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Phase II RCRA Facility Investigation Report

Table 1 Solid Waste Management Units

Volume I

June 1997



*49 CES/CEV
Holloman Air Force Base,
New Mexico*

PURPOSE OF DOCUMENT

- A. This Phase II Resource Conservation and Recovery Act (RCRA) facility investigation report documents the investigation of seven solid waste management units (SWMUs) and two areas of concern (AOCs) on Table 1 of Holloman Air Force Base's (AFB's) Hazardous and Solid Waste Amendments permit. This document was prepared for, and in cooperation with, the Base Environmental Office: 49 CES/CEV, 550 Tabosa Avenue, Holloman AFB, NM, 505/479-3931.
- B. Information contained in the report will be used to support the RCRA corrective action program and was also prepared to comply with the Installation Restoration Program.
- C. The primary objective of the investigation was to address the concerns of the U.S. Environmental Protection Agency and the New Mexico Environment Department pertaining to these SWMUs and AOCs.
- D. The report describes the regulatory framework and environmental setting; contains data evaluation criteria; and presents results, conclusions, and recommendations for each SWMU and AOC.
- E. Site closure (no further action), conditional site closure (conditional no further action), or voluntary corrective action is recommended for each of the SWMUs and AOCs. Recommendations are based on results of the remedial investigation.



Final

PHASE II RCRA FACILITY INVESTIGATION REPORT

**TABLE 1 SOLID WASTE MANAGEMENT UNITS
HOLLOMAN AIR FORCE BASE, NM**

VOLUME I

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

and

HQ ACC/CEVR
Langley Air Force Base, VA

Prepared by:

Foster Wheeler Environmental Corporation
143 Union Blvd., Suite 1010
Lakewood, Colorado 80203
303/988-2202

Radian Corporation
8501 North Mopac Blvd.
Austin, Texas 78720
512/454-4797

Under Contract No. DACW45-94-D-0003, DO No. 02, WAD 03 with:

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

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LIST OF ACRONYMS

AFB	Air Force Base
AOC	Area of concern
bgl	Below ground level
BTEX	Benzene, toluene, ethyl benzene, xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMI	Corrective measures implementation
CMS	Corrective measures study
CNFA	Conditional no further action
COC	Chemical of concern
COPC	Chemical of potential concern
DCA	1,2-dichloroethane
DD	Decision document
DL	Detection Limit
DPT	Direct push technology
EM	Electromagnetic
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
FS/CMS	Feasibility study/corrective measures study
FTA	Fire Training Area
HHSs	Human health standards
HQ-ACC	Headquarters-Air Combat Command
HSWA	Hazardous and Solid Waste Amendments
IRP	Installation Restoration Program
ITIR	Informal Technical Information Report
LNAPL	Liquid nonaqueous phase liquid
MIBK	4-methyl 2-pentanone
MS	Matrix spike
NCP	National Contingency Plan
NFA	No further action
NMED	New Mexico Environment Department

LIST OF ACRONYMS (Continued)

O/WS	Oil/water separator
POL	Petroleum, oil, and lubricants
QAPP	Quality assurance project plan
QA/QC	Quality assurance/quality control
RA	Remedial Action
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RLs	Reporting limits
RI	Remedial investigation
SARA	Superfund Amendments and Reauthorization Act
SC/NFA	Site closeout/no further action
SQCSR	Sampling quality control summary report
SVOCs	Semivolatile organic compounds
SWMUs	Solid waste management units
TDS	Total dissolved solids
TOX	Total organic halogens
TRPH	Total recoverable petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
UST	Underground storage tank
UTL	Upper tolerance limit
VCA	Voluntary corrective action
VOCs	Volatile organic compound

Section 1 INTRODUCTION

This report documents the results of a Phase II Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) of solid waste management units (SWMUs) and areas of concern (AOCs) at Holloman Air Force Base (AFB), New Mexico. The SWMUs and AOCs are a subset of those listed on Table 1 of Holloman AFB's federal Hazardous and Solid Waste Amendments (HSWA) permit.

1.1 Regulatory Framework

Since 1987, Holloman AFB has actively conducted an environmental restoration program. Initially the program was managed under the Air Force's Installation Restoration Program (IRP) but was integrated with the U.S. Environmental Protection Agency's (EPA's) RCRA corrective action program in 1991. A summary of the integration and how it applies to this investigation is provided below.

1.1.1 Installation Restoration Program

In 1983, Holloman AFB entered into the Air Force's IRP by conducting the *IRP Phase I Records Search* (CH2M Hill, 1983) that identified 41 sites. The IRP is a phased investigation and remediation program that follows the protocols of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the statutory amendments to CERCLA (the Superfund Amendments and Reauthorization Act [SARA]) requiring that federal facilities comply with the National Contingency Plan. Since 1987, Holloman AFB has been actively implementing their IRP program through remedial investigations (RIs), feasibility studies (FSs), and remedial actions.

1.1.2 RCRA Corrective Action Program

In September 1991, EPA Region VI

issued Holloman AFB the HSWA portion of their RCRA operating permit. The HSWA portions of the permit required that sites identified by the EPA during a 1987 RCRA facility assessment (RFA) be included in an RFI. The HSWA permit divided the Base's 113 SWMUs into three separate tables on the basis of their perceived risk to human health and the environment. The SWMUs believed to have the highest potential for risk were included on Table 1 of the HSWA permit; SWMUs believed to have less potential for risk were placed on Tables 2 and 3. Each Table has a schedule for implementing an RFI.

1.1.3 Program Integration

As appropriate, the Base must comply with the IRP and RCRA corrective action program. Both are similarly phased and ultimately intended to ensure that contaminated sites that pose a threat to human health or the environment are remediated. Figure 1-1 presents a simplified comparison of the two programs, and is included because terminology from both programs are referenced and used in this report.

In the preamble to the proposed RCRA Subpart S regulations, the EPA encourages coordination between the two independent programs. Since its HSWA permit was issued, Holloman AFB has integrated the two programs to reduce duplicative efforts. This approach has been embraced by EPA Region VI and the New Mexico Environment Department (NMED).

The IRP began prior to the RCRA corrective action program at Holloman AFB; therefore, many of the investigation activities for the RCRA corrective action program have been completed under the IRP. Because the two programs did not begin concurrently, the

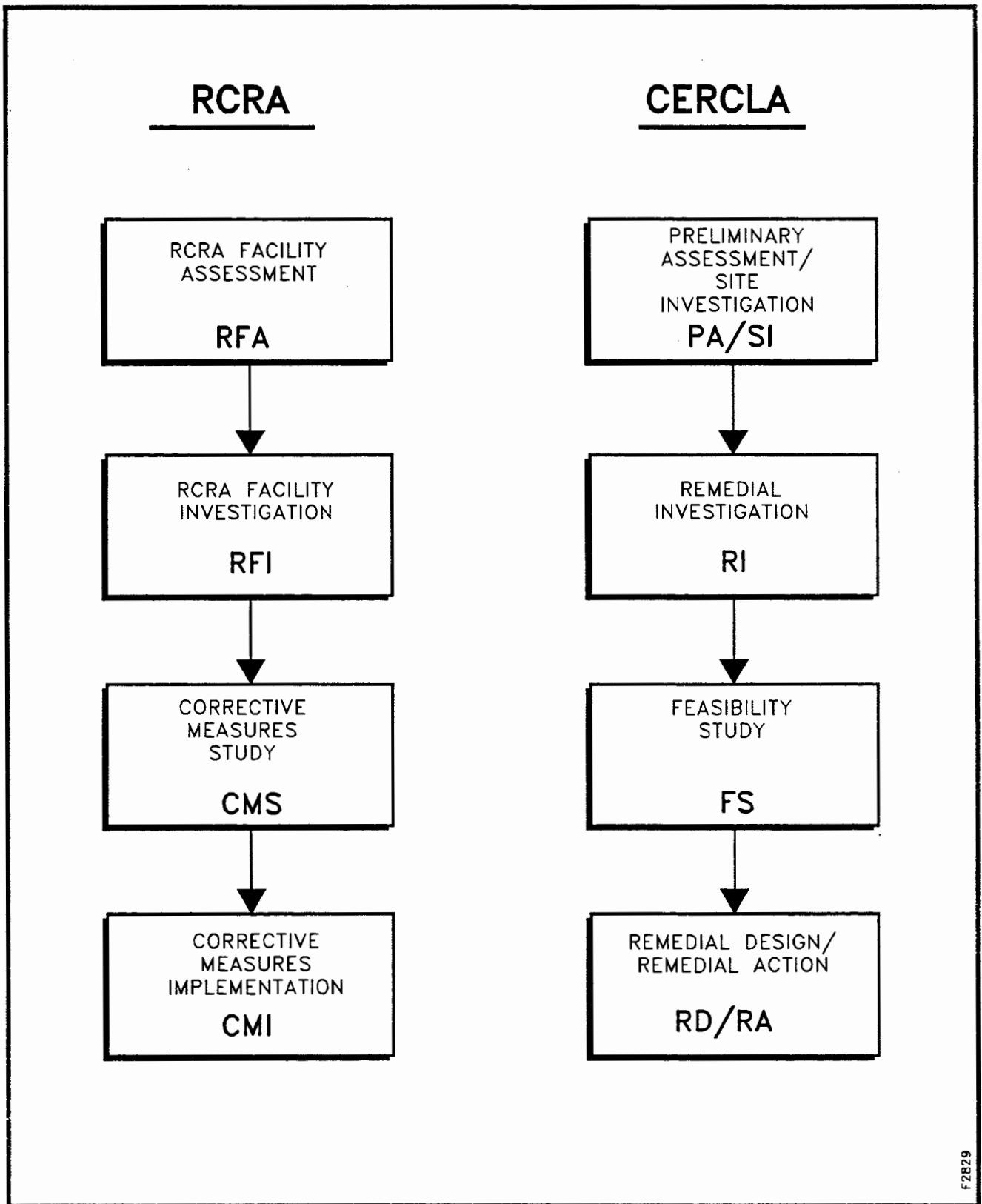


Figure 1-1. Comparison of RCRA Corrective Action Program and IRP Phases

terminology used for the IRP and the RCRA corrective action program varies depending on the time of the investigation and how the program was funded by the Department of Defense. Following are some of the issues that may cause some confusion between the two programs:

- Similar phases of the RCRA corrective action program and IRP have unique names and have both been used (i.e., RI vs. RFI).
- IRP sites and RCRA SWMUs have unique names and unique numerical or alphanumeric identifications. Both are provided initially in this report, but the SWMU name and identification will be used subsequently.
- Some IRP sites consist of multiple SWMUs, some of which are on different Tables in the HSWA permit. Holloman AFB made efforts to rectify this through Class I permit modifications, but some SWMUs still remain on separate Tables although they constitute only one IRP site. For example, IRP Site 31, the Fire Training Area (FTA), contains five SWMUs; two SWMUs are on Table 1 of the permit and three are on Table 2 of the permit.

Efforts are made in this report to clarify the history and terminology. All activities associated with this investigation and report are cited using the RCRA terminology.

1.2 Phase I Activities

Table 1 of the HSWA permit consists of 36 SWMUs, most of which are also IRP sites. The IRP sites and SWMUs have been investigated over several years and in many separate projects. Below is a summary of the reports that have addressed past investigations for the Table 1 SWMUs.

- Dames and Moore (1987)—*Confirmation/Quantification, Stage 1 Investigation for Holloman AFB, NM* (referred to herein as the *1987 Confirmation Investigation*).
- Walk, Haydel, and Associates (1989a)—*Baseline Risk Assessment for Holloman AFB, NM* (referred to herein as the *1989 RA*).
- Walk, Haydel, and Associates (1989b)—*Remedial Investigation (RI) Report, Holloman AFB, NM* (referred to herein as the *1989 RI*).
- Radian Corporation (1992b)—*Remedial Investigation (RI) Report—Investigation, Study, and Recommendation for 29 Waste Sites* (referred to herein as the *29 Sites RI*).
- Radian Corporation (1992c)—*Risk Assessment (RA) Report for the Remedial Investigation—Investigation, Study, and Recommendation for 29 Waste Sites* (referred to herein as the *29 Sites RA*).

These investigations are considered to be the Phase I activities for the IRP and RCRA corrective action program. Table 1-1 summarizes activities that were conducted at the SWMUs in order to meet Phase I requirements.

1.2.1 1987 Confirmation and 1989 RI Reports

In 1987, Holloman AFB conducted the 1987 confirmation investigation to confirm the presence of contamination at two sites identified during the 1983 IRP records search and five sites that were identified afterward. Included in these seven sites were the FTA (FT-31) and AOC-P (OT-44). Subsequently, these seven sites were included in the 1989 RI and 1989 RA to determine the source, nature, extent, and potential risk posed by the contamination found during the 1987 investigation.

**Table 1-1
Investigation Activities at Table 1 SWMUs**

SWMU	IRP Site	Preliminary Assessment	Phase I Activities			Phase II Activities		
		1983 IRP Records Search ^a	1987 Confirmation Investigation ^b	1989 RI ^c	1992 29 Sites RI ^d	1993 Predesign Investigation ^e	1994 Table 2 RFI ^f	1995 Table 1 Phase II RFI ^g
82	SD-08	X			X	X		X
102	OT-04	X			X			X
104	LF-29	X			X			X
132, AOC-A	OT-16 ¹	X			X		X	X
134	OT-24	X			X			X
FTA ²	FT-31	X	X	X			X	X
165, 179	OT-39 ³	X			X		X	
178	OT-36 ⁴	X			X		X	
197	OT-14	X			X			X
AOC-P	OT-44		X	X				X
AOC-T	SS-02 & SS-05	X			X	X		X

¹ IRP Site OT-16 also contains one Table 2 SWMU (118).

² The FTA (Fire Training Area) consists of two Table 1 SWMUs (170 and 171) and three Table 2 SWMUs (39, 127, and 135).

³ IRP Site OT-39 also contains two Table 2 SWMUs (177 and 181).

⁴ IRP Site OT-36 also contains one Table 2 SWMU (129).

^a The 1983 *IRP Phase I Records Search* (CH2M Hill, 1983) was conducted to identify sites that may have been adversely impacted by past site activities.

^b The 1987 *Confirmation/Quantification, Stage I Investigation Report* (Dames and Moore, 1987) conducted to determine the presence or absence of contamination at two sites identified during the 1983 *IRP Phase I Records Search* and five sites identified subsequent to the records search.

^c The 1989 *Remedial Investigation (RI) Report* (Walk, Haydel, and Associates, 1989b) investigated the source and nature of contamination detected during the 1987 *Confirmation/Quantification, Stage I Investigation*. A risk assessment was conducted to determine the risks posed by the contaminants at each site.

^d The 1992 *Remedial Investigation (RI) Report* (Radian, 1992b) determined the presence or absence of contamination at 29 IRP sites listed on Table 1 of the HSWA permit and the report also fulfilled the requirements of the Phase I RFI. Risk to human health and the environment posed by contamination (if present) was also evaluated during the investigation.

^e The predesign investigation was conducted as part of the 1993 *Feasibility Study—Investigation Study, and Recommendations for 29 Waste Sites* (Radian, 1993b) of the sites recommended for remedial action in the 1992 *29 Sites RI*. The 1993 predesign investigation determined the source and lateral extent of soil contamination exceeding the remedial action objectives (RAOs) established during the 1992 *CMS* (Radian, 1992a).

^f The 1994 *Table 2 RCRA Facility Investigation (RFI)* (Radian, 1994a) consisted of a field investigation of SWMUs listed on Table 2 of the HSWA permit. Due to its proximity to several Table 2 SWMUs, SWMU 132 was included in this investigation.

^g The 1995 *Table 1 Phase II RCRA Facility Investigation (RFI)* (Radian, 1995) was conducted to address EPA Region VI comments on the previous studies of SWMUs listed on Table 1 of the HSWA permit.

On the basis of the investigations, Holloman AFB prepared decision documents (DDs) in order to close some of the Phase I sites, including the FTA and AOC-P. However, NMED requested further investigation to 1) confirm that concentrations of total recoverable petroleum hydrocarbons (TRPH) at the FTA and AOC-P were less than the action level and 2) to define the extent of groundwater contamination at the FTA.

1.2.2 Investigation, Study, and Recommendation for 29 Waste Sites

In 1991 and 1992, Holloman AFB conducted an RI for 29 IRP sites. The objective of this investigation was to determine presence or absence of contamination and evaluate the potential risk to human health or the environment. The results are reported in the *29 Sites RI* (Radian, 1992b) and the *29 Sites RA* (Radian, 1992c). The investigation included most of the sites on Table 1 of the HSWA permit.

1.2.3 Results of Phase I Activities

On the basis of the RA and Phase I RI activities, recommendations were made. The recommendations ranged from site closeout/no further action (SC/NFA) to conducting a feasibility study/corrective measures study (FS/CMS). EPA Region VI and NMED reviewed the reports, as appropriate, and provided comments, direction, and requirements for future actions at each SWMU, which are summarized in Table 1-2. Some SWMUs required further investigation to adequately characterize the site. Comments from EPA Region VI (see Appendix C) were provided to Holloman AFB in a letter dated 3 November 1992.

In response to agency concerns, Holloman AFB prepared the *RCRA Phase II Facility Investigation Work Plan, Table 1 Solid Waste Management Units (Phase II Work Plan)* (Holloman AFB, 1993). This work plan was approved by EPA Region VI on 25 January 1994 in a letter from

Allyn M. Davis to Howard E. Moffit (Appendix C). The *Draft RFI Report* was required to be submitted to EPA Region VI by 25 April 1995, but Holloman AFB requested and received an extension. The revised submittal date is 23 June 1995.

1.3 Phase II Activities

Implementation of the Phase II activities to address the regulatory agency concerns has been completed though several separate events based on the timing of other investigative activities such as an FS/CMS and the RFI for Table 2 SWMUs. Table 1-1 summarizes the Phase II SWMUs and the various investigations.

The SWMUs included in this report are those that need additional investigation to address EPA Region VI concerns and to implement site recommendations for the Table 1 SWMUs. Table 1-3 lists these SWMUs and Figure 1-2 shows the location of each.

Five Table 1 Phase II SWMUs (132, 165, 178, 179, and AOC-A) were investigated as part of the Table 2 RFI. The results are not presented in this report but are contained in the *Phase I RCRA Facility Investigation Report, Table 2 Solid Waste Management Units* (Radian, 1994a).

1.3.1 Phase II Objectives

The overall objective of the Phase II activities was to resolve regulatory agency concerns regarding the data collected for each SWMU during Phase I activities. The SWMU-specific data objectives are presented in Section 3.

1.3.2 Phase II Activities Summary

The SWMU-specific data objectives were used to focus the Phase II RFI and considerable thought was invested in determining the optimum approach. As a result, a variety of investigation methods and techniques were employed to collect the necessary data. These are summarized in the approved Phase II RFI work plan.

**Table 1-2
Regulatory Agency Comments Regarding the Table 1 Phase II SWMUs**

SWMU	IRP Site	Regulatory Comments
82	SD-08	1) Install additional soil borings to define the extent of soil contamination around the northwestern perimeter of the wash-rack. 2) Install additional monitor wells to delineate the full extent of organochlorine pesticide contamination in the groundwater. 3) Define the source and extent of volatile organic compounds in MW-08-01. 4) Notify EPA of newly identified SWMU(s) and associated releases.
102	OT-04	1) Determine whether a release has occurred. 2) Submit plan to conduct removal action/interim measure.
104	LF-29	1) Install additional monitor wells to provide adequate flow path coverage or install soil borings to determine contamination.
132, AOC-A	OT-16 ¹	1) Determine full extent of organochlorine pesticide contamination in groundwater. 2) Determine full extent of organochlorine pesticide contamination in soil.
134	OT-24	1) Conduct periodic groundwater monitoring to verify VOC contamination in the two monitor wells.
FTA ²	FT-31	1) NMED requested confirmation that TRPH concentrations in soils did not exceed 1000 mg/kg. 2) Extent of groundwater has not been delineated.
165, 179	OT-39 ³	1) Determine vertical extent of contamination in soil. 2) Determine extent of contamination in groundwater.
178	OT-36 ⁴	1) Install additional monitor wells to provide adequate flow path coverage or install soil borings to determine contamination.
197	OT-14	1) Clarify recommended further actions to reduce unacceptable risk to on-site workers.
AOC-T	SS-02 & SS-05	1) Identify the source of soil and groundwater contamination. 2) Determine full extent of groundwater contamination.
AOC-P	OT-44	1) NMED requested confirmation that TRPH concentrations in soils did not exceed 1000 mg/kg.

¹ IRP Site OT-16 also contains one Table 2 SWMU (118).

² The FTA (Fire Training Area) consists of two Table 1 SWMUs (170 and 171) and three Table 2 SWMUs (39, 127, and 135).

³ IRP Site OT-39 also contains two Table 2 SWMUs (177 and 181).

⁴ IRP Site OT-36 also contains one Table 2 SWMU (129).

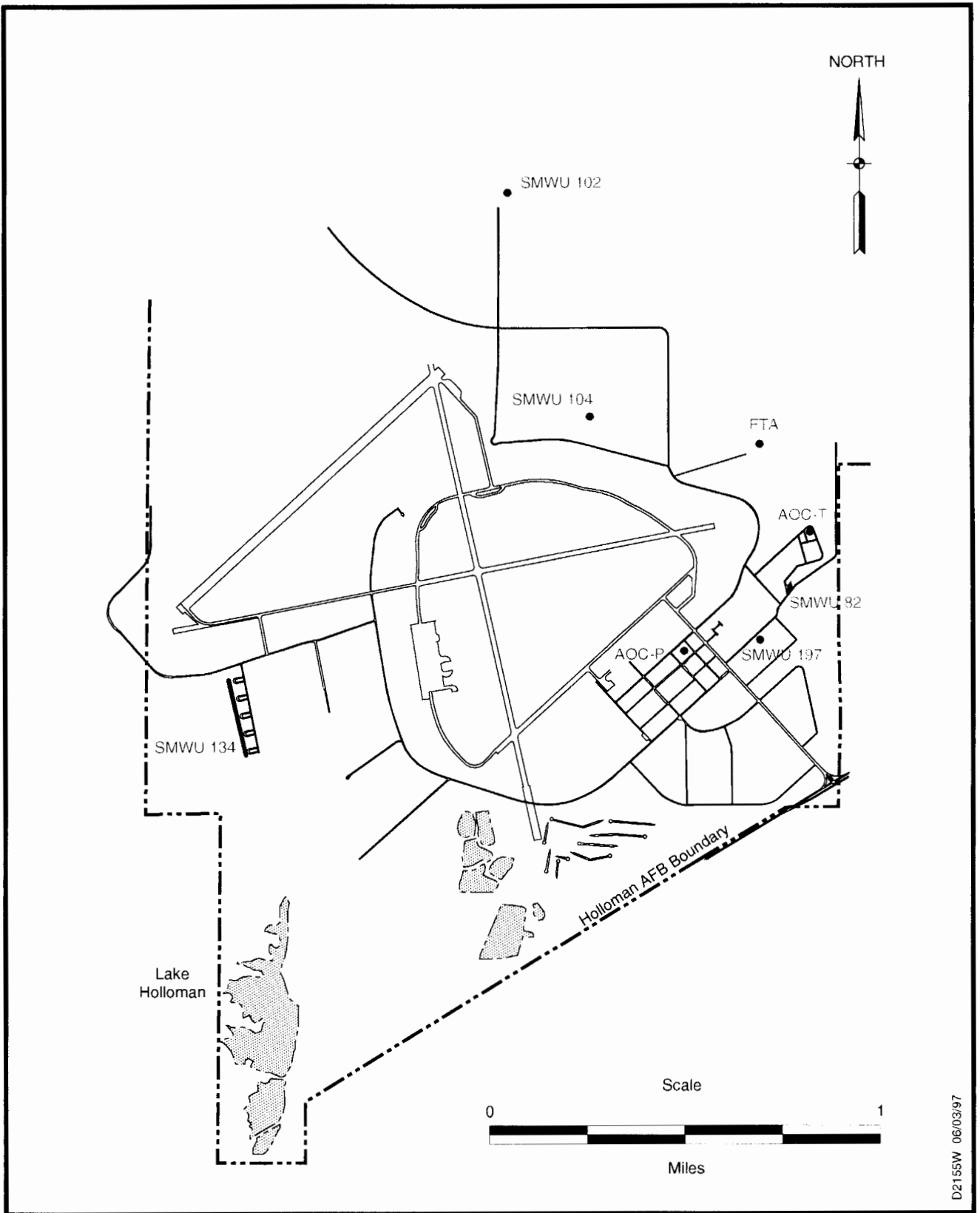


Figure 1-2. Solid Waste Management Units (SWMUs) Addressed by the this Report

Table 1-3
Units Evaluated Under the Table 1 Phase II RFI

Table No.	SWMU No.	Unit Description
1	82	Refuse Collection Truck Washrack (IRP Site 8)
1	102	Acid Trailer Disposal Site (IRP Site 4)
1	104	Former Army Landfill (IRP Site 29)
1	134	Former Equipment Storage Area (IRP Site 24)
1	170	Fire Department Training Area-1 (IRP Site 31)
1	171	Fire Department Training Area-2 (IRP Site 31)
1	197	Former Entomology Site (IRP Site 14)
1	AOC-P	Building 301 Fuel Tank Leak (IRP Site 44)
1	AOC-T	POL Spill Sites (IRP Sites 2 and 5)

Following the field investigations and prior to preparation of this report, a quality assurance/quality control (QA/QC) review of the analytical data was completed. QC data associated with this investigation indicated that chemical data are acceptable and defensible. Data show that project QC mechanisms effectively ensured that data reliability was within measured expected limits of sampling and analytical error. Data validation conclusions are presented in detail in the *Sampling and Quality Control Summary Report Table 1 Phase II RCRA Facility Investigation* (SQCSR) (FWEC and Radian, 1995).

Table 1-4 summarizes the conclusions reached for each SWMU evaluated within this report. Section 4 presents the site-specific results for each SWMU evaluated under the Table 1 Phase II RFI.

The *Phase I RCRA Facility Investigation Report, Table 2 Solid Waste Management Units* (Radian, 1994a) presents the site-specific results for SWMUs 118, 132, and ACC-A (OT-16);

SWMUs 129 and 178 (OT-36); and SWMUs 165, 177, 179, and 181 (OT-39).

The project goal and data objectives for each SWMU were met and no further investigation is required.

1.4 Project Organization

The contractor project team for the Table 1 Phase II RFI included:

- Foster Wheeler Environmental Corporation (Prime Contractor);
- Radian Corporation (RFI Contractor);
- Geo-Test, Inc. (drilling, field support services);
- Target (soil gas, geoprobe, on-site chemical analyses);
- Western Lands Surveying (Sureying Services);
- Quanterra, Inc. (Analytical Laboratory Services); and
- Thiokol (unconventional fuels anlayses).

**Table 1-4
Summary of Phase II RFI Conclusions**

SWMU	IRP Site	Objective	Conclusion	Recommendations
82	SD-08	Define extent of organochlorine pesticides in soil above health-based cleanup criteria.	Extent of organochlorine pesticide concentrations above the health-based cleanup criteria is limited primarily to the shallow soils in southern half of the refuse yard.	VCA and LTM; an impermeable cap over the affected soils will mitigate risk by eliminating the exposure pathway.
		Define extent of organochlorine pesticides in the groundwater.	Extent of elevated organochlorine pesticide concentrations is limited to an area immediately downgradient of the site but does not extend further downgradient.	
102	OT-04	Determine whether selenium concentrations are above the background concentrations in the groundwater.	All selenium concentrations were detected below the Basewide background UTL.	NFA
104	LF-29	Determine whether a release to groundwater has occurred at the site.	There is no evidence that a release from the site has occurred. VOCs in an upgradient monitor well were detected at much higher concentrations than in downgradient wells. The upgradient contaminant source is unknown at this time.	CNFA and LTM; the condition of NFA is LTM and institutional controls. Upgradient source will be investigated separately.
134	OT-24	Confirm the presence of BTEX in two monitor wells, and define the source (if present).	The presence of BTEX was not confirmed in the two monitor wells during the Phase II RFI. BTEX was detected in two isolated groundwater samples collected during field screening.	NFA
FTA ¹	FT-31	Define the extent of soil contamination.	Extent of TRPH contamination above the Base-specific cleanup level is limited to three distinct areas: SWMU 170, the oil/water separator area (SWMUs 39, 127, and 135), and near the JP-4 tank.	CNFA; the condition of NFA is the remediation of TRPH soil contamination
		Define extent of groundwater contamination.	Extent of BTEX contamination was primarily limited to the immediate oil/water separator area but not further downgradient. Low levels of BTEX were detected in wells downgradient of SWMU 170 and SWMU 171. Low levels of chlorinated VOCs were limited to a small area near the JP-4 tank.	
197	OT-14	Define extent of organochlorine pesticides in soil above health-based cleanup criteria.	Extent of organochlorine pesticide concentrations above the health-based cleanup criteria is limited to a band that runs east to west in the central portion of the site and extends to a depth of approximately 2 ft below ground level.	VCA: An impermeable cap over the affected soils will mitigate risk by eliminating the exposure pathway.
AOC-P	OT-44	Confirm TRPH concentrations are below 1000 mg/kg.	TRPH concentrations above 1000 mg/kg are limited to a localized area in the northern portion of the site.	VCA: TRPH soil contamination will be remediated.

**Table 1-4
(Continued)**

SWMU	IRP Site	Objective	Conclusion	Recommendations
AOC-T	SS-02 & SS-05	Identify source and extent of TRPH-contaminated soil	TRPH contamination is limited to the mounded area and extends to groundwater.	CNFA and LTM; the condition of NFA is the remediation of TRPH soil contamination.
		Define extent of BTEX contamination in the groundwater	BTEX contamination extends downgradient of the mounded area both to the northeast and southeast and terminates near the eastern edge of Dillard Draw. Groundwater does not discharge to the Draw.	

BTEX = Benzene, toluene, ethylbenzene, and xylenes.
 CNFA = Conditional No Further Action.
 LTM = Long-term monitoring.
 NFA = No Further Action.
 UTL = Upper tolerance limit.
 VCA = Voluntary Corrective Action.
 VOCs = Volatile organic compounds.

¹ The FTA consists of two Table 1 SWMUs (170 and 171) and three Table 2 SWMUs (39, 127, and 135).

Section 2 ENVIRONMENTAL SETTING

Section 2 describes the environmental setting of Holloman AFB, New Mexico. Detailed discussions of physiography, geology, and hydrogeology are presented. These discussions were compiled from existing Base records, published literature, previous reports, and this field investigation.

2.1 Geography

Holloman AFB is situated in south-central New Mexico, in the northwest-central part of Otero County (Figure 2-1). The Base occupies about 50,000 acres in the northeast quarter of Township 17S, Range 8E. Additional land extending northward is occupied by the White Sands Missile Range testing facilities. Privately and publicly owned lands border the remainder of the Base. The major highway serving the Base is Highway 70, which runs southwest from Alamogordo and forms a boundary between the Base and public lands. Alamogordo is located approximately 7 miles east of the Base. With a population of approximately 31,000, it is the only town of appreciable size within 40 miles of the Base. Holloman AFB has a population of approximately 5500.

2.2 Physiography

The Base is located in the Tularosa Basin, which is bound by the San Andres mountains (approximately 30 miles) to the west and the Sacramento mountains approximately 10 miles to the east. The basin's interior plain has low relief, with altitudes ranging from about 4000 ft in the southwest to about 4400 ft in the northeast. The surrounding mountains rise abruptly to altitudes of 7000–12,000 ft.

The climate in the Tularosa Basin is arid, with low annual rainfall and low relative humidity. The surrounding mountain ranges greatly

influence local weather. They modify approaching weather systems and provide orographic lifting, which produces summer thunderstorms. Mean annual precipitation is 7.9 in., mostly from thunderstorm activity from May through October. Winter is generally dry and is characterized by clear skies and erratic snowfall. The period from March through May is characterized by strong southerly wind flow and periods of blowing dust and sand.

The mean annual lake evaporation rate, commonly used as an estimate of the mean annual evapotranspiration rate, is approximately 67 in. per year. Therefore, the annual net precipitation (mean annual net precipitation minus mean annual evapotranspiration) for the Holloman AFB area is approximately -59 in. per year, representing a net loss in groundwater from evapotranspiration.

2.3 Geology

The Tularosa Basin is a bolson, or a basin that has no surface drainage outlet. Bolson deposits are sediments carried by water into a closed basin. The bolson fill in the Tularosa Basin is derived from the erosion of limestone, dolomite, and gypsum in the surrounding mountains. Coarser material is deposited at the base of the mountains; finer material is carried to the basin's interior. The near-surface bolson deposits consist of sediments that are of alluvial, eolian, lacustrine, or playa origin.

Alluvial fan deposits are characteristically laterally discontinuous units of interbedded sand, silt, and clay. The eolian deposits consist primarily of gypsum sand. Alluvial and eolian deposits are often indistinguishable because of the reworking of alluvial sediments by eolian processes. Lacustrine or playa deposits in the area consist of clay containing gypsum crystals. Lacustrine

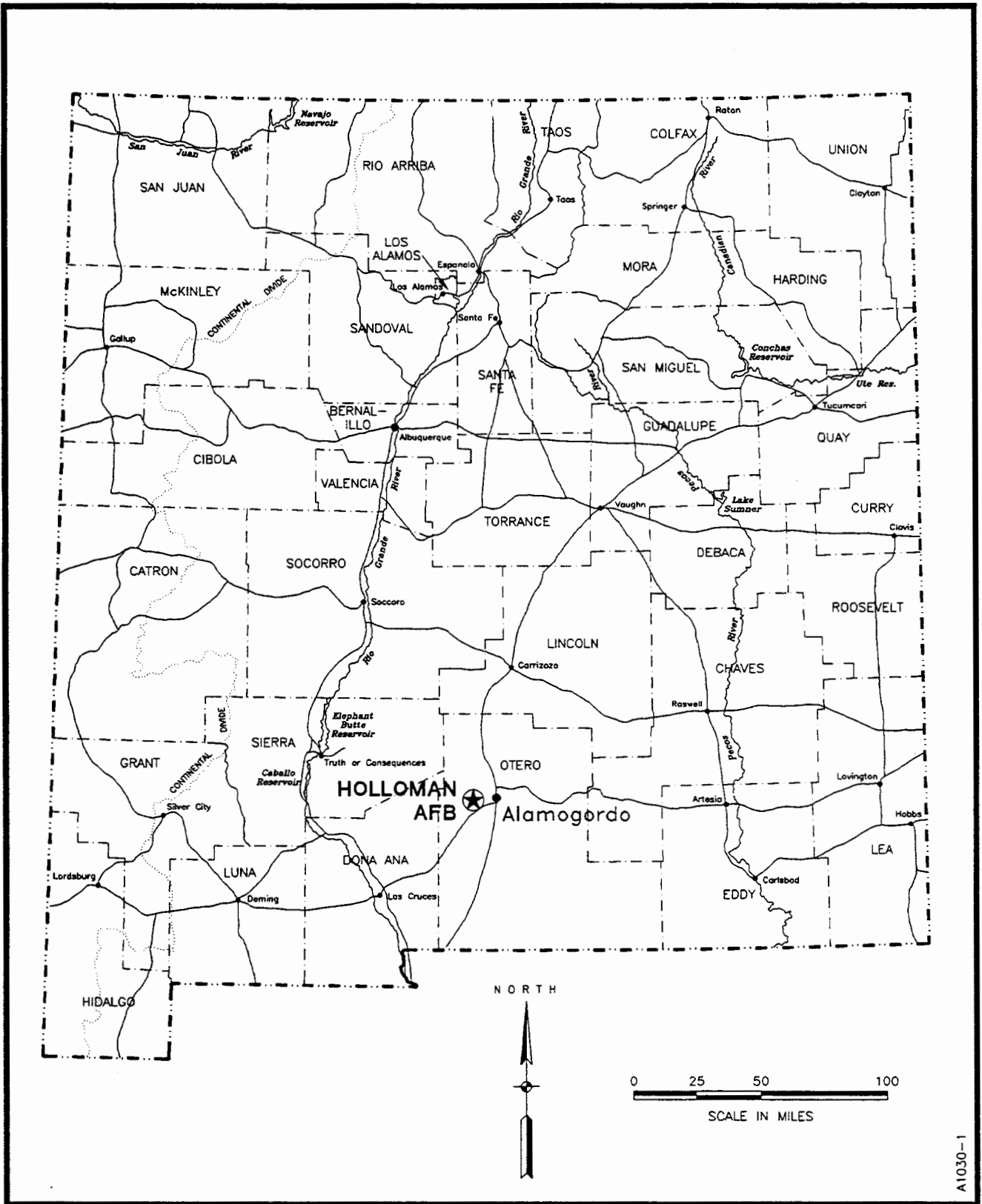


Figure 2-1. Location of Holloman AFB

deposits are juxtaposed with alluvial fan and eolian deposits throughout the Base (29 Sites RI—Radian, 1992b).

2.4 Current and Future Land Use

Land use surrounding Holloman AFB consists of residential areas to the east and northeast (Alamogordo), rangeland to the south, the White Sands National Monument to the west, and military activities to the north. The desert terrain of the area surrounding Holloman AFB has limited development in the immediate vicinity. There are no agricultural operations, residential communities, or large industrial operations located adjacent to the Base.

Holloman AFB is an active military installation and is expected to remain active for the foreseeable future. No transfer of military property to the public domain is anticipated. Public access to the Base is restricted.

Residential development on Base is limited by environmental and operational constraints, which include the 100-year floodplain, historic sites, and areas identified under the IRP. Safety and noise zones also limit residential development on Base. Future plans for residential development on Base include renovation of existing structures, replacement of inefficient buildings, and expansion into open areas in the southeast corner of the Base (*Horizons 2000 Facility Improvement Plan II*, 1987). Future land use is not expected to differ significantly from current land use practices.

2.5 Hydrogeology

Both surface water and groundwater contribute to the hydrological setting at Holloman AFB.

2.5.1 Surface Water

Since the Tularosa Basin is a closed basin with no surface water outlet, water is lost to

evaporation, transpiration, and infiltration, or collects in Lake Lucero, the lowest point in the basin, approximately 20 miles southwest of Holloman AFB.

The Base is crossed by several southwest-trending arroyos that control surface drainage in the undeveloped part of the Base (see Figure 2-2). These arroyos consist of Hay Draw, in the far northern part of the Base; Malone Draw and Rita's Draw, which drain into Lost River; and Dillard Draw to the east, which runs in a southwesterly direction along the eastern and southern boundaries of the Base. Lost River, the largest arroyo, is dammed near the western boundary of the Base. Runoff from Lost River, Malone Draw, and Rita's Draw collects in the dammed area. Drainage within the developed portions of the Base flows through ditches and culverts to various outfall areas.

The wastewater treatment system at Holloman AFB consists of seven aeration/evaporation lagoons. Southwest of these lagoons, a natural playa lake known as Lake Holloman receives some runoff from the Base as well as effluent from the sewage lagoons. A dam/dike has been constructed across the southern quarter of Lake Holloman. Seepage overflow from Lake Holloman filled an existing small playa lake known as Lake Stinky.

2.5.2 Groundwater

To understand the effects of groundwater on the environmental setting, groundwater flow and groundwater quality must also be understood.

Groundwater Flow

Groundwater occurs under unconfined conditions in the unconsolidated bolson deposits beneath Holloman AFB. The primary source of recharge for groundwater in the bolson aquifer is percolation of rainfall and stream runoff through the coarse, unconsolidated alluvial fan deposits

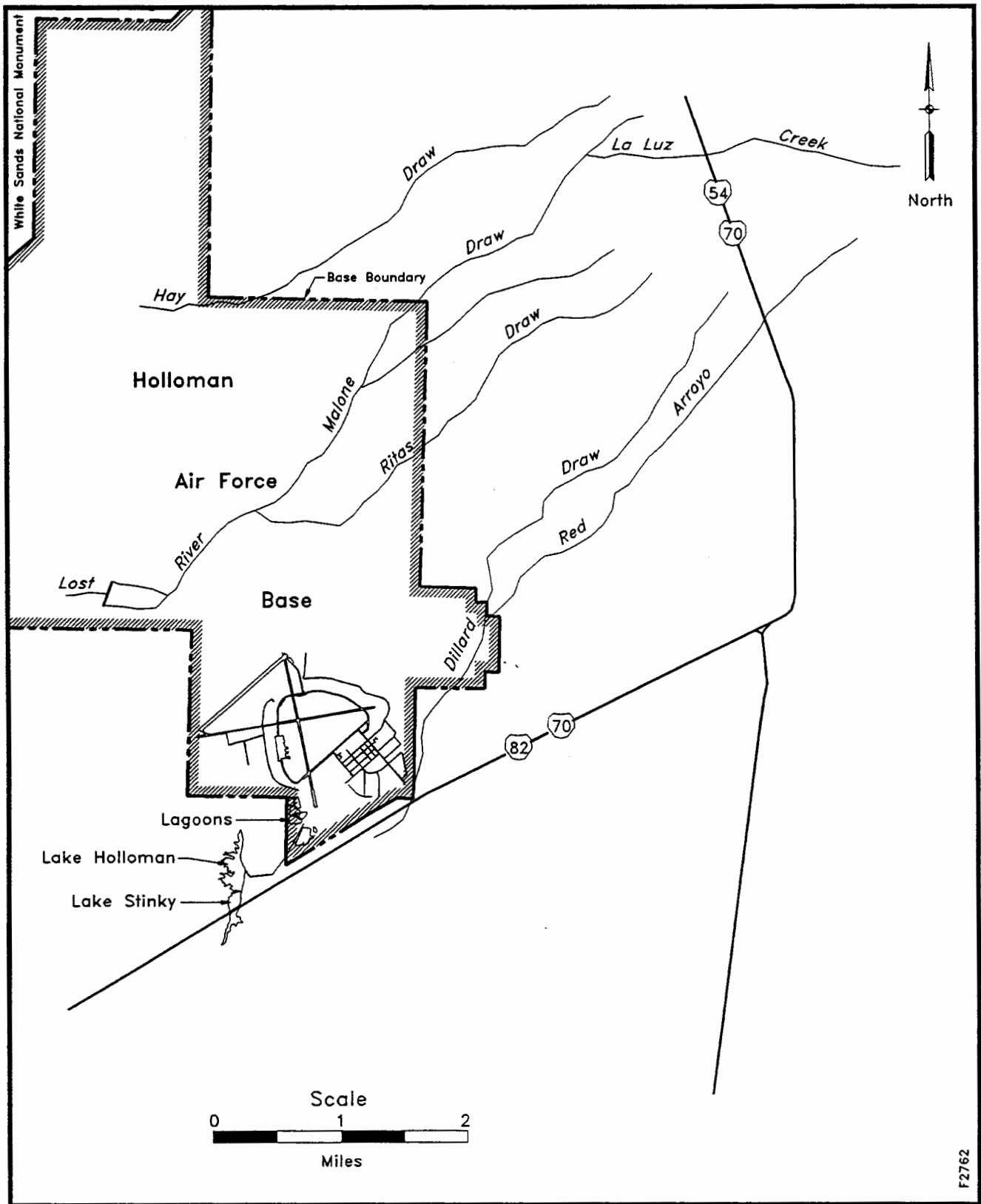


Figure 2-2. Surface Drainages at Holloman AFB

along the western flank of the Sacramento Mountains. Water migrates downward into the bolson fill aquifer and flows downgradient through progressively finer grained sediments into the basin. Beneath Holloman AFB the depth to groundwater ranges from less than 5 to nearly 50 ft below ground level (bgl).

In the vicinity of Holloman AFB, groundwater generally flows toward the west and southwest, following surface topography. Local groundwater flow direction, however, is influenced by the arroyos that drain the Base. In the southeastern portion of the Base, regional groundwater flows southwest, toward the Dillard Draw surficial drainage system. In the northern and western portions of the Base, groundwater flows in a more westerly direction, toward the Rita's Draw, Malone Draw, and Lost River drainages. Localized effects occur in areas immediately adjacent to arroyos, where groundwater flows directly toward drainage regardless of regional flow patterns.

Groundwater Quality

Water quality in the Tularosa Basin is good near the recharge areas at the base of the mountains, but groundwater becomes progressively more mineralized as it flows downgradient toward the interior of the basin. This decrease in water quality can be attributed to slow groundwater migration from recharge to discharge areas, and the presence of readily soluble minerals in the bolson sediments.

On the basis of New Mexico Water Quality Control Commission Regulations (NM WQCC 82-1, as amended through August 18, 1991, Parts 3-100 through 3-103), the groundwa-

ter beneath Holloman AFB is designated as unfit for human consumption because it exceeds New Mexico human health standards (HHSs) for total dissolved solids (TDS) and sulfate.

According to the EPA document *Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy* (EPA, 1986), the groundwater beneath Holloman AFB can be classified as Class III B. Class III groundwater is characterized by having a TDS concentration greater than 10,000 mg/L, and is not considered a source or a potential source of drinking water. Class III B groundwater is characterized by a low degree of interconnection to adjacent surface waters or groundwater of a higher class. Because the Tularosa Basin is a closed basin, its groundwater does not discharge or connect to any adjacent aquifers. Adjacent surface waters include Lost River and Lake Holloman, which also have high concentrations of TDS and thus are not potential drinking water sources.

2.6 Current and Future Water Use

At present, the primary fresh water resource for the City of Alamogordo is Lake Bonita, 60 miles northeast of the Tularosa Basin. Currently, there are no potable supplies of ground or surface water located on Base. Holloman AFB obtains its water supply from the City of Alamogordo and the Holloman AFB wells in Boles, San Andres, and Douglas well fields at the base of the Sacramento Mountains. No water supply wells are located on or near the Base because of poor groundwater quality. The nearest production well downgradient of Holloman AFB is a livestock well located 3.5 miles west of the Base (Radian, 1994a). No other downgradient or near-Base potable or irrigation wells exist.

Section 3

DATA OBJECTIVES AND EVALUATION CRITERIA

3.1 Data Objectives

This section summarizes the objectives of the Phase II RFI and the technical approach for achieving the objectives. It also presents the criteria used to evaluate the data and develop recommendations for each SWMU.

To ensure that the primary goal of the RFI was met, data objectives were developed for each Phase II SWMU. These objectives were designed to implement the Phase I site recommendations and gather additional data requested by the EPA Region VI and the NMED to resolve their concerns regarding the Phase I investigation data. The data objectives are presented in Table 3-1.

The data collected during the Phase II activities were used by Holloman AFB Environmental Flight personnel, Headquarters-Air Combat Command (HQ-ACC), and U.S. Army Corps of Engineers (USACE)-Omaha District personnel to develop recommendations (NFA, CNFA, voluntary corrective action [VCA], or further evaluation) at each site. The final decision for future action at each site in the RCRA corrective action program is made by the EPA Region VI; for the IRP sites, the NMED.

3.2 Data Collection

To meet the objectives of the investigation, a variety of types and quality of data was collected during the field investigation. Data were collected by various methods for soil and groundwater and ranged in quality from field test kits (Level II—EPA 1987) to fixed-laboratory analyses (Level III—EPA 1987). A summary of the type, method, purpose, and quality of the data is presented for each SWMU in Section 4 of this report.

3.3 Data Evaluation Criteria

This section summarizes the data validation and trigger criteria used to evaluate the data. This section also provides an overview of risk assessments conducted for the sites.

3.3.1 Data Validation Conclusions

Data were validated according to the requirements specified in the *Quality Assurance Project Plan (QAPP)* (Radian, 1994b). The *SQCSR* (FWEC and Radian, 1995) presents a complete description of the QA program implemented for this investigation, including the results of QC analyses, data validation procedures, results of data validation and potential data limitations, and results for all laboratory analyses performed.

Overall, the QC data associated with this investigation indicate that chemical measurement data are acceptable. An independent review found the data to be reliable, defensible, and usable for the purposes of this investigation. The majority of the QC results associated with the Holloman AFB Table 1 Phase II program were within the specifications outlined in the *QAPP* (Radian, 1994b). Overall data completeness for this project was calculated to be 99%.

When interpreting the data, the following potential limitations were considered:

Soil Samples

- Low matrix spike (MS) recoveries for antimony in soil indicate the results may be biased low by as much as 55%.
- Low MS recoveries for selenium in soil samples indicate the results may be biased low by as much as 55%.

Table 3-1
Data Objectives of the Phase II RFI

SWMU	IRP Site	Media Investigated	Phase II Objective(s)
82	SD-08	Soil	Define the extent of pesticide contamination above the cleanup criteria established for the site.
		Groundwater	Define the extent of pesticide contamination.
102	OT-04	Groundwater	Determine whether selenium concentrations are above background concentrations .
104	LF-29	Groundwater	Determine if a release has occurred because of site activities.
134	OT-24	Groundwater	Confirm the presence of and, if present, define the extent of groundwater contamination.
197	OT-14	Soil	Define the extent of pesticide contamination above the cleanup criteria established for the site.
AOC-P	OT-44	Soil	Confirm total recoverable petroleum hydrocarbons concentrations are below 1000 mg/kg.
AOC-T	SS-02 & SS-05	Soil	Identify the source and delineate extent of contamination above the cleanup criteria established for the site.
		Groundwater	Define the extent of groundwater contamination. Evaluate discharge of groundwater to the Dillard Draw.
FTA ¹	FT-31	Soil	Further define the nature and extent of contamination.
		Groundwater	Further define the nature and extent of contamination.

¹ The Fire Training Area (FTA) consists of two Table 1 SWMUs (170 and 171) and three Table 2 SWMUs (39, 127, and 135).

Groundwater samples

- Blank results for SW8020 indicate that some of the field groundwater sample results may be due to analytical background interference (or noise).
- Holding times for volatile organic compound (VOC) analysis samples 94-31-HP-F12-EBR, 94-31-HP-01-01R, 94-31-HP-02-01R, and 94-31-HP-03-01R, which were analyzed by SW8240, were missed. These samples were not re-collected. VOC results associated with these samples may be biased low.
- Low-level contamination of acetone, benzene, toluene, and xylenes in water samples collected for SW8240 analysis

- may have occurred during field activities.
- Methylene chloride concentrations in some samples may be due to the analytical background interference (or noise).
- Low MS recoveries for antimony in water samples indicate the results may be biased low by as much as 30%.

3.3.2 Trigger Criteria

Laboratory and field screening analytical results were compared with various trigger criteria to provide an indication of the nature and extent of contamination and/or to determine whether further action is necessary. Trigger criteria for this investigation included the following: analytical detection limits (DLs), remedial action objec-

tive (RAO) cleanup criteria presented in the *FS Report* (Radian, 1993b), and the Base-specific standard for TRPH. Each is discussed briefly below.

Analytical DLs were used to define the extent of contamination at each SWMU. This approach was selected over an “action level” trigger criterion for SWMUs without RAO cleanup criteria to ensure complete delineation of the target analytes.

Cleanup Criteria—Cleanup criteria were established for soils at SWMUs 82 and 197 in the CMS (see Radian, 1992a) as part of the RAO determination. RAO cleanup criteria are health-based action levels calculated using site-specific potential exposure pathways, contaminants, and receptors. The cleanup criterion for a site represents the level of specific constituents that can be present without posing a risk to human health or the environment. Soil containing constituents in excess of these concentrations may require remedial action. The site-specific criteria are discussed in their respective subsections of Section 4.

Base-Specific Standard for TRPH—The NMED established 1000 mg/kg as the cleanup level for TRPH at Holloman AFB (see Appendix C for regulatory correspondence). Currently, soil containing TRPH in excess of this concentration requires remediation.

3.3.3 Risk Assessment Overview

All of the SWMUs addressed by this report underwent a risk evaluation during the Phase I activities. With the exception of two sites, no unacceptable risk to human health or the environment were found. The risk evaluations are summarized below.

Phase I Risk Evaluations

During the Phase I activities, each of the SWMUs included in this report underwent a risk-

based screen and/or a full quantitative risk assessment. For most of the SWMUs, the Phase I data collected were initially processed through a simple risk screen. If the SWMU failed the screen, it was recommended to proceed directly to an FS/CMS stage. However, if the SWMU passed the screen, it was evaluated further with a quantitative risk assessment to validate the screen.

With the exceptions of SWMU 82, SWMU 197, and AOC-T, the risk evaluation concluded that the SWMUs did not pose unacceptable risk to human health and the environment. SWMU 82 and SWMU 197 were found to pose unacceptable occupational risk via soil exposure pathways. Insufficient data were available with which to evaluate the potential groundwater exposure pathway via discharge to the surface in a nearby arroyo at AOC-T.

No receptors to groundwater were identified during the *29 Sites RA* (Radian, 1992c) or the *1989 RA* (Walk, Haydel, and Associates, 1989a). However, because groundwater beneath the Base had not yet been fully characterized, groundwater was considered potable, and a hypothetical off-Base pathway and receptors were used to conservatively estimate risk.

Detailed information on the risk evaluations is available in the *29 Sites RA* (Radian, 1992c) and the *1989 RA* (Walk Haydel and Associates, 1989a).

Phase II Risk Evaluations

With the exception of the FTA and AOC-T, the SWMUs were not reevaluated for risk during the Phase II activities for the following reasons:

- The primary objective of the Phase II was to address the regulatory concerns, which were mainly to define the extent of con-

- tamination and not to further evaluate risk.
- With the exception of SWMUs 82 and 197, the Phase I risk assessment concluded that the SWMUs did not pose unacceptable risk to human health or the environment.
 - Groundwater beneath the Base is no longer considered a complete pathway because there are no potential receptors. The aquifer beneath the Base is a Class III B (nonpotable) aquifer, and therefore, is not considered a potential drinking water source (Section 2.5.2). Additionally, no discharge to surface water is present at the sites.

Because of the magnitude of additional data collected at the FTA, a quantitative risk assessment was conducted for the site. Exposure pathways and receptors were reevaluated for the FTA. Additional data collected at AOC-T was used to evaluate fully the potential groundwater exposure pathway via surface discharge at the site.

The quantitative risk assessment incorporated data for all constituents at the FTA that were detected at concentrations greater than 5% of the blank upper tolerance limit (UTL). Inorganic analytes were selected only if they were determined to be statistically different from the background mean (*Base-wide Background Study—Sewage Lagoons and Lakes Investigation, Holloman Air Force Base, Radian 1993a*) at Holloman AFB. These analytes, called chemicals of potential concern (COPCs) were then compared with their respective risk-based screening levels. The maximum detected concentration for each COPC was compared with a risk-based concentration calculated for the chemical using EPA Region III's methodology for risk-based screening (EPA, 1991) and the most current available toxicity information. The equations used for calculating

Region III levels are based on a residential exposure scenario and an ingestion pathway. COPCs with a maximum detected concentration below the conservative Region III risk-based level are considered to pose no significant risk to human health and were eliminated from further consideration. All other constituents were retained for further evaluation and are considered to be contaminants of concern (COCs). These COCs were then evaluated on an individual basis.

3.4 Decision-Making Methodology

To determine whether the overall objective had been met, the data evaluation criteria (including risk evaluation results) were used to compare the data collected with the data objectives. If the data objectives had not been met, the SWMU was recommended for further evaluation. If the objectives were met, then the concerns of the regulatory agencies had been addressed and the SWMU was recommended for one of three future actions:

No Further Corrective Action (NFA)—NFA was recommended for SWMUs where detected analytes did not exceed data evaluation criteria and therefore no significant release from the SWMU has occurred.

Conditional No Further Action (CNFA)—CNFA was recommended for SWMUs where TRPH concentrations exceeded the Base-specific standard for TRPH of 1000 mg/kg. The condition of NFA for these SWMUs is the remediation of TRPH-contaminated soil to the Base-specific standard.

Voluntary Corrective Action (VCA)—VCA was recommended for SWMUs where constituent concentrations exceeded trigger criteria or the risk evaluation indicated unacceptable risk.

Section 4

SITE-SPECIFIC RFI RESULTS

This section contains the results, conclusions, and recommendations for each site investigated during the Phase II RFI. Subsections 4.1 through 4.8 present site-specific discussions of the following:

- Executive summary for the site;
- Site description, including a site figure;
- Geology and hydrogeology;
- Summary of Phase I activities, including regulatory agency concerns regarding the results of the Phase I activities;
- Summary of Phase II activities;
- Summary of analytical results, including data tables presented at the end of each site-specific section; and
- Conclusions and recommendations for each site.

The Phase II SWMUs discussed in this section are listed in Table 1-3, and their locations are shown in Figure 1-2. Table 1-5 also lists objectives, conclusions, and recommendations for each site. The decision-making process used to evaluate the data and determine recommendations is discussed in Section 3.

All field activities were conducted using the approach and procedures outlined in the *Phase II RCRA Facility Investigation Work Plan, Volumes I-III* (Radian, 1994a).

Because of the amount of additional data collected at the FTA, a quantitative risk assessment was conducted to evaluate the potential risk to human health and the environment posed by the site. The results are summarized in Subsection 4.5 and the risk assessment is presented in Appendix A.

4.1 SWMU 82—Building 131 Washrack (IRP Site SD-08)

Organochlorine pesticides and metals were detected in the shallow soils at SWMU 82 (the Building 131 Truck Washrack); organochlorine pesticides were also detected in the groundwater during the 29 Sites RI. The associated risk evaluation concluded that pesticide concentrations in soil pose an occupational health risk. To mitigate this risk, the site entered into the FS/CMS process, which established cleanup criteria for health-based RAOs, estimated an area exceeding these cleanup criteria, and recommended the emplacement of an impermeable cap. The cap will eliminate the occupational risk by eliminating the dermal and inhalation exposure pathway. The Phase II RFI delineated the extent of organochlorine pesticide contamination in the groundwater. SWMU 82 is recommended for long-term groundwater monitoring to ensure that the remedial action is preventing further degradation of groundwater.

4.1.1 SWMU Description

SWMU 82 is located in the southeastern corner of the refuse collection yard near Building 131. The refuse collection yard is located southwest of the Petroleum, Oil, and Lubricant (POL) Storage Area and east of the Main Base area. The yard occupies approximately one-half acre and is surrounded by a chain-link fence. The yard is unpaved and has sparse vegetation only along the fence. The topography of the site is generally flat. Figure 1-2 shows the location of SWMU 82 on Holloman AFB, and Figure 4.1-1 shows the site layout.

The washrack was installed in 1942 and consisted of a rectangular concrete pad (approximately 1000 ft²). Refuse collection trucks were washed with soap and water at the washrack. Base records indicate that pesticides were routinely sprayed inside the trucks during the 1970s for fly control; however, this practice ceased in

1982. Drains located at the north end of the washrack connected to a sewer line that carried wastewater to an oil/water separator near the northwest corner of the washrack. According to site personnel, it was common for the sewer line to clog, causing the sump and oil/water separator to overflow onto the surrounding soil. The washrack contained cracks in the concrete and was replaced in 1992 with a new washrack in the same location.

Geology and Hydrogeology

Three monitor wells were installed during the Phase II RFI to a depth of 16.5 ft bgl. Drilling logs from these wells indicate that the stratigraphy at SWMU 82 consists primarily of silty and clayey sands. A layer of poorly-graded sand interbedded with thin layers of caliche and clayey sands was encountered in the boring closest to the washrack. Drilling logs from the 29 Sites RI (Radian, 1992b) also indicated the presence of a sand layer within the silty sand unit. This sand layer was not encountered in borings for the two wells installed further downgradient of the washrack. Phase II RFI drilling logs, presented in Appendix B.1, provide a detailed description of the site lithology.

Groundwater was encountered at 9 to 10 ft bgl at SWMU 82. Water level data collected during groundwater sampling at the site confirmed that the groundwater flow is to the northeast, as shown in Figure 4.1-2.

4.1.2 Phase I Activities

The site was identified in the *IRP Phase I Records Search* (CH2M Hill, 1983). As a result, the site was investigated under Phase I of the IRP as Site SD-08 in 1991. During the 29 Sites RI, soil samples were collected from six soil borings drilled in areas of potential contamination. Metals and organochlorine pesticides were detected in the surface soils at the site. The highest concentrations were detected in soil borings SB-08-01 and

SB-08-02 drilled near the southeastern corner of the washrack. Groundwater samples were collected from three monitor wells. Organochlorine pesticides and VOCs were detected in the groundwater. The highest concentrations of organochlorine pesticides were detected in the down-gradient monitor well MW-08-03. Sample locations are shown in Figure 4.1-1.

A preliminary risk-based screen was conducted for SWMU 82 as part of the 29 Sites RI. The screen indicated that organochlorine pesticide concentrations in the soil pose an unacceptable risk to human health and the environment (Radian, 1992b).

Because surface soils at SWMU 82 pose an unacceptable human health risk, remedial action was recommended. In addition, further investigation was recommended to define the extent of organochlorine pesticides and metals contamination in the soil and organochlorine pesticides in the groundwater at the site.

After reviewing the 29 Sites RI (Radian, 1992b), EPA Region VI issued a letter, received by the Base on 3 November 1992, requesting:

- The installation of additional soil borings to define the extent of soil contamination around the northwestern perimeter of the washrack;
- The installation of additional monitor wells to delineate the full extent of pesticide contamination in the groundwater;
- The definition of the source and extent of VOCs present in monitor well MW-08-01; and
- The notification of a newly identified SWMU and associated releases.

The highest concentrations of VOCs were detected in the upgradient monitor well MW-08-01. On the basis of site history and investigation

results, it was concluded that VOC concentrations detected in the groundwater were not due to site activities (Radian, 1992b). Holloman AFB identified a new AOC and is currently investigating the area.

4.1.3 Phase II Activities

The following additional investigations were conducted at SWMU 82 to address EPA Region VI concerns and implement the site recommendations:

- The corrective measures study in 1992;
- The feasibility study in 1993; and
- The Phase II RFI in 1994.

To select the appropriate remedial action, SWMU 82 was entered into the FS/CMS process. The *CMS Plan* (Radian, 1992a) established health-based RAOs for soil contamination at the site. The RAOs for the site are to prevent an unacceptable health risk posed to site workers by dermal contact and inhalation of contaminated soils. The cleanup criteria are presented in Table 4.1-1.

To determine the vertical and lateral extent of soil contamination exceeding the cleanup criteria, a predesign investigation was conducted in 1993. During the predesign investigation, 14 soil borings were installed to the groundwater table. Soil boring locations are shown in Figure 4.1-1.

To determine the extent of organochlorine pesticides in the groundwater, the Phase II RFI was conducted in 1994. During the investigation, groundwater samples were collected from seven temporary standpipes, installed using a direct push technology (DPT) rig, and located downgradient of SWMU 82. The samples were submitted to the laboratory for organochlorine pesticide analysis. The results of the DPT groundwater samples were used to place three new monitor wells down-

Table 4.1-1
Remedial Action Objectives for SWMU 82

Objective	Contaminant	Cleanup Criteria (mg/kg)	Comment
Prevent dermal contact with contaminated soil above the cleanup criteria.	4,4-DDD	4.0	Contaminated soil below the cleanup criteria does not present an occupational health risk.
	4,4-DDE	3.3	
Prevent inhalation of contaminated soil above the cleanup criteria.	4,4-DDT	1.1	
	Cadmium	0.29	
	Chlordane	0.14	
	Lead	12	
	Mercury	0.016	

gradient of the SWMU. Groundwater samples were collected from the three new wells (MW-08-05, MW-08-06, and MW-08-07) and two existing wells (MW-08-03 and HSTE-10-MW-01). The monitor well locations are shown in Figure 4.1-2.

Field Screening Results

The groundwater samples collected from the DPT locations were analyzed for organochlorine pesticides using EPA Method SW8080.

Concentrations of delta-BHC and alpha-BHC were detected at or below the detection limits. A concentration of 4,4'-DDD was detected below the detection limit in location HP-08-06. A concentration of gamma-BHC was measured at the detection limit in location HP-08-02. The results of the field screening were used to place one monitor well (MW-05) immediately downgradient, and two wells further downgradient of the SWMU. The field screening results are presented in Table B.6-1 of Appendix B.6.

Analytical Results

Soil samples collected at SWMU 82 were analyzed for cadmium, lead, mercury, and organochlorine pesticides using EPA Methods SW6010, SW7421, SW7471, and SW8080, respectively. The analytical results were presented in the *FS*

Report (Radian, 1993b) and Table 4.1-2 was adapted from that report.

The area exceeding the cleanup criteria at SWMU 82 was estimated to be 20,800 sq. ft and encompasses the southern half of the refuse yard (Radian, 1993b). The estimated extent is shown in Figure 4.1-1. The depth of affected soils was estimated to extend to 2 ft bgl, except in the immediate vicinity of soil borings SB-08-04, SB-08-06, and SB-08-11, where contamination was detected to 4 ft bgl. The greatest number of analytes and the highest concentrations were detected in soil borings SB-08-01 and SB-08-02 near the northeastern edge of the washrack. A total volume of 1540 yd³ was estimated to exceed the cleanup criteria at SWMU 82. The recommended remedial alternative for achieving the RAOs is source containment by constructing an impermeable cap over the affected soils.

All groundwater samples collected from monitor wells were analyzed for organochlorine pesticides using EPA Method SW8080. The analytical results are presented in Table 4.1-3. The greatest number and highest concentrations of organochlorine pesticides were detected in the monitor wells (MW-08-03 and MW-08-05) located immediately downgradient of the SWMU.

Monitor wells located further downgradient contained concentrations below detection limits. Concentrations of 4,4'-DDD and delta-BHC were detected below the detection limits in the samples. Similar concentrations of delta-BHC were detected in the laboratory method blanks, making its presence in the samples uncertain and likely due to low-level laboratory contamination. Concentrations of heptachlor epoxide were detected in monitor wells MW-08-03 (0.16 µg/L) and MW-08-05 (0.033 µg/L).

4.1.4 Conclusions

The lateral and vertical extent of organochlorine pesticide and metal concentrations in soil has been delineated. Contaminant concentrations were found to be highest in the southeastern corner of the refuse yard near and around the washrack. The concentrations pose an occupational health risk, and the selected corrective action to mitigate the risk is source containment

by the emplacement of an impermeable cap over the affected soils. Once the remedial action has been implemented, the exposure pathways to soil will be eliminated. As a result, the occupational health risk will also be eliminated.

Elevated organochlorine pesticide concentrations were detected only in the two monitor wells nearest the site.

4.1.5 Recommendations

A voluntary corrective action (VCA) was completed at SWMU 82. A modified cap was placed over the area in October 1996. Construction work plans were submitted to the NMED prior to initiation of field work. A DD was also approved by the NMED in September 1995, detailing the recommended remedial alternative and the requirement for long-term monitoring (LTM) at SWMU 82.