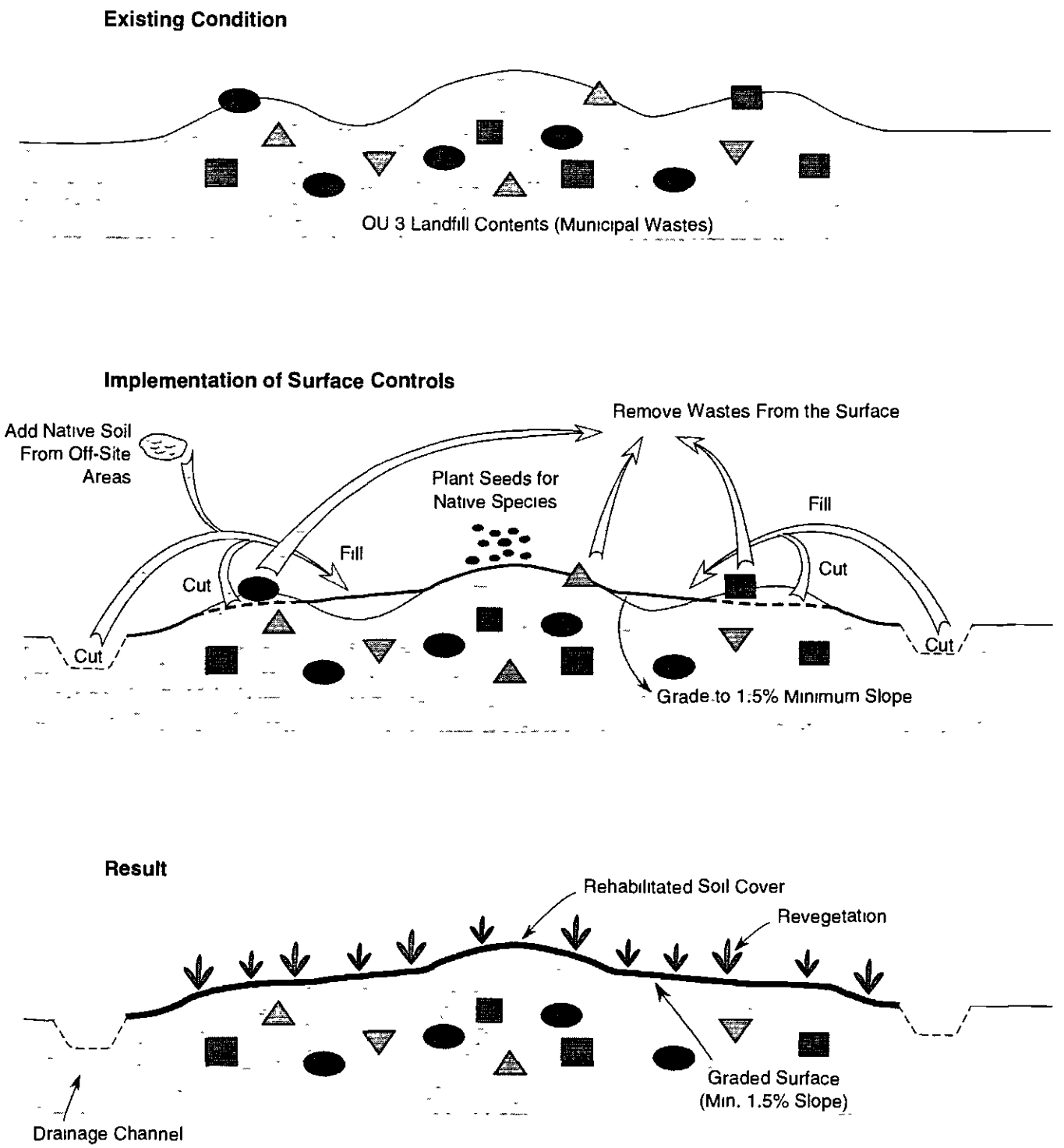
OT-69 TCE PLUMES (OU 3)

0 1500 3000
SCALE IN FEET

GEORGE AIR FORCE BASE
OPERABLE UNIT 3 FEASIBILITY STUDY
SITE LOCATIONS

Figure 6

10/97 GE



MONTGOMERY WATSON

GEORGE AIR FORCE BASE

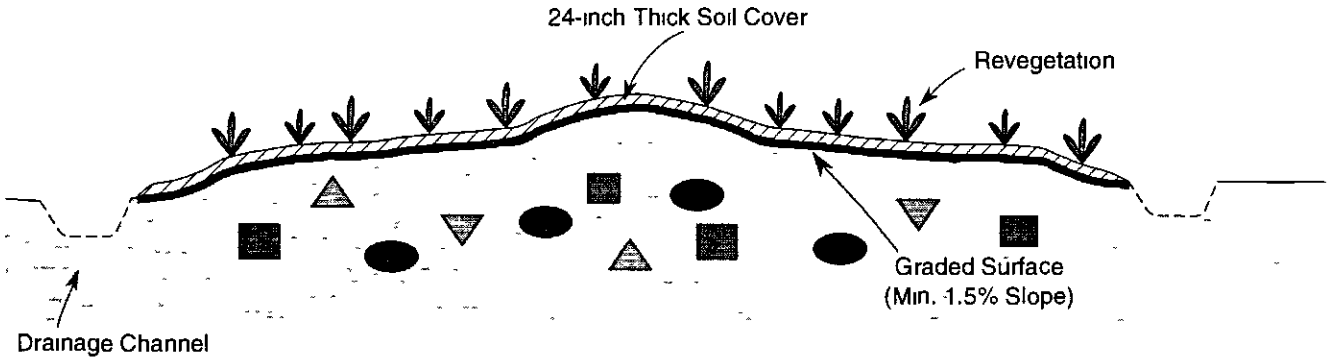
CONCEPTUAL DIAGRAM OF SURFACE CONTROLS/REHABILITATED SOIL COVER

OU 3 LANDFILL SITES

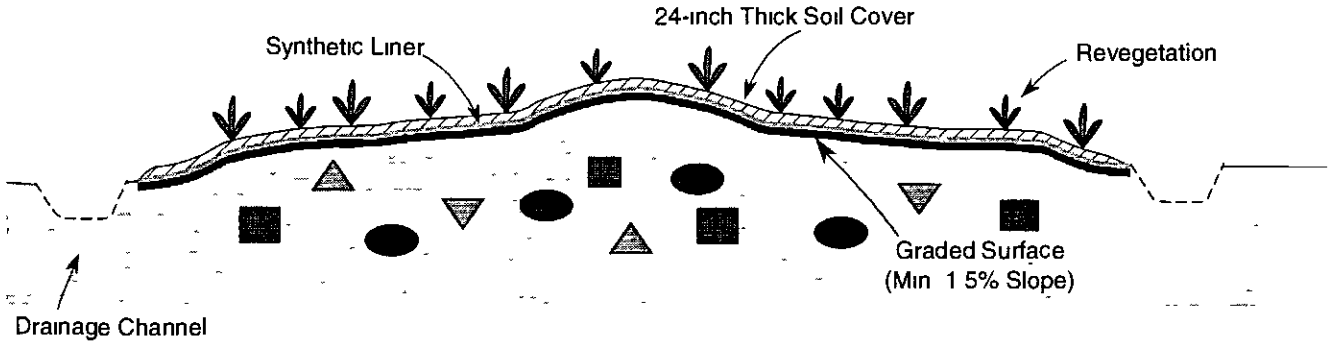
FIGURE 7

03/97 GE

Alternative 4: Native Soil Cover



Alternative 5: Synthetic Cap



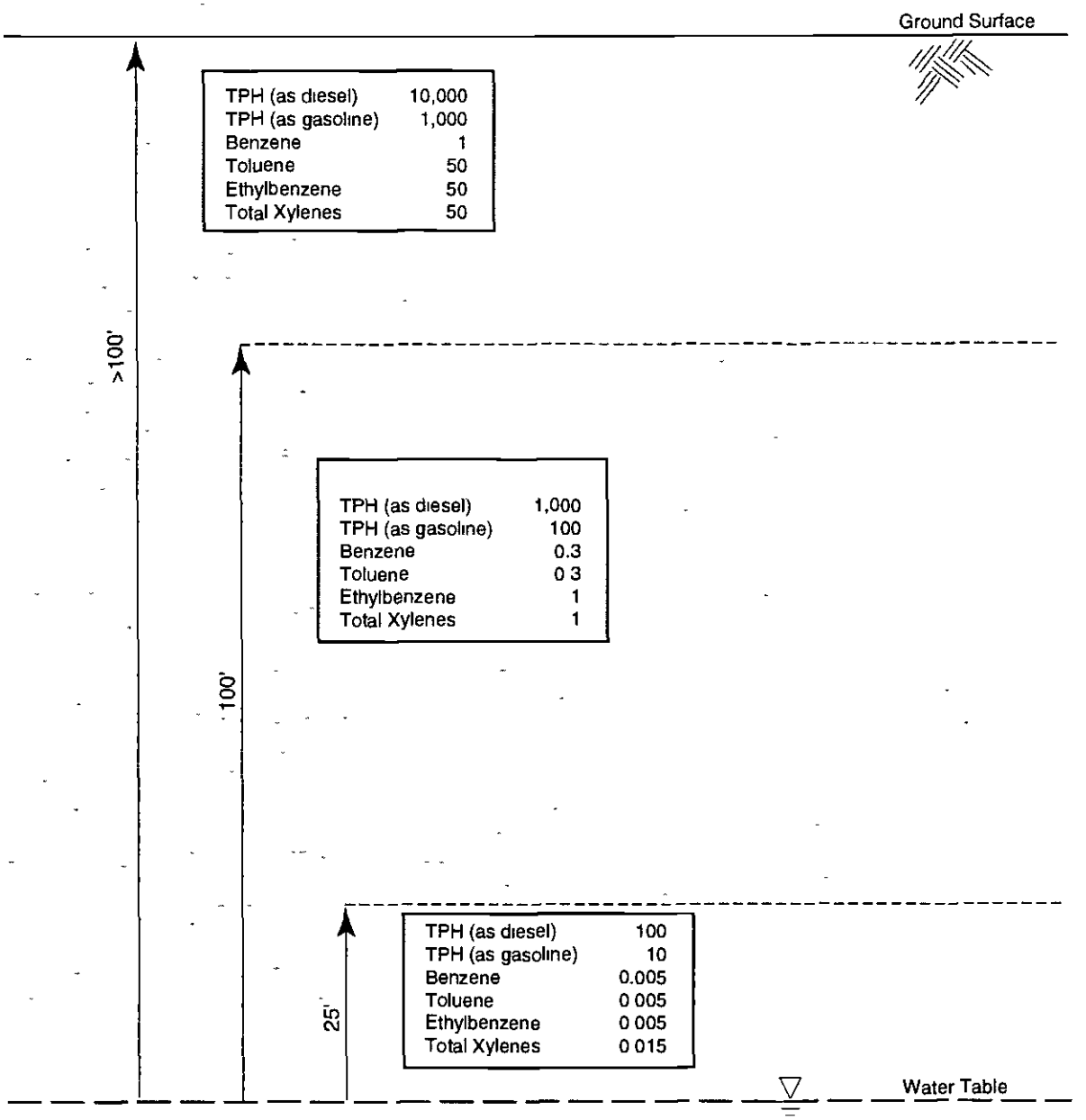
MONTGOMERY WATSON

GEORGE AIR FORCE BASE
CONCEPTUAL DIAGRAM OF CAPPING ALTERNATIVES

OU 3 LANDFILL SITES

FIGURE 8

03/97 GE



Notes
Not to scale
Units are mg/kg (ppm)

Source (LUFT Task Force, 1989)

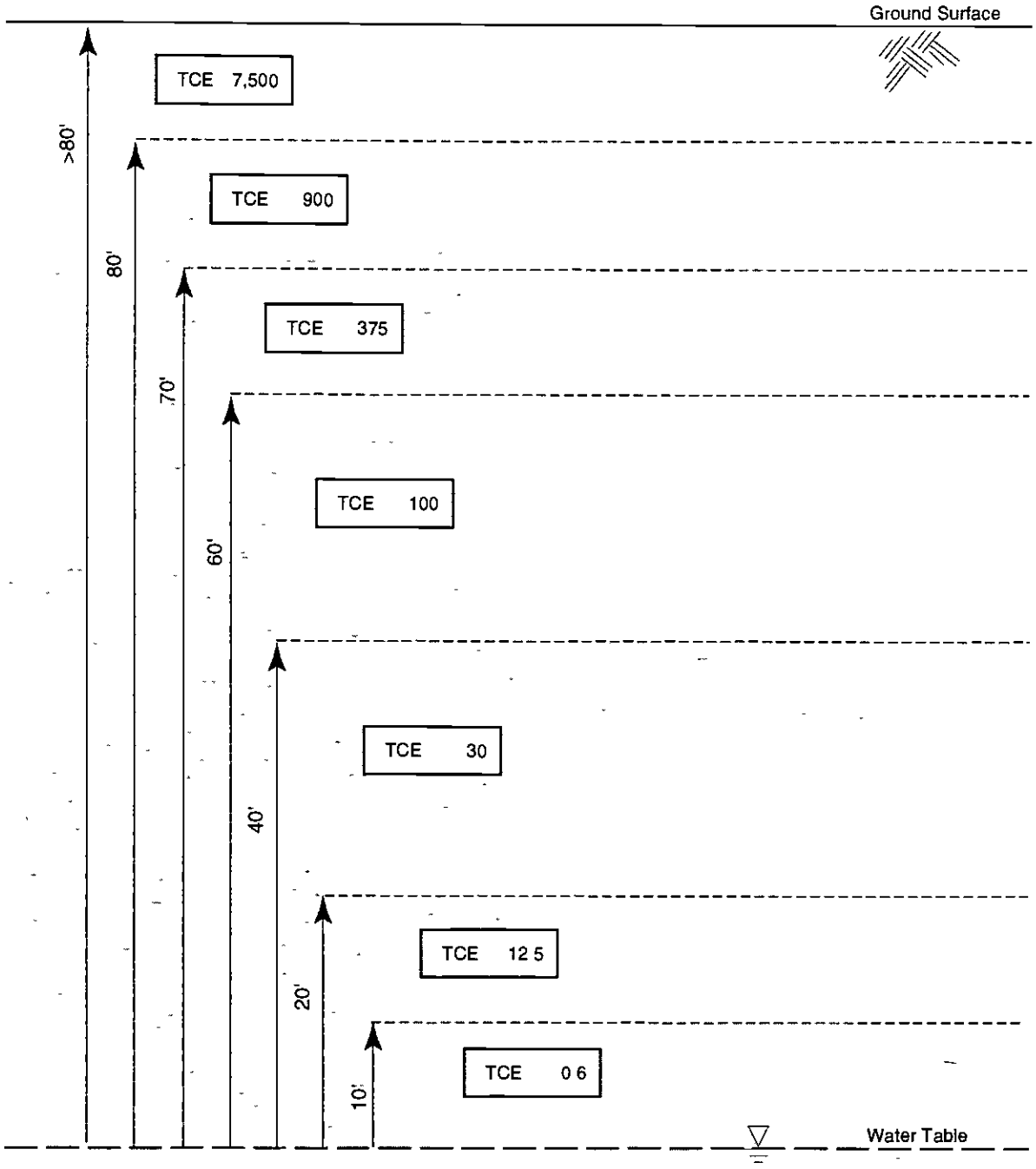
10/97 GE

MONTGOMERY WATSON

GEORGE AIR FORCE BASE

REMEDIATION GOALS FOR SOILS AT THE OU 3 TPH/VOC SITES

FIGURE 9



Notes
Not to scale
Units are µg/kg (ppb)

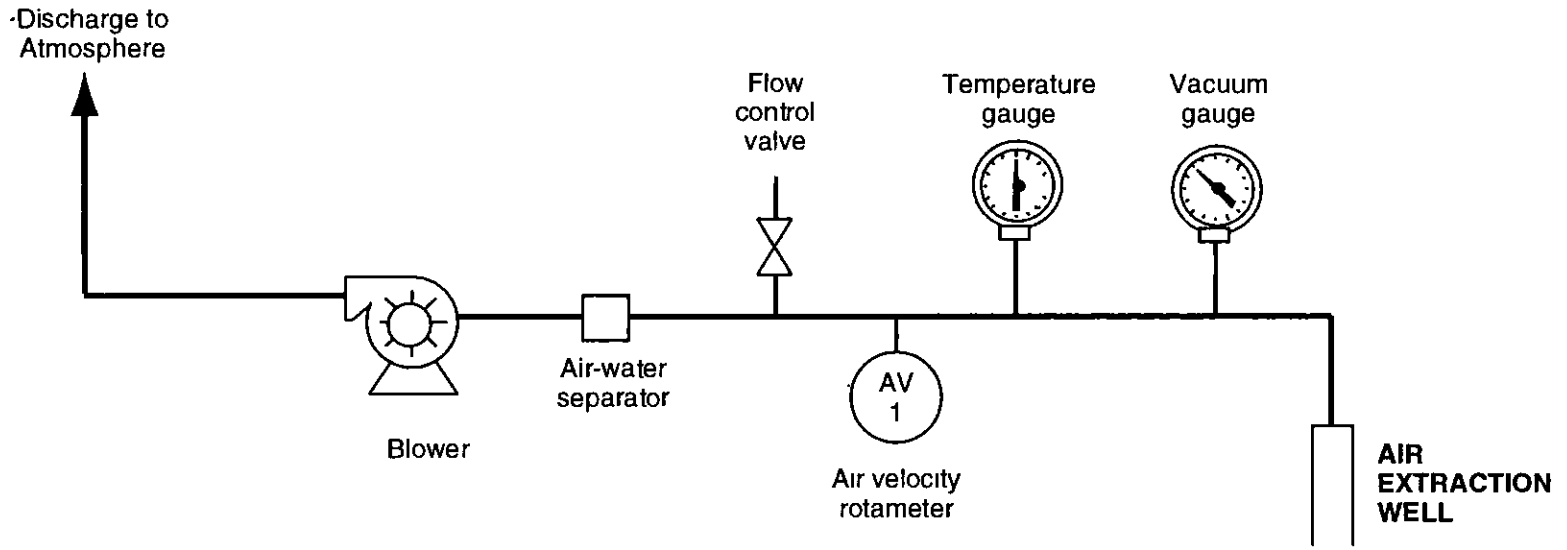
MONTGOMERY WATSON

GEORGE AIR FORCE BASE
REMEDIATION GOALS FOR TCE IN SOILS AT SITE FT-19c

FIGURE 10

Source SESOIL Modeling at FT-19c detailed in the OU 3 FS

10/97 GE



Note Not to Scale

06/95 GE

MONTGOMERY WATSON

SCHEMATIC OF SVE SYSTEM DESIGN

FIGURE 11

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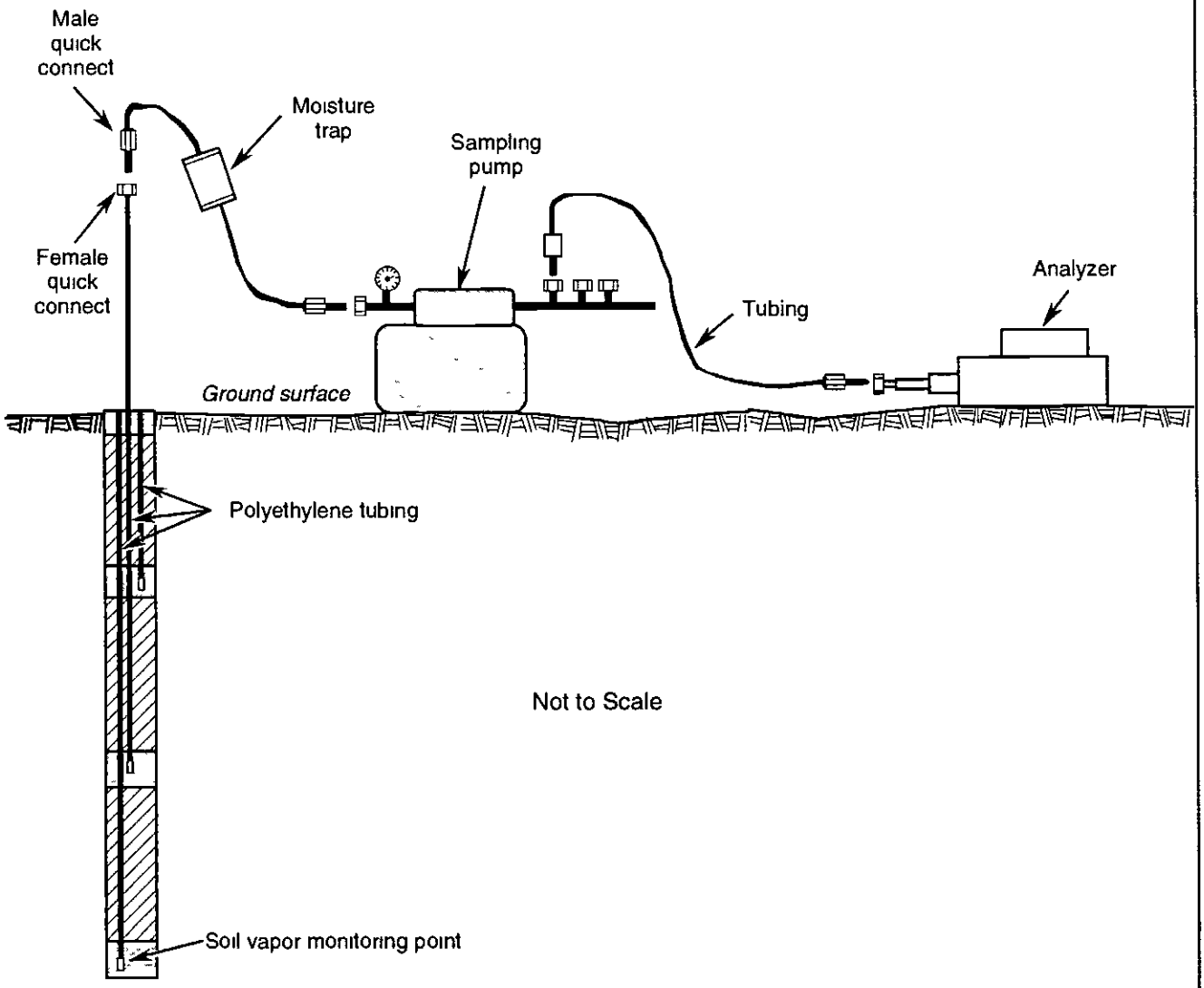


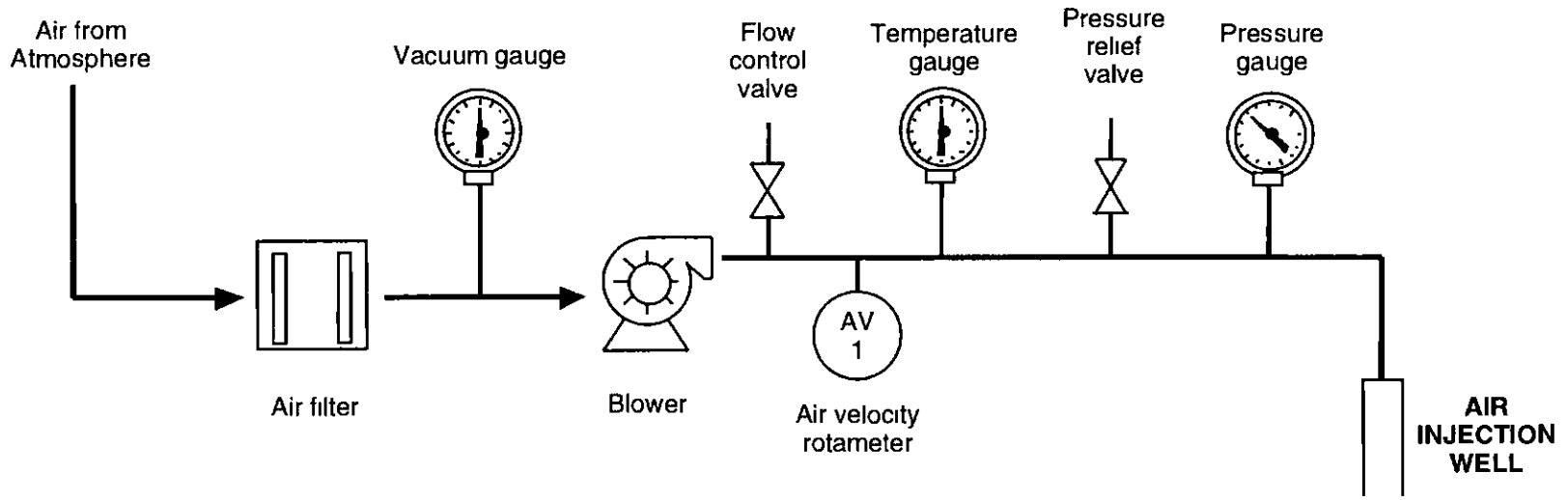
Modified from Hinchee, et al , 1992

06/95 GE

MONTGOMERY WATSON

SCHEMATIC DIAGRAM OF SOIL VAPOR SAMPLING FROM MONITORING POINT

FIGURE 12



Note Not to Scale

06/95 GE

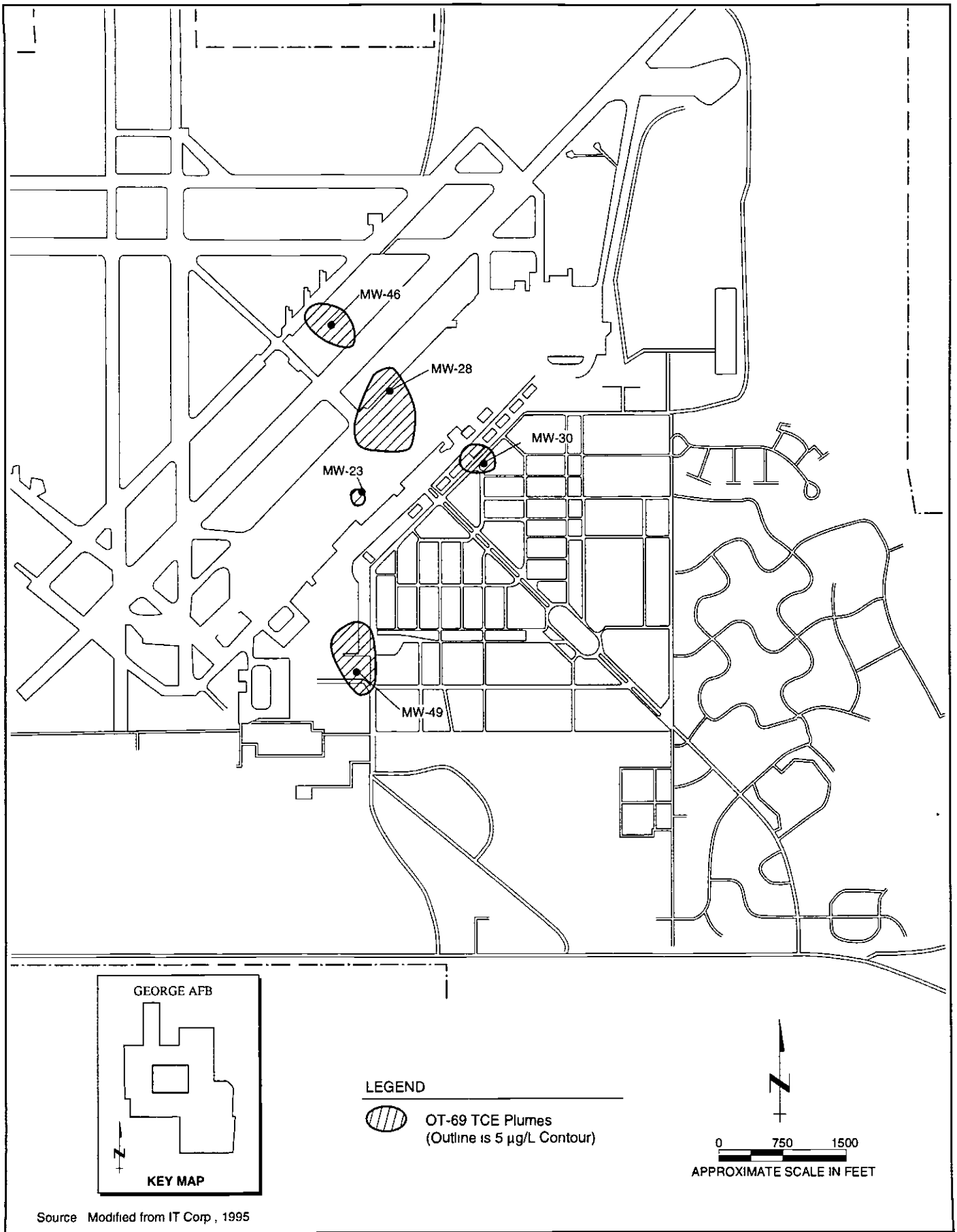
MONTGOMERY WATSON

SCHEMATIC OF BIOVENTING SYSTEM DESIGN

FIGURE 13

1294149

1294150



Source Modified from IT Corp , 1995

MONTGOMERY WATSON

GEORGE AIR FORCE BASE

SITE OT-69 LOCATION MAP

Figure 14

12/97 GE

1294151

TAB

Tables

TABLE 1

RECOMMENDED REMEDIAL ALTERNATIVES FOR OU 3 SITES
(page 1 of 3)

Site	Description	Document Presenting Selected Remedy	Investigation Activities Conducted By:	Reuse Parcel (USAF, 1993)	Selected Remedy
DP-01	Paint drum burial	WPA	-	D	NFA
DP-02	Pesticide and paint burial	WPA	-	A, D	NFA
DP-03	Acid and oil burial	OU 3 FS	MW	A	Alternative 4 (Soil Cover)
DP-04	Pesticide and oil burial	OU 3 FS	MW	A	Alternative 4 (Soil Cover)
LF-07 [a]	Base landfill	OU 3 FS	MW	K	Alternative 3 (Surface Controls/Existing Cover Rehabilitation) [a]
LF-08 [a]	Tetraethyl Lead (TEL) disposal	OU 3 FS	MW	K	Alternative 3 (Surface Controls/Existing Cover Rehabilitation) [a]
RW-09 [a]	Radioactive disposal	OU 3 FS	IT	K	Alternative 3 (Surface Controls/Existing Cover Rehabilitation) [a]
DP-10 [a]	Landfill (cartridges)	OU 3 FS	MW	K	Alternative 3 (Surface Controls/Existing Cover Rehabilitation) [a]
LF-11 [a]	Landfill (paper)	WPA	-	K	NFA
LF-12	Landfill street sweepings disposal site	OU 3 FS	MW	D	Alternative 3 (Surface Controls/Existing Cover Rehabilitation)
LF-13	Original base landfill	OU 3 RI	MW	C	NFA
LF-14	Base landfill	OU 3 FS	MW	A, D	Alternative 3 (Surface Controls/Existing Cover Rehabilitation)
DP-15 [a]	Munitions/oil	OU 3 FS	MW	K	Alternative 3 (Surface Controls/Existing Cover Rehabilitation) [a]
WP-16	POL leach field	OU 3 RI	M&E	D	NFA
WP-17	POL leach field	OU 3 FS	M&E	D	Alternative 9 (Bioventing)
SD-18	Fuel and oil disposal	WPA	-	A, B	NFA
FT-19a	Fire training area	OU 3 FS	M&E	A	Alternative 9 (Bioventing)
FT-19b	Waste burn pit	NA	M&E	A	Alternative 6 (No Action With Monitoring)
FT-19c	Fire training area	OU 3 FS	M&E	A	Alternative 8 (Soil Vapor Extraction)
FT-20 (soil)	Abandoned fire training area	OU 3 FS	MW	C	NFA
SS-21	Tip tank drainage area	OU 3 RI	M&E	C	NFA
OT-22	Golf course/waste water treatment plant irrigatio	WPA	-	F, J	NFA
SS-23	Salvage yard/hazardous waste storage yard	OU 3 RI	M&E	D	NFA
SS-24	Building 580 unserviced transformer storage	WPA	-	C	NFA
SD-27	Abandoned drain pit/dry well	OU 3 RI	M&E	D	NFA
SD-28	Abandoned drain pit/dry well	OU 3 RI	MW	C	NFA
WP-29	Sludge drying beds	WPA	-	C	NFA
WP-32	Leach field	OU 3 RI	MW	C	NFA
DP-33 [a]	Munitions	OU 3 FS	MW	K	Alternative 3 (Surface Controls/Existing Cover Rehabilitation) [a]

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TABLE 1

RECOMMENDED REMEDIAL ALTERNATIVES FOR OU 3 SITES
(page 2 of 3)

Site	Description	Document Presenting Selected Remedy	Investigation Activities Conducted By:	Reuse Parcel (USAF, 1993)	Selected Remedy
DP-34 [a]	Munitions/bombs	OU 3 FS	MW	K	Alternative 3 (Surface Controls/Existing Cover Rehabilitation) [a]
LF-35	Landfill (wood/debris disposal)	WPA	-	A, D	Land Use Restrictions/Posting of Warning Signs
LF-36	Construction debris/borrow pit	WPA	-	A	NFA
LF-37	Landfill (road materials burial)	OU 3 RI	MW	B	NFA
LF-38	Trash disposal	OU 3 RI	MW	B	NFA
LF-39	Construction debris/trash	OU 3 RI	MW	D, J	NFA
WP-40 [a]	Chemical toilet sludge	OU 3 FS	MW	K	Alternative 3 (Surface Controls/Existing Cover Rehabilitation) [a]
SD-41	Riprap for industrial drain discharge	WPA	-	A	NFA
SD-42	Riprap for off-base water supply	WPA	-	NA	NFA
LF-43	Rubble disposal	WPA	-	A	NFA
LF-44	Misc. trash/rubble disposal	OU 3 FS	MW	D	Alternative 2 (Institutional Controls)
LF-45	Construction demolition	WPA	-	A	NFA
DP-46	F-111 Aircraft burial	OU 3 RI	MW	D	NFA
DP-47	Aircraft parts burial	OU 3 RI	MW	C	NFA
OT-48	Salvage yard	WPA	-	D	NFA
OT-49	Aircraft crash residues	WPA	-	NA	NFA
OT-50	Earth embankment	OU 3 RI	M&E	B	NFA
OT-51	Test cells 799	OU 3 FS	M&E, MW	B	Alternatives 9 (Bioventing) and Natural Attenuation
SS-52 [a]	Creosote spill area	OU 3 FS	MW	K	Alternative 3 (Surface Controls/Existing Cover Rehabilitation) [a]
SS-53	Jet fuel spill	WPA	-	D	NFA
SS-55	Fuel spill collection point	OU 3 RI	MW	C	NFA
ST-56	Spill near Building 549	OU 3 RI	MW	C	NFA
SS-59	Building 819 fuel spill	OU 3 FS	M&E	B	NFA
DP-60	Sewerage sludge disposal	OU 3 RI	MW	A	NFA
OT-61	Shop waste disposal area	WPA	-	NA	NFA
OT-62	Rinse water disposal pit	WPA	-	NA	NFA
WP-63	Sewage sludge disposal areas	WPA	-	NA	NFA
OT-64	Transformer sites	WPA	-	NA	NFA
OT-65	Outlying revetments	OU 3 RI	MW	NA	NFA

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TABLE 1

RECOMMENDED REMEDIAL ALTERNATIVES FOR OU 3 SITES
(page 3 of 3)

Site	Description	Document Presenting Selected Remedy	Investigation Activities Conducted By:	Reuse Parcel (USAF, 1993)	Selected Remedy
OT-66	Nonpoint-source residential housing	WPA	-	NA	NFA
WP-68	Paint disposal pit	OU 3 RI	MW	C	NFA
OT-69	PCE/TCE Plume	IT RI/FS	IT	C	Alternative G-2 (Natural Attenuation/Institutional Controls)
	IRP Site Total	60 [b]			

Notes:

[a] Southeast Disposal Area (SEDA) Site RW-09 was investigated and a removal action was conducted by IT. However, Site RW-09 is included in the FS remediation boundary along with other SEDA sites including Sites LF-07, LF-08, DP-10, DP-15, DP-33, DP-34, WP-40, and SS-52. Site LF-11 is part of the SEDA, however, it is located outside of the FS remediation boundary.

[b] Sites FT-19a and FT-19c are counted as one site.

Acronyms: FS = OU 3 Feasibility Study Report (Montgomery Watson, 1997a)
IT RI/FS = IT RI/FS for OU 3 PCE/TCE Study Area (IT, 1995a)
M&E = Metcalf & Eddy
MW = Montgomery Watson
NA = Not Applicable
NFA = No Further Action
OU = Operable Unit
PCE = tetrachloroethene
RI = OU 3 Remedial Investigation Report (Montgomery Watson, 1996a)
TCE = trichloroethene
WPA = Work Plan Addendum (JMM, 1992)

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TABLE 2

SUMMARY OF OU 3 LANDFILL SITE CHARACTERIZATIONS

Site Name	Sampling Rationale/Investigation Results	Human Health Risk [b]	Ecological Risk
DP-03	• GPR indicated buried debris covering approximately 2 acres • Trace soil-gas detected • Nine SVOCs detected in one of the three surface samples • Fill materials including concrete, asphalt, metal, and gravel encountered at depths up to 7 feet in two of the three test pits • In the three subsurface samples, one VOC, 10 SVOCs, hydrocarbons, and lead detected above background levels • Vadose zone modeling indicated no risk to groundwater	• Cumulative Cancer Risk = 1 9E-5 (industrial/commercial worker scenario) • Hazard Index < 1 0 • Blood Lead < 1 0	A limited potential for ecological risk due to a limited distribution of PAHs
DP-04	• GPR indicated buried debris covering approximately 5 5 acres • Trace soil-gas detected • Three inorganics (lead, nickel and zinc) were detected above background in one of the three surface samples Three pesticides and hydrocarbons were also detected • Fill materials including concrete, asphalt, metal, plastic, wood, and gravel encountered at depths below 15 feet in five of the six test pits • Hydrocarbons, and two inorganics (lead and mercury) detected above background levels in the subsurface samples • Vadose zone modeling indicated no risk to groundwater	• Cumulative Cancer Risk = 6 7E-5 (industrial/commercial worker scenario) • Hazard Index < 1 0 • Blood Lead < 10	A potential ecological risk to burrowing mammals and their predators due mainly to the highly localized presence of Aroclor 1260
LF-12	• GPR indicated buried debris covering approximately 4 acres • Trace soil-gas detected • Three dioxins, hydrocarbons and four inorganics (barium, lead, mercury and zinc) detected above background in surface soil samples • Fill materials including concrete, metal, plastic, glass and plaster board encountered to depths of 10 feet in test pits • Hydrocarbons, and barium detected above background levels in the subsurface samples • Inorganic constituents below or near background were detected in groundwater • Vadose zone modeling indicated no risk to groundwater	• Cumulative Cancer Risk < 1 0E-06 (future adult resident scenario) • Hazard Index < 1 0 • Blood Lead < 10	A potential ecological risk to burrowing mammals and their predators due mainly to the highly localized presence of dioxins, lead, zinc, and barium
LF-14	• GPR indicated buried debris covering approximately 9 acres • Trace soil-gas detected • Four SVOCs, two pesticides, hydrocarbons and five inorganics (cadmium, copper, lead, mercury and zinc) detected above background in surface soil samples • Fill materials including concrete, asphalt, metal, plastic, wood, glass and gravel encountered at depths below 15 feet in test pits • Two VOCs, one SVOC, hydrocarbons, and two inorganics (lead and manganese) detected above background levels in the subsurface samples • Inorganic constituents below or near background were detected in groundwater • Vadose zone modeling indicated no risk to groundwater	• Cumulative Cancer Risk = 1 0E-5 (industrial/commercial worker scenario) • Hazard Index < 1 0 • Blood Lead < 10	A potential ecological risk to burrowing mammals and their predators due to the localized presence of cadmium, lead, zinc, pesticides, and PAHs
LF-44	• GPR indicated buried debris covering approximately 0 4 acres • Trace soil-gas detected • Hydrocarbons and lead detected above background in surface soil samples • Fill materials including concrete, metal, wood, trash and burned debris encountered to depths up to 9 feet in test pits • Hydrocarbons and two inorganics (antimony and lead) detected above background levels in the subsurface samples • Vadose zone modeling indicated no risk to groundwater	• PRG screening indicated site chemicals are within acceptable levels, therefore a risk calculation was not performed •Blood Lead < 10	Ecological impacts not significant
SEDA [a]	• GPR indicated buried debris covering approximately 50 acres • Trace soil-gas detected • Eight dioxins, one pesticide, hydrocarbons and 10 inorganics detected above background in surface soil samples • Fill materials including concrete, asphalt, metal, rubber, wood, glass, plaster board, and burned debris encountered at depths below 13 5 feet in test pits • Toluene, hydrocarbons, and 14 inorganics detected above background levels in the subsurface samples • Inorganic constituents below or near background were detected in groundwater • Vadose zone modeling indicated no risk to groundwater	• Cumulative Cancer Risk = 8 4E-5 (future adult resident scenario) • Hazard Index = 1 36 • Blood Lead < 10	A potential ecological risk to burrowing mammals and their predators due to the localized presence of several metals and dioxin/furan congeners

Notes

a The SEDA remediation boundary includes 9 sites (LF-07, LF-08, RW-09, DP-10, DP-15, DP-33, DP-34, WP-40, and SS-52)

b Highest cancer risk from all scenarios evaluated the scenario under which the highest cancer risk was calculated is presented

TABLE 3

SUMMARY OF DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR OU 3 LANDFILL SITES

Alternative	Protection of Human Health and the Environment	Compliance with ARARs	Effectiveness	Reduction of TMV	Implementability	Total Cost
1. No Action with monitoring	Does not reduce potential for future exposure.	Does not comply.	Not effective.	No reduction of TMV.	No technical limitations.	See Table 5.
2. Institutional Controls	Reduces potential for future exposure	Complies with ARARs.	Moderate effectiveness.	Reduces volume through surface restoration.	Easily implemented.	See Table 5.
3 Surface Controls/ Existing Cover Rehabilitation	Significantly reduces potential for future exposure.	Complies with ARARs.	Effective.	Reduces the mobility of the landfill contaminants by reducing surface water infiltration and controlling run-on/runoff	General site grading may be difficult in areas of uneven topography	See Table 5.
4. Soil Cover	Significantly reduces potential for future exposure.	Complies with ARARs.	Effective.	Same as Alternative 3, but provides greater reduction in infiltration through the addition of a soil cover.	Same as Alternative 3	See Table 5.
5 Synthetic Cap	Significantly reduces potential for future exposure.	Complies with ARARs	Effective.	Same as Alternative 4, but provides a greater reduction in infiltration through the addition of a synthetic liner	Same as Alternative 3	See Table 5.

ARAR - applicable or relevant and appropriate
TMV - toxicity, mobility, or volume

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TABLE 4

ARARs FOR GAFB OU 3 LANDFILL SITES DP-03, DP-04, LF-12, LF-14, AND THE SEDA
(Page 1 of 9)

Source	Standard Requirements, Criterion, or Limitation[a]	ARAR Status[b]	Description	Comment
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17766 Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Emergency Response Plan potential emergency conditions that may exceed the design of the site and could endanger the public health or environment must be anticipated Response procedures for these conditions must be addressed in the RD/RA plans	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7 8 Scope and Applicability pursuant to 14 CCR 17760
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17767c,d,e,f, & g Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Security at Closed Sites all points of access to the site must be restricted, except permitted entry points All monitoring, control, and recovery systems shall be protected from unauthorized access Notification signs must be posted at the site	Closure of Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7 8 Scope and Applicability pursuant to 14 CCR 17760
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17771a(2) Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Structure Removal dismantle and remove structures are required by the closure plan.	Closure or Postclosure Maintenance Standard of Title 14. CCR, Chapter 3, Article 7 8. Scope and Applicability pursuant to 14 CCR 17760.
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17772 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Decommissioning of Environmental Control Systems components of the environmental control systems, which have come into contact with leachate or landfill gas need to be dismantled and disposed of in a manner that will not pose a potential health threat	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7 8 Scope and Applicability pursuant to 14 CCR 17760
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17773a & c-e Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Final Cover: the design and construction of the final cover must meet specific performance standards regarding infiltration, landfill gas emissions, and reuse of the site This section incorporates the prescriptive standards of 23 CCR 2581(a), however, an engineered alternative that meets the performance standards is being proposed and must meet the engineered alternative criteria including 23 CCR 2510(b)&(c) and 2580(e).	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7 8 Scope and Applicability pursuant to 14 CCR 17760
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17774 a-e(1) & H (1)(2)(A)(B) Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Construction Quality Assurance (CQA) a CQA program must be designed and implemented It must include specific parameters (and for some components specific testing methods) for the final cover.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7 8. Scope and Applicability pursuant to 14 CCR 17760.

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TABLE 4

ARARs FOR GAFB OU 3 LANDFILL SITES DP-03, DP-04, LF-12, LF-14, AND THE SEDA
(Page 2 of 9)

Source	Standard Requirements, Criterion, or Limitation[a]	ARAR Status[b]	Description	Comment
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17776 Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Final Grades the final grades for the covered landfill must meet grading standards provided in 23 CCR 2581(b), and be based on local topography, climate conditions, and postclosure land use; they must be appropriate to control runoff and erosion Survey monuments must be installed to monitor settlement as required by 23 CCR 2580(d). Upon completion of closure activities and in the postclosure maintenance period, contour maps are required to calculate settlement using 2 foot contour intervals and the scale specified in 23 CCR 2597(b).	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8 Scope and Applicability pursuant to 14 CCR 17760
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17777a Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Final Site Face the design of the final site face must provide for the integrity of the final cover both under static and dynamic conditions	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7 8 Scope and Applicability pursuant to 14 CCR 17760
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17778 Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Final Drainage the design of the final cover and any associated collection and holding facilities must control runon and runoff produced by a 100-year 24-hour storm event as required by 23 CCR 2546(a),(c) & (D) and 2595(d)(2) and must be prepared according to CQA requirements	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7 8. Scope and Applicability pursuant to 14 CCR 17760.
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17779 Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Slope Protection and Erosion Control: the design and construction of the slopes must protect the integrity of the final cover and minimize soil erosion	Closure and Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7 8 Scope and Applicability pursuant to 14 CCR 17760
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17781 a & b Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Leachate Control During Closure and Postclosure· if leachate is being produced at the site, it must be monitored, collected, treated, and discarded pursuant to 23 CCR 2559, 2543, and 2546(b), respectively	The state does not intend that subsurface leachate monitoring and collecting systems need to be added to existing landfills unless leachate production and/or accumulation is evident

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TABLE 4

ARARs FOR GAFB OU 3 LANDFILL SITES DP-03, DP-04, LF-12, LF-14, AND THE SEDA
(Page 3 of 9)

Source	Standard Requirements, Criterion, or Limitation[a]	ARAR Status[b]	Description	Comment
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17783 (attempting an exemption) Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Gas Monitoring and Control During Closure and Post Closure landfill gases must be collected and analyzed, the concentration of combustible gas at the landfill boundary must be 5 percent or less, trace gases must not be at levels that cause adverse health or environmental impacts.	An exemption may be granted pursuant to 14 CCR 17783 17 once the proposed monitoring data is received
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17788 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Relevant and Appropriate	Postclosure Maintenance· the landfill must be maintained and monitored for no less than 30 years following closure and in accordance with 23 CCR 2581(c).	Maintenance and monitoring is to continue for 30 years following closure until it can be demonstrated that the landfill does not pose a threat to public health and safety or a threat to the environment.
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17796 Chapter 3, Article 7 8 Disposal Site Closure and Postclosure Maintenance	Applicable	Postclosure Land Use· Site Closure Design shall show one or more proposed uses of the closed site or show development that is compatible with open space The owner of the site must notify the agencies of any proposed changes in postclosure land Changes in the land use must be implemented in accordance with the standards in this section to ensure that public health and the environment are adequately protected	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7 8 Scope and Applicability pursuant to 14 CCR 17760.
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18262 3a(1-5B) & (8) Chapter 5, Article 3 4 Closure Plans	Relevant and Appropriate	Provides the content requirements for closure plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after January 1, 1988.
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18265.3a(1-7) and (9 & 10) Chapter 5, Article 3.4, Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements for postclosure maintenance plans for solid waste disposal sites	Applies to solid waste disposal sites that received waste after January 1, 1988
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18275 Chapter 5, Article 3 4, Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements to obtain certification that the solid waste disposal sites has closed pursuant to state standards	Applies to solid waste disposal sites that received waste after January 1, 1988

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TABLE 4

ARARs FOR GAFB OU 3 LANDFILL SITES DP-03, DP-04, LF-12, LF-14, AND THE SEDA
(Page 4 of 9)

Source	Standard Requirements, Criterion, or Limitation[a]	ARAR Status[b]	Description	Comment
Water Quality Control Plan for the Lahontan Region (Basin Plan)	Table 2-1, Beneficial Uses of Ground Waters in Upper Mojave Hydrologic Unit (628.20)	Applicable	Defines beneficial uses for groundwaters beneath GAFB as municipal, agricultural, industrial service, and freshwater replenishment	The identification of the groundwaters beneath landfill sites as potential drinking water sources forms a basis for selection of concentration limits, cleanup levels, and treatment levels.
	Objectives for Ground Water	Applicable	Defines the groundwater quality objectives for nondegradation, taste and odor, bacteria, chemical constituents, radioactivity, and minerals	Concentration limits, cleanup levels, and treatment levels must conform to the objectives
	California Water Code § 13176	Applicable	Requires the analysis of material to be performed in a State certified laboratory	For all investigation and remedial actions.
	California Water Code § 13370 et seq	Applicable	Requires compliance with Federal Clean Water Act requirements for surface water discharges Includes National Pollutant Discharge Elimination System Requirements for storm water runoff from certain construction or industrial activities The Air Force must comply with the substantive requirements for a) eliminating most non-storm water discharges, b) developing and implementing a storm water pollution prevention plan, and c) performing monitoring of storm water discharges For landfills that are inactive, prior to final closure, these regulations are contained in the SWRCB General Industrial Storm Water Permit (Order No 91-13-DWQ, as amended by Order No 92-12-DWQ)(NPDES No CAS000001) For Landfills that are going through final closure, these regulations are contained in the SWRCB General Construction Activity Storm Water Permit (Order No 92-08-DWQ)(NPDES No CAS000002).	
	California Water Code § 13750	Applicable	Requires an intent to drill notice to be filed with the State Department of Water Resources for water wells, monitoring wells, and cathodic protection wells.	For any well.
	California Water Code § 13750 5	Applicable	Requires well drillers to possess a C-57 license.	For any well
	California Water Code § 13752	Applicable	Allows other governmental agencies to obtain and submit well reports, provided the public is allowed to see them only after obtaining written permission from the owner	For any well.

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TABLE 4

ARARs FOR GAFB OU 3 LANDFILL SITES DP-03, DP-04, LF-12, LF-14, AND THE SEDA
(Page 5 of 9)

Source	Standard Requirements, Criterion, or Limitation[a]	ARAR Status[b]	Description	Comment
Discharges of Water to Land, Chapter 15, Title 23, CCR, Article 2 - Waste Classification and Management	§ 2510(g)	Relevant and Appropriate	Closed, inactive, or abandoned waste management units as of 11/27/84 may be required to implement a monitoring program If water quality impairment is discovered, corrective action may be required.	
	§ 2520	Relevant and Appropriate	Defines a waste classification and disposal criteria system. Requires accurate self-classification	The wastes within these landfills are classified as non-hazardous solid waste
	§ 2523	Relevant and Appropriate	Non-Hazardous Solid Waste - putrescible and non-putrescible waste that may be discharged to a Class III unit	
Discharges of Waste to Land, Chapter 15, Title 23, CCR, Article 4 - Construction Standards	§ 2546	Relevant and Appropriate	Precipitation and Drainage Controls - criteria for diversion and drainage of storm water	
	§ 2550 1	Relevant and Appropriate	Defines the type of monitoring programs that apply Different monitoring programs may apply at the same unit at the same time. The requirements (ROD) must specify the type of program applicable to the unit.	
Porter-Cologne Act Chapter 15	§ 2550.4	Relevant and Appropriate	Concentration Limits (CL) - Must be established for groundwater, surface water, and the unsaturated zone. Must be based on background, equal to background, or for corrective actions, may be greater than background (CLGTB), not to exceed the lower of the MCL or the concentration technologically or economically achievable.	
	§ 2550 7(b)(1)(A)	Relevant and Appropriate	Have a "sufficient number" of background MPts	
	§ 2550.7(b)(1)(B)	Relevant and Appropriate	For detection monitoring, have a sufficient number of MPts at the POC, additional locations as necessary, unsaturated zone, perched aquifers, and zones of highest conductivity.	
	§ 2550 7(b)(2)	Relevant and Appropriate	Background monitoring does not necessarily have to be upgradient of unit, it may be representative of upgradient conditions	

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TABLE 4

ARARs FOR GAFB OU 3 LANDFILL SITES DP-03, DP-04, LF-12, LF-14, AND THE SEDA
(Page 6 of 9)

Source	Standard Requirements, Criterion, or Limitation[a]	ARAR Status[b]	Description	Comment
	§ 2550 7(b)(4)	Relevant and Appropriate	Monitoring wells are to be constructed and cased in a manner to prevent being a conduit for contaminant transport	For all wells
	§ 2550.7(b)(5)	Relevant and Appropriate	Sampling interval shall be appropriately screened and equipped with a filter pack to enable representative groundwater sample collection	For all wells
	§ 2550 7(b)(6)	Relevant and Appropriate	The annular space shall be appropriately sealed to prevent cross-contamination	For all wells
	§ 2550 7(b)(7)	Relevant and Appropriate	Monitoring wells are to be adequately developed	For all wells
	§ 2550 7(e)(2)	Relevant and Appropriate	Cuttings to be logged during drilling under supervision of a registered geologist, lithology logs submitted to Regional Boards Soils - USGS, Rocks - as appropriate, Unsaturated Zone - record depth and thickness.	For all wells
	§ 2550 7(e)(3)	Relevant and Appropriate	Separate groundwater monitoring systems are not necessary for contiguous units	
	§ 2550 7(e)(4)	Relevant and Appropriate	Consistent sampling and analytical procedures are required incorporating· sample collection, sample preservation and shipment, analytical procedures, and chain-of-custody control	
	§ 2550 7(e)(5)	Relevant and Appropriate	Monitoring program to include appropriate methods for each COC and monitoring parameter (MPa)	The monitoring parameters are the metal surrogates chloride, sulfate, nitrate as nitrogen, total dissolved solids, and volatile organic constituents as defined by Appendix I of 40 CFR 258 The constituents of concern are those constituents listed in Appendix II of 40 CFR 258.
	§ 2550 7(e)(6)	Relevant and Appropriate	For each unit collect all data necessary to select an appropriate statistical method for establishing background As a minimum, quarterly sampling for one year, considering highest and lowest groundwater elevations	
	§ 2550 7(e)(7)	Relevant and Appropriate	Propose a statistical method for evaluation of each COC and MPa Must be specified in requirements (ROD) Selection criteria are given	

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TABLE 4

ARARs FOR GAFB OU 3 LANDFILL SITES DP-03, DP-04, LF-12, LF-14, AND THE SEDA

Source	Standard Requirements, Criterion, or Limitation[a]	ARAR Status[b]	Description	Comment
	§ 2550.7(e)(8)	Relevant and Appropriate	Acceptable Statistical Methods - ANOVA using mean values - ANOVA using median values - Tolerance or Prediction Interval - Control Charts - Alternate Proposal, verification criteria are included	
	§ 2550 7(e)(9)	Relevant and Appropriate	Performance Standards are given for each statistical method.	
	§ 2550 7(e)(10)	Relevant and Appropriate	Based upon the data collected and statistical method chosen to analyze the data, propose and justify a procedure to determine background for each COC and MPa, may use - background - method to update background with new data	
	§ 2550 7(e)(11)	Relevant and Appropriate	The requirements (ROD) shall specify the method chosen above	
	§ 2550 7(e)(12)	Relevant and Appropriate	For each COC and MPa the requirements (ROD) shall specify the sampling methods to establish background and for monitoring, consistent with. - the appropriate number and kind of samples for the statistical test chosen - the sampling method, including frequency and interval, ensuring independent samples	
	§ 2550 7(e)(13)	Relevant and Appropriate	Must collect groundwater surface elevation and field parameters each time a well is sampled	For each well
	§ 2550 7(e)(14)	Relevant and Appropriate	All data must be graphed at least manually, criteria are given graphs	Except where there is no new data, the guidelines of the PAT documents entitled Long Term Monitoring and Reporting Hydrogeologic Data are appropriate
	§ 2550.7(e)(15)	Relevant and Appropriate	The groundwater flow rate and direction must be determined	RPMs should adjust this requirement as necessary Semi-annual determination should be adequate

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TABLE 4

ARARs FOR GAFB OU 3 LANDFILL SITES DP-03, DP-04, LF-12, LF-14, AND THE SEDA
(Page 8 of 9)

Source	Standard Requirements, Criterion, or Limitation[a]	ARAR Status[b]	Description	Comment
	§ 2550 7(e)(16)	Relevant and Appropriate	All data collected shall be maintained The requirements (ROD) shall specify when data are to be reported	
	§ 2550 8	Relevant and Appropriate	Detection Monitoring	
	§ 2550 8(d)	Relevant and Appropriate	The requirements (ROD) shall specify the WQPS	
	§ 2550 8(e)	Relevant and Appropriate	MPas shall be proposed and specified in requirements (ROD) to include physical parameters, hazardous constituents, and reaction products to provide a reliable indication of a release A list of items to consider is given	MPas may be known as the Short List as opposed to the Long List of COCs
	§ 2550.8(f)	Relevant and Appropriate	Monitoring parameters and frequencies shall be as specified	
	§ 2550 8(g)	Relevant and Appropriate	COCs to be monitored if there is statistic evidence of a release	
	§ 2550 8(h)	Relevant and Appropriate	All data must be maintained so that statistical evidence of a release may be determined	
	§ 2550 8(i)	Relevant and Appropriate	Lists criteria for determining statistical evidence of a release, includes physical determination (i e , rapid pond declines or spills)	
	§ 2580(c)	Relevant and Appropriate	Prevents excessive irrigation on the final cover	
California Well Standards for water wells, monitoring wells, and cathodic protection wells	Bulletin 74-90 and 74-81, adopted pursuant to California Water Code § 13800	To Be Considered	Provides minimum construction and destruction criteria for water wells, monitoring wells, and cathodic protection wells Also includes criteria for borehole abandonment	For all wells
Hazardous Waste Control Laws	Title 22, California Code of Regulations (CCR), Division 4.5 Environmental Health Standards for Management of Hazardous Waste, Chapters 11, 12, 14, and 18	Applicable	Regulations governing hazardous waste control, identification and listing of hazardous waste, standards applicable to generators of hazardous waste waste transfer, treatment, storage, and disposal facilities; and land disposal restrictions	Only applicable if the wastes from the sites are classified as hazardous waste.
California Health and Safety Code, Div 26, Chapter 13	Mojave Desert Air Quality Management District (MDAQMD), Rule 401	Applicable	This rule prohibits the discharge of air contaminants which obscure visibility by more than 20 percent for a period of more than 3 minutes in any 1 hour	This regulation is applicable to any remedial action activity, which may cause a visible emission

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TABLE 4

ARARs FOR GAFB OU 3 LANDFILL SITES DP-03, DP-04, LF-12, LF-14, AND THE SEDA
(Page 9 of 9)

Source	Standard Requirements, Criterion, or Limitation[a]	ARAR Status[b]	Description	Comment
California Health and Safety Code, Div 26, Chapter 13	MDAQMD, Rule 402	Applicable	This rule prohibits the discharge of air contaminants in quantities which may cause injury, detriment, nuisance, or annoyance to any considerable number of persons or which endangers the comfort, response, health, or safety of any such person or which causes or has natural tendency to cause injury or damage to business or property	This regulation is applicable to any remedial action activity, which may discharge air contaminants as defined by the rule
California Health and Safety Code, Div 26, Chapter 13	MDAQMD, Rule 403	Applicable	This rule requires a person to take reasonable precaution not to cause or allow emissions of fugitive dusts from being airborne beyond the property line from which the emission originated	This regulation is applicable to any remedial action activity, which may cause the release of fugitive dust.
California Health and Safety Code, Div 26, Chapter 13	MDAQMD, Rule 1303	Applicable	This rule requires the installation of best available technology (BACT) to a new emission unit or modification of existing emissions unit	This regulation is applicable to any remedial action activity that may cause the emissions of 25 pound per day or more of any Nonattainment Air Pollutant

[a] Sections of Title 14 CCR and Title 23 CCR have been recodified into Title 27 CCR See Title 27 CCR for the new equivalent section numbers that apply

[b] The State does not agree on the characterization of certain ARARs in this table to be "Relevant and Appropriate" instead of "Applicable " However, because these requirements will be included in the ROD as ARARs, the State will not dispute this ROD

14 CCR - California Code of Regulations, Title 14
23 CCR - California Code of Regulations, Title 23
ANOVA - Analysis of Variance
ARAR - applicable or relevant and appropriate requirement
BACT - best available technology
CFR - Code of Federal Regulations
CL - concentration limits
CLGTB - Concentration Limit Greater than Background
COC - Constituent of Concern
CQA - Construction Quality Assurance
MCL - Maximum Contaminant Level
MDAQMD - Mojave Desert Air Quality Management District
MPa - monitoring parameter
MPts - Monitoring Points
POC - Point of Compliance
RD/RA - remedial design/remedial action
ROD - Record of Decision
RPM - remedial project manager
WQPS - Water Quality Protection Standards

TABLE 5

SUMMARY OF PRELIMINARY REMEDIAL ALTERNATIVE COSTS FOR OU 3 LANDFILL SITES [a]

Site	Cost Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
DP-03	Construction Cost	$5,000	$69,000	$230,000	$280,000	$370,000
	Direct Capital Cost	$6,500	$90,000	$290,000	$360,000	$470,000
	Total Capital Requirement	$8,000	$170,000	$440,000	$540,000	$680,000
	30-Year Present-Worth Cost	$460,000	$680,000	$1,100,000	$1,200,000	$1,400,000
DP-04	Construction Cost	$5,000	$70,000	$200,000	$250,000	$340,000
	Direct Capital Cost	$6,500	$91,000	$260,000	$320,000	$440,000
	Total Capital Requirement	$8,000	$170,000	$400,000	$480,000	$640,000
	30-Year Present-Worth Cost	$420,000	$640,000	$980,000	$1,100,000	$1,300,000
LF-12	Construction Cost	$0	$130,000	$430,000	$560,000	$860,000
	Direct Capital Cost	$0	$170,000	$540,000	$710,000	$1,100,000
	Total Capital Requirement	$0	$270,000	$780,000	$1,000,000	$1,500,000
	30-Year Present-Worth Cost	$450,000	$830,000	$1,600,000	$1,900,000	$2,700,000
LF-14	Construction Cost	$0	$330,000	$1,300,000	$1,800,000	$2,700,000
	Direct Capital Cost	$0	$420,000	$1,600,000	$2,300,000	$3,400,000
	Total Capital Requirement	$0	$600,000	$2,200,000	$3,200,000	$4,600,000
	30-Year Present-Worth Cost	$530,000	$1,400,000	$3,800,000	$5,300,000	$7,400,000
LF-44	Construction Cost	$0	$34,000	$130,000	$150,000	$190,000
	Direct Capital Cost	$0	$44,000	$160,000	$190,000	$240,000
	Total Capital Requirement	$0	$110,000	$270,000	$310,000	$370,000
	30-Year Present-Worth Cost	$370,000	$510,000	$740,000	$800,000	$900,000
SEDA	Construction Cost	$0	$610,000	$2,700,000	$3,800,000	$5,800,000
	Direct Capital Cost	$0	$780,000	$3,400,000	$4,800,000	$7,300,000
	Total Capital Requirement	$0	$1,100,000	$4,600,000	$6,500,000	$10,000,000
	30-Year Present-Worth Cost	$970,000	$2,600,000	$7,800,000	$11,000,000	$16,000,000

[a] Costs are as presented in the OU 3 FS Report (Montgomery Watson, 1997a).

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TABLE 6

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PRELIMINARY COST ESTIMATE FOR SITE DP-03 PREFERRED ALTERNATIVE
(Page 1 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COST (DCC)				
Construction Cost (CC):				
GENERAL				
Construction Trailer (Rental)	1	month	$500	$500
Temporary Utilities (Telephone/Power)	1	month	$1,500	$1,500
Decon Trailers	1	month	$2,400	$2,400
Health & Safety Equipment	1	month	$3,000	$3,000
Vehicle Decon Station	1	each	$5,000	$5,000
Vehicle Decon Equipment	1	month	$700	$700
Dust Control	1	month	$11,000	$11,000
Mobilization	1	lump sum	$20,000	$20,000
Demobilization	1	lump sum	$15,000	$15,000
SITE WORK				
Clear and Grub (w/ Class III Disposal)	180,000	SF	$0.07	$12,600
Soil Testing (compaction and density)	20	each	$100	$2,000
Excavate Native Soil (within 1 mile)	26,000	CY	$1	$26,000
Haul and Dump Native Soil	26,000	CY	$2	$52,000
Fill, Spread, and Compact Soil	26,000	CY	$0.50	$13,000
General Site Grading (min. 3% slope)	180,000	SF	$0.05	$9,000
Construct Drainage Channels (riprap)	1,500	LF	$20	$30,000
Erosion Control and Revegetation	180,000	SF	$0.05	$9,000
Maintain and Repair Haulage Roads	16,000	SF	$0 90	$14,400
Chain-Link Fencing (8 ft high, Barbed)	2,500	LF	$20	$50,000
Downgradient Monitoring Well (Installed)	1	lump sum	$5,000	$5,000
			Subtotal Construction Cost (CC)	$280,000
Supervision, Health & Safety		10% of CC		$28,000
Bid Contingency		10% of CC		$28,000
Scope Contingency		8% of CC		$22,400
			Subtotal Direct Capital Cost (DCC)	$360,000
INDIRECT CAPITAL COST				
Land Use Restrictions	1	lump sum	$50,000	$50,000
Pre-Design Studies		5% of DCC		$18,000
Engineering Design Services		5% of DCC		$18,000
Construction Management		10% of DCC		$36,000
Administrative Cost (GAFB/AFCEE)		15% of DCC		$54,000
			TOTAL CAPITAL REQUIREMENT	$540,000
PERIODIC OPERATING AND MAINTENANCE COST				
Annual Maintenance for Soil Cover		5% of DCC		$18,000
Annual Groundwater Monitoring (4 wells)	4	sample	$3,000	$12,000

TABLE 6

PRELIMINARY COST ESTIMATE FOR SITE DP-03 PREFERRED ALTERNATIVE
(Page 2 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Semi-Annual Groundwater Monitoring (2 wells)	2	sample	$3,000	$6,000
Quarterly Groundwater Monitoring (1 well)	2	sample	$3,000	$6,000
Semi-Annual Storm Water Monitoring (2 locations)	4	sample	$2,000	$8,000
5-Year Site Review	1	lump sum	$10,000	$10,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	30	
		30-YEAR PRESENT WORTH COST		$1,200,000

TABLE 7

PRELIMINARY COST ESTIMATE FOR SITE DP-04 PREFERRED ALTERNATIVE
(Page 1 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COST (DCC)				
Construction Cost (CC):				
GENERAL				
Construction Trailer (Rental)	1	month	$500	$500
Temporary Utilities (Telephone/Power)	1	month	$1,500	$1,500
Decon Trailers	1	month	$2,400	$2,400
Health & Safety Equipment	1	month	$3,000	$3,000
Vehicle Decon Station	1	each	$5,000	$5,000
Vehicle Decon Equipment	1	month	$700	$700
Dust Control	1	month	$11,000	$11,000
Mobilization	1	lump sum	$20,000	$20,000
Demobilization	1	lump sum	$15,000	$15,000
SITE WORK				
Clear and Grub (w/ Class III Disposal)	190,000	SF	$0.07	$13,300
Soil Testing (compaction and density)	20	each	$100	$2,000
Excavate Native Soil (within 1 mile)	21,000	CY	$1	$21,000
Haul and Dump Native Soil	21,000	CY	$2	$42,000
Fill, Spread, and Compact Soil	21,000	CY	$0 50	$10,500
General Site Grading (min. 3% slope)	190,000	SF	$0.05	$9,500
Construct Drainage Channels (riprap)	1,300	LF	$20	$26,000
Erosion Control and Revegetation	190,000	SF	$0.05	$9,500
Maintain and Repair Haulage Roads	12,000	SF	$0.90	$10,800
Chain-Link Fencing (8 ft high, Barbed)	2,000	LF	$20	$40,000
Downgradient Monitoring Well (Installed)	1	lump sum	$5,000	$5,000
			Subtotal Construction Cost (CC)	$250,000
Supervision, Health & Safety		10% of CC		$25,000
Bid Contingency		10% of CC		$25,000
Scope Contingency		8% of CC		$20,000
			Subtotal Direct Capital Cost (DCC)	$320,000
INDIRECT CAPITAL COST				
Land Use Restrictions	1	lump sum	$50,000	$50,000
Pre-Design Studies		5% of DCC		$16,000
Engineering Design Services		5% of DCC		$16,000
Construction Management		10% of DCC		$32,000
Administrative Cost (GAFB/AFCEE)		15% of DCC		$48,000
			TOTAL CAPITAL REQUIREMENT	$480,000
PERIODIC OPERATING AND MAINTENANCE COST				
Annual Maintenance for Soil Cover		5% of DCC		$16,000

TABLE 7

PRELIMINARY COST ESTIMATE FOR SITE DP-04 PREFERRED ALTERNATIVE
(Page 2 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Annual Groundwater Monitoring (3 wells)	3	sample	$3,000	$9,000
Semi-Annual Groundwater Monitoring (2 wells)	2	sample	$3,000	$6,000
Quarterly Groundwater Monitoring (1 well)	2	sample	$3,000	$6,000
Semi-Annual Storm Water Monitoring (2 locations)	4	sample	$2,000	$8,000
5-Year Site Review	1	lump sum	$10,000	$10,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	30	
	30-YEAR PRESENT WORTH COST			$1,100,000

TABLE 8

PRELIMINARY COST ESTIMATE FOR SITE LF-12 PREFERRED ALTERNATIVE
(Page 1 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COST (DCC)				
Construction Cost (CC):				
GENERAL				
Construction Trailer (Rental)	2	month	$500	$1,000
Temporary Utilities (Telephone/Power)	2	month	$1,500	$3,000
Decon Trailers	2	month	$2,400	$4,800
Health & Safety Equipment	2	month	$3,000	$6,000
Vehicle Decon Station	1	each	$5,000	$5,000
Vehicle Decon Equipment	2	month	$700	$1,400
Dust Control	2	month	$11,000	$22,000
Mobilization	1	lump sum	$20,000	$20,000
Demobilization	1	lump sum	$15,000	$15,000
SITE WORK				
Clear and Grub (w/ Class III Disposal)	600,000	SF	$0.07	$42,000
Soil Testing (compaction and density)	60	each	$100	$6,000
Excavate Native Soil (within 1 mile)	20,000	CY	$1	$20,000
Haul and Dump Native Soil	20,000	CY	$2	$40,000
Fill, Spread, and Compact Soil	20,000	CY	$0 50	$10,000
General Site Grading (min. 3% slope)	600,000	SF	$0.05	$30,000
Construct Drainage Channels (riprap)	1,800	LF	$20	$36,000
Erosion Control and Revegetation	600,000	SF	$0.05	$30,000
Maintain and Repair Haulage Roads	60,000	SF	$0.90	$54,000
Chain-Link Fencing (8 ft high, Barbed)	4,000	LF	$20	$80,000
			Subtotal Construction Cost (CC)	$430,000
Supervision, Health & Safety		8% of CC		$34,400
Bid Contingency		10% of CC		$43,000
Scope Contingency		8% of CC		$34,400
			Subtotal Direct Capital Cost (DCC)	$540,000
INDIRECT CAPITAL COST				
Land Use Restrictions	1	lump sum	$50,000	$50,000
Pre-Design Studies		5% of DCC		$27,000
Engineering Design Services		5% of DCC		$27,000
Construction Management		10% of DCC		$54,000
Administrative Cost (GAFB/AFCEE)		15% of DCC		$81,000
			TOTAL CAPITAL REQUIREMENT	$780,000
PERIODIC OPERATING AND MAINTENANCE COST				
Annual Maintenance for Surface Controls		5% of DCC		$27,000
Annual Groundwater Monitoring (4 wells)	4	sample	$3,000	$12,000

TABLE 8

PRELIMINARY COST ESTIMATE FOR SITE LF-12 PREFERRED ALTERNATIVE
(Page 2 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Semi-Annual Groundwater Monitoring (2 wells)	2	sample	$3,000	$6,000
Quarterly Groundwater Monitoring (1 well)	2	sample	$3,000	$6,000
Semi-Annual Storm Water Monitoring (2 locations)	4	sample	$2,000	$8,000
5-Year Site Review	1	lump sum	$10,000	$10,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	30	
	30-YEAR PRESENT WORTH COST			$1,600,000

TABLE 9

PRELIMINARY COST ESTIMATE FOR SITE LF-14 PREFERRED ALTERNATIVE
(Page 1 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COST (DCC)				
Construction Cost (CC):				
GENERAL				
Construction Trailer (Rental)	4	month	$500	$2,000
Temporary Utilities (Telephone/Power)	4	month	$1,500	$6,000
Decon Trailers	4	month	$2,400	$9,600
Health & Safety Equipment	4	month	$3,000	$12,000
Vehicle Decon Station	2	each	$5,000	$10,000
Vehicle Decon Equipment	4	month	$700	$2,800
Dust Control	4	month	$11,000	$44,000
Mobilization	1	lump sum	$20,000	$20,000
Demobilization	1	lump sum	$15,000	$15,000
SITE WORK				
Clear and Grub (w/ Class III Disposal)	1,900,000	SF	$0 07	$133,000
Soil Testing (compaction and density)	190	each	$100	$19,000
Excavate Native Soil (within 1 mile)	150,000	CY	$1	$150,000
Haul and Dump Native Soil	150,000	CY	$2	$300,000
Fill, Spread, and Compact Soil	150,000	CY	$0 50	$75,000
General Site Grading (min. 3% slope)	1,900,000	SF	$0.05	$95,000
Construct Drainage Channels (riprap)	3,500	LF	$20	$70,000
Erosion Control and Revegetation	1,900,000	SF	$0.05	$95,000
Maintain and Repair Haulage Roads	40,000	SF	$0.90	$36,000
Chain-Link Fencing (8 ft high, Barbed)	9,000	LF	$20	$180,000
			Subtotal Construction Cost (CC)	$1,300,000
Supervision, Health & Safety		8% of CC		$104,000
Bid Contingency		10% of CC		$130,000
Scope Contingency		8% of CC		$104,000
			Subtotal Direct Capital Cost (DCC)	$1,600,000
INDIRECT CAPITAL COST				
Land Use Restrictions	1	lump sum	$50,000	$50,000
Pre-Design Studies		5% of DCC		$80,000
Engineering Design Services		5% of DCC		$80,000
Construction Management		10% of DCC		$160,000
Administrative Cost (GAFB/AFCEE)		15% of DCC		$240,000
			TOTAL CAPITAL REQUIREMENT	$2,200,000
PERIODIC OPERATING AND MAINTENANCE COST				
Annual Maintenance for Surface Controls		5% of DCC		$80,000
Annual Groundwater Monitoring (5 wells)	5	sample	$3,000	$15,000

TABLE 9

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PRELIMINARY COST ESTIMATE FOR SITE LF-14 PREFERRED ALTERNATIVE
(Page 2 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Semi-Annual Groundwater Monitoring (3 wells)	3	sample	$3,000	$9,000
Quarterly Groundwater Monitoring (1 well)	2	sample	$3,000	$6,000
Semi-Annual Storm Water Monitoring (2 locations)	4	sample	$2,000	$8,000
5-Year Site Review	1	lump sum	$10,000	$10,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	30	
	30-YEAR PRESENT WORTH COST			$3,800,000

TABLE 10

PRELIMINARY COST ESTIMATE FOR SITE LF-44 PREFERRED ALTERNATIVE

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COST (DCC)				
Construction Cost (CC):				
Surface Restoration (w/ Class III Disposal)	70,000	SF	$0.08	$5,600
Chain-Link Fencing (8 feet high, Barbed)	1,400	LF	$20	$28,000
			Subtotal Construction Cost (CC)	$34,000
Supervision, Health & Safety		8% of CC		$2,720
Bid Contingency		10% of CC		$3,400
Scope Contingency		10% of CC		$3,400
			Subtotal Direct Capital Cost (DCC)	$44,000
INDIRECT CAPITAL COST				
Land Use Restrictions	1	lump sum	$50,000	$50,000
Engineering Design Services		5% of DCC		$2,200
Construction Management		10% of DCC		$4,400
Administrative Cost (GAFB/AFCEE)		15% of DCC		$6,600
			TOTAL CAPITAL REQUIREMENT	$110,000
PERIODIC OPERATING AND MAINTENANCE COST				
Annual Maintenance for Institutional Controls		5% of DCC		$2,200
Annual Groundwater Monitoring (2 wells)	2	sample	$3,000	$6,000
Semi-Annual Groundwater Monitoring (2 wells)	2	sample	$3,000	$6,000
Quarterly Groundwater Monitoring (1 well)	2	sample	$3,000	$6,000
Semi-Annual Storm Water Monitoring (2 locations)	4	sample	$2,000	$8,000
5-Year Site Review	1	lump sum	$10,000	$10,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	30	
			30-YEAR PRESENT WORTH COST	$510,000

TABLE 11

PRELIMINARY COST ESTIMATE FOR THE SEDA PREFERRED ALTERNATIVE
(Page 1 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COST (DCC)				
Construction Cost (CC):				
GENERAL				
Construction Trailer (Rental)	6	month	$500	$3,000
Temporary Utilities (Telephone/Power)	6	month	$1,500	$9,000
Decon Trailers	6	month	$2,400	$14,400
Health & Safety Equipment	6	month	$3,000	$18,000
Vehicle Decon Station	2	each	$5,000	$10,000
Vehicle Decon Equipment	6	month	$700	$4,200
Dust Control	6	month	$11,000	$66,000
Mobilization	1	lump sum	$20,000	$20,000
Demobilization	1	lump sum	$15,000	$15,000
SITE WORK				
Clear and Grub (w/ Class III Disposal)	4,000,000	SF	$0.07	$280,000
Soil Testing (compaction and density)	400	each	$100	$40,000
Excavate Native Soil (within 1 mile)	375,000	CY	$1	$375,000
Haul and Dump Native Soil	375,000	CY	$2	$750,000
Fill, Spread, and Compact Soil	375,000	CY	$0 50	$187,500
General Site Grading (min 3% slope)	4,000,000	SF	$0.05	$200,000
Construct Drainage Channels (riprap)	8,500	LF	$20	$170,000
Erosion Control and Revegetation	4,000,000	SF	$0 05	$200,000
Maintain and Repair Haulage Roads	80,000	SF	$0.90	$72,000
Chain-Link Fencing (8 ft high, Barbed)	14,500	LF	$20	$290,000
			Subtotal Construction Cost (CC)	$2,700,000
Supervision, Health & Safety		8% of CC		$216,000
Bid Contingency		10% of CC		$270,000
Scope Contingency		8% of CC		$216,000
			Subtotal Direct Capital Cost (DCC)	$3,400,000
INDIRECT CAPITAL COST				
Land Use Restrictions	1	lump sum	$50,000	$50,000
Pre-Design Studies		5% of DCC		$170,000
Engineering Design Services		5% of DCC		$170,000
Construction Management		10% of DCC		$340,000
Administrative Cost (GAFB/AFCEE)		15% of DCC		$510,000
			TOTAL CAPITAL REQUIREMENT	$4,600,000
PERIODIC OPERATING AND MAINTENANCE COST				
Annual Maintenance for Surface Controls		5% of DCC		$170,000
Annual Groundwater Monitoring (9 wells)	9	sample	$3,000	$27,000

TABLE 11

PRELIMINARY COST ESTIMATE FOR THE SEDA PREFERRED ALTERNATIVE
(Page 2 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Semi-Annual Groundwater Monitoring (6 wells)	6	sample	$3,000	$18,000
Quarterly Groundwater Monitoring (3 wells)	6	sample	$3,000	$18,000
Semi-Annual Storm Water Monitoring (2 locations)	4	sample	$2,000	$8,000
5-Year Site Review	1	lump sum	$10,000	$10,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	30	
		30-YEAR PRESENT WORTH COST		$7,800,000

TABLE 12

SUMMARY OF OPERABLE UNIT 3 TPH/VOC SITE CHARACTERIZATIONS

Site Name	Sampling Rationale/Investigation Results	Human Health Risk [a]	Ecological Risk
WP-17	• Some aerobic activity, indications of anaerobic activity • TPH, VOCs (BTEX), and chromium were detected above background • Vadose zone modeling indicated that benzene in soils will not adversely impact the groundwater quality	• Cumulative Cancer Risk < 1 0E-6 (construction worker scenario) • Hazard Index < 1 0 • Blood Lead < 10	There is no habitat available for ecological receptors, therefore, there is no potential ecological risk
FT-19a	• TCE, PCE, Chloroform, 1,1,1-TCA, and 1,1-DCE detected in soil-gas • TPH, VOCs (BTEX), SVOCs, and 5 metals were detected above background • Some aerobic activity occurring, very little anaerobic activity occurring at the site • Vadose zone modeling indicated that benzene in soils will not adversely impact the groundwater quality	• Cumulative Cancer Risk = 4 0E-6 (construction worker scenario) • Hazard Index < 1 0 • Blood Lead < 10	There is no habitat available for ecological receptors, therefore, there is no potential ecological risk
FT-19b	• Various constituents detected in soil-gas • TPH, VOCs, SVOCs, and 6 metals were detected above background • Test pit excavations revealed that medical wastes were primarily in the surface soils	• Cumulative Cancer Risk = 5 2E-6 (industrial/ commercial worker scenario) • Hazard Index < 1 0 • Blood Lead < 10	There is no habitat available for ecological receptors, therefore, there is no potential ecological risk
FT-19c	• TCE, PCE, Chloroform, and 1,1,1-TCA detected in soil-gas • TPH, VOCs (BTEX and TCE), SVOCs, and 11 metals detected above background • Some aerobic activity occurring, very little anaerobic activity occurring at the site • Vadose zone modeling indicated that TCE in soils may migrate to the groundwater in 75 years if untreated	• Cumulative Cancer Risk = 3 1E-6 (industrial/ commercial worker scenario) • Hazard Index < 1 0 • Blood Lead < 10	There is no habitat available for ecological receptors, therefore, there is no potential ecological risk
FT-20 (soil)	• TCE detected in soil-gas • TPH, TRPHs, and seven metals detected above background in soil samples No TCE detected • Inorganics below or near background were detected in downgradient groundwater • Vadose zone modeling indicated that contaminants detected at the site do not pose a threat to groundwater	• Cumulative Cancer Risk = 4 0E-5 (industrial/ commercial worker) • Hazard Index < 1 0 • Blood Lead < 10	There is no habitat available for ecological receptors, therefore, there is no potential ecological risk
OT-51	• No COPCs were detected in samples collected from the soil berm at Facility 807 • TPH and BTEX detected in samples collected from the soil berm at Facility 799 from 10 to 120 feet bgs Concentrations exceeded the screening criteria • TPH detected in samples collected from the engine test cells • TPH and BTEX were detected in crossgradient groundwater samples, but were not detected in downgradient samples • Groundwater Modeling indicated that benzene may migrate approximately 400 feet from the source area in 50 years • TPH detected in groundwater samples from two wells installed in the hot spot	• Preliminary screening indicated that the site does not pose a risk because the confirmed contamination is at depths that would not affect receptors in the risk assessment scenarios Therefore, a risk assessment calculation was not performed • Blood Lead < 10	There is no habitat available for ecological receptors, therefore, there is no potential ecological risk
SS-59	• TPH constituents detected in soil samples at concentrations exceeding the screening criteria	See Site OT-51	There is no habitat available for ecological receptors, therefore, there is no potential ecological risk
OT-69	• TCE and PCE detected above MCLs in groundwater • PCE not detected in soil samples, TCE detected in small percentage of soil samples • Highest levels of TCE will attenuate to 5 µg/L in 40 to 45 years • TCE limited to the upper 30 feet of the aquifer • Total volumes of TCE = 0 8 gallons and PCE = 0 006 gallons	• Total carcinogenic risk = 2E-05 No likely exposure pathways to on-base workers and off-base residents • Hazard Index < 1 0 • Blood Lead = not applicable	Because the site is comprised of groundwater, there is no completed exposure pathway for ecological receptors

Notes

a Highest cancer risk from all scenarios evaluated and the scenario under which the highest risk was calculated is presented

TABLE 13

NUMERICAL CLEANUP STANDARDS FOR TPH/VOC GROUNDWATER SITES

Constituent	Federal		California		Suggested Concentration to Meet Secondary MCL of 3 Odor Units	Cleanup Standard
	MCL	SMCL	MCL	SMCL		
Benzene	5	NA	1	NA	NA	1
Ethylbenzene	700	30	700	NA	29	29
Toluene	1,000	40	150	NA	42	40
Trichloroethene (TCE)	5	NA	5	NA	NA	5
Tetrachloroethene (PCE)	5	NA	5	NA	NA	5
Xylenes	10,000	20	1,750	NA	17	17

MCL = maximum contaminant level
NA = not applicable
SMCL = secondary maximum contaminant level

Note: All concentrations are presented in µg/L.

Source: "A Compilation of Water Quality Goals," California RWQCB, Central Valley Region (RWQCB, 1995).

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TABLE 14

SUMMARY OF DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR OU 3 TPH/VOC SITES

Alternative	Applicable Sites	Protection of Human Health and the Environment	Compliance with ARARs	Effectiveness	Reduction of TMV	Implementability	Total Cost
6. No Action for Soil	WP-17, FT-19a, FT-19b, FT-19c, FT-20 (soil), OT-51, SS-59	Does not reduce potential for future exposure.	Does not comply.	Not effective.	No reduction of TMV	No technical limitations.	See Table 16
7. Removal/Disposal	FT-20 (soil), SS-59	Reduces potential for future exposure	Complies with ARARs.	Effective.	Significant reduction of TMV through removal, treatment, and disposal of contaminated soils	Easily implemented.	See Table 16.
8 Soil Vapor Extraction	FT-19c	Significantly reduces potential for future exposure	Complies with ARARs.	Effective	Significant reduction of TMV.	Easily implemented.	See Table 16
9. Bioventing	WP-17, FT-19b, OT-51	Significantly reduces potential for future exposure.	Complies with ARARs.	Effective	Significant reduction of TMV	Easily implemented.	See Table 16.
10 No Action for Groundwater	OT-51	Does not reduce potential for future exposure.	Does not comply.	Not effective.	No reduction of TMV.	No technical limitations.	See Table 16
11. Oxygen Enhanced Bioremediation	OT-51	Significantly reduces potential for future exposure.	Complies with ARARs.	Effective.	Significant reduction of TMV.	Easily implemented.	See Table 16

ARARs - applicable or relevant and appropriate requirements
TMV - toxicity, mobility, or volume

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TABLE 15

ARARs FOR GAFB OU 3 TPH/VOC
SITES WP-17, FT-19a, FT-19b, FT-19c, OT-51, AND OT-69
(Page 1 of 9)

Source	Standard, Requirement, Criterion, or Limitation[a]	ARAR Status[b]	Description
Porter-Cologne Water Quality Control Act (California Water Code)	California Water Code § 13176	Applicable	Requires data analysis to be performed in a State certified laboratory. Potentially applicable to cleanup alternatives involving sampling.
Porter-Cologne Water Quality Control Act (California Water Code)	California Water Code § 13750.5	Applicable	Requires well drillers to possess a C-57 license. Potentially applicable to cleanup alternatives involving installation of wells
Porter-Cologne Water Quality Control Act, California Water Code Sections 13000, 13140, 13240	State Water Resources Control Board Resolution 68-16 Statement of Policy with Respect to Maintaining High Quality of Waters of the State (Resolution 68-16) §§ 1 and 2	See Description	The resolution establishes requirements for activities involving discharges of contamination directly into surface waters or groundwater (e.g., quality of pump and treat effluent into surface waters or groundwater). The Air Force and the State of California have not agreed whether State Water Resources Control Board Resolution No 68-16 is an ARAR for the remedial action at any of the OU 3 sites Therefore, this FS does not identify the requirement as an ARAR for the remedial action. The State asserts that the requirement is an ARAR, and that it requires soil remediation where a discharge impacts or threatens to impact the beneficial uses of waters of the State. The State has decided not to invoke dispute resolution because the proposed action will address threatened impacts to waters of the State
Porter-Cologne Water Quality Control Act, California Water Code Sections 13140, 13240, 13304, 13307	State Water Resources Control Board Resolution 92-49 (as amended) Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304 (Resolution 92-49) § III G	See Description	The USAF and USEPA agree that Resolution No 92-49, Section III G is an ARAR for purposes of the OU 3 RI/FS with respect to groundwater remediation at all groundwater sites and the soil remediation at OT-51 and FT-19. The USAF contends, for purposes of this RI/FS, that Section III G is a "relevant and appropriate" requirement The State contends Section III G is an "applicable" requirement The cleanup standards set forth in Table 13 satisfy the requirements of SWRCB Resolution 92-49.

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TABLE 15

ARARs FOR GAFB OU 3 TPH/VOC
SITES WP-17, FT-19a, FT-19b, FT-19c, OT-51, AND OT-69
(Page 2 of 9)

Source	Standard, Requirement, Criterion, or Limitation[a]	ARAR Status[b]	Description
Porter-Cologne Water Quality Control Act, California Water Code Sections 13240, 13241, 13242, 13243, 13382	Water Quality Control Plan for the Lahontan Region (Basin Plan) effective March 31, 1995 Table 2-2, Beneficial Uses for Groundwater of the Lahontan Region, Department of Water Resources Basin No. 6-42, Upper Mojave River Valley, page 2-46	Applicable	The beneficial uses of ground waters beneath GAFB are defined as. a) Municipal; b) Agricultural; c) Industrial, d) Fresh Water Replenishment; and e) Aquaculture. Potentially applicable to alternatives addressing groundwater contamination at Sites OT-51 and OT-69
Porter-Cologne Water Quality Control Act, California Water Code Sections 13240, 13241, 13242, 13243, 13382	Basin Plan Water Quality Objectives for Groundwaters, page 3-2, 3-12, and 3-13	Applicable	The water quality objectives that apply to affected ground waters are for: Coliform Bacteria, Chemical Constituents, Radioactivity, and Taste and Odor. Compliance will consider other potential ARAR standards such as State and Federal MCLs, Potentially applicable to alternatives addressing groundwater contamination at Sites OT-51 and OT-69 The cleanup standards for this ROD are set forth in Table 13.
Federal Safe Drinking Water Act, 40 CFR Part 141, Subpart G or California Hazardous Waste Control Law, 22 CCR	40 CFR 141.61 or Table 64444-A - Maximum Contaminant Levels - Organic Chemicals	Relevant and Appropriate	Primary MCLs for organic constituents which are contaminants of concern at the Site State MCLs which are more stringent than the Federal MCLs, or not addressed by Federal MCLs, and therefore potentially ARARs are: benzene, toluene, and xylene Potentially relevant and appropriate to remedial alternatives addressing groundwater at Sites OT-51 and OT-69. The cleanup standards for this ROD are set forth in Table 13.

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TABLE 15

ARARs FOR GAFB OU 3 TPH/VOC
SITES WP-17, FT-19a, FT-19b, FT-19c, OT-51, AND OT-69
(Page 3 of 9)

Source	Standard, Requirement, Criterion, or Limitation[a]	ARAR Status[b]	Description
CSDWA	Table 64449-A - Secondary Maximum Contaminant Levels, Consumer Acceptance Limits Table 64449-B - Secondary Maximum Contaminant Levels - Ranges	Relevant and Appropriate	Defines secondary maximum contaminant levels (SMCLs). Potentially relevant and appropriate to remedial alternatives addressing groundwater at Sites OT-51 and OT-69. The following "agree to disagree" language has been established between the Air Force and the state for this ARAR. "The State asserts that the narrative taste and odor water quality objective specified in the Water Quality Control Plan for Lahontan Regional Water Quality Control Board, which incorporates state primary and secondary drinking water standards, is an ARAR that applies to the establishment of cleanup levels at this OU. The Air Force agrees that the narrative taste and odor water quality objective is an ARAR, but does not agree that the secondary odor standard of three odor units is an ARAR because the measurement is subjective based upon the sensory determination of a panel The Air Force agrees to implement the taste and odor objective for toluene, ethylbenzene, and xylenes by using the numeric taste and odor standards proposed by USEPA, but not promulgated, as to be considered standards that will be identified as performance standards in this ROD. The numeric values in Table 13 reflect this agreement. The Air Force also agrees to evaluate compliance with the three odor unit objective, based on appropriate standard protocols, e.g., EPA Method 140 or Standard Methods for the Examination of Water and Wastewater, in determining whether the remedial action is complete. The State reserves its right to dispute, according to the terms of the Federal Facility Agreement, whether the Air Force has achieved compliance with the taste and odor objective in the Water Quality Control Plan."

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TABLE 15

ARARs FOR GAFB OU 3 TPH/VOC
SITES WP-17, FT-19a, FT-19b, FT-19c, OT-51, AND OT-69
(Page 4 of 9)

Source	Standard, Requirement, Criterion, or Limitation[a]	ARAR Status[b]	Description
Basin Plan Water Quality Objectives for Groundwaters, page 3-2 and 3-12	Memorandum titled "Beneficial Use-Protective Water Quality Limits For Components of Petroleum-Based Fuels", dated 17 May 1995 (replaces memoranda dated 3/26/90, 1/14/91, 7/6/92, 5/13/93, and 1/18/95) Central Valley Regional Water Quality Control Board - Jon Marshack	To Be Considered	Provides beneficial use protective water quality limits for components of petroleum based fuels
Porter-Cologne Water Quality Control Act (Porter Cologne Act), California Water Code Sections 13140 - 13147, 13172, 13260, 13263, 13267, 13304 Discharges of Waste to Land, Title 23, Chapter 15, California Code of Regulations (Chapter 15)	§ 2511(d)	Applicable	Exempts actions taken by or at the direction of public agencies from Chapter 15 requirements provided wastes removed are discharged in accordance with Chapter 15, Article 2 and wastes contained implement Chapter 15 requirements to the extent feasible.
Porter-Cologne Act Chapter 15	§ 2550.1(a)(4)	Relevant and Appropriate	Requires monitoring performance of selected remedial alternative. Potentially relevant and appropriate to remedial alternatives addressing groundwater contamination (Sites OT-51 and OT-69).
Porter-Cologne Act Chapter 15	§ 2550 4	Relevant and Appropriate	Concentration Limits (CL) - Must be established for groundwater, surface water, and the unsaturated zone Must be based on background, equal to background, or for corrective actions, may be greater than background (CLGTB), not to exceed the lower of the MCL or the concentration technologically or economically achievable (Sites OT-51 and OT-69)
Porter-Cologne Act Chapter 15	§ 2550.10	Relevant and Appropriate	Specifies requirements for ground water remedial action to ensure that the water quality protection standard is achieved throughout the zone affected by the release including, but not limited to, source control measures and monitoring

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TABLE 15

ARARs FOR GAFB OU 3 TPH/VOC
SITES WP-17, FT-19a, FT-19b, FT-19c, OT-51, AND OT-69
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Source	Standard, Requirement, Criterion, or Limitation[a]	ARAR Status[b]	Description
California Health and Safety Code, Div. 26, Chapter 13	Mojave Desert Air Quality Management District (MDAQMD), Rule 401	Applicable	Prohibits discharge of air contaminants which obscure visibility by more than 20 percent for a period of more than three minutes in any one hour Potentially applicable to any remedial alternative which may cause a visible dust.
California Health and Safety Code, Div. 26, Chapter 13	MDAQMD Rule 402	Applicable	Prohibits discharge of air contaminants in quantities which may cause injury, detriment, nuisance, or annoyance to any considerable number of persons or which endangers the comfort, response, health, or safety of any such person or which causes or has natural tendency to cause injury or damage to business or property Potentially applicable to any remedial alternative which may discharge air contaminants.
California Health and Safety Code, Div. 26, Chapter 13	MDAQMD Rule 403	Applicable	Requires reasonable precautions to not cause or allow emissions of fugitive dusts from being air borne beyond the property line from which the emission originated Potentially applicable to any remedial alternative which may cause the release of fugitive dust
California Health and Safety Code, Div. 26, Chapter 13	MDAQMD Rule 1303	Applicable	Requires the installation of Best Available Control Technology (BACT) to a new emission unit or modification of existing emissions unit. applicable to any remedial activity which may cause the emissions of 25 pound per day or more of any Nonattainment Air Pollutant.
	California Leaking Underground Fuel Tank (LUFT) Field Manual (amended 1989)	To Be Considered	State guidance document for determining soil cleanup levels for petroleum constituents See also RWQCB memorandum dated March 8, 1994 regarding Liquid Fuel Distribution System removal project and petroleum soil cleanup levels considered protective
California Water Code § 13800 and 13801	California Well Standards for water wells, monitoring wells, and cathodic protection wells	To Be Considered	Provides minimum construction and destruction criteria for water wells, monitoring wells, and cathodic protection wells. Also includes criteria for borehole abandonment
California Well Standards Bulletin 74-90 and 74-81	San Bernardino County Ordinance	To Be Considered	Provides minimum construction and destruction criteria for water wells, monitoring wells, and cathodic protection wells. Also includes criteria for borehole abandonment.

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TABLE 15

ARARs FOR GAFB OU 3 TPH/VOC
SITES WP-17, FT-19a, FT-19b, FT-19c, OT-51, AND OT-69
(Page 6 of 9)

Source	Standard, Requirement, Criterion, or Limitation[a]	ARAR Status[b]	Description
	Drilling, Coring, Sampling and Logging at Hazardous Substances Release Sites	To Be Considered	Provides minimum construction and destruction criteria for water wells, monitoring wells, and cathodic protection wells. Also includes criteria for borehole abandonment.
	Monitoring Well Design and construction for Hydrogeological Characterization	To Be Considered	
	Representative Sampling of Ground Water for Hazardous Substances	To Be Considered	
	Ground Water Modeling for Hydrogeological Characterization	To Be Considered	
Federal Safe Drinking Water Act	40 CFR 144 - Underground Injection Control Program	Applicable	Establishes substantive requirements for actions that involve injection of fluids into subsurface through wells. The injection cannot cause a violation of primary MCLs, must be maintained, must be monitored, and injection cannot take place until the well construction is complete. Applies to cleanup of OT-51.
Federal Clean Water Act 40 CFR 122	USEPA Administered Permit Programs: National Discharge Elimination System 40 CFR 122-26	Applicable	Requirements ensure stormwater discharges from remedial action activities do not violate surface water quality standards. To comply with this requirement, the USAF must comply with the requirements contained in the State General Industrial Storm Water Permit (Order No. 91-13-DWQ, as amended by Order No 92-12-DWQ, NPDES CAS000001).

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TABLE 15

ARARs FOR GAFB OU 3 TPH/VOC
SITES WP-17, FT-19a, FT-19b, FT-19c, OT-51, AND OT-69
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Source	Standard, Requirement, Criterion, or Limitation[a]	ARAR Status[b]	Description
Federal Clean Water Act	40 CFR §122.41(d), 122.41 (e), and 122.44(d)	Applicable	Reasonable steps must be taken to minimize or prevent discharges which have a reasonable likelihood of causing adverse impacts on surface water quality (40 CFR 122 41(d)). All equipment and facilities must be properly operated and maintained, including adequate laboratory controls and appropriate quality assurance procedures (40 CFR 122 41(e)). Discharges into surface water must achieve federal and state water quality standards (40 CFR 122 44(d)) Would apply to groundwater treatment at OT-69 and OT-51 if treatment alternatives employed extraction.
40 CFR Part 264, Subpart B (General Facility Standards), as delegated to the State and implemented through Hazardous Waste Control Law (HWCL) Title 22 Social Security, (22 CCR) Division 4.5, (Environmental Health Standards for the Management of Hazardous Wastes), Chapter 11, Articles 1-5, Chapter 12 (Standards Applicable to Generators of Hazardous Waste) and Chapter 14 (Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities), Articles 2	40 CFR §264 13 22 CCR §66262.11 22 CCR §66262 13 40 CFR §264.14 22 CCR §66262.14 40 CFR §264 15 22 CCR §66262.15	Applicable	Requires generator to determine if waste is a listed hazardous waste (40 CFR §264.13, 22 CCR §66262.11 and 22 CCR §66262.13). Requires security to prevent unknowing entry or to minimize unauthorized entry (40 CFR §264 14 and 22 CCR §66262.14). Requires inspections of hazardous waste storage facilities to detect malfunctions and deterioration, operator errors, and discharges. Potentially applicable to cleanup alternatives at facilities which involve on-site treatment, storage, or disposal of hazardous waste (i.e., investigation derived waste [IDW]).

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TABLE 15

ARARs FOR GAFB OU 3 TPH/VOC
SITES WP-17, FT-19a, FT-19b, FT-19c, OT-51, AND OT-69
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Source	Standard, Requirement, Criterion, or Limitation[a]	ARAR Status[b]	Description
40 CFR Part 264, Subpart C (Preparedness and Prevention) as delegated to the State and implemented through HWCL 22 CCR, Division 4.5, Chapter 14, Article 3 (Preparedness and Prevention)	40 CFR §§ 264 31-34 22 CCR §§ 66264.31-34	Applicable or Relevant and Appropriate	Requires that hazardous waste TSD facilities be designed, constructed, operated and maintained to minimize the possibility of fire, explosion, or release of hazardous waste (40 CFR § 264.31 and 22 CCR §66264 31) Potentially applicable or relevant and appropriate to cleanup alternatives at facilities which involve on-site treatment, storage, or disposal of hazardous waste (i.e., IDW).
40 CFR Part 264, Subpart D (Contingency Plan and Emergency Procedures) as delegated to the State and implemented through HWCL 22 CCR, Division 4.5, Chapter 14, Article 4 (Contingency Plan and Emergency Procedures)	40 CFR §§ 264 51-264.53.(a) and 264.55 22 CCR §§66264.51-53(a) and 66264.55	Applicable or Relevant and Appropriate	Requires development and, if appropriate, implementation of a contingency plan to minimize hazards to human health or the environment from fire, explosion, or release of hazardous substances (40 CFR § 264.51 and 22 CCR §66264.51). Plan must contain certain items (40 CFR §264.52 and 22 CCR §66264.52). Plan and emergency coordinator must be on-site (40 CFR §§ 264 53.(a) and 264.55; 22 CCR §§66264.53(a) and 66264.55). Potentially applicable or relevant and appropriate to cleanup alternatives at facilities which involve on-site treatment, storage, or disposal of hazardous waste (i.e., IDW).
40 CFR Part 264, Subpart I (Use and Management of Containers) as delegated to the State and implemented through HWCL 22 CCR, Division 4.5, Article 9 (Use and Management of Containers	40 CFR §§ 264.171 - 264 178 22 CCR §§ 66264.171 - 66264.178	Applicable or Relevant and Appropriate	Requires that containers used for storage be in good condition (40 CFR § 264.171 and 22 CCR §66264.171). Requires that containers used for storage be compatible with the hazardous substance (40 CFR § 264.172 and 22 CCR §66264.172). Requires proper management of containers during storage and handling (40 CFR § 264 173) Requires inspections of containers used to store hazardous substances (40 CFR § 264.174 and 22 CCR §66264.174). Requires adequate secondary containment for stored hazardous waste, as specified (40 CFR § 264.175 and 22 CCR §66264 175). Requires isolating stored, ignitable waste (40 CFR § 264.177 and 22 CCR §66264.177). Requires removal of stored hazardous waste at closure of the TSD hazardous waste facility (40 CFR § 264.178 and 22 CCR §66264.178). Potentially applicable or relevant and appropriate to cleanup alternatives at treatment, storage, or disposal facilities which store hazardous waste on-site (e.g., IDW).

TABLE 15

ARARs FOR GAFB OU 3 TPH/VOC
SITES WP-17, FT-19a, FT-19b, FT-19c, OT-51, AND OT-69
(Page 9 of 9)

Source	Standard, Requirement, Criterion, or Limitation[a]	ARAR Status[b]	Description
40 CFR Part 268 (Land Disposal Restrictions), Subpart A (General), Subpart C (Prohibitions on Land Disposal) and Subpart D (Treatment Standards) as delegated to the State and implemented through HWCL, 22 CCR, Division 4 5, Chapter 18 Articles 1-5 (Land Disposal Restrictions)	40 CFR §§ 268 1, 268.30-260.38 and 268-40-268.48 22 CCR §§ 66268.1 66268.30-66268 38 and 66268.40-66268-46	Applicable or Relevant and Appropriate	Identifies hazardous wastes that are restricted from land disposal and defines limited circumstances under which prohibited waste may be land disposed (40 CFR §§ 268 1 and 22 CCR §§ 66268.1). Prohibits land disposal of specified hazardous wastes subject to limited circumstances (40 CFR §§ 268.30-268.38 and 22 CCR §§66268.30-66268.38) Allows land disposal for certain hazardous wastes treated to specified standards (40 CFR §§ 268.40-268.46 and 22 CCR §§ 66268.40-66268-46). Potentially applicable or relevant and appropriate to cleanup alternatives for treatment, storage, or disposal facilities which require excavation and on-site disposal. ARAR status requires further identification of contaminants of concern.

a Sections of Title 14 CCR and Title 23 CCR have been recodified into Title 27 CCR. See Title 27 CCR for the new equivalent section numbers that apply
b The State does not agree on the characterization of certain ARARs in this table to be "Relevant and Appropriate" instead of "Applicable." Provided these requirements are included in the ROD as ARARs, the State will not dispute the ROD over the terms "Relevant and Appropriate" instead of "Applicable."

ARAR - applicable or relevant and appropriate requirements
BACT - Best Available Control Technology
CCR - California Code of Regulations
CFR - Code of Federal Regulations
CSDWA - California State Drinking Water Act
FS - feasibility study
GAFB - George Air Force Base
HWCL - Hazardous Waste Control Law
IDW - investigation derived waste
LUFT - Leaking Underground Fuel Tank
MCL - Maximum Contaminant Level
MDAQMD - Mojave Desert Air Quality Management District
NPDES - National Pollutant Discharge Elimination System
OU - operable unit
RI - remedial investigation
ROD - Record of Decision
RWQCB - Regional Water Quality Control Board
SDWA - Safe Drinking Water Act
SMCL - Secondary Maximum Contaminant Level
TPH - total petroleum hydrocarbon
TSD - treatment/storage/disposal
USAF - U.S Air Force
USEPA - U.S. Environmental Protection Agency
VOC - volatile organic compound

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SUMMARY OF REMEDIAL ALTERNATIVE COSTS FOR OU 3 TPH/VOC SITES

Site	Cost Criteria	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
WP-17	Construction Cost	$8,800	NA	NA	$46,400	NA	NA
	Direct Capital Cost	$12,900	NA	NA	$73,100	NA	NA
	Total Capital Requirement	$14,800	NA	NA	$107,000	NA	NA
	30-Year Present-Worth Cost	$110,000	NA	NA	$270,000	NA	NA
FT-19a	Construction Cost	$0	NA	NA	$228,480	NA	NA
	Direct Capital Cost	$0	NA	NA	$369,900	NA	NA
	Total Capital Requirement	$0	NA	NA	$501,000	NA	NA
	30-Year Present-Worth Cost	$170,000	NA	NA	$780,000	NA	NA
FT-19b	Construction Cost	$0	NA	NA	$40,600	NA	NA
	Direct Capital Cost	$0	NA	NA	$64,600	NA	NA
	Total Capital Requirement	$0	NA	NA	$95,000	NA	NA
	30-Year Present-Worth Cost	$170,000	NA	NA	$250,000	NA	NA
FT-19c	Construction Cost	$0	NA	$199,500	NA	NA	NA
	Direct Capital Cost	$0	NA	$326,900	NA	NA	NA
	Total Capital Requirement	$0	NA	$444,000	NA	NA	NA
	30-Year Present-Worth Cost	$170,000	NA	$680,000	NA	NA	NA
FT-20 (soil)	Construction Cost	$0	$27,600	NA	NA	NA	NA
	Direct Capital Cost	$0	$40,300	NA	NA	NA	NA
	Total Capital Requirement	$0	$52,800	NA	NA	NA	NA
	30-Year Present-Worth Cost	$170,000	$52,800	NA	NA	NA	NA
OT-51 (soil)	Construction Cost	$16,600	NA	NA	$182,900	NA	NA
	Direct Capital Cost	$24,200	NA	NA	$280,700	NA	NA
	Total Capital Requirement	$27,000	NA	NA	$383,000	NA	NA
	30-Year Present-Worth Cost	$280,000	NA	NA	$660,000	NA	NA
OT-51 (groundwater)	Construction Cost	NA	NA	NA	NA	$0	$3,500
	Direct Capital Cost	NA	NA	NA	NA	$0	$6,500
	Total Capital Requirement	NA	NA	NA	NA	$0	$62,000
	30-Year Present-Worth Cost	NA	NA	NA	NA	$250,000	$280,000
SS-59	Construction Cost	$8,800	$28,200	NA	NA	NA	NA
	Direct Capital Cost	$12,900	$41,200	NA	NA	NA	NA
	Total Capital Requirement	$14,800	$54,000	NA	NA	NA	NA
	30-Year Present-Worth Cost	$110,000	$54,000	NA	NA	NA	NA

NA - not applicable

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TABLE 17

PRELIMINARY COST ESTIMATE FOR SITE WP-17 PREFERRED ALTERNATIVE
(Page 1 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COSTS (DCC)				
Equipment Costs (EC)				
Aboveground collection Piping (2-inch PVC)	30	linear foot	$30	$900
Bioventing Blower (1.5 horsepower)	1	each	$4,000	$4,000
Valve/gauge	3	each	$150	$450
			Subtotal EC	$5,350
Construction Costs (CC)				
Surface Repair/Preparation	1	lump sum	$3,000	$3,000
Extend Power from Bldg 551 or 552	1	lump sum	$2,500	$2,500
Fence	40	feet	$20	$800
Visqueen	4,800	square feet	$2	$9,600
Pea Gravel	20	cubic yards	$90	$1,800
Vents and Monitoring Point Borings	1	lump sum	$15,864	$15,864
Equipment Pad	1	lump sum	$2,500	$2,500
Analytical	1	lump sum		$1,243
Mechanical		40% of EC		$2,140
Instrumentation		10% of EC		$535
Electrical		20% of EC		$1,070
			Subtotal CC	$46,402
Supervision, Health & Safety		8% of CC		$3,712
Bid Contingency		10% of CC		$4,640
Scope Contingency		8% of CC		$3,712
Contractors Overhead and Profit		20% of CC		$9,280
			Subtotal Direct Capital Costs (DCC)	$73,096
INDIRECT CAPITAL COSTS				
Treatability Study		lump sum		$9,455
Engineering Design Services		6% of DCC		$4,386
Construction Management		10% of DCC		$7,310
Administration Costs (GAFB/AFCEE)		15% of DCC		$10,964
Final O&M Manuals		2% of DCC		$1,462
			TOTAL CAPITAL REQUIREMENT	$107,000
PERIODIC OPERATING AND MAINTENANCE COSTS				
Bioventing (Years 1 - 3)				
Energy	10,000	kW-hr	$0.10	$1,000
Labor	250	hours	$60	$15,000
Maintenance Materials		5% of EC		$268

TABLE 17

PRELIMINARY COST ESTIMATE FOR SITE WP-17 PREFERRED ALTERNATIVE
(Page 2 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Quarterly Groundwater sampling (1 well)	4	sample	$3,000	$12,000
			Subtotal	$28,268
Demobilization (Year 3)				
System Demolition	1	lump sum	$20,000	$20,000
Vent/Well Abandonment	7	each	$3,000	$21,000
Site Closure Analyses	1	lump sum	$45,000	$45,000
			Subtotal	$86,000
Confirmation Sampling (Year 5)				
Boring Installation (1 boring)	1	lump sum	$4,892	$4,892
Analytical	1	lump sum	$1,388	$1,388
			Subtotal	$6,280
5-Year Site Review	1	lump sum	$5,000	$5,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	5	
			TOTAL PRESENT WORTH	$270,000

Assumptions:

1 After 3 year estimated cleanup time, there will be closure on the site and no continued monitoring.

2 One injection vent and 6 monitoring points will be installed as part of bioventing system.

3 One confirmation boring will be installed to a depth of 80 feet at the hot spot at the end of year 3. Five samples will be collected from the boring.

TABLE 18

PRELIMINARY COST ESTIMATE FOR SITE FT-19a PREFERRED ALTERNATIVE
(Page 1 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COSTS (DCC)				
Equipment Costs (EC)				
Aboveground collection Piping (2-inch PVC)	700	linear foot	$30	$21,000
Bioventing Blower (5 horsepower)	1	each	$11,000	$11,000
Valve/gauge	29	each	$150	$4,350
			Subtotal EC	$36,350
Construction Costs (CC)				
Surface Repair/Preparation	1	lump sum	$3,000	$3,000
Extend power from OU 1 Treatment System	1	lump sum	$75,000	$75,000
Fence	40	feet	$20	$800
Visqueen	19,600	square feet	$2	$39,200
Pea Gravel	90	cubic yards	$90	$8,100
Vents and Monitoring Point Borings	1	lump sum	$36,086	$36,086
Equipment Pad	1	lump sum	$2,500	$2,500
Analytical	1	lump sum		$1,999
Mechanical		40% of EC		$14,540
Instrumentation		10% of EC		$3,635
Electrical		20% of EC		$7,270
			Subtotal CC	$228,480
Supervision, Health & Safety		8% of CC		$18,278
Bid Contingency		10% of CC		$22,848
Scope Contingency		8% of CC		$18,278
Contractors Overhead and Profit		20% of CC		$45,696
			Subtotal Direct Capital Costs (DCC)	$369,931
INDIRECT CAPITAL COSTS				
Treatability Study		lump sum		$9,455
Engineering Design Services		6% of DCC		$22,196
Construction Management		10% of DCC		$36,993
Administration Costs (GAFB/AFCEE)		15% of DCC		$55,490
Final O&M Manuals		2% of DCC		$7,399
			TOTAL CAPITAL REQUIREMENT	$501,000
PERIODIC OPERATING AND MAINTENANCE COSTS				
Bioventing (Years 1 - 5)				
Energy	33,300	kW-hr	$0.10	$3,330
Labor	250	hours	$60	$15,000

TABLE 18

PRELIMINARY COST ESTIMATE FOR SITE FT-19a PREFERRED ALTERNATIVE
(Page 2 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Maintenance Materials		5% of EC		$1,818
Quarterly Groundwater Sampling (2 wells)	8	sample	$3,000	$24,000
			Subtotal	$44,148
Demobilization (Year 5)				
System Demolition	1	lump sum	$20,000	$20,000
Vent/Well Abandonment	14	each	$3,000	$42,000
Site Closure Analyses	1	lump sum	$45,000	$45,000
			Subtotal	$107,000
Confirmation Sampling (Year 5)				
Boring Installation (4 borings)	1	lump sum	$12,858	$12,858
Analytical	1	lump sum	$4,484	$4,484
			Subtotal	$17,341
5-Year Site Review		lump sum	$5,000	$5,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	5	
			TOTAL PRESENT WORTH	$780,000

Assumptions:

1 After 5 year estimated cleanup time, there will be closure on the site and no continued monitoring

2 Six injection vents and 9 monitoring points will be installed as part of bioventing system.

3 Three confirmation borings (one at each hot spot) will be installed each to a depth of 115 feet at the end of year 5. Five samples will be collected from each boring

TABLE 19

PRELIMINARY COST ESTIMATE FOR SITE FT-19c PREFERRED ALTERNATIVE
(Page 1 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COSTS (DCC)				
Equipment Costs (EC)				
Aboveground Collection Piping (2-inch PVC)	400	linear foot	$30	$12,000
SVE Blower (10 horsepower)	1	each	$20,000	$20,000
Valve/gauge	24	each	$150	$3,600
			Subtotal EC	$35,600
Construction Costs (CC)				
Surface Repair/Preparation	1	lump sum	$3,000	$3,000
Extend power from FT-19a treatment unit	1	lump sum	$10,000	$10,000
Fence	40	feet	$20	$800
Visqueen	20,000	square feet	$2	$40,000
Pea gravel	380	cubic yards	$90	$34,200
Vents and Monitoring Point Borings	1	lump sum	$45,945	$45,945
Equipment Pad	1	lump sum	$2,500	$2,500
Analytical	1	lump sum		$2,524
Mechanical		40% of EC		$14,240
Instrumentation		10% of EC		$3,560
Electrical		20% of EC		$7,120
			Subtotal CC	$199,489
Supervision, Health & Safety		8% of CC		$15,959
Bid Contingency		10% of CC		$19,949
Scope Contingency		8% of CC		$15,959
Contractors Overhead and Profit		20% of CC		$39,898
			Subtotal Direct Capital Costs (DCC)	$326,854
INDIRECT CAPITAL COSTS				
Treatability Study		lump sum		$9,455
Engineering Design Services		6% of DCC		$19,611
Construction Management		10% of DCC		$32,685
Administration Costs (GAFB/AFCEE)		15% of DCC		$49,028
Final O&M Manuals		2% of DCC		$6,537
			TOTAL CAPITAL REQUIREMENT	$444,000
PERIODIC OPERATING AND MAINTENANCE COSTS				
SVE (Years 1 - 5)				
Energy	67,000	kW-hr	$0 10	$6,700
Labor	250	hours	$60	$15,000
Maintenance Materials		5% of EC		$1,780

TABLE 19

PRELIMINARY COST ESTIMATE FOR SITE FT-19c PREFERRED ALTERNATIVE
(Page 2 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Quarterly Groundwater Sampling (2 wells)	8	sample	$3,000	$3,000
			Subtotal	$26,480
Demobilization (Year 5)				
System Demolition	1	lump sum	$20,000	$20,000
Vent/Well Abandonment	19	each	3,000	$57,000
Site Closure Analyses	1	lump sum	$45,000	$45,000
			Subtotal	$122,000
Confirmation Sampling (Year 5)				
Boring Installation (4 borings)	1	lump sum	$16,142	$16,142
Analytical	1	lump sum	$9,368	$9,368
			Subtotal	$25,510
5-Year Site Review	1	lump sum		$5,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	5	
		TOTAL PRESENT WORTH		$680,000

Assumptions:

1 After 5 year estimated cleanup time, there will be closure on the site and no continued monitoring.
2 Seven injection vents and 12 monitoring points will be installed as part of SVE system
3 Four confirmation borings (one at each hot spot) will be installed each to a depth of 115 feet at the end of year 5 Five samples will be collected from each boring

TABLE 20

PRELIMINARY COST ESTIMATE FOR SITE OT-51 SOILS PREFERRED ALTERNATIVE
(Page 1 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COSTS (DCC)				
Equipment Costs (EC)				
Aboveground collection Piping (2-inch PVC)	30	linear foot	$30	$900
Bioventing Blower (5 horsepower)	1	each	$11,000	$11,000
Valve/gauge	12	each	$150	$1,800
			Subtotal EC	$13,700
Construction Costs (CC)				
Downgradient Monitoring Well Installation	2	lump sum	$16,605	$16,605
Surface Repair/Preparation	1	lump sum	$3,000	$3,000
Extend power from OU 1 Treatment System	1	lump sum	$75,000	$75,000
Fence	40	feet	$20	$800
Visqueen	4,800	square feet	$2	$9,600
Pea Gravel	20	cubic yards	$90	$1,800
Vents and Monitoring Point Borings	1	lump sum	$45,113	$45,113
Equipment Pad	1	lump sum	$2,500	$2,500
Analytical	1	lump sum		$5,151
Mechanical		40% of EC		$5,480
Instrumentation		10% of EC		$1,370
Electrical		20% of EC		$2,740
			Subtotal CC	$182,859
Supervision, Health & Safety		8% of CC		$14,629
Bid Contingency		10% of CC		$18,286
Scope Contingency		8% of CC		$14,629
Contractors Overhead and Profit		20% of CC		$36,572
			Subtotal Direct Capital Costs (DCC)	$280,674
INDIRECT CAPITAL COSTS				
Treatability Study		lump sum		$9,455
Engineering Design Services		6% of DCC		$16,840
Construction Management		10% of DCC		$28,067
Administration Costs (GAFB/AFCEE)		15% of DCC		$42,101
Final O&M Manuals		2% of DCC		$5,613
			TOTAL CAPITAL REQUIREMENT	$383,000
PERIODIC OPERATING AND MAINTENANCE COSTS				
Bioventing (Years 1 - 5)				
Energy	16,700	kW-hr	$0.10	$1,670
Labor	250	hours	$60	$15,000
Maintenance Materials		5% of EC		$685

TABLE 20

PRELIMINARY COST ESTIMATE FOR SITE OT-51 SOILS PREFERRED ALTERNATIVE
(Page 2 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Quarterly Groundwater Sampling (2 wells)	8	sample	$3,000	$24,000
			Subtotal	$41,355
Demobilization (Year 5)				
System Demolition	1	lump sum	$20,000	$20,000
Vent/Well Abandonment	10	each	$3,000	$30,000
Site Closure Analyses	1	lump sum	$45,000	$45,000
			Subtotal	$95,000
Confirmation Sampling (Year 5)				
Boring Installation (4 borings)	1	lump sum	$16,652	$16,652
Analytical	1	lump sum	$5,305	$5,305
			Subtotal	$21,957
5-Year Site Review		lump sum		$5,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	5	
		TOTAL PRESENT WORTH		$660,000

Assumptions:

1 After 5 year estimated cleanup time, there will be closure on the site and no continued monitoring.

2 Four injection vents and 6 monitoring points will be installed as part of bioventing system

3 Four confirmation borings will be installed each to a depth of 120 feet at the end of year 5. Five samples will be collected from each boring.

4 Installation of two 135-foot downgradient monitoring wells would be required to satisfy long-term monitoring requirements

TABLE 21

1294199

PRELIMINARY COST ESTIMATE FOR SITE OT-51 GROUNDWATER PREFERRED ALTERNATIVE
(Page 1 of 2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COSTS (DCC)				
Initial Equipment Costs (IEC)				
ORC Filter Sock Canister	30	feet	$11	$330
			Subtotal IEC	$330
Periodic Equipment Costs (PEC)				
ORC filter socks (3 wells, 10 feet each)	30	feet	$32.50	$975
Shipping for ORC filter socks	138	lbs	$0.27	$37
			Subtotal PEC	$1,012
Construction Costs (CC)				
Installation of ORC	1	lump sum	$2,500	$2,500
Mobilization	1	lump sum	$500	$500
Demobilization	1	lump sum	$500	$500
			Subtotal CC	$3,500
Supervision, Health & Safety		8% of CC		$280
Bid Contingency		10% of CC		$350
Scope Contingency		8% of CC		$280
Contractors Overhead and Profit		20% of CC		$700
	Subtotal Direct Capital Costs (DCC)			$6,452
INDIRECT CAPITAL COSTS				
Land Use Restrictions	1	lump sum	$50,000	$50,000
Administration Costs (GAFB/AFCEE)	1	lump sum	$5,000	$5,000
Engineering Design Services		6% of DCC		$387
Final O&M Manuals		2% of DCC		$129
	TOTAL CAPITAL REQUIREMENT			$62,000
PERIODIC OPERATING AND MAINTENANCE COSTS				
Annual Groundwater Monitoring (4 wells)	4	sample	$3,000	$12,000
Semi-Annual Groundwater Monitoring (4 wells)	4	sample	$3,000	$12,000
Quarterly Groundwater Monitoring (2 wells)	4	sample	$3,000	$12,000
Semi-Annual ORC sock replacement (years 1-3)	2	each	$6,122	$12,245
5-Year Site Review	1	lump sum	$5,000	$5,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	5	
	TOTAL PRESENT WORTH			$280,000

TABLE 21

PRELIMINARY COST ESTIMATE FOR SITE OT-51 GROUNDWATER PREFERRED ALTERNATIVE
(Page 2 of 2)

Assumptions:

1 Oxygenation of upper portion of aquifer would be accomplished with system to be installed to remediate soils and the use of oxygen release compound (ORC) in the top 10' of groundwater in the 3 existing monitoring wells.
2 Installation of ORC will require a 2 person crew for 2 days
3 Source removal will be achieved through the use of a bioventing system.
4 ORC socks will be replaced every 6 months for 3 years starting at the end of the first 6 months.
5 Filter sock canister is reusable. They prevent socks from getting stuck in wells once spent.
6 Spent ORC socks can be disposed of in a sanitary landfill.
7 Groundwater cleanup will be achieved in 3 years. Groundwater monitoring will continue through year 5

TABLE 22

SUMMARY OF DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SITE OT-69

	Alternative	Protection of Human Health and the Environment	Compliance with ARARs	Effectiveness	Reduction of TMV	Implementability	Total Cost *
G-1	No Action	Does not reduce existing potential for future exposure.	Complies with ARARs.	Effective.	Reduces concentrations to acceptable levels through natural attenuation.	Very easy.	$0
G-2	Natural Attenuation/Institutional Controls	Reduces potential for future exposure	Complies with ARARs.	Effective.	Reduces concentrations to acceptable levels through natural attenuation	Very easy	$668,000
G-3	In Situ Air Sparging, SVE Recovery/Abatement in Vadose Zone, Groundwater Monitoring.	Significantly reduces potential for future exposure.	Complies with ARARs.	Effective	Significantly reduces TMV	Technically implementable	$14,876,000
G-4	Groundwater Extraction, Surface Groundwater Treatment with UV-Oxidation, Reinjection of Treated Groundwater.	Significantly reduces potential for future exposure.	Complies with ARARs.	Effective	Significantly reduces TMV.	Technically implementable.	$23,917,000
G-5	Groundwater Extraction, Surface Groundwater Treatment with GAC, Reinjection of Treated Groundwater.	Significantly reduces potential for future exposure.	Complies with ARARs	Effective	Significantly reduces TMV	Technically implementable	$11,005,000
G-6	Groundwater Extraction, Surface Groundwater Treatment with Thermally Abated Air Stripping, Reinjection of Treated Groundwater	Significantly reduces potential for future exposure.	Complies with ARARs.	Effective	Significantly reduces TMV.	Technically implementable.	$10,757,000

* Present worth with 7% discount rate.

ARAR - applicable or relevant and appropriate
TMV - toxicity, mobility, or volume

1294201

TABLE 23

SUMMARY OF REMEDIAL ALTERNATIVE COSTS FOR SITE OT-69 GROUNDWATER

Site	Cost Criteria	Alternative G-1	Alternative G-2	Alternative G-3	Alternative G-4	Alternative G-5	Alternative G-6
OT-69	Capital Cost	$0	$122,000	$13,090,000	$12,693,000	$5,211,000	$3,705,000
	O&M Cost	$0	$40,000	$1,911,000	$1,598,000	$825,000	$1,004,000
	30-Year Present Worth Cost	$0	$668,000	$14,876,000	$23,917,000	$11,005,000	$10,757,000

Source: (IT, 1995a)

1294202

TABLE 24

PRELIMINARY COST ESTIMATE FOR SITE OT-69 PREFERRED ALTERNATIVE (G-2)

Item/Description	Quantity	Unit	Unit Cost ($)	Total Cost ($)
DIRECT CAPITAL COST (DCC)				
Natural Attenuation Work Plan	1	lump sum	$56,000	$56,000
Install 10 Dedicated Sampling Pumps	1	lump sum	$31,000	$31,000
Allowance for Unidentified Equipment	1	lump sum	$9,000	$9,000
Allowance for Offloading and Setting Equipment	1	lump sum	$2,000	$2,000
Freight Allowance			$4,000	$4,000
			Subtotal Construction Cost (CC)	$102,000
Contingency		20% of CC		$20,000
			Subtotal Direct Capital Cost (DCC)	$122,000
			TOTAL CAPITAL REQUIREMENT	$122,000
PERIODIC OPERATING AND MAINTENANCE COST				
Annual Groundwater Monitoring (10 wells, 4 quarters)	40	wells		$39,000
Annual Maintenance Cost	1	lump sum	$1,000	$1,000
PRESENT WORTH				
		Discount Rate	7%	
		Years	46	
			30-YEAR PRESENT WORTH COST	$668,000

Assumptions:

Estimated duration of remediation is 46 years

Source IT, 1995a

TABLE 25

SUMMARY OF CURRENT REMEDIAL ALTERNATIVE COSTS FOR OU 3 SITES WITH ACCELERATED ACTIONS PERFORMED

Site	Selected Alternative	FS Estimated Present Worth Cost [a, b]	Actual Construction Cost to Date [c]	Current Estimated Annual O&M Cost [c]	Current Estimated Present Worth Cost [a, d]
Landfill Sites					
DP-03	4	$1,200,000	$340,000	$4,000	$1,100,000
DP-04	4	$1,100,000	$340,000	$4,000	$900,000
LF-12	3	$1,600,000	$1,093,000	$16,000	$2,200,000
LF-14	3	$3,800,000	$1,639,000	$24,000	$3,100,000
LF-44	2	$510,000	$51,000	$500	$390,000
SEDA	3	$7,800,000	$3,795,000	$53,000	$6,600,000
TPH/VOC Sites					
WP-17	9	$270,000	$72,000	$4,000	$210,000
FT-19a	9	$780,000	$191,000	$6,000	$450,000
FT-19c	8	$680,000	$224,000	$11,000	$520,000
OT-51 (Soil)	9	$660,000	$96,000	$6,000	$380,000

a) Includes long-term groundwater monitoring for an assumed period of time.

b) FS present worth costs are initial estimates as presented in the OU 3 FS Report (Montgomery Watson, 1997a) developed prior to implementation of accelerated actions.

c) Based on actual construction costs for accelerated actions performed to date.

d) Current estimated present worth is modified from FS present worth by including actual construction costs and current estimated O&M costs.

1294204

1294205

TAB

Appendix A

APPENDIX A

ACTION ITEMS TO MEET ROD REQUIREMENTS

APPENDIX A

ACTION ITEMS TO MEET ROD REQUIREMENTS

Table 1 of this document lists the Operable Unit (OU) 3 Installation Restoration Program (IRP) sites and presents the selected remedy for each site. As described in Section 2.9, accelerated actions have been initiated at some of the OU 3 Sites presented in this OU 3 Record of Decision (ROD). The following is a summary of the action items identified in this document to be performed to satisfy the requirements of this ROD for the OU 3 IRP sites:

- Develop OU 3 Landfill Post-Closure Maintenance and Monitoring Plan.
- Develop Water Quality Protection Standards (WQPS) for OU 3 Landfill sites. The WQPS will be developed within 6 months of the signing of this ROD and will be based on the available groundwater data to establish baseline values for which future sampling results will be compared.
- Develop detailed language describing access and land use descriptions.
- Prepare periodic Site WP-17 Bioventing operations and maintenance (O&M) Reports.
- Prepare Site WP-17 Closeout Report.
- Prepare periodic Site FT-19a Bioventing O&M Reports.
- Prepare Site FT-19a Closeout Report.
- Prepare periodic Site FT-19c SVE O&M Reports.
- Prepare Site FT-19c Closeout Report.
- Complete closure of large diameter casing well near Site OT-51.
- Prepare periodic Site OT-51 Bioventing O&M Reports.
- Prepare Site OT-51 Closeout Report.
- Prepare Site OT-69 Closeout Report.

1294208

TAB

Appendix B

APPENDIX B

CRITERIA FOR ACTIVE SITE REMEDIATION - SITE OT-69

1294210

INTERNATIONAL TECHNOLOGY CORPORATION

Memorandum

To. D. Caron, GAFB

Date: November 6, 1995

From: K. Brown, IT KB

IT Project No. 409887

Subject **CRITERIA FOR ACTIVE SITE REMEDIATION - SITE OT-69**

The following text addresses concerns stated by the California Regional Water Quality Control Board (RWQCB) in their October 16, 1995 correspondence.

Model Projections

Specific trichloroethene (TCE) concentration projections, over time, for monitoring wells located in the MW-49 and Operable Unit 2 (OU2) areas have been developed. Figure 3-1 of the TCE/PCE Remedial Investigation/Feasibility Study is attached and presents the impacted area locations. Tables 1 and 2 illustrate the decreasing concentration of TCE which is expected during natural attenuation. Predicted concentrations are stated as a range, showing 15 percent variation about the mean. This 15 percent range is used to account for non-analytical variances which may occur during sampling. Analytical method variances will also be considered (see **Criteria for Evaluating Data**).

Non-analytical variances are attributable to normal variations recognized with changes in sampling personnel, procedures, and equipment. These variances should be accounted for, especially during the sampling of a volatile.

A two-dimensional numerical model, Solute, was used to model the fate and transport of TCE. For a detailed discussion refer to Section 4.0 of the TCE/PCE RI/FS. Conservative estimates of modeling parameters such as hydraulic conductivity, dispersitivity, density, and porosity were used during modeling. As a result, no variability was built into the model that would account for analytical and non-analytical variances. All model data was generated using 1995 sampling results.

Ground Water Monitoring

Five monitoring wells located in the MW-49 area will be monitored three times per year from September 1995 through July 1996. These monitoring wells include MW-43, MW-41, MW-15, MW-49 and MW-60, and were selected for monitoring by the George Air Force Base (GAFB) remedial project managers (RPM). All wells will be sampled using a combination of slow purge and bailing techniques and analyzed for TCE via U.S. Environmental Protection Agency (EPA) Method 8010. The first round of groundwater sampling was completed on September 29, 1995. Additional rounds have been contracted and are scheduled for February and July 1996.

Following July 1996, these wells will be monitored yearly by Method 8010. During the evaluation of groundwater data the appropriateness of well selection will be evaluated.

TCE/PCE-impacted wells within OU2 include MW-28, MW-30, MW-46, MW-23, and MW-14. MW-23 and MW-14 were identified as no further action sites due to low concentrations; the remaining OU2 well locations will be monitored for TCE/PCE quarterly during the JP4 Natural Attenuation Treatability Study.

MW-23, included in 1995 sampling rounds, provides an illustration of the natural attenuation of chlorinated solvents in the presence of aromatic cometabolites (i.e., toluene). Specifically, the MW-23 7 micrograms per liter (μg/L) 1992 TCE concentration has been reduced to 2.8 μg/L (1995) with corresponding detection of biological byproducts (dichloroethane [DCA]).

The remaining OU2 wells (MW-28, MW-30, and MW-46) were not sampled directly in 1995, however, wells downgradient of these primary wells were sampled and analyzed by EPA Method 8010. In association with MW-28, downgradient wells MW-47, MW-33, and MW-31 were sampled twice in 1995 and will be monitored quarterly during 1996. TCE concentrations in MW-47, MW-33, and MW-31 were 1.1, 0.98, and 2.7 μg/L, respectively. Each well also had DCA, a degradation byproduct.

MW-36 and MW-64, downgradient of MW-30 and MW-46, were sampled in 1995 and contained approximately 3.1 and 1.4 μg/L TCE, respectively. DCA was detected in MW-64.

Overall, there is evidence supporting the cometabolic removal of TCE during OU2 plume natural attenuation. Sampling and analysis of selected OU2 wells will occur quarterly during 1996 and yearly thereafter.

Criteria for Evaluating Data

All data will be evaluated following the completion of each sampling event. Once data has been accepted as valid through review of the data quality objectives, results will be compared with the previous sampling results and predicted concentrations to screen for significant deviations. If there is a significant deviation in contaminant concentration, the well(s) will be resampled in a timely manner.

As noted in **Model Predictions**, predicted concentrations are stated as concentration ranges (15 percent around the predicted concentration). If the sampling data indicates that the TCE concentration is above the predicted range, the analytical variability of the sampling method must be determined. If the measured concentration is 2 analytical standard deviations above the predicted concentration range, verification measures will be initiated. Two standard deviations are necessary to assure that the contaminant concentrations are truly above the anticipated range given the extremely low contaminant concentrations that are being considered.

For example, if TCE concentrations at MW-41 are predicted to range from 1.50 to 2.02 μg/L during the second year of groundwater sampling, however, the actual concentration is measured at 2.5 μg/L, the following steps will be taken.

1. Determine the variability of the analytical method employed at the time of analysis.
2. Consider the analytical standard deviation and calculate the possible contaminant concentration range.
3. Determine if the calculated range in concentration is 2 standard deviations above the predicted concentration range.
4. If the concentration is 2 standard deviations above the predicted concentration range, initiate verification measures.
5. If the concentration is less than 2 standard deviations above the predicted concentration range, maintain routine sampling schedule.

If at the end of this process it is determined that the analytical standard deviation is 0.3 μg/L for the above example, then the possible contaminant range is calculated to range up to 2.62 μg/L. The measured concentration at MW-41 falls within this concentration range, therefore, the results indicate that the routine sampling schedule should be maintained.

Throughout data evaluation, the Air Force will maintain open lines of communication with all FFA signatories, including the Water Board.

Verification Measures

If it is decided through evaluation with the Water Board that significant concentration increases are documented per the criteria presented above in any of the wells sampled during a single event, the well will be resampled in a timely manner. Additionally, the predictive model will be rerun (baseline will not be changed - the model only calibrated) and selected monitoring wells reevaluated to determine their appropriateness in light of potential plume movement. All data and modeling results will be submitted to the GAFB RPM members for discussion prior to revising any sampling protocol.

Once the verification measurements are completed, the Air Force and regulatory agencies will meet again to review all data generated and decide on the requirement for an active remediation or further monitoring and recalibration of the predictive model. If no treatment or increased monitoring is required then aquifer monitoring will revert back to yearly.

Triggers for Active Remediation

During increased monitoring, if any of the wells tested indicate increased contaminant concentrations (per the method developed in Criteria for Evaluating Data), the Air Force will:

1. Implementation of the active remedy, or

2. Acceptance of a proposal to continue monitoring at an increased frequency, rerun the model, and/or re-evaluate the monitoring wells used.

Contingent Remedy
In the event that an active remediation system is required, in situ air stripping/soil vapor extraction (SVE) recovery will be implemented. The selection of this alternative is valid for at least 10 years based on the information available during the development of the RI/FS. No additional feasibility studies are anticipated prior to implementation. Revised cost estimates should be prepared for the year in which the contingent remedy would be implemented.

The implementation of in situ air stripping with SVE recovery at the MW-49 area would not negatively impact any vadose zone remediation since none is required. (No contaminant source areas were identified in the vadose zone.) It should also be noted that this contingent remedy applies only to the MW-49 area and may not be recommended for remediation of the OU2 area.

As future advances in engineering practice may occur, a reevaluation of remedial alternatives is recommended prior to implementation or selection of an active remedial system beyond the next decade. The requirement for additional feasibility studies should be determined during the reevaluation process.

Active remediation of OU2 will not adversely impact the natural attenuation of the MW-49 plume. The OU2 plume is downgradient of MW-49 and will encompass this TCE plume.

It should also be noted that the Air Force will maintain deed restriction/institutional controls on the property. In addition, the Air Force will pursue through the County of San Bernardino the identification of all Base wells within impacted areas as well exclusion zones as a secondary backup to deed restrictions. In the event that deed restrictions fail and a well is drilled into the plume, the Air Force will initiate well head treatment to remove any contaminant prior to water usage.

The Air Force also suggests that the protocol presented in this document be reviewed every five years along with the ROD by all regulatory parties of the FFA to provide an additional layer of surveillance to the process.

Financial Assurances
The U.S. Air Force will make a timely request for funds by identifying to the Department of the Air Force the funding needed to complete the ROD activities described in the most recently approved final ROD in accordance with Executive Order 12088 and OMB circular A-106 which is updated bi-monthly and for which funding requests are made at least two years in advance (when possible) and which are incorporated herein by reference, or any pertinent amendments to those requirements.

In the event that Congress fails to appropriate necessary funding for ROD activities at George Air Force Base, the following will occur:

a. The Air Force will so advise all FFA signatories within 90 days of such failure: and

b. The Air Force will provide to all FFA signatories documentation of all measures it will undertake to ensure that ROD activities are completed in accordance with the most recently approved ROD. These measures may include, but are not limited to, continuing to seek funding for implementing the contingent remedy.

cc: J. Cass, Water Board

Table 1
Predicted TCE Concentrations at MW-49 Area
George Air Force Base, California

IT Project No. 409887

Year	MW-49	MW-49 Range	MW-60	MW-60 Range	MW-43	MW-43 Range
Latest	25.07 (1995)	21.31 - 28.83	27.27 (1995)	23.18 - 31.36	ND (1993)	ND
1	20 90	17 77 - 24.04	28.38	24.12 - 32.64		
2	13.78	11.71 - 15.85	24.19	20 56 - 27.82		
3	13.55	11.52 - 15.58	22.84	19.41 - 26.27		
4	8.06	6 85 - 9.27	19.94	16.95 - 22.93		
5	8.35	7.10 - 9 60	19.04	16.18 - 21.90		
10	4 94	4.20 - 5.68	11.62	9.88 - 13.36	8.17	6.94 - 9.40
15			5.50	4.68 - 6.33	11.11	9.44 - 12.78
20					12.47	10.60 - 14.34
25					9.15	7.78 - 10.52
30					7.03	5.98 - 8.08
35					4.63	3.94 - 5.32

Note: All data presented as $\mu g/L$.
Blank results indicate that the predicted concentration is less than the 5 $\mu g/L$ MCL.

12944215

Table 2
Predicted TCE Concentrations Selected OU2 Sites
George Air Force Base, California

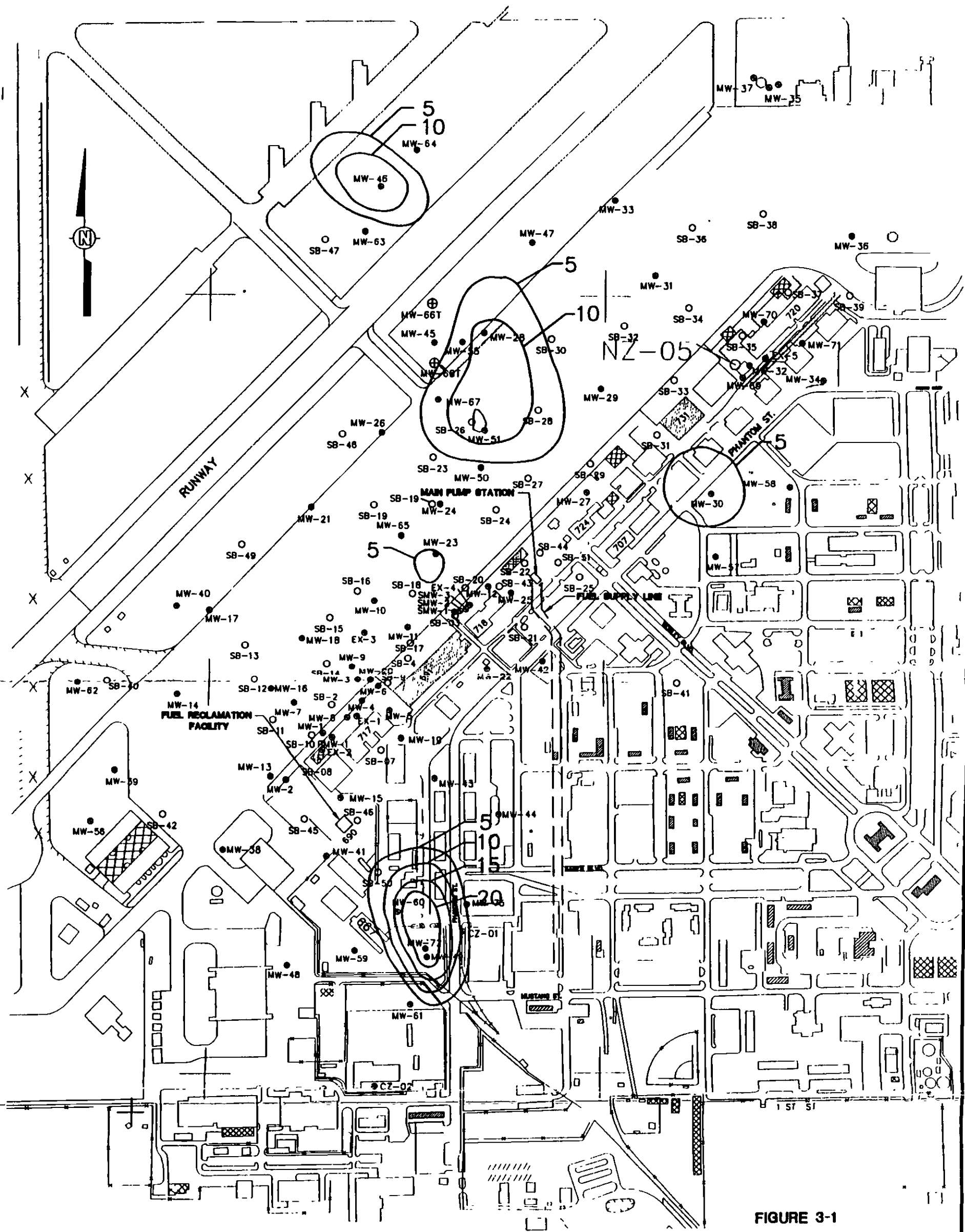
IT Project No. 409887

Year	MW-29	MW-29 Range	MW-30	MW-30 Range	MW-28	MW-28 Range	MW-46	MW-46 Range
Latest	7.10 (1995)	6.04 - 8.17	10.00 (1993)	8.50 - 11.5	14.00 (1993)	11.90 - 16.10	16.00 (1993)	13.60 - 18.40
1	1.21	1.03 - 1.39	4.54	3.86 - 5.22	8.74	7.43 - 10.05	5.77	4.90 - 6.64
2					7.54	6.41 - 8.67	5.80	4.93 - 6.67
3					7.27	6.18 - 8.36	5.56	4.73 - 6.39
4					7.03	5.98 - 8 08	5.33	4.53 - 6.13
5					6.14	5.22 - 7 06	5.34	4.54 - 6.14
10					4.64	3.94 - 5.34	4.66	3.96 - 5.36
15								
20								
25								
30								
35								
40								
45								
50								

Note: All data presented as $\mu g/L$.
Blank results indicate that the predicted concentration is less than the 5 $\mu g/L$ MCL.

1294216

DRAWN BY	MJS 5-31-95	CHECKED BY	J.Z.	7/12/95	DRAWING NUMBER 409887-B24
		APPROVED BY	B. Sibbett	7-12-95	



SCALE:

0 250 500 1000 FEET

BASEMAP IS A COMBINATION OF TWO CAD MAPS: FROM IT AND FROM JM MONTGOMERY (JMM OR MONTGOMERY WATSON) LARGER WELL DESIGNATIONS ARE FROM JMM.

FIGURE 3-1

CONTOUR OF GROUNDWATER TCE CONCENTRATION (SHALLOW AQUIFER)

GEORGE AIR FORCE BASE

PREPARED FOR

GEORGE AIR FORCE BASE CALIFORNIA

INTERNATIONAL TECHNOLOGY CORPORATION

1294217

1294218

TAB

Appendix C

APPENDIX C

ADMINISTRATIVE RECORD

(On file at the GAFB Environmental Programs Office

Contact: Air Force Base Conversion Agency

Department of the Air Force

AFBCA/DD, Building 321

13436 Sabre Boulevard

Victorville, California 92394)

1294220

TAB

Appendix D

APPENDIX D

RESPONSES TO AGENCY COMMENTS TO APRIL 1997 DRAFT ROD

RESPONSES TO USEPA COMMENTS DATED JULY 3, 1997 ON THE DRAFT RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

GENERAL COMMENTS

Comment No. 1: **As previously agreed at RPM meetings and confirmed in the OU 3 FS, GAFB would not justify selected remedies based on exceeding human health risk. Accordingly, delete or modify any reference to the same within the document.**

Response: As discussed at the August 14, 1997 RPM meeting, the justification for the selection of remedies is based on the nine CERCLA criteria, which includes protection of human health and the environment. Historically, the RPMs have requested that risk management decisions be considered for sites where the risk exceeded 1.0E-6. Text has been added to Section 2.9 (Current Site Status) to state that "in an effort to accelerate the remedial process, to minimize present and future environmental risks, reduce potential impacts to groundwater, and facilitate timely transfer of property to the community, cleanup activities have been initiated under the direction of the USAF, at some of the sites presented in this ROD" to clarify that site risk is not the only reason the RPMs agreed to implement remedial actions.

Comment No. 2: **An additional summary statement for Section 2 should cite that ecological risk concerns will be managed through a monitoring plan.**

Response: A discussion of the ecological monitoring plan has been added to Section 2.9.

Comment No. 3: **For clarity and consistency, Figure 6 should also show the location of LF-35 it was categorized as a site requiring some action.**

Response: Site LF-35 has been added to Figure 6.

Comment No. 4: **A brief summary should be made, for the results of GAFB's follow through with U.S. Fish and Wildlife (Doug Laye), for desert tortoise concerns related to the skeet ranges.**

Response: The subject of this ROD is the OU 3 IRP sites. The skeet ranges are not IRP sites.

Comment No. 5: **OT-69 should be cited that it has been transferred to OU 2. A very brief explanation should outline why it was transferred.**

Response: Site OT-69 is currently an OU 3 site. A sentence has been added to Section 1.0 clarifying that the TCE in the vicinity of FT-20 is now part of OU 2.

Comment No. 6: **Landfill sites (left in place) should show the planned deed restrictions and/or land use.**

Response: The text has been modified where appropriate to provide additional detail regarding deed and land use restrictions. See responses to the DTSC's (Ron Okuda's) comments. Actual restrictions will not be written until how the land transfer will occur is known.

Comment No. 7: **The pesticide dieldrin agreements for continuous monitoring requirement, additional investigation (if needed), and related contingent remedy discussed at the June 30, 1997 meeting should be cited in the ROD.**

Response: As agreed during the RPM Meeting on September 17, 1997, the dieldrin that has been detected in wells in the eastern portion of the base (in the vicinity of LF-39) are not currently considered part of OU 3; therefore, it is not presented in this ROD. Text has been added to Section 2.1.1 (Description of Operable Units) to state that the dieldrin detected in wells in the eastern portion of the base will be addressed as part of another OU.

RESPONSES TO DEPARTMENT OF TOXIC SUBSTANCES CONTROL COMMENTS DATED JUNE 27, 1997 ON THE DRAFT RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

RON OKUDA'S COMMENTS

Comment No. 1: **Section 2.5.2.2, Alternative 2: Institutional Controls Pages 2-24 and 2-25. This section in part states:**

"Alternative 2 includes access and land use restrictions, surface restoration, groundwater monitoring, and the 5-year site review.

Access restrictions will involve the installation of 8-foot-high chain-link fences with barbed wire and/or posting of warning signs posted along the perimeter of the site. The locations of the fences at each landfill would be determined as part of the design.

The implementation of land use restrictions at the OU 3 landfill sites will depend highly on the disposal and reuse plans for the GAFB property. There should be agreement between the USAF, future owners of the property, and the concerned regulatory agencies regarding the types of land use that may be restricted on site-by-site, parcel-by-parcel basis.

Surface restoration will involve..."

The land use restrictions are a part of the remedy and are necessary to assure the protectiveness of the remedy. The future owners of the property should not have the ability to negotiate the restrictions. The human health risk assessment was conducted to determine the risks associated with a future commercial/industrial use scenario. To protect human health, land use restrictions should be recorded prohibiting residential uses.

I recommend that the above underlined sentences be revised as follows:

"The implementation of land use restrictions at the OU 3 landfill sites will assure the protectiveness of the remedy and human health. Deed restrictions will be recorded to restrict use of the sites for the following purposes: (a) A residence, including any mobile home or factory built housing, constructed or installed for use as permanently

occupied residential human habitation, (b) A long-term care hospital for humans, (c) A traditional public or private school for persons under 21 years of age, (d) A day care center. In addition, the deed will prohibit the disturbance of the landfill cover, subsurface soils and fencing."

If the landfill is located over the contamination plume, the ROD should also mention a restriction against pumping/injection of groundwater.

If the BCT is aware of other restrictions that would be necessary to assure the protectiveness to human health and the environment, those restrictions should also be discussed/disclosed in ROD.

There is a possibility that the remedy is not compatible with the future reuse plan. If this is so, and the BCT does not (or cannot) change the remedy to accommodate the reuse plan, the ROD should provide a clear description of the constraints (land use restrictions) that the Local Redevelopment Authority will have to comply with in the future.

Any "agreements" that the Air Force, the Local Redevelopment Authority and the regulatory agencies can negotiate would be a protocol the future landowner or the Air Force will follow to seek a variance from the restrictions, or have the restrictions removed. The deed can have a section specifying that the future landowner can petition the U.S. EPA or other regulatory agencies based on revised/new data (i.e., data has demonstrated that bioremediation has reduced the concentration of the COPCs to a level that would allow residential development).

Response: The text has been modified as requested with minor revision for consistency and clarity.

Comment No. 2: **Section 2.6.2, Description of TPH/VOC Site Alternatives, Pages 2-53 and 2-54.**

The description of the land use restrictions in this section is inadequate. The discussion of Alternatives 8 (Soil Vapor Extraction) and Alternative 9 (Bioventing) state that "land use and access restrictions will be employed until remediation is confirmed to be complete"; however, the specifics of the restrictions are not discussed. Will the areas be fenced in a manner similar to the

landfills? Will restrictions be imposed to prevent disturbance of the remedy and groundwater monitoring wells? Will the future landowner be prohibited from disturbing the soil? This section needs further discussion of the restrictions.

Alternative 11 (Oxygen Enhancement with ORC) does mention land use restrictions to prohibit use for domestic purposes. In addition, I would recommend that the ROD include something about the restrictions to prohibit disturbance of the remedy and monitoring wells.

Response: Sections 2.6.2 and appropriate subsections have been modified to address these issues as follows:

- A separate paragraph has been added to Section 2.6.2.3 to specify the nature of land use and access restrictions for Alternative 8.
- A statement has been added to Section 2.6.2.4 that the land use and access restrictions for Alternative 9 would be the same as Alternative 8.
- The change requested for Alternative 11 (Section 2.6.2.6) has been made.

Comment No. 3: **There are numerous sites in the Draft OU 3 ROD that are proposed for NFA where the health risks were evaluated for a commercial/industrial, exposure scenario. If the sites are not protective enough for unrestricted uses (i.e., residential), land use restrictions should be imposed at those sites. This would mean that those sites are no longer eligible for a NFA decision.**

Response: The OU 3 RI Report details the approved methodology used for the risk assessments performed for OU 3 sites. Table ES-4 of the final OU 3 RI Report (Montgomery Watson, 1996a) presents the complete summary of the results of the human health risk assessment analysis.

Potential risk assessment exposure scenarios included: industrial/commercial, trespasser/visitor, construction worker (potential surface soil exposure), construction worker (potential subsurface soil exposure), and future resident. The exposure scenarios evaluated for a particular site were dependent on the expected exposure pathway and the proposed land use as presented in the Management Action Plan (MAP) (USAF, 1993). In most cases, multiple scenarios were evaluated for a particular site including the future resident scenario if the site was in a parcel with the potential for residential use.

To clarify this issue in the OU 3 ROD, the text that summarizes the risk assessment for each site requiring action has been revised to clearly present all risk assessment scenarios that were evaluated for that site and reference the MAP and OU 3 RI Report where appropriate.

RESPONSES TO DEPARTMENT OF TOXIC SUBSTANCES CONTROL COMMENTS DATED JULY 9, 1997 ON THE DRAFT RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

GENERAL COMMENTS

Comment No. 1: **During the Remedial Project Managers (RPM) meeting in Walnut Creek where the remaining risk assessment issues were discussed, it was agreed that the Air Force would include in the Record of Decision, the basis for expediting the accelerated actions was NOT risk based, rather it was for reuse considerations. The ROD must be absolutely clear on this issue and it need only state the agreements developed in this process.**

Response: The meeting referred to above was held to discuss human health risk assessment on October 1, 1996. This issue was discussed; however, in that context, it was also stated by the Air Force that the decisions to support the final remedy were based on the nine CERCLA criteria which includes overall protection of human health and the environment (i.e., risks). The outcome of that meeting was presented in minutes submitted to the RPMs October 7, 1996. Subsequent to the October 1, 1996 meeting, the RI was approved as final and the FS was revised (via inserts) and approved as final. The presentation of the decisions in the OU 3 ROD are consistent with the presentation in the final OU 3 FS.

In addition to the October 1, 1996 meeting, a ecological risk meeting was held on September 19, 1996. Please note that ecological risks are also considered in the determination of the most appropriate remedy.

This issue was again discussed during the August 14, 1997 RPM meeting regarding the preparation of the OU 3 Proposed Plan. At that time, it was agreed that risk management factors were considered in the decision whether to carry a site through the FS process or to propose no further action.

Comment No. 2: **The deed restrictions, land use limitations and access restrictions must be further delineated. Mr. Ronald Okuda, Environmental Assessment and Reuse Specialist has provided comments to bring the document up to par. Said comments are attached.**

Response: See responses to Ronald Okuda's comments.

Comment No. 3: **This ROD must provide contingencies for the ongoing field efforts in the event that the proposed remedies fail to perform as expected. For example, if it is found, through verification sampling that the Bioventing activities simply pushed the contaminants away from their original locations, it will be necessary to chase the contaminants, define their extent and implement an agreed to remedy. We hope this will not be necessary but it is necessary to consider the possibilities.**

Response: Text has been added to appropriate places in the document to clarify that the effectiveness of the remedies are being assessed as part of the ongoing O&M and long-term monitoring. Assessment of system effectiveness will be the focus of the 5-year site review.

Comment No. 4: **This ROD mentions OT-69 will be addressed as part of OU 2. The situation has changed and as of May 6, 1997 during the RPM meeting it was decided to include OT-69 groundwater plumes with OU 3. Please revise the text, figures and tables as necessary.**

Response: OT-69 has been added to the text as an OU 3 site.

Comment No. 5: **The ecological risk management agreements which were agreed to are missing and should be included in the ROD.**

Response: The primary agreement for ecological risk management was the presentation of an ecological monitoring plan. This plan is now summarized in Section 2.9. In addition, this section documents the actions that have occurred to date, including the hot spot removal that was performed prior to construction of the soil cover at Site DP-04 to reduce potential risk to burrowing animals.

SPECIFIC COMMENTS

Comment No. 1: **Pg. 1-1, Para. 3. Site OT-69 groundwater is described as having been relegated to OU 2 to be addressed. This is no longer accurate. It will stay with OU 3 and must be addressed in the ROD See General Comment No, 4.**

Response: See response to General Comment 4.

Comment No. 2: **Pg. 1-2, Para. 3. The last part of the first sentence, "and are cost effective." should be deleted. The Air Force could have saved**

considerable amounts of time and money had they pursed additional Remedial Investigations as requested by regulators. By expediting the accelerated actions in lieu of sampling, the Air Force may have committed themselves to post closure activities such as long term monitoring at the landfill sites. Which are rather costly. This part of the sentence must be deleted.

Response: All accelerated actions were performed with the consent and participation of the regulatory agencies through the RPM meetings, document reviews, remedial action work plans, etc. In addition, all sampling met or exceeded that presented in the final OU 3 Work Plan Addendum (JMM, 1992). The sites that were carried into the FS process were agreed upon in the final OU 3 FS Report. In the FS, cost analysis was performed to satisfy that aspect of the nine CERCLA criteria and was considered in alternative selection. Therefore, in that context, the most cost effective option for the site that required action was selected.

Comment No. 3: **Pg. 1-3, Para. 3. Please replace the name and title of the DTSC person who will sign this document. The proper name and title is:**

John E. Scandura, Chief
Southern California Operations
Office of Military Facilities
Department of Toxic Substances Control

Response: The text has been modified accordingly.

Comment No. 4: **Pg. 2-1, Para 2. The last sentence implies that Figure 6 has all the sites associated with all three Operable Units. This must be revised. In addition, it seems that the sites included on Figure 6 are only those sites which are action recommended. Please include sites LF-35 and OT-69 (groundwater) as well as any sites which have actions recommended.**

Response: The text now refers to Figure 2 which presents all three Operable Units. Sites LF-35 and OT-69 have been added to Figure 6.

Comment No. 5: **Pg. 2-2, Para 1. See previous comments on site OT-69 groundwater. Revise the last sentence accordingly.**

Response: The text has been modified accordingly. OT-69 has been added to the text as an OU 3 site.

Comment No. 6: **Pg. 2-7, Para 2. The last sentence which discusses OU 1 discharge of effluent into the arroyo is no longer accurate. Please re-iterate the existing conditions for OU 1 discharge as of the June 4, 1997 RPM meeting and the July 1, 1997 RPM meeting. The final OU 1 discharge will be in agreement with the ROD or the Team will have to go thru a ROD modification procedure.**

Response: The text has been revised to state that the arroyo intermittently receives discharge from the OU 1 extraction and treatment system.

Comment No. 7: **Pg. 2-9, Para 2. The DTSC recommends that the last sentence in paragraph 2 and paragraph 3 be deleted. The statements are speculative and can either be investigated or left out of the ROD.**

Response: The first sentence in question has been deleted. The second sentence has been revised.

Comment No. 8: **Pg. 2-11, Para 3. Please modify the last sentence as follows: replace "these investigations to" with "those investigations in an effort to..." Basically the Air Force refused to do additional characterization. The regulators did not force the issue since the work which was performed satisfied the minimum requirements. Never the less, the proposed revisions is more appropriate and must be included in this ROD.**

Response: The sentence is introductory and refers to basewide activities. To clarify, the text has been revised to state "the USAF has performed investigations in an effort to..." All OU 3 sampling met or exceeded that in the final OU 3 Work Plan Addendum (JMM, 1992).

Comment No. 9: **Pg. 2-13, Para. 6. The tense for this paragraph is incorrect, it will take place but has not taken place. In addition the dates have subsequently changed and must be updated. Currently the public meeting is scheduled for August 14, 1997 and the 30 day public comment period should start around July/August time frame. This section must be updated.**

Response: This version of the ROD is being submitted after the public meeting and public comment period have occurred. The text has been revised to state that the public meeting was held on October 8, 1997 and the public comment period ended on October 22, 1997. Past tense is now appropriate.

Comment No. 10: **Pg. 2-14, Para. 3. See prior comments regarding site OT–69. This site will not be addressed in the OU 2 ROD as stated in the document. This must be updated.**

Response: See responses to prior comments regarding site OT-69.

Comment No. 11: **Pg. 2-14, Para. 5. The use of land use restrictions for LF-35 in and of itself is insufficient. Deed restrictions, land use restrictions and access restrictions must be specified for all sites which have potential hazardous wastes and substances left in place. See Ronald Okuda's comments.**

Response: The text has been modified to be more clear. See responses to Ronald Okuda's comments.

Comment No. 12: **Pg. 2-16, Para. 1. The last sentence, in its present form is misleading. Actually, the modeling, shows that there is no potential for contaminant leaching in to the groundwater. The model has certain assumptions which may or may not correlate to the actual amount of contamination present. In practical terms, the post closure landfill requirements for monitoring apply at these landfills due to the high uncertainties associated with the data. This is due to the low quantity of analytical data available. In addition the remedy is to leave wastes in place which requires deed restrictions, access limitations and land use restrictions in perpetuity. This sentence and all such sentences may be deleted or replaced with language which incorporates the above comments.**

Response: The sentence referenced (and other similar sentences in the document) have been modified to state that "modeling results indicate that there is no potential for contaminant leaching to groundwater."

Comment No. 13: **Pg. 2-16, Para. 3. The first and second sentences contradict each other. Is there an ecological risk issue or not. The DTSC position is that there is since the desert tortoise can easily burrow below the 12 to 18 inches of cover placed on the landfills. The Air Force agreed to implement risk management measures to limit the access and future use of all the landfills. See the Risk Assessment meeting in Walnut Creek in December 1996. This agreement was reached in lieu of additional Remedial**

Investigations which may have been performed. The agreements from the meeting must be included in the ROD.

Response: The text has been revised to clarify the distinction between the qualitative ecological benchmark screening and the subsequent quantitative bioaccumulative food chain modeling.

At a meeting at the USEPA offices in San Francisco, California on December 11, 1995, it was agreed that food chain modeling for bioaccumulative compounds would be performed to address any perceived insufficiency of data. The text now reads that the localized presence of PAHs (not included in the bioaccumulative food chain modeling) may be a potential risk to ecological receptors. However, the food chain modeling performed for bioaccumulative compounds at DP-03 did not suggest a risk to vegetation or wildlife. This information is discussed in detail in the final OU 3 RI Report (see Table ES-5 for a summary). In addition, these results were presented at the ecological risk assessment meeting in Walnut Creek on September 19, 1996. It is assumed that this is the meeting which is referenced above.

A discussion of the ecological monitoring plan is now presented in Section 2.9 of the OU 3 ROD.

Comment No. 14: **Pg. 2-17, Para. 1. The last sentence needs a little clarification, add "within 100 years." or delete the phrase ". . . no potential" Once again due to the low confidence in the data sets used or high uncertainties, ALL these comments must be revised or deleted.**

Response: To clarify, this statement, and other similar statements for other sites, have been revised to read "within 100 years." All prior comments to the OU 3 RI/FS related to perceived concerns regarding the agency's low confidence in data sets and uncertainties were addressed in the final OU 3 RI/FS Reports. The text referenced is primarily a summary of discussions presented in the OU 3 RI and/or FS (for example, the specific text referenced is presented on page 3-7 of the final OU 3 FS [Montgomery Watson, 1997a]).

Comment No. 15: **Pg. 2-18, Para. 1. Comment 2-17, 1 applies at the end of the first paragraph.**

Response: See response to Specific Comment 14. See also page 3-3 of the final OU 3 FS (Montgomery Watson, 1997a).

Comment No. 16: **Pg. 2-18, Para. 2. Why was the highest estimated excess cancer risk estimated for the future risk scenario at this landfill? Landfills which are not clean closed should be evaluated for industrial/commercial scenarios like the other landfills.**

Response: To clarify this issue, the text that summarizes the risk assessment for each site requiring action has been revised to clearly present all risk assessment scenarios that were evaluated for that site.

For example, this site (LF-12) was evaluated for five scenarios (i.e., industrial/commercial, trespasser/visitor, etc.). The exposure scenarios evaluated for a particular site were dependent on the expected exposure pathway and the proposed land use as presented in the Management Action Plan (MAP) (USAF, 1993). The text referenced above is presenting the highest risk observed because it is the risk that would drive risk management decisions. The final OU 3 RI (Montgomery Watson, 1996a) presents the complete results of this analysis and discusses the approved methodology.

Comment No. 17: **Pg. 2-18, Para. 4. The paragraph implies that the remedies were selected based on risk. This is not the case and the paragraph must be re-written or deleted. See general comment No. 1. This section must be revised accordingly.**

Response: See response to General Comment 1. Risk was part of, but not the only, determining factor for carrying a site through the FS process (as stated in the text) for many sites. Through the FS process, risk management decisions were a consideration for the most appropriate remedy as part of the nine CERCLA criteria.

Comment No. 18: **Pg. 2-19, Para. 2. Comment 2-17, 1 also applies here.**

Response: See response to Specific Comment 14. See also page 3-4 of the final OU 3 FS (Montgomery Watson, 1997a).

Comment No. 19: **Pg. 2-19, Para. 3. Why does the Air Force evaluate risk for industrial/commercial in LF-14 and for the future resident scenario in LF-12? Landfills are landfills and should be evaluated to one standard, commercial/industrial, based on current EPA guidance which addresses evaluation for future use under the current use scenario. The risk numbers must be comparable, i.e., address the landfills in this ROD under the industrial/commercial scenario for human health.**

Response: See response to Specific Comment 16.

Comment No. 20: **Pg. 2-20, Para. 2. This paragraph is in need of being re-written. The Base Closure Team (BCT) agreed not to stop work on the accelerated actions with the condition that the work would *not* be justified under CERCLA by risk assessment methodologies. The Air Force agreed. This paragraph, and other similar paragraphs, can quantify the human risk for commercial/industrial scenarios with its associated confidence levels. However, the basis for proceeding with the work was the Air Force's prerogative to expedite reuse. The DTSC would like to see these points stipulated clearly in the ROD.**

Response: See responses to General Comment 1 and Specific Comment 17. See also page 3-5 of the final OU 3 FS (Montgomery Watson, 1997a).

Comment No. 21: **Pg. 2-21, Para. 1. How odd that a site which has no Chemicals of Potential Concern (COPCs) was proposed for site closure. Never the less, it has been closed. The previous comment applies. In addition, what are the potential ecological impacts at landfill site LF-44 from physical disturbances?**

Response: As stated in the text, closure actions were considered in the text because of the exposed debris. The ecological impacts are "stress on vegetation ... related to former site activities."

Comment No. 22: **Pg. 2-22, Para. 1,2. In paragraph 1, comment 2-17, 1 applies. In paragraph 2, comment 2-19,3 applies.**

Response: See response to Specific Comments 14 and 19. See also page 3-2 of the final OU 3 FS (Montgomery Watson, 1997a).

Comment No. 23: **Pg. 2-22, Para. 3. In this paragraph and other such paragraphs delete all illogical statements which are contradictory. For example the COPCs are naturally occurring yet they pose an ecological risk? Most potentially responsible parties do not remediate back ground conditions. In addition, general comment No. 1 applies here.**

Response: See response to General Comment 1. The ecological risks determined were a result of metals as well as dioxin/furan congeners. The intent is to provide the large quantity of information in as logical of fashion as possible.

Comment No. 24: **Pg. 2-24, Para. 7. As regards to access restriction, see previous comments and Ronald Okuda's comments. The last sentence has an inappropriate tense, the location of the fences do not have to be determined, they are in place. Do not be afraid to state the facts, whatever they are.**

Response: See responses to Ronald Okuda's comments.

The tense is appropriate as written. This section (2.5.2) presents the alternatives that were evaluated for all landfill sites, not necessarily the actions that have occurred (i.e., it is part of the summary of the FS process and discusses what would be done if a particular alternative were selected for a particular site). Section 2.9 has been added to the ROD that details the actions that have occurred to date.

Comment No. 25: **Pg. 2-24, Para. 8. See Ronald Okuda's comments. Specify who the concerned regulatory agencies are which will determine the types of land use that may be restricted on the next page.**

Response: See responses to Ronald Okuda's comments.

Comment No. 26: **Pg. 2-27, Para. 5,6. The DTSC would prefer to see the term "reduced" in place of "practically eliminate" for these two paragraphs. Rodents will burrow into the cover, as well as the desert tortoise if the fences are not maintained. There needs to be details included in the ROD which addresses the need for ecological monitoring, post closure land fill cover requirements and access control in the future.**

Response: The text has been modified accordingly.

Comment No. 27: **Pg. 2-30, Para. 6. Risks have been effectively reduced to zero? This is stretching risk assessment too far. Risk reduction has been accomplished to some degree and this amount of risk reduction can be quantified. The quantified level of risk reduction can replace "zero."**

Response: The statement regarding reduction of risks to zero has been revised to clarify that potential risk is minimized. At a risk assessment meeting between the RPMs on September 19, 1996 the issue of recalculation of risk was a point of some discussion (see meeting minutes). Subsequent to that time, all agency comments to the OU 3 RI and FS report were addressed and it was accepted that a post-

remediation quantitative risk assessment would not be prepared for the sites. Therefore, quantitative risk numbers are not available.

Comment No. 28: **Pg. 2-34, Para. 5,6. It is possible that the state would accept alternative 1 had the Air Force done additional site characterization to better quantify the risks. There is a possibility that the Air Force would have done the accelerated actions in spite of the low levels of risk for reuse reasons. However the DTSC must consider and where appropriate does accept the no action alternative. Alternatives 1 and 2 must therefore be revised accordingly.**

Response: As discussed at the August 14, RPM meeting, the agencies did not historically accept no action (Alternatives 1) for the landfills in question. Alternative 2 was only acceptable for Site LF-44. The text as written is historically accurate.

Comment No. 29: **Pg. 2-36, Para. 4. Please delete line 3. Alternative 4 is less expensive but NOT equally effective in satisfying the RAO's.**

Response: Alternative 5 differs from Alternative 4 in that is has the addition of a synthetic liner. The purpose of the liner is to further protect against potential infiltration. Although at first glance Alternative 5 may seem more effective than Alternative 4, the data does not support this. The HELP model evaluation performed and presented in the final OU 3 FS indicated that the synthetic liner would not significantly aid in meeting this RAO.

Comment No. 30: **Pg. 2-37, Para. 2. Why is the resident scenario used for LF-12? See previous comments on this issue.**

Response: See response to Specific Comment 16.

Comment No. 31: **Pg. 2-38, Para. 5. Same comment as 2-37, 2 for the SEDA.**

Response: See response to Specific Comment 16.

Comment No. 32: **Pg. 2-41, 3rd bullet. Delete this bullet.**

Response: See response to Specific Comment 2.

Comment No. 33: **Pg. 2-43, Para. 5. For site WP-17 state the highest levels found and the evaluation criteria to which it was compared. The term "significantly lower than the evaluation" is nebulous.**

Response: The text has been revised to summarize the evaluation criteria in Section 2.6.1. The term "significantly" has been removed from the sentence in question. The text in this paragraph has been revised to clarify the point that the evaluation criteria were exceeded in one of 11 borings.

Comment No. 34: **Pg. 2-48, Para. 3. The DTSC does not consider the Air Force contractors, M&E, the correct entity to conclude that no further action was warranted. Normally, the potentially responsible party proposes recommendations, such as no further action and the base closure team can concur unless we disagree amongst the BCT. In such cases the US E.P.A. concludes on the CERCLA issues and the Regional Board or DTSC concludes on state issues.**

Response: The text in this sentence, and any similar sentences, have been revised to give the more appropriate explanation that the conclusions were drawn, reported, and agreed to by the RPMs.

Comment No. 35: **Pg. 2-50, Para. 4. Figure 10 has a typographical error which shows the cleanup goal for soils 20 feet above the groundwater at 125 μg/kg. This must be corrected.**

Response: The figure has been modified accordingly.

Comment No. 36: **Pg. 2-52, Para. 6. Which additional monitoring wells are necessary to satisfy which specific monitoring components?**

Response: The monitoring wells referred to are hypothetical and therefore do not have names. The text is summarizing the FS process (alternative development) and is stating that additional monitoring well installation might be required. For example, if an alternative with a groundwater monitoring component was selected for a site were sufficient downgradient monitoring wells were not available.

Comment No. 37: **Pg. 2-53, Para. 7. Bioventing is an acceptable cleanup method. However, it has been proven by confirmation sampling events that this process simply moves certain contaminants from area X to areas around X. We hope this is not the case here but a contingency should be included where the Air Force commits to remedying such a possibility.**

Response: Text has been added to appropriate places in the document to clarify that the effectiveness of the remedies are being assessed as part of the ongoing O&M and long-term monitoring. Assessment of system effectiveness will be the focus of the 5-year site review. Confirmation sampling (soil or vapor) will be collected to confirm the remedies have been completed prior to site closure.

Comment No. 38: **Pg. 2-(55-61). The use of alternative 6,7,8 and 9 for soil and alternatives 10 and 11 for groundwater makes it difficult to compare. why not, rather, use the name of the process? This will make it much clearer and easier to read.**

Response: Each alternative is defined at first use. In addition, a table is presented cross referencing the number and name of each alternative with the CERCLA criteria as follows: Table 3 for landfill sites, Table 14 for TPH/VOC sites, and Table 22 for Site OT-69.

Comment No. 39: **Pg. 2-(62-67). The DTSCs general comment No. 1 applies throughout this section. The risk must be de-emphasized throughout the ROD as agreed to by the BCT.**

Response: See response to General Comment 1.

Comment No. 40: **Pg. 2-69, Para. 2. There are very few technologies which can completely remove and treat contaminated soils. Lets replace completely with adequately.**

Response: The text has been modified to state that the remedies "will remove and treat contaminants in soils to below acceptable levels."

Comment No. 41: **Pg. 2-69, Para. 5. In line 4 lets replace the term remedial with accelerated actions since the work did not take place via an approved ROD.**

Response: The text has been modified accordingly.

Comment No. 42: **Pg. 3-1, Para. 2. The date has slipped form July 15, 1997 to a proposed date of August 14, 1997 for the public meeting. Lets keep the tense correct on these documents as they are being revised.**

Response: See response to Specific Comment 9.

Tables

The Air Force should use the actual dollar amounts spent for the actions taken thus far where the information is available. The tables must be updated.

Response:

Table 25 presents a summary of current present work cost estimates as well as actual remedial action costs for the accelerated actions performed for OU 3 sites. The text has been modified to clarify this point.

RESPONSES TO LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD COMMENTS DATED JULY 11, 1997 ON THE DRAFT RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

GENERAL COMMENTS

Comment No. 1: **Board staff comments on the draft Proposed Plan are dated May 5, 1997. Enclosed with Board staff comments was Regional Board Resolution 6-97-62 authorizing the Executive Officer to sign the OU 3 ROD provided there are not significant changes and that the following comments are satisfactorily addressed.**

Response: Comment noted.

Comment No. 2: **The ROD must indicate that the Regional Board has agreed to the natural attenuation alternative for the Site OT-69 chlorinated solvent plumes provided an active contingent remedy is specified in the ROD and will be implemented. This contingency will be implemented if the Regional Board deems that the natural attenuation remedy is not restoring water quality objectives in a timely manner.**

Response: Text presenting this information has been added to Sections 2.7.3.8 and 2.9.2.

Comment No. 3: **The cover letter to the draft ROD indicates that Site OT-69 has not been included in the document because the remedial project managers (RPMs) were still discussing whether to include the site or not in the OU 3 ROD. The RPMs met on Tuesday, May 6, 1997 and decided that the Site OT-69 plumes investigated by IT Corp will be part of the OU 3 ROD.**

Response: The five plumes investigated by IT as Site OT-69 have been included in the OU 3 ROD.

Comment No. 4: **The RPMs also decided to consider the trichloroethylene (TCE) in ground water beneath Site FT-20 part of OU 2, know as Site FT-20 (Groundwater). Therefore, the OU 3 ROD should indicate that No Further Action for Site FT-20 (Soils) is appropriate. The ROD must indicate that a decision regarding Site FT-20 (Groundwater) will be made after further investigations are conducted to determine the nature and extent of the TCE plume in the regional aquifer as part of OU 2. The Air Force has not responded to the**

Board staff request (May 5, 1997) for a time schedule for conducting additional investigations at this site.

Response: The text has been revised to clarify that Site FT-20 (soil) is an OU 3 site for which No Further Action is recommended, and that "final decisions regarding potential actions at the Site FT-20 (groundwater) will be determined in the OU 2 ROD."

Comment No. 5: **Closure activities at the landfill sites is now complete as indicated in the draft ROD and long-term post closure maintenance shall continue. Active soil remediation is in progress at Sites OT-51, WP-17 and FT-19 as indicated in the draft ROD. The ROD should reflect actual site closure and remediation costs as provided by Montgomery Watson by letter dated April 22, 1997. During the May 6, 1997 RPM meeting, Montgomery Watson indicated that the table attached to the April 22, 1997 letter did not include monitoring costs. The long term costs should include collection of groundwater monitoring data for an assumed period of time. The cost estimate tables should include all costs (to date and projected) and state assumptions.**

Response: The table referred to was included in the Draft OU 3 ROD as Table 22. During the May 6, 1997 RPM meeting, Montgomery Watson stated that the table column entitled "Current Estimated Annual O&M Cost" did not include monitoring. However, it was also stated that monitoring costs are included in the present worth cost (i.e., the total costs include monitoring as written). This table (now Table 25) has been revised to clarify that is presents the current estimates for sites where accelerated actions have occurred to date using actual construction costs. In addition, assumptions have been modified for clarification.

Comment No. 6: **Table 13 shows Quality Goals for TPH/VOC Groundwater Site (OT-51). Changes should be made to this table. Comments 7-10, below, pertain to this table.**

Response: See response to comments 7 through 10.

Comment No. 7: **The numerical standard for odor (adopted secondary MCL) is 3 odor units and must be added to the table. Please see Table 64449-A, Title 22, Cal. Code of Regulations. References should be made to agreements made at the June 30, 1997 Applicable or Relevant and Appropriate Requirements negotiations, meeting with attorneys present, regarding the applicability of this criteria. In**

other words, the State and Air Force would disagree regarding the applicability of the 3 odor unit secondary drinking water standard, however the Air Force will clean up to that standard.

Response: The header of the column titled "Taste and Odor Threshold" in the Draft ROD has been revised to "Suggested Concentration to Meet Secondary MCL of 3 Odor Units."

The "agree to disagree" language established for OU 2 during the June 30, 1997 specifically regarding the 3 odor units has been added where appropriate to Table 15 (ARARs for TPH/VOC sites).

Comment No. 8: **A footnote should be added to the table clarifying that the proposed federal secondary maximum contaminant levels are constituent specific and may be used to represent the 3 odor units for petroleum hydrocarbons, however when used independently, they may not accurately reflect odor of a complex mixture. The proposed federal secondary standards are not promulgated, however the 3 odor unit secondary standard is promulgated.**

Response: See response to Comment 13. The requested language has been added to Table 15.

Comment No. 9: **Napthalene must be added to the table. A value of 20 µg/l is recommended as "To-Be-Considered" and is the numerical water quality objective unless an alternate standard acceptable to the Regional Board is proposed. This is the USEPA recommended health advisory for toxicity other than cancer.**

Response: Napthalene is not a COPC for OU 3. Note that IT Corp. has sampled for napthalene in and around the OU 2 plume and the results have been nondetect (see "OU 2, Routine Plume Monitoring Informal Report, September 1997," page 9). The use of napthalene as a surrogate COPC is not an appropriate precedent to set in this ROD. Note that text has been added to the ROD to indicate sampling frequency and analyte selection for the long term monitoring program may be modified as the program progresses (see response to Comment 23).

Comment No. 10: **Dieldrin must be added to the table. A value of 0.0022 µg/l is recommended as "To-Be-Considered" and is the numerical water quality objective unless an alternate standard acceptable to the Regional Board is proposed. This is the Cal-EPA cancer potency factor as a water quality criteria.**

Response: As agreed during the RPM Meeting on September 17, 1997, the dieldrin that has been detected in wells in the eastern portion of the base are not currently considered part of OU 3; therefore, dieldrin has not been added to the table. Text has been added to Section 2.1.1 (Description of Operable Units) to state that the dieldrin detected in wells in the eastern portion of the base is not considered part of OU 3 and will be addressed as part of another OU.

Comment No. 11: **The ROD must indicate that collection of confirmation samples at Sites WP-17, OT-51, and FT-19 is required to verify that the soil cleanup levels indicated in Figures 9 and 10 are attained. Please correct the 20 foot above ground water cleanup level shown on figure 10 from 125 µg/kg to the correct numerical value.**

Response: Text has been added to Section 2.6.2 to state that "prior to closure of a TPH/VOC site for which a remedy has been implemented, confirmation samples (soil and/or vapor to estimate soil concentrations) would be collected as necessary to demonstrate that soil cleanup levels presented on Figure 9 are achieved." Note that this section precedes the description of alternatives for the TPH/VOC sites. The description of alternatives also indicates that confirmation samples (soil and/or vapor) will be collected to confirm that remediation goals have been achieved.

Figure 10 has been revised to state the correct value of 12.5 µg/kg.

Comment No. 12: **The ROD must indicate that the active remediation systems (soil vapor extraction and bioventing) will operate so long as the systems continue contaminant mass reduction in a manner that is technically and economically feasible.**

Response: Text has been added to Section 2.6.2 to state that based on the remediation goals, a remedy would be implemented and operated until the mass of contaminants remaining was such that no impact to groundwater was anticipated.

Comment No. 13: **Recently Board staff sent the Air Force a letter dated June 27, 1997 requesting a Preliminary Assessment/Site Investigation (PA/SI) for the occurrence of the pesticide dieldrin in wells located adjacent to Landfill Site LF-39. Dieldrin is present at levels of approximately 0.12 µg/l. The draft ROD indicates that No Further Action is appropriate based on the Air Force contention that Site LF-39 was never a landfill. This request for additional site information is not made at the "11th hour" as indicated by the Air Force during the June 30, 1997 meeting. Board staff have**

previously indicated that the western portion of the landfill beneath base housing was not properly investigated, that No Further Action was not appropriate, and that dieldrin was of concern (May 2, 1995 Board staff comments on the OU 3 Remedial Investigation/Feasibility Study). The ROD must provide supporting rationale for the recommendations made. As agreed to during the June 30, 1997 meeting, the ROD may include a remedy for Site LF-39 that indicates long term monitoring for pesticides will be conducted in the affected wells. The ROD should indicate that a contingent remedy will be evaluated if: 1) water production causes plume movement or 2) if the PA/SI results indicate a need. The PA/SI may be conducted outside of OU 3, allowing the OU 3 ROD to be completed and decisions related to the dieldrin in groundwater to be made outside of OU 3.

Response: LF-39 is proposed for no further action (NFA) based on site-specific data. Because dieldrin is located in wells upgradient of LF-39, this site is not considered a source. Therefore it is appropriate that LF-39 be an NFA site because dieldrin was not found in site soils.

The ROD does not make a statement regarding LF-39 never being a landfill. All comments to the OU 3 RI/FS Reports were addressed in writing and are presented in appropriate appendices to those reports. These comments were provided to the RPMs with the final submittal.

As agreed during the RPM Meeting on September 17, 1997, the dieldrin that has been detected in wells in the eastern portion of the base (in the vicinity of LF-39) are not currently considered part of OU 3; therefore, it is not presented in this ROD. However, text has been added to Section 2.1.1 (Description of Operable Units) to clarify this point.

Comment No. 14: **The ROD must indicate that the abandoned well casing downgradient of Site OT-51 will be properly sealed and decommissioned. Please refer to Board staff memorandum dated February 2, 1995 with information provided to the Air Force regarding appropriate decommissioning methods.**

Response: Section 2.6.4.2 has been revised to state that the preferred alternative for OT-51 includes the decommissioning of the abandoned well downgradient of the site.

Comment No. 15: **The ROD must clarify a number of issues for the Site OT-51 JP-4 plume comments, 16 to 19 pertain to this issue.**

Response: See response to Comments 16 through 19.

Comment No. 16: **ORC is proposed as a contingent remedy for the Site OT-51 JP-4 ground water plume. Based on information in the Basewide Groundwater Monitoring Report for the February 1997 Sampling Event, dated June 1997, prepared by Montgomery Watson, long term monitoring of the JP-4 plume is appropriate.**

Response: Section 2.6.4.2 states that the preferred alternative for OT-51 includes long term monitoring.

Comment No. 17: **The criteria that will be used to determine when the contingent remedy will be implemented must be stated. Board staff have previously indicated that natural attenuation is acceptable if plume stability is demonstrated and concentration reductions occur as expected (May 5, 1997 Board staff memorandum with comments on the draft OU 3 Proposed Plan and Staff Report dated April 1997).**

Response: As agreed during the conference call between the RWQCB, USAF, DTSC, and Montgomery Watson on October 14, 1997, the text has been modified where appropriate to state that the implementation of the oxygen releasing chemicals would be contingent on the continued reductions of COPCs in groundwater in a reasonable time frame. Data collected as part of the basewide long-term monitoring program have shown that the plume is characterized and concentrations are being reduced.

Comment No. 18: **The expected duration to attain cleanup to water quality objectives must be stated. This duration calculation must include all assumptions used.**

Response: Based on best engineering judgment, it is anticipated that the groundwater will be remediated to within acceptable levels within 5 years. The is primarily based on the fact that the source is being removed by installation of a bioventing system and the recent basewide groundwater monitoring data indicating that levels of COPCs are decreasing (Montgomery Watson, 1996 d, e, f and 1997 d, e, f). The text of the ROD has been revised to cite this recent groundwater monitoring data.

Comment No. 19: **Currently there are insufficient groundwater monitoring points downgradient of the plume. Additional downgradient**

groundwater monitoring points are necessary to verify site conditions during monitoring prior to closure.

Response: The draft ROD discussed the need for additional monitoring points downgradient of Site OT-51 in Sections 2.6.2.1 and 2.6.2.5. In addition, Table 20 included 2 wells as part of the FS cost estimate. An additional statement has been added to Section 2.6.4.2 that one or two wells will be installed to satisfy the long-term monitoring requirement for Site OT-51.

Comment No. 20: **Because the closure activities at the landfill sites are complete, the ROD should include references to Table 4 (Landfill ARARs) describing the compliance status of each ARAR. This will allow a determination of which ARARs apply during the post-closure maintenance and monitoring phase.**

Response: Text has been added to Section 2.9 (Site Status) that "as part of the 5-year review, the status of compliance with ARARs will be evaluated and reported."

Comment No. 21: **The ROD must clarify when the landfill post-closure maintenance and monitoring plan will be submitted to meet the substantive requirements of the following section of the California Code of Regulations, Title 23, Chapter 15: §2580(a), §2581(c), and §2597.**

Response: The draft "Site Closeout Report for DP-03, DP-04, LF-12, LF-14, and the Southeast Disposal Area" was submitted in June 1997. The proposed maintenance activity schedule is presented in this report and is summarized on Table 12-3 of the Closeout Report. This document is referenced where appropriate in the text of the ROD.

Comment No. 22: **The ROD must include information to determine if a landfill release has occurred. Board staff have previously indicated that the Water Quality Protection Standard (WQPS) must be specified in the ROD.**

Response: As agreed during the conference call between the RWQCB, USAF, DTSC, and Montgomery Watson on October 14, 1997, text has been added in Section 2.9 as follows; "Water Quality Protection Standards (WQPS) will be developed to assess whether there has been a release from the landfills. The WQPS will be developed within 6 months of the signing of this ROD and will be based on the available groundwater data to establish baseline values for which future sampling results will be compared."

Comment No. 23: **The Site Close-out Reports for DP-03, DP-04, LF-12, LF-14 and the Southeast Disposal Area, dated June 1997, provided by Montgomery Watson, Section 12, Table 12-2, gives useful information regarding analyte selection. The elements of long term monitoring should be incorporated in the ROD, giving flexibility for future changes.**

Response: Text has been added to Section 2.9 to state that "as part of the monitoring program, monitoring wells associated with the landfills are sampled and analyzed for halogenated volatile organic compounds (HVOCs) (EPA method 8260 suggested), and landfill indicator parameters (pH, total dissolved solids, chloride, sulfate, and nitrate). The sampling frequency and analyte selection may be modified as the program progresses."

Comment No. 24: **As discussed during July 1, 1997 meeting, for long term detection monitoring at landfills, it is not necessary to sample for metals unless sufficient data has not yet been collected for determining the WQPS. It is necessary to monitor for volatile organic compounds in all landfill detection monitoring wells by USEPA method 8260.**

Response: See response to Comment 23.

TAB

Appendix E

APPENDIX E

RESPONSES TO AGENCY COMMENTS TO NOVEMBER 1997 DRAFT FINAL ROD

RESPONSES TO USEPA COMMENTS DATED DECEMBER 5, 1997 ON THE NOVEMBER 1997 DRAFT FINAL RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

GENERAL COMMENTS

Comment No. 1: **Page 1-3, Revise EPA's approval signature to the following:**
Daniel D. Opalinski
Chief, Federal Facilities Cleanup Branch
Environmental Protection Agency
Region IX

Response: Agree. The text has been modified accordingly.

Comment No. 2: **Pages 2-17/18, 3rd/4th respective paragraphs. EPA's comment number one on the draft ROD concerning human health risk was not adequately addressed. There are still instances where the ROD cites the remedy selection was based mainly on human health risk, specifically with DP-03/04. Again, human health risk was only one of several, but not the main deciding factor used for remedy selection. This must be made clear throughout the document as stated in our previous comments in the FS and the Draft ROD comments.**

Response: The sentences in question have been removed from the document as agreed during the December 23, 1997 RPM meeting.

Text in Section 2.9 (Current Site Status) of the November 1997 Draft Final ROD states that "in an effort to accelerate the remedial process, to minimize present and future environmental risks, reduce potential impacts to groundwater, and facilitate timely transfer of property to the community, cleanup activities have been initiated under the direction of the USAF, at some of the sites presented in this ROD" to clarify that site risk is not the only reason the RPMs agreed to implement remedial actions.

The section referenced is 2.5.1, which summarizes the RI/FS activities and presents the risk assessments performed. The sites were considered in the OU 3 FS because of the exceedence of risk (human and ecological). Remedy selection is based on the nine CERCLA criteria as detailed in the subsequent Section 2.5.3.

RESPONSES TO USEPA DECEMBER 5, 1997 COMMENTS (Continued)

Comment No. 3: **Section 2.5.4.2, first bullet. "grading existing soil cover to a slope of 1.5 to 25 percent to promote surface runoff...wastes." Delete the underlined as shown, and any reference to same throughout the document, because our official landfill discussions only involved 1 to 3 percent grade. Although you responded to our concerns about LF-14 that only "field changes" occurred, we disagree with your response resulting that no changes were made without our knowledge. Because of the steep slope on the landfill caps modified during its construction, a contingency plan should address potential erosion problems in the Operations and Maintenance document.**

Response: Agree. The text has been modified to remove the statement specifying 1.5 to 25 percent slope.

Additionally, Section 2.5.4.2 been modified to state that a contingency plan will be implemented should the remedy no longer be protective of human health and the environment. Contingency plans will be described as necessary as part of the O&M documentation.

Comment No. 4: **EPA's draft ROD comment number six concerning land use applies. The known land use restrictions, for the OU 3 sites, should be described in more detail in the final ROD. If this is not possible, the ROD should state that the language and form of the land use restrictions will be provided to EPA for approval prior to implementation. The sites for which land use restrictions are part of the remedy are:**

Sites DP-03 and DP-04	**(page 2-40)**
Sites LF-13, LF-14, and SEDA	**(page 2-41)**
Site LF-44	**(page 2-41)**
Site FT-19c	**(page 2-69)**
Sites WP-17, FT-19a, OT-51 (soil)	**(page 2-70)**

In addition, the description of Site OT-51 (groundwater) on page 2-69 mentions land use restrictions, but there is no parallel reference in the detailed description on page 2-70. Assuming that land use restrictions are intended to be part of the remedy at Site OT-51 (groundwater), appropriate language should be added to page 2-70.

Response: The text has been modified to contain the language agreed upon at the December 23, 1997 RPM meeting. The sections describing the selected remedy for each of the sites listed above (i.e., Sections 2.5.4.2 and 2.6.4.2) have been revised to include the agreed upon language

specific to the alternatives selected (i.e., landfill covers, bioventing, etc.).

The USEPA will have the opportunity to review the language for any final deed restrictions.

(Note typographical error in the comment: LF-13 should be LF-12.)

Comment No. 5: **Montgomery Watson (MW) requested regulatory concurrence to shut down or reduce in scope the operation systems for various TPH/VOC sites being remediated. Since mid 1995, the recurring message by MW/GAFB was that these sites would be cleaned in "two years." GAFB should provide the rationale in the RD/RA document of when and why each system can be reduced or shut down. During the November RPM meeting, MW wanted to shut down the bioventing system at WP-17. EPA cannot concur with this until sufficient supporting data/rationale is provided. The ROD should cite that groundwater monitoring details for the appropriate TPH/VOC sites will be included in the basewide monitoring plan.**

Response: Section 2.9.2.7 of the Draft Final ROD provides the requested information regarding citation of an approved long-term basewide groundwater monitoring plan. In addition, as agreed upon during the December 23, 1997 RPM meeting, the following language has been added to Section 2.9.2.7: "the rationale for system shut down will be provided in subsequent RD/RA documents."

The other points of the comment are not discussed in the ROD but are referring to subsequent documents and/or meetings. The ROD does not make any recommendations for changes in operations of the TPH/VOC remediation systems. Note that is was the RWQCB that recommended shutting down Site WP-17 at the November 1997 RPM meeting.

RESPONSES TO URSG CONSULTANTS COMMENTS DATED DECEMBER 5, 1997 ON THE NOVEMBER 1997 DRAFT FINAL RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

GENERAL COMMENTS

Comment No. 1: **Section 2.6.4.2, Detailed Description of the TPH/VOC Site Preferred Alternative, page 2-69.**

a.) Site FT-19c, last bullet: "collection of confirmation samples (soil or vapor [to estimate soil concentrations]) to assess remedy completion."

Confirmation sampling should reveal concentrations of COPCs in both soil vapor and soils. It is recommended that the phrase "soil or vapor" be replaced by "soil and vapor."

Response: Agree. The text has been revised to state "soil and vapor" samples will be collected to assess remedy completion.

b.) Sites WP-17, FT-19a, OT-51 (soil), page 2-70.

The above comment applies to these sites.

Response: See response to Comment 1a.

Third bullet: "implementation of long-term groundwater monitoring in accordance with the basewide long-term groundwater monitoring plan (Montgomery Watson, 1996c).

The 1996 basewide long-term groundwater monitoring plan was never received and approved. This bullet should be revised and state that a basewide long-term groundwater monitoring plan will be developed for approval to address groundwater quality concerns at these sites. This comment also applies the second bullet under site OT-51 (groundwater), page 2-70.

Response: Please note that the base has been operating under an approved plan (Montgomery Watson, 1995c and 1996c). However, for clarity this reference has been removed from the page in question. The 1996 plan is now referenced in the document only when discussing specific sampling events that have already occurred.

When referring to future long-term monitoring in general, the text throughout the document has been modified to refer to "an approved long-term groundwater monitoring plan for GAFB."

Sections 2.9.1.4 and 2.9.2.7 discuss long-term monitoring and state that "sampling frequency and analyte selection may be modified as the program progresses."

d) Sites OT-51

The Remedial Investigation Report/OU 3 indicates that a Hydropunch sample (groundwater at SBS-25) contains benzene of 1,000 µg/L. GAFB should cite that additional contingency plans may be required in case implementation of oxygen release chemicals show little effect. A potential anaerobic state at the site would make ORC ineffective.

Response: *(Note: no comment "c" was received. The numbering system has been left unchanged to be consistent with the original comments submitted by the USEPA.)*

At the request of the RWQCB, the Draft Final ROD is written such that the use of oxygen-releasing chemicals (Alternative 11) is a contingency and natural attenuation is the final remedy (see Section 2.6.4.2). The text has been modified where appropriate to clarify this decision. Additionally, note that an anaerobic state is a condition under which the use of oxygen releasing chemicals would be considered.

Regarding HydroPunch® sampling, Section 2.6.1.5 documents in the Draft Final ROD that HydroPunch® samples were collected in borings SBS-25 and SBS-27. This information is further detailed in the OU 3 RI, finalized in April 1996. This document explains that HydroPunch® data is Level III (nondefinitive) and therefore is suitable for screening purposes only. The HydroPunch® samples were the basis for monitoring well placement.

Comment No. 2: **Section 2.7.1, Summary of Site OT-69 Characteristics and Risk Assessment, page 2-73.**

First paragraph, line 1: "Site OT-69 consists of the TCE and PCE groundwater contamination that was detected in the flight line and operations support facilities area."

Locations of TCE/PCE contaminated areas were not clear to the reader even though Figure 14 is referenced later in this paragraph. The ROD is a primary document and is meant to be stand-alone. GAFB should indicate the location of each TCE/PCE contaminated area in the text and provide a name for each area so that the reader may distinguish one from the other.

Response: Formal "names" for the plumes have not currently been identified. As agreed during the December 23, 1997 RPM Meeting, Figure 14 has been revised to show select affected wells to aid in plume identification.

Comment No. 3: **Section 2.7.4.2, Detailed Description of the Site OT-69 Preferred Alternative, page 2-84.**

a) **Line 3: "In addition, continued monitoring of the natural attenuation plume will be achieved through annual groundwater monitoring of approximately 10 wells"**

   The frequency of monitoring and number of wells should be deleted from ROD and be stated in a site-specific groundwater monitoring plan. GAFB should state that the site-specific groundwater monitoring plan will be developed to address monitoring details for OT-69.

Response: Agree. The text has been modified to remove "approximately 10 wells."

When referring to future long-term monitoring in general, the text throughout the document has been modified to refer to "an approved long-term groundwater monitoring plan for GAFB."

Sections 2.9.1.4 and 2.9.2.7 discuss long-term monitoring and state that "sampling frequency and analyte selection may be modified as the program progresses."

b) **The ROD should cite a contingency plan if TCE levels remain high at OT-69 (e.g., well MW-72). The contingency plan can be developed in the RD/RA document that should include the following: (1) which contaminated areas will be involved, (2) cite the predicted concentrations at each well, and (3) rationale for any active remedial actions. It is recommended that active remedial actions be taken when measured TCE concentrations**

is 50 percent higher than the predicted concentration (mean value).

Response: Agree. The text has been modified to state, "More active remedies would be considered as a contingency if the natural attenuation remedy is not restoring water quality in a timely manner. The criteria under which active remediation would be initiated at Site OT-69 were detailed in a memorandum prepared by IT which is included as Appendix B to this ROD (IT, 1995b). . . If it is determined that natural attenuation is not restoring water quality, more active remedies would be assessed as part of the 5-year review process and may include alternatives assessed as part of this ROD or additional new technologies that may become available."

RESPONSES TO DEPARTMENT OF TOXIC SUBSTANCES CONTROL COMMENTS DATED DECEMBER 2, 1997 ON THE NOVEMBER 1997 DRAFT FINAL RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

GENERAL COMMENTS

Comment No. 1: **The DTSC concurs with the Regional Water Quality Control Board, Lahontan Region, comments.**

Response: Comment noted.

Comment No. 2: **High quality analytical samples will be required in order to demonstrate that the remedial action objectives have been satisfied for all remedies.**

Response: Agree. The ROD identifies where analytical samples are proposed (i.e., long-term groundwater monitoring, confirmation samples for TPH/VOC sites).

SPECIFIC COMMENTS:

Comment No. 1: **Page 2-40, para. 3. The ROD must clearly specify in general terms that Operations and Maintenance (O&M) will be implemented as outlined in a regulatory agency approved plan.**

Response: As agreed during the December 23, 1997 RPM meeting, Section 2.5.4.2 has been modified to state that contingency plans will be described as necessary as part of the O&M documentation. Section 2.9.1.5 has been modified to state that "if instances of burrowing animal problems continue to persist, an appropriate contingency plan will be developed and presented in a subsequent O&M document."

In addition, Section 2.5.4.4 references ongoing O&M activities and Appendix C states that a Post-Closure Monitoring and Maintenance Plan will be developed for the OU 3 landfill sites.

Comment No. 2: **Page 2-52, para. 5. This section addressees groundwater protection levels as outlined in Figures 9 and 10. Two revisions must be made to this section:**

(a) **First, it must be made clear that these levels are purely for groundwater quality protection. This must be so indicated in the text and in the figures.**

(b) **Second, these levels appear to be unacceptable for human and ecological health. The risk, especially at the surface must be evaluated with a human and ecological health risk assessment based on high quality data points which are to be obtained when the remedies have run their course. This risk assessment must take into account all pathways and chemicals of potential concern.**

Ultimately any remedy which is not deemed by a regulatory agency to be protective is inadequate and must be further remedied.

Response: (a) Agree. The text has been modified accordingly.

(b) Agree. The remedy must be protective.

Comment No. 3: **Page 2-53, para. 2. The same comment as Page 2-52 above, applies to this paragraph.**

Response: See response to Comment 2.

Comment No. 4: **Page 2-67, para. 1. FT-19 groundwater does in fact have groundwater contaminated with TCE above regulatory thresholds. The agreement is to monitor nearby wells and take any necessary actions. The ROD should include language state that the groundwater monitoring plan which is implemented for FT-19 must meet all the remedial action objectives either per Operable Unit or on a basewide basis.**

Response: As discussed in Section 2.6.1.2, the TCE in the groundwater beneath FT-19 is part of OU 1. For this reason, it is not addressed in the OU 3 ROD.

Comment No. 5: **Page 2-69, para. 4, fifth bullet. The current bullet 5 spells out that soil or vapor samples will be obtained for confirmation purposes. Replace the word "or" with the word "and." Both are needed for site closure.**

Response: Agree. The text has been modified accordingly.

Comment No. 6: **Page 2-70, para. 1. The same comment as for page 2-69 above applies for sites WP-17. FT-19c and OT-51. In addition, the OT-51 groundwater site may require a contingency plan if the preferred alternative proves inadequate.**

Response: See Response to Specific Comment 5.

The text describing the selected remedy for OT-51 groundwater states that the remedy includes "implementation of oxygen releasing chemicals as a contingency if COPCs in groundwater do not decrease to water quality goals within a sufficient time frame." Section 2.9.2.4 goes into further detail by stating "If subsequent rounds of long-term monitoring do not continue to show the trend of decreasing levels of COPCs, the contingent remedy of installation of oxygen-releasing chemicals described for Alternative 11 (Section 2.6.2.6) will be implemented."

Comment No. 7: **Page 2-84, para. 3. The number of wells and the frequency of sampling should be established in an appropriate long term monitoring plan which addresses the remedial action objectives for each ROD or basewide. Please delete "approximately 10 wells."**

In addition, a contingency plan should be included for OT-69 should groundwater levels remain above action levels.

Response: Agree. The text has been modified to remove "approximately 10 wells."

Regarding the contingency plan for Site OT-69, as agreed during the December 23, 1997 RPM meeting, this comment has been addressed as follows:

1) The text in Section 2.9.2.5 and has been modified to state "the criteria under which active remediation would be initiated at Site OT-69 were detailed in a memorandum prepared by IT which is included as Appendix B to this ROD." This memorandum includes the plume maps and concentration predictions made in October 1995.

2) The text in quotations from the RWQCB's Specific Comment 3 has been included in Section 2.9.2.5.

3) The "Criteria for evaluating data" and "Financial assurances" sections of IT's November 1995 memorandum have been summarized in Section 2.9.2.5.

Comment No. 8: **Page 2-89, para. 7. The discussion of the agreed upon remedy for OT-69 is incomplete. The section is missing a summary of the International Technology Memorandum dated November 6, 1995 which spells out the detailed methodology from passive monitoring to active remedy. The ROD must include this information.**

In addition, the ROD must include the specific land use prohibitions regarding the placement of water production wells in the upper aquifer in the vicinity of the flightline. These land use prohibitions must be agreed to and approved by the governing regulatory agencies. The release from such prohibitions must be agreed to, in writing by the Department of Toxic Substances Control or the Lahontan Regional Water Quality Control Board.

Response: See response to Specific Comment 7.

Regarding land use restrictions, Section 2.7.4.2 (Detailed Description of the Site OT-69 Preferred Alternative) states that the remedy will "include land use restrictions prohibiting installation of wells for domestic purposes in the affected aquifer and deed restrictions prohibiting use of contaminated water." In addition, Section 2.7.4.2 refers the reader to Section 2.9.2.5 for further detail.

RESPONSES TO LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD COMMENTS DATED DECEMBER 3, 1997 ON THE NOVEMBER 1997 DRAFT FINAL RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

SPECIFIC COMMENTS

Comment No. 1: **Page 1-2, Section 1.4, Description of Selected Remedies. Please delete the phrase "the USAF, the USEPA, and the Sate of California have determined." Section 1.2 of the ROD states that the State of California concurs with the remedy. The role of the State is to concur with, not approve, the selected remedy. The statement that the State "determined" a final remedy would suggest that the State is making a discretionary decision subject to the California Environmental Quality Act.**

Response: Agree. The text has been modified to state that the USAF has determined the final action with the concurrence of the regulatory agencies.

Comment No. 2: **Page 2-53, Section 2.6.2, Description of TPH/VOC Site Alternatives. Please change the last sentence of the paragraph on this page as follows. "Prior to closure of a TPH/VOC site for which a remedy has been implemented, confirmation samples (soil or vapor [to estimate soil concentrations]) would be collected as necessary to demonstrate that *no further impact to groundwater remains using the soil levels presented in Figure 9 and 10 as a goal* ~~soil cleanup levels present on Figure 9 are achieved.~~" As indicated in the prior sentence, site closure is dependent on threat to water quality and the numerical levels shown in the figures are a goal to meet the cleanup objective.**

Response: As agreed during the December 23, 1997 RPM meeting, the text has been modified as follows: "Prior to closure of a TPH/VOC site for which a remedy has been implemented, confirmation samples (soil and vapor) would be collected as necessary to demonstrate that soil cleanup levels presented on Figures 9 and 10 are achieved. If contamination remaining in soil can be demonstrated to have no impact to groundwater quality, concentrations remaining in soil may exceed the numerical values presented in Figures 9 and 10, and the site may be considered for closure."

Comment No. 3: **Page 2-89, Section 2.9.2.5, Site OT-69. The discussion of the remedy agreed to by the Regional Board is incomplete and does**

not reference the active contingent remedy spelled out in the November 6, 1995 Memorandum prepared by IT Corp, on behalf of the Air Force. The ROD must clearly indicate the scope of the Site OT-69 remedy agreed to the Regional Board. The ROD should include the following language:

"The monitoring and response plan proposed by the Air Force was developed based upon computer modeling simulations that estimate specific future concentrations in particular wells projecting that water quality objectives will be restored in about 50 years. If the expected reductions do not occur in the projected time frame, plus or minus 15% of the projected concentration, then the data will be evaluated. If the data are less than 2 standard deviations of the projected concentrations then monitoring may continue. If the data are greater than two standard deviations, then the wells will be resampled and the data re-evaluated. If the data are still greater than two standard deviations of the original projected concentrations, then an active remedy consisting of Air Sparging with Soil Vapor Extraction will be implemented or the agencies will reach consensus regarding a technical decision for implementing some other appropriate active remedy. The ROD will be amended at that time to specify the ARARs for the contingent remedy."

In addition, the ROD must include a map of the plumes and tables with predicted TCE concentrations in selected wells. The tables must clearly indicate that projected future concentrations are based upon data collected in the summer of 1995 and the time projections were made in October 1995 as a reference date. The monitoring frequency and specific wells may vary as determined by remedial project managers.

The ROD must specifically indicate that the Air Force will provide for land use prohibitions regarding the placement of water production wells in the upper aquifer in the vicinity of the flightline. Such land use restrictions must be included in any parcel, lease or deed and recorded with the County. The specific language contained in the site parcel lease or deed restriction must be reviewed and approved by the regulatory agencies. The ROD must indicate that a Well Exclusion Zone, administered by San Bernardino County will be considered and implemented, if feasible. The State Department of Toxic Substances Control or Regional Water Quality Control Board, Lahontan Region must

approve removal of the deed restriction. Further, the ROD must include the Federal Certification of ensuring that financial resources will be obtained to implement the active contingent remedy. Refer to 22250, Title 27, Cal. Code of Regs for the requirements of Federal Certification.

Response: As agreed during the December 23, 1997 RPM meeting, this comment has been addressed as follows:

1) The text in Section 2.9.2.5 has been modified to state "the criteria under which active remediation would be initiated at Site OT-69 were detailed in a memorandum prepared by IT which is included as Appendix B to this ROD." This memorandum includes the requested plume maps and concentration predictions made in October 1995.

2) The text in quotations (with revision for consistency and clarity) has been included in Section 2.9.2.5.

3) The "Criteria for evaluating data" and "Financial assurances" sections of IT's November 1995 memorandum have been summarized in Section 2.9.2.5.

4) Regarding land use restrictions, Section 2.7.4.2 (Detailed Description of the Site OT-69 Preferred Alternative) states that the remedy will "include land use restrictions prohibiting installation of wells for domestic purposes in the affected aquifer and deed restrictions prohibiting use of contaminated water." In addition, Sections 2.7.4.2 refers the reader to Section 2.9.2.5 for further detail.

Comment No. 4: **Table 4, ARARs for GAFB OU 3 Landfill Sites, DP-03, DP-04, LF-12, LF-14 and the SEDA. Board staff previously indicated to the Air Force that Title 27, Cal. Code of Regs was recently adopted to replace portions of Titles 14 and 23, Cal. Code of Regs. The appropriate new section numbers should be cited in this table. Otherwise, the following footnote should be placed at the end of the table and flagged. "These sections of Title 14 Cal. Code of Regs and Title 23 Cal. Code of Regs have been recodified into Title 27 Cal. Code of Regs. See Title 27 Cal. Code of Regs for the new equivalent section numbers that apply."**

Response: The above footnote has been added to Table 4 (on page 10 of 10) with minor revision for consistency and clarity.

RESPONSES TO RWQCB DECEMBER 3, 1997 COMMENTS (Continued)

Comment No. 5: **Table 15, page 1 of 9, fourth item [SWRCB Resolution 92-49]. Please delete the last sentence in the description which states "In a separate forum, the Department of Defense (DoD), USEPA Region IX, and the State are attempting to globally resolve the ARAR status of SWRCB Resolution 92-49, including Section III.G, for all DoD sites within the State." Board staff understand that there are no current efforts in progress, or planned, to resolve the ARAR status of SWRCB Resolution 92-49.**

Response: The table has been modified accordingly.

Comment No. 6: **Table 15, page 6 of 9, second item [NPDES Stormwater Program]. Please include the following sentence after the existing sentence in the description column. "To comply with this requirement, the Air Force must comply with the requirements contained in the State General Industrial Storm Water Permit (Order No. 91-13-DWQ, as amended by Order No. 92-12-DWQ, NPDES No. CAS000001)." The State administers the federal NPDES stormwater program.**

Response: The table has been modified accordingly.

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RESPONSES TO USEPA COMMENTS DATED FEBRUARY 2, 1998 ON THE NOVEMBER 1997 DRAFT FINAL RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

Comment No. 1: **Pages 2-37 and 2-65, Selected Remedies. The DF ROD is presented more like a FS rather than a decision document. The reader cannot easily identify the selected remedy for each site, the main purpose of a ROD. Accordingly, the ROD should clearly document the selected remedy along with the estimated cleanup time for sites in active remediation. Sites that have already been remediated should show the dates of their completion.**

Response: The presentation of the OU 3 ROD is consistent with the USEPA's "A Guide to Developing Superfund Records of Decision" (dated May 1990, Directive: 9335.3-02FS-1). In accordance with this guidance document, the elements of the FS are summarized (i.e, summary of site characteristics and risks, descriptions of alternatives, comparative analysis of alternatives using the nine CERCLA criteria, and the selected remedy). This guidance document is now cited in Section 1.2.

Statements have been added to Sections 2.5.4 and 2.6.4 explicitly stating the "selected remedy" for each site and the estimated duration of cleanup or date of remediation completion.

The selected remedies for OU 3 sites are also identified in other places in the document as follows: 1) Table 1 summarizes all 60 OU 3 sites and identifies the selected remedy, and 2) Section 2.9 summarizes the current site status and presents the action that has occurred, dates that remedial action was performed, and dates of completion (where applicable).

Comment No. 2: **Pages 2-40/41/69/70, various OU 3 sites. The revised land use comment developed during the December 22, 1997 meeting, "implementation of access and land use restrictions such as preventing construction activities that would impair the integrity of the existing cover," is a good start, but still falls short of meeting CERCLA and DoD requirements. The Under Secretary of Defense's memorandum of July 25, 1997 (re: land use), which outlined CERCLA requirements, requires the following specific land use language in the ROD:**

- **Identify future land use assumptions or objectives.**

- **Specify land use restrictions and how they will be enforced (e.g., deed restrictions, easements, inspection/monitoring, zoning, etc.). Potential deed restrictions should also be documented (e.g., no residential use, no groundwater use for drinking, etc.). Refer to our December 5th letter for more guidance.**

Response

The purpose of the meeting held on December 23, 1997 during which the OU 3 ROD was discussed was to agree to the final language that would be acceptable to all agency RPMs. During that meeting, the comments from the USEPA's letter dated December 5, 1997 were read and specific language to address each comment was developed.

In addition to the language agreed upon during the December 23, 1997 meeting, the text in the above referenced sections has been modified to include language suggested by the USEPA in subsequent telephone conversations with the USAF. This includes notations that signage will be posted on the fences at the landfills warning against unauthorized vehicular traffic, restricting access to equipment at the TPH/VOC sites, and preventing installation of monitoring or injection wells accept for environmental purposes at the landfill and TPH/VOC sites.

Comment No. 3:

Page 2-88, Ecological Monitoring Plan.

- **Because of desert tortoise habitat identified in a 1990 survey, GAFB should coordinate Section 7 consultation with the U.S. Fish and Wildlife Service, and the State Fish and Game, to develop a sound ecological monitoring plan.**

- **Section 2.9.1.5, 3rd paragraph, last sentence: "If the burrows are constructed by species common to the area,...condition." This seems to imply that burrows made by species not common to the area would not be repaired. Accordingly, the section, "constructed by species common" should be deleted and replaced with "If burrows are found in the area, the burrows...condition."**

- **A three month lapse time is not responsive in maintaining landfill cap integrity for burrowing problems. Burrows in the cap should be repaired as soon as possible to minimize ecological risk problems.**

Response:

- The ecological monitoring plan will be included as part of separate remedial action documentation. Appendix C of the Draft Final

RESPONSES TO USEPA FEBRUARY 2, 1998 COMMENTS (Continued)

ROD identifies the action items to meet ROD requirements, which included developing an OU 3 Landfill Post-Closure Maintenance and Monitoring Plan.

- Details regarding the ecological monitoring plan will be presented in the OU 3 Landfill Post-Closure Maintenance and Monitoring Plan discussed above.

- The text as written indicates that minor repairs may be implemented in 30 days. Additional details regarding the ecological monitoring plan will be presented in the OU 3 Landfill Post-Closure Maintenance and Monitoring Plan discussed above.

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TAB

Appendix F

APPENDIX F

RESPONSES TO AGENCY COMMENTS TO FEBRUARY 1998 DRAFT FINAL ROD

RESPONSES TO LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD COMMENTS DATED MARCH 24, 1998 ON THE FEBRUARY 1998 DRAFT FINAL RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

SPECIFIC COMMENTS

Comment No. 1: **Table 15, Title 27 Cal. Code of Regs (CCR) - Board staff indicated that the note added to Table 4, also applies to Table 15. That note states: "Sections of Title 14 CCR and Title 23 CCR have been recodified into Title 27 CCR. See Title 27 CCR for the new equivalent numbers that apply." Please include this statement at the end of Table 15 or indicate the correct Title 27 section numbers in Table 15.**

Response: The statement previously included on Table 4 has been added to Table 15.

Comment No. 2: **Tables 4 and 15, Footnote versus Note - The above referenced statement was added to Table 4 as a "Note". Board staff strongly believe that this statement should be included to Table 4 (and 15) as a referenced footnote, to provide the proper emphasis. This is because the current state standards are not as indicated in the table. Title 23 currently only applies to hazardous waste. Board staff provided the option of including the footnote rather than revising the table (as preferred) to minimize the time spent in finalizing this document. Please include the above statement as a footnote rather than a note.**

Response: The language previously included as a "Note" has been referenced with a superscript "a" in the "Standard, Requirement, Criterion, or Limitation" column of Tables 4 and 15 to reference the footnote identified with a superscript "a" on the last page of the table.

Comment No. 3: **Table 15, Inclusion of State Ground Water Standards for Cleanup (Concentration Limits) - When the Applicable or Relevant and Appropriate Requirements (ARAR) were negotiated between the legal staff of the respective parties to the Federal Facilities Agreement (FFA), Operable Unit Three did not contain Site OT-69 (Small solvent plumes selected for natural attenuation). Subsequent to the development of the ARAR tables, Site OT-69 was included with OU-3. Therefore, Section 2550.4 (Concentration Limits) must be added to Table 15. The correct citation should be Title 27, § 20400. Please include reference to**

RESPONSES TO RWQCB MARCH 24, 1998 COMMENTS (Continued)

this section in Table 15.

Response: The primary meeting to negotiate ARARs was held on August 20, 1996 at the USEPA offices in San Francisco, California. At that meeting, Section 2550.4 was deleted from the ARARs list for the TPH/VOC sites and agreed to by all parties. Site OT-69 was part of the discussion regarding the TPH/VOC sites.

RESPONSES TO UNITED STATES ENVIRONMENTAL PROTECTION AGENCY COMMENTS DATED MARCH 19, 1998 ON THE FEBRUARY 1998 DRAFT FINAL RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

SPECIFIC COMMENTS

Comment No. 1: **In Section 2.9.1.5., Ecological Monitoring For the Landfill Areas, 3rd paragraph, the next-to-last sentence states: "If the burrows are constructed by species common to the area, the burrows will be filled with native soil materials to restore the soil cover to its original condition." This appears to mean that burrows will not be repaired if the burrowing species are not common to the area. When EPA questioned this language during the RPM meeting, apparently inconsistent explanations were provided by representatives of Montgomery Watson, to the effect that all burrows would be filled, and/or that burrows used by special-status species (such as burrowing owls or desert tortoises) would not be filled. The section should be rewritten to make clear what is intended. EPA's position is that all burrows should be filled.**

Response: The text has been modified accordingly.

Comment No. 2: **In Section 2.9.1.5, 3rd paragraph, the last sentence should be revised to specify that George AFB will coordinate with the State Department of Fish and Game and the U.S. Fish and Wildlife Service to develop the ecological monitoring plan as part of the Operations and Maintenance document.**

Response: The text has been modified accordingly.

Comment No. 3: **In Section 2.9.1.5, 4th paragraph, EPA believes that a three-month lapse time is not responsive in maintaining landfill cap integrity for burrowing problems. Burrows in the cap should be repaired as soon as possible, when discovered during the scheduled landfill inspections, to minimize ecological risks to burrowing mammals.**

Response: The text has been modified accordingly.

RESPONSES TO UNITED STATES ENVIRONMENTAL PROTECTION AGENCY COMMENTS DATED MARCH 26, 1998 ON THE FEBRUARY 1998 DRAFT FINAL RECORD OF DECISION FOR OPERABLE UNIT 3 SITES GEORGE AIR FORCE BASE, CALIFORNIA

SPECIFIC COMMENTS

Comment No. 1: **2.9.1.5., 3rd paragraph, page 2-106: delete the following in its entirety; "If burrows are observed, the animals . . . O&M document."**

Replacement language: "The Air Force will consult with the State Department of Fish and Game to develop a burrows management protocol for the O&M document. A contingency plan for recurring burrow problems and the specific details of the ecological monitoring plan will be presented in the subsequent O&M document."

Response: The text has been modified accordingly.

Comment No. 2: **2.9.1.5, 4th paragraph, page 2-107: delete the following in its entirety; "An effort will be made to make repairs within 3 months of the maintenance inspection, when possible."**

Replacement language: "An effort will be made to make revegetative repairs as soon as it is practical based on seasonal timing."

Response: The text has been modified accordingly.

FINAL PAGE

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