LIBRARY COPY

Headquarters, Air Combat Command
Langley Air Force Base,
Virginia

Draft Final

Preliminary Assessment and Site Investigation Report

Investigation of Four Waste Sites

November 1993

49 CES/CEV
Holloman Air Force Base,
New Mexico

PURPOSE OF DOCUMENT

A. This preliminary assessment and site investigation report documents the Investigation of Four Waste Sites and was prepared to comply with the Installation Restoration Program. Information contained in the report will also be used to support the Resource Conservation and Recovery Act corrective action program where applicable. The regulatory framework for each of the sites investigated is summarized in the report. 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. The site-specific sections of the report contain investigation summaries, results, conclusions, and recommendations.

C. Site closeout or further investigation is recommended for each of the four sites. Detailed recommendations are provided for sites requiring further investigation. The data evaluation criteria used to develop conclusions and recommendations are presented in a separate section of the report.

DCN 93-269-069-23-02
RCN 269-069-23-07

PRELIMINARY ASSESSMENT AND SITE INVESTIGATION REPORT

INVESTIGATION OF FOUR WASTE SITES HOLLOMAN AIR FORCE BASE, NM

DRAFT FINAL

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

and

HQ ACC/DEVC
Langley Air Force Base, VA

Prepared by:

Radian Corporation
8501 N. MoPac Boulevard
P.O. Box 201088
Austin, Texas 78720-1088
512/454-4797

Under Contract No. DACW45-91-D-0018 with:

US Army Corps of Engineers
Omaha District
Omaha, Nebraska

November 1993

TABLE OF CONTENTS

		Page
1	**INTRODUCTION**	1-1
	1.1 Regulatory Overview	1-1
	1.1.1 Regulatory Programs	1-1
	1.1.2 Project Regulatory Framework	1-2
	1.2 Summary of Investigation	1-3
	1.3 Report Organization	1-4
2	**ENVIRONMENTAL SETTING**	2-1
	2.1 Geography	2-1
	2.2 Physiography	2-2
	2.3 Geology	2-2
	2.4 Hydrogeology	2-2
	2.4.1 Surface Water	2-2
	2.4.2 Groundwater	2-3
3	**DATA QUALITY OBJECTIVES and EVALUATION CRITERIA**	3-1
	3.1 Data Quality Objectives	3-1
	3.2 Data Evaluation Criteria	3-2
	NOT SURNO BUT AU - AOC	
4	**SITE SS–12—JP-4 FUEL LINE SPILL SITE**	4-1
	4.1 Site Description	4-1
	4.2 Site Investigation	4-1
	4.3 Geology and Hydrogeology	4-3
	4.4 Conclusions	4-3
	4.4.1 Presence or Absence of Contamination	4-3
	4.4.2 Significance of Contamination	4-5
	4.5 Recommendations	4-6
5	**SITE SD–27—PAD 9 WASHRACK AREA**	5-1
	5.1 Site Description	5-1
	5.2 Site Investigation	5-2
	5.3 Geology and Hydrogeology	5-3
	5.4 Conclusions	5-4
	5.4.1 Presence or Absence of Contamination	5-4
	5.4.2 Significance of Contamination	5-4
	5.5 Recommendations	5-6

TABLE OF CONTENTS

		Page
6	**SITE OT–35—SPENT SOLVENT DISPOSAL AREA**	6-1
	6.1 Site Description	6-1
	6.2 Site Investigation	6-1
	6.3 Geology and Hydrogeology	6-2
	6.4 Conclusions	6-2
	6.4.1 Presence or Absence of Contamination	6-2
	6.4.2 Significance of Contamination	6-3
	6.5 Recommendations	6-3
7	**SITE LF–58—INCINERATOR/LANDFILL**	7-1
	7.1 Introduction	7-1
	7.1.1 PA/Investigation Overview	7-1
	7.1.2 Organization of Section 7	7-1
	7.2 Site Description	7-1
	7.3 Site Investigation	7-2
	7.3.1 Soil Boring Investigation	7-2
	7.3.2 Electromagnetic (EM) Surveys	7-3
	7.3.3 Waste Excavation and Characterization	7-5
	7.4 Environmental Setting	7-6
	7.4.1 Physiography	7-6
	7.4.2 Geology	7-10
	7.5 Conclusions	7-10
	7.5.1 Presence or Absence of Contamination	7-10
	7.5.2 Significance of Contamination	7-12
	7.6 Recommendations	7-14
	7.6.1 Surface Soil	7-14
	7.6.2 Waste Areas	7-15
	7.6.3 Groundwater	7-15
	7.7 Photographic Log	7-15
8	**ACRONYMS and SYMBOLS**	8-1
9	**REFERENCES**	9-1
	APPENDIX A—DATA EVALUATION CRITERIA	A-1
	APPENDIX B—FIELD DATA	B-1
	APPENDIX C—PA REFERENCES	C-1

Section 1
INTRODUCTION

The investigation of four waste sites (shown in Figure 1–1) at Holloman Air Force Base (AFB), New Mexico, was conducted as part of the U.S. Air Force (USAF) Installation Restoration Program (IRP). The investigation had three overall objectives:

❶ Determine the presence or absence of contamination at four waste sites;
❷ Determine significance of contamination, if present; and then
❸ Recommend site closeout or further investigation.

Section 1 contains information about the regulatory structure of the investigation, a brief project history, and a summary of conclusions and recommendations. Section 1 concludes with an overview of the remaining sections of this report.

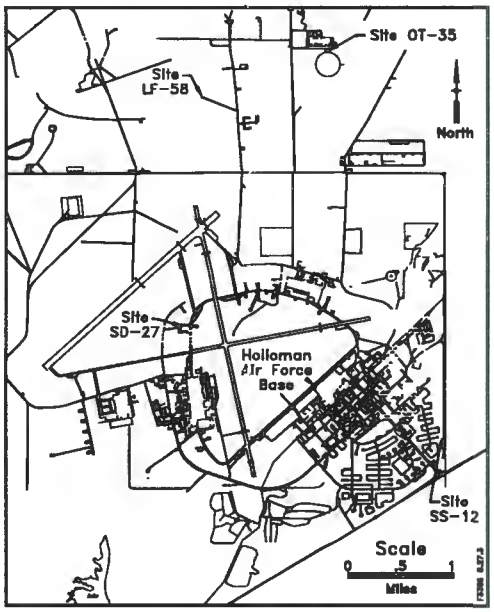


Figure 1–1 Locations of the Four Sites at Holloman AFB

1.1 Regulatory Overview

1.1.1 Regulatory Programs

Holloman AFB is implementing the IRP to ensure that routinely generated hazardous wastes are properly characterized and managed, and that past disposal sites are identified and remediated, as necessary, to eliminate hazards to human health and the environment. The IRP follows the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the 1986 statutory amendments to CERCLA (the Superfund Amendments and Reauthorization Act [SARA]) requiring federal facilities to comply with the National Contingency Plan.

Furthermore, Holloman AFB is subject to the requirements of the Resource Conservation and Recovery Act (RCRA) corrective action program because of their RCRA permit to operate an on-site storage facility for currently generated hazardous wastes. The Hazardous and Solid Waste Amendments (HSWA) portion of the Base's RCRA permit requires that the Base investigate and remediate the release of any hazardous waste or constituents from active and inactive solid waste management units (SWMUs) listed on Tables 1, 2, and 3 of the HSWA permit.

As appropriate, the Base must comply with the requirements of the two programs. Figure 1-2 presents a side-by-side comparison of the primary phases for implementation of the IRP and the RCRA corrective action program. Both programs are similarly phased and ultimately intended to ensure remediation of contaminated sites that pose a threat to human health or the environment. In the preamble to the proposed RCRA corrective action rules, the U.S. Environmental Protection Agency (EPA) encourages coordination of the two independent programs. The activities necessary for these programs have been coordinated as appropriate to reduce duplicative efforts. Integration of the programs has already been implemented and accepted for the RCRA Table 1 SWMUs in the *Remedial Investigation (RI) Report - Investigation, Study and Recommendation for 29 Waste Sites* (Radian, 1992).

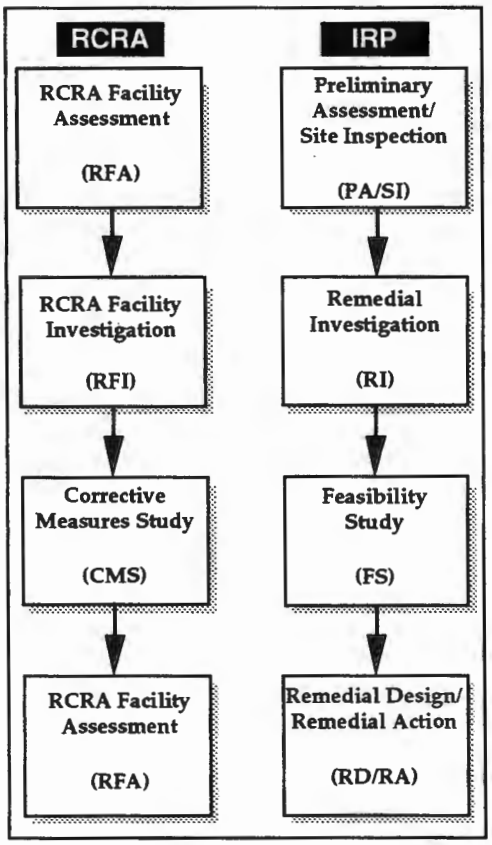


Figure 1–2 Comparison of RCRA Corrective Action and IRP Phases

1.1.2 Project Regulatory Framework

The four sites included in this report were selected for investigation under the IRP by Holloman AFB. The four sites are listed in Table 1-1 by their IRP and SWMU names and numbers.

Table 1-1
The Four Sites Under Investigation at Holloman AFB

IRP Site		SWMU		HSWA Permit Table
Number	Name	Number	Name	
SS–12	JP-4 Fuel Line Spill Site	AOC-K	Northeast Base Spill	NA
SD–27	Pad 9 Washrack Area	141	Pad 9 Drainage Pit	2
OT–35	Spent Solvent Disposal Area	PRI-2 & PRI-5 Area	Solvent Burn Area and Solvent Evaporation Area	NA
LF–58	Incinerator/Landfill	*231	Incinerator/Landfill	3

Note—NA = Not applicable.
*Class 1 Permit modification under review .

Sites SS-12, SD-27, and OT-35 were identified and recommended for further investigation in the *Installation Restoration Program Records Search for Holloman AFB, New Mexico* (CH2M Hill, 1983). Site LF-58 was identified subsequent to the IRP records search and was addressed for the first time in this investigation. Site investigations were conducted at each site to determine whether any of the sites would require further investigation. Since Site LF-58 was newly identified, it also required a preliminary assessment (PA). The PA is the first step in the IRP process, and involves an intensive literature search to determine whether site investigation is needed.

IRP Sites SS-12, SD-27, and OT-35 are all SWMUs identified in the *RCRA Facility Assessment Preliminary Review/Visual Site Inspection Report* (A.T. Kearney, 1987), but only SD-27 was listed in the HSWA permit (Table 2). Therefore Site SD-27 (SWMU 141) is required to undergo the RCRA corrective action program, and Sites SS-12 and OT-35 are not subject to these requirements. This investigation for Site SD-27 (SWMU 141) was approved in the *RCRA Facility Investigation (RFI) 28 Sites Phase I Work Plan* (Radian, 1993).

Furthermore, Section IV of the HSWA permit requires that newly identified SWMUs be included in the HSWA permit and be addressed in an RFI. A Class 1 permit modification requesting that Site LF-58 be included on Table 3 of the permit is currently under public review, and the *Chemical Data Acquisition Plan (CDAP)* (Radian, 1993) for this investigation has been submitted with the request for permit modification for EPA Region VI approval.

This is the IRP report for all four sites, so all names, references, and recommendations are in IRP terminology.

1.2 Summary of Investigation

The investigative phases and activities for this project are presented in Figure 1-3.

All field work was performed as described in the *CDAP* (Radian, 1993). Data validation program procedures and findings are presented in the *Sampling and*

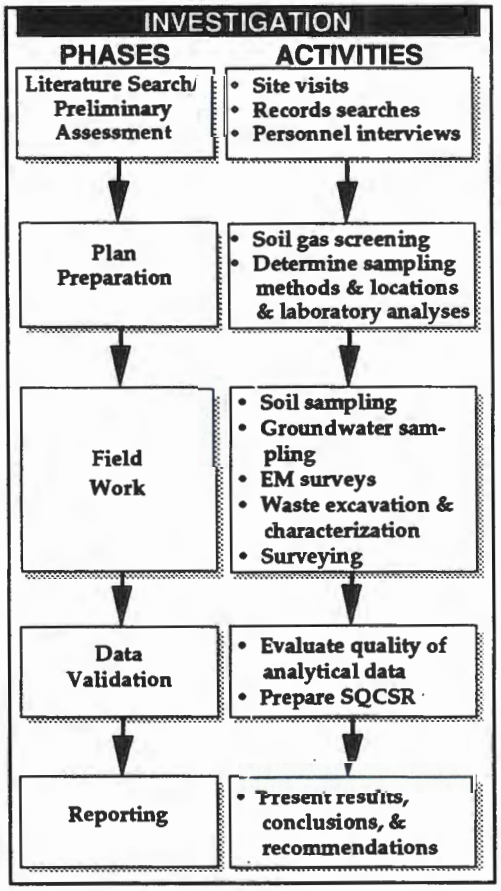


Figure 1–3 Phases and Activities for the Investigation of Four Waste Sites

Quality Control Summary Report (SQCSR) (Radian, 1993). This PA and site investigation report presents results, conclusions, and recommendations for each of the four waste sites. Conclusions address the presence or absence of contamination, and the significance of contamination for each site on the basis of a comparison of results to data evaluation criteria presented in Section 3. Recommendations for site closeout or further investigation were made based on the significance of contamination and the completeness of information for each site. Recommendations are summarized in Table 1-2. Detailed recommendations are provided in the site-specific sections.

1.3 Report Organization

There are a total of nine sections in this report. The contents of Sections 2–9 are outlined below.

Section 2—Environmental Setting. Presents information about physiography, geology, and hydrogeology. This information is fundamental to the technical development of the investigation, and provides background information that is referred to throughout the report.

Section 3—Data Quality Objectives and Evaluation Criteria: Provides the guidelines used to evaluate analytical results and formulate conclusions, including discussions of data validation findings, laboratory reporting limits, statistical background levels, conceptual site models, and action levels.

Sections 4, 5, 6, and 7—Site-Specific Results, Conclusions, and Recommendations: Contain the results, conclusions, and recommendations for Sites SS-12, SD-27, OT-35, and LF-58, respectively. Detailed site-specific discussions cover the following:

- Regulatory status;
- Description of site history and features;
- Summary of specific field activities;
- Interpretation of site geology and hydrogeology, including geologic cross sections;
- Presentation and discussion of analytical results;
- Discussion of the presence or absence of contamination and the significance of contamination; and
- Recommendations.

Table 1–2
Summary of Relevant Findings and Recommendations for Four Waste Sites

Site	Findings	Recommended Actions
SS-12	Minimal presence of fuel hydrocarbons.	*Site closeout*
SD-27	Fuel hydrocarbons detected; limited PCB contamination; radioactivity levels within normal range.	*Site closeout*
OT-35	No volatile organic compounds detected; radioactivity levels within normal range.	*Site closeout*
LF-58	Diesel, aniline, and unknown volatile and semivolatile organic compounds detected in surface soils near the incinerator; buried drums and other debris encountered in waste areas.	*Further investigation of soil in waste areas and near the incinerator; collect groundwater data*

Section 7 also serves as the PA report for Site LF-58. The contents of this section follow the site investigation format used for the other site-specific sections, since the site investigation, rather than the PA, represents the most comprehensive work done at the site. PA requirements are incorporated into appropriate subsections, and a photographic log (a PA requirement) is included. PA references are listed at the end of the section.

Section 8—Acronyms and Symbols: Contains a list of acronyms used throughout the report and their meanings, as well as the footnote and site map symbols used to indicate footnotes in the tables and site-map reference points found in the site-specific sections.

Section 9—References: Contains a list of references cited in the report.

Section 2
ENVIRONMENTAL SETTING

The following section describes the environmental setting of Holloman AFB, New Mexico. Detailed discussions of physiography, geology, and hydrogeology are included to meet the needs of the PA for Site LF–58. These data 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 Section T.17S., R.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.

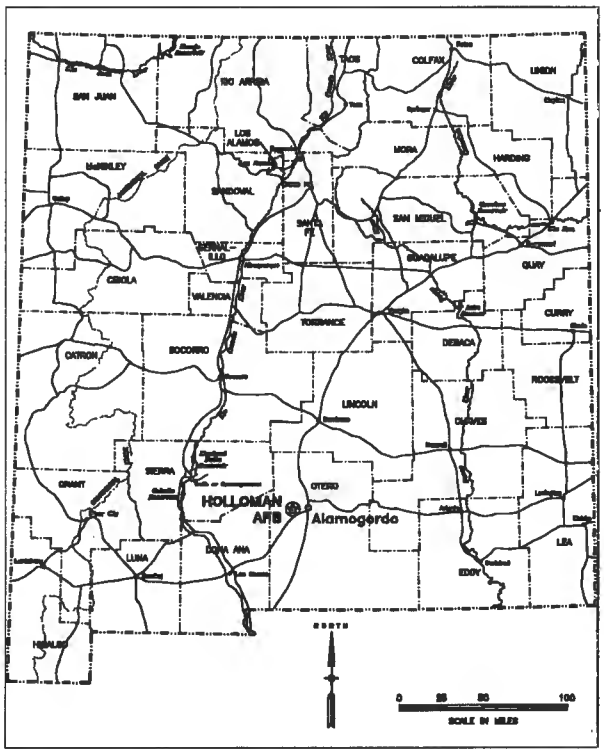


Figure 2-1 Location of Holloman AFB, NM

2.2 Physiography

The Base is located in the Tularosa Basin, which is bounded by the San Andres mountains in the west and the Sacramento mountains in 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 minus 59 in. per year, representing a net loss in groundwater due to 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, and 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 due to the reworking of alluvial sediments by eolian processes. Lacustrine or playa deposits in the area consist of clay containing gypsum crystals. Lacustrine deposits are juxtaposed with alluvial fan and eolian deposits throughout the Base (Radian, 1992).

2.4 Hydrogeology

2.4.1 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 Ritas 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 Ritas

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 through and overflow of the dam have created a small playa lake known as Lake Stinky.

2.4.2 Groundwater

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 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 ft to nearly 50 ft below ground level (BGL).

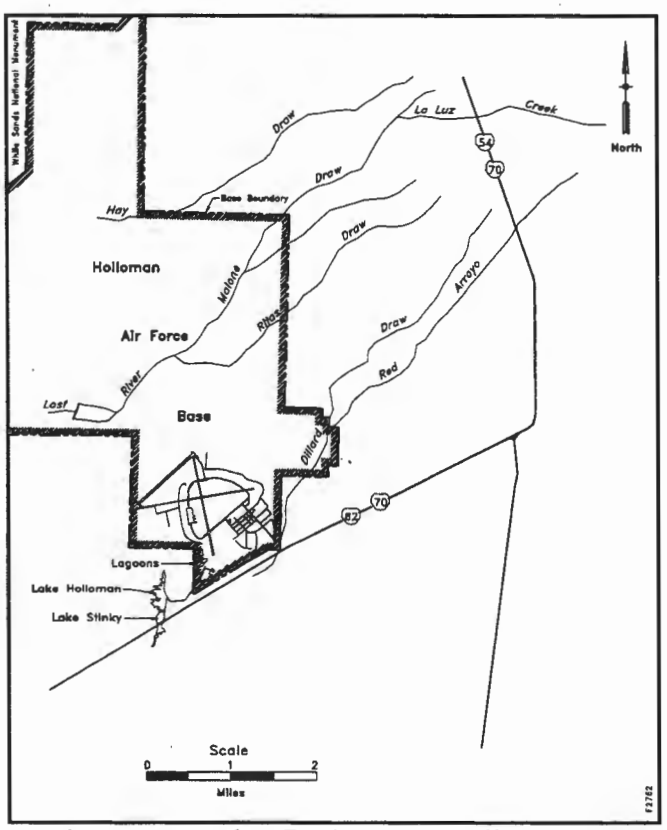


Figure 2-2 Surface Drainages at Holloman AFB

A Base-wide synchronous water-level survey was conducted in March 1993. A potentiometric surface map of the aquifer is shown in Plate 1. 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 Ritas Draw, Malone Draw, and Lost River drainages. Localized effects occur in areas immediately adjacent to arroyos, where groundwater flows directly toward drainages 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 groundwater 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 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 groundwaters 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.

Groundwater Use

No water supply wells are located on Base because of poor groundwater quality. The nearest production well downgradient of Holloman AFB is a livestock well located 10 miles southwest of the site (USGS, 1992). No other down gradient or near-Base potable or irrigation wells exist. Because groundwater beneath the Base is not potable, drinking water for the Base is obtained from the Alamogordo municipal water supply, and from well fields at the base of the Sacramento mountains.

Section 3
DATA QUALITY OBJECTIVES and EVALUATION CRITERIA

This section presents the data quality objectives (DQOs) for the project, the evaluation criteria used in data interpretation, and the process used to develop conclusions and recommendations.

3.1 Data Quality Objectives

To ensure that the goals of this investigation were met, DQOs for data collection and data interpretation activities were developed. DQOs are a statement of the "quality" of data required to meet project objectives. DQOs include detailed specifications of the following:

- The types of data required to make a decision;
- The quantity of data required to make a decision; and
- Measurement objectives for each type of data collected.

DQOs are established to ensure that sufficient data are available for decision makers to resolve project objectives. Figure 3-1 presents the individuals and agencies who will interact in the decision-making process for these sites. Ultimately, the decision maker for the IRP is the New Mexico Environment Department (NMED), and the decision maker for the RCRA corrective action program is EPA Region VI in conjunction with the NMED.

HAVE THESE BEEN ESTABLISHED?

The DQOs presented in this section are not complete for any forthcoming phases of investigative or remedial activity. As more information is gathered about contamination at any of the sites, and as project objectives are refined, DQOs will be defined iteratively for each activity.

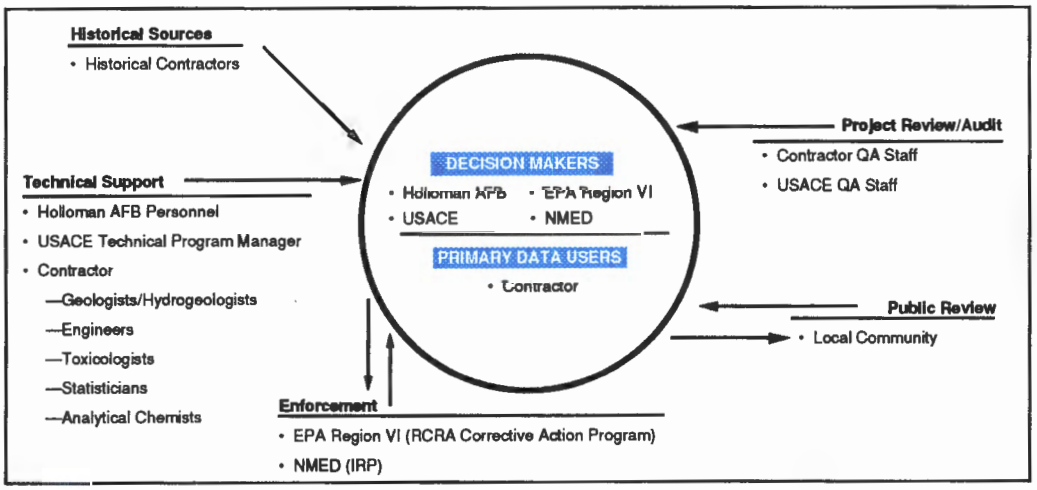


Figure 3–1 Decision-Making Pathway for Four Sites, Holloman AFB

The primary objective of the investigation is to determine the presence or absence of contamination at each of the four sites. The primary decision is to recommend site closeout or further action. There are only two options for this primary decision for each site: to close out the site or to investigate the site further. Table 3-1 presents the objectives and data needs of the investigation.

To complete the objectives listed in Table 3-1 and resolve the primary decision, a variety of types of data were collected during the field investigation. The types of data collected, data collection procedures, contaminants of concern, and the quality assurance/quality control (QA/QC) program for validating the data are presented in the *CDAP* (Radian, 1993). A complete discussion of the QA/QC program and data validation can be found in the *SQCSR* (Radian, 1993).

3.2 Data Evaluation Criteria

To determine the presence or absence and significance of contamination at the individual sites, analytical results were compared with the various evaluation criteria, presented in Table 3–2.

Detailed discussions of data evaluation criteria are provided in Appendix A. All of the criteria shown in Table 3–2 were taken into account when assessing the presence or absence and significance of contamination; and developing recommendations. Detection limits and upper tolerance limits (UTLs) for background conditions were used to determine the presence or absence of contamination. Conceptual site models were used to determine whether exposure pathways were complete for detected constituents to pose a risk to human health or the environment. Proposed Subpart S action levels were used both as a basis of comparison among the sites and to estimate whether detected constituent concentrations might require further investigation.

Table 3–1
Summary of Investigation Objectives and Data Needs

Objectives	Data Needs
Objective 1:	
Determine the presence or absence of contamination at each of the sites.	• Presence or absence of organic contaminants at concentrations greater than quantitation limits; and • Presence or absence of inorganic contaminants at concentrations greater than background.
Objective 2:	
Determine the significance of contamination (i.e., recommend site closeout of further investigation).	• Contaminant transport mechanisms; • Dispersion potential; • Proximity of populations and environments at risk; • Routes of exposure; and • Nature and extent defined

Table 3–2
Data Evaluation Criteria

CRITERIA	CONCLUSIONS
Data validation conclusions	Data acceptability and defensibility
Laboratory reporting limits	Presence or absence of analytes
Statistical background levels (UTLs)	Presence or absence of metal compounds
Background radioactivity levels and acceptance criteria*	Presence or absence of elevated levels of radioactivity
Conceptual site models	Significance of contamination with respect to migration pathways and receptors
Proposed RCRA Subpart S action levels	Significance of contamination with respect to risk-based regulatory criteria

**Waste Acceptance Criteria for Radioactive Solid Waste Disposal at SWSA–6*. Oak Ridge National Laboratory, 1993 (ORNL criteria).

Figure 3–2 illustrates the decision-making process for determining site close-out or further investigation. The qualitative assessment of risks posed by the presence of contamination and the need to define the nature and extent of contamination were the primary basis for recommendations. Site-specific recommendations for further investigation are an estimate of the information needed to assess the nature and extent of contamination, assess risk posed by contamination, and support a corrective measures study, if necessary.

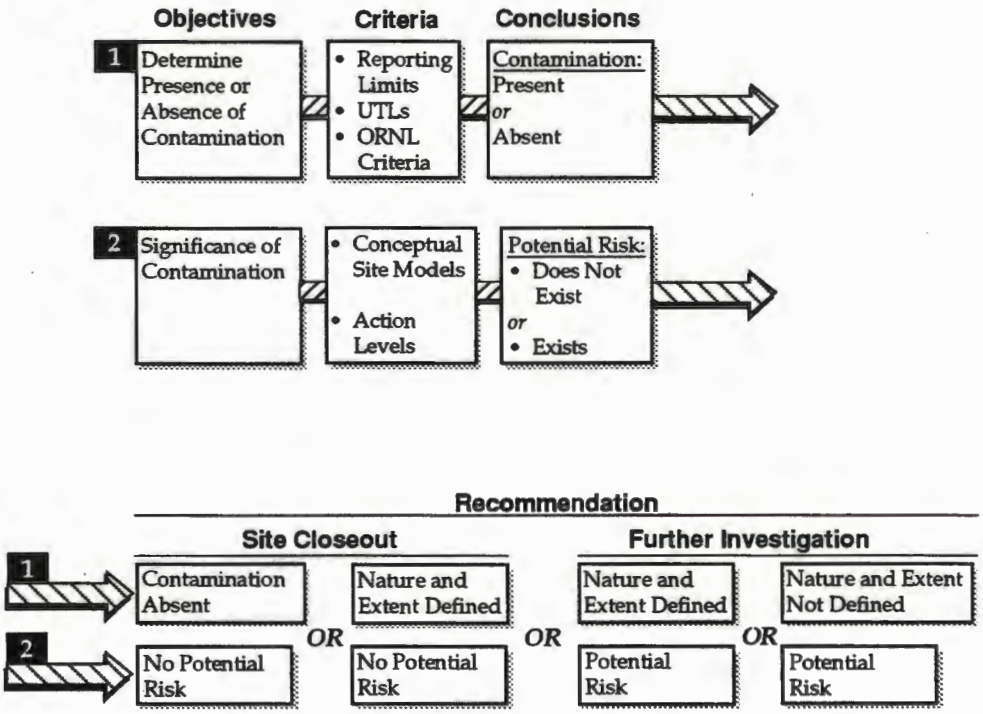


Figure 3–2 Decision-Making Process for Determining Site Closeout or Further Investigation

Section 4
SITE SS-12—JP-4 FUEL LINE SPILL SITE

Section 4 details the results of the IRP site investigation for Site SS-12.

4.1 Site Description

The JP-4 Fuel Line Spill Site is located immediately east of the main Base housing area near the Standard Transpipe JP-4 pipeline, the main pipeline serving the petroleum, oil, and lubricant (POL) area. Site features are illustrated in Figure 4-1.

In 1975, approximately 2000 gal. of JP-4 were spilled at the site. The spill was the result of a rupture in the fuel line from excessive pressure. The majority of the fuel was reportedly recovered when it collected in a pit and was pumped into a tank truck shortly after the spill. The date of occurrence, the quantity of fuel spilled, and the location of the spill could not be confirmed during the literature search.

In early 1992, an alleged fuel product was encountered while digging a trench for a storm sewer being installed approximately 250 ft west (hydrologically upgradient) of the pipeline.

4.2 Site Investigation

This investigation focused on two principal areas of possible contamination:

❶ The segment of the JP-4 pipeline that ruptured in 1975 (BH-12-01, 02, 04, and 05); and
❷ An area where the alleged fuel product was encountered during storm sewer installation (BH-12-03 and 06).

Soil and groundwater sampling locations are shown in Figure 4-1 (see Section 8 for explanation of symbols). A total of

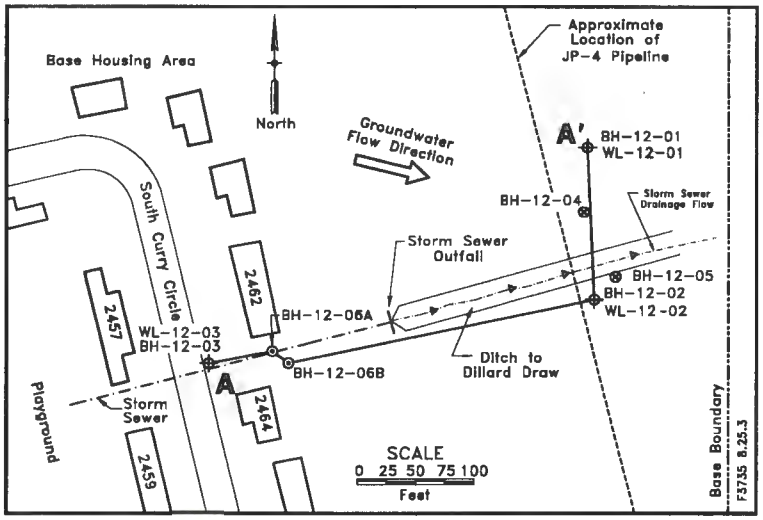


Figure 4–1 Site SS-12 Features

Table 4-1
Site SS-12 Investigation Summary

Suspected Contaminants	Types of Samples Collected	Results Summary
JP-4	One soil sample each from six soil borings	Kerosene in 1 sample; unidentified organics in diesel analysis in 1 sample*
		Unidentified organics in diesel analyses for 2 wells*
	One groundwater sample each from three groundwater monitoring wells	Toluene in 1 well; possible (unconfirmed) toluene in 1 other well†
		Benzene in WL-12-01 and 12-02
		Ethylbenzene, xylenes, and gasoline in WL-12-02

Note—Samples were analyzed for total fuel hydrocarbons (TFH). *Diesel analyses of both soil and groundwater samples showed the presence of organic species not matching the diesel pattern. †Toluene result did not meet confirmation criteria, indicating probable presence of compound other than toluene.

six soil samples and three groundwater samples were collected at Site SS-12 and submitted for chemical analysis. Table 4–1 lists the nature of the contaminants of concern, types of samples collected, and a summary of results for Site SS-12. Soil gas surveys were conducted at the site in November 1992, and results were reported in the *CDAP* (Radian, 1993).

Three of the soil borings were completed as monitor wells. The wells were installed in potential source areas to determine local groundwater flow direction and whether there has been a release to groundwater. Results of both the soil and groundwater analyses are summarized in Tables 4–2 and 4–3, respectively.

Table 4-2
Concentrations of TFH Analytes in Site SS-12 Soils

		SW8015ME—Extractable Fuel Hydrocarbons (µg/g)			
		Diesel		Kerosene	
Location	Depth (ft)	Result	(RL)	Result	(RL)
BH-12-01	0–2	ND	(3.2)	ND	(6.5)
BH-12-02	0–2	ND	(3.1)	35	(6.1)
BH-12-03	3–5	ND	(3.1)	ND	(6.2)
BH-12-04	1.5–2	ND	(3.0)	ND	(6.0)
BH-12-05	0.5–1	ND	(3.2)	ND	(6.5)
BH-12-06	2–4	3.1[GB@]	(2.9)	ND	(5.8)

Note—RL = Reporting limit. ND = Not detected. Refer to Chapter 8 for explanation of footnote(s).

Table 4-3
Concentrations of TFH Analytes in Site SS-12 Groundwater

WHAT IS THIS?

	SW8015ME* (µg/L)		SW8015MP—Purgeable Fuel Hydrocarbons (µg/L)									
	Diesel		Benzene		Ethylbenzene		Gasoline		Toluene		Xylenes (total)	
Location	Result	(RL)	Result	(RL)	Result	(RL)	Result	(RL)	Result	(RL)	Result	(RL)
WL-12-01	ND	(48)	0.49[C@]	(0.3)	ND	(0.3)	ND	(50)	0.66[C@]	(0.3)	ND	(0.5)
WL-12-02	170[GB@]	(48)	0.4[C@]	(0.3)	3.6[C]	(0.3)	670[G]	(50)	5.3[GB]	(0.3)	1.2[G@]	(0.5)
WL-12-03	170[GB@]	(40)	ND	(0.3)	ND	(0.3)	ND	(50)	ND	(0.3)	ND	(0.5)

Note—RL = Reporting limit. ND = Not detected. Refer to Chapter 8 for explanation of footnote(s).
*Extractable Fuel Hydrocarbons

NAPHTHALENE 50

NM 10 — 950 — 950 — 620
EPA — 4,000 — 10,000 — 70,000
SUBPART S (CALC) 1.2 — 3,900 — 7000 — 70,000
27,000
– FOUL ODOR IN THESE WELLS.

B– DETECTED IN METHOD BLANK
G– ANALYTE NOT CONFIRMED.
@– MEASURED RESULT < 5 TIME RL

4.3 Geology and Hydrogeology

The subsurface conditions at Site SS-12 were defined by direct sampling and observation of the drilling operations at the site. Drilling logs located in Appendix B provide a detailed description of site stratigraphy.

To correlate and interpret site stratigraphy, cross section A-A′, presented in Figure 4-2, was constructed from drilling logs and water-level data for Site SS-12. Figure 4-1 shows the location of the cross section. Site stratigraphy consists primarily of clay and clayey sand. Silt and silty sand lenses, ranging in thickness from 4 to 6 ft, are interbedded with the sand and clay in three of the four soil borings. This stratigraphy is typical of the alluvial, eolian, and playa deposits in the Tularosa Basin.

Groundwater occurs in clayey sand in a shallow unconfined aquifer approximately 3 ft BGL. A three-point plot using March 1993 water-level data was calculated to determine local groundwater flow direction and hydraulic gradient. Groundwater flow at the site is to the east–southeast toward Dillard Draw, as shown in Figure 4-1. The magnitude of the hydraulic gradient is approximately 1.8×10^{-3}. All water-level measurements and calculations are provided in Appendix B.

4.4 Conclusions

4.4.1 Presence or Absence of Contamination

Soil

As shown in Table 4-2, kerosene was detected in one soil sample from Site LF-12 (BH-12-02, 0–2-ft depth). Very low levels (just over reporting limit) of unidentified organic compounds eluting in the diesel range were also detected in one soil sample from the 2–4-ft depth at BH-12-06. As discussed in Appendix A, unidentified organic contaminants were detected at similar concentrations in laboratory blanks analyzed together with samples from Site LF-12. Therefore, the unidentified species detected in the sample from BH-12-06 are likely attributable to this low level laboratory contaminantion rather than to the presence of organic compounds in the sample itself. In both the field sample and the blank, the organic compounds detected were not iden-

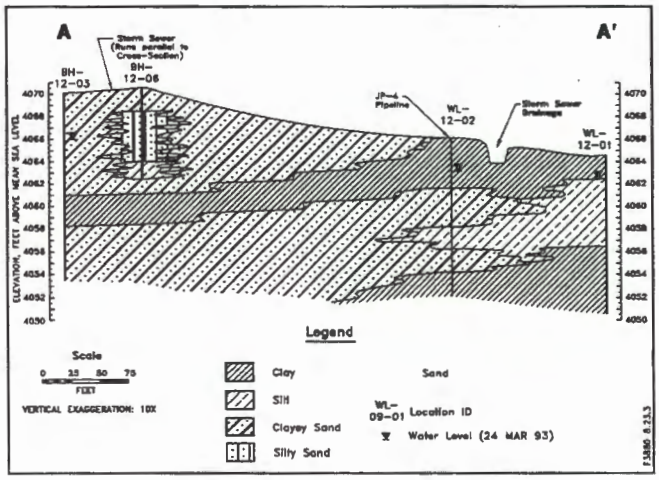


Figure 4–2 Site SS-12 Geologic Cross Section

tified as diesel, and were "G" flagged as not matching the diesel pattern.

Kerosene detected in the soil sample from BH-12-02 is located adjacent to the JP-4 pipeline and ditch that receives runoff from the storm sewer. The concentration of kerosene was 35 µg/g, which is not indicative of a release from the JP-4 pipeline. Instead, it is more likely a result of runoff from the storm sewer that accumulates in the ditch. Furthermore, the concentration of kerosene is significantly less than the NMED cleanup criteria for fuel-contaminated soil (1000 mg/kg total recoverable petroleum hydrocarbons, TRPH) at Holloman AFB. Although TRPH is determined by using EPA 418.1, the total of modified SW8015 extractable compounds (i.e., kerosene) provides a meaningful comparison with EPA 418.1. By using the modified SW8015 results, potential TRPH concentration of soil cuttings are estimated to be 35 µg/g, which is orders of magnitude below the New Mexico TRPH standard of 1000 mg/kg.

Groundwater

As indicated in Table 4-3, benzene, ethylbenzene, and toluene were detected at low concentrations in groundwater samples from WL-12-01 and WL-12-02. However, diesel fuel was not detected in any of the samples from Site LF-12. As indicated in Table 4-3, unidentified organics eluting in the diesel range were detected in the diesel analyses of groundwater samples collected at WL-12-01 and WL-12-03. These unidentified compounds were quantitated by the laboratory against a diesel standard, but were "G" flagged, indicating that they did not match the characteristic pattern for diesel. The results in Table 4-3 are also annotated with the "G" flag. This is explained in more detail in Appendix A.

Table 4-3 also shows one groundwater sample (from WL-12-012) as having unidentified organic compounds eluting in the gasoline range, but not matching the characteristic pattern for gasoline. The unidentified analytes were quantitated against the gasoline standard, but reported with a "G" flag to indicate that they do not meet the identification criteria for gasoline.

One of the toluene results reported in Table 4-3 is also flagged "G" to indicate that the analyte does not meet all of the identification criteria for toluene. In this case, the "G" flag has a slightly different connotation than it does when used for analyses in which the target analyte is a complex mixture of compounds identified by pattern matching (e.g., gasoline, diesel). Toluene is a single compound that shows up as a single chromatographic peak. Confirmed identification by modified Method 8015 (purgeables) consists of getting a peak of the same magnitude at the characteristic retention times for toluene on two dissimilar chromatographic columns. The "G" flag on the toluene result indicates that the peaks on the primary and confirmation columns were of significantly different magnitudes. This is typically due to the presence of an unknown compound eluting at the toluene retention time on one or both of the columns. It is possible that toluene is also present, but its presence cannot be confirmed because of the interfering analyte.

Benzene and toluene were detected in groundwater from WL-12-01 at 0.49 and 0.66 µg/L, respectively. Benzene and ethylbenzene were detected in groundwater from WL-12-02 at 0.4 and 3.6 µg/L, respectively. These monitor wells are located along the JP-4 pipeline. Soil gas re-

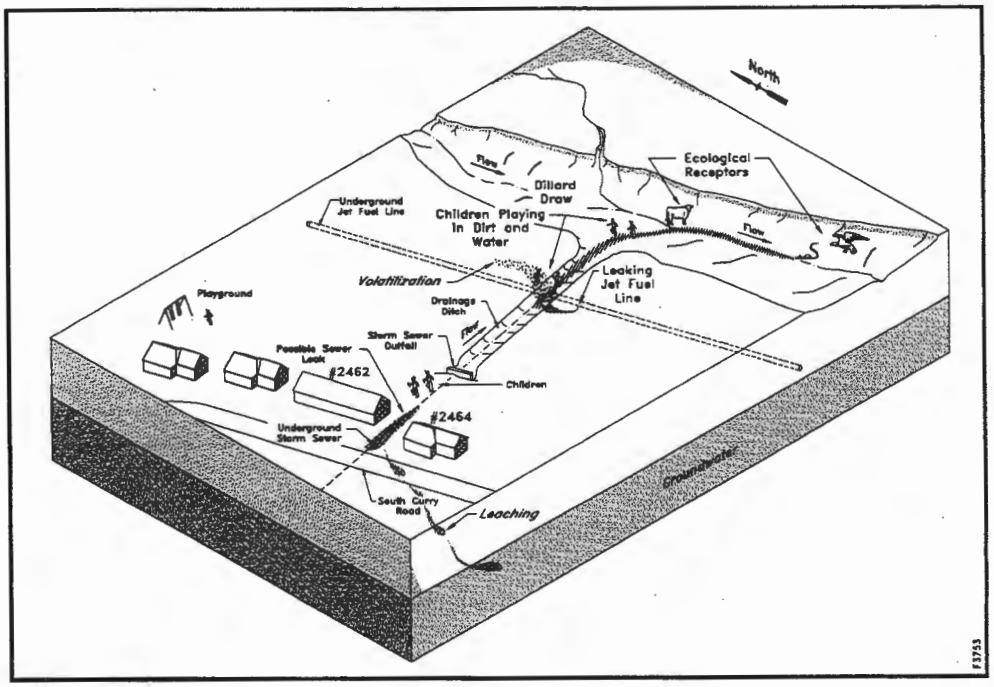


Figure 4–3 Site SS-12 Conceptual Site Model

sults presented in the *CDAP* (Radian, 1993) also indicated that fuel hydrocarbons were present where WL-12-01 and WL-12-02 were installed. However, soil gas results southeast (downgradient) of the pipeline do not indicate the presence of fuel hydrocarbons. On the basis of these results, it is believed that the volatile organic compounds(VOCs) detected in the groundwater from WL-12-01 and WL-12-02 are restricted to the area along the pipeline. There is no evidence to suggest that they have migrated downgradient. Furthermore, the detected concentrations and field results indicate that free product is not present at the site. Finally, no fuel hydrocarbons were detected in groundwater from WL-12-03, located between the houses adjacent to the storm sewer.

4.4.2 Significance of Contamination

Figure 4-3 depicts possible migration pathways to both human and ecological receptors. The fuel hydrocarbon constituents detected in soil and groundwater from the site could migrate through the environment via several different mechanisms. Volatilization and fugitive dust generation could transport contaminants to ambient air since the physical nature of fuel hydrocarbons is conducive to volatilization. This is unlikely, however, because minimal levels of fuel hydrocarbons were detected in site soil samples.

Surface water runoff could carry dissolved constituents and particulate matter. This is possible, because surface water runoff does collect next to the storm sewer outfall at the site; however, it is unlikely that there is sufficient contamination at the site to pose an exposure risk via this mechanism.

Infiltration and subsequent percolation could result in constituent transport

to groundwater. Some fuel hydrocarbons were detected in groundwater, though their presence is probably due to surface runoff from the street rather than from a release at the site.

Off-Base residents are not expected to be affected by the site. Receptors in the area include residents in the nearby housing area, and any wildlife and vegetation that are at the site. Exposure would be primarily the result of children or adults playing at the site or in Dillard Draw and ecological receptors being exposed through dermal contact or incidental ingestion of water and/or sediments. Shallow groundwater in the area is nonpotable, so exposure via ingestion of contaminated groundwater is unlikely. Inhalation of volatile compounds and contaminated particulate matter could also lead to human as well as ecological exposure. The potential for exposure for plants and animals is typically much higher than for humans because they are generally much more dependent on the environment for subsistence and may live their entire life in one area.

Given the levels of constituents detected in soils and groundwater, it is unlikely that exposure by any of these pathways poses a risk to human health or the environment. No constituents in soil samples were detected at concentrations above risk-based action levels.

Unidentified organic compounds eluted in the gasoline range, but did not match the characteristic pattern for gasoline. If the compound was gasoline, it would have exceeded the RCRA Subpart S health-based action level for gasoline.

However, the action level used was for carcinogenic risk from drinking water, which is not a realistic comparison, since the water at the site is nonpotable. Instead, an action level for recreational exposure was derived. Assumptions were that children swam in water from the site and were being exposed to contaminants dermally and by incidental ingestion for 2.6 hours per day for 20 days per year for seven years. Twenty days per year is an estimate of the number of days per year of rainfall sufficient to result in standing water at the site.

Exposure from swimming is a conservative assumption because there is never sufficient water for swimming at the site. In reality, the children would only play in the mud; thus the actual potential for dermal exposure and incidental ingestion would be far less than if the children were actually swimming. The calculated recreational exposure action level based on these assumptions is 123.75 mg/L, and the detected concentration in the groundwater sample for the unidentified organic compound from WL-12-02 was 670 µg/L. Therefore, even if the unidentified organic compound was gasoline, it is well below the action level derived for recreational exposure.

4.5 Recommendations

Fuel hydrocarbon constituents were detected at the site. The extensive soil gas, soil, and groundwater investigation defined the nature and extent of contamination. Furthermore, on the basis of a qualitative risk assessment, detected concentrations do not pose a potential risk to human health or the environment. Therefore, site closeout is recommended.

Preparation of proposed plans and decision documents for public review will be required for official site closeout of Site SS–12.

Section 5
SITE SD-27—PAD 9 WASHRACK AREA

Section 5 details the results of the IRP site investigation for Site SD-27. This site is also SWMU 141 on Table 2 of Holloman AFB's HSWA permit, and must be addressed under the RCRA corrective action program in an RFI. The work done for this field investigation was submitted and approved in the *28 Sites Phase I RFI Work Plan* (Radian, 1993), and the results of this investigation will be used to support the Phase I RFI.

5.1 Site Description

The Pad 9 Washrack Area is located east of Taxiway F near Building 882. The washrack was reportedly used to wash down drones and manned aircraft that had flown through clouds of nuclear blast materials in the late 1940s and early 1950s.

Colonel Forrest Spresster, formerly of the Holloman AFB Bioenvironmental office, was contacted to obtain more information about the site. In the early 1970s, Colonel Spresster interviewed civilian employees who knew of activities at the Pad 9 washrack. The planes washed at the site were reportedly involved in a project studying fallout from nuclear explosions. The planes were equipped with air sampling devices and were flown through blast clouds to collect fallout samples. The samples were reportedly analyzed on site at a building that no longer exists. The location of the building could not be confirmed during the literature search. Following sampling activities, the planes were washed down with water. According to Colonel Spresster, the pad has not been used for aircraft maintenance since these activities took place.

All runoff from the washrack drained into an unlined pit directly south of the pad area. The pit was approximately 12 ft deep. In May 1976, Colonel Spresster collected soil samples from the bottom of the pit and submitted them for analysis. The analytical results indicated no radiation above normal background levels. The pit was backfilled after this soil sampling event.

Site features are illustrated in Figure 5-1. The pad is in fair condition, exhibiting some cracks mainly along concrete seams. The sump in the middle of the pad

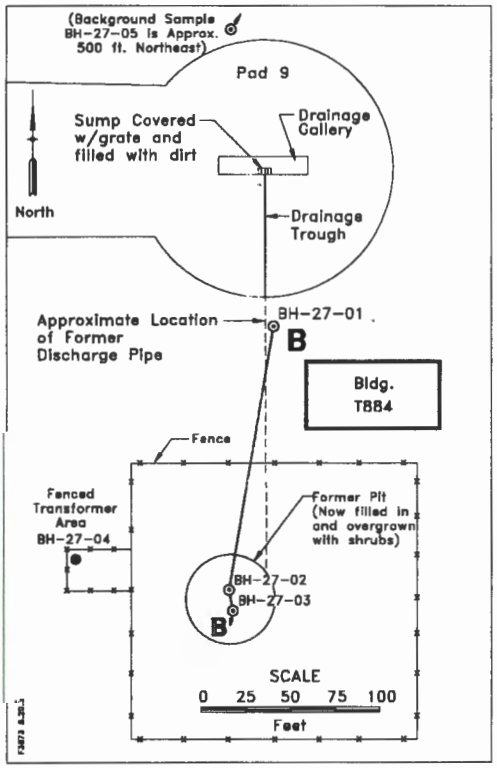


Figure 5–1 Site SD-27 Features

is filled with soil and has plants growing in it. The drainage gallery from the sump to the southern edge of the pad is filled with dirt. It is not known whether the dirt in the sump and drainage gallery is underlain by concrete, or whether runoff drained through a pipe or a lined or unlined ditch.

The area of the former pit is now surrounded by a slightly damaged wire-mesh fence and is overgrown with bushes and small trees, most of which were removed for this investigation. An abandoned transformer is located adjacent to the fence west of the former pit. The abandoned transformer is surrounded by a chain-link fence. The ground around the abandoned transformer is stained.

5.2 Site Investigation

This investigation focused on three principal areas of possible contamination:

- ❶ The former Pad 9 drainage pit (BH-27-02 and 03);
- ❷ The fenced transformer area (BH-27-04); and
- ❸ An area south of Pad 9 near the former drainage pipe (BH-27-01).

A total of six soil samples were collected at Site SD–27. Table 5–1 lists the nature of the contaminants of concern, types of samples collected, and results for Site SD–27. The results of soil analyses for organic constituents, radioactivity, and PCBs are summarized in Tables 5-2, 5-3, and 5–4, respectively. Soil sampling locations are shown in Figure 5-1.

Table 5-1
Site SD-27 Investigation Summary

Suspected Contaminants	Types of Samples Collected	Results Summary
PCBs	One surface sample from the abandoned transformer area analyzed for PCBs	PCBs detected
Alpha, beta, and gamma radiation	One sample from just south of the pad Three samples from the two borings in the former pit area; one background sample	Alpha and beta radiation detected at levels comparable to background
Fuels	One sample from former pit	Fuel hydrocarbons detected in sample from base of former pit area

Table 5-2
Concentrations of TFH Analytes in Site SD-27 Soils

		SW8015ME Extractable Fuel Hydrocarbons (µg/g)		SW8015MP Purgeable Fuel Hydrocarbons (µg/kg)					
		Kerosene		Ethylbenzene		Toluene		Xylenes (Total)	
Location	Depth (ft)	Results	(RL)	Results	(RL)	Results	(RL)	Results	(RL)
BH-27-03	8–10	430	(68)	680[c]	(41)	51[c●]	(41)	2700[c]	(68)

Note—RL = Reporting limit. Refer to Section 8 for explanation of footnote(s).

NMED – 1,000,000 ppb ~~ALL~~ TPH ALLOWED IN SOIL.

Table 5-3
Radioactivity Levels in Site SD-27 Soils

		SW9310 Gross Alpha and Gross Beta (pCi/g)			
		Gross alpha		Gross beta	
Location	**Depth (ft)**	**Result**	**(RL)**	**Result**	**(RL)**
BH-27-01	0–2	8.95	(3.63)	16.69	(5.52)
BH-27-02	6–8	19.29	(3.76)	15.31	(5.22)
BH-27-03	8–10	13.5	(3.71)	12.15	(5.92)
BH-27-05*	4–6	7.35	(3.61)	7.68	(5.94)

Note—RL = Reporting limit. Refer to Section 8 for explanation of footnote(s). *Background sample.

Table 5-4
Concentrations of PCBs in Site SD-27 Soils

		SW8080—PCBs (µg/kg)	
		PCB-1254	
Location	**Depth (ft)**	**Result**	**(RL)**
BH-27-04	0–2	200●	(87)

Note—Refer to Section 8 for explanation of footnote(s).

5.3 Geology and Hydrogeology

The subsurface conditions at Site SD–27 were defined by direct sampling and observation of the drilling operations at four soil borings. Drilling logs located in Appendix B provide a detailed description of site stratigraphy.

To correlate and interpret the site stratigraphy, cross section B-B′, shown in Figure 5-2, was constructed from boring logs for Site SD–27. Figure 5-1 shows the location of the cross section. Site lithology consists primarily of silt interbedded with lenses of clay and sandy clay. In the vicinity of the former waste disposal pit, shown in Figure 5-1, fill material was encountered at a depth of 8 ft. A clayey sand unit with caliche underlies the pit.

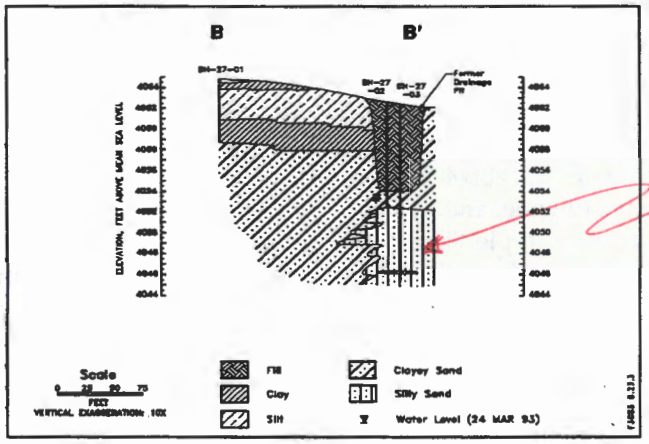


Figure 5–2 Site SD-27 Geologic Cross Section

5.4 Conclusions

5.4.1 Presence or Absence of Contamination

As presented in Table 5-3, gross alpha and beta radioactivity were detected at comparable levels in potentially affected areas and background. In addition, detected radioactivity levels were compared with *Waste Acceptance Criteria for Radioactive Solid Waste Disposal at SWSA-6* (Oak Ridge National Laboratory [ORNL],1993). Solids with alpha activity exceeding 30 pCi/g are considered radioactive waste by ORNL. None of the samples at Site SD-27 exceeded these levels; thus, radioactivity is not a problem at this site.

Stained soil with a fuel odor was encountered at the base of the former pit below the water table. However, soil above the water table was not stained (it is primarily fill used to cover the former pit). Fuel staining was observed in all of the three soil borings below the water table; soil was stained from approximately 8 to 16 BGL. It is believed that the extent of affected media is limited to the saturated soil below the former pit. The source of fuel staining is most likely the result of runoff from Pad 9 that drained into the unlined pit.

A sample of the stained soil was collected and analyzed for TFH (modified SW8015) from one of three soil borings (BH-27-03) drilled in the former pit, and the results are presented in Table 4-2. Kerosene, ethylbenzene, toluene, and xylenes were detected in the sample. The total concentration of these analytes (both extractable and purgeable compounds) is 3.8 mg/kg. The New Mexico standard for remediation of fuel-contaminated soil (TRPH determined by EPA 418.1) is 1000 mg/kg. Although the samples from Site SD-27 were analyzed using modified SW8015, the total concentration of the extractable and purgeable compounds provides a very conservative comparison for TRPH using EPA 418.1 (this method only determines concentrations of extractable compounds). Therefore, by using the modified SW8015 results, potential TRPH concentration of saturated soil cuttings may be 3.8 mg/kg, which is orders of magnitude below the New Mexico TRPH standard of 1000 mg/kg.

Soil adjacent to the former transformer area was collected and analyzed for PCBs. PCBs were detected at a concentration of 200 µg/kg. On the basis of visual observations, the affected soil is restricted to an area on the north side of the Pad, which is approximately 3 ft wide by 5 ft long by 2 ft deep.

5.4.2 Significance of Contamination

Figure 5-3 depicts possible contaminant migration and exposure pathways for both human and ecological receptors. The constituents detected in site soils could migrate through the environment via several different mechanisms. Volatilization is likely to be minimal, given the semivolatile nature of PCBs, and the fact that the fuel hydrocarbon contamination is at the base of the former pit and is buried. Fugitive dust generation, which can transport contamination to ambient air, is of minimal concern because radioactivity was detected at levels comparable to background, the surface area of PCB contamination is very small, and the petroleum hydrocarbons detected at the site are buried.

Migration via surface water runoff, which can carry dissolved constituents and particulate matter, is minimal. There

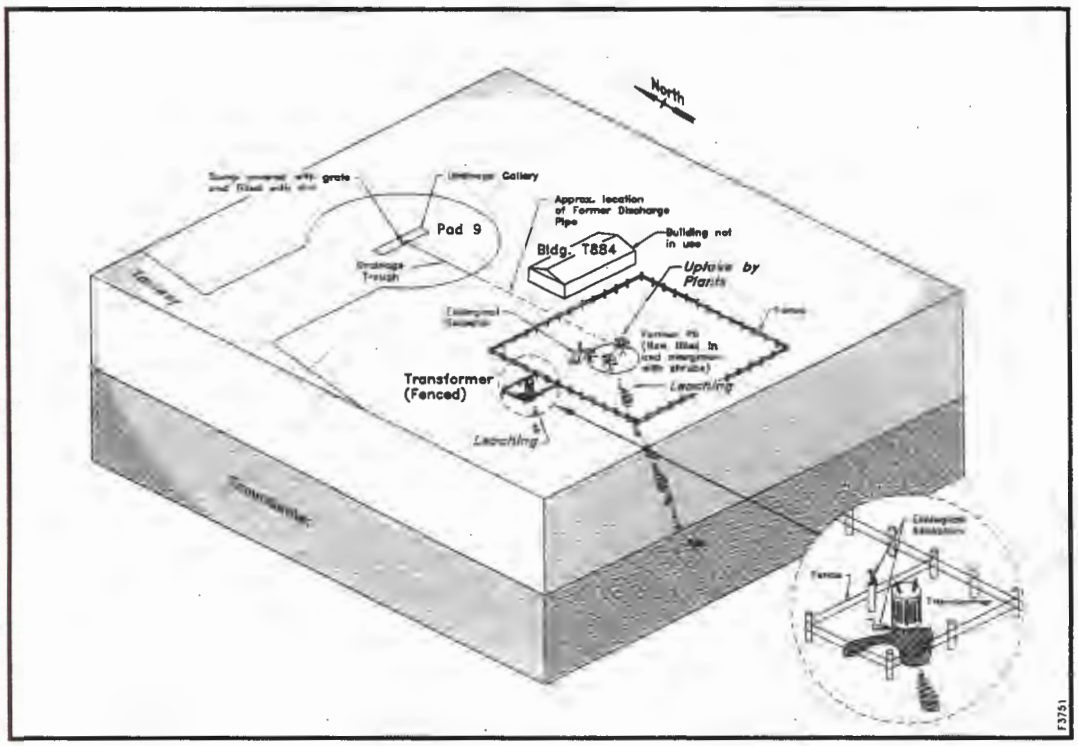


Figure 5–3 Site SD-27 Conceptual Site Model

is no known area where surface water runoff from the site collects, and the only surface contamination at the site is a very small area of PCB-contaminated soil. Infiltration and percolation of contaminants to groundwater are the most likely modes of contaminant transport at this site. The sample in which petroleum hydrocarbons were detected was taken from below the water table. However, groundwater is nonpotable and does not discharge anywhere near the site.

Off-Base residents are not expected to be affected by the site. Access to the site is severely restricted, since it is across the flightline. Ecological receptors may be exposed, via dermal contact or ingestion, to the PCBs at the surface in the former transformer area, and to fuel hydrocarbons from the former sump pit through uptake by plants. Access to the PCB-contaminated soil is restricted because the abandoned transformer area is surrounded by a chain-link fence.

The ARARs presented in the RI report (Radian, 1992) specify cleanup criteria for PCBs specified in 40 CFR Part 761, Subpart G. Requirements for cleanup of PCBs in outdoor electrical substations are contained in 40 CFR Sections 761.125(c)(2)(i) and (ii). Contaminated soil will be cleaned to either 25 or 50 mg/kg by weight provided that a label or notice is visibly posted in the area. Concentrations of PCBs at the site (200 µg/kg) are well below EPA-required cleanup criteria for PCBs. Appendix A provides a summary of the ARARs presented for PCBs at Holloman AFB.

The rule also states that in exceptional spill situations, site-specific risk factors may warrant cleanup to more stringent concentration levels. A site-specific health-based concentration was determined to evaluate whether a potential risk could exist, given existing and potential future exposure scenarios.

To evaluate potential risk for current and potential future occupational exposure scenarios, a risk-based concentration was calculated by using realistic yet conservative exposure scenarios. The site-related risk-based concentration for PCB-1254 is based on dermal exposure for an adult worker. This is based on a carcinogenic slope factor of 7.7 mg/kg/day; exposure for 5 days/week, eight hours/day, and 250 days/year for 25 years. Since no inhalation unit risk or inhalation slope factor exists, a risk-based concentration for air could not be determined. The risk-based concentration was calculated to be 987 µg/kg. This is not generated as a cleanup level, but as a check to determine what concentrations may present unacceptable risk. Appendix A contains calculations used for this risk-based level.

The concentrations of PCBs detected in the soil was 200 µg/kg, which is significantly lower than the estimated occupational exposure concentration of 987 µg/kg.

5.5 Recommendations

Unsaturated soil has not been affected by the operations at Pad 9. Therefore, no ongoing source of contamination is present in the unsaturated zone at the former pit. The saturated soil does contain some fuel hydrocarbons that are a result of runoff from the tarmac. The concentrations of the fuel constituents are, however, significantly lower than the NMED standard for remediation. Because there is no ongoing source of contamination in the unsaturated soil, and fuel concentrations are well below the 1000-mg/kg cleanup criteria, no further investigation is warranted for the former pit at Site SD-27.

PCBs present in the soil at the transformer pad are below reasonable health-based levels anticipated for existing and potential future occupational exposure scenarios. Furthermore, concentrations are below cleanup levels specified for "other restricted access areas" in 40 CFR Section 761.123. Therefore, no further action is recommended for the soil adjacent to the transformer.

Preparation of CERCLA proposed plans and decision documents for public review will be required for official site closeout. In addition, a RCRA Class 3 permit modification is necessary for a change to no-further action status.

Section 6
SITE OT-35—SPENT SOLVENT DISPOSAL AREA

Section 6 details the results of the IRP site investigation for Site OT-35.

6.1 Site Description

The Spent Solvent Disposal Area is located near the Primate Research Laboratory (PRL). Spent solvents containing radioactive tracers (carbon-14 and tritium) had reportedly been disposed of intermittently on the ground at the site since the 1950s. Information obtained during the literature search was supplemented by a site visit with Mr. Harry Ridge, a long-time PRL employee.

New PRL facilities have been under construction near the former solvent evaporation area since 1991. The area sustains heavy vehicle traffic and appears to have been graded. Site features are illustrated in Figure 6-1.

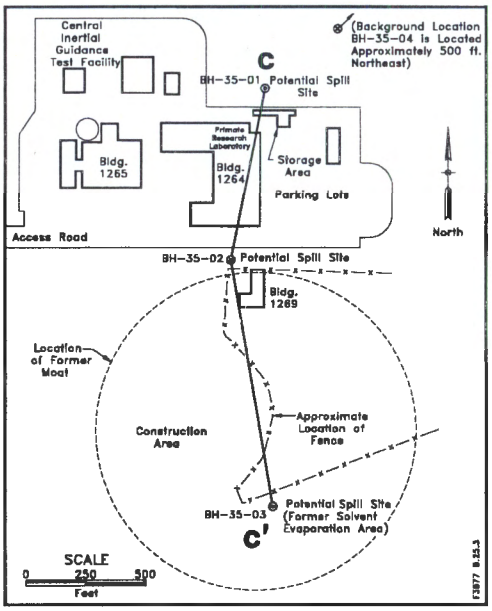


Figure 6–1 Site OT-35 Features

6.2 Site Investigation

This investigation focused on three principal areas of possible contamination:

❶ An area of stressed vegetation behind Building 1264 (BH-35-01);
❷ A slightly vegetated area near Building 1269 where stained soils were observed (BH-35-02); and
❸ An area several hundred yards south of Building 1269 that was identified as the former solvent evaporation area where spent solvents were set out in evaporation pans for disposal (BH-35-03).

A total of six samples were collected at Site OT-35 and submitted for chemical analysis. Table 6–1 lists the nature of the contaminants of concen, types of samples collected, and a summary of results for Site OT–35. A background sample was collected approximately 500 ft northeast of the site and analyzed for alpha, beta, and gamma radioactivity only. Soil boring locations are shown in Figure 6-1. The results of soil analyses for radioactivity are summarized in Table 6–2.

Table 6-1
Site OT-35 Investigation Summary

Suspected Contaminants	Types of Samples Collected	Results Summary
Solvents with radioactive tracers	Two samples each from three soil borings at potential source areas	No VOCs detected; Gross alpha, beta, and gamma radioactivity detected at background levels.

6.3 Geology and Hydrogeology

The subsurface conditions at Site OT-35 were defined by direct sampling and observation of the drilling operations for three soil borings. Drilling logs located in Appendix B provide a detailed description of site stratigraphy.

To correlate and interpret site stratigraphy, cross section C-C′, shown in Figure 6-2, was constructed from the boring logs for Site OT-35. The location of the cross section is shown in Figure 6-1. Site stratigraphy consists primarily of two broadly defined lithologic units. The uppermost unit consists of 10 ft of silt and silty sand; 25 ft of clay underlies the uppermost unit. Interbedded lenses of sand and silt, ranging in thickness from 1 to 6 ft, occur within the clay layer. The clay layer grades into clayey sand in the southern portion of the site.

6.4 Conclusions

6.4.1 Presence or Absence of Contamination

Detected radioactivity levels were comparable to levels in the background sample. Radioactivity levels were also compared with *Waste Acceptance Criteria for Radioactive Solid Waste Disposal at SW SA-6* (Oak Ridge National Laboratory [ORNL], 1993). None of the radioactivity levels detected in Site OT–35 soils samples

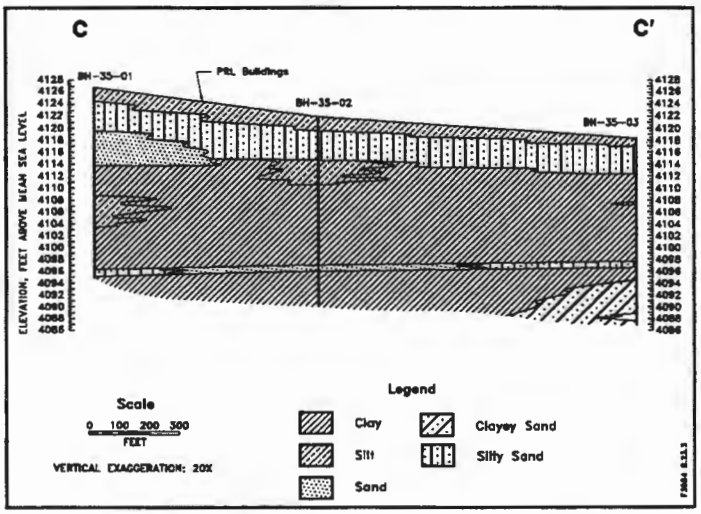


Figure 6–2. Site OT-35 Geologic Cross Section

Table 6-2
Concentrations of Inorganic Analytes in Site OT-35 Soils

		SW9310—Gross Alpha and Gross Beta (pCi/g)				E901.1—Gamma Radiation (pCi/g)	
		Gross Alpha		Gross Beta		Total Gamma	
Location	Depth (ft)	Result	(RL)	Result	(RL)	Result	(RL)
BH-35-01	0–2	21.21	(3.97)	19.08	(5.18)	0.33	(100)
	25–27	15.08	(3.83)	19.51	(5.15)	ND	(100)
BH-35-02	2.5–4.5	4.01	(3.52)	5.83	(5.43)	ND	(100)
	10–12	12.06	(3.51)	17.94	(5.47)	ND	(100)
BH-35-03	0–2	6.61	(3.16)	ND	(5.05)	ND	(100)
	5–7	ND	(3.0)	ND	(5.5)	ND	(100)
BH-35-04	0–2	7.87	(2.93)	5.95	(5.61)	ND	(100)

Note—RL = Reporting limit. ND = Not detected.

exceeded ORNL criteria. Radioactivity, therefore, is not a problem at the site. No VOCs were detected in site soil samples. There does not appear to be any contamination at the site.

6.4.2 Significance of Contamination

Although there does not appear to be any contamination at Site OT-35, Figure 6-3 is included to show possible migration pathways to human and ecological receptors had contamination been present.

6.5 Recommendations

There is no contamination at the site, and thus no risks to human health or the environment. Therefore, site closeout is recommended. Preparation of CERCLA proposed plans and decision documents for public review will be required for official site closeout.

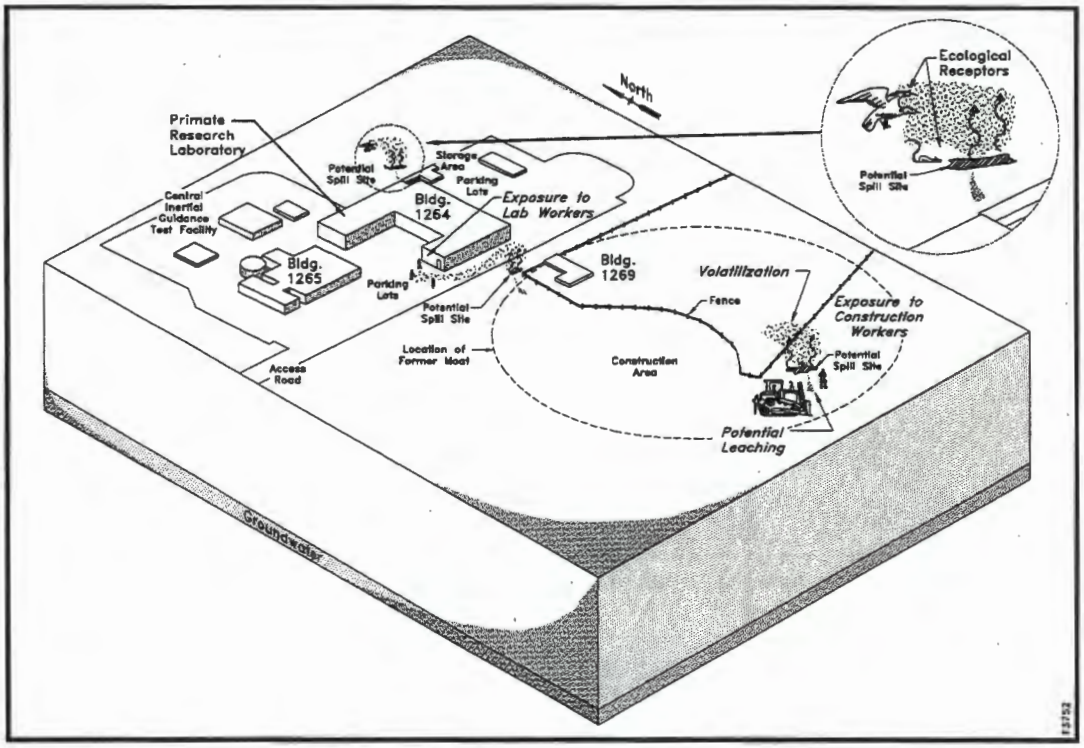


Figure 6–3 Site OT-35 Conceptual Site Model

Section 7
SITE LF-58—INCINERATOR/LANDFILL

Section 7 details the results of the PA and the site investigation for Site LF-58 under the IRP. Site features are illustrated in Figure 7–1. Site LF-58 is a new site, and thus requires a PA in addition to a site investigation under the IRP.

Section IV.F of Holloman AFB's HSWA permit requires that newly identified SWMUs be addressed under the RCRA corrective action program in an RFI. A permit modification requesting that Site LF-58 be included on Table 3 of the permit is in progress, and the *CDAP* was submitted for approval as the Phase I RFI work plan for the site. The proposed SWMU number is 231. Pending approval of the *CDAP*, this investigation will be used to support the Phase I RFI.

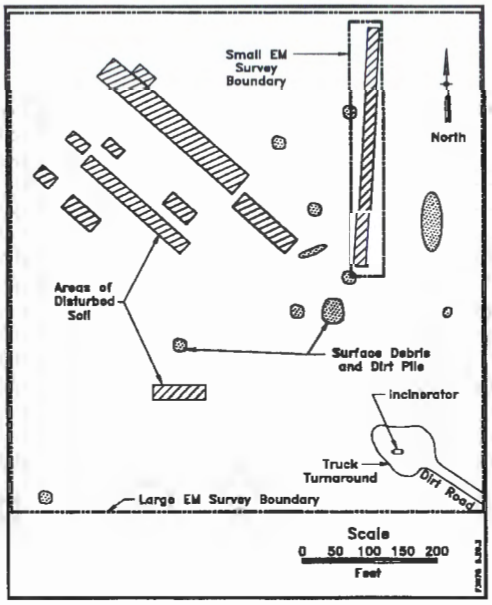


Figure 7–1 Site LF-58 Features

7.1 Introduction

7.1.1 PA/Investigation Overview

Preparation of a PA is part of the remedial response process within the IRP. The purpose of the PA is to collect information about the site, assess potential threats to human health and the environment, and determine the need for further action at the site. The PA was conducted in accordance with guidelines set forth by CERCLA as amended by SARA, and as prescribed in *Guidance for Performing Preliminary Assessments Under CERCLA* (U.S. EPA, 1991). The scope of the PA includes a review of available file information, site reconnaissance, and a comprehensive receptor identification.

Following the PA, a site investigation was performed. The site investigation is the step prior to an RI in the IRP process. The purpose of the site investigation is to confirm the presence or absence of contamination in suspect areas identified during the PA.

7.1.2 Organization of Section 7

Information from both the PA and the site investigation is incorporated in this section. Since the site investigation represents the most comprehensive work done at the site, this section follows the format used in the other site-specific sections of this report. PA data are included where applicable; a photographic log is included at the end of the section; PA references are provided in Appendix C. Photos are referenced throughout the text where applicable.

7.2 Site Description

Site LF-58 is located on a dirt road off De Zonia Road, several hundred yards

storage area (now the Base equestrian facility).

The incinerator is a small (10-ft square) brick structure with a metal roof, a burner, and a 30- to 40-ft-tall stack (see Photo A). According to Mr. Marvin Weber, a former project officer for the unconventional fuels program, the incinerator operated from 1955 to 1960, and was used to dispose of unconventional fuels used for the Aerobee sounding rocket, including aniline, xylidine, and furfuryl alcohol (PA Reference 1). During the initial site visit, old warning signs mentioning aniline, xylidine, and furfuryl alcohol were found several hundred yards east, west, and north of the site (PA reference 2).

Unconventional fuels were reportedly transported to the site in tank trucks that parked north of the incinerator at a stainless steel fill line with an electrical ground (see Photo B). Fuel was pumped into the fuel line in much the same way the gasoline tank of a car is filled. Approximately 100 ft southwest of the incinerator is another fill line, presumably for conventional fuel, like kerosene or diesel, used to start the burner (PA Reference 2). The burner was lit using conventional fuel, then a valve was opened, exposing the unconventional fuel to the flame (PA Reference 1).

Several areas of purple stained soil were found near the incinerator (see Photo E). Water was observed pooling over these stained areas during rainfall, so they were easily located (PA Reference 3). One of the purple stained areas is approximately 100 ft north of the incinerator, next to the stainless steel fill line and electrical ground. The source of the staining is not known, but it may be the result of spillage of unconventional fuels while unloading tank trucks (PA Reference 2).

The suspected burial areas under investigation are located in a 700 ft x 700 ft study area northwest of the incinerator, which exhibits disturbed soils and a variety of debris, including some stainless steel equipment. The areas of disturbed soil include the suspected landfill mentioned in the scope of work (USACE, 1992) and several other possible burial areas. The suspected landfill is located several hundred feet north of the incinerator and is approximately 350 ft long and 10 ft wide (PA Reference 2). The northwest trending depressions of disturbed soil located throughout the study area are also possible burial areas.

7.3 Site Investigation

This investigation focused on two principal areas of possible contamination:

1. The area around the inactive incinerator (soil boring investigation), and
2. A larger area characterized by debris and disturbed soil that includes the suspected landfill mentioned in the scope of work (USACE, 1992) and other suspected burial areas (EM surveys and waste excavation and characterization).

Site features are illustrated in Figure 7-1.

7.3.1 Soil Boring Investigation

A total of six soil samples were collected from Site LF-58 and submitted for chemical analysis (see Table 7-1). Soil borings were drilled near the incinerator in suspect areas as indicated by soil gas survey results and observed purple stain-

survey results and observed purple staining (see Photos D and E). Soil boring locations are shown in Figure 7-2. The results of soil analyses for organic compounds are summarized in Table 7-2. Tentatively identified compounds (TICs) were detected in volatile and semivolatile organic analyses and are listed in Table 7-3. These compounds have not been positively identified and their concentrations are uncertain. The results of soil analyses for inorganic compounds are summarized in Table 7-4.

7.3.2 Electromagnetic (EM) Surveys

Two electromagnetic (EM) surveys were conducted at Site LF-58 to identify locations of buried waste and guide subsequent waste excavation and characterization activities (see Photo C). One survey was conducted at 50-ft intervals over the entire site, and another was conducted at 10-ft intervals over the area of the suspected landfill. The EM survey areas are shown in relation to site features in Figure 7-1.

Data for both the quadrature and in-phase components were collected to measure the terrain conductivity and magnetic field, respectively. The terrain conductivity and magnetic field were contoured and are shown in Figures 7-3 and 7-4, respectively, for the large grid, and in Figure 7-5 for the small grid. Potential buried wastes were identified by anomalous contour patterns that look like holes or mounds. Some anomalies were reflected on both terrain conductivity and magnetic field results, whereas others were reflected only on one or the other, depending on the nature of the anomaly.

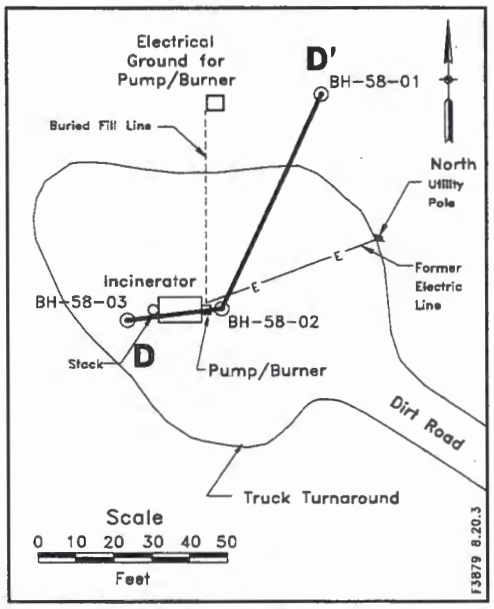


Figure 7–2 Site LF-58 Soil Boring and Cross-Section Locations

Table 7-1
Site LF-58 Investigation Summary

Suspected Contaminants	Types of Samples Collected	Results Summary
Unconventional Fuels	Two samples each from three soil borings, analyzed for TFH, volatile and semivolatile organic compounds, and metals.	Aniline and unknown volatile and semivolatile organic compounds present. Some metals detected above background in soil samples.
Buried Waste	Two EM surveys Waste excavation and characterization	See discussion in text.

Table 7-2
Soil Analyses for Organic Compounds from Site LF-58

		SW8015ME (µg/g)		SW8240—Volatile Organics (µg/kg)				SW8270—Semivolatile Organics (µg/kg)	
		Diesel		Methylene Chloride		Xylenes		Aniline	
Location	Depth (ft)	Result	(RL)	Result	(RL)	Result	(RL)	Result	(RL)
BH-58-01	0–2	1200[GB]	(29)	13[●]	(5.7)	9.7[B●]	(5.7)	ND	(11,000)
	25–27	ND	(3.0)	ND	(6.7)	ND	(6.7)	ND	(440)
BH-58-02	0–2	260[B]	(14)	ND	(5.7)	ND	(5.7)	15,000[●]	(3800)
	20–22	3.5[GB●]	(3)	ND	(6.1)	ND	(6.1)	ND	(410)
BH-58-03	0–2	ND	(3.2)	ND	(6.4)	ND	(65)	ND	(430)
	20–22	3.5[GB●]	(3)	ND	(6.1)	ND	(62)	ND	(410)

Note—RL = Reporting limit. ND = not detected. Refer to Section 8 for explanation of footnote(s).

Table 7-3
Tentatively Identified Compounds (TICs) from Site LF-58

		SW8240—Volatile Organics (µg/kg)						
		Tetrahydro-furan B	Unknowns					
			Unknown	B	B 2	B 3	$C_8H_9O_2N$	Alcohol
Location	Depth (ft)	Result	Result	Result	Result	Result	Result	Result
BH-58-01	0–2	8	ND	24	23	45	26	8
	25–27	8	ND	72	36	ND	6.6	ND
BH-58-02	0–2	8	ND	5.7	160	48	ND	ND
	20–22	11	ND	15	26	33	ND	30
BH-58-03	0–2	10	ND	78	26	ND	ND	ND
	20–22	ND	27	62	ND	ND	ND	ND

		SW8270—Semivolatile Organics (µg/kg)						
		Unknowns		Unknown Dimethylanilines				
		Unknown	B	UD	2	3	4	5
		Result	Result	Result	Result	Result	Result	Result
BH-58-01	0–2	ND	ND	140,000	120,000	64,000	ND	ND
	25–27	ND	ND	ND	ND	ND	ND	ND
BH-58-02	0–2	ND	ND	19,000	15,000	2700	3100	6500
	20–22	ND	ND	ND	ND	ND	ND	ND
BH-58-03	0–2	210	430	ND	ND	ND	ND	ND
	20–22	ND	ND	ND	ND	ND	ND	ND

Note—UD = Unknown dimethylaniline. ND = not detected. TICs do not have detection limits. Their presence and concentration are uncertain.

Table 7-4
Concentrations of Inorganic Anlytes in Site LF-58 Soils

	BH-58-01				BH-58-02				BH-58-03			
	Depth (ft)				Depth (ft)				Depth (ft)			
	0-2		25–27		0-2		20–22		0-2		20–22	
	Analyses				Analyses				Analyses			
Analytes	Result	(RL)	Result	(RL)	Result	(RL)	Result	(RL)	Result	(RL)	Result	(RL)
					SW6010—Metals (mg/kg)							
Aluminum	6400	(19)	670	(20)	7800	(18)	1600	(18)	6600	(21)	2600	(17)
Barium	63	(0.96)	34	(0.98)	76	(0.89)	26	(0.9)	65	(1)	31	(0.87)
Beryllium	0.44•	(0.19)	ND	(0.2)	0.44•	(0.18)	ND	(0.18)	0.31•	(0.21)	0.24•	(0.17)
Calcium	170,000	(390)	240,000	(390)	150,000	(360)	210,000	(360)	180,000	(410)	120,000	(350)
Chromium	5.9	(0.96)	1.4•	(0.98)	7.2	(0.89)	1.6•	(0.9)	5.7	(1)	2.9•	(0.87)
Cobalt	2.3•	(0.96)	ND	(0.98)	2.5•	(0.89)	ND	(0.9)	2.1•	(1)	0.93•	(0.87)
Copper	5.6•	(1.9)	ND	(2)	6.8•	(1.8)	1.8•	(1.8)	4.8•	(2.1)	ND	(1.7)
Iron	5300	(4.8)	740	(4.9)	6900	(4.5)	1500	(4.5)	5200	(5.2)	2400	(4.4)
Magnesium	4300	(96)	970	(98)	6300	(89)	1100	(90)	5600	(100)	1300	(87)
Manganese	120	(0.96)	120	(0.98)	170	(0.89)	17	(0.9)	110	(1)	19	(0.87)
Nickel	5.1•	(1.9)	ND	(2)	5.2•	(1.8)	ND	(1.8)	3.8•	(2.1)	ND	(1.7)
Potassium	1900	(290)	ND	(290)	2400	(270)	290•	(270)	2000	(310)	690•	(260)
Sodium	900	(96)	1200	(98)	900	(89)	810	(90)	1300	(100)	1200	(87)
Thallium	ND	(9.6)	10•	(9.8)	ND	(8.9)	9.4•	(0)	14•	(10)	ND	(8.7)
Vanadium	10	(1.9)	ND	(2)	11	(1.8)	3.2•	(1.8)	9.6•	(2.1)	4.6•	(1.7)
Zinc	16	(1.9)	ND	(2)	23	(1.8)	5.2•	(1.8)	16	(2.1)	6.7•	(1.7)
					SW7060—Arsenic (mg/kg)							
Arsenic	1.7•	(0.38)	ND	(0.41)	1.9	(0.36)	0.59•	(0.37)	2.2	(0.4)	1.3•	(0.36)
					SW7421—Lead (mg/kg)							
Lead	2.1	(0.29)	ND	(0.31)	5.6	(1.1)	0.38•	(0.28)	2	(0.3)	1.1•	(0.27)
					SW7740—Selenium (mg/kg)							
Selenium	2.9	(0.48)	2.4•	(0.51)	2.8	(0.45)	2.1•	(0.46)	3	(0.5)	2.3•	(0.45)

Note—RL = Reporting limit. ND = not detected. Refer to Section 8 for explanation of footnote(s).

7.3.3 Waste Excavation and Characterization

Waste excavation and characterization activities were conducted in locations where anomalies were detected during the EM survey. A total of 33 exploratory pits were dug (see Photo I). The locations of pits 1 through 19 are shown in the overlays to Figures 7-3 and 7-4. Pit 20 was dug in the mound near De Zonia Road, which was not part of the EM survey grid and is not shown in the figures. Following the excavation of the first 20 pits, 13 more pits were dug near pits where waste was found in order to determine the approximate lateral extent of the waste bodies. Pit

locations, dimensions, and contents are listed in Appendix B.

Waste was found in five distinct "waste areas" across the site. The waste areas are shown in the overlays to Figures 7-3 and 7-4, and are labeled A, B, C, D, and E. The sizes and contents of the waste areas are described in Table 7-5.

Pits 11–15 were dug in the suspected landfill area north of the incinerator where a detailed EM survey over a small grid was conducted. Survey results indicated only small magnetic and conductivity anomalies, and though the soil in the excavated pits appeared to be disturbed, no evidence of waste burial was found (see Photo G).

Pits 20 and 33 were dug in a large dirt mound west of De Zonia Road and south of the dirt access road for the site. The mound was not included in the EM surveys, but looked as though it could be a burial site. A concrete retaining wall was encountered in one of the pits, but there was no other evidence of buried material in either pit.

7.4 Environmental Setting

7.4.1 Physiography

Figure 7-6 is a physiographic map of the area surrounding Site LF-58. The site is located at 32° 53′ 3″ north latitude and 106° 6′ 10″ west longitude (PA Reference 4). The site is remote and uninhabited. Site topography is flat, and local vegetation consists of grasses, cacti, and shrubs.

Table 7-5
Waste Area Description for Site LF-58

Waste Area	Waste Area Dimensions (ft)	Contents
A	120 X 30 X 5	Highly deteriorated, rusted drums and other debris (see Photos J, K, and L). Samples of yellow- and pink-stained soils, soil that looked burned, and friable green crystalline material were collected for HazCat analysis (see Photos M and N). All had a neutral pH and were nonoxidizing and nonflammable.
B	150 X 30 X 4	Aluminum drums, approximately 55 gal. in capacity and in good condition, with "Acid, Nitric, White, Fuming" or "Acid, Nitric, Red, Fuming" stenciled on the side (see Photos O, P, and Q). The pH of wipe samples from the drums was 7, so the drums appear to have been rinsed out prior to burial.
C	30 X 30 X 4	Metallic debris.
D	50 X 30 X 5	Deteriorated rusted drums. A sample of purple soil found in the pit was collected for HazCat analysis. The sample had a pH of 7 and was nonoxidizing and nonflammable.
E	50 X 30 X 10	Deteriorated, rusted drums and a corrugated metal pipe.

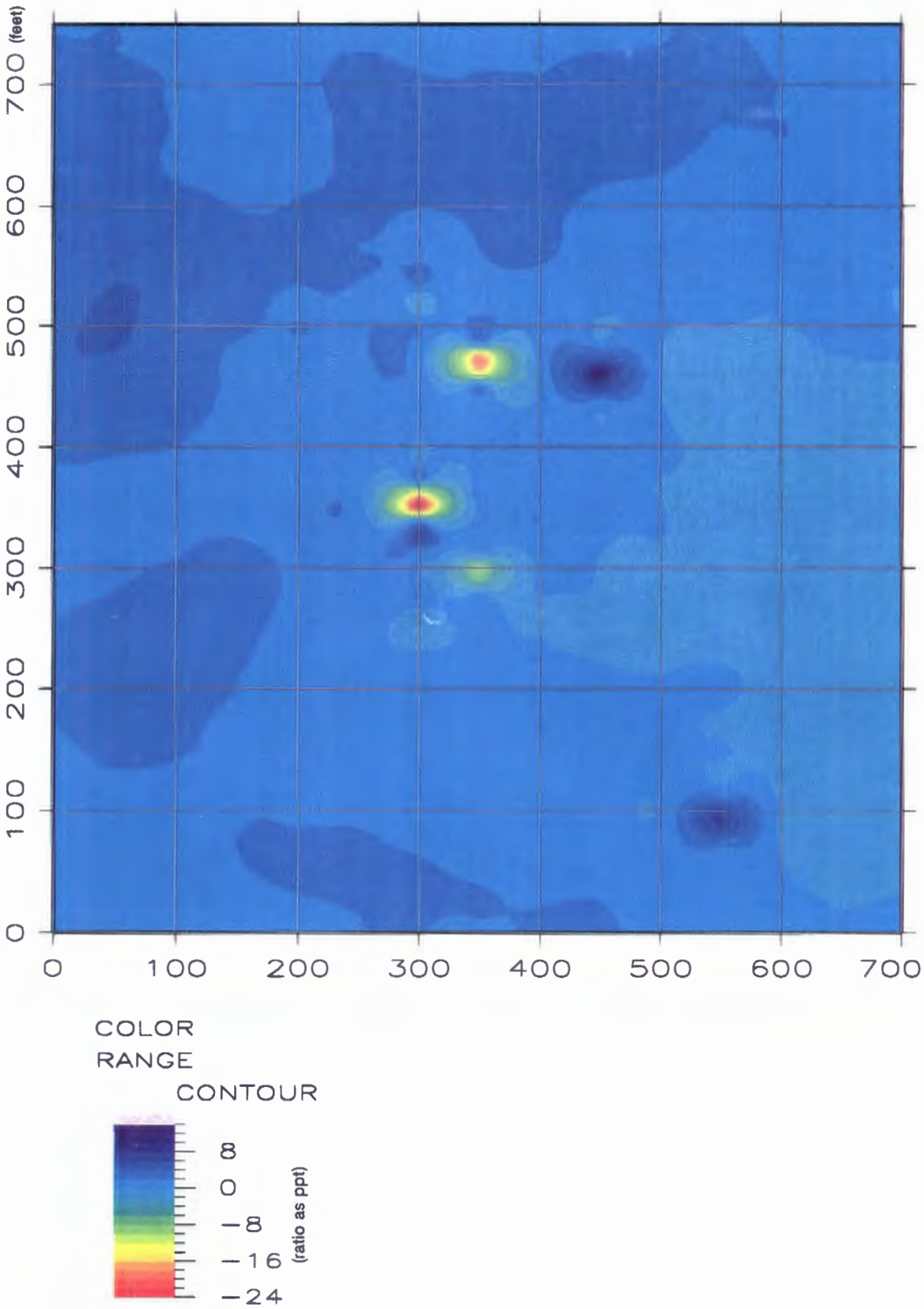


Figure 7–3 Terrain Conductivity Results for Site LF-58 EM Survey

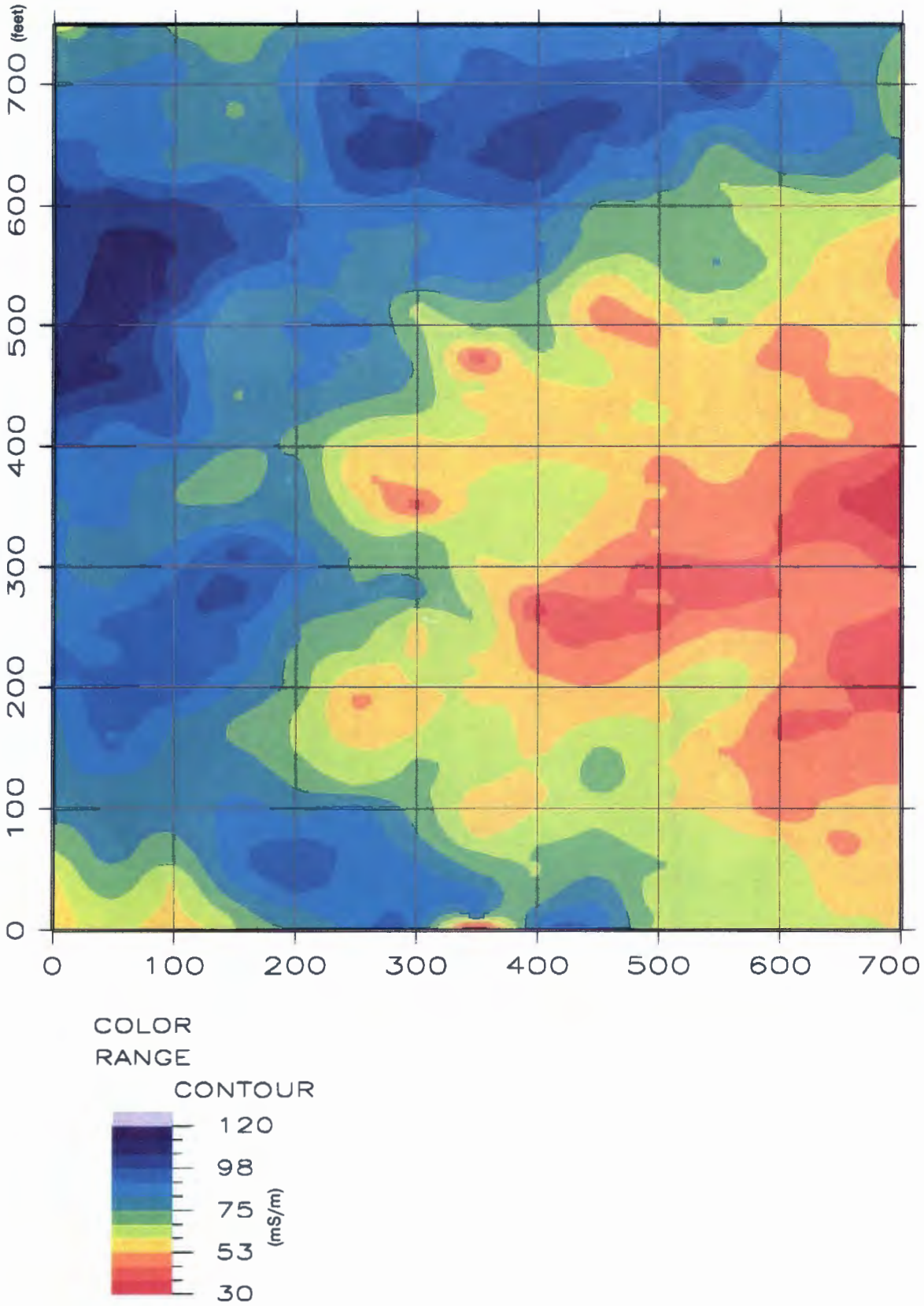


Figure 7–4 Magnetic Results for Site LF-58 EM Survey

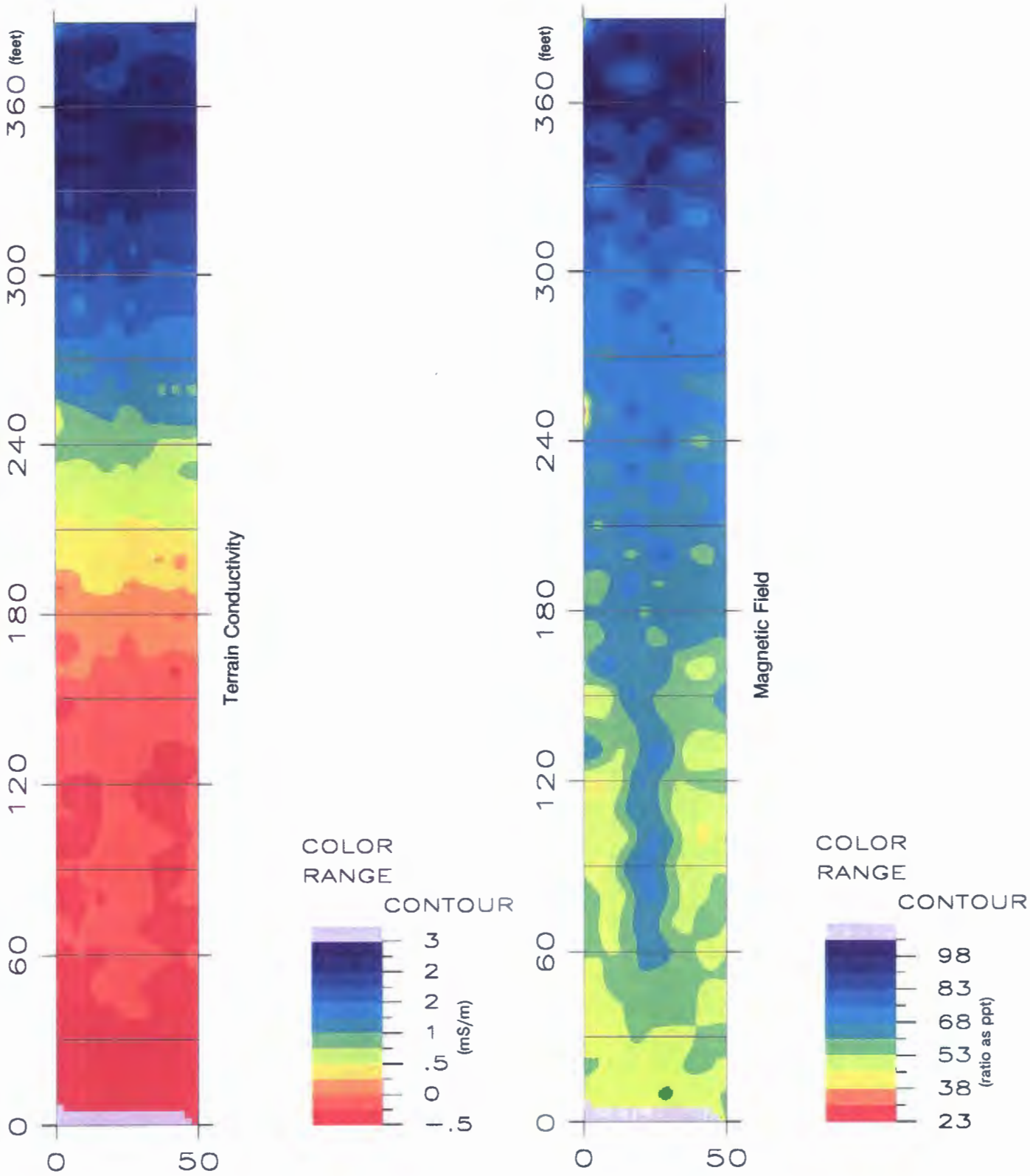


Figure 7–5 Terrain Conductivity and Magnetic Results for EM Survey of Suspected Landfill

There is no surface water drainage or collection area at the site. The nearest surface water drainage is Ritas Draw, approximately 1 mile north of the site. Ritas Draw is an arroyo with an intermittent stream. The 100-year floodplain for the area lies entirely within the arroyo (PA Reference 5). The nearest body of surface water is Lost River, approximately 2 miles west of the site. Groundwater occurs at a depth of 25 to 30 ft in a shallow, unconfined, nonpotable aquifer.

7.4.2 Geology

The subsurface conditions at Site LF-58 were defined by direct sampling and observation during the drilling of three soil borings. Drilling logs located in Appendix B provide a detailed description of site stratigraphy.

To correlate and interpret site stratigraphy, cross section D-D', shown in Figure 7-7, was constructed from the drilling logs for Site LF-58. The location of the cross section is shown in Figure 7-2. Site stratigraphy consists mainly of silts and sands. The upper unit is 8 ft of silty sand, underlain by 8 ft of silt that extends across the site. The silt is underlain by interbedded sand and silty sand. Interbedded clay and sandy clay lenses were seen in all borings, but do not form a continuous confining layer beneath the site.

Drilling activities for soil borings at LF-58 and monitor wells at IRP Site 36 (located 2000 ft southeast) indicate that groundwater occurs under water-table conditions approximately 30 ft BGL. Furthermore, as seen at IRP Site 36, groundwater is estimated to flow westward at a gradient of approximately 10^{-3}.

7.5 Conclusions

7.5.1 Presence or Absence of Contamination

Aniline was detected in the surface soil sample from BH-58-02, and unknown volatile and semivolatile compounds were

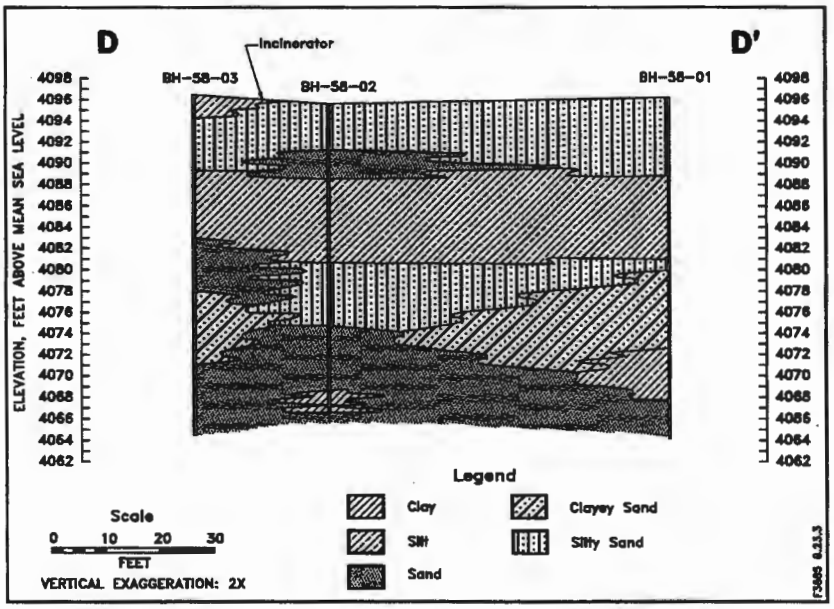


Figure 7–7 Site LF–58 Geologic Cross Section

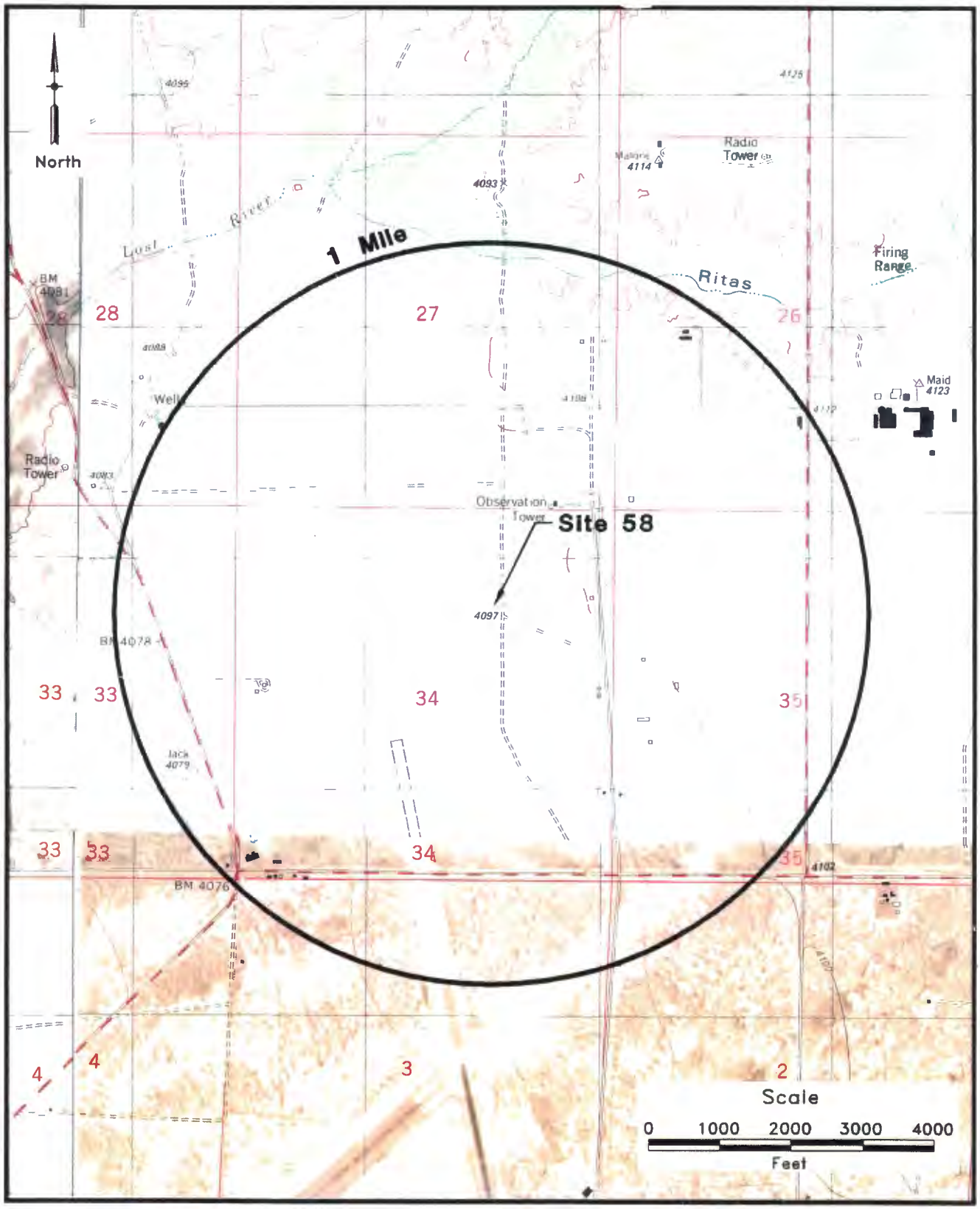


Figure 7–6 Physiographic Map of Site LF-58

detected in the surface soil samples from BH-58-01 and BH-58-02. Both of these borings were in purple stained areas where unconventional fuel spills are suspected (see Photos D and E). Unknown volatile and semivolatile organic compounds were also detected in all site soil samples. Aniline is an unconventional fuel, and the detection of various unknown compounds may indicate the presence of other unconventional fuels that are not on the analyte lists used for this project.

Diesel fuel was not detected in any of the samples from Site LF-58. However, as indicated in Table 7-2, unidentified organics eluting in the diesel range were detected in the diesel analyses of soil samples collected at the 0–2-ft depth at BH-58-01 and BH-58-02. These unidentified compounds were quantitated by the laboratory against a diesel standard, but were flagged with a "G" to indicate that they did not match the characteristic pattern for diesel. The results in Table 7-2 are also annotated with the "G" flag.

Very low levels of unidentified organics eluting in the diesel range were also detected in soil samples from the 20–22-ft depth at BH-58-02 and BH-58-03. As discussed in Appendix A, unidentified organic contaminants were detected at similar concentrations in laboratory blanks analyzed together with samples from Site LF-28. Therefore, the unidentified species detected in the samples from the 20–22-ft depth are likely attributable to this low-level laboratory contamination rather than to the presence of organics in the samples themselves. In both the field samples and the blanks, the organic compounds detected were not identified as diesel, and were "G" flagged as not matching the diesel pattern.

The metals chromium, copper, iron, manganese, and zinc were detected at concentrations exceeding their UTLs in the 0–2-ft sample from BH-58-02. Thallium was detected at a concentration above its UTL in the 0–2-ft sample from BH-58-03. No metals were above their UTLs in BH-58-03. These results are consistent with the organic analytes that were mostly detected in BH-58-02.

It is important to note that contaminants detected in the soil (i.e., aniline and metals) were only in the surface samples and were not in the soil samples at depth. This suggests that surface contaminants have not vertically migrated and groundwater is most likely unaffected by the release.

7.5.2 Significance of Contamination

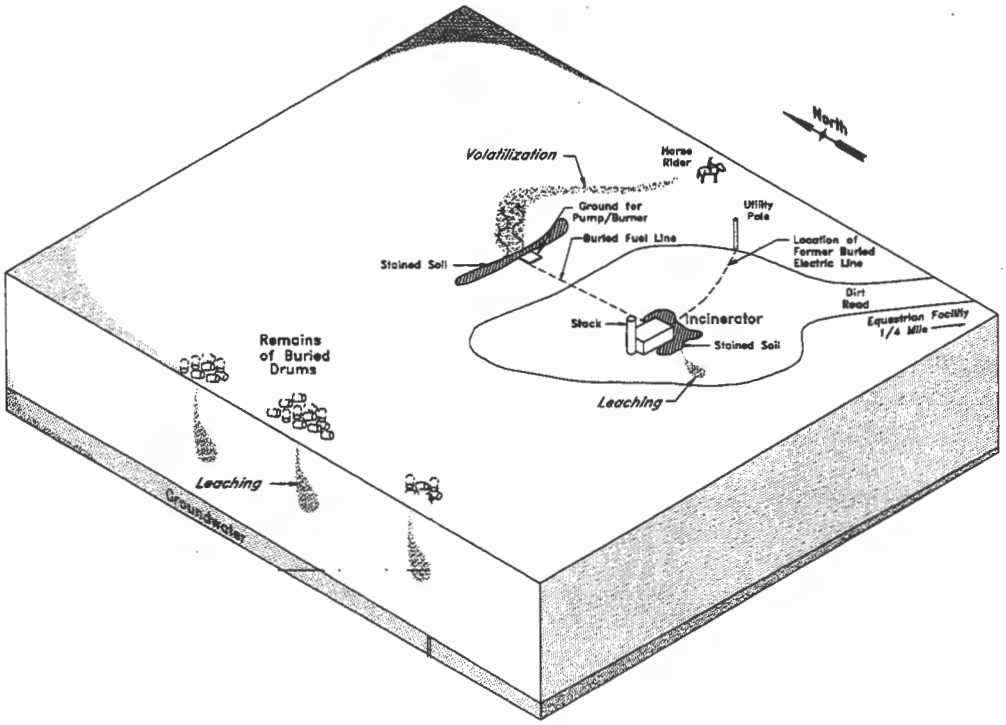
The conceptual site model in Figure 7-8 depicts possible contaminant migration and exposure pathways for both human and ecological receptors. Contaminants in surface soils at the site could migrate through the environment via several different mechanisms. Volatilization and fugitive dust generation could transport the contaminants to ambient air, which is likely since the majority of contamination is believed to be in shallow surface soil, and the physical nature of the detected constituents is conducive to volatilization. Infiltration and subsequent percolation could result in contaminant transport downward to groundwater; however, the groundwater beneath the site is not potable and does not discharge nearby.

Surface water runoff could carry dissolved constituents and particulate matter off site, though this is unlikely because there are no known areas at or near the site where surface water runoff accumulates.

Furthermore, the site receives only infrequent rainfall, which typically infiltrates or evaporates quickly.

Off-Base residents are not expected to be affected by the site. There are no fisheries or drinking water intakes downgradient of the site (PA Reference 6). The nearest downgradient production well is a livestock well located approximately 10 miles southwest of the site (PA Reference 7). Human receptors in the area are restricted to visitors on horseback from the Base equestrian facility located approximately 1/4-mile east of the site. Since contamination is primarily at or near the surface, dermal contact with, or incidental ingestion of, fugitive dust is the most likely route of exposure. Potential human receptors within 4 miles of the site include the 7900 workers and 5400 residents (some of whom are included in the number of on-Base workers) (PA Reference 8). However, these people are unlikely to come in contact with site contamination, since the site is remote and contaminant transport mechanisms are limited. The Main Base area where the majority of workers and residents are located is approximately 2–3 miles from the site.

Ecological receptors include any wildlife and vegetation that are present at the site. The potential for exposure is typically much higher for plants and animals than for humans because plants and animals are generally much more dependent on the environment for subsistence and may live their entire life in one area. Ritas Draw and Malone Draw are habitats for



F3755

Figure 7–7 Site LF-58 Site Conceptual Model

the White Sands Pupfish, which is listed as endangered (Group 2) by the state (PA Reference 9). However, these areas are not downgradient of the site. The peregrine falcon, a federally designated endangered species, has been seen near the sewage treatment system and Lakes Holloman and Stinky, located 3–4 miles south of Site LF-58 (PA Reference 10). For a more extensive listing of endangered species inhabiting the surrounding areas, refer to the *Risk Assessment Report for the Remedial Investigation – Investigation, Study and Recommendation for 29 Waste Sites*, Appendix K (Radian, 1992).

No positively identified analytes were detected at concentrations above risk-based action levels. Since the presence and concentration of TICs are uncertain, they cannot be compared with risk-based action levels.

7.6 Recommendations

Contamination was detected in surface soil samples, and buried waste was found in five areas at the site. The nature and extent of contamination associated with surface soils and waste areas is unknown. Further investigation is recommended to determine the nature and extent of contamination, and to support a risk assessment and a corrective measures study, if required. The objectives for further investigation at the site are as follows:

- ❑ Determine the volume of affected soil in the vicinity of the incinerator;
- ❑ Determine whether there is contamination associated with the waste areas; and
- ❑ Determine whether groundwater has been affected.

Each of these objectives and the recommended means of obtaining the required data are discussed below.

7.6.1 Surface Soil

Surface soil contamination was encountered in the vicinity of the incinerator. The following actions are recommended to determine the nature and extent of soil contamination:

- ❑ Collect surface and shallow subsurface soil samples on a grid covering potentially contaminated areas in the vicinity of the incinerator. Determine the number and location of samples through field observations and results from these investigations. Collect samples from a variety of depths, depending on their location. Depths will range primarily from 0 to 6 ft BGL.
- ❑ Analyze samples for any or all of the following, depending on their location:
  - TCLP VOCs (collect at worst-case location for disposal purposes);
  - VOCs, including unconventional fuels;
  - TCLP semivolatile organic compounds (collect at worst-case location for disposal purposes); and
  - Semivolatile organic compounds, including unconventional fuels.
- ❑ Include the following unconventional fuels on analyte lists for volatile and semivolatile organic compounds: NMDA, dimethylanilines, xylidines, hydrazines; and furfuryl alcohol.

Such compounds can be detected by SW8240 and SW8270 analysis if the gas chromatogram is calibrated using the appropriate standards.

7.6.2 Waste Areas

Waste burial activities may have resulted in soil contamination. The following actions are recommended to determine the presence or absence of soil contamination in the waste areas:

- ❑ Drill eight soil borings in the following locations:
  - Two borings in Waste Area A;
  - Three borings in Waste Area B; and
  - One boring each in Waste Areas C, D, and E.
- ❑ From each boring collect a composite sample from intervals in the potentially contaminated zone, and a sample from the interval below the potentially contaminated zone.
- ❑ Analyze samples for the following:
  - VOCs, including unconventional fuels;
  - Semivolatile organic compounds, including unconventional fuels;
  - Metals; and
  - TCLP, as necessary for disposal.

These are general recommendations for planning purposes only. They may change as DQOs for further investigation at the site are refined.

Further investigation at this site will be conducted under the RCRA corrective action program in a Phase II RFI. A Phase II RFI Work Plan will be prepared and submitted to EPA Region VI and NMED for approval.

7.6.3 Groundwater

Groundwater contamination below stained surface soil is not expected, since soil samples taken from just above the water table indicate that contamination has not reached that depth. However, groundwater contamination could result from infiltration and percolation of surface contamination in the waste areas (if present). If soil samples collected from below the waste areas suggest that vertical migration of waste constituents has occurred, then groundwater investigation is recommended. The following actions are recommended to determine the presence or absence of groundwater contamination pending analytical results of soil samples:

- ❑ Collect groundwater samples downgradient (W-NW) of each of the following locations (pending soil results):
  - Waste Area A;
  - Waste Areas B and C; and
  - Waste Areas D and E.
- ❑ Sample groundwater and analyze for the following:
  - VOCs, including unconventional fuels;
  - Semivolatile organic compounds, including unconventional fuels; and
  - Metals.

7.7 Photographic Log

Pages 7–16 to 7–27 present a photographic log of field activities for Site LF-58, a PA requirement.

PHOTOPLATE 1

Site LF-58 Photodocumentation Log Captions

A. *The incinerator is a 6 X 10 X 6 ft brick structure with a metal roof, a burner/pump on one side, and a 30–40-ft stack on the opposite side. It is located in a flat, sparsely populated area of the Base.*

B. *The inlet to a stainless steel fuel line and an electrical ground for the tank trucks that unloaded unconventional fuels are located about 50 ft north of the incinerator. The fuel line runs underground to the burner/pump on the incinerator.*

C. *Two EM surveys were conducted at the site: a large survey over the whole site and a small survey over the suspected landfill.*

A

B

C

PHOTOPLATE 2

Site LF-58 Photodocumentation Log Captions

D. *Three soil borings were drilled at the site to collect soil samples from areas where contamination was indicated by a passive soil gas survey.*

E. *Purple stained soil was found in two of the three areas where soil samples were collected.*

F. *Prior to waste excavation, the locations of conductivity and/or magnetic anomalies found during the EM surveys were staked. Shown is a staked excavation location along the suspected landfill.*

D

E

F

PHOTOPLATE 3

Site LF-58 Photodocumentation Log Captions

G. *Only native (undisturbed) soil was found in the five excavations at the suspected landfill.*

H. *Most of the EM anomalies occurred in areas of disturbed soil northwest of the incinerator. Shown is a staked excavation location in such an area.*

I. *Locations with EM anomalies were excavated in level C protection using a backhoe. Waste was found at several locations.*

G

H

I

PHOTOPLATE 4

Site LF-58 Photodocumentation Log Captions

J. *Degraded conventional 55-gal. drums were excavated from several locations.*

K & L. *Purple- and yellow-stained soils and degraded drums were found in Waste Area A.*

J

K

L

PHOTOPLATE 5

Site LF-58 Photodocumentation Log Captions

M & N. *When stained soil was encountered, samples were collected for Haz Cat analysis. All samples were found to be nonreactive. The yellow and pink samples are from Waste Area A; the purple sample is from stained surface soil near BH-58-01.*

O. *Aluminum drums were encountered in Waste Areas B and C.*

M

N

O

PHOTOPLATE 6

Site LF-58 Photodocumentation Log Captions

P. *Aluminum drums were encountered in Waste Areas B and C.*

Q. *Thirteen aluminum drums were removed from the ground; still more were encountered but not removed. Twelve of the drums removed were labeled "White Fuming Nitric Acid," and one was labeled "Red Fuming Nitric Acid." The drums were empty.*

R. *At the completion of excavation activities, all pits were backfilled.*

P

Q

R

Section 8
ACRONYMS and SYMBOLS

Section 1

AFB	Air Force Base
CDAP	*Chemical Data Acquisition Plan*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	U.S. Environmental Protection Agency
HSWA	Hazardous and Solid Waste Amendment
IRP	Installation Restoration Program
PA	Preliminary Assessment
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SARA	Superfund Amendments and Reauthorization Act
SQCSR	*Sampling and Quality Control Summary Report*
SWMU	Solid Waste Management Unit
USAF	U.S. Air Force

Section 2

BGL	Below Ground Level
HHS	Human Health Standards
TDS	Total Dissolved Solids

Section 3

DQO	Data Quality Objectives
NMED	New Mexico Environment Department
QA/QC	Quality Assurance/ Quality Control
UTLs	Upper Tolerance Limits

Section 4

POL	Petroleum, Oil, and Lubricant
TFH	Total Fuel Hydrocarbons
TRPH	Total Recoverable Petroleum Hydrocarbons
VOCs	Volatile Organic Compounds

Section 5

ORNL	Oak Ridge National Laboratory

Section 6

PRL	Primate Research Laboratory

Section 7

EM	Electromagnetic
TIC	Tentatively Identified Compounds

Footnote Symbols

B = Detected in the method blank.

C = Confirmed on second column.

G = Analyte not confirmed. Ratio of results from primary and secondary GC columns greater than 3 (for analyses involving second-column confirmation); or characteristic pattern of target analyte(s) is not identifiable (for analyses involving pattern matching).

@ = Measured result is less than five times the detection limit.

Map Symbols

Cross Section (e.g., A A′)

Bore Hole

Hand Auger

Monitoring Well

Section 9
REFERENCES

1. Interview with Mr. Pete Carbajal, Personnel at POL Storage Area, October and November, 1992.

2. CH2M Hill, *Installation Restoration Program Records Search for Holloman AFB, New Mexico*, 1983.

3. Cole, Richard A., et al. *A Limnological Study of Lake Holloman with Management Recommendations for Multiple Use.* NMSU, Las Cruces, NM. 15 May 1981.

4. *The Electronic Handbook of Risk Assessment Values.* Electronic Handbook Publishers, Bellevue, WA. 15 April 1993.

5. A.T. Kearney, Inc. *RCRA Facility Assessment Preliminary Review/Visual Site Inspection Report.* 1987.

6. Orr, B.R. and R.G. Myers. *Water Resources in Basin-Fill Deposits in the Tularosa Basin, New Mexico.* U.S. Geological Survey, Water Resources Investigation Report 85-4219. Albuquerque, NM. 1986.

7. Radian Corporation. *Base-wide Background Investigation for Holloman AFB, New Mexico.* 1993.

8. Radian Corporation. *Chemical Data Acquisition Plan (CDAP).* 1993.

9. Radian Corporation. *Holloman AFB Baseline Risk Assessment.* 1992.

10. Radian Corporation. *Site Safety and Health Plan (SSHP).* 1993.

11. Radian Corporation. *Sampling and Quality Control Summary Report (A-E SQCSR) (Draft).* 1993

12. Interview with Mr. Harry Ridge, PRL Custodian and Former Base Maintenance Crew, November, 1993.

13. Letter from Capt. Forrest Spresster, Former Chief of Environmental Health Services, 25 May 1976.

14. Telephone conversation with Col. Forrest Spresster, Former Chief of Environmental Health Services, 28 October 1992.

15. Letter from Capt. Joseph R. Stencel, Radian Measurements Division, 11 August 1976.

16. State of New Mexico. *Water Quality Control Commission Regulations, as Amended through August 18, 1991.* Water Quality Control Commission, Santa Fe, NM. 1991.

17. U.S. Army Corps of Engineers. *Scope of Services.* September, 1992.

18. U.S. Department of Agriculture Soil Conservation Service and Forest Service. *Soil Survey of Otero Area, New Mexico; Parts of Otero, Eddy, and Chaves Counties.* Washington, D.C. 1981.

19. U.S. Environmental Protection Agency. *Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities (proposed rule).* Federal Register, Vol. 55, No. 145, pp. 30798-30884, 27 July 1990.

20. U.S. Environmental Protection Agency. *Drinking Water Regulations and Health Advisories.* 1991.

21. U.S. Environmental Protection Agency. *Guidance for Conducting Preliminary Assessments under CERCLA.* Publication 9345.0-01A. 1991.

22. U.S. Environmental Protection Agency. *Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA.* EPA/540/G-89/004. 1988.

23. U.S. Environmental Protection Agency. *Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy. Final Draft.* Office of Groundwater Protection (WH-550G), Washington, D.C. 1986.

24. U.S. Environmental Protection Agency. *Health Effects Summary Table (HEAST).* Annual FY-1991. NTS No. PB91-921199. 1991.

25. U.S. Environmental Protection Agency. *Integrated Risk Information System (IRIS).* 1992.

26. U.S. Environmental Protection Agency. *Proposed RCRA Corrective Action Rules.* Federal Register, Vol. 55, 27 July 1990.

27. U.S. Geological Survey, Data from the Groundwater Site Inventory, 1992.

28. Interview with Mr. Marvin Weber, Former Project Officer for Unconventional Fuels Program, October, 1992.

29. *Waste Acceptance Criteria for Radioactive Solid Waste Disposal at SW SA-6* (Oak Ridge National Laboratory [ORNL], 1993).

APPENDIX A

Data Evaluation Criteria

A.1 QA/QC Results

A.2 Laboratory Reporting Limits

A.3 Statistical Background Levels

A.4 Radioactivity Acceptance Criteria

A.5 Conceptual Site Models

A.6 Proposed RCRA Subpart S Action Levels, PCB ARARs, and Site-Specific Health-Based Levels

A.1

QA/QC Results

Data Evaluation Conclusions

Overall, QA/QC data associated with this investigation indicate that chemical measurement data are acceptable and defensible. Data show that QC mechanisms were effective in ensuring measurement data reliability within expected limits of sampling and analytical error.

When interpreting data, the following potential limitations should be considered:

- Field duplicate results indicate that the gross alpha and gross beta results are variable–perhaps because the concentrations approach the detection limit. The variability should not affect data quality since each reported concentration is provided with a sample-specific accuracy range.

- Diesel results for sample WL-12-03-01 may be biased high due to an unknown contaminant in the blanks that elutes in the diesel retention time window.

DETAILED EXPLANATION OF MODIFIED SW8015 RESULTS, SITES SS-12 AND LF-58

As discussed in the body of this report, diesel fuel was not detected in any of the soil or groundwater samples from Holloman Sites SS-12 and LF-58. However, unidentified organics eluting in the diesel range were detected in the diesel analyses of both soil and groundwater samples. In some samples, these were at very low concentrations (less than five times the reporting limit), and are likely attributable to low-level laboratory contamination. This attribution is supported by method blanks analyzed contemporaneously with the SS-12 and LF-58 samples that showed similarly low concentrations of unidentified organics eluting at similar chromatographic retention times. However, for all of the soil blanks and all but one of the water blanks, the contamination was below the reporting limit and the result was reported as "ND."

Much higher concentrations of unidentified organic compounds were seen during the diesel analyses of several of the SS-12 and LF-58 samples. Because the characteristic diesel pattern was absent in the chromatogram, these compounds are not considered to indicate the presence of diesel. However, the compounds seen in these analyses are not attributable to laboratory contamination but, rather, presumably represent the presence of organics other than those analyzed for. Indications of the presence of non-target organic species also were seen in the purgeable analyses for fuel hydrocarbons. Additional information on the low level contamination seen in some of the diesel blanks and on the higher levels of unidentified species seen in the samples is presented below.

A.1 Low-Level Laboratory Contamination

Contamination was detected above the reporting limit in a single Holloman TPH diesel laboratory blank. This contamination was identified as not being attributable to diesel, and the reported result was flagged with a "G" flag to indicate that it did not meet the identification criteria for diesel. A copy of the chromatogram for this blank is shown in Figure 1. As indicated in the figure, the contamination shows up as several peaks eluting

very early in the diesel retention time window. A typical chromatogram of a diesel standard (the laboratory control sample, which is carried through the extraction step like a sample) is shown for comparison in Figure 2. Comparison of the two chromatograms clearly shows, first of all, that the contaminant is not diesel. It further shows that the contamination would not interfere with the detection of diesel if it were actually present in the field samples. This further illustrated in Figure 3, which shows a chromatogram of a diesel standard (a laboratory control sample analyzed at the same time as Holloman field samples) in which the contamination is present. In this figure, the characteristic diesel pattern is still clearly identifiable, despite the presence of the contaminant peaks. Finally, Figure 4 shows the chromatogram for the single Holloman sample analyzed at the same time as the blank shown in Figure 1. The characteristic contaminant peaks are visible, as are a number of other small peaks. However, the diesel pattern is clearly not identifiable in this chromatogram. The result of 170 μg/L reported for this sample was flagged as not matching the diesel pattern, as was done for the other results for diesel analyses reported above the reporting limit.

The single diesel blank result above the reporting limit was a liquid method blank. Contamination was not detected above the reporting limit in any of the solid method blanks, and all results were reported as "ND." However, examination of the chromatograms for blanks reported as ND shows the same very small contaminant peaks as seen in the liquid blank that exceeded the reporting limit and in several of the field samples. This is illustrated in Figure 5, which shows the chromatogram for the soil sample from BH-12-04, which was reported as "ND." The same small contaminant peaks are clearly visible, but when quantitated against a diesel standard they represent only 2.6 μg/g in this sample. Since the reporting limit for this sample was 3.0 μg/g, this result was reported as "ND." Figure 6 shows a very clean method blank, analyzed in the same batch as the sample in Figure 5, which also shows the contaminant peaks. Quantitated against the same diesel standard, this blank represents a contaminant concentration of 0.8 μg/g, reported as "ND" because it was below the method reporting limit of 2.5 μg/g.

Thus, examination of the chromatograms shows that the same peaks are present in the samples and blanks at similar concentrations. This indicates that the very low concentrations of unidentified organics in two of the LF-58 soil samples (BH-58-02, 20-22 ft. depth and BH-58-03, 20-22 ft. depth) and in one of the SS-12 samples (BH-12-06, 2-4 ft. depth) are probably attributable to low-level laboratory contamination, rather than to the actual presence of these compounds in the field samples. Had the field sample results reported as "ND" been reported using an uncensored data reporting convention, they would have been reported as numerical values with "J" flags to indicate that they were less than the method reporting limit and with "G" flags to indicate that the observed peaks did not match the diesel pattern and therefore did not meet the identification criteria for diesel.

Only a single Holloman sample was analyzed as part of the batch in which the blank contamination exceeded the diesel reporting limit. This sample was a duplicate of a sample extracted at a different time and analyzed as part of a different batch. The duplicate sample result confirmed the result obtained in the presence of the blank that exceeded the acceptance limits, indicating that the presence of the low-level contamination had no significant impact on the sample result.

Radian has been working since the contaminant was first observed in the diesel analyses to identify and eliminate it, as part of the process of continuous improvement in Radian's laboratory. This work has shown the contaminant (or contaminants) to be attributable to surface interactions between samples and glass surfaces that have had contact with freon. Freon is used as the extraction solvent for TPH analyses using EPA Method 9071 (Soxhlet extraction) for analysis by EPA Method 418.1 (IR). Historically, glassware used in the Method 9071 extractions was commingled with glassware from other extraction methods during the glassware washing steps. This appears to have been the primary route of contamination. Steps have been taken to segregate the glassware used in the Method 9071 extractions, and this has resulted in a marked decrease in contamination levels seen in the diesel analyses. Radian is currently in the process of completely segregating the freon extractions from other extractions altogether, in an effort to further reduce both the

incidence and magnitude of contamination. Figure 7 shows a plot of results for diesel laboratory blanks covering a time period from July 1992 to the present. This time period includes all of the Holloman work (late February through early April, 1993). As indicated in the plot, the average level of concentration has been significantly reduced, particularly over the past six to eight months. The uncontaminated LCS shown in Figure 2, above, is an example of current performance.

In summary, the low level contamination that was seen and reported in one diesel blank was not diesel. The contaminant peaks were quantitated and reported because they fell within the retention time window for diesel, but the results were clearly flagged in the laboratory reports as not matching the diesel pattern. Because the contaminant peaks eluted very early in the diesel window, they would not have interfered with the laboratory's ability to detect the characteristic diesel pattern had diesel been present in any of the field samples. The contamination also did not interfere with diesel quantitation, since diesel was not detected in any samples.

Because the diesel results were reported using a censored data reporting convention, similar, but lower concentrations of contaminant were reported as "ND" in other blanks and in some samples because they fell below the method reporting limit.

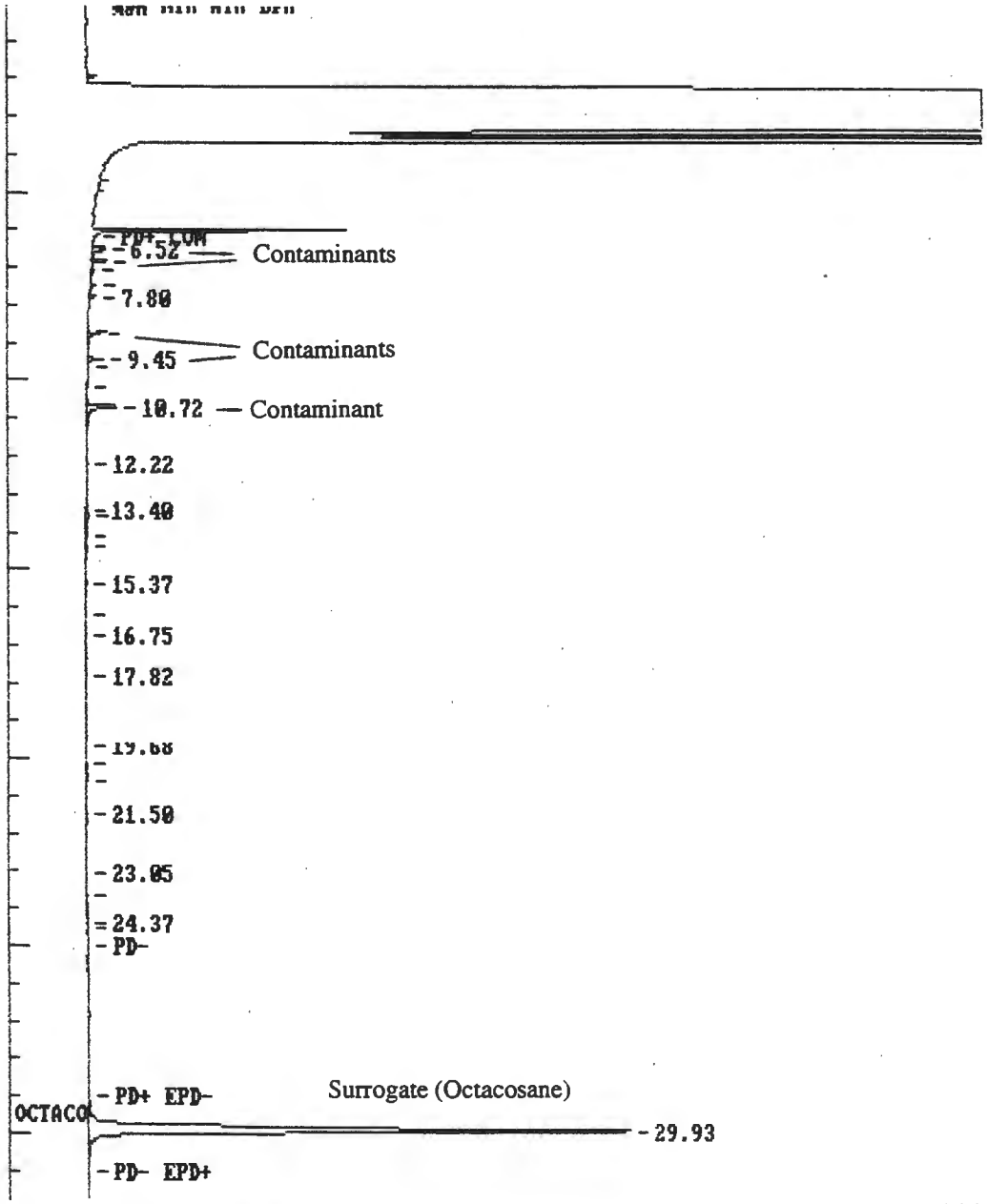
Finally, all diesel results are considered valid because all but one blank result met the blank acceptance criteria specified in the project QAPP, and the single sample result in that batch was confirmed by results for a duplicate sample extracted and analyzed separately. There is no impact on Holloman measurement data quality or on decisions based on the data due to either the nature or level of this contamination.

A.2 Unidentified Organic Species

Unidentified organic species eluting in the diesel range were detected in two Site SS-12 groundwater samples (Locations WL-12-02 and WL-12-03) and in two of the Site

LF-58 soil samples (0-2 foot depth at Locations BH-58-01 and BH-58-02). These unidentified compounds were quantitated by the laboratory against a diesel standard, but were flagged with a "G" flag indicating that they did not match the characteristic pattern for diesel. However, unlike the very low concentrations of contaminants seen in the samples discussed above, the compounds seen in analyses of these four samples are not attributable to laboratory contamination. Rather, the peaks seen in the diesel analysis presumably represent the presence of organic species other than those analyzed for. It is also possible that some of the material in these samples is attributable to weathered fuel hydrocarbons, although this cannot be confirmed based on available analytical data. The chromatogram for one of these samples was shown in Figure 4, above. Chromatograms of the other three samples are shown in Figures 8 through 10. The peaks seen in these chromatograms are clearly very different from the low level contaminant peaks seen in the previous chromatograms. These chromatograms also show that the organic species present in these samples are not identifiable as diesel, because they clearly do not match the diesel pattern (Figure 2).

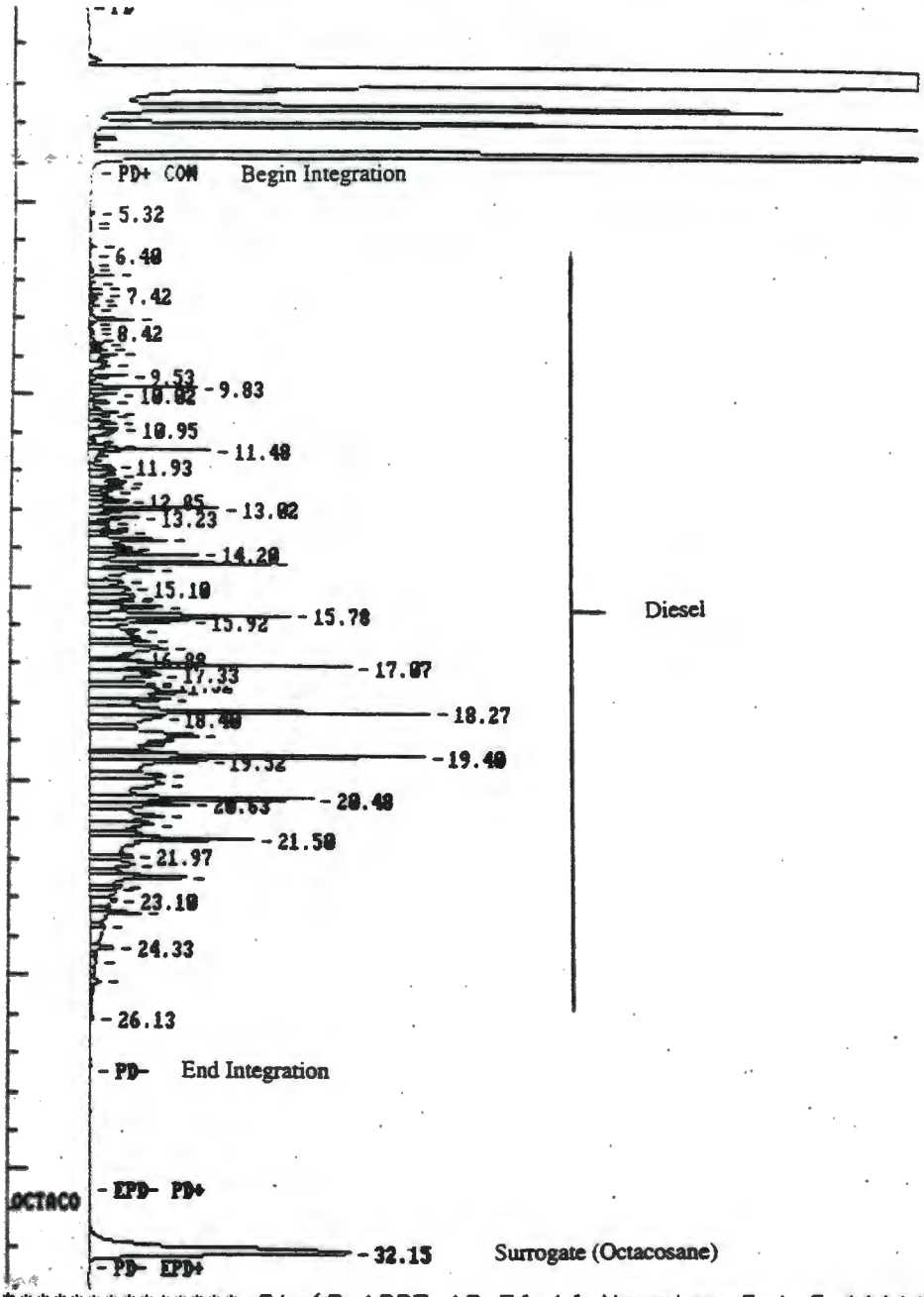
Areas, times, and heights stored in: M:GM0118.ATB
Data File = M:GM0118.PTS Printed on 04-02-1993 at 09:03:07
Start time: 0.00 min. Stop time: 39.00 min. Offset: 0 mv.
Full Range: 75 millivolts



********** 04-02-1993 09:02:51 Version 5.1 **********
* Sample Name: 93032280ARB, METHOD BLANK ext 3/25/93 Data File: M:GM0118 *
* Date: 04-02-1993 02:47:47 Method: DM033023 02-10-1993 13:49:07 # 24 *
* Interface: 0 Cycle#: 18 Operator DKS Channel#: 0 Vial#: N.A. *
* Starting Peak Width: 10 Threshold: .001 Area Threshold: 75 *
****
* Instrument Type: MONTE Column Type: DB-1 *
* Solvent Description: *
* Conditions: *
* Detector 0: FID Detector 1: *
* Misc. Information: *
****

Figure 1. Example Chromatogram of Diesel Blank with Contamination

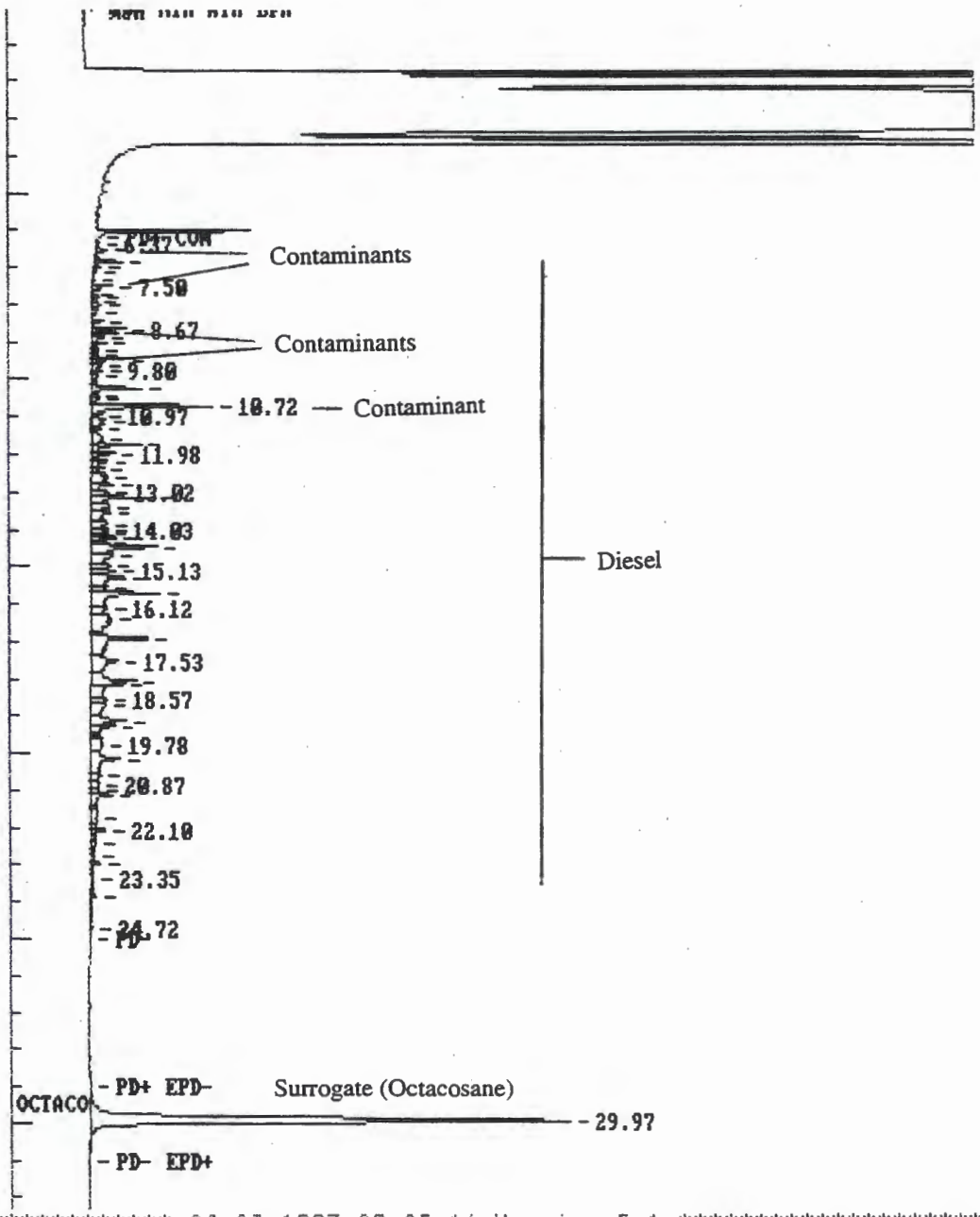
as, times, and heights stored in: W:113FR6.ATB
a File = W:113FR6.PTS Printed on 06-18-1993 at 19:34:57
rt time: 0.00 min. Stop time: 35.00 min. Offset: 0 mv.
l Range: 75 millivolts




```
******************** 06-18-1993 19:34:14 Version 5.1.5 ********************
* Sample Name: LCS93606, LCS                          Data File: W:113FR6      *
* Date: 06-18-1993 18:59:11 Method: W:113FPT  06-17-1993 09:03:17  #  421 *
* Interface: 14  Cycle#:  6    Operator DKS Channel#: 0    Vial#: N.A.      *
* Starting Peak Width:  10   Threshold: 1  Area Threshold: 100              *
*****************************************************************************
* Instrument Type: GERMAINE GC11        Column Type: DB-1                   *
*              Solvent Description:                                         *
* Conditions: 40C 2MIN 10C/MIN 270C 10MIN                                   *
*             Detector 0: FID                    Detector 1:                *
* Misc. Information:                                                        *
*****************************************************************************
```

Figure 2. Example Chromatogram of Diesel Standard (Recent LCS) without Contamination

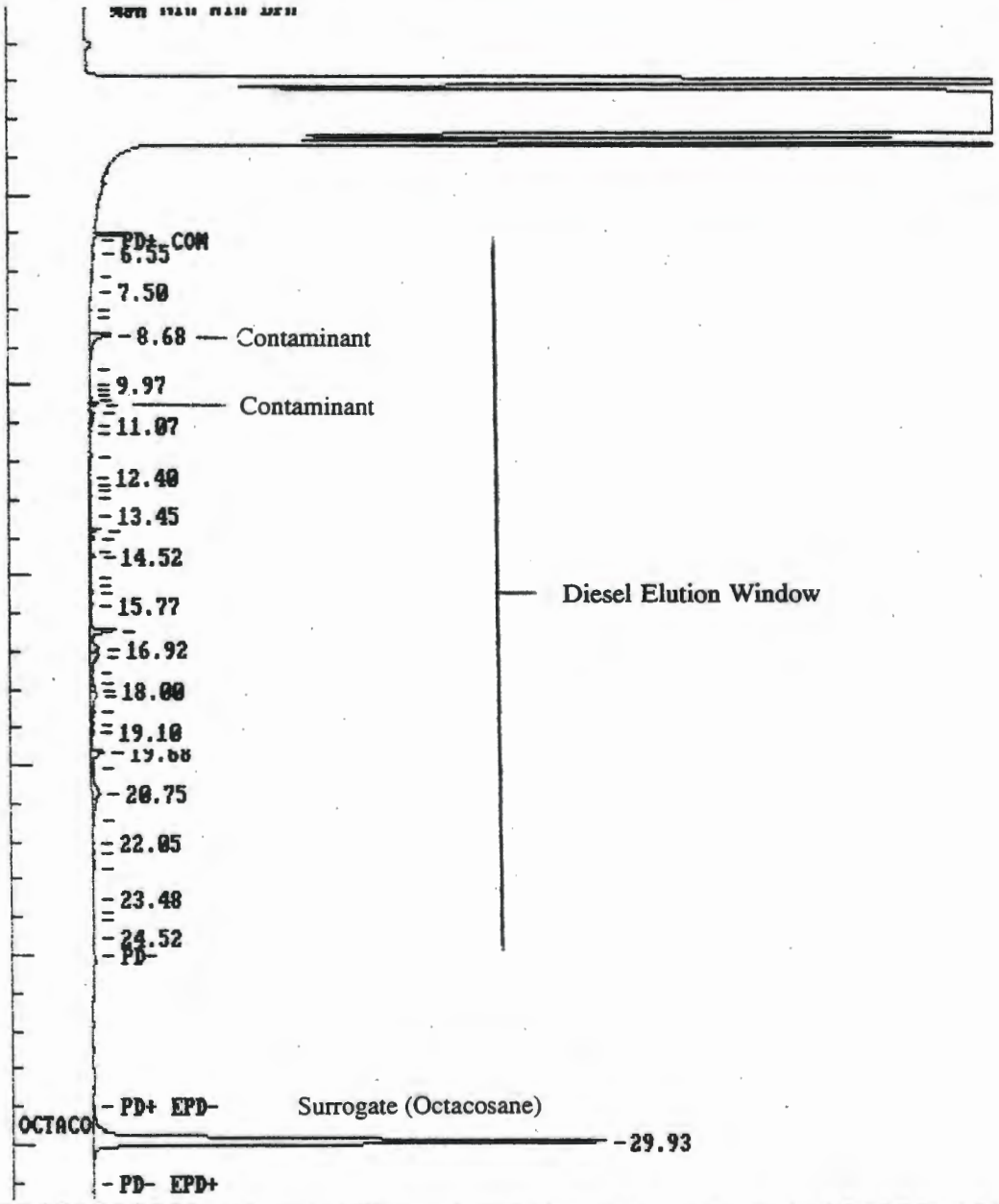
Areas, times, and heights stored in: M:GM0120.ATB
Data File = M:GM0120.PTS Printed on 04-02-1993 at 09:05:46
Start time: 0.00 min. Stop time: 39.00 min. Offset: 0 mv.
Full Range: 75 millivolts




```
******************** 04-02-1993 09:05:16 Version 5.1 *********************
* Sample Name: 93032280 12AQ, LCS  ext 3/25/93  Data File: M:GM0120      *
* Date: 04-02-1993 04:31:12 Method: DM033023  02-10-1993 13:49:07  #  24 *
* Interface: 0   Cycle#:  20   Operator DKS Channel#: 0    Vial#: N.A.   *
* Starting Peak Width:  10   Threshold: .001  Area Threshold: 75         *
***************************************************************************
* Instrument Type: MONTE                Column Type: DB-1                 *
*            Solvent Description:                                         *
* Conditions:                                                             *
*           Detector 0: FID                 Detector 1:                   *
* Misc. Information:                                                      *
***************************************************************************
```

Figure 3. Example Chromatogram of Diesel Standard (Holloman SS-12 LCS) with Contamination

Data File = M:GM0122.PTS Printed on 04-02-1993 at 14:09:57
Start time: 0.00 min. Stop time: 39.00 min. Offset: 0 mv.
Full Range: 75 millivolts




```
******************** 04-02-1993 14:09:02 Version 5.1 ********************
* Sample Name: 930322804A, WL-12-03-01 ext 3/25/93 Data File: M:GM0122      *
* Date: 04-02-1993 06:14:39 Method: M:DM033023 02-10-1993 13:49:07  #  24 *
* Interface: 0   Cycle#:  22   Operator DKS Channel#: 0    Vial#: N.A.     *
* Starting Peak Width:  10   Threshold: .001  Area Threshold: 75           *
*****************************************************************************
* Instrument Type: MONTE                    Column Type: DB-1               *
*            Solvent Description:                                           *
* Conditions:                                                               *
*            Detector 0: FID                    Detector 1:                 *
* Misc. Information:                                                        *
*****************************************************************************
```

Figure 4. Chromatogram of SS-12 Groundwater Sample from Location WL-12-03

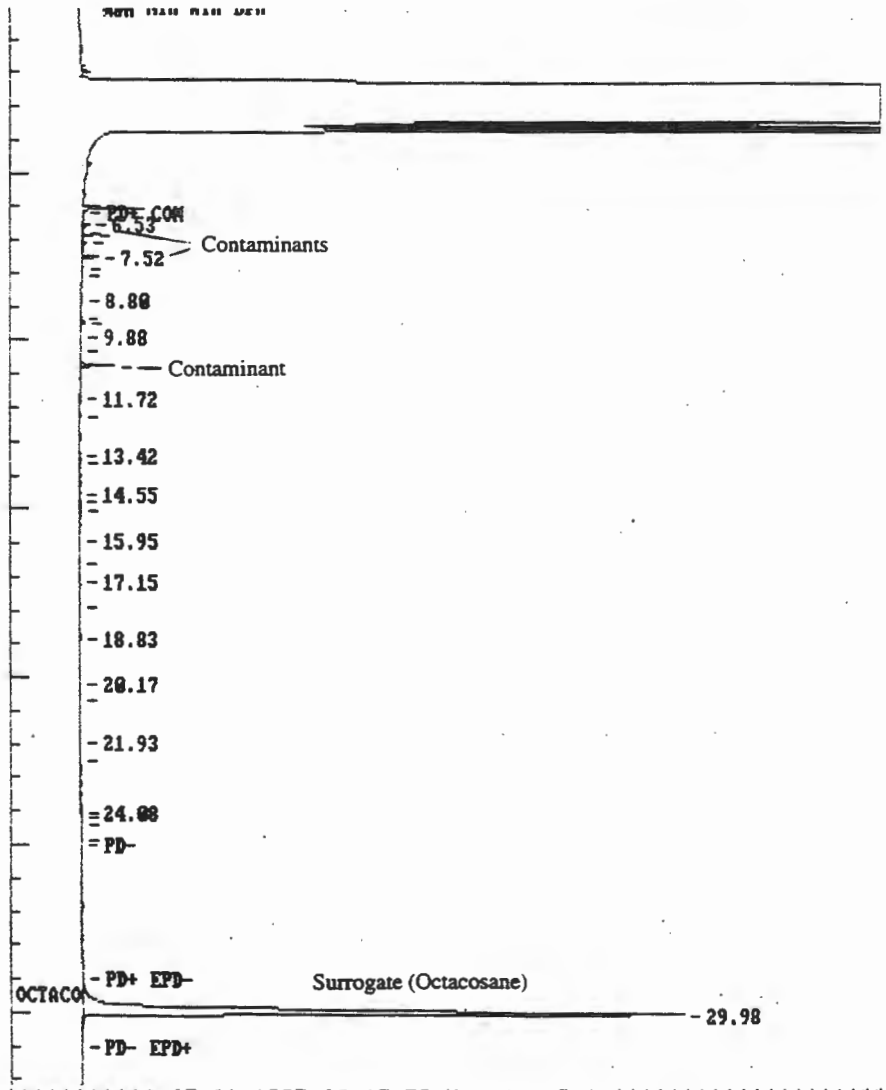
23	24.383		0.0139	0.03422	209	35	2.9 1			3.5607E-05
24	29.983	OCTACOSANE	38.0926	93.60582	554401	56228	9.9 1	0	1.638	6.8719E-05

1280

TOTAL AMOUNT = 40.6948

40.69 - 38.09 = 2.6 ug/g
dryweight
BLOD

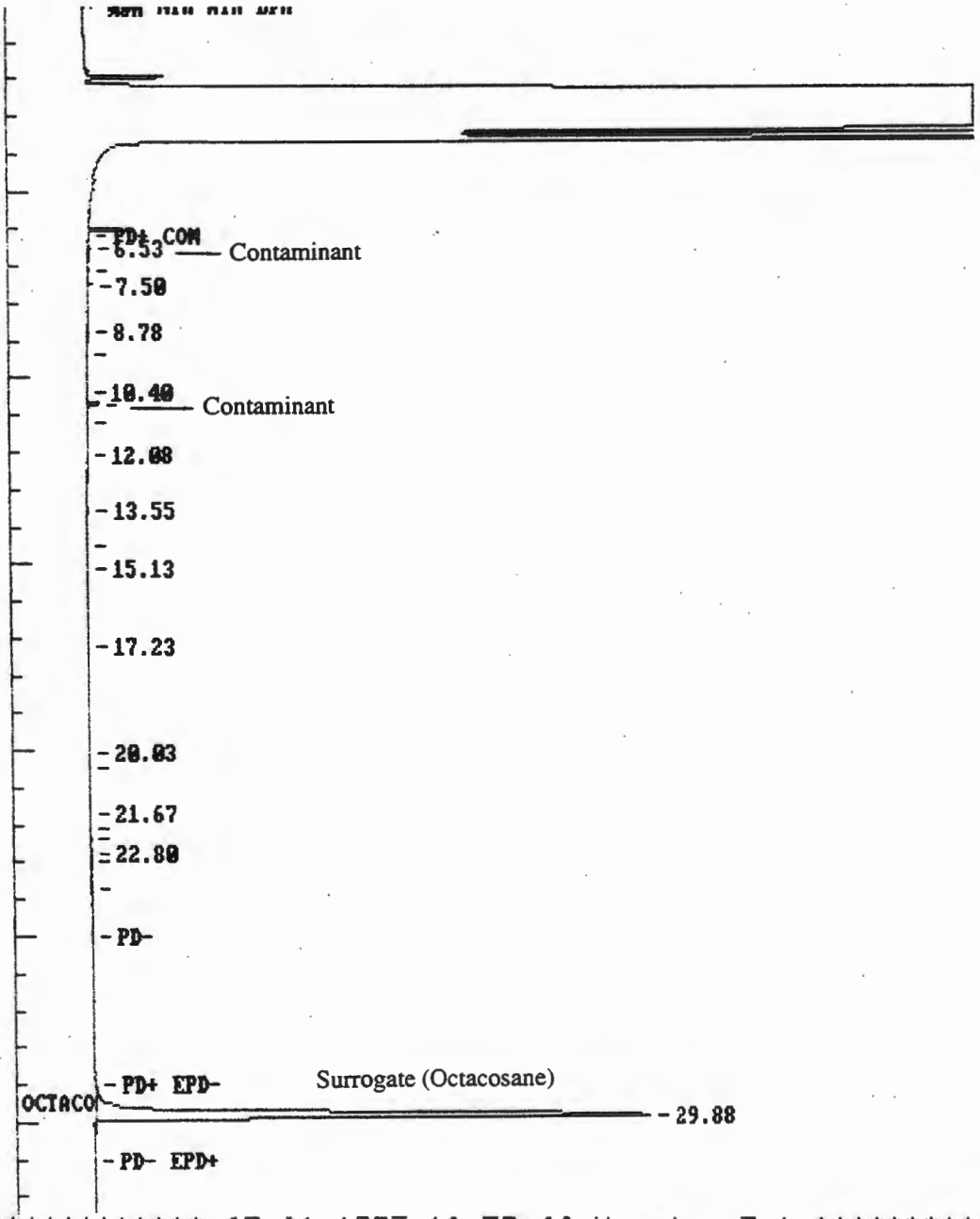
Areas. times. and heights stored in: M:CM2627.ATB
Data File = M:CM2627.PTS Printed on 03-01-1993 at 09:13:57
Start time: 0.00 min. Stop time: 39.00 min. Offset: 0 mv.
Full Range: 75 millivolts




```
******************** 03-01-1993 09:13:39 Version 5.1 **********************
* Sample Name: 930226104A, BH-12-04-01-01        Data File: M:CM2627       *
* Date: 02-27-1993 08:10:47 Method: DM033023  02-10-1993 13:49:07  #  24  *
* Interface: 0   Cycle#:  27   Operator DKS Channel#: 0    Vial#: N.A.    *
* Starting Peak Width:  10   Threshold: .001  Area Threshold: 75          *
*************************************************************************
* Instrument Type: MONTE                Column Type: DB-1                 *
*            Solvent Description:                                         *
* Conditions:                                                             *
*           Detector 0: FID                  Detector 1:                  *
* Misc. Information:                                                      *
*************************************************************************
```

Figure 5. Chromatogram of a Soil Sample from Site SS-12 (Location BH-12-04) Reported as "ND"

Areas, times, and heights stored in: M:CM267.ATB
Data File = M:CM267.PTS Printed on 03-01-1993 at 10:52:56
Start time: 0.00 min. Stop time: 39.00 min. Offset: 0 mv.
Full Range: 75 millivolts




```
******************** 03-01-1993 10:52:44 Version 5.1 ********************
* Sample Name: 930227505ARB, METHOD BLANK        Data File: M:CM267       *
* Date: 02-26-1993 14:54:35 Method: M:DM033023 02-10-1993 13:49:07  #  24 *
* Interface: 0   Cycle#:  7    Operator DKS Channel#: 0    Vial#: N.A.    *
* Starting Peak Width:  10   Threshold: .001  Area Threshold: 75          *
*************************************************************************
* Instrument Type: MONTE                  Column Type: DB-1               *
*              Solvent Description:                                       *
* Conditions:                                                             *
*            Detector 0: FID                    Detector 1:              *
* Misc. Information:                                                      *
*************************************************************************
```

Figure 6. Chromatogram of a Method Blank Reported as "ND"

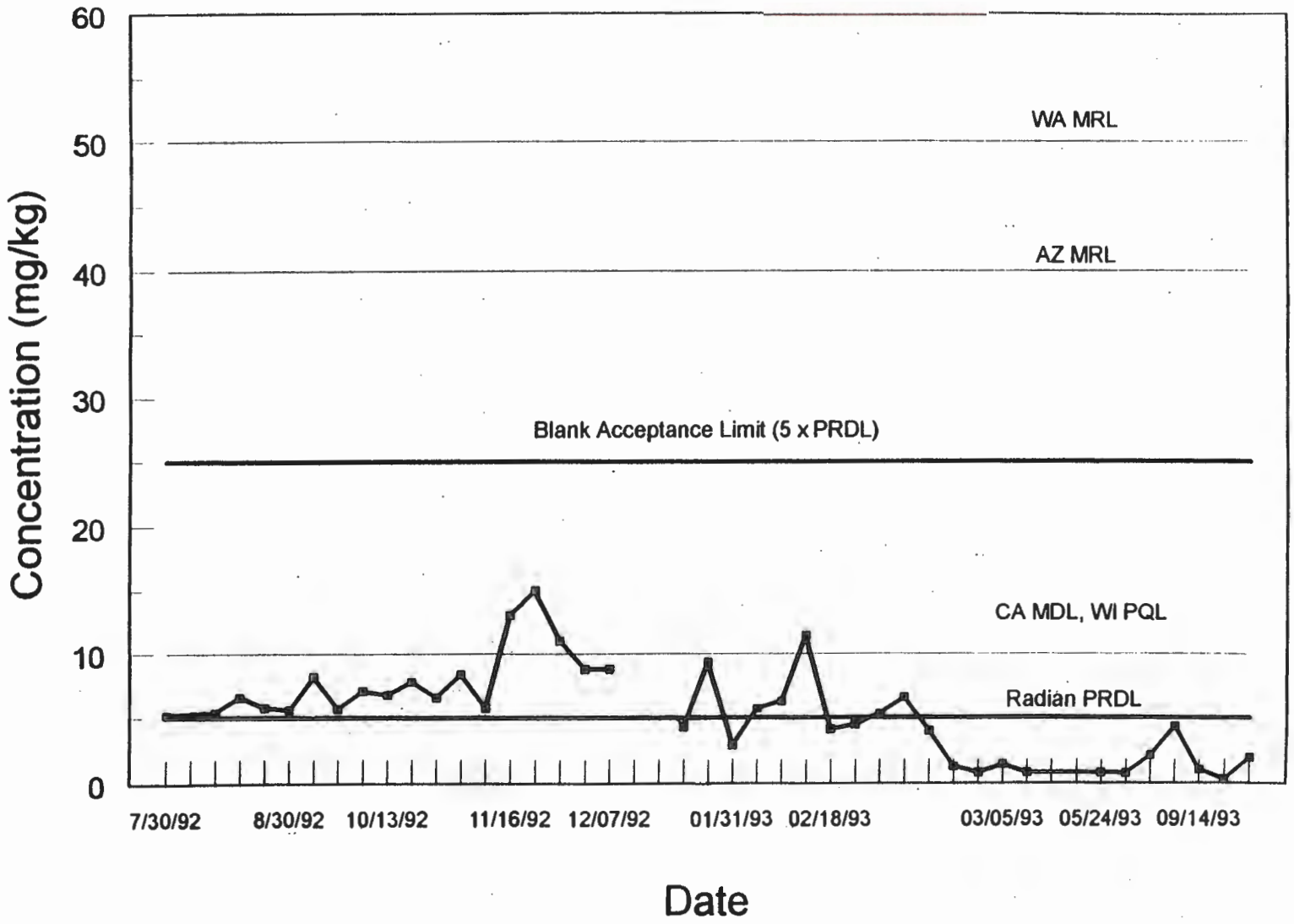
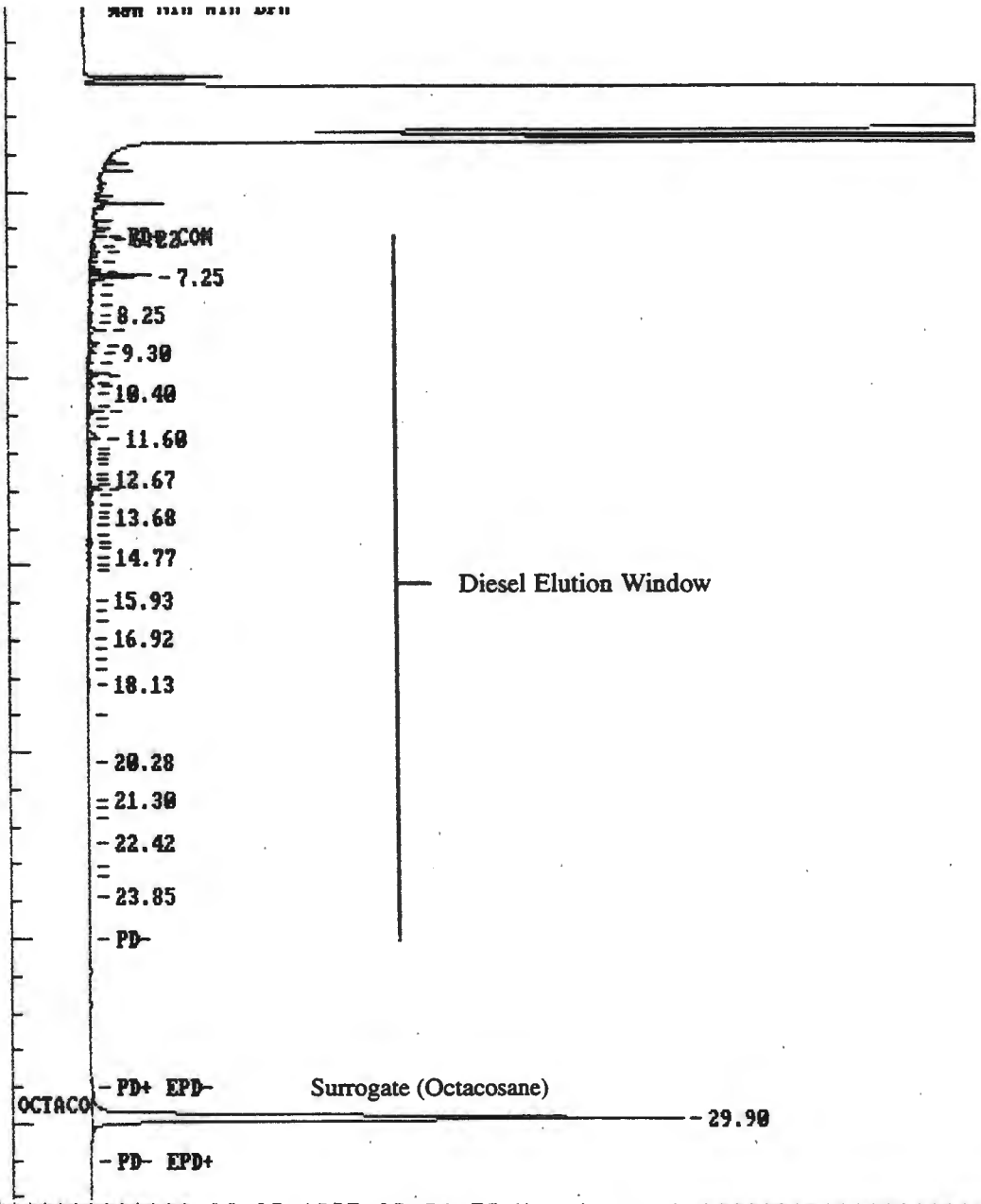


Figure 7. Laboratory Blank Results for Diesel - July 1992 through September 1993

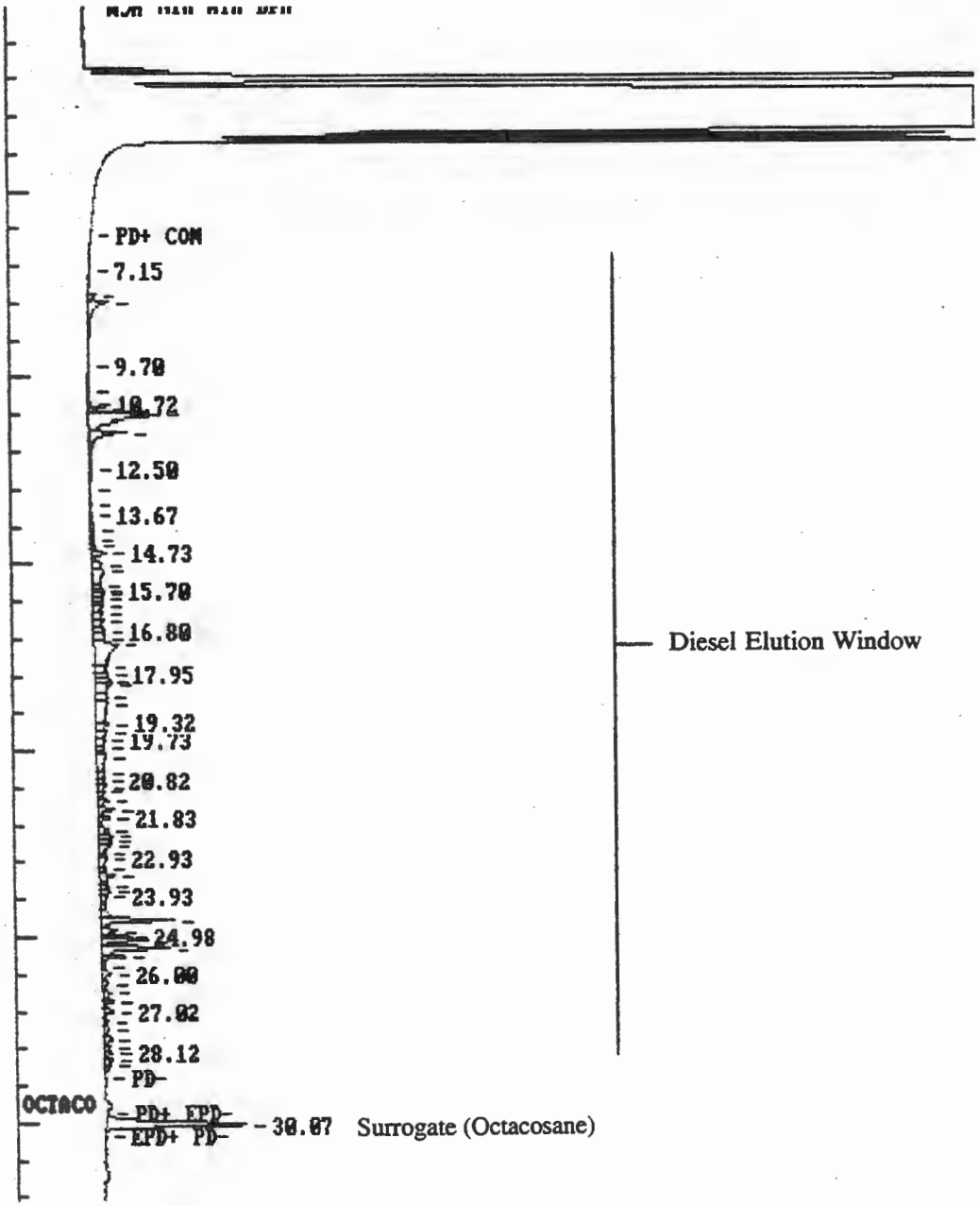
Areas, times, and heights stored in: M:GM0114.ATB
Data File = M:GM0114.PTS Printed on 04-02-1993 at 08:57:01
Start time: 0.00 min. Stop time: 39.00 min. Offset: 0 mv.
Full Range: 75 millivolts




```
******************** 04-02-1993 08:56:35 Version 5.1 ********************
* Sample Name: 930322802A, WL-12-02-01 ext 3/22/93 Data File: M:GM0114      *
* Date: 04-01-1993 23:20:10 Method: DM033023  02-10-1993 13:49:07  #  24   *
* Interface: 0   Cycle#:  14   Operator DKS Channel#: 0    Vial#: N.A.     *
* Starting Peak Width:  10   Threshold: .001  Area Threshold: 75           *
***************************************************************************
* Instrument Type: MONTE                Column Type: DB-1                  *
*            Solvent Description:                                          *
* Conditions:                                                              *
*           Detector 0: FID                 Detector 1:                    *
* Misc. Information:                                                       *
***************************************************************************
```

Figure 8. Chromatogram of SS-12 Groundwater Sample from Location WL-12-02

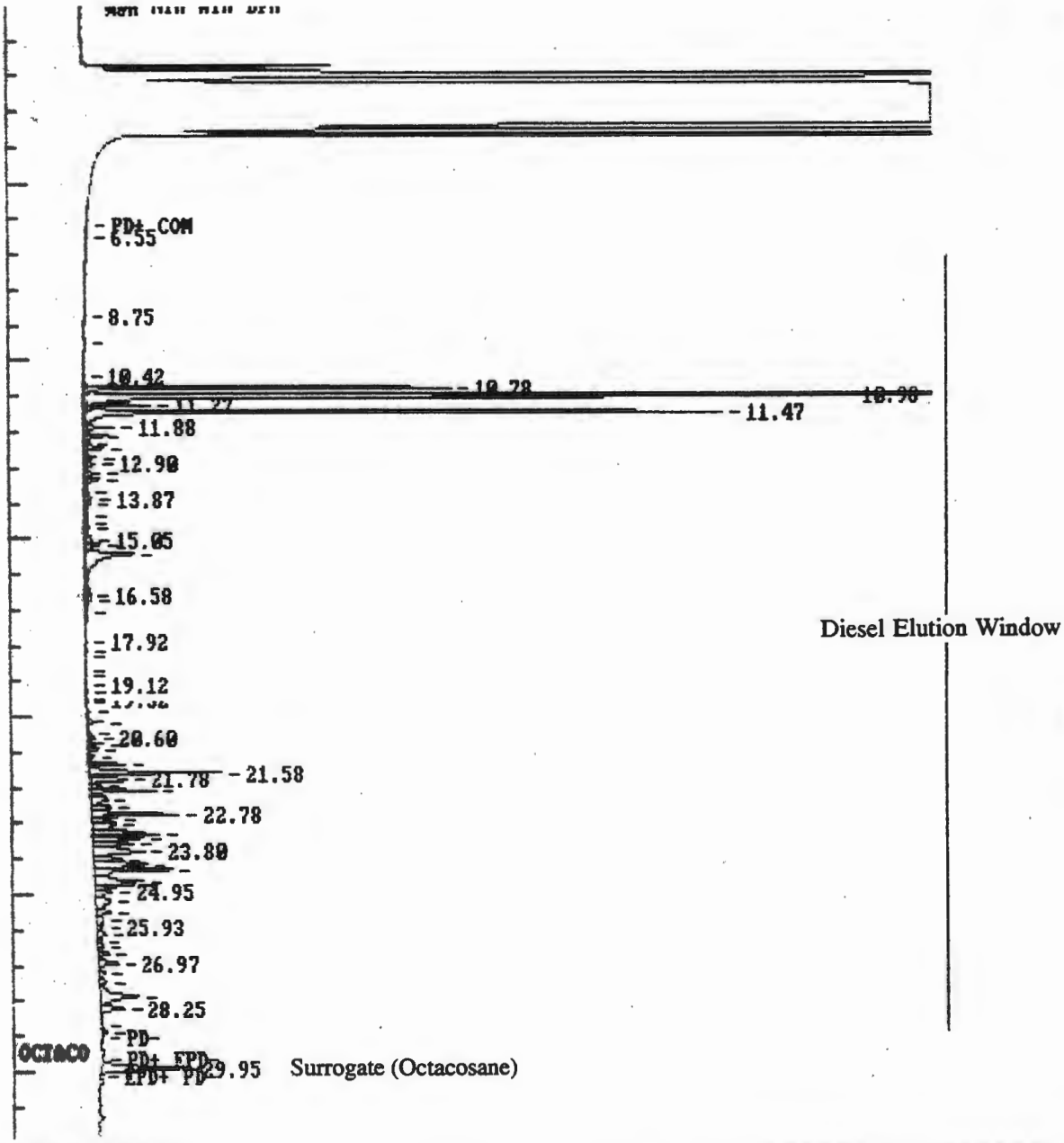
Data File = m:em0514.PTS Printed on 03-08-1993 at 15:09:11
Start time: 0.00 min. Stop time: 39.00 min. Offset: 0 mv.
Full Range: 75 millivolts




```
******************** 03-08-1993 15:07:34 Version 5.1 *********************
* Sample Name: 930227501A, BH-58-02-01-01          Data File: m:em0514      *
* Date: 03-05-1993 23:53:19 Method: DM033023 02-10-1993 13:49:07  #  24    *
* Interface: 0   Cycle#:  14   Operator DKS Channel#: 0    Vial#: N.A.     *
* Starting Peak Width:  10   Threshold: .001  Area Threshold: 75           *
*************************************************************************
* Instrument Type: MONTE                  Column Type: DB-1                *
*              Solvent Description:                                        *
* Conditions:                                                              *
*            Detector 0: FID                    Detector 1:               *
* Misc. Information:                                                       *
*************************************************************************
```

Figure 9. Chromatogram of LF-58 Soil Sample from Location BH-58-02

Data File = m:em0526.PTS Printed on 03-08-1993 at 10:53:26
Start time: 0.00 min. Stop time: 39.00 min. Offset: 0 mv.
Full Range: 75 millivolts



********** 03-08-1993 10:51:46 Version 5.1 **********
* Sample Name: 930226103A. BH-12-01-01-01 Data File: m:em0526 *
* Date: 03-05-1993 34:15:48 Method: DM033023 02-10-1993 13:49:07 # 24 *
* Interface: 0 Cycle#: 26 Operator DKS Channel#: 0 Vial#: N.A. *
* Starting Peak Width: 10 Threshold: .001 Area Threshold: 75 *
****
* Instrument Type: MONTE Column Type: DB-1 *
* Solvent Description: *
* Conditions: *
* Detector 0: FID Detector 1: *
* Misc. Information: *
****

Figure 10. Chromatogram of LF-58 Soil Sample from Location BH-58-01

A.2

Laboratory Reporting Limits

Laboratory Reporting Limits

The presence or absence of organic constituents was determined by laboratory reporting limits. A laboratory reporting limit is the minimum concentration of a constituent that can be measured and reported with confidence. Constituents measured at concentrations above laboratory reporting limits in normal samples were considered to be present at the site unless they were also blank detected. Laboratory reporting limits are listed with detected concentrations in the site-specific analytical summary tables in Sections 4, 5, 6, and 7.

A.3

Statistical Background Levels

Statistical Background Levels

The presence or absence of inorganic contaminants was determined by a comparison of detected concentrations with established UTLs for background concentrations. Inorganic constituents detected at concentrations above UTLs were considered present at elevated levels at the site.

An insufficient number of samples were collected during this investigation to perform statistical analyses to determine site-specific UTLs for inorganic analytes. Instead, inorganic results from this investigation were compared with the UTLs for Base-wide background concentrations for naturally occurring inorganic constituents established in the *Base-wide Background Investigation* (Radian, 1993) for Holloman AFB. This statistical comparison provided a valid method of determining whether detected concentrations differ from naturally occurring background concentrations.

Table 2-1

Summary Statistics for Soil

Analayte	Method	Summary Statistics (units = mg/Kg)						Warning Limit	Upper Tolerance Limit	Basis
		Minimum	Maximum	Mean	Standard Deviation	Median	Pseudosigma			
Aluminum	SW6010	260.0000	6200.0000	3106.6667	1866.6548	2800.0000	.	4855.6696	8764.4972	Combine
Antimony	SW6010	-9.2980	7.8410	-0.6770	3.9327	-0.2114	.	2.6865	7.2844	Field
Antimony	SW7041	-0.0490	0.1400	0.0674	0.0613	0.0640	.	0.1249	0.2533	Combine
Arsenic	SW6010	-9.2120	8.2380	0.1165	3.3548	0.1520	.	2.9842	6.8833	Field
Barium	SW6010	14.0000	65.0000	35.7778	16.0295	30.0000	.	50.7970	84.3632	Field
Beryllium	SW6010	-0.0410	0.4000	0.1323	0.1152	0.1100	0.0371	0.1500	0.4000	Field
Boron	SW6010	5.2000	11.0000	8.8444	2.0348	8.5000	.	10.7510	15.0118	Combine
Cadmium	SW6010	-0.3762	0.5600	0.1832	0.0929	0.0036	.	0.2538	1.0359	Field
Calcium	SW6010	160000.000	250000.000	223333.333	25495.0976	230000.000	7412.8984	240000.000	250000.000	Field
Chromium	SW6010	0.3600	4.8000	2.3400	1.4071	2.2000	.	3.6584	6.6049	Field
Cobalt	SW6010	0.2600	1.7000	0.9156	0.5179	0.7600	.	1.4008	2.4852	Field
Copper	SW6010	1.8000	3.8000	2.9222	0.6340	3.1000	.	3.5163	4.8438	Field
Iron	SW6010	180.0000	4500.0000	2275.5556	1348.1015	2000.0000	.	3538.6887	6361.6513	Field
Lead	SW6010	-22.0000	-9.8000	-14.0889	3.8822	-13.0000	.	-10.4514	-2.3221	Field
Lithium	SW6010	3.6000	15.0000	7.7778	3.3063	7.2000	.	10.8757	17.7993	Field
Magnesium	SW6010	1700.0000	12000.0000	5411.1111	3050.1821	4500.0000	.	8269.0458	14656.2132	Field
Manganese	SW6010	7.5000	120.0000	46.1667	33.2378	37.0000	.	77.3095	146.9104	Field
Mercury	SW7471	-0.0640	-0.0080	-0.0270	0.0123	-0.0250	.	-0.0164	-0.0006	Combine
Molybdenum	SW6010	0.2500	4.2000	1.7289	1.2197	1.7000	.	2.8717	5.4258	Field

Table 2-1

(Continued)

Analyte	Method	Summary Statistics (units = mg/Kg)						Warning Limit	Upper Tolerance Limit	Basis
		Minimum	Maximum	Mean	Standard Deviation	Median	Pseudosigma			
Nickel	SW6010	1.2000	4.7000	2.3889	1.0635	2.4000	.	3.3854	5.6125	Field
Potassium	SW6010	91.0000	1800.0000	917.8889	522.4343	800.0000	.	1407.3951	2501.3873	Field
Selenium	SW6010	-12.0000	12.9100	-0.4608	5.4684	-0.9654	.	4.2112	10.5310	Combine
Silicon	SW6010	180.0000	400.0000	276.6667	68.3740	280.0000	.	340.7312	483.9082	Field
Silver	SW6010	-1.5130	1.1560	-0.2009	0.4628	-0.1800	.	0.1948	0.7342	Combine
Sodium	SW6010	590.0000	5000.0000	1550.0000	1564.5207	900.0000	363.2320	3400.0000	5000.0000	Field
Strontium	SW6010	800.0000	2600.0000	1600.0000	487.3397	1600.0000	.	2056.6236	3077.1267	Field
Thallium	SW6010	-9.9230	12.3300	0.9036	5.1710	0.7436	.	5.3226	11.3153	Combine
Thallium	SW7841	-0.0620	0.1600	0.0425	0.0030	-0.0098	.	0.0670	0.4977	Field
Tin	SW6010	-3.7470	4.0780	-0.0122	1.5741	-0.0173	.	1.3340	3.1743	Combine
Titanium	SW6010	0.6000	140.0000	73.8444	40.7666	75.0000	.	112.0416	197.4081	Field
Uranium	SW6010	-15.0000	12.9200	-1.0999	6.6739	-1.2175	.	4.6080	12.4107	Combine
Vanadium	SW6010	1.3000	11.0000	6.6333	2.9120	6.7000	.	9.3618	15.4597	Field
Zinc	SW6010	0.3200	15.0000	6.7244	4.4612	5.6000	.	10.9045	20.2464	Field

Field = statistics based on field samples only.
Combine = statistics based on combination field and blank data.

A.4

Radioactivity Acceptance Criteria

Background Radioactivity Levels and Acceptance Criteria

Since very little regulatory guidance exists for radioactivity levels in soils, detected alpha, beta, and gamma radioactivity levels were compared with levels in site background samples, and to the *Waste Acceptance Criteria for Radioactive Solid Waste Disposal at SWSA-6* (Oak Ridge National Laboratory [ORNL], 1993). ORNL waste acceptance criteria are as follows:

- Gross alpha activity less than 30 pCi/g (unless transuranics are present, but no transuranics are expected at any of the four sites); and

- Beta/gamma emitting radioactivity less than 48.6 pCi/g.

CONTROLLED COPY
DMC
76

Scott

WASTE ACCEPTANCE CRITERIA

FOR

RADIOACTIVE SOLID WASTE DISPOSAL AT SWSA-6

WMRA-WMPC-203

Prepared by:

Waste Minimization, Planning, and Certification Department
Environmental Programs Coordination Section
Waste Management and Remedial Action Division

Date: April, 1993

Prepared by the
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831
operated by
Martin Marietta Energy Systems, Inc.
for the
U.S. Department of Energy
under Contract No. DE-AC05-84OR21400

SUBJECT: WASTE ACCEPTANCE CRITERIA

Very Low Activity waste shall be stored in the appropriate facility at SWSA-6.

9.2 Waste Container Requirements

VLA waste shall be double bagged in 4-mil polyethylene bags, with magenta radiation markings, each bag sealed with tape and placed inside an outer container. Large items that will not fit into a plastic bag must be double wrapped in plastic and securely taped.

Very Low Activity Waste shall be packaged in 4' x 4' x 6' metal boxes. The RSWO group will assign a Low Level Number (LLN) to the box and a RSWO representative shall apply the LLN to all four sides of the box.

In the event that the generator's waste will not fill a 4' x 4' x 6' metal box, the waste may be staged at the SWSA for packaging by SWSA personnel, provided that the waste is acceptable for transfer.

Large items of Very Low Activity Waste that do not fit into a 4' x 4' x 6' metal box require approval from the RSWO supervisor prior to waste acceptance and transfer.

9.3 Dose Rate Requirements

The radiation survey results shall not exceed 300 dpm/100 cm^2 of alpha or 0.05 mrem/h of beta-gamma to be classified as very low activity waste and stored by RSWO. Also smearable contamination shall not exceed the limits of subsection 4.1.11 above.

Free release limits: Transferable (smear) level: <20 dpm/100 cm^2 alpha, and <200 dpm/100 cm^2 beta-gamma*. Direct (probe) level: <300 dpm/100 cm^2 alpha, and <1000 dpm/100 cm^2 beta-gamma. For soil: Curie content less than or equal to 8.9 picocuries/gram (4.0×10^{-9} Ci/pound) alpha and 48.6 picocuries/gram (2.2×10^{-8} Ci/pound) beta-gamma.

*Except ^{125}I, ^{129}I, and ^{227}Ac which have a limit of 20 dpm/100 cm^2 and ^{3}H and ^{14}C which have a limit of 1000 dpm/100 cm^2.

9.4 Labeling Requirements

The waste container shall be labeled with a "Radiation Hazard Tag," form UCN-2785. The RSWO representative shall apply the Low Level Number to all four sides of the box.

[18] From: Hal Butler at OKR_PO01 8/16/93 1:06PM (1414 bytes: 19 ln)
To: Laura Maley at AUS_PO04
Subject: Re: radioactivity levels
---------- Message Contents ----------

Laura,

Both results, gross alpha and gross beta, look a little higher than what one would expect to find in non enriched background samples. One of the facilities here in Oak Ridge(Y-12 Plant), where Uranium is handled in abundance,treat all solid samples having a gross Alpha activity exceeding 30pCi/g as rad waste. Another facility(Oak Ridge National Laboratory), where transuranics are present,classifies soil having greater than 8.9pCi/g as rad waste(unless alpha spec analysis confirms the absence of transuranics). ORNL also classifies soil having greater than 48.6pCi/g of beta/gamma emitting radioactivity as rad waste.

How confident are you of the data? What kind of error bars were used to quantify the data? Might look into that. Certainly nothing to be alarmed about with the gamma data. There has been approx. 6nCi/square foot of Cs-137 spread over the entire earth from weapons tests(fallout).

Hal B.
483-9870 EX 283

A.5

Conceptual Site Model

Conceptual Site Models

Conceptual site models illustrate potential pathways and receptors through which site contaminants could cause health and environmental risks. Exposure pathways are complete if contaminants can come into contact with receptors, either through direct exposure or migration and dispersion. Conceptual site models for each site are included in the site-specific sections.

A.6

Proposed RCRA Subpart S Action Levels, PCB ARARs, and Site-Specific Health-Based Levels for PCBs

Proposed RCRA Subpart S Action Levels

The proposed RCRA Subpart S in 40 CFR Part 264 contains methodology and criteria for calculating risk-based action levels (action levels) for contaminants in soil, water, and air. Action levels derived according to these criteria represent valid, reasonable estimates of levels in media at or below which corrective action is unlikely to be necessary. Action levels are not, however, cleanup standards.

Soil action levels derived from reference doses (RfDs) or carcinogenic slope factors (SFs). The more stringent level was chosen in cases where contaminants have both Rfd- and SF-derived action levels. Action levels for groundwater are Maximum Contaminant Levels (MCLs), New Mexico Human Health Standards (HHSs), or are derived from RfDs or SFs. In cases where multiple action levels were available for a specific contaminant, the most stringent value was used. Table 3-2 is a compilation of the most stringent action levels for soil and groundwater constituents detected at the four sites.

Action levels for soil and water were calculated using recommended exposure assumptions from Appendix D of the proposed rule, equations from Appendix E of the proposed rule, and RfDs or SFs available from the EPA. Concentrations used as action levels for carcinogens are associated with a 1E-06 upperbound excess cancer risk for Class A and B carcinogens, and a 1E-05 upperbound excess cancer risk for Class C carcinogens. Action levels for systemic toxicants are based on concentrations at which the human population could be exposed on a daily basis without appreciable risk of adverse health effects.

The RfDs and SFs used were verified in *The Electronic Handbook of Risk Assessment Values* (*EHRAV*), April 15, 1993 edition. Values not listed in *EHRAV* were taken from EPA's Health Effects Assessment Summary Tables (HEAST) FY 1992, or were derived from MCLs or HHSs.

Table A-1

Action Levels for Contamination Detected at the Holloman AFB Four Sites

Chemical	EPA Carc. Class	Oral RfD (mg/kg/d)	Oral SF 1/(mg/kg/d)	Soil Action Level (noncarc.) (mg/kg)	(carc.) mg/kg	Water Action Level (noncarc.) (mg/L)	(carc.) mg/L	Drinking Water MCLs e (mg/L)	N.M. HHS f (mg/L)
Aluminum				--	--	--	--		5
Aniline			5.7E-03 a	--	1.23E+02	--	6.14E-03		
Arsenic	A	3.0E-04 b		2.40E+01	--	1.05E-02	--	0.05	0.1
Barium		7.0E-02 b		5.60E+03	--	2.45E+00	--	2	1
Benzene	A		2.9E-02 b	--	2.41E+01	--	1.21E-03	0.005	0.01
Beryllium	B2	5.0E-03 a	4.3E+00 b	4.00E+02	1.63E-01	1.75E-01	8.14E-06	0.004	
Chromium III	D	1.0E+00 b		8.00E+04	--	3.50E+01	--	0.1	0.05
Chromium VI	A	5.0E-03 b		4.00E+02	--	1.75E-01	--	0.1	0.05
Cobalt				--	--	--	--		0.05
Copper	D	4.0E-02 d		3.20E+03	--	1.40E+00	--	1.3 j	1
Diesel	D	8.0E-03 g		6.40E+02	--	2.80E-01	--		
Ethylbenzene	D	1.0E-01 b		8.00E+03	--	3.50E+00	--	0.7	0.75
Gasoline	C	2.0E-01 i	1.7E-03 i	1.60E+04	4.12E+02	7.00E+00	2.06E-02		
Kerosene	D	2.0E-02 h		1.60E+03	--	7.00E-01			
Lead	B2	1.0E-03 d		8.00E+01	--	3.50E-02	--	0.015 j	0.05
Manganese	D	1.4E-01 b		1.12E+04	--	4.90E+00	--		
Methylene chloride	B2	6.0E-02 b	7.5E-03 b	4.80E+03	9.33E+01	2.10E+0	4.67E-03	0.005	0.1
Nickel	D	2.0E-02 b		1.60E+03	--	7.00E-01	--	0.1	0.2
PCB-1254	B2		7.7E+00 b	--	9.09E-02	--	4.55E-06	0.0005	0.001

Table A-1

(Continued)

Chemical	EPA Carc. Class	Oral RfD (mg/kg/d)	Oral SF 1/(mg/kg/d)	Soil Action Level (noncarc.) (mg/kg)	(carc.) mg/kg)	Water Action Level (noncarc.) (mg/L)	(carc.) mg/L	Drinking Water MCLs e (mg/L)	N.M. HHS f (mg/L)
Selenium	D	5.0E-03 b		4.00E+02	--	1.75E-01	--	0.05	0.05
Thallium				--	--	--	--	0.002	
Toluene	D	2.0E-01 b		1.60E+04	--	7.00E+00	--	1	0.75
Vanadium	D	7.0E-03 b		5.60E+02	--	2.45E-01	--		
Xylenes	D	2.0E+00 b		1.60E+05	--	7.00E+01	--	10	0.62
Zinc	D	3.0E-01 b		2.40+04	--	1.05E+01	--		10
Beta particle activity	A				--	--	--	4 mrem	
Photon activity (gamma)	A				--	--	--	4 mrem	
Gross alpha activity	A				--	--	--	15 pCi/L	

a The Electronic Handbook of Risk Assessment Values, Electronic Handbook Publishers, Bellevue, WA. April 15, 1993.

b "EPA's IRS Chemical Information Data Base," L.H. Keith, ed. Lewis Publishers, Chelsea, MI. 1st Quarter, 1993.

c Calculated based on drinking water MCL (EPA, April, 1991)

d Calculated based on NM HHS.

e From EPA "Drinking Water Regulations and Health Advisories," May ,1993; except as noted.

f From State of New Mexico Water Quality Control Commission Regulations," as amended through August 18, 1991.

g Value for marine diesel from EPA 1992.

h Value for JP-5 from EPA 1992.

i Value for gasoline from EPA 1992.

j EPA, Office of Water, Action Level.

B.2.6 Polychlorinated Biphenyls (PCBs)

40 CFR Part 761, Subpart G

The EPA has established regulations for the management of PCBs at 40 CFR Part 761. Generally, these rules apply to PCBs present in concentrations of 50 ppm or greater.

B.2.6.1 PCB Spill Cleanup

In 1987, EPA adopted amendments to the PCB regulations establishing spill cleanup requirements. These requirements only apply to PCB spills which occur after the effective date of the rule (4 May 1987). Existing spills (i.e., spills that occurred before the effective date of the policy) are excluded from the scope of the rules; cleanup requirements at these sites are established at the discretion of EPA, through its regional offices.

The 1987 regulatory amendments do apply to the cleanup of PCBs in concentrations less than 50 ppm if the material that was originally spilled contained concentrations greater than 50 ppm.

B.2.6.2 PCB Cleanup Criteria

EPA's PCB spill cleanup rules use a risk-based approach which requires cleanup to different levels depending upon: 1) spill location; 2) the potential for exposure to residual PCBs remaining after cleanup; 3) the concentration of PCBs initially spilled; and 4) the nature and size of the population at risk of exposure.

Requirements for the cleanup of high-concentration PCB spills (containing 500 ppm or greater PCBs) and low concentration spills involving one pound or more PCBs by weight are contained in 40 CFR Section 761.125.

Restricted Access Areas

Requirements for cleanup of PCB spills in outdoor electrical substations are contained in 40 CFR Sections 761.125 (c)(2)(i) and (ii). Contaminated solid surfaces (both impervious and nonimpervious) will be cleaned to a PCB concentration of 100 $\mu g/100\ cm^2$. Contaminated soil will be cleaned either to 25 or 50 ppm PCBs by weight provided that a label or notice is visibly placed in the area.

Other restricted access (nonsubstation) locations are "areas other than electrical substations that are at least 0.1 kilometer (km) from a residential/commercial area and limited by man-made barriers (i.e., fences and walls)...[or] substantially limited by naturally occurring barriers such as mountains, cliffs, or rough terrain. These areas generally include industrial facilities and extremely remote rural locations" (40 CFR Section 761.123). In accordance with these guidelines and definitions, most Holloman AFB sites where PCB contamination occurs are considered to be "other restricted access areas." Cleanup criteria for PCB spills in other restricted access areas are 10 $\mu g/100\ cm^2$ for high-contact solid surfaces; 10 $\mu g/100\ cm^2$ for low-contact, indoor, impervious surfaces; 10 $\mu g/100\ cm^2$, or 100 $\mu g/100\ cm^2$ with encapsulation for low-contact, indoor, nonimpervious surfaces; 100 $\mu g/100\ cm^2$ for low-contact outdoor surfaces; and 25 ppm by weight for soil.

Nonrestricted Access Areas

Requirements for cleanup of PCB spills in "nonrestricted access areas" are contained in 40 CFR Sections 761.125 (c)(4)(i)-(v). "Nonrestricted access areas" are defined in 40 CFR Section 761.123 as "any area other than restricted access, outdoor electrical

substations, and other restricted access locations...in addition to residential/commercial areas, these areas include unrestricted access rural areas." In accordance with this definition, the area outside the substation fence at Site 11 is considered a "nonrestricted access area." Soil cleanup criteria for PCB spills in nonrestricted access areas are 10 ppm by weight provided the soil is excavated to a minimum depth of 10 inches. The excavated soil will be replaced with clean soil (less than 1 ppm PCBs).

The rules state that in exceptional spill situations, site-specific risk factors may warrant additional cleanup to more stringent numerical decontamination levels. Site-specific characteristics such as shallow depth of groundwater, type of soil, or the presence of a shallow well may pose an exceptionally high potential for groundwater contamination by PCBs. Under these circumstances the Regional Administrator may require additional cleanup in order to avoid unreasonable risk.

Calculation of Health-Based Level for Occupational Exposure

The equation is

mg/kg = [risk]/[(CF x SA x AF x ABS x EF x ED/ BW x AT)]

Risk = .00001
CF = Conversion factor = .00001
SA = surface area = 4300 (face, arms, hands)
AF = soil to skin adherence factor = 1 (default)
ABS = absorption efficiency = 3.16E-06 (PCBs)
EF = exposure frequency = 20 years
BW = body weight = 70 kg
AT = averaging time = 70 years x 365 years
Result = 6840 μ/kg

APPENDIX B

Field Data

B.1 Drilling Logs

B.2 Well Construction Diagrams

B.3 Well Development Logs and Photos

B.4 Groundwater Sampling Logs

B.5 Site 12 Groundwater Gradient Calculation

B.6 Synchronous Water Level Survey Results

B.7 Site 58 Waste Pit Contents

B.8 Surveying Data

B.1

Drilling logs

Key to Borehole Drilling Logs

All boreholes were drilled by Southwest Engineering Inc. (SEI) using a CME hollow-stem auger drill rig. Augers were 4-inch I.D./8-inch O.D., and samples were taken with 2 foot stainless steel split spoons. All boreholes were started and completed on the date listed at the top of the drilling log. The borehole location, and borehole elevation are listed in the surveying data (Appendix B.8). All measurements are recorded in feet.

GRAIN SIZE:

VF	Very fine
F	Fine
M	Medium
C	Coarse

GRADING:

P	Poorly graded
W	Well graded

MOISTURE:

S	Saturated
W	Wet
M	Moist
D	Dry

USCS CLASS (ASTM D 2487):

GW	Well-graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well-graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand
ML	Silt
MH	Silt (elastic)
CL	Clay (lean)
CH	Clay (fat)

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 2
FOUR SITES (HOLL_4S)	BH-12-01	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithcode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SILTY	CLAY	BROWN	10YR 4/3			M	LOW	CL	STCL	2,7,7,8	0-2	0.7	
1															
2		SANDY	SILT	BROWN	10YR 5/3	VF	P	M	LOW	ML	SDSL	9,5,4,5	2-4	2.0	
3															WATER AT 3.5 FT.
4												3.2.3.3	4-6	2.0	
5															
6															
7															
8			CLAY	GREYISH BROWN	10YR 5/2			S	HIGH	CH	CLAY				
9															

F3713

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 2
FOUR SITES (HOLL_4S)	BH-12-01	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithcode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												0,0,0,0	10–12	0.3	
11															
12												2,3,2,3	12–14	2.0	
13															
14															TD = 14 FT.
15															
16															
17															
18															
19															

F3713

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 2
FOUR SITES (HOLL_4S)	BH-12-02	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SANDY	CLAY	BROWN	10YR 5/3	VF	P	M	LOW	CL	SDCL	3,3,4,4	0-2	2.0	
1															
2												3,3,5,5	2-4	2.0	
3															
		SILTY	CLAY	BROWN	10YR 5/3			M	LOW	CL	SDCL				
4															
		CLAYEY	SAND	BROWN	10YR 5/3	VF	P	M		SC	SDCL	7,8,8,6	4-6	2.0	
5															
6												2,2,2,2	6-8	2.0	
7															
8		SANDY	SILT	GREY	10YR 5/1	F	P	S		ML	SDSL	0,0,0,0	8-10	1.5	FOUL ODOR
9															

F3714

DRILLING LOG

Project (PROJIO)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 2
FOUR SITES (HOLL_4S)	BH-12-02	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
11		CLAYEY	SAND	DK. GREY	2.5Y 4/1	F	P	S		SC	SDCL	0,0,1,5	10-12	2.0	FOUL ODOR
12			CLAY	DK. GREY BRN	2.5Y 4/2			S	HIGH	CH	CLAY	0,0,0,0	12-14	2.0	FOUL ODOR LESS DISCOLORATION IN CLAY LAYER
13															
14															TD = 14 FT.
15															
16															
17															
18															
19															

F3714

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 2
FOUR SITES (HOLL_4S)	BH-12-03	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithcode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		CLAYEY	SAND	DK. GREY BRN	10YR 4/2	F	P	D		SC	SDCL	9,11,6,3	0-2	2.0	ALCOHOL ODOR
1															
2															
3												6,6,10,7	3-5	2.0	
4															
5												1,0,0,0	5-7	1.0	
6															
7															WATER AT 7.5 FT.
8		SANDY	CLAY	LT. GREY	10YR 7/1	F	P	S	LOW	CL	SDCL		8-10		
9															

F3715

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 2
FOUR SITES (HOLL_4S)	BH-12-03	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												6.11.16.26	10-12	2.0	STAINED GREY FOUL ODOR
11															
12		CLAYEY	SAND	PALE BROWN	10YR 6/3	F	P	S	LOW	SC	SDCL	7,12,12,15	12-14	2.0	
13															
14															
15												6,13,20,39	14-16	2.0	
16															TD = 16.5 FT.
17															
18															
19															

F3715

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 1
FOUR SITES (HOLL_4S)	BH-12-06	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithcode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
1		CLAYEY	SAND	DK. YELLOW BRN	10YR 4/4	F	P	D	LOW	SC	SDCL	6,8,9,11	0-2	2	
2		SILTY	SAND	YELLOWISH BRN	10YR 5/4	F	P	D		SM	SDSL	2,2,2,1	2-4	2	INTERBEDDED WITH CALICHE LAYERS
3															
4															HIT STORM SEWER CONCRETE ON FIRST HOLE -MOVED SOUTH 5 FT.
5												8,6,6,9	4-6	1.5	
6															
7		SANDY	SILT	V. PALE BRN	10YR 8/4	F	P	S	LOW	ML	SDSL		6-8	2	SOME CLAY WATER AT 7 FT.
8															TD 8.0 FT.
9															

F3716

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 1
FOUR SITES (HOLL_4S)	BH-27-01	LEM	RADIAN (RAD)	20 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithcode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SILTY	SAND	DK. GREY BRN	10YR 4.2	F	P	D		SM	SDSL	3.8.8.29	0–2	1.8	WINDY, DUSTY
		SILTY	CLAY	YELLOWISH BRN	10YR 5/4			D	LOW	CL	STCL				
1		CLAYEY	SILT	LT. YELLOW BRN	10YR 6/4			D	LOW	ML	STCL				
2															
3		SANDY	SILT	PALE YELLOW	2.5Y 8/4	VF	P	M	LOW	ML	SDSL	9.8.9.9	2–4	1.8	CALICHE LAYERS
4															
5		SANDY	CLAY	PALE YELLOW	2.5Y 8/4	VF	P	S	LOW	CL	SDCL	4.7.7.6	4–6	2.0	
6															TD 6.0 FT.
7															
8															
9															

F3779

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 1
FOUR SITES (HOLL_4S)	BH-27-02	LEM	RADIAN (RAD)	20 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		CLAYEY	SILT	LT. YELLOW BRN	2.5Y 6/3			D	LOW	ML	FILL	0,2,1,1	0-2	1.8	ROOTS AND TWIGS FROM 0.0-0.5 FT. SOME SAND
1															
2												1,2,1,2	2-4	1.8	
3															
4												2,2,4,2	4-6	2.0	
5															
6												2,2,10,12	6-8	2.0	
7		CLAYEY	SAND	DARK GREY	2.5Y 4/1	VF	P	S		SC	SDCL				PIT (NATIVE SOIL) AT 7 FT. FUEL ODOR STAINED BLACK
8												12,50+	8-9	1.0	
9															TD = 10.0 FT.

F3718

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 2
FOUR SITES (HOLL_4S)	BH-27-03	LEM	RADIAN (RAD)	21 FEB 93	

Depth	Graphic Log	Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Intrusive (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		CLAYEY	SILT	LT. YELLOW BRN	2.5Y 6/3			M	LOW	ML	FILL	1,2,3,2	0-2	1.9	
1															
2															
3															
4												1,1,1,1	4-6	1.0	
5															
6															
7															
8		CLAYEY	SAND	DK. GREY	2.5Y 4/1	VF	P	S		SC	SDCL	0,0,1,2	6-8	0	
9		SANDY	SILT	GREENISH GREY	5GY 6/1	VF	P	S	LOW	ML	SDSL	26,50+	8-9	1.0	CALICHE FUEL ORDER

F3719

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 2
FOUR SITES (HOLL_4S)	BH-27-03	LEM	RADIAN (RAD)	21 FEB 93	

Depth	Graphic Log	Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithcode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												18,21,19,26	10-12	2	FUEL ODOR STAINED GREY
11															
12												8,10,12,14	12-14	2	FUEL ODOR STAINED GREY
13															
14												5,9,17,22	14-16	2	FUEL ODOR STAINED GREY
															CLAY FROM 14-14.5 FT.
15		SILTY	CLAY	LT YELLOW BRN	10YR 6/4			S	HIGH	CH	STCL				UNSTAINED
		SANDY	SILT	GREENISH GREY	5GY 6/1	VF	P	S	LOW	ML	SDSL				
16															TD = 16 FT.
17															
18															
19															

F3719

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCOMP)	Date (LOGDATE)	Sheet 1 of 1
FOUR SITES (HOLL_4S)	BH-27-05	LEM	RADIAN (RAD)	21 FEB 93	

Depth	Graphic Log	Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		CLAYEY	SILT	LT. YELLOW BRN	10YR 6/4			M	LOW	ML	STCL	3,7,6,7	0-2	1.9	COLOR LIGHTER AT BASE OF UNIT
1															
												7,5,2,2	2-4	2	
2															
3		SANDY	SILT	LT. YELLOW BRN	10YR 6/4	VF	P	M	LOW	ML	SDSL	2,2,3,4	4-6	2	
															CALICHE
4															
5		SILTY	SAND	LT. YELLOW BRN	10YR 6/4	VF	P	S		SM	SDSL	4,4,8,10	6-8	2	
6															
7															
8															TD = 8 FT.
9															

Lithologic Description

F3720

DRILLING LOG

Project (PROJID): FOUR SITES (HOLL_4S)
Location: (LOCID): BH-35-01
Inspector: LEM
Company: (LOGCODE): RADIAN (RAD)
Date: (LOGDATE): 21 FEB 93

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SANDY	SILT	BROWN	10YR 4/3	VF	P	D		ML	SDSL	1,2,3,4	0-2	1.5	
1															
2		SILTY	SAND	PALE YELLOW	2.5Y 8/3	F	P	D		SM	SDSL	3,8,13,10	2.5-4.5	1.3	
3															
4															
5												5,5,8,11	5-7	1.5	
6		SILTY	SAND	LT. YELLOW BRN	2.5Y 6/4	VF	P	D		SM	SDSL				
7			SAND	YELLOWISH BRN	10YR 5/4	VF	P	D		SP	SD	10,14,10,20	7.5-9.5	1.9	SOME SILT
8															
9															

F3721

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 4
FOUR SITES (HOLL_4S)	BH-35-01	LEM	RADIAN (RAD)	21 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	(VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												16,20,28,36	10-12	2	
11															
12															
13															
14		SILTY	CLAY	DK. YELLOW BRN	10YR 4/5			D	HIGH	CH	STCL	5,6,10,16	15-17	2	GYPSUM CRYSTALS
15															
16															
17															
18		SANDY	SILT	DK. YELLOW BRN	10YR 4/6	VF	P	D	LOW	ML	SDSL	8,9,10,9	20-22	2	
19															

F3721

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 3 of 4
FOUR SITES (HOLL_4S)	BH-35-01	LEM	RADIAN (RAD)	21 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
21															
22															
23															
24		SILTY	CLAY	YELLOWISH BRN	10YR 5/4			M	HIGH	CH	STCL	3,3,7,5	25-27	2	
25															
26															
27															
28															
29															

F3721

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 4 of 4
FOUR SITES (HOLL_4S)	BH-35-01	LEM	RADIAN (RAD)	21 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
31		SILTY	SAND	BROWN	10YR 5/3	VF	P	S		SM	SDSL	10,13,10,9	30-32	2	IRON STAINING
32		SILTY	CLAY	YELLOWISH BRN	10YR 5/6			S	HIGH	CH	STCL				TD = 32 FT.
33															
34															
35															
36															
37															
38															
39															

F3721

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 4
FOUR SITES (HOLL_4S)	BH-35-02	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		CLAYEY	SILT	PALE YELLOW	2.5Y 8/2			M	LOW	ML	STCL	4,5,6,7	0-2	1.8	SOME SAND DRAEGER TUBE FOR CHLOROFORM = 0
1															
2															
		SILTY	SAND	PALE YELLOW	2.5Y 7/4	F	P	D		SM	SDSL	17,20,18,15	2.5-4.5	2.0	
3															
		SILTY	SAND	LT. YELLOW BRN	10YR 6/4	VF	P	D		SM	SDSL				
4															
5												13,13,17,18	5-7	1.6	
6															
7															
		SANDY	SILT	PALE YELLOW	2.5Y 7/3	F	P	D		ML	SDSL	10,16,15,20	7.5-9.5	2.0	DRAEGER TUBE FOR CHLOROFORM = 0
8															
9															
			SILT	YELLOWISH BRN	10YR 5/4			D	LOW	ML	SILT				

F3722

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 4
FOUR SITES (HOLL_4S)	BH-35-02	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												7,10,10,11	10-12	2.0	
11		SANDY	SILT	PALE BROWN	10YR 6/3	M	P	D		ML	SDSL				
12		SANDY	CLAY	YELLOWISH BRN	10YR 5/4	F	P	D	LOW	CL	SDCL				
13															
14		SANDY	CLAY	STRONG BROWN	5YR 4/6	F	P	D	LOW	CL	SDCL				GYPSUM CRYSTALS
15												8,16,20,21	15-17	2.0	
16															
17															
18															
19															

F3722

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 3 of 4
FOUR SITES (HOLL_4S)	BH-35-02	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												3,6,6,10	20-22	2.0	
21															MOIST AT 21.3 FT.
22															
23															
24															
25			SAND	V. PALE BRN	10YR 7/4	VF	P	S		SP	SD	6,5,5,5	25-27	2.0	WATER AT APPROX. 25 FT. ANGULAR CONTACT AT TOP OF SAND
26		CLAYEY	SAND	STRONG BROWN	7.5YR4/6	VF	P	S	HIGH	CH	SDCL				
27															
28															
29															

F3722

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 4 of 4
FOUR SITES (HOLL_4S)	BH-35-02	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												4,3,3,5	30-32	0.0	
31															
32															TD = 32 FT.
33															
34															
35															
36															
37															
38															
39															

F3722

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 4
FOUR SITES (HOLL_4S)	BH-35-03	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SANDY	SILT	V. PALE BRN	10YR 7/3	M	P	D		ML	SDSL	17,25,25,15	0-2	1.6	CALICHE
1															
2		SILTY	SAND	BROWN	7.5YR5/4	F	P	D		SM	SDSL	7,10,15,12	2.5-4.5	1.8	
3															
4												10,19,25,20	5-7	1,8	
5															
6															
7		SILTY	CLAY	BROWN	7.5YR5/4			D	HIGH	CH	STCL	9,16,17,22	7.5-9.5	2.0	GYPSUM CRYSTALS
8															
9															

Lithologic Description

F3723

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 4
FOUR SITES (HOLL_4S)	BH-35-03	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SILTY	SAND	YELLOWISH BRN	10YR 5/4	VF	P	D		SM	SDSL	15,17,15,20	10-12	2.0	
11		SILTY	CLAY	REDDISH BRN	5YR 4/4			M	HIGH	CH	STCL				GYPSUM CRYSTALS SMALL (.5 CM) SAND LENSES
12															
13															
14															
15												6,15,17,22	15-17	2.0	
16												6,15,17,22	15-17	2.0	
17															
18															
19															

F3723

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 3 of 4
FOUR SITES (HOLL_4S)	BH-35-03	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithcode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												11,18,16,11	20-22	2.0	
21		SILTY	SAND	DK. YELLOW BRN	10YR 4/6	VF	P	M		SM	SDSL				
22		SILTY	CLAY	REDDISH BRN	5YR 4/4			M	HIGH	CH	STCL				
23															
24		CLAYEY	SAND	DK. YELLOW BRN	10YR 4/6	VF	P	M		SC	SDCL				
25												7,10,8,9	25-27	2.0	
26															
27															
28															
29															

F3723

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 4 of 4
FOUR SITES (HOLL_4S)	BH-35-03	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithcode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
			SAND	PALE YELLOW	2.5Y 7/4	VF	P	M		SP	SD	6,7,7,5	30-32	2	
31		CLAYEY	SAND	PALE OLIVE	5Y 6/3	VF	P	S		SC	SDCL				
32															TD = 32 FT.
33															
34															
35															
36															
37															
38															
39															

F3723

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 4
FOUR SITES (HOLL_4S)	BH-58-01	LEM	RADIAN (RAD)	16 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SILTY	SAND	PURPLE		VF	P	D		SM	SDSL	12,27,29,24	0-2	2.0	STAINED,- REPELS WATER
1															
2		SILTY	SAND	LT. YELLOW BRN	10YR 6/4	VF	P	D		SM	SDSL	11,18,16,16	2.5-4.5	2.0	STAINING ENDS BETWEEN 2 AND 2.5 FT.
3															
4															
5												14,16,27,22	5-7	2.0	
6		SILTY	SAND	BROWN	7.5YR5/4	VF	P	D		SM	SDSL				
7			SILT	LT. GREY	10YR 7/2			D	LOW	ML	SILT	13,26,30,40	7.5-9.5	2.0	
8															
9															

F3724

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 4
FOUR SITES (HOLL_4S)	BH-58-01	LEM	RADIAN (RAD)	16 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												13,23,20,40	10-12	2.0	
11															
12															
13															
14															
15															
16											NDPS	26, 50+	15-17	0.0	NO RECOVERY
17		CLAYEY	SAND	LT. RED BRN	5YR 6/4	F	P	D	LOW	SC	SDCL	20,20,27,48	20-22	2.0	
18															
19															

F3724

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 3 of 4
FOUR SITES (HOLL_4S)	BH-58-01	LEM	RADIAN (RAD)	16 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
21															
22															
23															
24		SANDY	SILT	V. PALE BRN	10YR 8/2	VF	P	D	LOW	ML	SDSL	16,40,50+	25-26.5	1	
25															
26															
27															
28															WATER AT 28 FT.
29			SAND	PALE BRN	10YR 6/3	F	P	S		SP	SD				

F3724

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 4 of 4
FOUR SITES (HOLL_4S)	BH-58-01	LEM	RADIAN (RAD)	16 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	(VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												33,30,37,24	30-32	2	
31															
32															TD = 32 FT.
33															
34															
35															
36															
37															
38															
39															

F3724

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 3
FOUR SITES (HOLL_4S)	BH-58-02	LEM	RADIAN (RAD)	17 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SILTY	SAND	REDDISH BRN	5YR 5/4	VF	P	D		SM	SDSL	2,9,18,35	0-2	1.5	REPELS WATER
1															
2												12,12,12,4	2.5-4.5	2.0	
3															
4															
5			SAND	BROWN	7.5YR5/4	F	P	D		SP	SD	4,6,9,14	5-7	2.0	
6			SAND	REDDISH BROWN	7.5YR7/6	VF	P	D		SP	SD				
7															
8		CLAYEY	SILT	V. PALE BRN	10YR 7/3			D	LOW	ML	STCL	12,17,22,18	7.5-9.5	2.0	
9															

F3725

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 3
FOUR SITES (HOLL_4S)	BH-58-02	LEM	RADIAN (RAD)	17 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												9,10,15,22	10-12	2.0	ABUNDANT MOTTLING AND GYPSUM CRYSTALS FROM 10 TO 15 FT.
11															
12															
13															
14															
15		SILTY	SAND	BRN	7.5YR5/4	VF	P	D		SM	SD	7,10,11,22	15-17	2.0	
16															
17															
18															
19															

F3725

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 3 of 3
FOUR SITES (HOLL_4S)	BH-58-02	LEM	RADIAN (RAD)	17 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithcode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
21			SAND	V. PALE BRN	10YR 8/3	VF	P	D		SP	SD	13,37,32,50	20-22	2	
22															
23															
24															
25												50+	25-25.5	0.5	
26															
27															
28		SILTY	CLAY	LT. YELLOW BRN	2.5Y 6/4			S	LOW	CL	STCL	8,10,19,50+	27-29	2	WATER AT 28 FT. RUSTY STYAINING
29		CLAYEY	SILT	BROWN	7.5YR5/4			S	LOW	ML	STCL				TD = 29 FT.

F3725

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 4
FOUR SITES (HOLL_4S)	BH-58-03	LEM	RADIAN (RAD)	17 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
1, 2		SANDY	SILT	YELLOWISH BRN	10YR 5/4	VF	P	M		ML	SDSL	2,4,10,18	0-2	2.0	DAMP
3, 4, 5, 6, 7		SILTY	SAND	V. PALE BRN	10YR 7/4	F	P	M		SM	SDSL	10,8,11,13	2.5-4.5	2.0	DAMP
												15,30,22,13	5-7	2.0	
8, 9		CLAYEY	SILT	PALE YELLOW	2.5Y 8/3			M	LOW	ML	STCL	17,27,37,34	7.5-9.5	2.0	SOME SAND

F3726

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 4
FOUR SITES (HOLL_4S)	BH-58-03	LEM	RADIAN (RAD)	17 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
11															SOME SAND. ABUNDANT MOTTLING AND GYPSUM
12															
13															
14			SAND	PALE YELLOW	2.5Y 8/2	VF	P	D		SP	SD	50+	15-15.5	0.5	
15															
16															
17															
18															
19		CLAYEY	SAND	LT. YELLOW BRN	10YR 6/4	VF	P	D		SC	SDCL	18,39,50+	20-21.5	1.0	

F3726

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 3 of 4
FOUR SITES (HOLL_4S)	BH-58-03	LEM	RADIAN (RAD)	17 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	Lithocode (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
21															
22															
23															
24															
25															
											NDPS	30,50+	25-26	0.0	NO RECOVERY
26			SAND	BROWN	10YR 4/3	F	P	S		SP	SD				
27															
28															
29															

F3726

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 4 of 4
FOUR SITES (HOLL_4S)	BH-58-03	LEM	RADIAN (RAD)	17 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	(VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												5,14,30,24	30–32	1.0	
31															
32															TD = 32. FT.
33															
34															
35															
36															
37															
38															
39															

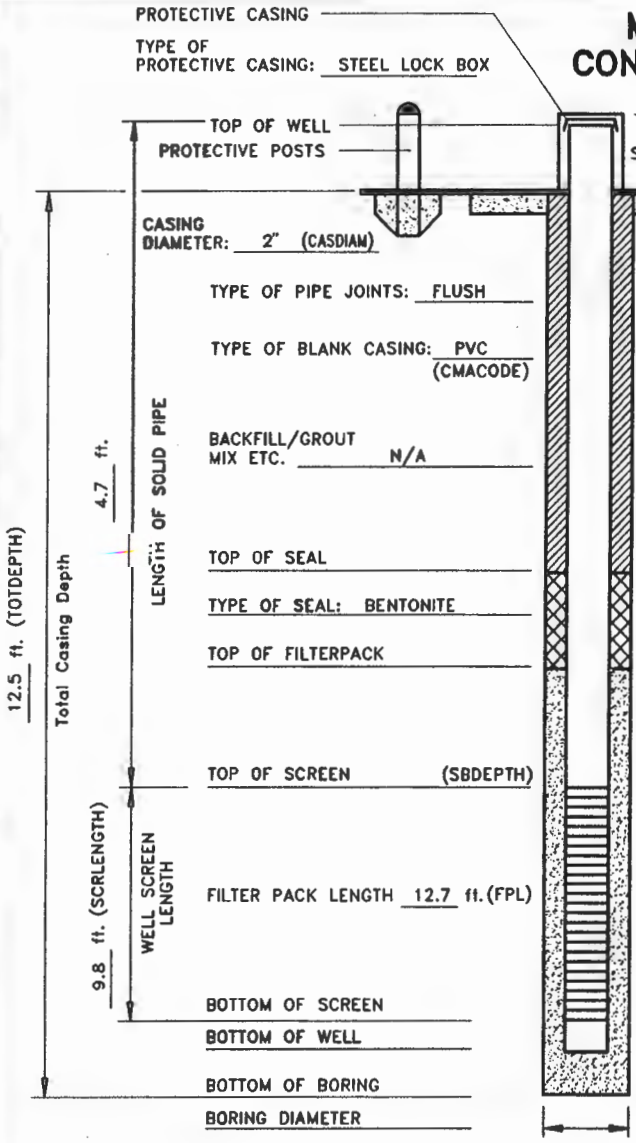
F3726

B.2

Well Construction Diagrams

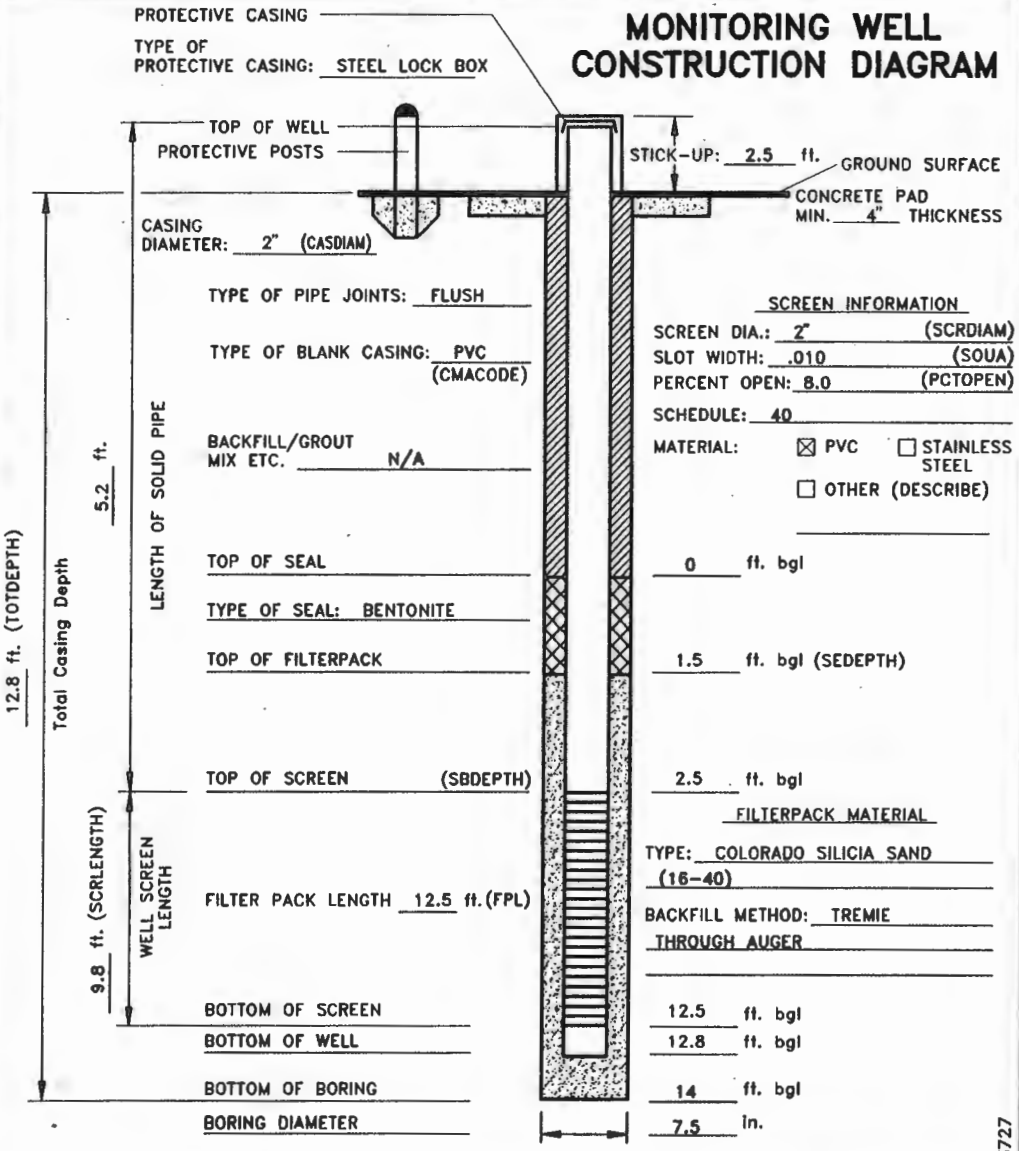
Project (PROJID) HOLLOMAN FOUR SITES (HOLL_4S)	Well I.D. (LOCID) WL-12-01
Well Owner (VVL WELCODE) USAF	Well Type (WL WTCODE) MONITOR WELL (MNW)
Installer LEM	Date Started (INSDATE) 18 FEB 93 / Date Completed 18 FEB 93
Location Coordinates: (NCORD) (North) 667903.12	(ECORD) (East) 556211.81
Elevation Top of Casing (MPELV) 4066.39 FT.	Completion Method (VVL WCMCODE) GRAVEL PACK W/ SCREEN (GS)
Sole Source Aquifer Code (VVL SAQCODE) N/A	
Drilling Method HOLLOW STEM AUGER	Completion Zone (VVL GZCODE) WATER TABLE AQUIFER (W)
Remarks (REMARKS)	

MONITORING WELL CONSTRUCTION DIAGRAM



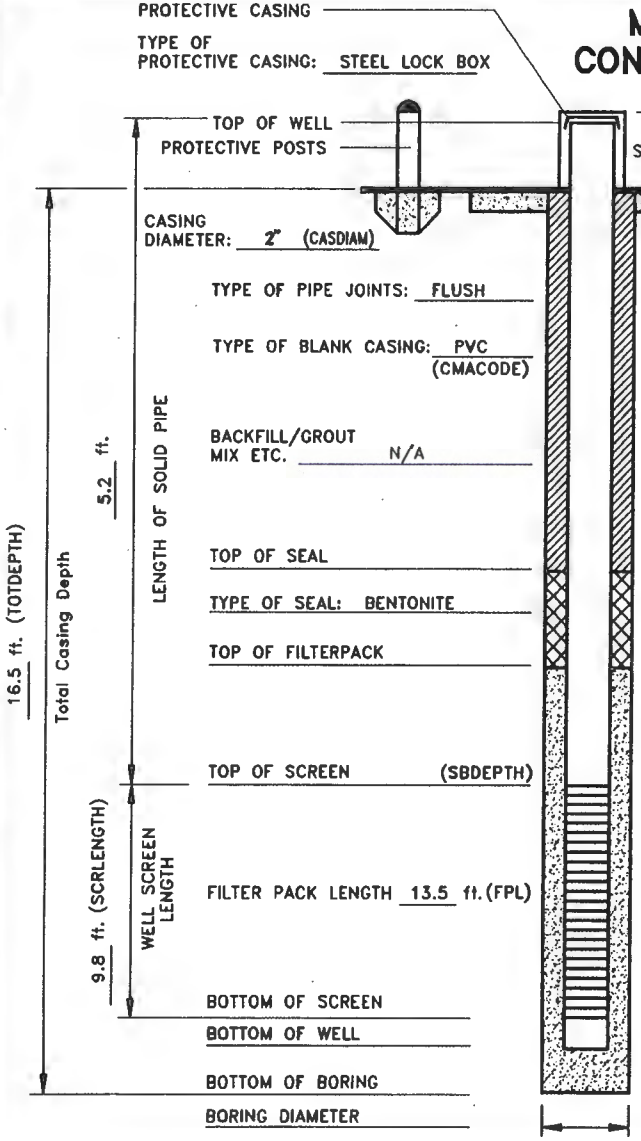
Project (PROJID) HOLLOMAN FOUR SITES (HOLL_4S)	Well I.D. (LOCID) WL-12-02
Well Owner (VVL WELCODE) USAF	Well Type (WL WTCODE) MONITOR WELL (MNW)
Installer LEM	Date Started (INSDATE) 20 FEB 93 / Date Completed 20 FEB 93
Location Coordinates: (NCORD) (North) 667768.80	(ECORD) (East) 556217.94
Elevation Top of Casing (MPELV) 4068.06 FT.	Completion Method (VVL WCMCODE) GRAVEL PACK W/ SCREEN (GS)
Sole Source Aquifer Code (VVL SAQCODE) N/A	
Drilling Method HOLLOW STEM AUGER	Completion Zone (VVL GZCODE) WATER TABLE AQUIFER (W)
Remarks (REMARKS)	

MONITORING WELL CONSTRUCTION DIAGRAM



Project (PROJID) HOLLOMAN FOUR SITES (HOLL_4S)	Well I.D. (LOCID) WL-12-03
Well Owner (VVL WELCODE) USAF	Well Type (WL WTCODE) MONITOR WELL (MNW)
Installer LEM	Date Started (INSDATE) 19 FEB 93 — Date Completed 19 FEB 93
Location Coordinates: (NCORD) (North) 667716.05	(ECORD) (East) 555883.96
Elevation Top of Casing (MPELV) 4069.85 FT.	Completion Method (VVL WCMCODE) GRAVEL PACK W/ SCREEN (GS)
Sole Source Aquifer Code (VVL SAQCODE) N/A	
Drilling Method HOLLOW STEM AUGER	Completion Zone (VVL GZCODE) WATER TABLE AQUIFER (W)
Remarks (REMARKS)	

MONITORING WELL CONSTRUCTION DIAGRAM



B.3

Well Development Logs and Photos

WELL DEVELOPMENT LOG

SHEET 1 OF 1

PROJECT (PROJ. ID)	WELL ID (LOCID)	(LOGDATE)	(LOGTIME)
HOLLOMAN LAKES AND LAGOONS (HOLL_LL)	WL-12-01	3-2-93	10:00

PERFORMED BY (LOGCODE)	DEVELOPMENT METHOD	SURGE TECHNIQUE
RAD	Purge Pump	Purge Pump

WATER LEVEL (STATDEP)	TOTAL DEPTH (SOUNDING)	LOWEST WATER LEVEL DURING DEVELOPMENT (PUMPDEP)
INITIAL 3.62' FINAL 4.0'	INITIAL 15.32' FINAL 15.40'	

TOTAL VOL. REMOVED 220 GALLONS – TIME ELAPSED 6.83 HRS = PRODUCTION RATE (PRODRATE) 32.21 gph

PRODUCTION RATE (PRODRATE)
RECOVERY DEPTH (DEPWAT) N/A
RECOVERY TIME (RECTIME) N/A

Time	Cum. Volume (gal)	Water Quality Temp.	pH	Cond.	Turb.	Comments
11:10	14.94	15.6°C	7.26	13.74	284.2	water is turbid
11:30	19.92	16.3	7.39	14.36	7000	Discharge is .5 gpm
12:00	29.88	15.7	7.37	14.01	980	Discharge - 0.5 gpm
12:30	44.82	16.3	7.40	14.20	880	Discharge - 0.4 gpm
13:00	69.94	15.7	7.45	15.20	8000	Discharge - 1.3 gpm
14:10		Pump OFF				
14:30	85.71	15.4	7.44	15.02	1200	Discharge - 1.2 gpm
15:00	99.82	15.7	7.37	15.10	274	Discharge - 0.44 gpm
15:30	124.94	15.7	7.32	18.80	360	Discharge - 1.33 gpm
16:04	146.52	15.4	7.41	15.43	70	Discharge -0.625 gpm
17:00	160.0	15.5	7.38	15.06	70	Discharge - 0.33 gpm
18:00	220.0	14.8	7.30	16.60	372	Discharge - 1.4 gpm
Field Measurements:						Time

Remarks (Remarks) °C mV/cm

Total Volume Removed _____ gallons

Time for Removal _____ hrs/min

D1872B

WELL DEVELOPMENT LOG

SHEET 1 OF 1

PROJECT (PROJ_ID)	WELL ID (LOCID)	(LOGDATE)	(LOGTIME)
HOLLOMAN LAKES AND LAGOONS (HOLL_LL)	WL-12-02	3-2-93	1150

PERFORMED BY (LOGCODE)	DEVELOPMENT METHOD	SURGE TECHNIQUE
RAD	Purge Pump	Purge Pump

WATER LEVEL (STATDEP)	TOTAL DEPTH (SOUNDING)	LOWEST WATER LEVEL DURING DEVELOPMENT (PUMPDEP)
INITIAL 5.41 FINAL 5.52	INITIAL 15.1 FINAL 15.12	8.8

TOTAL VOL. REMOVED 165 GALLONS – TIME ELAPSED 3.5 HRS = PRODUCTION RATE (PRODRATE) 47

PRODUCTION RATE (PRODRATE)
RECOVERY DEPTH (DEPWAT) N/A
RECOVERY TIME (RECTIME) N/A

Time	Cum. Volume (gal)	Water Quality				Comments
		Temp.	pH	Cond.	Turb.	
1400	19.5	17.9	7.24	7660	>8000	Pump rate = 0.5 GPM
1425	30		7.23	7380	>8000	.55 GPM
1450	41.5		7.28	7600	2880	
1520	60		7.31	7500	436	.6 GPM
1540	68.5		7.35	7320	1224	Pump @ bottom; still sediment
1605	82		7.31	7970	576	1.1 GPM; pump @ bottom
1645	100		7.25	8100		1.2 GPM; less sediment after surging
1705	123.5		7.23	8130	328	1.44 GPM; v. little sediment
1720	145		7.32	8170		1.5 GPM; surged @ upper portion of screen
1740	165		7.28	8140	212	1.2 GPM; trace sediment
Field Measurements:						Time

Remarks (Remarks)
Total Volume Removed 165 gallons

Time for Removal 3 hr 40 min hrs/min

D1872B

WELL DEVELOPMENT LOG

SHEET ____ OF ____

PROJECT (PROJ. ID)	WELL ID (LOCID)	(LOGDATE)	(LOGTIME)
HOLLOMAN LAKES AND LAGOONS (HOLL_LL)	WL-12-03	3-4-93	0930

PERFORMED BY (LOGCODE)	DEVELOPMENT METHOD	SURGE TECHNIQUE
RAD	Purge Pump	Purge Pump

WATER LEVEL (STATDEP)	TOTAL DEPTH (SOUNDING)	LOWEST WATER LEVEL DURING DEVELOPMENT (PUMPDEP)
INITIAL 7.82 FINAL 8.05	INITIAL 15.6 FINAL 15.6	

TOTAL VOL. REMOVED 141 GALLONS - TIME ELAPSED 4.75 HRS = PRODUCTION RATE (PRODRATE) 30

PRODUCTION RATE (PRODRATE)
RECOVERY DEPTH (DEPWAT) N/A
RECOVERY TIME (RECTIME) N/A

Time	Cum. Volume (gal)	Water Quality				Comments
		Temp.	pH	Cond.	Turb.	
0955	15	17.9	6.71	2850	346	0.48 GPM Lt. Brown color.
1015	23	18.0	6.66	2880		Pump @ bottom; sediment in water
1040	37	17.8	6.64	2870	354	0.66 GPM
1102	47	18.3	6.63	2920		0.65 GPM; Pump @ bottom; water clears up quickly after surging.
1125	60	17.9	6.65	2860	49	Water very clear; increased pump rate
1150	70	18.6	6.62	2920		1.0 GPM
1205	80	18.6	6.63	2920	274	0.64 GPM; pump @ bottom
1230	88	18.7	6.63	2940		0.6 GPM; trying to develop upper portion
1240	105	18.8	6.63	2930	46	0.8 GPM; pump @ bottom
1330	123	18.8	6.65	2960	380	0.3 GPM; pump 2 ft. above bottom
1400	129	18.7	6.66	2940		0.4 GPM; not very turbid
1415	141	18.9	6.67	2920	320	1.2 GPM; lt. brown/tan color after vigorous surging
Field Measurements:						Time

Remarks (Remarks)
Total Volume Removed 141 gallons

Time for Removal 4 hr. 20 min hrs/min

D1872B

WL-12-01

BEFORE AFTER

WL-12-02

BEFORE AFTER

WL-12-03

BEFORE AFTER

B.4

Groundwater Sampling Logs

TITLE: IRP Groundwater Sampling Log

PROJECT Holloman AFB Four Sites investigation **DATE** 18 March 93

SUBJECT **SHEET** 1 **OF** 1 **SHEETS**

INSTALLATION ID (AFID)	WELL ID (LOCID)	(LOGDATE)	(LOGTIME)
HOLMN	WL-12-03	18 March 93	1200

PERFORMED BY (LOGCODE)	WATER LEVEL (STATDEP) INITIAL / FINAL	TOTAL DEPTH (SOUNDING) INITIAL / FINAL
RAD	6.74 / 6.86	15.66 / 15.66

SATURATED THICKNESS	WELL VOLUME	AMOUNT TO PURGE
8.92	1.4	7.1

PURGE METHOD:
Teflon Bailer

Time (LOGTIME)	Cum. Volume (gal)	Water Quality: Temp	pH	Cond.	Turb.	Water Level	Comments
1230	2	65°F	6.77	3290			cloudy - grey
1235	4	65°F	6.79	3200			" "
1239	6	65°F	6.84	3230			" "
1244	8	65°F	6.82	3140			" "
1321	10	66°F	6.84	3200	1560 NTU		FINAL MEASUREMENTS
Final Measurements:							

SAMPLING METHOD (SMCODE)

Sample ID	(MATRIX)	Preservative	Analysis	Sample Type Code (SACode)	Comments
~~93~~ WL-12-03-01	L/WG	pH<2 w/ HCl cool 4°C	SW8015MP SW8015ME	N ↓	MKD Dup. & MS/MSD
WL-12-03-02	L/WG	pH<2 w HCl cool 4°C	SW8015MP SW8015ME	FD ↓	
WL-12-03-03	L/WG	pH<2 w/ HCl cool 4°C	SW8015MP SW8015ME	EB ↓	

TITLE: IRP Groundwater Sampling Log

PROJECT Investigation of Four Waste Sites

SUBJECT

DATE 18 March 1993

SHEET 1 OF 1 SHEETS

INSTALLATION ID (AFID)	WELL ID (LOCID)	(LOGDATE)	(LOGTIME)
HOLMN	~~MW~~ WL-12-02	18Mar93	1050

PERFORMED BY (LOGCODE)	WATER LEVEL (STATDEP) INITIAL / FINAL	TOTAL DEPTH (SOUNDING) INITIAL / FINAL
RAD	5.5 / 5.54	15.12 / 15.12

SATURATED THICKNESS	WELL VOLUME	AMOUNT TO PURGE
9.62	1.5 gallons	7.7 gallons

PURGE METHOD: Teflon Bailer

Time (LOGTIME)	Cum. Volume (gal)	Water Quality Temp	pH	Cond.	Turb.	Water Level	Comments
1100	2	64°F	7.41	7180			V. turbid. Dark grey/brown
1105	4	62°F	7.27	7420			↓
1108	6	60.5°F	7.47	6990			
1111	8	60.5°F	7.35	7110			↓
1120		61.0°F	7.41	7140	3240 NTU		FINAL sample taken for turbidity
Final Measurements:							

SAMPLING METHOD (SMCODE)

Sample ID	(MATRIX)	Preservative	Analysis	Sample Type Code (SACode)	Comments
WL-12-02-01	L/WG	pH<2 w/ HCl	SW 8015 MP SW 8015 ME	N ↓	

TITLE: IRP Groundwater Sampling Log

PROJECT Investigation of Four Waste Sites

DATE 18 March 1993

SUBJECT

SHEET 1 **OF** 1 **SHEETS**

INSTALLATION ID (AFID)	WELL ID (LOCID)	(LOGDATE)	(LOGTIME)
HOLMN	~~MW~~ WL-12-01	18Mar 93	9:30

PERFORMED BY (LOGCODE)	WATER LEVEL (STATDEP)	TOTAL DEPTH (SOUNDING)
RAD	INITIAL 3.74 FINAL 3.80	INITIAL 15.44 FINAL 15.44
SATURATED THICKNESS	**WELL VOLUME**	**AMOUNT TO PURGE**
11.7	1.9 Gallons	9.5 Gallons

PURGE METHOD: Teflon Bailer

Time (LOGTIME)	Cum. Volume (gal)	Water Quality				Water Level	Comments
		Temp	pH	Cond.	Turb.		
1008	2	64°F	7.5	15,500			cloudy - v. light brown
1013	4	63°F	7.6	15,500			" " " " "
1018	7	60°F	7.5	15,200			" light greyish brown
1023	8.5	59°F	7.5	15,000			" light brown
1027	10	60°F	7.5	14,900			" " "
1035	—	60°F	7.5	15,100	2160 NTU		FINAL - after sampling
Final Measurements:							

SAMPLING METHOD (SMCODE)

Sample ID	(MATRIX)	Preservative	Analysis	Sample Type Code (SACode)	Comments
WL-12-01-01	L/WG	pH<2 w/ HCl	SW 8015M P SW 8015M E	N ↓	

B.5

Site 12 Groundwater Gradient Calculation

File Name: Gradient.wk1
Date: 9/20/91
By: R. Harald Petrini

This spreadsheet will calculate the magnitude and direction of the hydraulic gradient for a three-point problem based on vector analysis.

The input required for the spreadsheet consists of three sets of x,y,z (well coordinates and water level elevation) in consistent units into the input block. The coordinates must be referenced such that the positive x direction is East, the postive y direction is North, and the positive z direction is vertically upward.

The spreadsheet calculates the magnitude of the gradient and its azimuth in degrees clockwise from North. Results are automatically written to the output block. For intermediate steps, refer to the gradient calculation beginning below the input-output blocks.

Ground water velocities and travel times could easily be evaluated.

Input Block		Output Block	
Well 1 =	WL-12-01	Gradient Magnitude and Direction	
x1 =	556211.80	Magnitude =	1.8306E-03 length/length
y1 =	667903.10	Direction =	103.92 degrees CW
z1 =	4062.65		from North
Well 2 =	WL-12-02		
x2 =	556217.90		
y2 =	667768.80		
z2 =	4062.58		
Well 3 =	WL-12-03		
x3 =	555664.00		
y3 =	667716.00		
z3 =	4063.15		

GRADIENT CALCULATION:

Create Difference Vectors A and B:

		dx1	dy1	dz1	
A =	<	-6.10E+00	1.34E+02	7.00E-02	>
		dx2	dy2	dz2	
B =	<	3.28E+02	1.87E+02	-5.00E-01	>

Calculate Normal Vector to the plain:

N =	<	-8.02E+01	1.99E+01	-4.52E+04	>

Invert if z component is negative

		nvx	nvy	nvz	
N =	<	8.02E+01	-1.99E+01	4.52E+04	>

Magnitude of Hydraulic Gradient:

Grad = 1.8306E-03

Direction of Hydraulic Gradient:

dx = 8.02E+01

dy = 1.99E+01

In the following, the value of 1.00E+6 for alpha indicates that the condition being tested is not true. If the condition is true for cases 1 or 2, the correct value of alpha is copied down to case 3.

Case 1: If nvx is equal to zero:

Alpha = 1.00E+06

Case 2: If nvx is greater than zero:

Alpha = 1.81E+00

Case 3: If nvx is less than zero:

Alpha = 1.81E+00

Conversion from Radians to degrees clockwise from North:

Angle (CW from North) = 1.04E+02

B.6

Synchronous Water Level Survey Results

Location id	TOC elev.	Easting	Northing	Ground elev.	Sample Date	GW from TOC	GW above MSL
MWD-01	4030.66	540864.7	663846.3	4028.34	MAR 1993	8.39	4022.27
MWD-02	4023.30	542460.1	658545.0	4021.37	MAR 1993	5.46	4017.84
MWD-03	4047.41	547567.4	665970.9	4045.48	MAR 1993	5.05	4042.36
MWD-04	4031.86	544323.1	661959.6	4030.19	MAR 1993	6.84	4025.02
MWD-05	4039.34	544355.8	664708.0	4036.86	MAR 1993	6.19	4033.15
MWD-06	4030.20	537661.0	659274.1	4027.98	MAR 1993	11.45	4018.75
MWP-01	4047.51	547500.0	666007.6	4045.09	MAR 1993	5.16	4042.35
MWS-01	4041.72	547227.9	664038.4	4038.99	MAR 1993	5.33	4036.39
MWS-03	4042.66	544339.4	666310.3	4040.93	MAR 1993	6.68	4035.98
MWS-04	4034.46	544926.6	662213.7	4031.49	MAR 1993	8.72	4025.74
MWS-05	4033.47	543989.3	662360.6	4031.32	MAR 1993	9.15	4024.32
MWS-06	4031.52	539431.7	663611.0	4029.44	MAR 1993	11.83	4019.69
MWS-07	4030.24	538199.2	662546.3	4028.22	MAR 1993	12.02	4018.22
MWS-08	4033.15	539393.4	660347.2	4031.02	MAR 1993	14.8	4018.35
MWS-09	4020.67	537626.8	655436.3	4018.42	MAR 1993	9.60	4011.07
MWS-10	4030.00	539545.0	657713.6	4027.85	MAR 1993	13.65	4016.35
MWS-11	4027.23	541772.1	660788.6	4025.17	MAR 1993	9.8	4017.43
MWS-12	4048.31	547576.0	665999.0	4046.01	MAR 1993	7.43	4040.88
MWS-13	4032.34	544352.9	661961.1	4030.05	MAR 1993	8.53	4023.81
MWS-14	4032.43	544338.7	661960.5	4030.20	MAR 1993	8.27	4024.16
MWS-15	4037.71	544342.9	664406.4	4034.86	MAR 1993	4.59	4033.12
MWS-16	4029.46	537775.9	659637.6	4027.46	MAR 1993	10.92	4018.54
MW-01	4053.42	548658.6	666311.5	4050.54	MAR 1993	9.95	4043.47
MW-02	4039.78	544566.9	663814.8	4037.08	MAR 1993	5.50	4034.28
MW-02&5-05	4094.35	555464.1	674168.2	4092.45	MAR 1993	14.28	4080.07
MW-03	4037.38	544469.1	662878.2	4034.71	MAR 1993	8.06	4029.32
MW-03-01	4094.18	555557.4	673929.6	4092.12	MAR 1993	13.91	4080.27
MW-04	4030.30	545215.8	660699.4	4027.65	MAR 1993	5.90	4024.4
MW-04-01	4110.71	545657.8	689476.9	4108.86	MAR 1993	40.34	4070.37
MW-04-04	4073.69	545632.8	689997.7	4071.45	MAR 1993	5.6	4068.09
MW-05	4039.30	544358.3	664831.0	4036.55	MAR 1993	5.19	4034.11
MW-06	4031.21	544970.0	661445.2	4028.45	MAR 1993	6.98	4024.23
MW-07	4039.88	544379.9	665147.6	4037.37	MAR 1993	5.74	4034.14
MW-08	4040.50	544474.4	664520.5	4037.90	MAR 1993	6.01	4034.49
MW-08-02	4088.16	554746.0	672220.7	4086.19	MAR 1993	10.38	4077.78
MW-09	4042.59	546285.9	665312.4	4040.34	MAR 1993	8.00	4034.59
MW-09-01	4085.85	554157.3	672320.6	4085.85	MAR 1993	7.98	4077.87
MW-10	4043.39	546007.9	666135.8	4040.97	MAR 1993	7.94	4035.45
MW-11	4039.71	543896.9	665207.0	4037.76	MAR 1993	7.90	4031.81
MW-12	4040.25	543686.8	664672.2	4038.36	MAR 1993	9.85	4030.4
MW-12-01	4066.39	556211.8	667903.1	4064.54	MAR 1993	3.74	4062.65
MW-12-02	4068.06	556217.9	667768.8	4066.22	MAR 1993	5.48	4062.58
MW-12-03	4070.44	555884.0	667716.0	4070.44	MAR 1993	6.70	4063.74
MW-13	4036.49	543927.9	664216.1	4035.13	MAR 1993	6.10	4030.39

Location id	TOC elev.	Easting	Northing	Ground elev.	Sample Date	GW from TOC	GW above MSL
MW-14	4034.13	543904.8	662841.7	4031.95	MAR 1993	7.70	4026.43
MW-15	4032.70	544403.8	662252.2	4030.85	MAR 1993	7.66	4025.04
MW-16	4031.84	537886.9	660473.0	4029.71	MAR 1993	13.24	4018.6
MW-16-01	4076.90	553922.9	669399.4	4074.93	MAR 1993	7.23	4069.67
MW-17	4032.17	537585.9	658079.3	4030.17	MAR 1993	14.08	4018.09
MW-18	4019.42	538105.1	656338.2	4018.60	MAR 1993	8.13	4011.29
MW-19-01	4048.74	548304.9	663965.6	4046.60	MAR 1993	7.38	4041.36
MW-21-01	4046.59	542925.4	667762.0	4044.18	MAR 1993	7.29	4039.3
MW-22-01	4038.99	540855.9	666347.3	4037.70	MAR 1993	11.58	4027.41
MW-23-01	4037.11	540402.0	666077.7	4035.79	MAR 1993	10.62	4026.49
MW-24-01	4049.39	538127.5	669683.2	4047.97	MAR 1993	14.36	4035.03
MW-24-05	4041.24	538415.0	666973.6	4040.24	MAR 1993	11.86	4029.38
MW-26-01	4062.28	543091.7	673624.0	4060.45	MAR 1993	6.56	4055.72
MW-28-01	4092.94	548805.6	676265.7	4091.19	MAR 1993	12.53	4080.41
MW-29-01	4103.37	549358.1	677999.6	4102.16	MAR 1993	24.33	4079.04
MW-30&33-01	4104.70	552710.9	676333.3	4103.31	MAR 1993	23.48	4081.22
MW-36-01	4105.03	546510.7	684691.6	4102.13	MAR 1993	31.24	4073.79
MW-36-03	4099.71	545646.3	684024.6	4097.34	MAR 1993	28.07	4071.64
MW-37-01	4077.22	537843.1	686025.1	4076.08	MAR 1993	31.53	4045.69
MW-37-03	4079.66	538441.3	687430.9	4077.62	MAR 1993	28.69	4050.97
MW-37-06	4085.29	539149.3	688953.5	4084.13	MAR 1993	35.76	4049.53
MW-BG-01	4207.73	554457.1	708995.7	4206.10	MAR 1993	36.57	4171.16
MW-BG-02	4199.28	556491.9	703541.4	4197.40	MAR 1993	43.80	4155.48
MW-BG-03	4138.28	554937.2	695648.9	4136.14	MAR 1993	11.83	4126.45
MW-BG-04	4074.51	544874.4	689873.8	4072.65	MAR 1993	4.62	4069.89

B.7

Site 58 Waste Pit Contents

Table B-1

Waste Characterization Pit Summary

Pit	Grid Location *	Dimensions	Contents
1	253 N, 407 W	8x4x5	Rusted drums, purple soil
2	297 N, 352 W	8x6x4	Aluminum drums
3	357 N, 407 W 10 ft W-NW 20 ft W-NW 30 ft W-NW 40 ft W-NW	1) 15x10x4 2) 5x3x4 3) 5x3x4 4) 10x3x5 5) 4x3x3	Aluminum drums Aluminum drums Aluminum drums Aluminum drums Native soil
4	473 N, 352 W	20x10x4	Rusted drums, yellow soil
5	259 N, 302 W 10 ft E-NE 30 ft E-NE 70 ft E-NE	1) 10x5x4 2) 5x5x4 3) 5x5x4 4) 8x3x4	Metallic debris Metallic debris Native Soil Native Soil
6	184 N, 443 W 30 ft NE	1) 6x6x4 2) 8x6x10	Native Soil Rusted drums
7	313 N, 653 W	8x5x3	Native Soil
8	378 N, 550 W	8x5x4	Native Soil
9	513 N 400 W	10x6x5	Rusted drums, burned soil
10	637 N, 508 W 20 ft NW	1) 5x5x4 2) 5x5x4	Native Soil Native Soil
11	67 N (small grid)	10x2x6	Native Soil
12	144 N (small grid)	12x2x6	Native Soil
13	265 N (small grid)	12x2x4	Native Soil
14	310 N (small grid)	10x2x6	Native Soil
15	350 N (small grid)	12x2x6	Native Soil
16	435 N, 550 W	8x8x3	Native Soil
17	0 N, 350 W	6x6x4	Native Soil
18	10 N, 450 W	10x10x3	Native Soil

Table B-1

(Continued)

Pit	Grid Location *	Dimensions	Contents
19	35 N, 200 W	6x4x8	xNative Soil
20	Mount W of De Zonia Road	8x2x6	Concrete retaining wall
21	Between Pits 1 and 6	8x3x4	Native Soil
22	W of Pit 6	10x10x6	Native Soil
23	E of Pit 6	10x2x8	Rusted drums
24	NE of Pit 6	5x2x3	Native Soil
25	NE of Pit 6	5x2x3	Corrugated pipe
26	E of Pit 1	4x3x3	Rusted drums
27	E of Pit 1	5x3x4	Native Soil
28	W of Pit 1	5x4x4	Native Soil
29	Between Pits 2 and 3	5x2x3	Aluminum drums
30	Betweenn Pits 4 and 9	8x4x4	Metallic debris, pink soil
31	NW of Pit 9 NW of Pit 9	1) 8x2x5 2) 4x2x3	Metallic debris Native Soil
32	E of Pit 4	8x8x4	Metallic debris, green soil
33	Mound W of De Zonia Road	80x2x5	Clean Fill

* Large grid over entire site

B.8

Surveying Data

WESTERN LANDS SURVEYING 00000

JOB NAME.....RADIAN FILE..RADIAN00

08 1993 TIME 15:06:45

POINTS.....COORDINATES...N/E/EL/DESCR.----------210

#	NORTH	EAST	ELEVATION	DESCRIPTION
1	686015.974000	544105.322000	4097.47	HCP1 NE COR
2	685267.137000	544134.992000	4095.38	HCP2 SE COR
3	685266.906935	544133.978236	0.00	
4	0.000000	0.000000	0.00	
5	685413.412837	544029.210427	0.00	PT 1 NAIL
6	685359.924412	544005.496133	4095.00	57-2 PT2
7	685352.853115	543977.609161	4094.96	57-3 PT3
8	685442.525544	544014.212348	4095.47	57-1 PT4
9	685627.245984	543961.156882	4095.24	PT5
10	685634.209903	543966.120150	4095.82	GRPT6 NW
11	685635.809657	543936.265587	4095.58	GRPT7 SW
12	686003.497749	543985.693677	4097.30	GRPT8 NE
13	686005.037688	543955.103988	4097.24	GRPT9 SE
14	685990.633012	544100.536982	0.00	MISC 10BH
15	685966.388963	544089.469112	0.00	MISC11BH
[illegible]	686004.685182	544100.475716	0.00	MISC12BH
17	686004.720675	544100.357258	0.00	MISC13BH
18	688460.271000	550428.167000	4127.35	HCP3 35-1
19	687914.804000	551686.584000	4135.62	HCP4 CP
20	687912.715836	551685.906576	0.00	
21	688858.563237	550691.609539	4127.08	BH3504
22	688460.655083	550428.016727	4126.88	BH3501
23	687729.970357	550285.341855	4122.00	BH3502
24	686685.295271	550461.616155	4118.25	BH3503
25	668336.803000	556168.675000	4066.40	HCP5 IR
26	667737.410000	556145.300000	4067.08	HCP6 IR
27	667768.802229	556217.936663	4068.06	WL1202CA
28	667903.120324	556211.811369	4064.54	WL1201GR
29	667903.120324	556211.811369	4066.39	WL1201CAS
30	667846.277138	556208.853676	4064.60	BH1204
31	667768.802229	556217.936663	4066.22	WL1202GR
32	667788.795171	556236.224572	4064.86	BH1205CAS
33	667709.933299	555952.487945	4070.63	BH1206B
34	667714.449126	555948.162639	4070.55	BH1206A
35	667712.332106	555885.176052	4070.14	BH1203
36	667716.047543	555883.961657	4070.44	WL1203 CAS
[illegible]	673873.625000	544272.337000	4066.57	HCP7 IR
[illegible]	673713.211000	543753.767000	4064.83	HCP8 BH2701
39	673553.224037	543730.880341	4061.43	BH2703
40	673564.616122	543728.778523	4062.63	BH2702
41	667716.047543	555883.961657	4069.85	WL1203CA

42	673581.855948	543643.092619	4063.92	BH2704
43	674369.538599	544117.602806	4066.99	BH2706

APPENDIX C

PA References

C.1 Telephone conversation log with Mr. Marvin Weber, former project officer for the unconventional fuels program, 22 and 28 October 1992.

C.2 Laura Maley's field notes. Radian Corporation. pp. 1, 4, 13, 14, and 15.

C.3 Telephone conversation log with Mr. Craig Sovka, Northeast Research Institute, Inc. (passive soil gas subcontractor), 3 December 1992.

C.4 U.S. Geological Survey. 7.5-Minute Topographical Quadrangle Maps of New Mexico: Holloman, 1982; Garton Lake, 1982; Malone Draw, 1982; Lost River, 1982.

C.5 Flood Plain Maps--reference verbage pending.

C.6 Telephone conversation log with Mr. R. Wilkson, Holloman AFB, 1 April 1992.

C.7 U.S. Geological Survey. Data from the groundwater site inventory, 1992.

C.8 Cost Analysis. *Economic Resource Impact Statement.* Holloman Air Force Base, New Mexico, 1991. p.7.

C.9 Interview with Mr. R.E. Jennings, Radian Corporation, 2 April 1992.

C.10 New Mexico Department of Game and Fish. *Handbook of Species Endangered in New Mexico*, 1988. pp. C-176-1 and 2.1.

C.1

Telephone conversation log with Mr. Marvin Weber, former project officer for the unconventional fuels program, 22 and 28 October 1992.

RADIAN CORPORATION

TELEPHONE CALL RECORD
☐ Incoming Call
☒ Outgoing Call

Project No. 269-069-23-02	Distribution LEM File
Project Name Holloman AFB - 4 Sites	
Date 20 Oct 92	Time 15:30
Person Calling Laura Maley	Activity Radian Corp.
Person Called Marvin Weber (505) 437-1255	Activity former test track employee - Holloman Air Force Base
General Subject LF-57 Incinerator/Landfill Site	

TOPICS DISCUSSED AND ACTION TAKEN

I asked Mr. Weber if he knew anything about the Incinerator/Landfill west of the former unconventional fuels storage area (site 36). He said he knew of the incinerator and had been there during its years of operation, but did not know anything about the landfill. He said that the incinerator had been used during the 1950's to dispose of furfuryl alcohol - a fuel for a sounding rocket made by Aerojet General. He said that the fuel was transported to the launch site in drums or tank trailers; and that the drums and tank trailers were also used to transport the waste fuel to the incinerator. He said tank trailers were usually used because they had a pump that could be used to transfer the waste fuel into the incinerator. He said we'd be lucky to find anything at the site. He said that Walt Andre had worked w/ unconventional fuels before he had and probably wouldn't know much about this site.

Signature: Laura E. Maley

9-85-21364

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call

☒ Outgoing Call 437-1255

Project No. 269-069-23-02	Distribution LEM File
Project Name Holloman AFB 4 Sites	
Date 28 Oct 92	Time 1530
Person Calling Laura Maley	Activity Radian
Person Called Marvin Weber	Activity Former Project Officer for Unconventional Fuels Progr
General Subject LF57	

TOPICS DISCUSSED AND ACTION TAKEN

Talked to Marvin Weber again about the LF-57 Incinerator. He said the Aerobee sounding rocket was made by Aeroject General of California. It used a mixture of 65% furfuryl alcohol and 35% aniline as fuel - sometimes adding a small amount of the reverse mixture (65% aniline and 35% furfuryl alcohol). Xylidine was used occasionally as an experimental replacement for aniline. He said very little fuel would have been spilled when transferring it to the incinerator - maybe a pint - about as much as would spill when pumping fuel into a car. He doubted that any residue would be left following incineration. To ignite the fuel, kerosine (or a similar substance) was used to start a flame and when it got going a valve was opened to allow the fuel to be incinerated.

Signature: Laura E. Maley

9-85-21364

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call

☒ Outgoing Call 437-1255

Project No. 2169-069-23-02	Distribution LEM
Project Name Holloman AFB 4 Sites	
Date 28 Oct 92	Time 1530
Person Calling Laura Maley	Activity Radian
Person Called Marvin Weber	Activity Former Project Officer for Unconventional Fuels Program
General Subject LE57.	

TOPICS DISCUSSED AND ACTION TAKEN

The period of operation of the incinerator was approximately 1955 to 1960. He thinks that the debris around the incinerator is probably from the same period. They used stainless steel and other special metals in the fuels program. He doesn't know of burial of other chemicals in the area but wouldn't be surprized if that had occurred. He was interested in what we had found at the acid trailer burial site.

Signature: Laura E. Maley

9-85-21364

C.2

Laura Maley's field notes. Radian Corporation. pp. 1, 4, 13, 14, and 15.

m Page No. 20 October 92

1445 Tried to call Capt. Sprester at (714) 655-3952. He is no longer there. He has been transfered to Kadena AFB in Japan. (see contact report)

1500 Contacted Pete Carbajal - personnel at POL Storage Area - about SS-12 - the Fuel Line Spill Site. He said he knew of two spills - one caused by a bulldozer hitting the Standard Transpipe Corp. Pipeline, and another discovered when the pipeline contractor tested the line and discovered a small leak. He knows where one of the spills was, and could probably find the other one. The contact at Standard Transpipe is Jim Wilson. Mr. Carbajal will be available next week to make a site visit. (see contact report)

1515 Called Ron Schotter - he wasn't in, but may be in after 4:00 (5:00 here).

1530 Called Marvin Weber - a former test track employee - to talk about LF-57 - the Incinerator/Landfill. He said he knew of the incinerator and had been there during its period of operation, but did not know of the landfill. He said it had been used during the 1950's to dispose of furfuryl alcohol - a fuel for a sounding rocket made by Aerojet General. He said the fuel was transported to the incinerator in drums or tank trailers, usually in tank trailers because they had a pump that could be used to transfer the fuel to the incinerator. I mentioned Walt Andre, and he said that he (Walt) had been there even earlier and probably wouldn't know much about this site. (see contact report).

1700 Tried to call Ron Schotter - not in - will try tomorrow.

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
[illegible]	20 Oct 92		

From Page No. ~~Signs~~ Old warning signs at site 57 say the following (see photo)
(signs have fallen down and are difficult to read)

Aniline, Xylidine
Furfuryl Alcohol
DANGER!
Causes poisoning
Vapor extremely poisonous
Do NOT breathe vapor
Avoid splashing
Spillage may cause fire
or liberate dangerous fumes
~~#~~ in case of contact immediately
(ILLEGIBLE)
water. Remove clothing
Get medical attention

Some stainless steel debris can be found in the ~~#~~ brush near the incinerator - it looks like new - maybe evidence of use of corrosives.

There are some mounds and trenches (disturbed soils) north of the incinerator - they were probably used in film burning (disposal of top secret films etc.) and possibly burial of experimental chemicals - judging from what we found down the road at Site 4.

Photos of debris, broken glass bottles, incinerator, and glassy material - presumably scraped from inside of incinerator

Little ash should have been produced in the ~~C~~ burning of the experimental fuels - so any ash in the landfill would probably be associated with film burning.

Witnessed & Understood by me, | Date | Invented by | Date

m Page No. 29Oct92

Site 35 from main gate

Continue down First St until it dead ends at Delaware
Turn right on Delaware
Stay to the left ~~and get onto~~ and continue on Perimeter road which turns into Sabre Road.
After the forced left turn onto Douglas take the first paved right turn onto Vandegrift. Take the first right turn - leading to the PRL.

Site 57 from main gate
- First street until it ends at Delaware
- Right on Delaware
- Keep left and get on Perimeter Road
- Turns into Sabre Road
- Forced left at Douglas
- Second paved right at DeFonia Rd.
- approx. 0.5 mile
- left on dirt road - incinerator visible

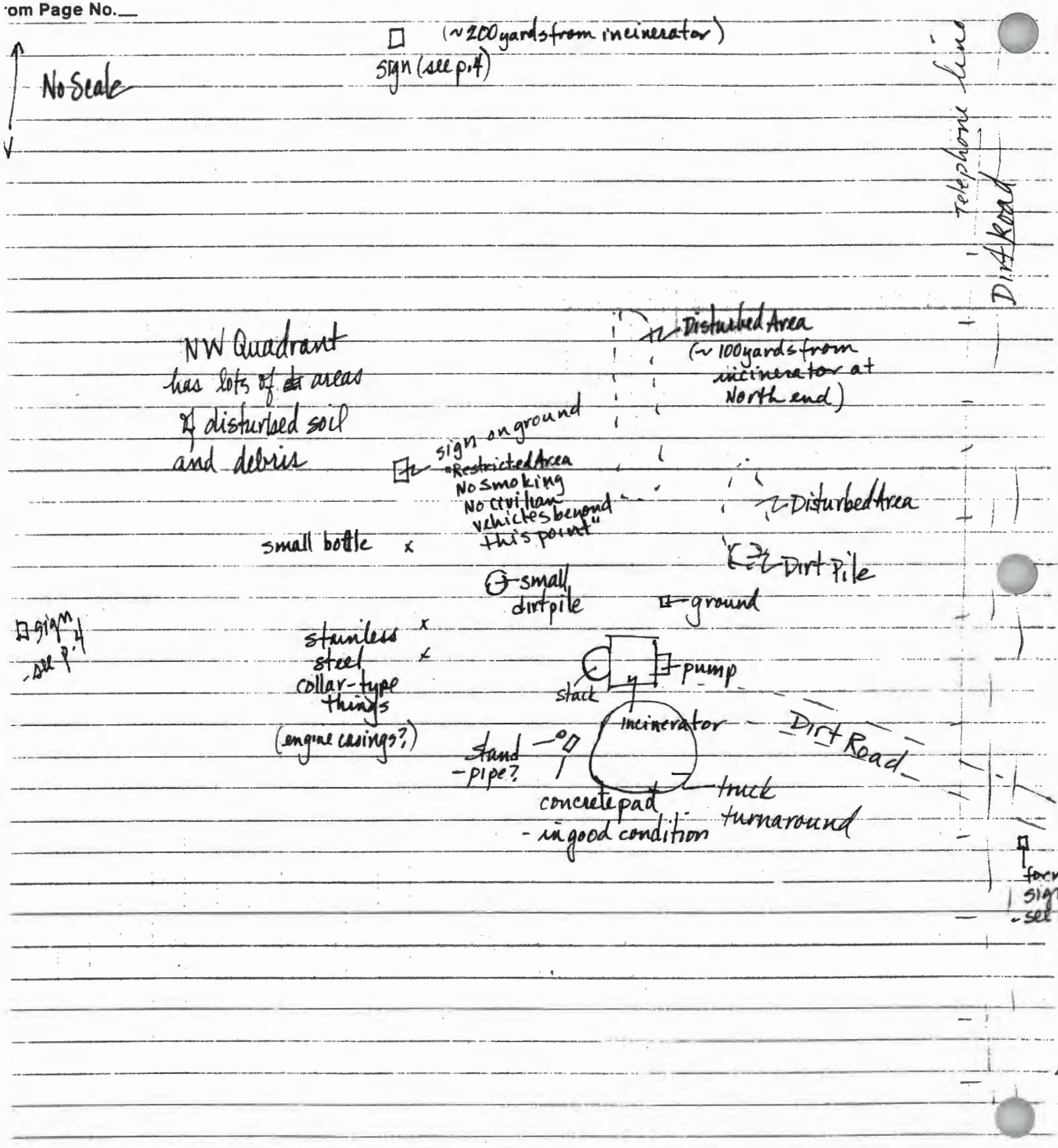
Walk around Site 57 - See site map next page

- Main truck turnaround is adjacent to incinerator to the south

- Not exactly sure where landfill is
  - two areas of disturbed soil N of incinerator - look sort of like they were trenched or something
  - random disturbed soil in quadrant NW of incinerator also stainless steel equipment, a sign, and a single small bottle.
  - small standpipe (or something) and ~~[illegible]~~ concrete pad in good condition south-southwest of incinerator.
  - area south of incinerator is relatively undisturbed.

Witnessed & Understood by me,	Date	Invented by	Date

From Page No.



To Page No.

Witnessed & Understood by me.	Date	Invented by	Date

TITLE

Project No.

Book No. 27882

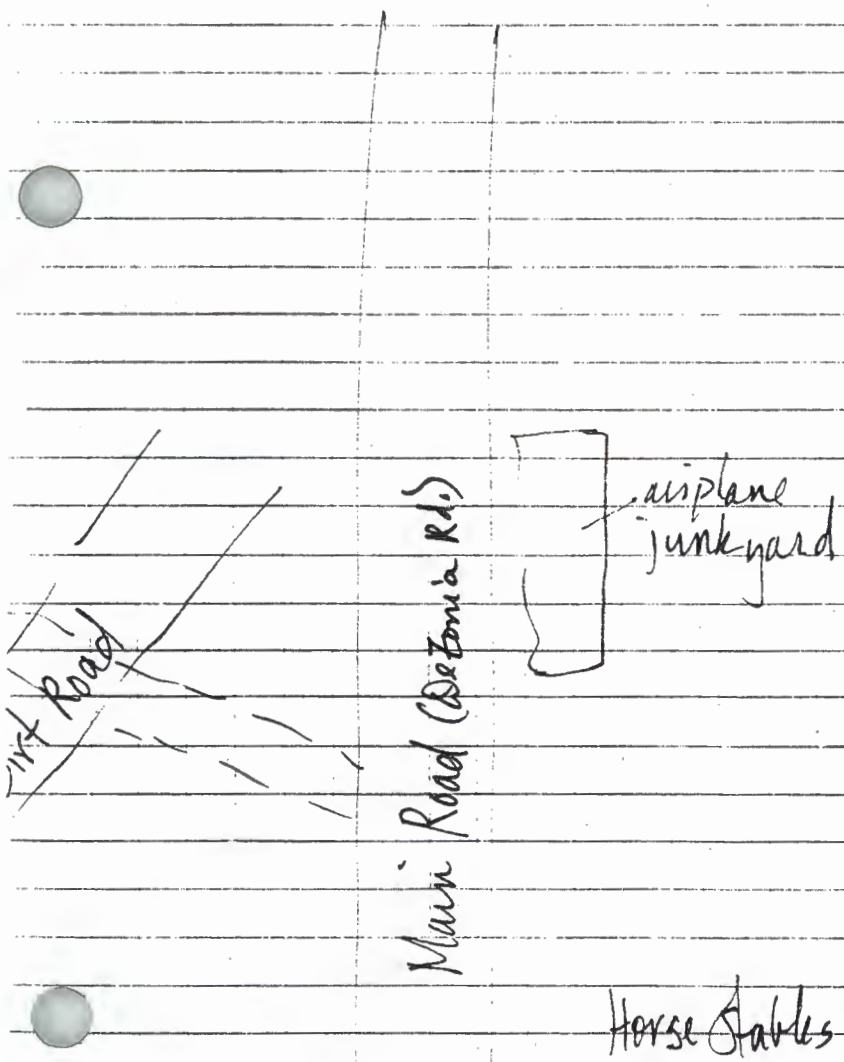
RADIAN CORPORATION

From Page No. 290 of 92

1430 Return to office

Call Ishmael Sanchez - PRL employee (probably Harry Ridge) said he was one of the original interviewers (for RI for 29 sites) and doesn't have much more to add. Spoke of the solvent evaporation area inside the moat.

1445 Look at areal photos



To Page No.

Witnessed & Understood by me,	Date	Invented by	Date

C.3

Telephone conversation log with Mr. Craig Sovka, Northeast Research Institute, Inc. (passive soil gas subcontractor), 3 December 1992.

RADIAN CORPORATION

TELEPHONE CALL RECORD
☒ Incoming Call
☐ Outgoing Call

Project No. 269-069-23-03	Distribution
Project Name Holloman AFB - Four Sites	
Date 3 Dec 92	Time 1700
Person Calling Craig Sovka	Activity NERI (203) 677-9666
Person Called Laura Maley	Activity Radian
General Subject Passive Soil Gas Surveys	

TOPICS DISCUSSED AND ACTION TAKEN

Craig Sovka called from Holloman to tell me that - of the 32 receptors placed at site 12 - only 8 were recovered. The others had been removed and could not be found. The remaining receptors were located downgradient of the pipeline, and upgradient of the pipeline along the storm sewer. Craig will submit the 8 receptors recovered to the lab - and NERI will write their results based on these samples -. The receptors at the other two sites were undisturbed and were collected without difficulty. Craig also noticed at Site 57 that the rain did not soak in the the ground in areas where the purple spills are found - he says the rainwater pools on the surface above the stain - making the spill areas easy to spot.

Signature: Laura E. Maley

9185-21364

C.4

U.S. Geological Survey. 7.5-Minute Topographical Quadrangle Maps of New Mexico: Holloman, 1982; Garton Lake, 1982; Malone Draw, 1982; Lost River, 1982.*

* Not included due to size.

C.5

Flood Plain Maps--reference verbage pending.*

* Not included due to size.

C.6

Telephone conversation log with Mr. R. Wilkson, Holloman AFB, 1 April 1992.

RADIAN CORPORATION

TELEPHONE CALL RECORD
☐ Incoming Call
☐ Outgoing Call

Project No.	
Project Name	Holloman
Date	1 April 92
Time	1630
Person Calling	Rodger Wilkson
Activity	Holloman AFB
Person Called	Bob Borger
Activity	Radian
General Subject	Base Information, Site 42 and Site 51

Distribution

TOPICS DISCUSSED AND ACTION TAKEN

— He said Lost River flows (a little) under dam via culverts (does not drain into Lake Holloman), and is not accessable to public, it is not a fishery (nothing like that downstream)

— Radioactive waste Area: he will try to get info from

Brooks AFB San Antonio (Radioactive info)
Maxwell AFB Alabama (Archives)
Langley AFB Virginia (Bio Sur Headquart

— He will get back on this info.
He said someone heard there was plutonium in the enclosed fire.

Signature:

9-85-21364

C.7

U.S. Geological Survey. Data from the groundwater site inventory, 1992.*

* Not included due to size.

C.8

Cost Analysis. *Economic Resource Impact Statement.* Holloman Air Force Base, New Mexico, 1991. p.7.

REF 21
PAGE 1 OF 2

ECONOMIC RESOURCE IMPACT STATEMENT 1991

TUTOR ET ULTOR

HOLLOMAN AIR FORCE BASE, NEW MEXICO

PREPARED BY: COST ANALYSIS AS OF 30 SEPTEMBER 1991

TABLE 5. SUMMARY OF PERSONNEL BY CLASSIFICATION AND HOUSING LOCATION

-- As of 30 September 1991 --

Classification	(#) Living On Base	(#) Living Off Base	(#) Total
APPROPRIATED FUND MILITARY			
Active Duty Permanent Party	2,409	2,413	4,822
ANG/Reserve Permanent Party	3	14	17
Trainees/Cadet	0	0	0
Traditional Guardsmen/Reserve	86	0	86
TOTAL	2,498	2,427	4,925
ACTIVE DUTY MILITARY DEPENDENTS	2,931	3,267	6,198
APPROPRIATED FUND CIVILIAN			
General Schedule			716
Federal Wage Board			324
Other			245
TOTAL			1,285
NONAPPROPRIATED FUND, CONTRACT CIVILIAN, AND PRIVATE BUSINESS			
Civilian NAF			317
Civilian BX			133
Contract Civilians, n.e.i.*			744
Private Businesses on-base by type:			
Branch Bank			4
Credit Union			12
Other Civilians, n.e.i.*			526
TOTAL			1,736
MILITARY RETIREES			
Air Force			1,427
Army			269
Navy			103
Marines			24
Coast Guard			10
TOTAL			1,833

* Not elsewhere included

C.9

Interview with Mr. R.E. Jennings, Radian Corporation, 2 April 1992.

REF 20
PAGE 1 OF 1

RADIAN CORPORATION

TELEPHONE CALL RECORD
☐ Incoming Call
☐ Outgoing Call

Project No.	
Project Name	HOLLOMAN AFB NM
Date	2 APRIL 92
Time	900 AM
Person Calling	BOB BORGER
Activity	RADIAN
Person Called	RALPH JENNINGS
Activity	RADIAN
General Subject	PUPFISH HABITAT.

Distribution

TOPICS DISCUSSED AND ACTION TAKEN

RALPH STATED THAT SOME PARTS OF THE LOST RIVER, MALONE DRAW, AND THE LOWER PORTION OF RITAS DRAW ~~ARE~~ HABITATS FOR THE WHITESANDS PUPFISH. HE ALSO STATED THAT AT THE TIME OF HIS VISIT (OCT 91), LOST RIVER WAS DRY AND THAT THERE WAS REPORTEDLY NO REGULAR FLOW. HE ALSO STATED THAT HE DID NOT OBSERVE ANY PUPFISH.

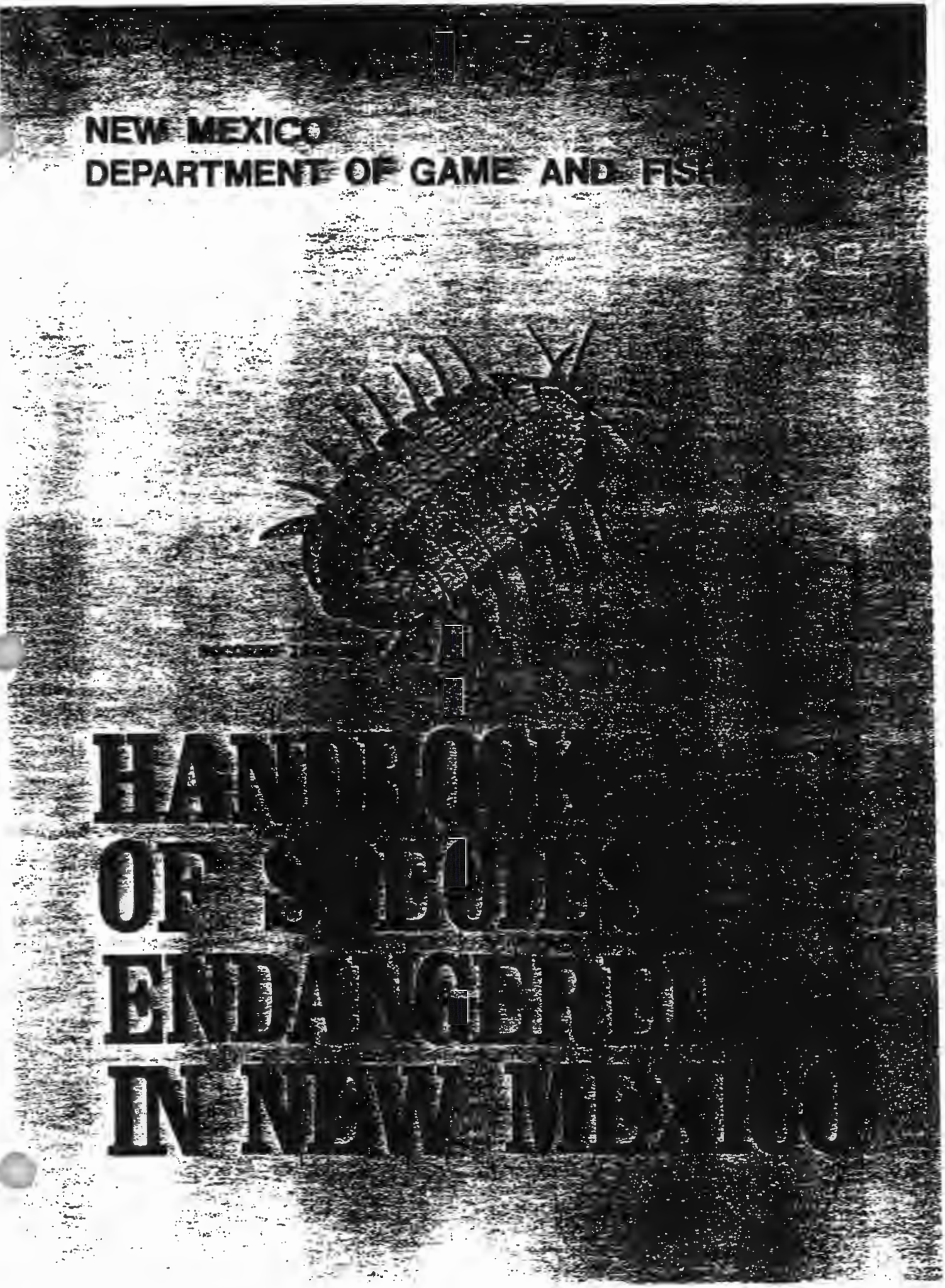
Signature: RBG

9-85-21364

C.10

New Mexico Department of Game and Fish. *Handbook of Species Endangered in New Mexico*, 1988. pp. C-176-1 and 2.1

NEW MEXICO
DEPARTMENT OF GAME AND FISH



HANDBOOK OF ENDANGERED IN NEW MEXICO

Account: C-176

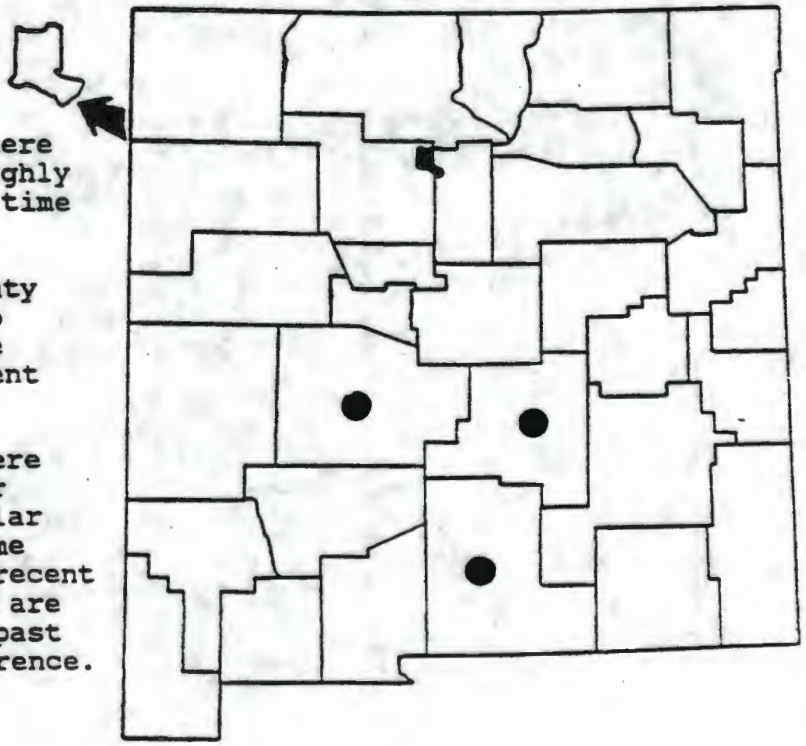
WHITE SANDS PUPFISH (Cyprinodon tularosa)
Listing status: New Mexico: Endangered (group 2), first listed Jan. 24, 1975 (NMGF Reg. 563); Federal: Notice of review as endangered/threatened.

Distinguishing features: The White Sands pupfish is a member of the family Cyprinodontidae, which is characterized by small body size (usually less than 60 mm total length), a branched third ray in the anal fin, rounded dorsal and caudal fins, and a more-or-less protruding lower jaw--with the mouth upwardly directed (Eddy and Underhill 1978). Cyprinodont fishes can be further distinguished from the related livebearer family (Poeciliidae) by the male anal fin: in cyprinodonts this is unmodified, but in poeciliids it is an elongated intromittent organ (gonopodium). Pupfish differ from other cyprinodontids in their compressed, tricuspid jaw-teeth and typically chunky build. The White Sands pupfish is best identified by its range, which is confined to the Tularosa Basin (Propst et. al. 1985). Its geographically-nearest congener, the Pecos pupfish (C. pecosensis), differs in having few or no scales on the breast or abdomen; these areas are fully scaled or almost so in the White Sands species (Miller and Echelle 1975).

Other descriptive details: Non-breeding White Sands pupfish are light, brownish-gray dorsally and white to silvery ventrally (Miller and Echelle 1975; Suminski 1977). In breeding males, the belly is whitish to pale orange, and the remainder of the body is pale to deep metallic blue. The fins are bright orange, except for the caudal--which is pale to yellowish green. Breeding females are whitish to silvery, slightly suffused with greenish-yellow. Their pectoral and pelvic fins are pale yellow, and the remaining fins are nearly colorless to watery-white. Both sexes have grayish to golden vertical bars along the length of the body, plus a dark blotch or spot at the posterior base of the dorsal fin. The maximum total length is about 48 mm.

Distribution: The White Sands pupfish is endemic to central-southern New Mexico (Miller and Echelle 1975). New Mexico: The species is restricted to the Tularosa Basin, where found in Malpais Spring and the Lost River (Otero Co.), Salt Creek (Socorro Co.), and Mound Springs (Lincoln Co.); these are the key habitat areas for the species (Propst et al. 1985). An introduced population formerly occurred near Alamogordo (Suminski 1977).

Enlargement of Los Alamos Co. (see dark area on the *map.)



solid circle: indicates a county where the listed species is known or is highly likely to occur regularly in recent time (i.e., 1960 or later).

half-solid circle: indicates a county where the listed species is known to occur less than regularly, but where regular occurrence is likely in recent time (i.e., 1960 or later).

open circle: indicates a county where the listed species is known to occur less than regularly, and where regular occurrence is unlikely in recent time (1960 or later). Included here are recent reports that are unsubstantiated or are otherwise questionable, as well as past (pre-1960) records of regular occurrence.

*See Introduction for the names and locations of the other counties.

REF 14
PAGE 3 OF 3

Biology: The White Sands pupfish occupies shallow pools and calm spring runs, which are characterized by high fluctuations in daily temperatures, very saline water, and substrates of silt, sand, and gravel (Miller and Echelle 1975; Suminski 1977). Salt grass (Distichlis stricta) and salt cedar (Tamarix chinensis) border these areas, and pondweed (Potamogeton) is the only aquatic vascular plant present. The White Sands pupfish feeds mainly on algae and mosquito larvae, but it will also consume its own eggs and fry. Spawning begins when a water temperature of 18 C is reached, this normally being in early April and continuing through August. Most spawning occurs in the shallow periphery of the habitat, where males establish their territories. The species is apparently polygamous, meaning that a male mates with more than one female. Females spawn several times in each season, emitting 12-15 eggs during any single spawning episode. The number of mature ova per female is up to 338. The White Sands pupfish grows quite rapidly in the first year of life, attaining a total length of up to 35 mm. Subsequent growth rates diminish, as the fish ages. Mean longevity is about two years, and few fish survive to age four.

Status: The White Sands pupfish is abundant and reasonably secure in its limited habitat, which is the remnant of the much larger, Pleistocene Lake Otero (Miller and Echelle 1975). Potential threats to the species are dewatering, pollution, and other disturbance to the habitat (Propst et al. 1985). In addition, given that this pupfish has probably been isolated for millennia and remains the only fish occurying its habitat, it can be presumed that the introduction of non-native aquatic species would have detrimental affects upon White Sands pupfish populations--notably in the form of increased predation and/or competition.

Conservation: Maintenance of the habitat of the White Sands pupfish is essential for the species' survival (Propst et al. 1985). In addition, non-native acquatic species must be excluded from its habitat, including fishes, bullfrogs (Rana castesbeiana), and the like. Currently, a conservation plan for the White Sands pupfish is being developed.

Bibliography: Echelle, A.A., A.F. Echelle, and D.R. Edds. 1987. Population structure of four pupfish species (Cyprinodontidae: Cyprinodon) from the Chihuahuan Desert region of New Mexico and Texas: allozymic variation. Copeia 1987: 668-681; Eddy S. and J.C. Underhill. 1978. How to know the freshwater fishes. Wm. C. Brown Publishers, Dubuque, IA; Miller, R.R. and A.A. Echelle. 1975. Cyprinodon tularosa, a new cyprinodontid fish from the Tularosa Basin, New Mexico. Southwest. Nat. 19:365-377; Propst, D.L., M.D. Hatch, and J.P. Hubbard. 1985. White Sands pupfish (Cyprinodon tularosa). New Mex. Dept. Game and Fish, Handbook Spec. End. in New Mexico:FISH/CT/CY/TU:1-2; Suminski, R.R. 1977. Life history of the White Sands pupfish and distribution of Cyprinodon in New Mexico. New Mex. St. Univ., MS thesis.

Citation: New Mexico Department of Game and Fish (Santa Fe, NM 87503). 1988. Handbook of Species Endangered in New Mexico, C-176:1-2.