INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For Holloman Air Force Base, New Mexico

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CH2M HILL

Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
TACTICAL AIR COMMAND
DIRECTORATE OF ENGINEERING AND ENVIRONMENTAL PLANNING
LANGLEY AIR FORCE BASE, VIRGINIA 23665

AUGUST 1983

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This report has been prepared for the United States Air Force by CH2M HILL SOUTHEAST, INC., for the purpose of aiding in the implementation of the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, nor the Department of Defense.

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Prepared by

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Gainesville, Florida

August 1983

Contract No. F08637-80-G0010-0019

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EXECUTIVE SUMMARY

A. INTRODUCTION

1. CH2M HILL was retained on December 20, 1982, to conduct the Holloman Air Force Base (AFB) records search under Contract No. F08637-80-G0010-0019, with funds provided by Tactical Air Command (TAC).

2. Department of Defence (DoD) policy, directed by Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations.

3. *To implement the DoD policy, a four-phase* Installation Restoration Program has been directed. Phase I, the records search, is the identification of potential problems. Phase II (not part of this contract) consists of follow-on field work to determine the extent and magnitude of contaminant migration. Phase III (not part of this contract) consists of technology base development (evaluation of alternatives for remedial actions) to support the development of project plans for controlling migration or restoring the installation. Phase IV (not part of this contract) includes those efforts which are required to control identified hazardous conditions.

4. The Holloman AFB records search included a detailed review of pertinent installation records, contact with 16 government organizations for documents relevant to the

records search effort, and an onsite base visit conducted by CH2M HILL during the week of May 16 through May 21, 1983. Activities conducted during the onsite base visit included interviews with 54 past and present base employees, ground tours of base facilities, a detailed search of installation records, and a helicopter overflight to identify past disposal areas. The installations addressed in the records search include Holloman AFB, the Boles and San Andres Well Field Area, Bonita Lake, El Paso Radar Site and Silver City Radar Site.

B. MAJOR FINDINGS

1. Current major industrial operations at Holloman AFB include the aerospace ground equipment shops, corrosion control shops, and flightline maintenance shops. The total quantity of waste fuels, oils and solvents generated from the base is approximately 48,000 gallons per year. Limited information was available on quantities of waste POL generated prior to 1977.

2. Major methods of past waste POL disposal at Holloman AFB have been as follows: (1) fire department training exercises, some limited recycling (1942 - 1965); (2) recycling and fire department training exercises (1969 - 1979); and (3) contractor sale or removal through DPDO (1979 - present).

3. Interviews with past and present base employees resulted in the identification of 43 past disposal or spill sites at Holloman AFB and the approximate dates that these sites were active (see Figures 1 and 2, pages 3 and 4, for site locations).

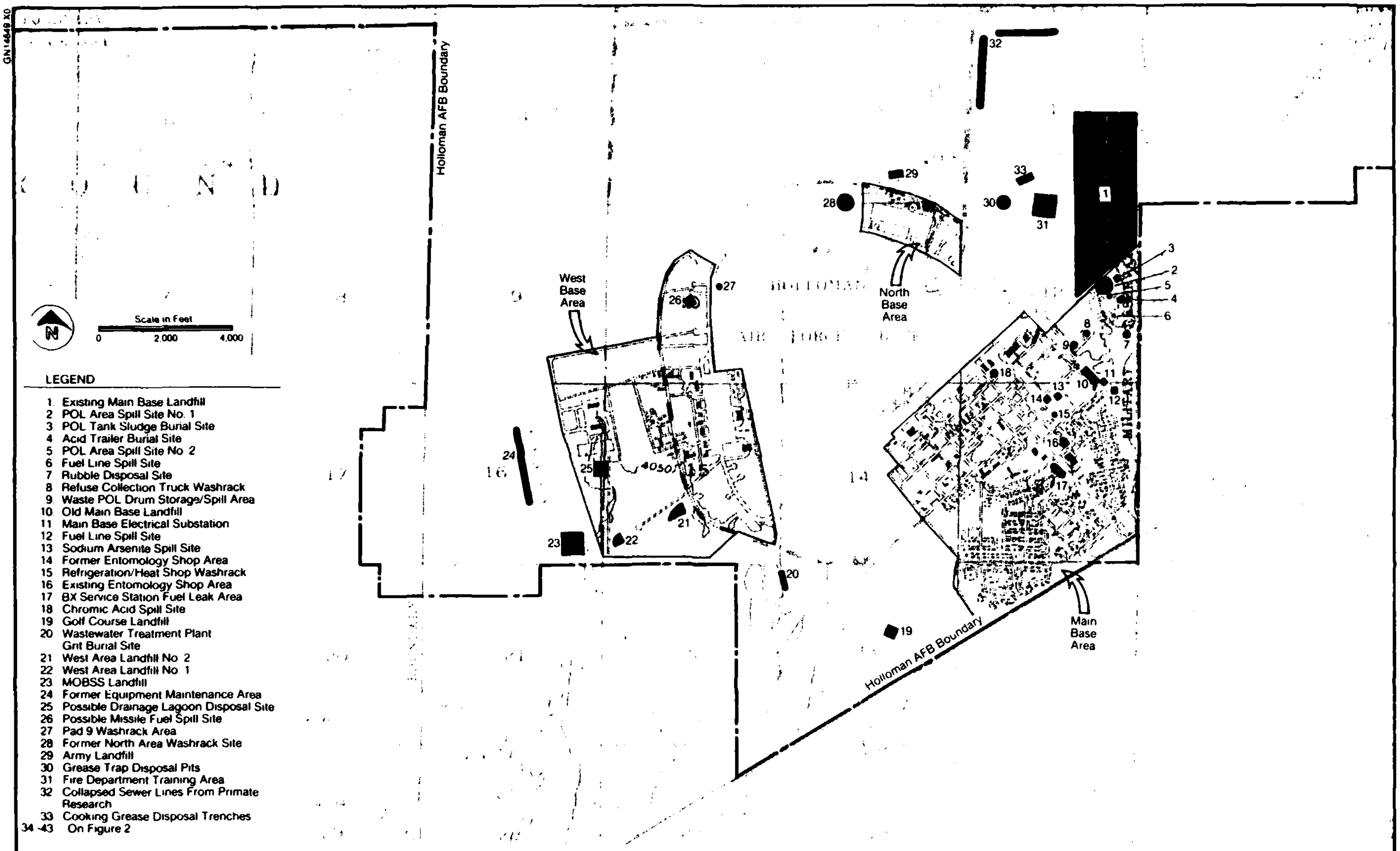

FIGURE 1. Identified Disposal and Spill Sites at Holloman AFB.

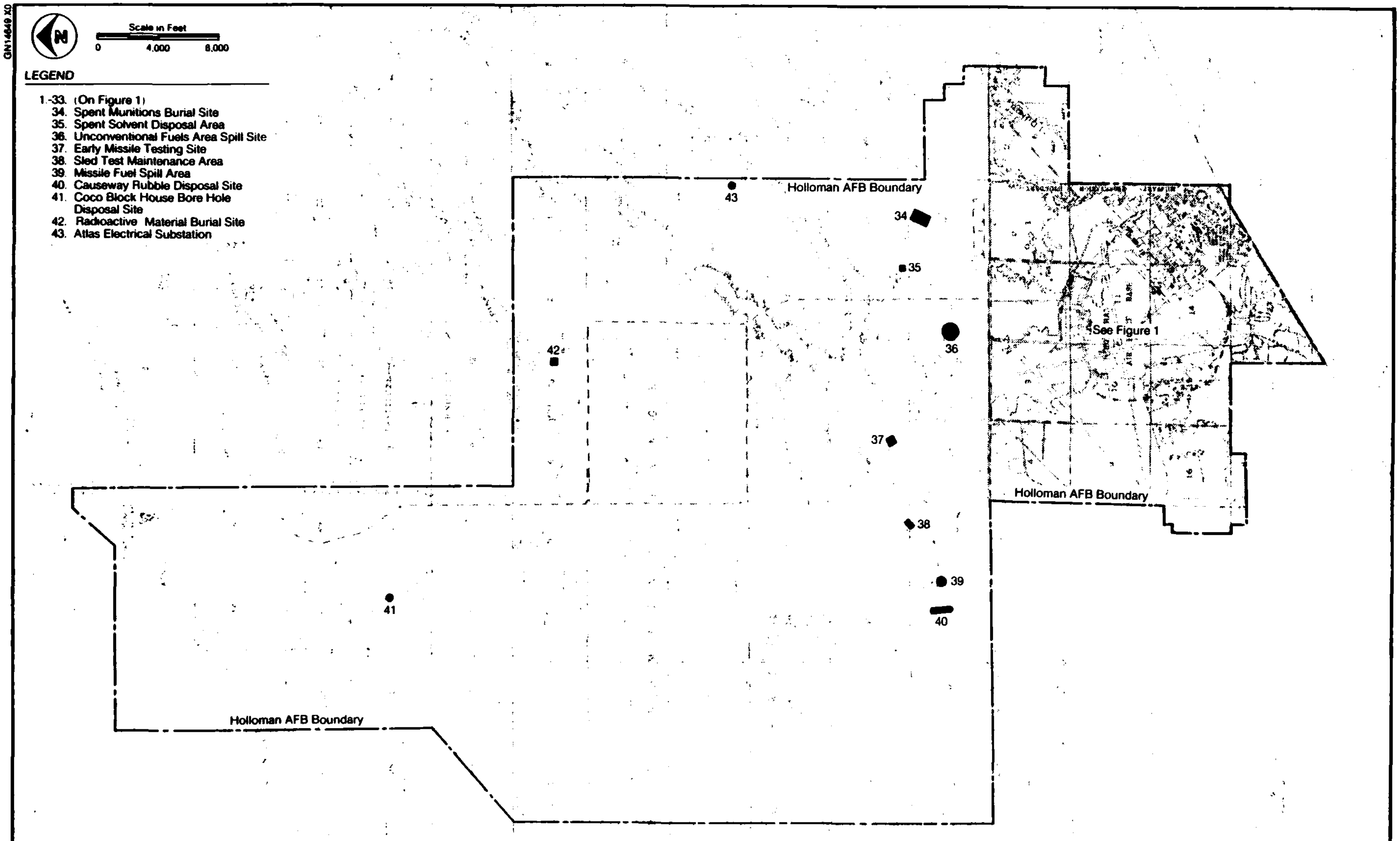

FIGURE 2. Identified Disposal and Spill Sites at Holloman AFB—(Continued).

4. No evidence of environmental stress resulting from past disposal of hazardous wastes was observed at Holloman AFB.

C. CONCLUSIONS

1. Direct evidence was found of the existence of a gasoline contaminant plume floating on the ground water beneath the BX Service Station (Site No. 17). Other than the above, available water quality data and information from base records and from interviews gave no direct evidence to indicate that migration of hazardous contaminants exists within or beyond Holloman AFB boundaries.

2. Information obtained through interviews with 54 past and present base personnel (1/3 with 20 or more years at the installation), base records, shop folders, and field observations indicates that hazardous wastes have been disposed of on Holloman AFB property in the past.

3. The potential for ground-water contamination at Holloman AFB is high due to the high ground-water table (less than 10 feet below land surface). This potential is reduced somewhat by the low precipitation and high evaporation rate in the area which results in a low driving force for vertical contaminant migration. The potential adverse impact of ground-water contamination beneath Holloman AFB is reduced by the fact that the ground water in this area is naturally high in total dissolved solids (>10,000 mg/l) and therefore is not usable as a potable water supply.

4. Table 1 presents a priority listing of the rated sites and their overall scores. Site No. 17 has the most significant potential (relative to other Holloman AFB sites)

Table 1
PRIORITY LISTING OF DISPOSAL AND SPILL SITES

Site No.	Site Description	Overall Score
17	BX Service Station Fuel Leak Area	66
1	Existing Main Base Landfill	47
13	Sodium Arsenite Spill Site	45
18	Chromic Acid Spill Site	45
32	Collapsed Sewer Line from Primate Research	45
31	Fire Department Training Area	44
14	Former Entomology Shop Area	43
8	Refuse Collection Truck Washrack	43
16	Existing Entomology Shop Area	43
30	Grease Trap Disposal Pits	43
39	Missile Fuel Spill Area	43
9	Waste POL Drum Storage/Spill Area	42
36	Unconventional Fuels Area Spill Site	42
22	West Area Landfill No. 1	41
23	MOBSS Landfill	41
12	Fuel Line Spill Site	40
24	Former Equipment Maintenance Area	40
2	POL Area Spill Site No. 1	39
5	POL Area Spill Site No. 2	39
6	Fuel Line Spill Site	39
27	Pad 9 Washrack Area	39
3	POL Tank Sludge Burial Site	38
10	Old Main Base Landfill	38
25	Possible Drainage Lagoon Disposal Site	38
19	Golf Course Landfill	37
38	Test Sled Maintenance Area	37
28	Former North Area Washrack Site	36
15	Refrigeration/Heat Shop Washrack	34
21	West Area Landfill No. 2	34
20	Sewage Treatment Plant Grit Burial Site	33
26	Possible Missile Fuel Spill Site	33
37	Early Missile Testing Site	33
35	Spent Solvent Disposal Area	32
41	Coco Block House Bore Hole Disposal Site	31

for environmental impact. A large quantity of gasoline, estimated at 100,000 - 150,000 gallons, leaked from an underground fuel line located beneath the BX Service Station in 1981. There is a serious safety concern over the potential for ignition or explosion of the gasoline should it begin to seep into nearby sanitary sewers or storm drains.

5. The remaining rated sites (No. 1-3, 5-6, 8-10, 12-28, 30-32, 35-39, and 41) as well as the sites that were not rated, are not considered to present a significant concern for adverse effects on health or the environment.

6. The records search did not indicate any significant environmental concerns for the Boles and San Andres Well Field Area, Bonita Lake, the El Paso Radar Site, or the Silver City Radar Site. Therefore, no Phase II work is recommended for these off-base installations.

D. RECOMMENDATIONS

1. A Phase II monitoring program is recommended for Site No. 17, the BX Service Station Fuel Leak Area, to determine the presence and extent of a free product gasoline lens in this area and to obtain data necessary to determine the feasibility of recovery of the floating gasoline layer. The program includes the installation of 12 shallow groundwater observation wells and the use of non-laboratory field techniques to determine the presence and thickness of the free product gasoline lens. Preliminary details of the Phase II monitoring program are provided in Section VI and in Appendix K of this report. The final details of the monitoring program, including the exact locations of the observation wells, should be finalized as part of the Phase II program.

2. Other environmental recommendations were discussed during the out-briefing with base staff in addition to the Phase II monitoring and include: (1) provision of a secure central storage location for PCB items, (2) implementation of a central collection service for maintenance of oil/water separators and (3) implementation of a scheduled leak testing program for underground POL storage tanks. Also, the past practice of conducting landfill operations in arroyos should not be allowed to recur in the future.

3. Recommendations as to appropriate land use restrictions pertaining to identified disposal sites are also included in Section VI of this report.

I. INTRODUCTION

A. BACKGROUND

The United States Air Force, due to its primary mission, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Sections 6003 and 3012 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and state agencies to inventory past disposal sites and make the information available to the requesting agencies.

The Department of Defense (DoD) developed the current Installation Restoration Program (IRP) to assure compliance with these hazardous waste regulations. The DoD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DoD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP will be the basis for remedial actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as clarified by Executive Order 12316.

To conduct the IRP Hazardous Materials Disposal Sites Records Search for Holloman AFB, New Mexico, CH2M HILL was retained on December 20, 1982 under Contract No. F08637-80-G0010-0019 with funds provided by Tactical Air Command (TAC). The installations included in the records search include: (1) Holloman AFB; (2) the Boles and San Andres Well Field Area, (3) Bonita Lake Water Supply, (4) El Paso Radar Site and (5) Silver City Radar Site. A location map of these sites is shown on Figure 3, (page I-3).

The records search is Phase I of the DoD Installation Restoration Program and is intended to review installation records to identify possible hazardous waste-contaminated sites and to assess the potential for contaminant migration. Phase II (not part of this contract) consists of follow-on field work as determined from Phase I. Phase II consists of a preliminary survey to confirm or rule out the presence and/or migration of contaminants and if necessary, additional field work to determine the extent and magnitude of the contaminant migration. Phase III (not part of this contract) consists of technology base development (evaluation of alternative remedial actions) to support the development of project plans for controlling migration or restoring the installation. Phase IV (not part of this contract) includes those efforts which are required to control identified hazardous environmental conditions.

B. AUTHORITY

The identification of hazardous waste disposal sites at Air Force installations was directed by Defense Environmental Quality Program Policy Memorandum 81-5 (DEQPPM 81-5) dated 11 December 1981, and implemented by Air Force message dated 21 January 1982, as a positive action to ensure compliance of Air Force installations with existing environmental regulations.

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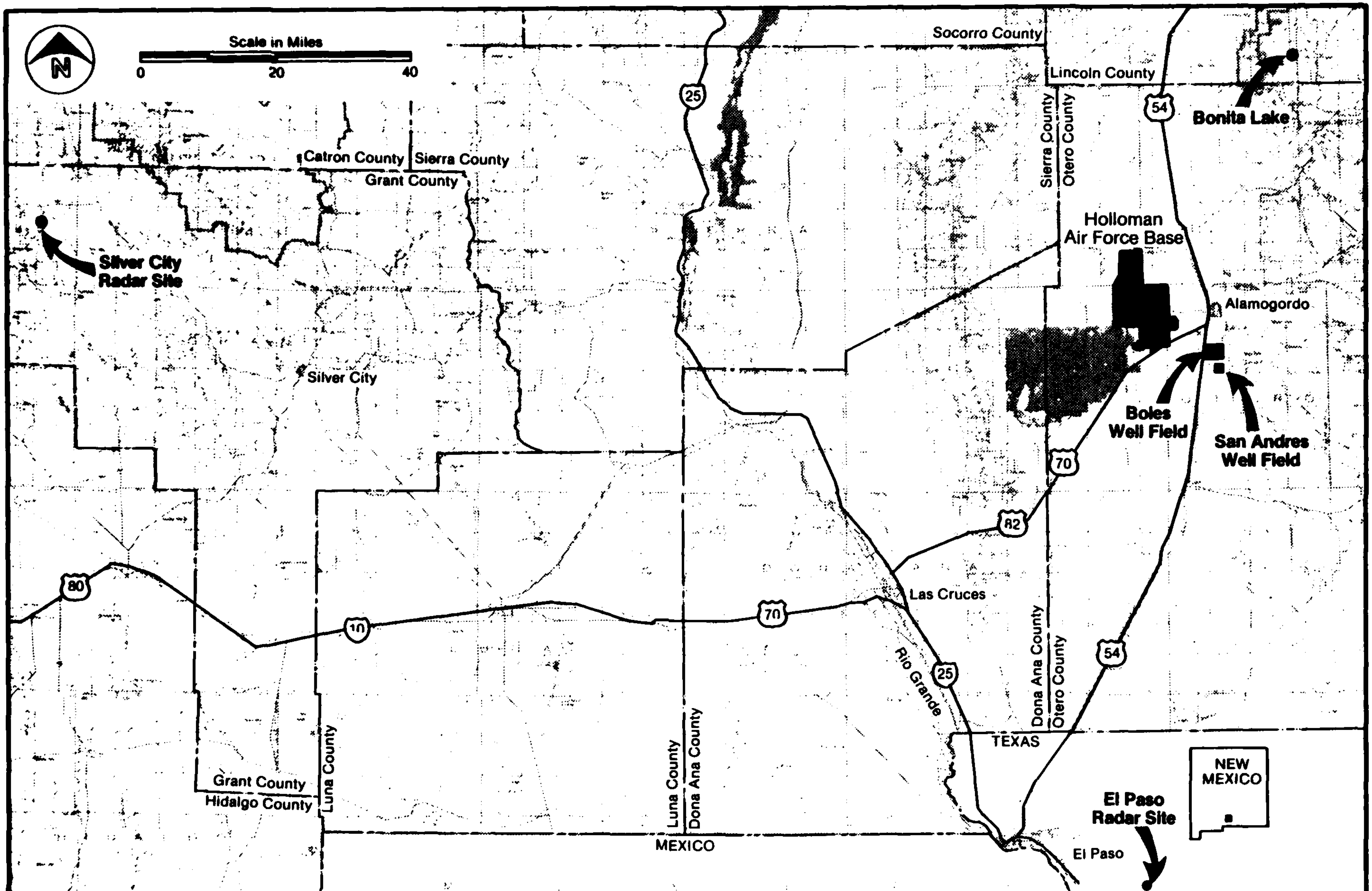

FIGURE 3.
Location Map of Holloman AFB, Boles and San Andres Well Fields, Bonita Lake, and Silver City and El Paso Radar Sites.

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C. PURPOSE OF THE RECORDS SEARCH

The purpose of the Phase I records search is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites and spill sites on DoD facilities. The existence and potential for migration of hazardous material contaminants were evaluated at Holloman AFB by reviewing the existing information and conducting an analysis of installation records. Pertinent information included the history of operations, the geological and hydrogeological conditions which may have contributed to the migration of contaminants, and the ecological settings which indicated environmentally sensitive habitats or evidence of environmental stress.

D. SCOPE

The records search program included a pre-performance meeting, an onsite base visit, a review and analysis of the information obtained, and preparation of this report.

The pre-performance meeting was held at Holloman AFB, New Mexico, on February 1, 1983. Attendees at this meeting included representatives of the Air Force Engineering and Services Center (AFESC), Tactical Air Command (TAC), Holloman AFB, and CH2M HILL. The purpose of the pre-performance meeting was to provide detailed project instructions, to provide clarification and technical guidance by AFESC, and to define the responsibilities of all parties participating in the Holloman AFB records search.

The onsite base visit was conducted by CH2M HILL from May 16 through 21, 1983. Activities performed during the on-site visit included a detailed search of installation records, a ground tour, a helicopter overflight of the installation, and interviews with past and present base personnel. Prior to the onsite base visit the base provided a press release announcing the study and urging people who may have knowledge of past on-base disposal practices to contact Holloman AFB representatives. At the conclusion of the onsite base visit, the Combat Support Group Commander was briefed on the preliminary findings. The following individuals comprised the CH2M HILL records search team:

1. Mr. Norm Hatch, Project Manager (M.S. Chemistry, 1972; M.S. Environmental Engineering, 1973)

2. Mr. Tom Emenhiser, Assistant Project Manager (B.S. Chemistry, 1974)

3. Mr. Gary Eichler, Hydrogeologist (M.S. Engineering Geology, 1974)

4. Mr. Rick Mishaga, Ecologist (Ph.D. Ecology, 1977)

Resumes of these team members are included in Appendix A. Government organizations were contacted for information and relevant documents. Appendix B lists the organizations contacted.

Individuals from the Air Force who assisted in the Holloman AFB records search include the following:

1. Mr. Myron Anderson, AFESC, Program Manager, Phase I

2. Mr. Gil Burnet, TAC, Command Program Manager, Phase I

3. Lt. David Jorgenson, Holloman AFB, Environmental Coordinator

4. Capt. Keith Chandler, Holloman AFB, Chief of Bioenvironmental Engineering

E. METHODOLOGY

The methodology utilized in the Holloman AFB records search is shown graphically on Figure 4 (page I-7). First, a review of past and present industrial operations was conducted at the base. Information was obtained from available records such as shop files and real property files, as well as interviews with past and present base employees from the various operating areas of the base. The information obtained from interviewees on past activities was based on their best recollection. A list of interviewees from Holloman AFB with areas of knowledge and years at the installation, is given in Appendix C.

The next step in the activity review process was to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from all the industrial operations on the base. Included in this part of the activity review was the identification of landfill and burial sites; as well as other possible sources of contamination such as major PCB or solvent spills, or fuel-saturated areas resulting from significant fuel spills or leaks.

A helicopter overflight and a general ground tour of identified sites was then made by the records search team to gather site-specific information including evidence of environmental stress and the presence of nearby drainage ditches or surface-water bodies. These water bodies were inspected for any evidence of contamination or leachate migration.

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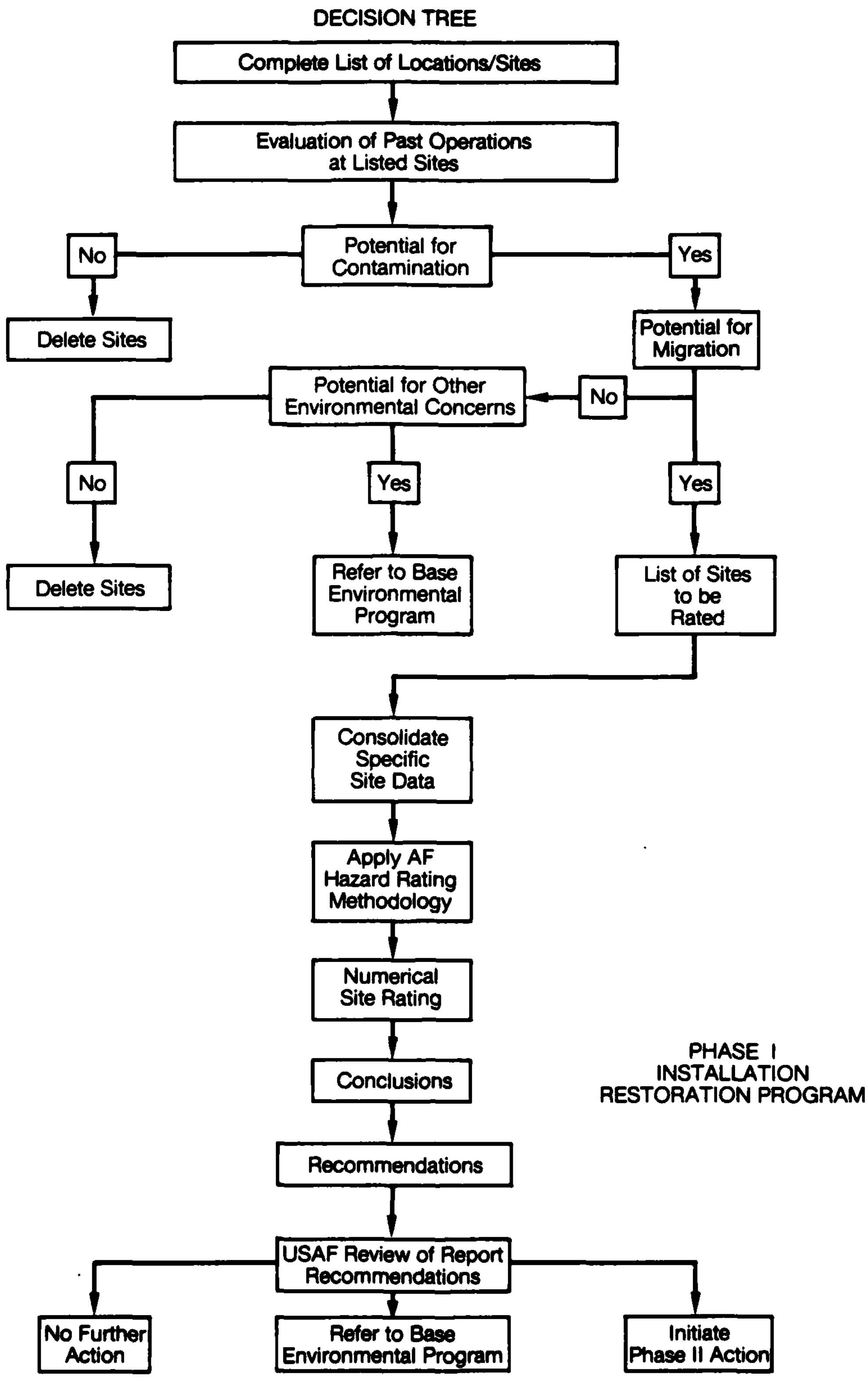

FIGURE 4.
Records Search Methodology.

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A decision was then made, based on all of the above information, as to whether a potential existed for hazardous material contamination from any of the identified sites. If not, the site was deleted from further consideration. Minor operations and maintenance deficiencies were noted during the investigations and were made known at the outbriefing.

For those sites at which a potential for contamination was identified, the potential for migration of this contamination was evaluated by considering site-specific soil and ground-water conditions. If there was no potential for contaminant migration, but other environmental concerns were identified, the site was referred to the base environmental monitoring program. If no further environmental concerns were identified, the site was deleted from consideration. If the potential for contaminant migration was identified, then the site was rated and prioritized using the site rating methodology described in Appendix I, "Hazard Assessment Rating Methodology."

The site rating indicates the relative potential for adverse environmental impact at each site. For those sites showing a significant potential, recommendations were made to quantify the potential contaminant migration problem under Phase II of the Installation Restoration Program. For those sites showing a low potential, no Phase II work was recommended.

II. INSTALLATION DESCRIPTION

A. LOCATION

Holloman AFB is located on approximately 50,700 acres of land in Otero County in south-central New Mexico approximately 75 miles north-northeast of El Paso, Texas. The base lies in the northernmost reaches of the Chihuahuan desert in a trough area called the Tularosa Basin bounded on the east and west by the Sacramento and San Andres Mountains, respectively. The nearest population center is the city of Alamogordo which is located about seven miles east of the base boundary. The major highway serving the base is U.S. Highway 70 which runs in a southwesterly-northeasterly direction along the southern base boundary. The current base boundary is shown on Figure 5, page II-2, and the real estate interests of the base (i.e., land withdrawn from public domain, leased acreage, etc.) are shown on Figure 6, page II-3. Off-base installations include the Boles and San Andres well field area approximately 14 miles southeast of the base, Bonita Lake water supply approximately 60 miles northeast of the base, El Paso Radar Site approximately 75 miles south-southwest of the base, and Silver City Radar Site approximately 165 miles west of the base (Figure 3, page I-3). A detailed description of the off-base facilities is included in Section VII of this report.

B. ORGANIZATION AND HISTORY

Holloman AFB, formerly known as Alamogordo Army Air Field, was initiated as a wartime temporary facility with construction beginning on February 6, 1942. At the end of World War II, the air field was briefly inactivated. The base was transferred in March 1947 to the Air Material Command with the mission to be "Provide facilities and accomplish development and testing of pilotless aircraft, guided missiles,

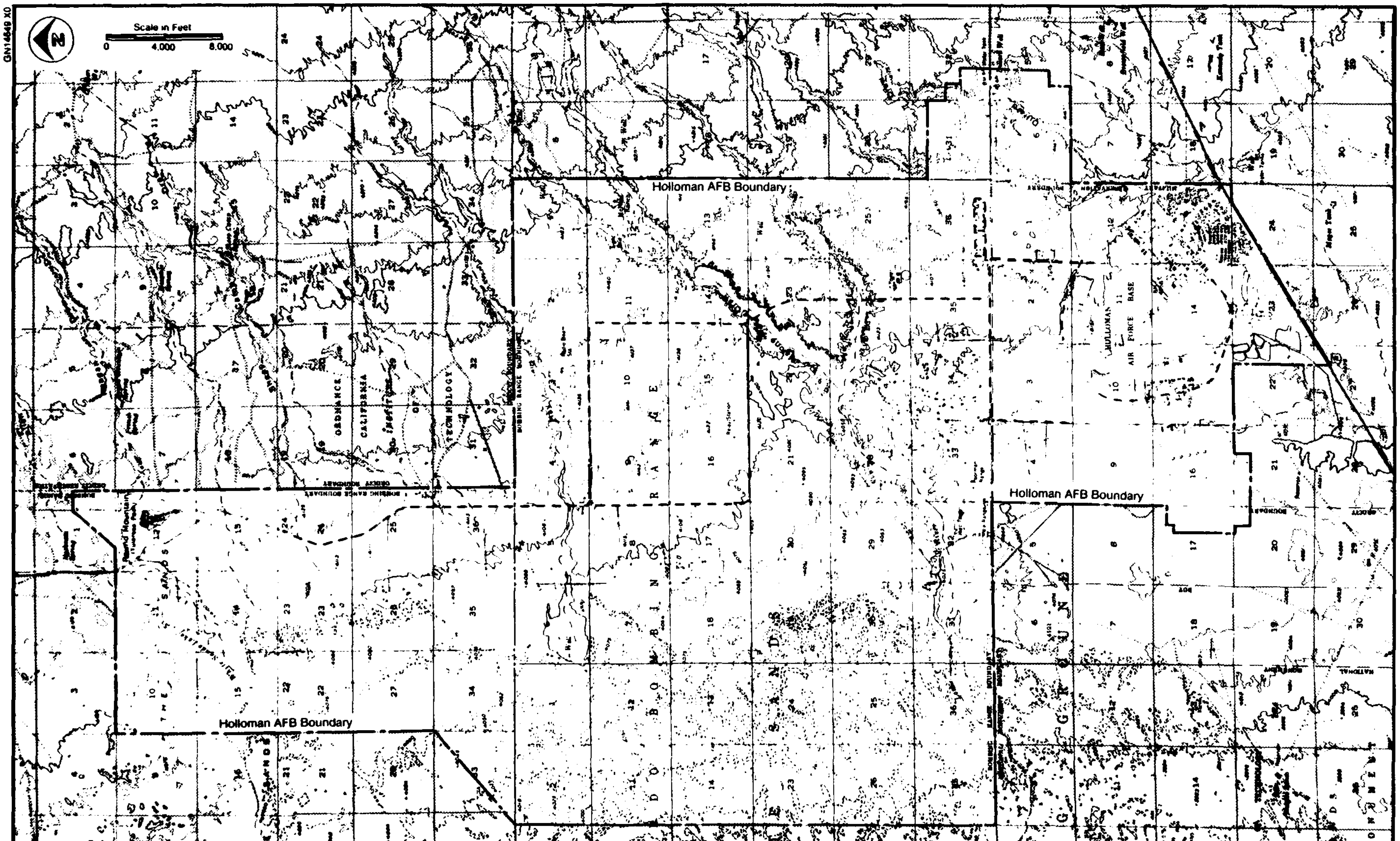

FIGURE 5.
Site Map of Holloman AFB.

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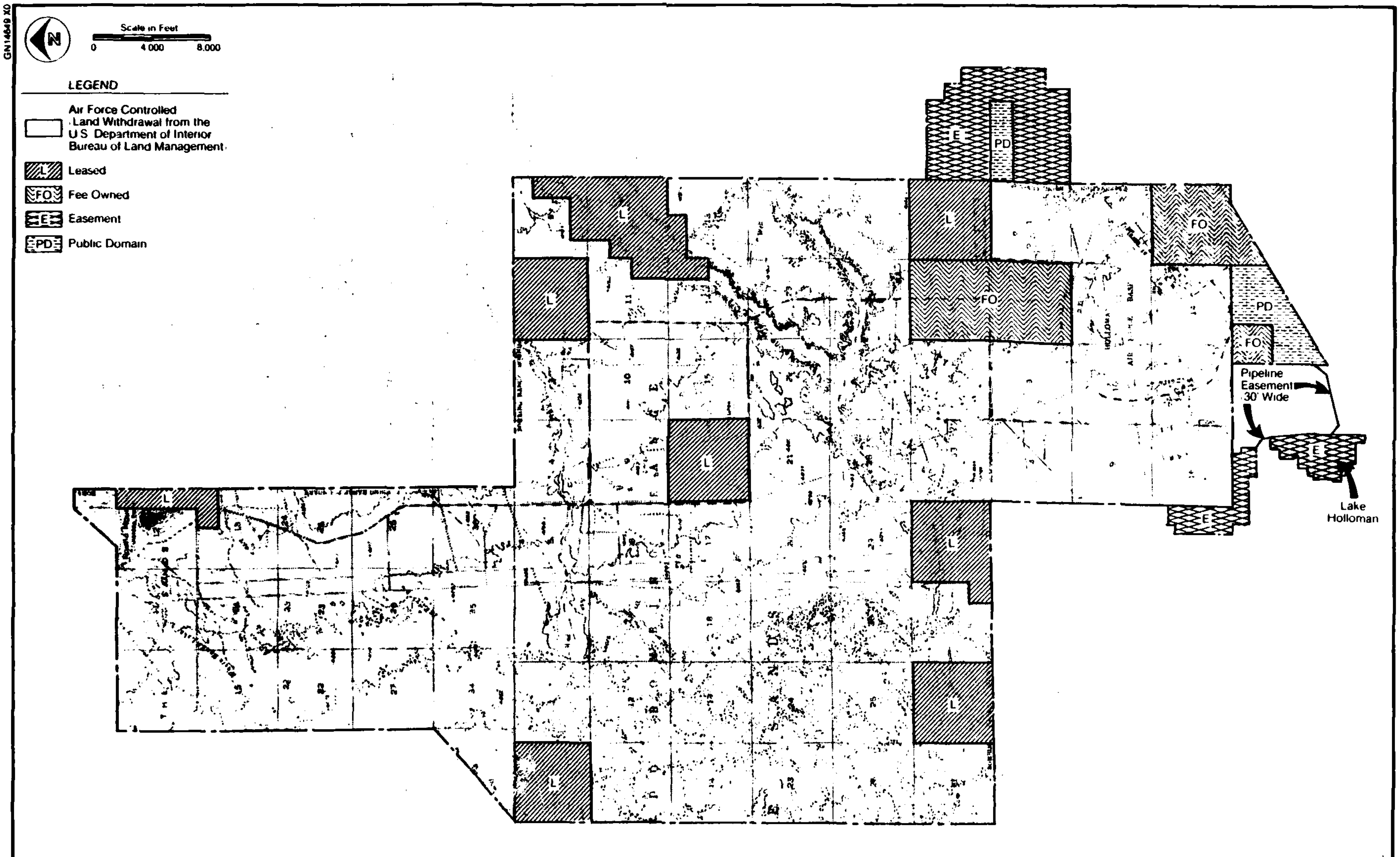

FIGURE 6.
Holloman AFB Real Estate Map

and allied equipment in support of the Air Material Command Research and Development Program." When the Air Research and Development Command was formed in 1951, the base was placed under the guidance of the Air Force Missile Test Center at Patrick AFB, Florida. On October 10, 1952, the base was named one of the development centers of the Air Research and Training Development Command and became Holloman Air Development Center. Five years later, on September 1, 1957, the center was designated as the Air Force Missile Development Center under the Air Force Systems Command (AFSC). On January 1, 1971, the base was transferred from AFSC to TAC with the 49th Tactical Fighter Wing assuming host responsibilities. On January 1, 1977, the 479th Tactical Training Wing was assigned to Holloman AFB. On December 1, 1980, the 833rd Air Division was reactivated and became operational at Holloman AFB.

Current TAC organizations at Holloman AFB include the 49th Tactical Fighter Wing, the 479th Tactical Training Wing, and the 4449th Mobility Support Squadron. Tenant organizations include the Air Force Systems Command's 6585th Test Group, the 1877th Communications Squadron, the Air Force Commissary Service, seven Army agencies, an operating location of the 325th Fighter Weapons Wing, and detachments of the AF Contract Maintenance Center, AF Geophysics Laboratory, Aeronautical Systems Division, AF Audit Agency, AF Office of Special Investigations, Area Defense Counsel, 3rd Weather Wing, 25th Weather Squadron, Defense Logistics Agency, Defense Mapping Agency, AF Data System Design Center, 40th Aerospace Rescue and Recovery Squadron and the 3785th Field Training Group. Also, New Mexico State University operates the primate research center located on-base. A more detailed description of the base history and its mission is included in Appendix D.

III. ENVIRONMENTAL SETTING

A. METEOROLOGY

Holloman AFB is centered in the Tularosa Basin with mountain ranges to the east and west. The climate is arid with low annual rainfall and low relative humidity. The mountain ranges to the east and to the west have a dramatic influence on the local weather; they provide orographic lifting to produce summer thunderstorms and modify approaching weather systems.

Holloman AFB receives most of its total annual rainfall from thunderstorm activity during the May through October period. These thunderstorms are due to a combination of orographic lifting and convection and are extremely variable in intensity and location. Frontal and squall line type thunderstorms do also occur, but their occurrence is infrequent. Normally, the most favorable weather for aircraft operations is from late October through November. The winter season is generally dry, characterized by clear skies and erratic snowfall from year to year. Normally the snow melts shortly after falling or within 24 hours. The period from March through May is characterized by a strong southerly wind flow and periods of blowing dust and sand.

Meteorological data for Holloman AFB is presented in Table 2. For the 39 years of record, the average annual monthly mean temperature was 61° F. The mean daily high averaged 75°F while the mean daily low averaged 47°F. The highest temperature, 109°F, was recorded in June 1982; the lowest, -11°F, occurred in January 1962. The average frost free dates range from April 5 to November 10. The annual precipitation averaged 7.9 inches with annual extremes from

Table 2

METEOROLOGICAL DATA FOR HOLLOMAN AFB[a]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average or Extreme
Temperature (°F)													
Monthly mean	41	46	52	61	69	79	81	79	73	62	49	42	61
Mean daily high	54	60	66	76	84	94	93	91	86	76	63	55	75
Mean daily low	28	31	37	45	54	64	68	66	60	48	35	26	47
Record high	78	80	90	94	103	109	108	106	102	92	82	75	109
Record low	-11	0	9	23	26	44	52	54	38	26	3	2	-11
Precipitation (in)													
Monthly mean	0.5	0.4	0.3	0.2	0.4	0.7	1.2	1.3	1.2	0.9	0.3	0.5	7.9
Record maximum	1.9	1.4	3.0	0.8	2.9	3.6	3.7	4.4	3.9	4.2	2.5	2.4	4.4
Record minimum	0	T[b]	0	0	0	T	T	0.2	T	0	0	0	0
Relative humidity (%)													
4 a.m. mean	66	61	52	40	42	42	60	66	68	61	61	63	57
1 p.m. mean	42	35	27	19	20	19	31	35	38	34	34	37	31
Surface wind													
Mean velocity (Kt)	4	4	6	7	6	6	5	5	4	4	4	4	5
Prevailing direction	N	N	S	S	S	S	S	S	S	S	S	S	S

[a]Source: AWS Climatic Brief, prepared by USAF Environmental Tactical Applications Center, Scott AFB, 1982.
Station: Holloman AFB, New Mexico.
Period of record: September 1942 to December 1981.

[b]T = trace.

2.5 inches to 13.5 inches. The mean annual lake evaporation rate, commonly used to estimate the mean annual evapotranspiration rate, averages an estimated 67 inches per year. Therefore, the annual net precipitation (mean annual precipitation minus mean annual evapotranspiration) for the Holloman AFB area is approximately -59 inches per year. The wettest months are typically June, July, and August. Measurable snow can be anticipated from November to February.

B. PHYSICAL GEOGRAPHY

Holloman AFB is located in the southern part of the Tularosa Basin. The basin is approximately 120 miles long and 35 miles wide, extending from the southern end of Chupadera Mesa almost to the Texas border. (Figure 7, page III-4). The Tularosa Basin is part of a structural basin which is more than 200 miles long and 24 to 60 miles wide, extending from southeastern Socorro County, New Mexico southward to Chihuahua, Mexico. In the vicinity of the base, the Tularosa Basin is bounded 8 miles to the east by the Sacramento Mountains and 20 miles to the west by the San Andres Mountains.

Other striking physiographic features within the Tularosa Basin include the Malpais, a massive basalt lava flow located approximately 45 miles north of Holloman AFB and White Sands, extensive dunes of gypsum sand adjoining the base to the west.

Elevations within the Tularosa Basin range from 4,400 feet above mean sea level (ft-msl) at the northeast corner to 4,000 ft-msl in the southwest corner, sloping downward to the southwest. Elevations at the base range from 4,100 to 4,028 ft-msl, excluding Tularosa Peak.

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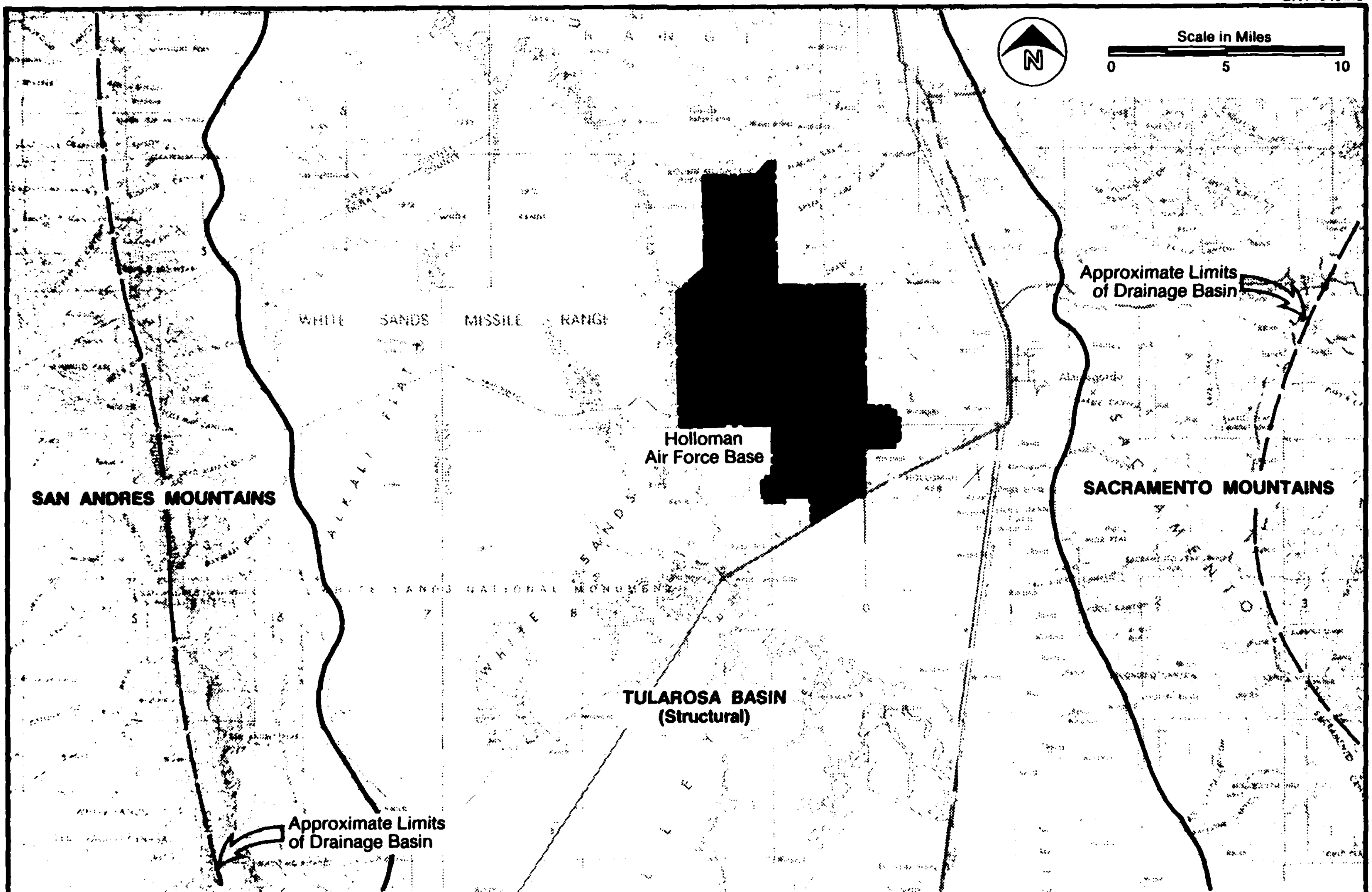

FIGURE 7.
Physiographic Map.

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Elevations in the Sacramento Mountains reach 12,000 ft-msl and range from 7,000 to 9,000 ft-msl within the San Andres Mountains.

The Tularosa Basin is a closed basin with regard to surface drainage. No surface water leaves the basin. Surface water is either lost to evaporation and infiltration or collects in the lowest point in the basin at or near Lake Lucero. This lake is located at the southwest edge of the gypsum dune field west of the base. Surface water within the basin makes its way to Lake Lucero. Here, also a discharge point for groundwater, sulfate salts are concentrated by evaporation. The prevailing southwest winds then pick up and transport the salts, primarily gypsum, in a northeastly direction to continue building the dune field of the White Sands National Monument.

The base is crossed by several southwest trending "arroyos" or intermittent stream beds including Lost River (the largest), Dillard Draw and several smaller tributaries such as Red Arroyo and Arroyo Cavacita. Lost River is fed by ground water seeps or springs. The river appears and disappears along its course as springs add water and evapotranspiration and infiltration recapture it.

Most of the base is covered with well drained soils (fine sandy loam) formed in gypsiferous sediments of eolian (wind blown) or alluvial (stream deposition) origin. The soils are thin and overlie discontinuous beds of gypsum. The soils are nearly level with slopes ranging from 0 to 5 percent. A typical soil profile as described by the U.S. Department of Agriculture, Soil Conservation Service, is as follows:

A Horizon - 0 to 3 inches; very pale brown very find sandy loam, pale brown moist; weak medium and coarse granular structure; soft, very friable, nonsticky and nonplastic; very few very fine and fine roots; common very fine and fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.

C1 Horizon - 3 to 13 inches; very pale brown very fine sandy loam, brown moist; massive; soft, very friable, slightly stickly and nonplastic very few fine and medium roots; common fine and very fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.

C2 Horizon - 12 to 20 inches; very pale brown gypsum, pale brown moist; massive; soft, very friable, slightly sticky and nonplastic; very few fine and medium roots; few fine and common very fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.

C3 Horizon - 20 to 60 inches; white gypsum, pale brown moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine interstitial pores; strongly calcareous; moderately alkaline.

Permeability of the soil horizons range from 4×10^{-4} to 1×10^{-3} cm/sec (moderately permeable).

Geologically, the Tularosa Basin is a graben structure, bounded on the east and west by mountains which are actually tilted fault blocks. The basin had its beginning over 270 million years ago when most of southern New Mexico was covered by a shallow sea. During the succeeding years there were periods of inundation and each cycle left behind successive layers of sediments. Then, approximately 70 million years ago, a major mountain building episode occurred creating the Rocky Mountains. This upheaval, caused the Tularosa area to be uplifted, forming a broad, gentle arch. As time passed, tectonic adjustments to the mountain building event took place and the top of this arch or dome collapsed (approximately 10 million years ago) along nearly vertical fault planes. The large area which collapsed or settled formed what is now the Tularosa Basin.

The fault planes have produced steep scarps clearly visible on the west side of the Sacramento Mountains. The basin itself is underlain mostly by unconsolidated bolson deposits more than 4,000 feet thick in the vicinity of Holloman AFB. A bolson is a basin which has no surface drainage outlet. Bolson deposits refer to sediments carried by water into the closed basin or bolson. Figure 8 illustrates a general east-west geologic cross section in the vicinity of Holloman AFB which depicts the configuration of the bolson deposits. Figure 9 presents a geologic cross-section in the vicinity of the Holloman AFB. Table 3 lists geologic strata occurring within the basin.

Only the uppermost bolson deposits are of significance to this investigation.

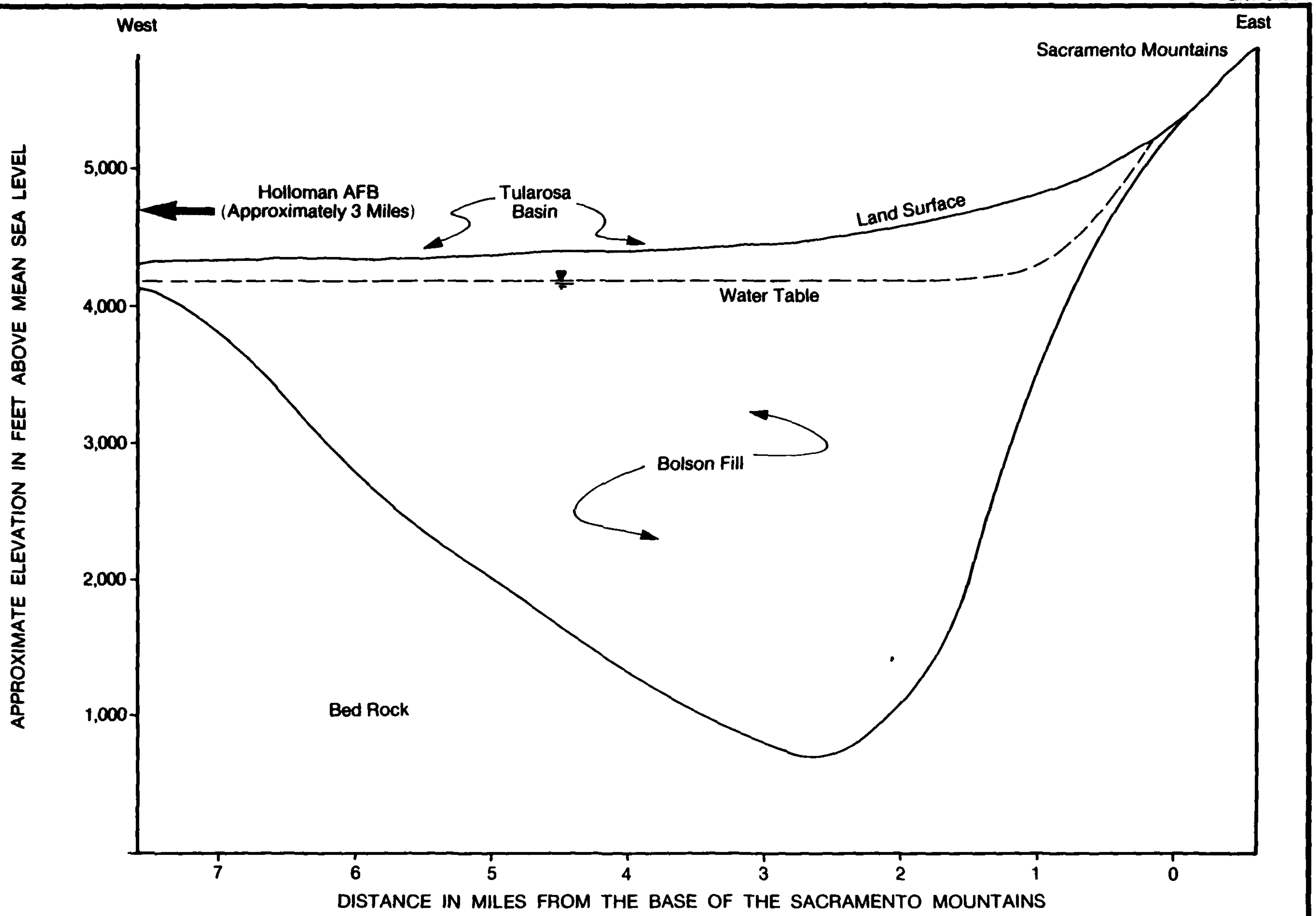

FIGURE 8.
Generalized East-West Geologic Cross Section.

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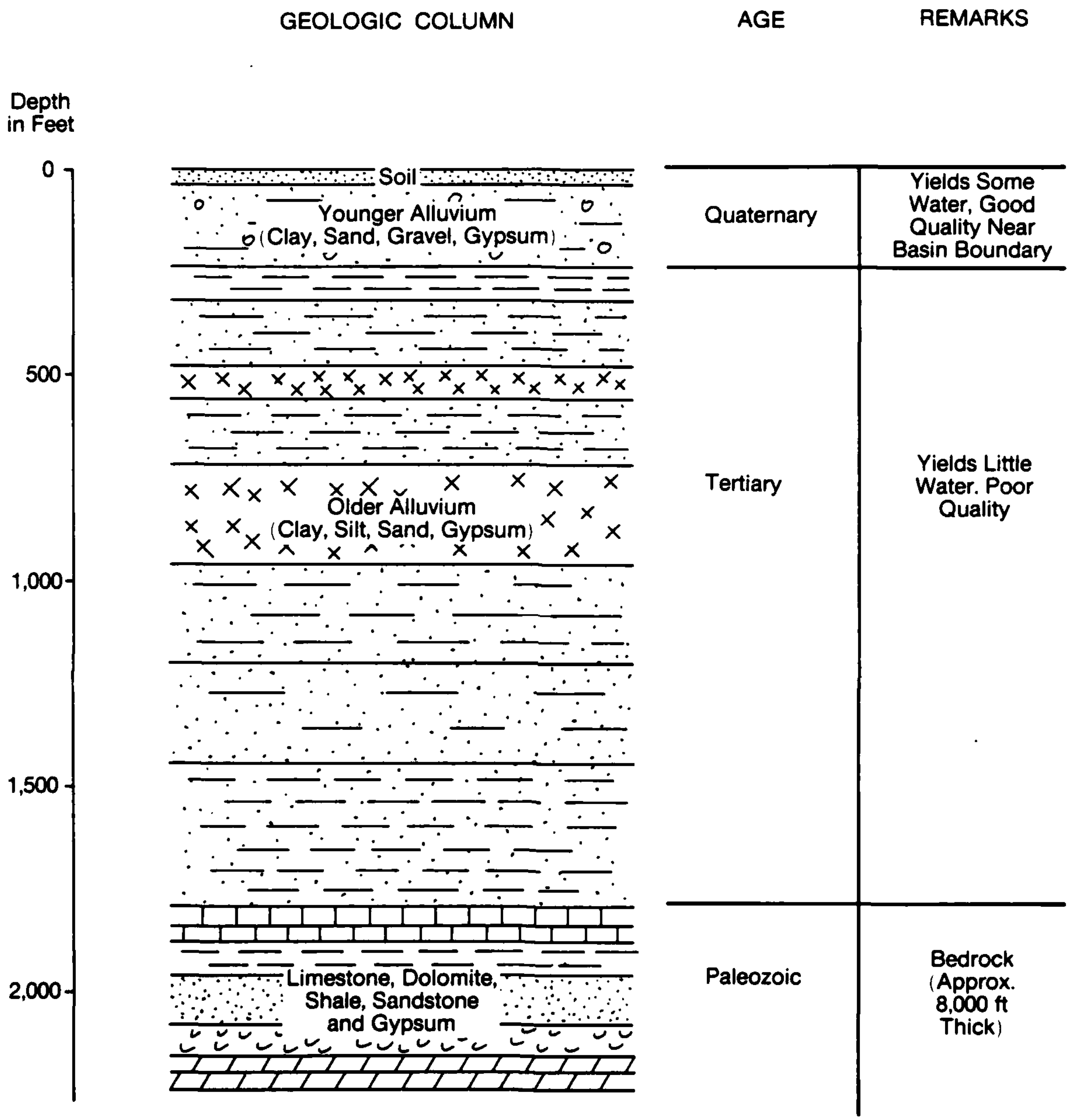

Source: USGS

FIGURE 9.
Generalized Geologic Column at Holloman AFB.

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Table 3
GENERALIZED STRATIGRAPHIC SECTION AND WATER-BEARING CHARACTER OF THE ROCKS IN THE TULAROSA BASIN AND ADJOINING AREAS, NEW MEXICO AND TEXAS

Note: Stratigraphy and rock descriptions are based largely on work of Kottlowski and others, 1956

System	Series	Rock Unit	Description	Hydrology	Igneous Rock Unit	Description	Hydrology
Quaternary		Terrace deposits	Covers several square miles of Sierra Blanca in Otero County, and smaller patches elsewhere in the general area.	Not known to contain water			
Tertiary	Miocene to Pleistocene	Bolson deposits	Upper part Quarternary in age: thickness of Quarternary section not known but probably does not exceed 500 feet in most places: mostly unconsolidated clay, clay, sand, and gravel derived from the surrounding higher areas.				Intrusive igneous rocks generally are relatively impermeable, are poor aquifers, and are barriers to the movement of water, except where they are fractured or weathered: do not readily absorb precipitation but are major areas from which water runs off to adjacent areas where it becomes available for ground-water recharge; a few springs discharge from these rocks, and the water from the springs generally is not highly mineralized; some basalt flows are extremely permeable and constitute major recharge areas because precipitation is readily absorbed before much of it evaporates; more recent basalt flows, such as those in the northern parts of Tularosa Basin and Jornada Del Muerto, support very little vegetation that might intercept precipitation before it reaches the water table.
		Santa Fe Group	Sandstone, sand, gravel, loess, volcania rocks; thickness not known, occur along the Rio Grande Valley in southern New Mexico.	Includes the major aquifers in the region; relatively permeable--particularly the coarse stream-laid deposits along the Rio Grande flood plain, where many irrigation wells yield more than 1,000 gpm; deposits generally contain potable water along the margins of the alluvial basins, but the water becomes increasingly mineralized toward the centers of the basins. In some areas, as in the north-central part of Tularosa Basin, water even in the marginal deposits is highly mineralized.	Extrusive and intrusive rocks	Present in many places in the region; along flanks of Sierra Blanca, volcanic extrusive rocks are cut by dikes; crests of several hills south of Carrizozo and near Oscura are composed of sills; basalt flows cover large areas in northern part of Tularosa Basin.	
	Miocene	Datil Formation	A thick sequence of volcanic rocks including minor amounts of conglomerate in the Cerro Colorado area; about 1,000 feet thick,				
	Eocene	Love Ranch Formation of Kottlowski and others (1956) and Baca Formation	Love Ranch Formation in the foothills of the San Andres Mountains and along the west side and at the south end of the Organ Mountains; about 2,000 feet thick. Baca Formation is grayish-red conglomeratic sandstone, siltstone, and conglomerate, prominently exposed at the west side of Cerro Colorado; as much as 1,000 feet.				

Table 3--Continued

System	Series	Rock Unit	Description	Hydrology	Igneous Rock Unit	Description	Hydrology
Tertiary		Cub Mountain Formation of Budine (1956) and McRae Formation of Kelley and Silver (1952)	Cub Mountain on the eastern, northern, and western flanks of Sierra Blanca and in the outlying hills between Three Rivers and Carrizozo, yellow to gray sandstone, siltstone, and variegated and red shale; 500 to 1,000 feet thick; correlative with part of the McRaw Formation between the Caballo Mountains and the Fra Cristobal Range; about 3,000 feet thick.				
Cretaceous	Upper						
		Mesaverde Group	Shale, siltstone, and sandstone and local coalbeds; more than 2,000 feet thick in the Caballo Mountains.				
		Mancos Shale	Mostly gray to black and some green shale and some thin limestone and sandstone beds; thickness in the Oscura-Three Rivers area is at least 1,000 feet.				
	Upper and Lower	Dakota Sandstone	Mainly light-gray to white quartzitic sandstone; 50 to possibly 300 feet thick; unit crops out in the Caballo Mountains, in the Carthage coalfield area north of Cerro Colorado, in the Three Rivers and Carrizozo-White Oaks area, at the east side of Sierra Oaks area, at the east side of Sierra Blanca, and caps the prominent cuesta east of the Malpais and southeast of Carrizozo.	Mostly poor aquifers, although some of the sandstone beds of Cretaceous age yield small quantities of generally impotable water to wells in the northeastern part of Tularosa Basin in the vicinity of Carrizozo.			

Table 3--Continued

System	Series	Rock Unit	Description	Hydrology	Igneous Rock Unit	Description	Hydrology
Triassic	Upper	Dockum Group	Red and reddish-purple siltstone shale, and sandstone; crops out in northern part of region; in scattered outcrops in the vicinity of Carrizozo and south of Three Rivers; at one small locality in the San Andres Mountains, north of Rhodes Canyon' in the Three Rivers area; and in a relatively large area about 15 miles north of Carrizozo.		•		

C. HYDROLOGY

Surface water resources within the Tularosa Basin are limited by the high evapotranspiration rate and low annual rainfall. Perennial streams occur in the mountainous regions surrounding the basin including Rio Tularosa, Rio Bonita, and Eagle Creek. Rio Bonita, located northeast of Tularosa and approximately 60 miles from Holloman AFB discharges to Bonita Lake which in turn is tapped for water supply, some of which is transmitted by pipeline to the base.

The intermittent streams and arroyos occurring within the basin are important drainage features only during the infrequent heavy rainfall, conveying surface water southwest to the basin's lowest elevation point.

Man-made and/or modified surface water features have some significance in an area otherwise devoid of lakes, rivers, and streams. The wastewater treatment system at Holloman AFB consists of six aeration/evaporation lagoons located in the southwest corner of the base. Just southwest of these lagoons, a natural playa occurs which receives discharge from the base as well as seepage from the sewage lagoons. The inundated portion of the playa is referred to as Lake Holloman. A dam/dike has been constructed across the south one quarter of the playa creating Lake Holloman, which is outside the Holloman AFB boundaries.

Another man-made surface water feature of significance is Garton Lake. This lake was created in 1916 by artesian flow of warm water (94°F) discharging from an abandoned oil test well which was not plugged. The lake is located approximately 4 miles southwest of Holloman AFB and is maintained by the U.S. Forest Service and is part of the

White Sands National Monument. The lake and surrounding area are used as a teaching facility and environmental laboratory.

Surface drainage within the undeveloped parts of the base is controlled by the major arroyos including Lost River and Dillard Draw and their tributaries. Surface flows are directed southwest toward the White Sands National Monument. Lost River at one time discharged into White Sands National Monument after traversing the base. Now, Lost River has been dammed on the base just east of the property boundary. This was done to ensure that base storm drainage which may contain runoff from areas of heavy fuel use would not enter the National Monument.

Drainage within the developed portion of the base flows by way of ditches and culverts to the southwest corner of the base, in the vicinity of the wastewater treatment lagoons. Figure 10 illustrates base topography and drainage patterns.

Ground water occurs within the unconsolidated bolson fill at Holloman AFB. The base obtains most of its water supply from wells installed in the fill. The base well fields (Boles, Douglas, and San Andres) are located off base at the foot of the Sacramento Mountains just south of Alamogordo. Ground water beneath Holloman AFB is highly mineralized containing dissolved solids in excess of 10,000 parts per million.

The bolson fill aquifer is developed within the younger alluvium, deposited by stream action after being eroded from the Sacramento Mountains. The coarser materials carried by streams discharging from the mountains is deposited at the base of the range where the abrupt change in relief reduces

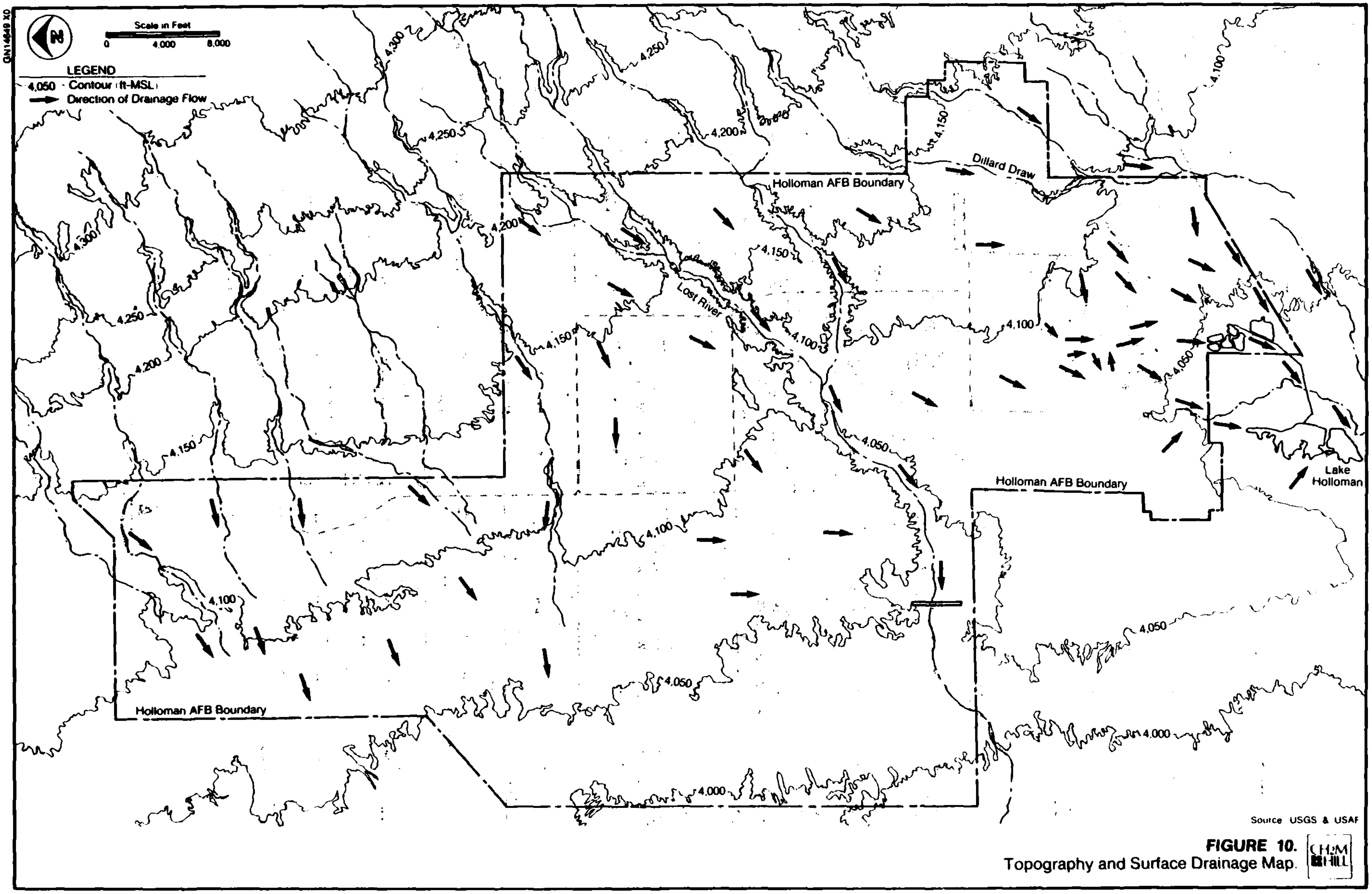

FIGURE 10.
Topography and Surface Drainage Map.

the hydraulic gradient and thus the stream's ability to transport the larger sediments. As the alluvial fans built up over geologic time, with coarser materials close to the basin/mountain interface and finer farther away, the sediments began to fill with ground water. Recharge occurs most easily through the coarser material at the foot of the mountain. Water then enters the bolson fill aquifer at the edge of the basin and moves downgradient discharging by evapotranspiration in the basin's interior, near White Sands.

Figure 8, page III-8, illustrates a general east-west geologic cross section taken through the base well field. This figure illustrates the relationship between the Sacramento Mountains and the bolson fill relative to ground water occurrence. At the base of the mountain, the hydraulic gradient is quite steep but then flattens out quickly. In the vicinity of Holloman AFB, the ground surface slopes to the southwest gently but at a slightly higher rate than the water table. Depth to water table at the well fields near the mountains is 270 feet or more below land surface (bls) while at Holloman AFB the water table is 5 to 10 feet bls. Figure 11 illustrates the configuration of the water table. Like surface drainage, ground water flows to the southwest, discharging by evapotranspiration.

The bolson fill is derived from salvage rocks, such as limestone, dolomite and particularly gypsum, of the surrounding mountains. Fresh water recharges the fill at the base of the mountains. Since the bolson fill consists of highly soluble materials, ground water will quickly dissolve formation minerals and water quality will degrade with increased contact time. In fact, the only fresh groundwater in the vicinity is near the source recharge.

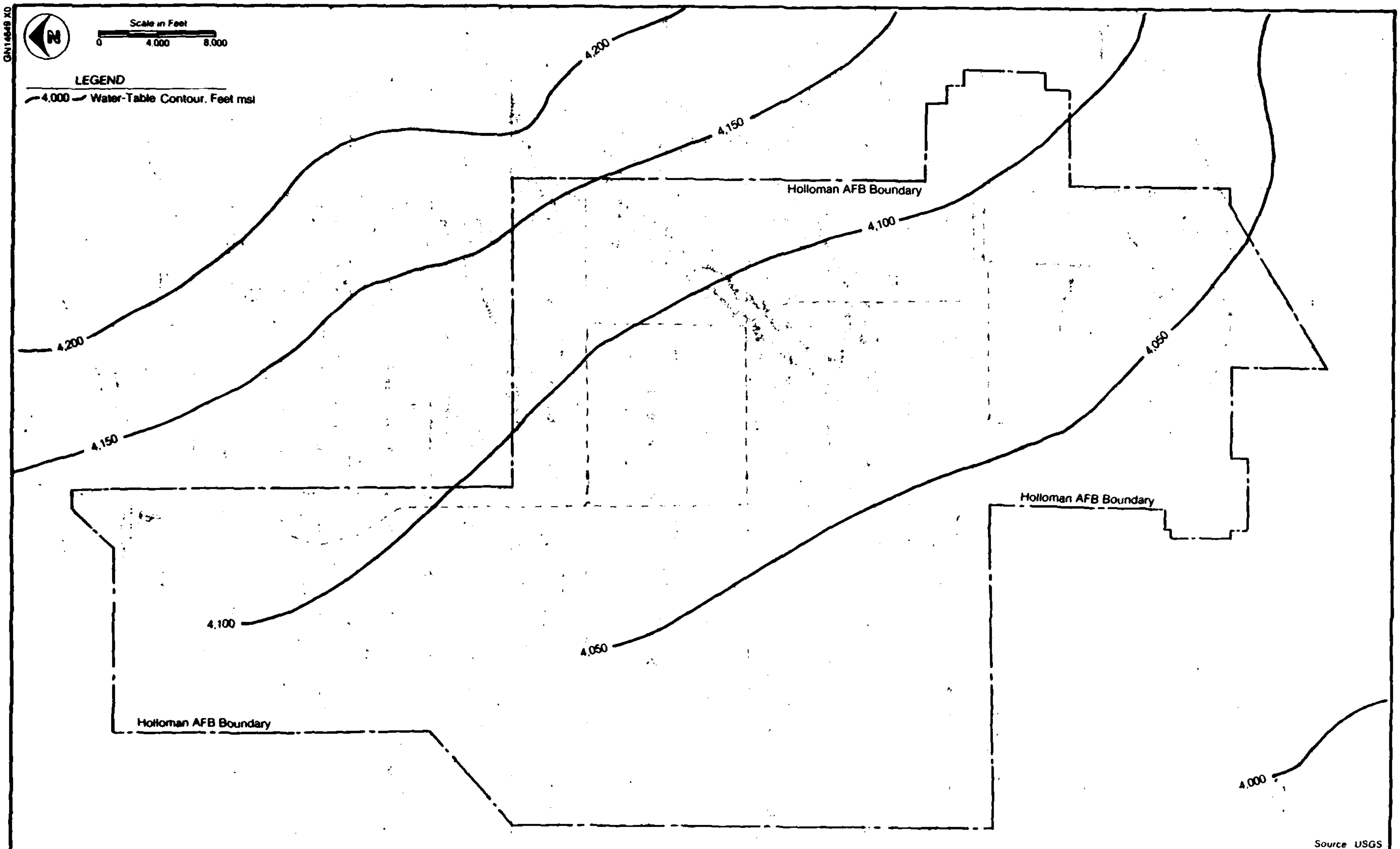

FIGURE 11.
Altitude of the Water Table, 1968-70.

The potential for ground-water contamination by other than natural sources is quite high at Holloman AFB. The water table is very near the surface (less than 10 feet) over most of the base. The soils occurring at Holloman AFB are moderate in permeability. However, the relief is also very low; therefore liquid contaminants placed on the surface would have a tendency to seep into the ground or evaporate rather than runoff. Contaminants entering the ground-water at Holloman AFB would most likely move very slowly (due to the very low hydraulic gradient and moderately low permeability) to the southwest, towards the White Sands National Monument. Although the potential is high for contaminants placed on the surface to enter the ground-water system it should be noted that the groundwater at Holloman AFB is naturally high in dissolved mineral content (primarily sulfate and chloride) and is not used for a water supply.

Discharge of contaminants via surface water courses is of greater significance. Contaminants which make their way to the wastewater lagoons by way of sanitary sewers could be discharged off base either by seepage through the lagoon dike or overflow during times of high water level. Flow from these facilities would discharge to Lake Holloman.

D. ENVIRONMENTALLY SENSITIVE CONDITIONS

1. Habitat

The Tularosa Basin which includes Holloman AFB forms one of the northernmost extensions of the Chihuahuan Desert. In this desert system, large, dry inland basins ("bolsons"), like the Tularosa, are common. Because of the lack of external drainage, bolson soils have become highly saline. At Holloman AFB, the soils are not only saline but gypsiferous, and native plant distributions are primarily a reflection of these soil characteristics. Generally, low, open bunchgrass--salt-tolerant shrub communities dominate the flats and gently undulating low hills that comprise most of the base, with the exception of the gypsum dunes west of the sled test track, the salt-tolerant arroyo and springs communities, and the extensive horticultural plantings on the base proper. The primary aquatic habitats on the base include the small ponds associated with local springs and seeps and Lake Holloman. These plant communities and aquatic habitats are discussed below.

The bunchgrass-shrub community is dominated by alkali sacaton (Sporobolus airoides) and chamisa or fourwing saltbush (Atriplex canescens). Other common grasses and shrubs include gypgrass (Sporobolus nealleyi), gyp grama (Bouteloua breviseta), tobosa grass (Hilaria mutica), coldenia (Coldenia hispidissima) and mormon-tea (Ephedra trifurca). In general, this community is low (2 to 3 feet) and sparse (15 to 20 percent ground cover). Annual summer herbs can be numerous depending on summer rainfall.

The gypsum dunes along the western sections of Holloman AFB are generally devoid of vegetation. Along the dune edges and between dunes the following grasses may occur--giant dropseed (Sporobolus giganteus), spike dropseed (Sporobolus contractus), and Indian ricegrass (Oryzopsis hymenoides).

The Lost River-Malone Draw is the primary arroyo system on base. It essentially bisects the base from northeast to southwest. Vegetation within the arroyo varies from dense monospecific stands of alkali sacaton to sparse seep borders of iodinebush (Allenrolfea filifolia) and seepweed (Suaeda suffrutescens). The lower end of Lost River arroyo near the White Sands National Monument is a barren salt flat for most of the year. Iodinebush and seepweed are also common, along with saltcedar (Tamarisk pentandra) at the occasional seeps scattered throughout the base. Larger seeps or ponded areas may have more diverse vegetation including willows (salix sp.) and mesquite (Prosopis juliflora). Aquatic vegetation in seeps and at Lake Holloman consists of planktonic algae. Blue-green algae are most abundant at Lake Holloman with lesser numbers of green algae, cryptophytes, and diatoms (Cole et al. 1981). Emergent wetland plants, e.g., cattails (Typha) and tules (Scirpus), are generally found near less saline water sources like the drainage ditches on the base proper.

Wildlife on Holloman AFB includes a wide variety of migratory mammals and birds and nonmigratory species adapted for desert existence. Mule deer is the primary big game species that may use open ranges in the more isolated reaches of the base. Feral horses also range across the base and adjacent missile range. Smaller mammalian species include coyotes, badgers, skunks, black-tailed jackrabbits, desert cottontails, kangaroo mice, pocket mice, pocket gophers, and several species of bats.

The diversity of birds occurring on the base is reflected by the 115 species recorded for Lake Holloman which includes aquatic birds as well as desert species (Appendix E). Game birds in the vicinity of the base include migratory waterfowl at Lake Holloman and mourning doves and scaled quail in desert uplands. The more common desert birds include turkey vultures, red-tailed hawk, nighthawks, swallows, flycatchers, roadrunner, horned lark, warblers, and desert sparrows.

Approximately 12 species of snakes and 11 species of lizards can be expected to occur on the base and surrounding habitats. Spadefoot toads are the most common amphibians. The only native fish known to occur in the area is the White Sands pupfish. Mosquito fish have been introduced into Lake Holloman for mosquito control.

2. Threatened and Endangered Species

A literature search of the New Mexico Heritage Program data base for Threatened and Endangered species indicated recorded documentation for two species. A peregrine falcon, which is listed Federally as Endangered, was observed hunting at Lake Holloman in 1976. The second species, the White Sands pupfish, is listed as State Threatened.

IV. FINDINGS

A. ACTIVITY REVIEW

1. Summary of Waste Disposal Practices

The history of Holloman AFB dates back to February 6, 1942. At that time, the mission of the base, then named the Alamogordo Army Air Field, was to train heavy bombardment groups for service overseas. Following a short inactivation period after World War II, the Air Material Command reactivated the base and utilized it as one of the primary locations for guided missile and space research and development. The 6585th test group began operations at Holloman in the early 1950's with the construction of the test sled track. The 49th Tactical Fighter Wing was assigned to the base in 1968. The 4449th Mobility Support Squadron started operations at Holloman in 1972. The 479th Tactical Training Wing was assigned to the base in 1977. The flying mission prior to 1968 was research and development oriented and the aircraft assigned were mainly Systems Command aircraft of numerous types which were retrofitted with special equipment and tested at the base.

During the late 1940's and early 1950's, all of the major industrial shops on base were located in Hanger 3 (Building 302). Army Air Operations Shop Facilities moved to their present location, Building 1079 in the North Area, in 1951. The Army Air Operations Directorate operates helicopters and fixed wing aircraft for the recovery of drones and missiles from the White Sands Missile Range. The 6585th Test Group Sled Construction and Maintenance shops prepare and maintain the drone aircraft used for target training, construct rocket sleds for the test track and in addition, these shops perform transient maintenance on Systems Command aircraft. As indicated above, most major industrial shops for aircraft maintenance were located in Hanger 3 in the main base area. Aircraft general maintenance was performed in Hanger 4 (Building 301). The aircraft washrack was located behind Hanger 4. Aircraft maintenance on aircraft stationed in the west area during the early 1950's (Building 868) was performed in the main base area until the late 1960's when separate industrial shops were established in the west area.

Current major industrial operations for the base include the aerospace ground equipment maintenance shops, flightline maintenance shops, allied trade shops, and corrosion control shops. These operations generate varying quantities of waste oils, hydraulic and transmission fluids, waste fuels (JP-4 and MOGAS), spent solvents and industrial cleaners.

The total quantity of waste oils, waste fuels, spent solvents and cleaners generated from the base is approximately 48,000 gallons per year and includes 28,000 gallons of waste oils and solvents and 20,000 gallons per year of waste fuels. Waste POL quantities generated prior to 1977 would have been less than current amounts due to the smaller number of aircraft assigned to the base although limited information was available on waste quantities. Based upon interviews with base personnel, relatively small amounts of the waste products were generated from the beginning of the base operations in 1943 through the mid 1960's. Quantities of waste products increased from the late 1960's through the late 1970's as current major base organizations (MOBSS, 479th TTW, 49th TFW) became operational at Holloman AFB.

Based upon information contained in shop files, the bioenvironmental engineer's records and interviews with base personnel, the following summary for past and present industrial waste management and disposal practices was developed.

Waste Oils and Solvents

- 1942 - 1965: The standard practice for disposal of waste oils and solvents was burning during fire department training exercises. Waste engine oils and lube oils, hydraulic and transmission fluids, and solvents were collected in drums by the various shop personnel and transported to the Fire Department Training Area (Disposal Area 31). The drums were stored until they were burned during scheduled training exercises. Some recycling and reuse was conducted during this time and some interviewees indicated that some dumping in the surrounding desert could also have occurred. However, Fire Department training was the primary method of disposal.

- 1965 - 1979: Waste engine oils and solvents were transported to the POL Drum Storage Site (Site No. 9). From there, the waste materials were either downgraded to a less critical use or removed off-base by a designated contractor. Some POL wastes were still used during fire department training exercises and some disposal of POL wastes on the ground and into the sanitary sewer also occurred.

- 1979 - Present: Holloman AFB Regulation 19-1 (HAFB 19-1) describes the present management requirements for waste POL materials including their collection, segregation, storage and disposal. Each shop is required to maintain a designated and clearly marked waste accumulation area. The collection containers are placed on concrete pads, are electrically grounded, and have closure devices to prevent the vaporization and/or entry of water or other mixtures not compatible with the product being collected. Waste engine oils, transmission fluids and hydraulic fluids are segregated from waste fuel and solvents and placed in specially colored drums. Accumulation of waste materials into any single drum is limited to 90 days. At that time the material is either (1) reused for its intended purpose if required specifications are met, (2) downgraded to a less critical use if possible, (3) reused for a secondary benefit or (4) transferred to the Defense Property Disposal Office (DPDO) for disposal action. The DPDO accepts accountability of the waste materials and, depending upon the types and quantities of wastes in question, may or may not take physical custody. Based upon field visits to the corrosion control shops, AGE and propulsion shops, the major base industrial operations appear to be in compliance with HAFB 19-1.

Waste Fuels

- 1942 - 1969: The majority of the waste fuels were also burned during fire department training exercises. The waste fuels were collected in bowsers, transferred to storage drums, and delivered to the fire training area (Site 31) for use during fire department training exercises.

- 1969 - 1979: Waste fuels were collected in bowsers and transferred to the 10,000-gallon underground storage tank located near Taxiway 4. The waste fuels from the storage tank were sold to contractors for reuse through the DPDO. Waste fuels were also used in fire department training sessions.

- 1979 - Present: Current handling procedures for waste fuel products are described in HAFB 19-1. Waste fuels are sampled and tested by the base fuels laboratory to determine if the fuels meet required specifications for reuse or if they are to be placed in the underground storage tank near Taxiway 4 for disposal through DPDO.

2. Industrial Operations

The industrial operations at Holloman AFB are predominantly associated with the maintenance and repair of the aircraft listed below:

- F-15 aircraft maintained by the 49th Tactical Fighter Wing in the West Base Area.
- T-38 aircraft maintained by the 479th Tactical Training Wing located in the Main Base Area.
- Aircraft and test sled equipment maintained by the 6585th Test Group in the North Area.
- Equipment and vehicles maintained by the 4449th Mobility Support Squadron in the West Base Area.
- Vehicles and equipment maintained by the 833rd Transportation Squadron and the 833rd Combat Support Group in the Main Base Area.

- o Helicopters and fixed wing aircraft maintained by the Army Air Operations Directorate in the North Area.

Appendix F contains a master list of the industrial operations.

A review of base records, shop visits, and interviews with past and present base personnel resulted in the identification of the operations in which the majority of the industrial chemicals are handled. Table 4 summarizes the major industrial operations and includes estimated quantities of wastes generated as well as past and present disposal practices for these wastes. Descriptions of the major industrial activities for Holloman are provided below.

a. <u>479th CRS Propulsion Shop</u>

The 479th CRS Propulsion Shop is located in Building 300. The shop is responsible for routine maintenance and checks on the J-85 (T-38) engines. These operations include the tear down and build-up of engines. Descaling compound (25 percent potassium hydroxide, 15 percent potassium gluconate, 15 percent monotriethanolamines) is contained in a 200 gallon tank. Parts that have been dipped into this tank are rinsed with the washwaters which are then discharged to the sanitary sewer. The shop utilizes 880 gallons per year of carbon removing compound (20 percent monoethanolamine and 10 percent butyl cellusolve). The shop also generates approximately 600 gallons per year of PD-680 and 400 gallons per year of lubricating oil. The lubricating oils and drums of the cleaners and solvents generated from draining and cleaning the tanks are stored in the area's accumulation point and subsequently transferred to DPDO. This shop has been in its current location since

Table 4
MAJOR INDUSTRIAL OPERATIONS SUMMARY

Organization/Shop Name	Present Location (Bldg. No.)	Waste Material	Current Estimated Waste Quantity	Treatment/Storage/Disposal Methods 1940–1980
479th CRS				
AGE	282	JP-4, MOGAS	1,300 gal/yr	Fire Dept. Training (1940–1950); Fire Dept. Training (1950–1960); Storage Tank No. 28[a] (1960–1979); DPDO (1979–)
		PD-680 Hydraulic Fluid Engine Oils Transmission Fluid Brake Fluid Cleaning Compound	700 gal/yr 660 gal/yr 600 gal/yr 200 gal/yr 600 gal/yr 200 gal/yr	Fire Dept. Training (1940–1950); Fire Dept. Training (1950–1965); Drum Storage[b] (1965–1979); DPDO (1979–)
Corrosion Control	308	Polyurethane Paint Paint Thinners Paint Strippers	100 gal/yr 300 gal/yr 480 gal/yr	Fire Dept. Training (1940–1950); Fire Dept. Training (1950–1965); Drum Storage[b] (1965–1979); DPDO (1979–)
Jet Propulsion	300	PD-680 Carbon Remover Compound Alkali Cleaning Compound Lubricating Oil	600 gal/yr 1,000 gal/yr 400 gal/yr 400 gal/yr	Fire Dept. Training (1940–1950); Fire Dept. Training (1950–1965); Drum Storage[b] (1965–1979); DPDO (1979–)
Inspection Section	500	PD-680 Engine Oil Hydraulic Fluid	1,500 gal/yr 200 gal/yr 350 gal/yr	Fire Dept. Training (1940–1950); Fire Dept. Training (1950–1965); Drum Storage[b] (1965–1979); DPDO (1979–)

[a]Shop personnel delivered waste fuels directly to storage tank No. 28 for subsequent service contract action.

[b]Shop personnel delivered drums to waste POL storage area for subsequent service contract action.

----assumed time frame.

Table 4--Continued

Organization/Shop Name	Present Location (Bldg. No.)	Waste Material	Current Estimated Waste Quantity	Treatment/Storage/Disposal Methods (1940 – 1950 – 1960 – 1970 – 1980)
833rd Transportation Squadron				
General Purpose Vehicle Maintenance	198	Engine Oils Hydraulic Fluid PD-680 Alkali Cleaning Compound Antifreeze	1,920 gal/yr 300 gal/yr 60 gal/yr 180 gal/yr 900 gal/yr	Fire Dept. Training → Fire Dept. Training → Drum Storage[b] → DPDO
Allied Trades	135	Paint Thinners PD-680	100 gal/yr 230 gal/yr	Fire Dept. Training → Fire Dept. Training → Drum Storage[b] → DPDO
833rd Civil Engineering				
Corrosion Control	55	Paint Thinners Lacquer Thinners	130 gal/yr 200 gal/yr	Fire Dept. Training → Fire Dept. Training → Drum Storage[b] → DPDO
Entomology Shop	21	Dilute rinse water	1,800 gal/yr	Septic Tank → Septic Tank → Septic Tank → Sewage Lagoons

[a]Shop personnel delivered waste fuels directly to storage tank No. 28 for subsequent service contract action.

[b]Shop personnel delivered drums to waste POL storage area for subsequent service contract action.

----assumed time frame.

Table 4--Continued

Organization/Shop Name	Present Location (Bldg. No.)	Waste Material	Current Estimated Waste Quantity	Treatment/Storage/Disposal Methods (1940–1980)
6585 Test Group				
AGE	1080	PD-680 Hydraulic Fluid Engine Oil	200 gal/yr 200 gal/yr 220 gal/yr	Fire Dept. Training → Drum Storage[b] → DPDO
		JP-4, MOGAS	1,300 gal/yr	Fire Dept. Training → Storage Tank No. 28[a] → DPDO
Corrosion Control	1178	Polyurethane Paint Paint Thinners PD-680	100 gal/yr 200 gal/yr 300 gal/yr	Fire Dept. Training → Drum Storage[b] → DPDO
4449th MOBSS				
Corrosion Control	901	Polyurethane Paint Paint Thinners	300 gal/yr 1,020 gal/yr	Drum Storage[b] → DPDO
Transportation	901	PD-680 Lube Oil Transmission Fluid	660 gal/yr 1,320 gal/yr 660 gal/yr	Drum Storage[b] → DPDO

[a]Shop personnel delivered waste fuels directly to storage tank No. 28 for subsequent service contract action.

[b]Shop personnel delivered drums to waste POL storage area for subsequent service contract action.

----assumed time frame.

Table 4--Continued

Organization/Shop Name	Present Location (Bldg. No.)	Waste Material	Current Estimated Waste Quantity	Treatment/Storage/Disposal Methods (1940–1980)
49th TFW				
Corrosion Control	809	Polyurethane Paint Lacquers PD-680 Naptha	200 gal/yr 460 gal/yr 1,980 gal/yr 270 gal/yr	Drum Storage[b] (ca. 1968–1979); DPDO (1979 →)
AGE	822	JP-4	1,000 gal/yr	Storage Tank No. 28[a] (ca. 1968–1979); DPDO (1979 →)
		Hydraulic Fluid Engine Oils PD-680	200 gal/yr 300 gal/yr 1,500 gal/yr	Drum Storage[b] (ca. 1968–1979); DPDO (1979 →)
Test Cell	809	Lube Oil PD-680 Grade 1010 Oil	2,640 gal/yr 660 gal/yr 1,320 gal/yr	Drum Storage[b] (ca. 1968–1979); DPDO (1979 →)

[a]Shop personnel delivered waste fuels directly to storage tank No. 28 for subsequent service contract action.

[b]Shop personnel delivered drums to waste POL storage area for subsequent service contract action.

----assumed time frame.

1978. Prior to that, it was located in the West Base Area for one year. Shop operations and the quantities and types of annual waste generation has been relatively constant since 1977. Prior to 1980, waste oils and solvents were transported in drums to the POL storage area (Site No. 9) for subsequent service contract action for off-base recycle or disposal.

b. 479th CRS Aerospace Ground Equipment (AGE) Shop

The 479th AGE Shop is located in Building 282. This section is responsible for the maintenance, servicing, and delivery of all powered and nonpowered aerospace ground equipment assigned to the 479th TTW. Operations involve inspection, disassembly, repair and replacement of AGE units and their component parts. The shop contains a PD-680 solvent dip tank which is drained and cleaned monthly. Approximately 700 gallons of waste PD-680 per year are collected at the area's accumulation point and transferred to DPDO. A total of 1,300 gallons/year of waste fuels (JP-4, MOGAS) are transferred to the underground storage tank near Taxiway 4. Spent hydraulic fluid (660 gallons per year) is collected and sent to DPDO. A total of 1,300 gallons of engine and lubricating oils are generated annually by the AGE Shop. Floor drain washings are collected in the shop's oil/water separator. The effluent from the separator discharges to the sanitary sewer. The 479th TTW AGE Shop has been in its present location since 1978 and prior to that it was located in the West Base Area for approximately one year. Shop operations and the quantities and types of wastes generated has been relatively constant since 1977. Prior to 1980, waste oils and solvents were transported in drums to the POL storage area (Site No. 9) for subsequent service contract action for off-base recycle or disposal.

c. <u>479th CRS Corrosion Control/Washrack</u>

The 479th CRS Corrosion Control Shop is located in Building 308. Stripping and priming is conducted at the T-38 washrack area near the flightline. Waste polyurethane paints, paint thinners, and strippers are collected in 55 gallons drums and placed in the area's waste accumulation point located near Building 308. These drums are then delivered to DPDO. Prior to 1980, waste oils and solvents were transported in drums to the POL storage area (Site No. 9) for subsequent service contract action for off-base recycle or disposal.

Approximately 880 gallons of these waste materials are generated annually by the shop. The present T-38 washrack was constructed in 1969. The drain was connected to an oil/water separator with the effluent discharged to the storm drain along Delaware Avenue. The flow from this stormwater drain eventually discharges into Lake Holloman. Connection of the oil water separator to the sanitary sewer was accomplished in December of 1980. Current refinishing procedures for T-38 aircraft at the washrack includes paint stripping with expoxy paint remover and aircraft skin etching with chromic compounds.

Approximately 3 aircraft are processed weekly at the washrack, resulting in an estimated weekly wastewater flow from the washrack of 2,400 gallons or 124,800 gallons annually.

d. <u>479th CRS Inspection Section</u>

The 479th CRS Inspection Section is located in Building 500. Personnel in this shop perform all scheduled maintenance inspections of T-38 aircraft. They inspect the aircraft for structural stress and repairs. They are also responsible for component replacement as required. The aircraft are disassembled, inspected, repaired and tested. Annual quantities of waste liquids transferred to DPDO from the shop include PD 680--1,500 gallons; Engine oil--200 gallons; and hydraulic fluid--350 gallons.

This shop has been in its present location since 1978 and before that was located in the West Base Area for one year. Since 1977, shop operations and the quantities and types of waste generated annually have been relatively constant. Prior to 1980, waste oils and solvents were transported in drums to the POL storage area (Site No. 9) for subsequent service contract action for off-base recycle or disposal.

e. <u>833rd Transportation Squadron--General Purpose Vehicle Maintenance</u>

The General Purpose Vehicle Maintenance Shop is located in Building 198. This shop is responsible for the maintenance, removal, repair and replacement of various components from general purpose vehicles, i.e., sedans, pickup trucks, etc. Servicing of vehicles consists of oil changes, radiator flushing and servicing, power steering and brake fluid refilling and draining. Waste liquids generated annually for delivery to DPDO include engine oil--1,920 gallons; PD 680--60 gallons; alkali cleaning compound--180 gallons; antifreeze--900 gallons; hydraulic fluid--300 gallons. The shop's rinsewaters flow to an oil/water separator and then into the sanitary sewer. Prior to 1980, waste oils and solvents were collected for service contract action for off-base recycle or disposal (1965-1979), and used in fire department training exercises (prior to 1965).

f. <u>833rd Transportation Squadron--Allied Trades</u>

Allied Trades Shop is located in Building 135. Painting and body work for cars, vans and trucks are accomplished in this shop. The shop contains a spray paint booth used for the spray finishing of the vehicles. The room is equipped with a water-wash exhaust system. The exhaust system is designed to draw the overspray toward the water-wash collection system. Periodically, the washwater and scum are disposed of into the sanitary sewer. PD-680 and paint thinners are stored in the area's waste materials accumulation point and subsequently transferred to the DPDO. Approximately 330 gallons of these liquids are generated annually by the shop. Shop operations and types and quantities of wastes generated increased from the late 1960's to the late 1970's as the current base organizations (49th TFW, 479th TTW) became assigned to Holloman. Allied Trades Shop operations have been relatively constant since 1978. Prior to 1980, waste oils and solvents were collected for service contract action for off-base recycle or disposal (1965-1979), and used in fire department training exercises (prior to 1965).

g. <u>833rd Civil Engineering Entomology Shop</u>

The Entomology shop is located in Building 21 in the Civil Engineering Complex. This shop provides for the bulk storage of the herbicides and pesticides utilized on the base. The weighing and mixing of the chemicals prior to application is also accomplished within this shop. Rinsewaters from the cleaning of the mixing equipment drains to a holding tank adjacent to the shop building. These rinsewaters are then periodically drained to the A and B Lagoons of the base wastewater treatment system. Rinsing of the spray equipment is accomplished at the application site. An estimated 1,800 gallons per year of rinsewater are transferred to the waste treatment lagoons.

The Entomology Shop has been in its present location since 1977. Prior to this, it was located in Building 67. Prior to construction of the rinsewater holding tank in 1980, all rinsewaters were discharged to a septic tank drainfield. Entomology operations vary seasonally. During the summertime there is a significant increase in the quantities of herbicides and other pesticides utilized to combat the increased growth rate of weeds and to reduce mosquito populations.

h. 833rd Civil Engineering Paint Shop

This shop is located in Building 55. This shop is responsible for the painting of all structural facilities on base. This includes the use of spray paints, thinners and brush painting. Examples include painting traffic lines/parking areas, and the painting of the insides and outsides of buildings. Shop personnel manufacture all base signs, posters and facility markings. The shop generates 330 gallons of waste paint and lacquer thinner annually. These materials are collected in 55 gallon drums and delivered to DPDO. Prior to 1980, waste thinners and solvents were collected for service contract action for off-base recycle or disposal (1965-1979), and used in fire department training exercises (prior to 1965).

i. 6585 Test Group AGE Shop

The 6585 Test Group AGE Shop is located in Building 1080. This shop is responsible for the maintenance, servicing, and delivery of all powered and non-powered AGE assigned to the test group. All rinsewaters from the shop drain into an oil/water separator. The shop annually generates 660 gallons of contaminated engine oil, PD-680, and hydraulic fluid. Also, 1,300 gallons of waste JP-4 are generated annually. These materials are collected in the area's waste materials accumulation point and delivered to the DPDO. Shop operations and types and quantities of wastes generated have been relatively constant since the early 1950's when the Test Group was assigned to Holloman AFB. Before 1980, waste JP-4 was transferred directly to storage tank 28 for service contract action for off-base recycle or disposal (1969-1979) and used in fire department training exercises (prior to 1969). Prior to 1980, waste oils and solvents were collected for service contract action for off-base recycle or disposal (1965-1969) and used in Fire Department Training exercises (prior to 1965).

j. 4449 MOBSS Corrosion Control Shop

The 4449 MOBSS Corrosion Control Shop is located in Building 901. The shop provides corrosion control capabilities for all War Readiness equipment. The shop uses no chemical strippers. Old paint removal is accomplished by sanding. Toluene is applied in small quantities to cloths for cleaning equipment surfaces. The used cloths are placed in a designated drum and disposed of in the Base sanitary landfill. The shop generates and transfers to DPDO 1,320 gallons per year of polyurethane paints and paint thinner wastes.

The MOBSS Corrosion Control Shop has been located in Building 901 since 1976. From 1972 (when MOBSS was assigned to Holloman) to 1976, the Shop was located in the West Base Area. Shop operations have been relatively constant since 1972. Prior to 1980, waste oils and solvents were collected for service contract action for off-base recycle or disposal.

k. 4449 MOBSS Transportation

This shop is located in Building 901. The MOBSS Transportation shop has been located in Building 901 since 1976 and in the West Base Area from 1972-1976. This section is responsible for all vehicle maintenance associated with the 4449 MOBSS war readiness fleet. This consists of tune-ups, component replacement and other minor repairs. The section performs only minor welding and body work and limited spray painting. The shop generates waste lube oil--1,320 gallons per year; PD 680--660 gallons per year; and transmission fluid--660 gallons per year. Disposal of these items is conducted through DPDO. Prior to 1980, waste oils and solvents were transported in drums to the POL storage area (Site No. 9) for subsequent service contract action for off-base recycle or disposal.

l. 49th TFW, EMS Corrosion Control Shop

The 49th EMS corrosion control shop is located in Building 809. The shop repaints 49th TFW aircraft and AGE equipment. In addition, the shop sands fiberglass radar domes prior to painting. This shop also manages the 49th TFW aircraft washrack. The shop generates and turns into DPDO 1,980 gallons of waste PD-680 annually, 660 gallons of waste polyurethane paint, paint thinners, and lacquers annually, and 270 gallons of waste naptha per year. Prior to 1980, waste oils and solvents were collected for service contract action for off-base recycle or disposal (1965-1979), and used in fire department training exercises (prior to 1965). For one year (1977-1978) the shop was located in the Main Base Area. From 1978 the shop has been in its present location. The rinsewaters from the operations are being discharged to the oil/water separator, located across the street from the washrack area, that discharges into the sanitary sewer system. Shop operations, types and quantities of wastes generated have been relatively constant since 1977.

m. 49th TFW EMS Aerospace Ground Equipment

The AGE Shop is located in Building 822. This shop repairs, delivers and services all AGE (powered and non-powered). This consists of component replacement, service and delivery of equipment to maintenance personnel. The shop performs a small amount of touch-up painting using aerosol spray paints. The shop generates 1,500 gallons of waste PD-680 annually, 500 gallons of engine and lube oils per year, and 1,000 gallons of waste JP-4 fuel per year. The shop was located in the Main Base Area for one year (1977-1978). It has been in its present location since 1978. Since the 49th TFW has been assigned to Holloman AFB, the shop has handled a relatively constant amount of annual repair work and consequently types of wastes and quantities generated annually have been constant. Prior to 1980, waste oils, fuels and solvents were collected for service contract action for off-base recycle or disposal.

n. 49th TFW CRS Test Cell

The 49th CRS Test Cell Shop is located in Building 809. The shop is responsible for repairing and troubleshooting F-100 (F-15 fighter jets) engines. The engine must be operated at different power levels to make operational checks. Annual quantities of waste materials generated include jet lube oil - 2,640 gallons; PD-680-- 660 gallons; grade 1010 oil--1,320 gallons. All waste materials are accumulated for delivery to DPDO. Prior to 1980, waste oils and solvents were collected for service contract action for off-base recycle or disposal. The shop has been located in the same location since the 49th TFW was assigned to Holloman.

o. 6585th Test Group Corrosion Control

The 6585th Test Group Corrosion Control Shop is located in Building 1178. This shop is responsible for the painting, priming, and paint stripping of drone aircraft utilized for jet fighter (F-15) target practice. Approximately 660 gallons per year of waste paint thinners, polyurethane paint and PD-680 are generated by the shop. Waste materials are currently collected in drums and transferred to DPDO for disposition. Prior to 1980, waste oils and solvents were collected for service contract action for off-base recycle or disposal (1965-1979), and used in fire department training exercises (prior to 1965).

3. Fuels

Fuel and other petroleum products are received at Holloman AFB and stored in the POL area located at the northwest end of Delaware Avenue. Bulk storage facilities for JP-4 receive fuel by pipeline, railcar, or by commercial tank truck. Distribution of fuel to using facilities onbase is by Air Force tank truck. The main JP-4 storage tanks are aboveground and the major underground fuel lines have cathodic protection. Numerous tanks are located at various areas throughout the base for storage of diesel fuel, heating oil, and MOGAS. An inventory of major POL storage tanks is given in Appendix G. The main fuel storage tanks at the POL area are leak tested annually.

Unconventional liquid fuels used in test sled launching are stored in a separate isolated fuels area known as the 49 Supply LOX area. The LOX area has a liquid oxygen storage capacity of 9,000 gallons, and a liquid nitrogen storage capacity of 8,000 gallons. Liquid rocket propellants currently stored include unsymmetrical dimethylhydrazine (UDMH) in drums and inhibited red fuming nitric acid in 3,000 gallon trailer units.

The main fuel storage tanks in the POL area are inspected every 5 years for sludge accumulation and cleaned if necessary. When cleaned in the past, the bottom sludge, consisting of small quantities of rust, sediment, and water with some residual fuel, was buried in a location outside the POL fenced area (Site No. 3). Some of the sludge in the past came from AVGAS storage tanks. Soil samples were taken at this site and found to contain extractable lead, as measured by the EP toxicity test, within acceptable EPA standards.

Waste JP-4 from aircraft wing tanks is collected in bowsers and transported to a 10,000 gallon underground storage tank (Tank 28) and sold through the Defense Property Disposal Office (DPDO). This practice has been followed since the late 1960's. Waste oils and solvents are accumulated in drums and then transported to the DPDO storage yard for final disposition. In the past, mid 1960's until 1979, the waste oil and solvent drums were stored outside on the ground in a central storage area (Site No. 9) until sold for BTU value. Many spills and leaks have occurred in this area in the past (Site No. 9).

In 1981, an inventory discrepancy of MOGAS at the BX service station led to the discovery that a substantial amount of MOGAS was being lost (Site No. 17). It was subsequently discovered that the fuel was being lost through a corroded underground fuel line. Fuel loss is estimated to be between 100,000 - 150,000 gallons. Numerous test holes were drilled to determine the extent of the MOGAS plume and an unsuccessful attempt was made to recover the gasoline. Most of the gasoline is still floating on the groundwater beneath the BX service station and vicinity. Occasional gasoline odors have been noted in the BX service station and in a sewage pump station located across the street near the base hospital.

Several fuel spill incidents were reported by the interviewees. One of the large bulk JP-4 storage tanks overtopped about 2 years ago filling the tank dike area with fuel (Site No. 2). It is estimated that as much as 30,000 gallons of JP-4 was spilled, most of which was recovered. Periodic overtopping was also reported at the location of fourteen above-ground 25,000-gallon JP-4 storage tanks (now removed) in the POL area (Site No. 5). Approximately 8,000 gallons of JP-4 was spilled from a ruptured fuel line on the south side of the POL area fence (Site No. 6). This occurred in 1979 and most of the fuel was recovered. Another spill occurred near the base housing area in the mid 1970's when a blown fuel line sleeve resulted in about 2,000 gallons of JP-4 being spilled on the ground (Site No. 12). Most of the spilled fuel was recovered. Small quantities of unconventional fuel spills have also been reported at the test sled launch area (Site No. 39), at the unconventional fuels mixing and storage area (Site No. 36) at a past Navy missile test facility (Site No. 26) and at a past test sled launch area (Site No. 41).

An offbase JP-4 storage tank owned by a private contractor has leaked fuel into the ground water downgradient of the Boles Well Field area. Even though the contamination is downgradient of the well field, it may still pose a threat to the Boles water supply wells.

Due to the corrosive nature of the soils in the Holloman AFB area, potential corrosion of underground POL storage tanks is a major concern and major tanks are inspected and leak tested regularly.

4. <u>Fire Department Training Activities</u>

Fire department training activities have been common at Holloman AFB since 1942. Prior to 1979, waste fuels and some waste oils and solvents were routinely transported in drums to the fire department training area for use in the exercises. Since 1979, only new JP-4 fuel has been used in the exercises. A 5,000 gallon underground steel tank encased in concrete was installed at that time to store the JP-4. Fire department training exercises have always been conducted in the same general area as the existing fire department training area (Site No. 31) which is located just east of the skeet range. An oil/water separator was also installed in 1979 for pretreatment of fire training area runoff. The training exercises have always been conducted in cleared, circular, earthern-bermed areas using mock aircraft. Fire trenches were also in use during the 1950's and 1960's.

In the past, the exercises were conducted about once per month using 1,800-2,700 gallons of waste POL per exercise. Currently the exercises are conducted about twice every 3 months using about 2,500 gallons of JP-4 per exercise. Prior to 1965, protein foam and water were predominantly used to extinguish the fires. Since 1965, an agent referred to as "Aqueous Film-Forming Foam" (AFFF) has been used in major fire department training exercises. AFFF is a non-corrosive, biodegradable, fluorocarbon substance with foam stabilizers. Common practice has been to pre-saturate the fire training area with water. The POL wastes were then poured onto a mock aircraft just prior to the exercises and burned. Further discussion of the Fire Department Training Area is given in Section IV.B.

5. Polychlorinated Biphenyls (PCBs)

The main potential source of PCBs at the Holloman AFB is electrical transformers. There are about 1,000 in-service transformers at Holloman AFB. A program is underway to sample in-service transformers for PCB content. Transformers which are identified as PCB items will be properly labelled, inspected, and properly stored and disposed of when taken out of service.

Currently, thirty-three out-of-service electrical transformers are stored in ABLE 51 (former drone launch building) awaiting laboratory results for PCB content. Presumptive flame tests indicate that the PCB content of all of these stored transformers is less than 5 percent. If laboratory results show that any of the transformers contain regulated PCB concentrations, the Defense Property Disposal Office (DPDO) will take accountability for the final disposition of these items. The procedure of routinely testing out-of-service transformers for PCB content and DPDO accountability for PCB items has been in effect since 1979. Prior to this time, out-of-service transformers were sold for salvage. Until recently (1983) out-of-service transformers were stored at the Atlas substation and at various accumulation points on-base while awaiting final disposition.

Interviews with knowledgeable base personnel indicated that transformer oil from the large oil circuit breaker (OCB) transformers at the four electrical substations was periodically drained on the ground and changed in the past. From the mid 1950's until 1979, the oil in the OCB transformers was routinely checked every 5 years and if necessary, replaced with new transformer oil. The old oil was drained on the ground at two locations: the main base electrical substation (Site No. 11) and the Atlas electrical substation (Site No. 43). In 1979, soil samples were collected in oil stained areas where transformer oil dumping occurred. Results showed that the soils did not contain PCBs.

There are no records or oral reports of any major PCB spills from leaking or blown transformers or during handling of any PCB materials. There were no reports or indications of out-of-service transformers or capacitors being disposed of in base landfills in the past.

6. Pesticides

Pesticides are commonly used at Holloman AFB for weed and pest control. Pesticides have been stored in the Entomology Shop (Building 21) since 1977. From 1968 until 1977, the Entomology Shop was located in Building 67 in the Civil Engineering yard. Prior to 1968, the Entomology Shop was located in the old Building 59 (no longer existing) which was near Building 66. The major pesticides used during 1982 for control of roaches, ants, termites, and mosquitos and other pests included Sevin (273 lb), Diazinon (51 lb), and Malathion (256 lb). The major herbicides used during 1982 for control of mixed weeds and grasses included Bromacil (148 lb), Monuron (141 lb) and Ouncmherb (162 lb). Overall pesticide usage at Holloman AFB is small relative to other Air Force installations. Proper pesticide preparation and application procedures are followed. Empty pesticides containers are triple rinsed, punctured with holes, and disposed of in the base landfill. In general, pesticides were consumed in use in the past and there were no reports or indications of large quantities of pesticides disposed of in landfills or burial sites.

Small quantities of outdated pesticides that were stockpiled by 4449 MOBSS were disposed of in 1978. Malathion liquid (185 gallons) and Diazinon liquid (287 gallons) were neutralized with lime and soapy water and then disposed of in a trench (Site No. 23). This disposal was accomplished in accordance with existing EPA guidelines, EPA-620/2-75-057, June 1975. Small quantities of additional pesticides including pyrethrum liquid (6 gallons), calcium cyanide (3 lb) and Lindane (4 gallons) were also disposed of in the sanitary landfill (Site No. 1).

It is suspected that some soil contamination may have resulted from the washdown of pesticide application equipment in the past at the former Entomology Shop location (Building 67). A composite soil sample was collected in 1977 and analyzed for pesticides. The soil was sampled at a depth of about 3 inches approximately 20 feet from the stored pesticide containers. The results showed the presence of low levels (1 to 20 parts per million) of Diazinon, Lindane, Heptachlor, DDT, DDE, Dieldrin and Delta BHC. Malathion was also present at a much higher level (11.5 grams/kilogram of soil). A written memorandum found in the base records indicated that the affected area was treated in place with lime and activated carbon (Site No. 14). Normal procedure was to use the CE washrack to clean pesticide application equipment with rinsings discharged to the sanitary sewer.

In 1979, eighty-three 30-gallon containers of sodium arsenite (Agent Blue) solution were stored in an excavated depression located at the northeast corner of the

833rd CSG Civil Engineering Yard (Site No. 13). The herbicide was to be used to sterilize the ground beneath a proposed runway construction area. The runway construction project decreased in scope and excess containers of the sodium arsenite herbicide were subsequently shipped to Pine Bluff Arsenal, Arkansas. During storage, some seepage of herbicide solution was noted around the bungholes of some of the containers. One of the stored containers was found to be empty and had a hole in the container bottom. It is possible that the contents of this container leaked out into the earthen storage area. Estimated quantities of sodium arsenite solution leaked or spilled on the ground range from 2 to 30 gallons. A memo found in the base records recommended that, after removal of the containers, the earthen storage area be excavated to a depth of 2 ft and buried beneath the runway construction. It is not known if this procedure was carried out.

Washwater from rinsing of pesticide application equipment at the existing Entomology Shop (Building 21) was discharged to a drain/leach field in the past. Prior to discharge to the leach field, the washwater was retained in a holding tank and then neutralized with lime or caustic soda. A sewer line break subsequently occurred after the holding tank and the pesticide washwater exfiltrated onto the area around the break forming a pit (Site No. 16).

Currently, all washwater is contained in the holding tank which is periodically pumped out by a tanker truck which takes the contents to the sewage lagoons for treatment. All pesticides in current use are biodegradable. Section IV.B. of this report gives a further discussion of pesticide disposal and spill sites.

7. Wastewater Treatment

The combined sanitary and industrial wastewater from Holloman AFB is treated in a 5-celled, 86-acre facultative lagoon system. The first two cells have mechanical surface aeration to help maintain an aerobic top zone. These two cells operate in parallel and receive the raw wastewater after primary screening, comminution, and grit removal. The partially treated wastewater flows from these two cells into the remaining three cells which are operated in series. These three cells do not have mechanically assisted aeration. The treated effluent flows to Lake Holloman, a 166-acre lagoon formed by a constructed dam across a natural playa. Lake Holloman is recharged primarily by the treated wastewater effluent.

The industrial contribution to the total wastewater flow is small and originates primarily from aircraft maintenance operations. Influent wastewater characteristics are typical of weak strength domestic wastewater. A description of the lagoon system is given below:

Designation	Area (acres)	Depth (ft)	Volume (Million Gallons)	Year Constructed
A	10.6	5.2	18	1943
B	11.4	5.2	19	1943
C	15.1	5.0	25	1955
E	9.6	5.2	16	1955
G	39.75	5.0	65	1970
Total	86.45	--	143	--

Mechanical surface aerators were added to Lagoons A and B in 1976 to correct previous oxygen depletion problems during hot weather conditions. Final effluent disposal is by evaporation from the surface of the lagoons and Lake Holloman. An Air Force study conducted in 1975 by Bryant concluded that, based on lagoon influent and effluent flow measurements during winter conditions when the evaporation rate is low, the lagoon bottoms have self-sealed and very little percolation into the groundwater is occurring. During wintertime conditions when evaporation is low, Lake Holloman occasionally overflows the dam spillway and forms a temporary lagoon between the spillway and US Highway 70. During the summer months, this area is a major source of offensive odors generated primarily as the result of algae die-off and decomposition when the area begins to dry due to high evaporation rates. Holloman AFB is in the process of repairing the dam spillway and has recently completed construction of a 69-acre spray irrigation system to dispose of excess Lake Holloman water during periods of low evaporation. These actions will hopefully eliminate any major future flows (and subsequent odor problems) to the area adjacent to Lake Holloman. The screenings removed by the bar rack and grit removed by the grit chamber are landfilled in a nearby trench (Site No. 20). In the past, several incidents of bird mortality (primarily ducks) have occurred due to botulism. This was a result of anaerobic conditions in the lagoons during extreme hot weather which resulted in the profileration of the anaerobic bacteria Clastridium botulinum in the lagoons. This situation is not unique to Holloman AFB and has occurred periodically throughout the Southwest. No incidents of bird kills have occurred at the lagoons since the installation of the aerators in 1976. The Holloman AFB wastewater treatment plant discharge is not regulated by state or federal regulatory agencies, since the effluent does not discharge to a navigable water as defined by by EPA, or to a natural water course as defined by the New Mexico Water Quality Control Commission.

The original wastewater treatment system included five Imhoff tanks operated in parallel with the effluent discharged to the lagoon treatment system. Sludge from the Imhoff tanks was dewatered on drying beds and then used around the base as a soil conditioner. The Imhoff tanks were discontinued in the early 1970s.

Recent operating records show that average daily flows range from 2.0 to 3.0 million gallons per day (mgd). Periodic overtopping of the lagoons has been a problem in winter months during periods of low evaporation and high rainfall.

A recent investigation by base staff identified the presence of raw sewage, probably from a cross connection, in the New Mexico Avenue storm drain. This problem has been corrected; however, due to the corrosive nature of the soils at Holloman AFB, similar problems may occur at other locations in the future.

Because the soils in the Holloman AFB area are corrosive, there have been numerous corrosion problems with steel and concrete sewer lines. The base is converting to plastic sewer lines whenever possible. In particular, a section of sewer line serving the primate research and quarantine areas had collapsed in the 1970's resulting in sewage from these research facilities exfiltrating into the surrounding area (Site No. 32). The collapsed sewer lines were replaced with plastic pipe in 1980.

The base performs routine testing of the wastewater treatment system. Dissolved oxygen and pH are measured daily in all lagoons and in Lake Holloman. In addition, chemical oxygen demand, nitrate, phosphate, suspended solids and fecal coliform bacteria counts are conducted 2 to 3 times per month on the wastewater lagoon system influent, effluent, and Lake Holloman. Inspection of recent operating reports indicates the presence of good dissolved oxygen levels in the lagoons and good treatment performance by the lagoon system. Special analyses have also been conducted periodically for heavy metals and pesticides. These results are discussed in Section IV.A.8 "Available Water Quality Data."

There are 11 oil/water separators connected to the sanitary sewer system which provide pretreatment to various industrial shop discharges. An inventory of oil/water separators is given in Appendix H. Most of these oil/water separator pretreatment facilities were installed in the 1970's. Currently, each generating facility is responsible for periodically inspecting and cleaning the oil/water separators. When cleaned, the accumulated oil is hand dipped from the unit and placed in 55-gallon drums. The drums are transferred to DPDO for final disposition. In the past, the oil/water separators were cleaned by a contractor. The contents were placed in drums and sent to a waste POL drum storage area for subsequent service contract action. Numerous spills have occurred in this drum storage area in the past (Site No. 9 - see Section IV.B for further discussions).

There are also numerous septic tanks in use throughout the base. Some of these septic tanks are suspected of having received industrial wastes in the past (Sites No. 8, 15, 24, and 38 - see Section IV.B. for further discussions).

8. Available Water Quality Data

Potable water for Holloman AFB is obtained from two sources: surface water from Bonita Lake, and ground water from wells located on the western slope of the Sacramento Mountains. The water from Bonita Lake, equally owned by the Air Force and the City of Alamogordo, is transported to the City water treatment plant by an Air Force owned pipeline. Water treatment at the city's plant consists of filtration and chlorination. Ground water is obtained from three well fields: Boles Wells (9 wells, government owned), San Andres Wells (6 wells, government owned) and Douglas Wells (6 wells, government leased). All water, both from the city and from the wells is piped to Holloman AFB in a single 16-inch pipeline. The water is chlorinated and fluoridated at the base prior to distribution. The base water distribution system is sampled routinely for bacteriological quality. Results show that the water is free from bacterial contamination. The water entering the base and composite samples from the individual well fields are analyzed annually for primary drinking water standards. The results show that the water onbase and from the well fields does not have detectable levels of primary drinking water standard heavy metals and pesticides. Additional results show that the water does not contain detectable concentrations of cyanide, phenols or trichloroethylene (TCE). Radioactivity analyses show that the water meets primary drinking water standards for radioactivity. The water is naturally high in total dissolved solids (600-1,000 mg/l) and in sulfate (250-725 mg/l).

Wastewater treatment system influent, treatment lagoon effluent and Lake Holloman are analyzed periodically for heavy metals, pesticides, phenols, cyanide and oil and grease. A review of past results shows that the above parameters are either absent or if detected, present at very low concentrations.

A limnological study of Lake Holloman was completed by New Mexico State University in 1980 and included chemical testing of water, phytoplankton, benthic algae, zooplankton, sediments, bottom macroinvertebrates, and bird tissue. Chemical analyses included heavy metals, chlorinated hydrocarbons, and gross radiation. No chlorinated hydrocarbons were detected in any of the samples. Radiation was either very low or absent. Total cadmium, chromium, nickel and lead were present in some of the sediment and algae samples at low concentrations which are not considered harmful.

A detailed hazardous waste evaluation of the wastewater treatment system was conducted by Sprester in 1982. Composite wastewater and bottom sediment samples were collected from each of the five treatment lagoons and Lake Holloman and analyzed for heavy metals and pesticides. EPA approved sample collection, chain of custody and test methods were used in the evaluation. Bottom sediment samples, subjected to EP toxicity testing, were negative for heavy metals and pesticides. Some low concentrations of heavy metals and pesticides, well within EPA standards, were found in the wastewater samples. The highest value found was total chromium in the wastewater influent which averaged 0.055 mg/l (well below EPA standard of 5 mg/l). Hexavelent chromium was not detected in any of the samples.

Some sampling is conducted periodically on the flight line storm drainage ditch and on Lost River. Analyses include heavy metals, pesticides, cyanide, phenol, and oil and grease. A review of past testing results shows that the above constituents were either absent or if detected, present at low concentrations.

A special sampling was conducted by Sprester in 1977 on a small pond and on Lost River Arroyo in the vicinity of the 6585 Test Group Test Track Facility. The purpose of the sampling was to obtain information on the quality of the ground water in this area. Total dissolved solids content exceeded 10,000 mg/l and, therefore, the water is not regulated by the State of New Mexico. An atomic absorption heavy metals scan showed the presence of low concentrations of chromium in the pond sample and low concentrations cadmium, lead, and silver in the Lost River sample.

Soil sampling has been conducted (1980, 1982, and 1983) at the POL tank sludge burial site (Site No. 3). Sludge from the cleaning of POL tanks was routinely buried at this location in the past. The results show that, although the total lead content of the subsurface soil in this area is high, the extractable lead as determined from the EP toxicity test is low (0.5 mg/l) and within acceptable EPA standards (5 mg/l).

Soil sampling was conducted in 1982 at the Radioactive Material Burial Site (Site No. 42). The soil samples were taken from small animal burrows around the concrete slab marking the site location. The results showed that radioactive constituents in the soil were within normal environmental limits for Holloman AFB.

Soil sampling was conducted in 1976 at the sump in the Pad 9 Washrack Area (Site No. 27). The washrack was used to wash drones and manned aircraft that had flown through clouds of nuclear blasts in the late 1940's and early 1950's. Radiation in the soil samples was at background levels.

Soil sampling was conducted in 1983 near Building 281 at the Chromic Acid Spill Site (Site No. 18). Chromium plating operations were conducted at Building 281 in the past. When chromium plating operations were discontinued in the late 1970's, the contents of vats containing chromic acid were dumped on the ground. Soil samples were collected in the yellow-stained ground area where the spill occurred. EP toxicity test results showed the presence of low concentrations of hexavelent chromium (0.6 mg/l) within acceptable EPA standards (5 mg/l).

Soil sampling was conducted in the unconventional fuels mixing and storage area, also known was the LOX area (Site No. 36). In 1979, soil samples were collected on the ground surfaces outside buildings 1191 and 1192 where fuel spills were suspected of having occurred in the past. The samples were analyzed for unsymmetrical dimethylhydrazine (UDMH) rocket fuel and the results were negative. In 1981, soil samples were collected in pits outside Buildings 1191 and 1192 which receive runoff from fuel storage areas, including small quantities of spilled and waste fuels. The samples were analyzed for hydrazine, fluoride, analine and nitrate and the results were negative.

Water samples were collected in 1978 at a small pond in Lost River Arroyo near Building 1176 and the rocket sled buildup area (Site No. 39). Vented rocket fuels from test sled fueling operations have drained to this small pond in the past. The water samples were analyzed for hydrazine, UDMH, JP-4, and nitrate. Results were negative for hydrazine, UDMH and JP-4, while nitrate was present at low concentrations (1.2 - 12 mg/l).

Soil sampling has also been conducted onbase for pesticides and PCB's. The results have been discussed in the preceding sections IV.A.5 and IV.A.6 of this report.

9. Other Activities

The review of the records and information obtained during the interviews produced no evidence of the past or present storage, disposal, or handling of biological or chemical warfare agents at Holloman AFB.

Some small scale explosive ordnance disposal (EOD) activities are conducted at Holloman AFB. Burn pits and a burn kettle facility are located in an area north of the munitions storage area (Site No. 34). Small items such as small arms rounds, survival flares, aircraft egress cartridges and impulse cartridges are deactivated in the burn pits. When full, the inert residue in the burn pits is covered with 8 feet of soil and a new burn pit is excavated. The burn kettle is used for proficiency training or deactivation of outdated small arms munitions. Inert residue from the Oscura Range, located 4 miles north of Holloman AFB, is occasionally transported to Holloman AFB for disposal in burial trenches. The residue comes from concrete filled practice bombs, solid cast metal bombs and missile engine residues which are collected during periodic range clearance operations.

A unique activity conducted at Holloman AFB is primate research. This activity began in the early 1960's when the Air Force performed behavioral studies on the first chimpanzees used in early space flights. Since then, the operation of the primate research facilities has been transferred to private institutions including Albany Medical College from 1971 - 1980, and New Mexico State University since 1980. Primate research activities conducted in the past include cancer risk, drug therapy, disease studies and the evaluation of automobile safety devices. The main research buildings are located southwest of the munitions storage area. A quarantine area, used to isolate newly acquired animals and, periodically, to conduct disease studies, is located in an isolated area south of the main research area. Pathological tissues from research studies are incinerated, bagged and sent to the main base landfill for disposal (Site No. 1). Animal wastes are normally discharged to the sanitary sewage system. An exception is when disease studies are conducted in the quarantine area during which time the animal wastes are collected, bagged, and sent to the main base landfill for disposal. Other waste items such as vials, syringes, and gowns are also sent to the main base landfill for disposal. Small quantities (20 - 70 gallons/year) of waste laboratory solvents, including xylene, methanol, toluene and acetone are evaporated in sand filled drums behind the main research area. Small quantities of radioactive tracers including iodine 125, carbon 14 and tritium are used in some of the studies. Waste tracers and some waste solvents in small quantities are diluted and discharged to the sanitary sewer. The past break in the sewer line serving the primate research areas resulted in exfiltration of waste material into the surrounding area (Site No. 32). There was also a verbal report, unconfirmed, that some solvents containing radioactive tracers may have been disposed of in the past on the ground behind the main research area (Site No. 35).

The records search indicated that only small quantities of trichloroethylene (TCE) are currently being used at Holloman AFB for cleaning of liquid oxygen survival equipment. The TCE is consumed in use. There was no indication that TCE was used in large quantities in the past. Most TCE usage has been replaced by 1,1,1-trichloroethane.

B. DISPOSAL SITES IDENTIFICATION AND EVALUATION

Interviews conducted with 54 past and present base personnel (Appendix C), 1/3 of which had 20 or more years at Holloman AFB, resulted in the identification of 43 disposal and spill sites at Holloman AFB. A preliminary screening was performed on all the identified sites based on the information obtained from the interviews and available records from the base and outside agencies. Using the decision tree process described in the Methodology section, a determination was made whether a potential exists for hazardous material contamination in any of the identified sites. For those sites where hazardous material contamination was considered significant, a determination was made whether significant potential exists for contaminant migration from these sites. These sites were then rated using the U.S. Air Force Hazard Assessment Rating Methodology (HARM), which was developed jointly by the Air Force, CH2M HILL, and Engineering-Science for specific application to the Air Force Installation Restoration Program. The HARM system considers four aspects of the hazard posed by a specific site: (1) the receptors of the contamination, (2) the waste and its characteristics, (3) potential pathways for waste contaminant migration, and (4) any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating. A more detailed description of the HARM system is included in Appendix I. A total of 43 disposal and spill sites were identified at Holloman AFB. Of these, a total of 34 were rated using the HARM rating system. A complete listing of all sites including potential hazards is given in Table 5. Copies of the completed rating

Table 5
LISPOSAL AND SPILL SITES SUMMARY

Site No.	Site Description	Hazard Potential Contamination	Hazard Potential Migration	Rating
1	Existing Main Base Landfill	Yes	Yes	Yes
2	POL Area Spill Site No. 1	Yes	Yes	Yes
3	POL Tank Sludge Burial Site	Yes	Yes	Yes
4	Acid Trailer Burial Site	No	No	No
5	POL Area Spill Site No. 2	Yes	Yes	Yes
6	Fuel Line Spill Site	Yes	Yes	Yes
7	Rubble Diposal Site	No	No	No
8	Refuse Collection Truck Washrack	Yes	Yes	Yes
9	Waste POL Drum Storage/Spill Area	Yes	Yes	Yes
10	Old Main Base Landfill	Yes	Yes	Yes
11	Main Base Electrical Substation	No	No	No
12	Fuel Line Spill Site	Yes	Yes	Yes
13	Sodium Arsenite Spill Site	Yes	Yes	Yes
14	Former Entomology Shop Area	Yes	Yes	Yes
15	Refrigeration/Heat Shop Washrack	Yes	Yes	Yes
16	Existing Entomology Shop Area	Yes	Yes	Yes
17	BX Service Station Fuel Leak Area	Yes	Yes	Yes
18	Chromic Acid Spill Site	Yes	Yes	Yes

Table 5--continued

Site No.	Site Description	Potential Hazard		Rating
		Contamination	Migration	
19	Golf Course Landfill	Yes	Yes	Yes
20	Wastewater Treatment Plant Grit Burial Site	Yes	Yes	Yes
21	West Area Landfill No. 2	Yes	Yes	Yes
22	West Area Landfill No. 1	Yes	Yes	Yes
23	MOBSS Landfill	Yes	Yes	Yes
24	Former Equipment Maintenance Area	Yes	Yes	Yes
25	Possible Drainage Lagoon Disposal Site	Yes	Yes	Yes
26	Possible Missile Fuel Spill Site	Yes	Yes	Yes
27	Pad 9 Washrack Area	Yes	Yes	Yes
28	Former North Area Washrack Site	Yes	Yes	Yes
29	Army Landfill	No	No	No
30	Grease Trap Disposal Pits	Yes	Yes	Yes
31	Fire Department Training Area	Yes	Yes	Yes
32	Collapsed Sewer Lines from Primate Research	Yes	Yes	Yes
33	Cooking Grease Disposal Trenches	No	No	No
34	Spent Munitions Burial Site	No	No	No
35	Spent Solvent Disposal Area	Yes	Yes	Yes
36	Unconventional Fuels Area Spill Site	Yes	Yes	Yes
37	Early Missile Testing Site	Yes	Yes	Yes
38	Sled Test Maintenance Area	Yes	Yes	Yes
39	Missile Fuel Spill Area	Yes	Yes	Yes
40	Causeway Rubble Disposal Site	No	No	No
41	Coco Block House Bore Hole Disposal Site	Yes	Yes	Yes
42	Radioactive Material Burial Site	No	No	No
43	Atlas Electrical Substation	No	No	No

forms are included in Appendix J, and a summary of the site ratings is given in Table 6.

Site Ratings

A description of each site, including a brief discussion of the rating, is presented below. Approximate locations of the sites are shown in Figures 12 and 13, pages IV-42 and IV-43. Approximate dates of major disposal and spill sites are provided in Figure 14, page IV-44.

The receptors varied only slightly for all of the disposal and spill sites, ranging from a low of 3 to a high of 22. The main factors influencing the receptors subscore were population density and distance to the reservation boundary. The receptors subscore was low for all sites because there were no critical environments located within a one mile radius of any of the sites and the ground-water beneath the base is non-potable (greater than 10,000 mg/l of TDS).

1. Landfills

a. Site No. 1--Existing Main Base Landfill

The Existing Main Base Landfill (overall score of 47) has been in operation from 1958 to the present. The landfill utilizes the trench and fill disposal method and is operated by a private contractor. The contractor is also responsible for refuse pickup. The entire fenced area designated for the landfill is 160 acres. The landfill is located east of the fire department training area and north of the POL stoiage area. The landfill receives domestic solid waste and non-toxic, non-hazardous solid waste materials from the industrial shops. Small quantities of

Table 6
SUMMARY OF DISPOSAL AND SPILL SITES RATINGS

Site No.	Site Description	Subscore (% of Maximum Possible Score in Each Category)			Factor for Waste Management Practices	Overall Score	Page Reference of Site Rating Form
		Receptors	Waste Characteristics	Pathways			
1	Existing Main Base Landfill	17	60	65	1.0	47	J-1
2	POL Area Spill Site No. 1	19	48	57	.95	39	J-3
3	POL Tank Sludge Burial Site	22	45	48	1.0	38	J-5
5	POL Area Spill Site No. 2	19	48	57	.95	39	J-7
6	Fuel Line Spill Site	19	48	57	.95	39	J-9
8	Refuse Collection Truck Washrack	14	60	54	1.0	43	J-11
9	Waste POL Drum Storage/Spill Area	17	60	50	1.0	42	J-13
10	Old Main Base Landfill	18	40	57	1.0	38	J-15
12	Fuel Line Spill Site	22	48	57	.95	40	J-17
13	Sodium Arsenite Spill Site	18	60	57	1.0	45	J-19
14	Former Entomology Shop Area	18	60	57	.95	43	J-21
15	Refrigeration/Heat Shop Washrack	18	32	51	1.0	34	J-23
16	Existing Entomology Shop Area	18	60	51	1.0	43	J-25
17	BX Service Station Fuel Leak Area	18	80	100	1.0	66	J-27
18	Chromic Acid Spill Site	18	60	57	1.0	45	J-29
19	Golf Course Landfill	15	60	50	1.0	37	J-31
20	Sewage Treatment Plant Grit Burial Site	12	30	57	1.0	33	J-33
21	West Area Landfill No. 2	12	40	50	1.0	34	J-35
22	West Area Landfill No. 1	16	40	57	1.0	41	J-37
23	MOBSS Landfill	13	60	50	1.0	41	J-39
24	Former Equipment Maintenance Area	12	50	57	1.0	40	J-41
25	Possible Drainage Lagoon Disposal Site	17	40	57	1.0	38	J-43
26	Possible Missile Fuel Spill Site	9	40	50	1.0	33	J-45
27	Pad 9 Washrack Area	9	50	57	1.0	39	J-47
28	Former North Area Washrack Site	9	50	50	1.0	36	J-49
30	Grease Trap Disposal Pits	12	70	48	1.0	43	J-51
31	Fire Department Training Area	12	64	57	1.0	44	J-53
32	Collapsed Sewer Line From Primate Research	17	60	57	1.0	45	J-55
35	Spent Solvent Disposal Area	13	40	43	1.0	32	J-57
36	Unconventional Fuels Area Spill Site	9	60	57	1.0	42	J-59
37	Early Missile Testing Site	3	40	57	1.0	33	J-61
38	Test Sled Maintenance Area	14	40	57	1.0	37	J-63
39	Missile Fuel Spill Area	12	60	57	1.0	43	J-65
41	Coco Block House Bore Hole Disposal Site	3	24	67	1.0	31	J-67

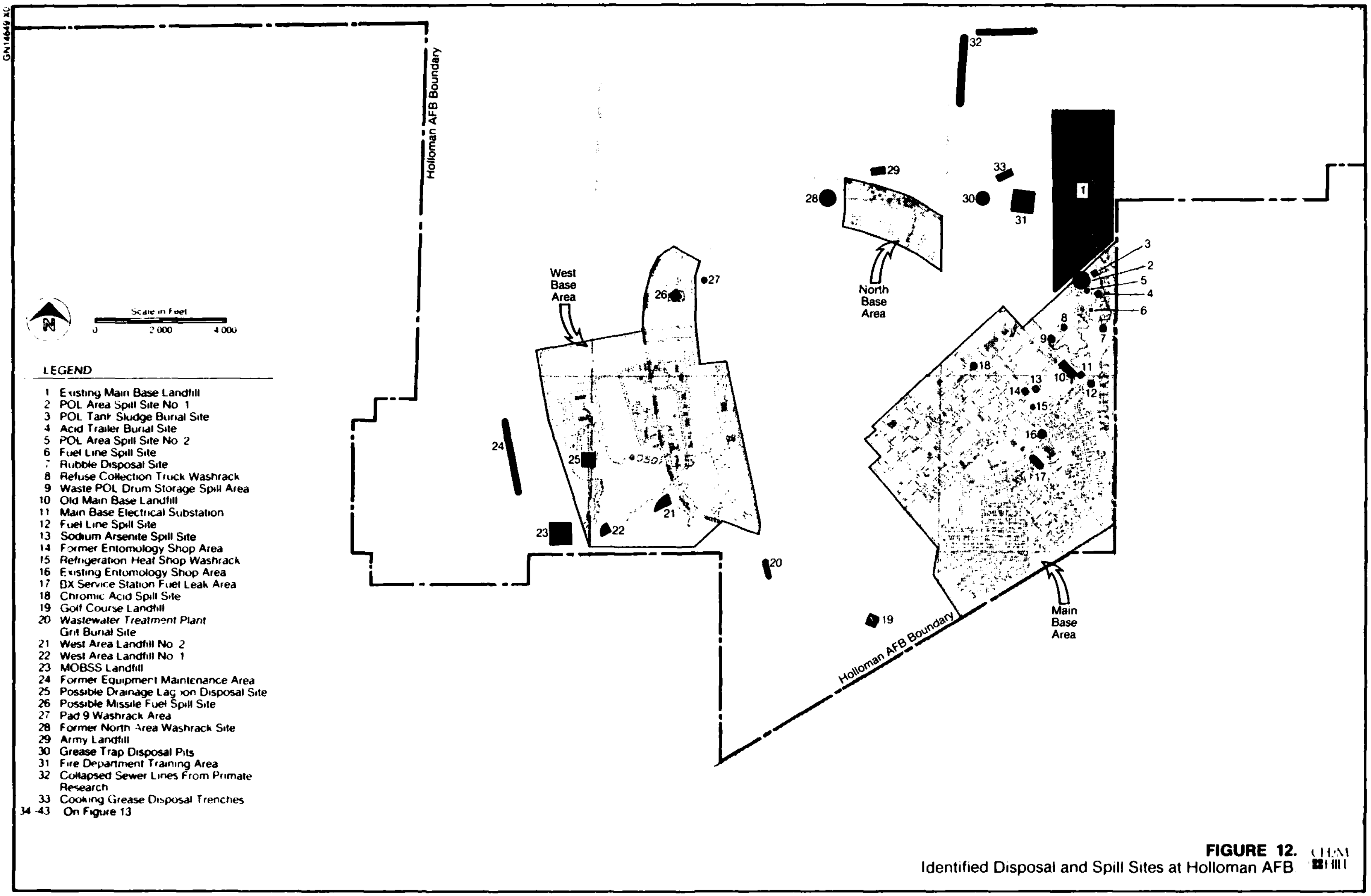

FIGURE 12.
Identified Disposal and Spill Sites at Holloman AFB

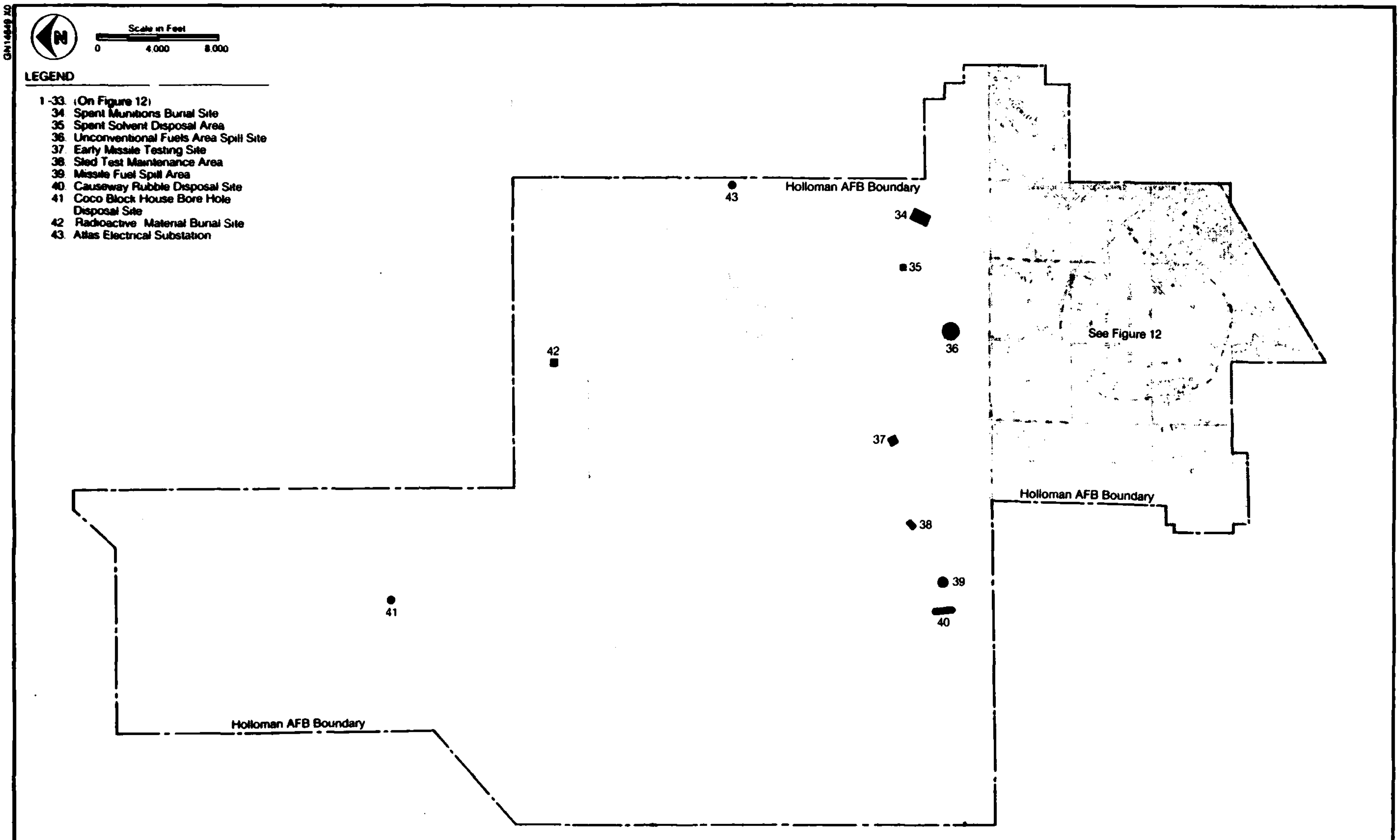

FIGURE 13.
Identified Disposal and Spill Sites at Holloman AFB—(Continued).

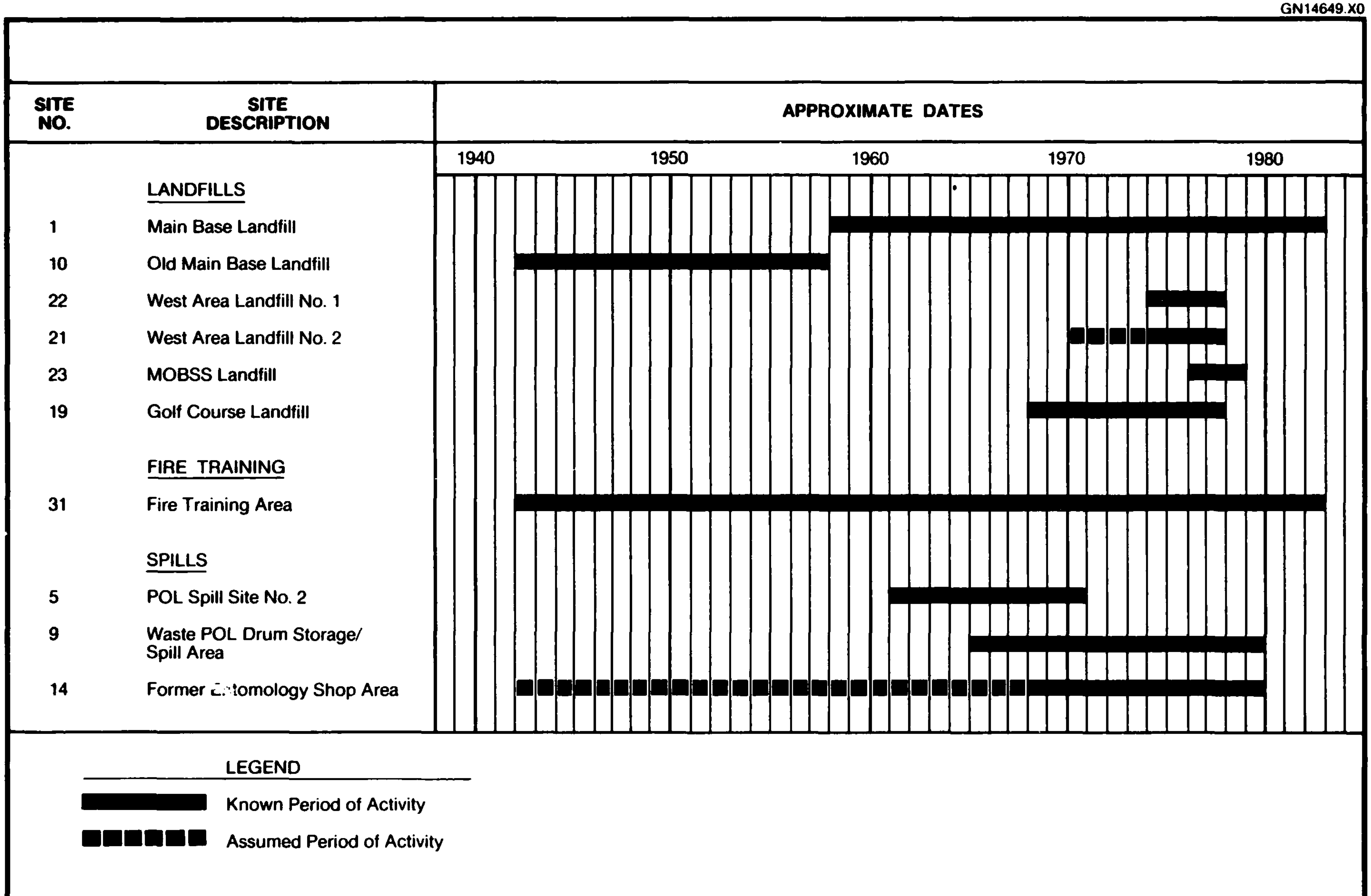

FIGURE 14.
Historical Summary of Activities at Major Disposal and Spill Sites at Holloman AFB.

waste oils and solvents and pesticides are known to have been disposed of at this site in the past.

The landfill received an overall HARM rating score of 47. A waste characteristics subscore of 60 was assigned due to the small confirmed disposal of hazardous materials. A high pathways subscore (65) resulted from the site's proximity to a nearby drainage ditch.

b. Site No. 10--Old Main Base Landfill

The Old Main Base Landfill, (overall score of 38) was operated from 1942 to 1958. This landfill covered an area of approximately 20 acres just north of the existing residential housing area and east of the civil engineering complex. The landfill received base domestic solid waste and one interviewee indicated that some drums containing waste oils and solvents may have been disposed of at this landfill in the past. A base incinerator was located in this area in the past and the ash from this operation was also buried in the landfill.

The landfill received an overall HARM rating of 38. A waste characteristics subscore of 40 was assigned to the site due to the small suspected disposal of hazardous materials. A pathway subscore of 57 was obtained due to the proximity of a nearby drainage ditch to the site.

c. Site No. 22--West Area Landfill No. 1

The West Area Landfill No. 1 (overall score of 38) was located in an arroyo near the Solar Observatory, Building 910. The landfill covered a 2 to 3 acre area and was used during the years of 1974 to 1978. A December 28, 1978 memo in the bioenvironmental engineer's pollution file describes the landfill site and indicates that items such as plastic sheets, boxes, and empty cans were the types of solid wastes disposed of at the site. Disposal operations were stopped after the location was identified as an unapproved landfill site. A waste characteristics subscore of 40 was assigned due to the small suspected disposal of hazardous waste at the site. One interviewee indicated that some 55 gallon drums were observed during the active period of the landfill. A pathway subscore of 57 was assigned to the site due to the proximity of a nearby drainage ditch (250 feet).

d. Site No. 21--West Area Landfill No. 2

The West Area Landfill No. 2 (overall score of 34) was located near the base golf course, south of fairway No. 7. The landfill covered an area of 1 to 2 acres and was active from the early 1970's (assumed) until 1977. Bioenvironmental Engineering records indicate that waste materials contained at the site included paper bags, food cans, boxes, boards, and tree limbs. One interviewee also indicated that some 55 gallon drums were observed during the active period of the landfill. Disposal operations were stopped after the site was identified as an unapproved landfill site. This landfill is located 800 feet from the nearest drainage ditch. Due to the proximity of the drainage ditch and the suspected disposal of small quantities of hazardous waste, the overall HARM rating for the site was 34 with subscores of 40 for waste characteristics, and 50 for pathways.

e. Site No. 23--MOBSS Landfill

The 4449th MOBSS Landfill (overall score of 41) was located west of the Solar Observatory and received waste disposal items from 1976 to 1979. Cans of diazinon, dibromochloromethane, and 55-gallon drums of unknown contents were observed at the disposal site. The site was relatively small and encompassed an area of less than one-half acre.

The landfill is located 600 feet from the nearest drainage ditch. The overall score given to the site was 41. Due to the small confirmed quantities of hazardous waste materials observed at the landfill, the waste characteristics for the site was assigned a subscore of 60. The pathways subscore for the site was 50.

f. Site No. 19--Golf Course Landfill

The Golf Course Landfill (overall score of 37) was located due south of the golf course and approximately 800 feet north of the base boundary. It was operated for roughly 10 years from 1968 to 1978. The landfill was used primarily as a disposal site for golf course grass clippings however, some disposal of unused rodenticides also occurred. The nearest surface drainage ditch is located 1,000 feet from the landfill and resulted on a pathways subscore of 50. A waste characteristics subscore of 60 was assigned to the landfill due to the small quantities of confirmed site disposal of hazardous waste materials.

2. POL Spill Sites

a. Site No. 2--POL Spill Site No. 1

From the early 1960's to the early 1970's, fuel tanks (now removed) contained in the POL storage area were periodically overtopped (overall score of 39). Most of waste disposal items from 1976 to 1979. Cans of diazinon, dibromochloromethane, and 55-gallon drums of unknown contents were observed at the disposal site. The site was relatively small and encompassed an area of less than one-half acre.

The landfill is located 600 feet from the nearest drainage ditch. The overall score given to the site was 41. Due to the small confirmed quantities of hazardous waste materials observed at the landfill, the waste characteristics for the site was assigned a subscore of 60. The pathways subscore for the site was 50.

f. Site No. 19--Golf Course Landfill

The Golf Course Landfill (overall score of 37) was located due south of the golf course and approximately 800 feet north of the base boundary. It was operated for roughly 10 years from 1968 to 1978. The landfill was used primarily as a disposal site for golf course grass clippings however, some disposal of unused rodenticides also occurred. The nearest surface drainage ditch is located 1,000 feet from the landfill and resulted on a pathways subscore of 50. A waste characteristics subscore of 60 was assigned to the landfill due to the small quantities of confirmed site disposal of hazardous waste materials.

2. POL Spill Sites

a. Site No. 2--POL Spill Site No. 1

From the early 1960's to the early 1970's, fuel tanks (now removed) contained in the POL storage area were periodically overtopped (overall score of 39). Most of these fuels were retained in the POL area and recovered. This site is located 900 feet from the base boundary and 500 feet from the nearest drainage ditch. A pathways subscore of 57 was assigned to the site. The overall score for the site was 39.

b. Site No. 5--POL Spill Site No. 2

In 1978, approximately 30,000 gallons of JP-4 fuel was spilled (overall score of 39) when the main JP-4 fuel tank in the POL area was overtopped (Tank No. 7). Approximately 95 percent of the fuel was recovered with the remainder of the fuel seeping into the gravel base of the POL storage area. The spill site was assigned an overall score of 39. As a result of the small confirmed quantity of fuel spilled and not recovered, the waste characteristics subscore was 48. The pathways subscore was 57.

c. Site No. 6--Fuel Line Spill Site

In 1979, a base road grader was operating in the area approximately 200 feet south of the POL storage area. The grader ruptured the JP-4 fuel line and before the fuel flow could be stopped, approximately 8,000 gallons of JP-4 was spilled onto the ground. Clean-up operations were immediately initiated and the majority of the fuel was recovered. The spill area was located 500 feet from the base boundary and 500 feet from the nearest drainage ditch. The overall HARM score applied to this spill was 39. Due to the small confirmed quantities of fuel spilled and not recovered, the site was assigned a waste characteristics subscore of 48. A pathway subscore of 57 was given to the site.

d. <u>Site No. 12--Fuel Line Spill Site</u>

In 1975, approximately 2,000 gallons of JP-4 fuel was spilled (overall score of 40) in the area just northeast of the main base housing complex. The spill resulted from a ruptured fuel line due to excessive line pressure. The JP-4 was collected in a pit and pumped into a tank truck. The majority of the fuel was recovered. The spill area was located 500 feet from the base boundary and less than 50 feet from the nearest surface drainage ditch. The overall score for the spill site was 40. A waste characteristics subscore of 48 was given to the site due to the small confirmed quantity of fuel spilled and not recovered. A pathways subscore of 57 was given to the site due to the proximity of the drainage ditch to the spill area.

e. <u>Site 17--BX Service Station Fuel Leak Area</u>

The BX Service Station (overall score of 66) is located in the Main Base Area near the hospital. In January 1981, discrepancies in MOGAS storage tank inventories were noted. Excavation of the area around the tank showed that fuel had been leaking into the ground water through corroded fuel lines. An estimated 100,000 to 150,000 gallons of MOGAS were spilled from the corroded lines. The service station has been in its present location since the early 1950's and some of the below ground storage tanks currently being utilized were installed more than 20 years ago.

Test wells drilled around the station indicated that fuel was floating on top of the shallow ground-water table. Recovery wells were drilled and a total of 5,500 gallons of liquids were pumped out and analyzed for fuel content. Analysis of the pumped liquids indicated a 95 percent water content. Underground fuel lines have recently been replaced with fiberglass to prevent further spills caused by corroded steel pipe. A tank pressure testing program has also been implemented. At the current time, all underground fuel storage tanks are considered to be in satisfactory condition.

There is still evidence of spilled fuel on top of the shallow ground-water table. There have been reports of strong gasoline odors from BX Service Station personnel and from the hospital area. The spill site received an overall rating of 66. The service station is located within a densely populated area of the base. It is situated 2,000 feet from the base boundary and 600 feet from the nearest surface drainage ditch. A waste characteristics subscore of 80 was given to the site because of the large confirmed quantity of MOGAS spilled in the area. Because there is direct evidence of migration of the MOGAS to the test holes drilled around the service station, the pathways subscore was 100.

3. Fire Department Training Area

The Fire Department Training Area, Site No. 31, (overall score of 44) is located north of the main base area and west of the current main base landfill. It is the only identified site of fire department training on the base and has been located in the same general area since the base was activated. The area currently consists of a circular, gravel-lined region with the runoff from training exercises being collected in an oil/water separator (installed in 1980) prior to discharge to an open pit. Up until 1979, waste oils, solvents, and fuels were delivered to the fire department training area from all major industrial shops. Since 1979, only new fuel has been used in fire department training exercises. Current training exercises include pre-soaking the area with water prior to fuel application and ignition. Fuels used for igniting fires are stored in an underground steel tank near the site.

Most of the ignition materials are consumed in the fires, however, some percolation of these materials into the ground water is inevitable. The site received a waste characteristics subscore of 64 due primarily to the known disposal of fuels, waste oils and solvents at the site. The training area is located approximately 400 feet from the nearest surface drainage ditch. The resulting pathway subscore was 57. An overall HARM score of 44 was assigned to the Fire Department Training Area.

4. Other Sites

a. Site No. 3--POL Tank Sludge Burial Site

Site No. 3 (overall score of 38) is located east of the POL storage area and south of the main base landfill. The areal extent of the disposal area is approximately 10 feet by 6 feet. The depth of the pit is unknown but assumed to be 4 feet deep. The site was intermittently used from 1955 to 1975 for disposal of sludges from fuel storage tanks (AVGAS, JP-4, MOGAS). The contents of the pit at the disposal site consisted of rags, iron fragments, and dark red stained soil. The white soil surrounding the site is highly gypsiferous with a pH of 8-10. On January 19, 1980, six soil samples were analyzed from the site by the bioenvironmental engineering staff. Analytical results for lead indicated elevated concentrations and averaged 1,019 parts per million (ppm) for the six samples. However, these samples were not analyzed according to RCRA standard procedures. Soil samples were again collected from the site in August of 1982 and were analyzed by the E.P. extraction procedure outlined by the rules and regulations of RCRA. The values found not only for lead, but for all extractable metals were within acceptable limits of RCRA standards.

The site was assigned an overall rating of 38. Due to the small confirmed quantities of lead disposed of the site the waste characteristics subscore was 45. The pathways subscore for the site was 48.

b. <u>Site No. 4--Acid Trailer Burial Site</u>

In 1958, 2 empty fuming nitric acid transport trailers were buried just east of the POL storage area. The trailers were washed out with water prior to burial.

The site was not rated since no hazardous waste materials were known or suspected to be involved in the trailer burial.

c. <u>Site No. 7--Rubble Disposal Site</u>

From 1965 (assumed) to the present, construction materials (wood, sheet metal, wire, nails, etc.) have been disposed of at the rubble disposal site located southeast of the POL storage area and just west of the base boundary. The site was not rated since no known or suspected hazardous waste materials have been buried at the site.

d. Site No. 8--Refuse Collection Truck Washrack

The Refuse Collection Truck Washrack (overall score of 43) is located southwest of the POL storage area and north of the main base area. Refuse collection trucks and equipment are washed with soap and water with the rinsewaters being discharged to a drainfield. The refuse collection truck washrack has been located in the same place since the beginning of base operations in 1942. One interviewee indicated that pesticides were routinely sprayed inside the trucks during the 1970's for fly control. The current refuse collection contractor indicated that this was not a current practice, nor had it been done since 1981.

The overall score for the washrack site is 43. The waste characteristics subscore was 60 for this area since small confirmed quantities of pesticides were disposed of into the washrack's leach field. The resulting pathways subscore for the site was 54.

e. Site No. 9--Waste POL Drum Storage/Spill Area

The Waste POL Drum Storage/Spill Area (overall rating of 42) is located west of Building No. 1 and north of the Main Base area. Between the years of 1965 to 1980, the majority of waste engine oils, hydraulic and transmission fluids, solvents, and waste fuels were stored here in 55 gallon drums. The drums of stored material from this location were either burned during fire training exercises or processed for subsequent service contract action for off-base recycle or disposal. Numerous small spills and overflowing of drums (particularly during the summertime) have occurred.

The overall score for the waste POL drum storage area is 42. Because small confirmed quantities of hazardous materials were spilled at the site, the waste characteristics subscore is 60. Due to the distance of the site from the nearest surface drainage ditch (800 feet) the pathways subscore is 50.

f. Site No. 11--Main Base Electric Substation

The Main Base Electric Substation is located just north of the Main Base near the eastern boundary of the installation.

Until 1979, the standard practice of exterior electric shop personnel was to dispose of transformer insulation oil on the ground in the vicinity of the substation.

In March 1979, the base Bioenvironmental Engineer collected samples of the oil stained soils around the substation and submitted them for polychlorinated biphenyls (PCB's) analysis. No PCB's were detected in the soil samples. Since no hazardous waste materials were disposed of at the site, the area was not rated.

The current practice (since 1974) is to collect and turn in all transformer oils to DPDO. Analyses for PCB's are then conducted on the oils to determine appropriate disposal procedures.

g. Site No. 13--Sodium Arsenite Spill Site

The Sodium Arsenite Spill Site (overall rating of 45) is located in the Civil and Engineering Complex next to the DPDO storage facility. A total of eighty 30-gallon containers of sodium arsenite, a weed killer, was being stored at this location in 1979. The herbicide was being applied to the subsoils underlying an area of new runway construction. In August of 1979, the Base Bioenvironmental Engineer surveyed the storage area and found that one of the cans was empty and had a hole in the bottom.

Approximately 75 cans of the herbicide containers were not needed on base and were shipped to the U.S. Army Pine Bluff Arkansas Arsenal. The overall score for the spill site was 45. Primarily due to the nearest surface water drainage ditch being approximately 25 feet from the site, a pathways score of 57 was assigned. Since a small confirmed quantity of hazardous waste was spilled of at the site, the waste characteristics subscore assigned was 60.

h. Site no. 14--Former Entomology Shop Area

The Former Entomology Shop Area (overall score of 43) was located in Building 67. From 1968 to 1977, pesticide spraying and washing equipment were rinsed out in an open area adjacent to the building. In July, 1977 soil samples were collected from the rinse area and showed the presence of several persistent pesticides at low levels.

As a result of these analyses, the soils in the disposal area were treated with lime and powdered charcoal. The top 6-8 inches of soil were then tilled.

The overall rating for the site was 43. Since confirmed spills of small quantities of pesticides has occurred, the site was assigned a waste characteristics subscore of 60. A pathways subscore of 57 was given to the site primarily because it is located less than 50 feet from the nearby surface drainage ditch.

i. Site No. 15--Refrigeration/Heat Shop Washrack

The Refrigeration/Heat Shop Washrack (overall score of 34) is located in the Civil Engineering Complex. For the period of 1971 to 1981, a sulfuric acid solution was utilized to de-scale cooling system equipment. The rinsewater was discharged to a septic tank drainfield. The washrack is located 2,200 feet from the base boundary and less than 25 feet to the near surface drainage ditch. The site received an overall score of 34. Due to the medium quantities of hazardous waste disposed of at the site, the waste characteristics subscore was 32 (sulfuric acid has a persistence factor of 0.4).

The pathways subscore 51 was due mostly to the proximity of the site to the nearest surface drainage ditch.

j. Site No. 16--Existing Entomology Shop Area

The Existing Entomology Shop Area (overall score of 43) is located in Building 21 in the civil engineering complete. From 1977 to 1980, rinsewaters produced from washing the mixing equipment was discharged to a septic tank drain field located in back of the building. After approximately 2 years of discharging the rinsewaters in this manner, a large open cavity developed as a result of a break in the sewer line leading to the drain field. In 1980, the shop started collecting the rinsewaters in a holding tank and subsequently transferred the materials by tank truck to the wastewater lagoon system for disposal.

The overall score for this site was 43. The disposal of small confirmed quantities of hazardous waste resulted in a waste characteristics subscore of 60. A pathways subscore of 51 was given to the site.

k. Site No. 18--Chromic Acid Spill Site

The Chromic Acid Spill Site (overall score of 45) is located near Building 281 in the Main Base Area.

The 479th CRS maintained a chrome plating shop in Building 281 until the late 1970's. When the operation was discontinued, the full chromic acid vats were temporarily stored on the south side of the building. It is estimated that approximately 500 gallons of chromic acid were spilled on the ground in this storage area with some of the acid reaching the surface drainage ditch just west of the storage area. In 1982, ten yellow stained soil samples were collected and composited for hexavalent chromium analysis. The E.P. extraction quantity of hexavalent chromium found in the composite sample was equivalent to 0.600 mg/l.

The overall rating for this spill site was 45. A waste characteristics subscore of 60 was assigned as a result of the small confirmed disposal of hazardous waste materials. Due to the proximity of the surface drainage ditch (less than 50 feet), the pathways subscore was 57.

l. Site No. 20--Wastewater Treatment Plant Grit Burial Site

From 1942 to the present, all settled solids from the grit chamber located at the head of the waste treatment lagoons have been buried in shallow excavation pits (overall score of 33) just east of the fence surrounding the treatment system. A shallow pit is first excavated, the grit materials are deposited and then soils are backfilled into the pit. It is possible that small amounts of solvents and heavy metals may have been associated with the grit materials. A waste characteristic subscore of 30 was given to the site due to the small suspected quantity of hazardous materials disposed of in the burial pits. A pathways score of 57 was given to the site.

m. Site No. 24--Former Equipment Maintenance Area

The Former Equipment Maintenance Area (overall score of 40) is located in the west base area in Building 920 - 924. Waste solvents, cleaners, and oils from the industrial operations locations in these buildings during 1959 to 1969 may have been washed down the drains and discharged to the septic tanks that serviced the area.

A pathways subscore for the site of 57 resulted primarily from the proximity of the nearest surface drainage ditch (less than 50 feet from the site). Because medium quantities of hazardous wastes were suspected of being discharged to the septic tanks, a waste characteristics subscore of 50 was assigned to the area.

n. Site No. 25--Possible Drainage Lagoon Disposal Site

The drainage lagoon (overall score of 38) receives surface runoff from the MOBSS area (Buildings 901 and 902). According to one interviewee, outdated chemicals such as pesticides, HTH, and solvents have been disposed of in the drainage lagoon from around 1977. During the base tour, three 55 gallons drums of unknown chemicals were observed by the edge of lagoon. Visual inspection of the lagoon did not reveal any signs of POL waste disposal.

The site received a relatively low waste characteristics subscore of 40 because the drainage lagoon is only suspected of being a hazardous waste disposal site. A pathways score of 57 was assigned because the lagoon is itself a surface water.

o. Site No. 26--Possible Missile Fuel Spill Site

This Possible Missile Fuel Spill Site (overall score of 33) is located just south of Pad 8, near Building 882. The Navy utilized this area during 1976 for missile testing. It was reported that waste fuels from these tests were disposed of on the ground just south of Pad 8. Due to the small suspected quantities of hazardous waste disposed at the site, the waste characteristics subscore was 40. The site is located approximately 300 feet from the nearest surface drainage ditch. The resulting pathways subscore assigned was 50.

p. Site No. 27--Pad 9 Washrack Area

According to civilian Air Force employees, the washrack (overall score of 34) was utilized to wash down drones and manned aircraft that had flown through clouds of nuclear blast materials in the late 1940's and early 1950's. All drainage from the wash are sent to a sump. There are no sanitary sewer lines to the area, therefore any radioactive materials washed off the aircraft would still be located in the sump or the surrounding area. In May of 1976, radiation measurements were obtained from the sump and soil samples were collected and submitted for analysis. All readings and analysis indicated that there were no radiation levels detected above normal background.

A waste characteristics subscore of 50 was given to the site due to the large suspected quantities of hazardous waste materials that could have been disposed of in the drainage sump. A pathways subscore of 57 was given to the site primarily because a surface drainage ditch is located less than 25 feet from the area.

q. Site No. 28--Former North Area Washrack

During the 1950's, this washrack (overall score of 36) was the main wash area for vehicles and equipment located in the north base area. Oils, detergents, and possibly some fuels were washed off the rack area and allowed to drain into the surrounding soils.

A waste characteristics subscore of 50 was given to the site because suspected large quantities of moderately hazardous materials could have been disposed of at this location. The washrack is approximately 1,600 feet from nearest surface water. The resulting pathways subscore for this location was 50.

r. Site No. 29--Former Army Landfill

From the early 1950's to 1975, spent munitions and missiles were disposed of by the army at this site located near the north base building area. Since no known hazardous waste materials were disposed of at the site, it was not rated.

s. <u>Site No. 30--Grease Trap Disposal Area</u>

The grease trap disposal pits (overall score of 43) are located west of the fire department training area. From 1972 to 1979, shallow trenches were dug and reportedly received wastes from base grease traps, oil/water separators and grit from the wastewater treatment system. One interviewee indicated that quantities of various pesticides (diazinon, malathion, pyrethrum) were also disposed of here, but this could not be verified.

The site was assigned a waste characteristics score of 70 due to the large suspected quantities of hazardous materials that may have been disposed of at the site. A pathways subscore of 48 was assigned primarily because the nearest surface water is located more than 2,000 feet from the site.

t. <u>Site no. 32--Collapsed Sewer Lines from the Primate Research Area</u>

Approximately 3,000 to 4,000 feet of sewer lines from the primate research institute were suspected of being corroded, with certain portions thought to be totally collapsed from the early 1960's to 1981 when the lines were repaired. During the period when the lines were badly corroded/collapsed, quantities of carbon-14, iodine and tritium tracers as well as solvents were suspected of exfiltrating into the groundwater. The quantities of solvents and radioactive isotopes utilized by the institute is small, however, no specific information was available as to the amounts of these materials that could have entered the shallow ground water.

Due to the fact that small confirmed quantities of hazardous waste were discharged into the soils and groundwater around the sewer lines, the site was assigned a waste characteristics subscore of 60. Primarily due to a surface drainage ditch being less than 50 feet from the sewer lines a pathways subscore of 57 was assigned.

u. Site No. 33--Cooking Grease Disposal Trenches

During the helicopter overflight conducted at the base, survey team members observed several shallow trenches located north and west of the fire department training area. Bioenvironmental engineering personnel later identified these trenches as being the disposal site for cooking greases from base kitchens. Since no hazardous waste is known to be disposed of at this site, the area was not rated.

v. Site No. 34--Spent Munition Burial Site

Excavation pits are utilized for the disposal of all spent munitions rounds detonated by the EOD. The pits are examined carefully to ensure no live rounds of ammunition are contained in them prior to backfilling. Since no hazardous waste materials are associated with the disposal operations, it was not rated.

w. Site No. 35--Spent Solvent Disposal Area

One interviewee indicated that spent solvents and radioactive tracers were disposed of on the ground near the Central Inertia Guidance Test Facility and ignited. This disposal practice was said to have occurred intermittently since the 1950's.

The overall score for this site was 32. It was given a waste characteristic subscore of 40 since small suspected quantities of hazardous waste materials may have been disposed at the site. The disposal and burning of the solvents and tracers at this site could not be verified by other interviewees. Due to the nearest surface water being approximately 2,000 feet from the site, it was assigned a pathways score of 43.

x. Site No. 36--Unconventional Fuels Area Spill Site

The Unconventional Fuels Area Spill Site (overall score of 42) is located in the Supply LOX (liquid oxygen) Area near Buildings 1191 and 1192. The fuels currently being handled by this area include unsymetrical dimethylhydrazine (UDMH), JP-4, and inhibited red fuming nitric acid (IRFNA). The JP-4 and UDMH are mixed together in a 1:1 ratio to form the liquid propellent JPX. The Supply LOX Area stores, mixes, and transports IRFNA and JPX to the test track. Propellent grade UDMH is received on transporters and stored in these containers until issued. Buildings 1191 and 1192 have a total of four runoff pits that receive all spilled fuels and floor washings from the concrete pad storage and mixing areas. In June of 1981, soil samples were obtained from the fuel disposal pits and analyzed for hydrazine, fluoride, nitrate, and aniline. No significant levels of waste fuels were detected in any of the soil samples.

In March of 1979, soil samples were randomly collected from areas known to have received UDMH runoff from the fuel storage area. The results of these analyses indicated that no UDMH was present in former spill sites.

The overall score for this site was 42. Since small confirmed quantities of hazardous waste have been spilled at the site, the waste characteristics subscore was 60. A pathway subscore of 57 was given to the site primarily because the nearest surface water drainage ditch is located 380 feet from the LOX storage area.

y. Site No. 37--Early Missile Testing Site

The Early Missile Testing Site (overall score of 33) was utilized from 1947 to 1955 and is located east of the test sled maintenance area. Rockets thought to have been tested here include the V-2 rocket. Solid fuel propellants were thought to have been primarily utilized including nitrocellulose + nitroglycerone, and potassium perchlorate + polysulfide. Waste products thought to have been spilled at the site as a result of these fuels include lead oxide, nitrate compounds, hydrochloric and sulfuric acids.

The site was given an overall score of 33. Due to the small suspected quantities of hazardous waste though to have been spilled at the site, a waste characteristics score of 40 was assigned. A pathways score of 57 was assigned to the site.

z. Site No. 38--Sled Test Maintenance Area

From 1951 when the test track area became operational until 1979 waste oils, solvents and paint strippers (overall score of 37) utilized in the sled industrial maintenance area (Building 1166) were suspected of being discharged to the area's septic tank drainfield. All waste POL products have since 1979 been accumulated in 55 gallon drums and turned into DPDO. A waste characteristics subscore of 40 was assigned due to the small suspected quantities of hazardous materials which may have been disposed of in the septic tank system. Since the area is located less than 50 feet from the nearest surface drainage ditch, a pathways subscore of 57 resulted. The overall score for the maintenance area was 37.

aa. Site No. 39--Missile Fuel Spill Area

The Missile Fuel Spill Area (overall score of 43) is located at the test sled launch area near Building 1176.

The launch pad at the south end of the track was constructed with concrete drains and a water deluge system. Spilled oxidizers and fuels were delivered to separate drains, diluted with water and flushed into the Lost River. In 1975, catch basins were installed to collect the spilled liquid fuels. Oxidizer vent lines from the engines were also installed and designed to discharged into the catch basins. Since 1975, no propellants have been intentionally released to the open drains. Surface and ground-water samples were collected from the Lost River in the vicinity of the test track in July of 1979. The results indicated that the test track had no observable impact upon the Lost River water quality. Waste propellants are currently collected, treated, and disposed of in the treatment system located in Building 1176.

The site was assigned an overall score of 43. Due to the small confirmed quantities of hazardous waste materials spilled to the Lost River at this location, the site was assigned a waste characteristics subscore of 60. Because the spill site was located less than 50 feet from a surface water, the pathways subscore was 57.

bb. Site No. 40--Causeway Rubble Disposal Site

Concrete rubble was utilized as a base construction material for the road leading across the Lost River southwest of the test track launch pad. Since no hazardous waste was known to be associated with the rubble disposal, the site was not rated.

cc. Site No. 41--Coco Block House Bore Hole Disposal Site

During the mid 1960's, sled launch operations were conducted in the northern test track area near the Coco Block House. A 250 foot well was utilized to dispose of any nitric acid spills that may have occurred during launch operations. The disposal well was described by one interviewee as being used very infrequently during this time. An overall score of 31 was assigned to the disposal well. A waste characteristics subscore of 24 was given to the site due to the small confirmed disposal of hazardous materials and a persistency of 0.4 for nitric acid. Primarily due to the direct access to the ground water, a pathways subscore of 67 was assigned.

dd. Site No. 42--Radioactive Material Burial Site

The radioactive material burial site is located in a remote northeastern area of Holloman AFB. The site was created in the early 1950's and closed during or prior to 1959. The exact type and quantity of radioactive materials disposed of at the site are not known. The materials are buried in a cylinder 10 feet in length and 5.5 feet in diameter. The cylinder is buried 2-4 feet below grade with a 4-inch thick concrete cover. Periodic measurements and soils analyses have indicated that there have been no radioactive leaks from the cylinder. The site was consequently not rated.

ee. Site No. 43--Atlas Electrical Substation

The Atlas Substation is located in the northern portion of Holloman AFB near the eastern boundary.

Until 1979, the standard practice of exterior electric shop personnel was to dispose of transformer insulation oil on the ground in the vicinity of the substation.

In 1979, the Base Bioenvironmental Engineer collected samples of the oil stained soils around the substation and submitted them for polychlorinated biphenyls (PCB's) analysis. No PCB's were detected in the soil samples. Since no hazardous waste materials were disposed of at the site, the area was not rated.

The current practice (since 1974) is to collect, analyze, and turn in all PCB transformer oils to DPDO for appropriate disposal.

C. Environmental Stress

No evidence of environmental stress resulting from past disposal of hazardous wastes was observed during the helicopter overflight and ground tours of Holloman AFB. Desert vegetation recovers slowly from disturbance caused by clearing or excavation, so that past disturbances are typically visible from the air.

V. CONCLUSIONS

A. Information obtained through interviews with 54 past and present base personnel, base records, shop folders, and field observations indicates that hazardous wastes have been disposed of on Holloman AFB property in the past.

B. No evidence of environmental stress resulting from past disposal of hazardous wastes was observed at Holloman AFB.

C. Direct evidence was found of the existence of a gasoline contaminant plume floating on the ground water beneath the BX Service Station (Site No. 17). Other than the above, available water quality data, and information from base records and from interviews gave no direct evidence to indicate that migration of hazardous contaminants exists within or beyond Holloman AFB boundaries.

D. The potential for ground-water contamination at Holloman AFB is high due to the high ground-water table (less than 10 feet below land surface). This potential is reduced somewhat by the low precipitation and high evaporation rate in the area which results in a low driving force for vertical contaminant migration. The potential adverse impact of ground-water contamination beneath Holloman AFB is reduced by the fact that the ground water in this area is naturally high in total dissolved solids (>10,000 mg/l) and therefore, is not usable as a potable water supply.

E. Table 7 presents a priority listing of the rated sites and their overall scores. Site No. 17 has the most

Table 7
PRIORITY LISTING OF DISPOSAL AND SPILL SITES

Site No.	Site Description	Overall Score
17	BX Service Station Fuel Leak Area	66
1	Existing Main Base Landfill	47
13	Sodium Arsenite Spill Site	45
18	Chromic Acid Spill Site	45
32	Collapsed Sewer Line from Primate Research	45
31	Fire Department Training Area	44
14	Former Entomology Shop Area	43
8	Refuse Collection Truck Washrack	43
16	Existing Entomology Shop Area	43
30	Grease Trap Disposal Pits	43
39	Missile Fuel Spill Area	43
9	Waste POL Drum Storage/Spill Area	42
36	Unconventional Fuels Area Spill Site	42
22	West Area Landfill No. 1	41
23	MOBSS Landfill	41
12	Fuel Line Spill Site	40
24	Former Equipment Maintenance Area	40
2	POL Area Spill Site No. 1	39
5	POL Area Spill Site No. 2	39
6	Fuel Line Spill Site	39
27	Pad 9 Washrack Area	39
3	POL Tank Sludge Burial Site	38
10	Old Main Base Landfill	38
25	Possible Drainage Lagoon Disposal Site	38
19	Golf Course Landfill	37
38	Test Sled Maintenance Area	37
28	Former North Area Washrack Site	36
15	Refrigeration/Heat Shop Washrack	34
21	West Area Landfill No. 2	34
20	Sewage Treatment Plant Grit Burial Site	33
26	Possible Missile Fuel Spill Site	33
37	Early Missile Testing Site	33
35	Spent Solvent Disposal Area	32
41	Coco Block House Bore Hole Disposal Site	31

significant potential (relative to other Holloman AFB sites) for environmental impact. A large quantity of gasoline, estimated at 100,000 - 150,000 gallons, leaked from an underground fuel line located beneath the BX service station in 1981. Subsequent installation of monitoring wells defined a plume of gasoline floating on top of the ground water beneath the BX service station. An attempt was made to recover the gasoline but was unsuccessful. Some subsurface biodegradation of the gasoline has probably occurred; however most of the leaked gasoline is probably still floating on top of the water table. The flat topography and low hydraulic gradient would tend to minimize dispersion and movement of the plume which is still probably concentrated in the area beneath the BX service station. Fuel odors have been reported in the BX Service Station and in a sewage pumping station located across the street near the base hospital. The high total dissolved solids content of the ground water, making it unusable for a potable water supply, would minimize the ground-water contamination impact of the gasoline plume. However, there is a serious safety concern over the possible ignition and explosion of gasoline should it begin to seep into nearby sanitary sewers or storm drains. This concern is amplified by the presence of the base hospital and elementary school which are located nearby.

F. The remaining rated sites (Sites No. 1-3, 5-6, 8-10, 12-28, 30-32, 35-39, and 41) as well as the sites that were not rated are not considered to present a significant concern for adverse effects on health or the environment.

VI. RECOMMENDATIONS

A. PHASE II PROGRAM

A Phase II monitoring program is recommended for Site No. 17, the BX Service Station Fuel Leak Area (Figure 15, page VI-2), to determine the presence and extent of a free product gasoline lens in this area and to obtain data necessary to determine the feasibility of recovery of the floating gasoline layer. This program is recommended because of safety concerns, i.e., explosion potential resulting from large accumulations of gasoline just below the ground surface. Ground-water contamination is not the primary concern because the ground water is naturally high in total dissolved solids and is not usable as a potable water supply. It is recommended that twelve shallow PVC observation wells be installed at the site. The approximate locations of the wells are shown on Figure 16 in Appendix K. Each well should be drilled to a depth of 5 feet below the water table and screened from approximately 5 feet above the water table to the bottom of the well.

The presence and estimated thickness of a free product gasoline lens (i.e. gasoline floating on top of the ground water) can be determined by the following field techniques:

1. Steel measuring tape with water and oil-finding pastes.

2. Conductivity probes.

3. Composite liquid waste sampler.

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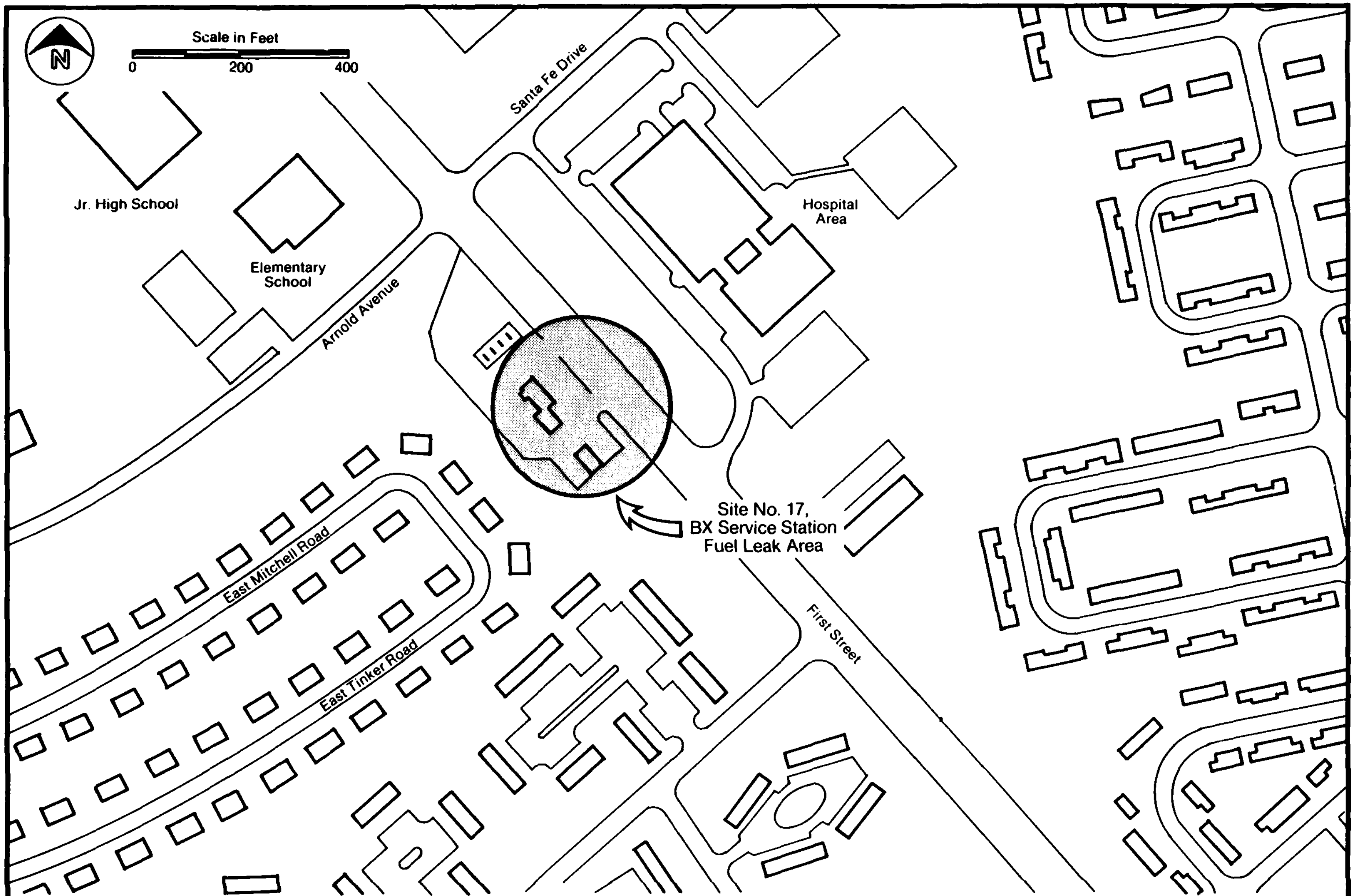

FIGURE 15.
Location Map of Site Recommended for Phase II Monitoring.

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Further details on the field measurement techniques are included in Appendix K. The presence and thickness of a free product gasoline lens can be determined by the above field measurements techniques and, therefore, no laboratory analyses are recommended.

B. OTHER ENVIRONMENTAL RECOMMENDATIONS

Other environmental recommendations that were discussed with base staff during the out-briefing are described below:

1. A secure central storage location should be provided for PCB items prior to disposition by DPDO.

2. The base should consider the implementation of a collection service, e.g., pumper truck, to routinely remove accumulated oil in the onbase oil/water separator pretreatment facilities. The cleaning of oil/water separators is currently done manually by individual shop personnel and at times may be neglected.

3. Underground POL storage tanks should be leak tested regularly (e.g., pressure checks, inventory checks, stick checks) especially because of the high corrosivity of the soils in the Holloman AFB area.

4. The past practice of conducting landfill operations in arroyos should not be allowed to recur as this practice is disruptive to the natural drainage of the area.

C. LAND USE RESTRICTION FOR IDENTIFIED SITES

It is recommended that land use restrictions at the identified disposal and spill sites at Holloman AFB be considered. The rationale for imposing land use restrictions include: (1) to provide the continued protection of human health, welfare, and environment; (2) to ensure that the migration of potential contaminants is not promoted through improper land uses; (3) to facilitate the compatible development of future USAF facilities; and (4) to allow for identification of property which may be proposed for excess or outlease.

The recommended guidelines for land use restrictions at each of the identified disposal and spill sites at Holloman AFB are presented in Table 8. A description of the land use restriction guidelines is presented in Table 9. Land use restrictions at sites recommended for Phase II monitoring should be re-evaluated upon the completion of the Phase II monitoring program and changes made where appropriate.

Table 8
RECOMMENDED GUIDELINES FOR LAND USE RESTRICTIONS

Site No.	Site Description	Recreational Use	Well Construction On or Near the Site	Housing On or Near the Site	Agricultural Use	Surface-Water Impoundments (Lagoons, Irrigation)	Disposal Operations	Construction	Excavation	Operations or Ignition Sources	Material Storage	Silvicultural Use	Vehicular Traffic	Site Access
1	Existing Main Base Landfill	X	X	X	X	X	--	X	X	--	--	--	--	--
2	POL Area Spill Site No. 1	X	X	X	X	X	X	--	--	--	--	--	--	--
3	POL Tank Sludge Burial Site	X	X	X	X	X	X	X	X	--	--	--	--	--
4	Acid Trailer Burial Site	X	X	X	X	X	X	X	X	--	--	--	--	--
5	POL Area Spill Site No. 2	X	X	X	X	X	X	--	--	--	--	--	--	--
6	Fuel Line Spill Site	X	X	X	X	X	X	--	--	--	--	--	--	--
7	Rubble Disposal Site	--	--	--	--	--	X	--	--	--	--	--	--	--
8	Refuse Collection Truck Washrack	X	X	X	X	X	X	--	--	--	--	--	--	--
9	Waste POL Drum Storage/Spill Area	X	X	X	X	X	X	--	--	--	--	--	--	--
10	Old Main Base Landfill	X	X	X	X	X	X	X	X	--	--	--	--	--
11	Main Base Electrical Substation	X	X	X	X	X	X	--	--	--	--	--	--	--
12	Fuel Line Spill Site	X	X	X	X	X	X	--	--	--	--	--	--	--
13	Sodium Arsenite Spill Site	X	X	X	X	X	X	--	--	--	--	--	--	--
14	Former Entomology Shop Area	X	X	X	X	X	X	--	--	--	--	--	--	--
15	Refrigeration/Heat Shop Washrack	X	X	X	X	X	X	--	--	--	--	--	--	--
16	Existing Entomology Shop Area	X	X	X	X	X	X	--	--	--	--	--	--	--
17	BX Service Station Fuel Leak Area	X	X	X	X	X	X	X	X	X	--	--	--	--
18	Chromic Acid Spill Site	X	X	X	X	X	X	--	--	--	--	--	--	--
19	Golf Course Landfill	X	X	X	X	X	X	X	X	--	--	--	--	--
20	Wastewater Treatment Plant Grit Burial Site	X	X	X	X	X	--	X	X	--	--	--	--	--
21	West Area Landfill No. 2	X	X	X	X	X	X	X	X	--	--	--	--	--
22	West Area Landfill No. 2	X	X	X	X	X	X	X	X	--	--	--	--	--
23	MOBSS Landfill	X	X	X	X	X	X	X	X	--	--	--	--	--
24	Former Equipment Maintenance Area	X	X	X	X	X	X	--	--	--	--	--	--	--

Table 8--Continued

Site No.	Site Description	Recreational Use	Well Construction On or Near the Site	Housing On or Near the Site	Agricultural Use	Surface-Water Impoundments (Lagoons, Irrigation)	Disposal Operations	Construction	Excavation	Operations or Ignition Sources	Material Storage	Silvicultural Use	Vehicular Traffic	Site Access
25	Possible Drainage Lagoon Disposal Site	X	X	X	X	NA	X	NA	NA	--	NA	NA	NA	NA
26	Possible Missile Fuel Spill Site	X	X	X	X	X	X	--	--	--	--	--	--	--
27	Pad 9 Washrack Area	X	X	X	X	X	X	--	--	--	--	--	--	--
28	Former North Area Washrack Site	X	X	X	X	X	X	--	--	--	--	--	--	--
29	Army Landfill	X	X	X	X	X	X	X	X	--	--	--	X	X
30	Grease Trap Disposal Pits	X	X	X	X	X	X	X	X	--	--	--	--	--
31	Fire Department Training Area	X	X	X	X	X	X	X	X	--	--	--	--	--
32	Collapsed Sewer Lines from Primate Research	X	X	X	X	X	X	--	--	--	--	--	--	--
33	Cooking Grease Disposal Trenches	X	X	X	X	X	--	--	--	--	--	--	--	--
34	Spent Munitions Burial Site	X	X	X	X	X	--	X	X	X	--	--	X	X
35	Spent Solvent Disposal Area	X	X	X	X	X	X	--	--	--	--	--	--	--
36	Unconventional Fuels Area Spill Site	X	X	X	X	X	X	--	--	--	--	--	--	--
37	Early Missile Testing Site	X	X	X	X	X	X	--	--	--	--	--	--	--
38	Sled Test Maintenance Area	X	X	X	X	X	X	--	--	--	--	--	--	--
39	Missile Fuel Spill Area	X	X	X	X	X	X	--	--	--	--	--	--	--
40	Causeway Rubble Disposal Site	--	--	--	--	--	X	--	--	--	--	--	--	--
41	Coco Block House Bore Hole Disposal Site	X	X	X	X	X	X	--	--	--	--	--	--	--
42	Radioactive Material Burial Site	X	X	X	X	X	X	X	X	--	--	--	--	--
43	Atlas Electrical Substation	X	X	X	X	X	X	--	--	--	--	--	--	--

Note: NA = Not Applicable.

Table 9
DESCRIPTION OF LAND USE RESTRICTION GUIDELINES

Guideline	Description
Recreational use	Restrict the use of the site for recreational purposes.
Well construction on or near the site	Restrict the placement of any wells (except for monitoring purposes) on or within a reasonably safe distance of the site. This distance will be site specific based on hydrogeologic conditions.
Housing on or near the site	Restrict the use of housing structures on or within a reasonably safe distance of the site.
Agricultural use	Restrict the use of the site for agricultural purposes to prevent food chain contamination.
Surface-water impoundments (lagoons, irrigation)	Restrict the use of the site for surface-water impoundments, lagoons, or irrigation. Water infiltration could provide a driving force and promote contaminant migration.
Disposal operations	Restrict the use of the site for waste disposal operations, whether above or below ground.
Construction	Restrict the construction of structures which make permanent (or semi-permanent) and exclusive use of a portion of the site's surface.
Excavation	Restrict the disturbance of the cover or subsurface materials.
Burning operations or ignition sources	Restrict unnecessary sources of ignition, due to the possible presence of flammable compounds.
Material storage	Restrict the storage of any and all liquid or solid materials on the site.
Silvicultural use	Restrict the use of the site for silvicultural uses (root structures could disturb cover or subsurface materials)
Vehicular Traffic	Restrict the passage of unnecessary vehicular traffic on the site due to the presence of explosive material(s) and/or of an unstable surface.
Site Access	Restrict access to the site to prevent unknowing or accidental direct contact with potentially hazardous substances.

VII. OFF-BASE FACILITIES

A. INTRODUCTION

Four off-base facilities were included in the Holloman AFB records search: the Boles and San Andres well field area, Bonita Lake water supply system, El Paso Radar Site and Silver City Radar Site. The locations of these facilities are shown on Figure 3, page I-3. Interviews of personnel knowledgeable about the facilities and a helicopter overflight of the Boles and San Andres well field area were conducted during the week of May 16 through May 20, 1983.

B. BOLES AND SAN ANDRES WELL FIELD AREA

The Boles and San Andres well field area is located approximately 14 miles southeast of Holloman AFB on the western slope of the Sacramento Mountains. The area consists of 2,128 acres of fee purchased land and 5,207 acres of easements, land withdrawn from the public domain and general use license and general use permit land. This well field area, along with the nearby privately owned Douglas well field area, provides the primary source of water for Holloman AFB. Facilities include 15 water supply wells with associated storage tanks and pumping stations. No known hazardous waste disposal or spill sites were identified in the Boles and San Andres well field area. A privately owned (Navajo) fuel storage tank has leaked and contaminated the ground water downgradient of the Boles and San Andres well field area. Although this contamination is downgradient, it may pose a threat to the well field area.

C. BONITA LAKE

Bonita Lake is located approximately 60 miles northeast of Holloman AFB in the Sacramento Mountains, and provides water to the City of Alamagordo and Holloman AFB. Holloman AFB owns a 22-inch water transmission line constructed by the Air Force in 1957. Maintenance of the water transmission line is performed by the City of Alamogordo. The transmission line is situated on 77 acres of perpetual easement and 78 acres of general use license and general use permit land. No known hazardous waste disposal or spill sites were identified in the Bonita Lake area.

D. SILVER CITY RADAR SITE

The Silver City Radar Site is located on one acre of Federal Aviation Administration (FAA) owned land approximately 60 miles northwest of Silver City, New Mexico and 165 miles west of Holloman AFB. The site is a joint surveillance system facility for FAA air traffic control and Air Force defense operations. Air Force personnel are responsible for office work and radar scope manning. All maintenance is accomplished by FAA personnel. Sanitary wastewater is disposed of onsite in a septic tank/drainfield system. Water is trucked to the site and pumped into an onsite water storage tank. Solid waste, primarily trash, is hauled offsite by a contractor for disposal. No large quantities of solvents or cleaners are used at the site. Periodically, spent, low-level radioactive magnetron tubes are containerized and sent to Holloman AFB for final disposition. No known hazardous waste disposal or spill sites were identified at the Silver City Radar Site.

E. EL PASO RADAR SITE

The El Paso Radar Site is located on one acre of FAA owned land approximately 75 miles south-southwest of Holloman AFB in Horizon City, Texas. This site is similar in description and function as the Silver City Radar Site, with the exception that water and sewage service are provided by Horizon City. No known hazardous waste disposal or spill sites were identified at the El Paso Radar Site.

F. CONCLUSIONS

The records search did not identify any past hazardous waste disposal or spill sites at any of the off-base facilities.

G. RECOMMENDATIONS

Since no sites were identified, Phase II monitoring and land use restrictions are not recommended for any of the off-base facilities.

GLOSSARY OF TERMS

GLOSSARY OF TERMS

ALLUVIUM - A general term for clay, silt, sand, gravel, or similar unconsolidated detrital material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semisorted sediment in the bed of the stream or on its flood plain or delta.

ARROYO - An intermittent stream bed.

AQUIFER - A geologic formation, or group of formations, that contains sufficient saturated permeable material to conduct ground water to yield economically significant quantities of ground water to wells and springs.

BOWSER - A small mobile tank used to recover and transport POL products.

CONFINING STRATA - A strata of impermeable or distinctly less permeable material stratigraphically adjacent to one or more aquifers.

CONTAMINANT - As defined by section 104(a)(2) of CERCLA, shall include, but not be limited to, any element, substance, compound, or mixture, including disease causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformation, in such organisms or their offspring.

DOWNGRADIENT - A direction that is hydraulically down slope. The downgradient direction can be determined through a potentiometric survey or through the evaluation of existing water level elevations referenced to a common datum (mean sea level).

EP TOXICITY - A laboratory test designed to identify a solid waste as hazardous. A liquid extract from the solid waste is analyzed for selected metals and pesticides. If one or more of the parameters tested for is present in concentration greater than a maximum value, then the solid waste is considered a hazardous waste in accordance with RCRA definition.

EVAPOTRANSPIRATION - Evaporation from the ground surface and transpiration through vegetation.

FLOOD PLAIN - The relatively smooth valley floors adjacent to and formed by alluviating rivers which are subject to overflow.

FRIABLE - Condition of a rock or mineral that crumbles naturally or is easily broken, pulverized, or reduced to powder.

GROUND WATER - All subsurface water, especially that part that is in the zone of saturation.

HAZARDOUS WASTE (expanded version of the RCRA definition) - A solid waste which because of its quantity, concentration, or physical, chemical or infectious characteristics may -

(A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible, illness; or

(B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed.

LEACHING - The separation or dissolving out of soluble constituents from a rock or ore body by percolation of water.

MIGRATION (Contaminant) - The movement of contaminants through pathways (ground water, surface water, soil, and air).

NET PRECIPITATION - Mean annual precipitation minus mean annual evapotranspiration.

OROGRAPHIC - Associated with or induced by the presence of mountains.

OUTWASH PLAIN - A broad, outspread, flat or gently sloping, alluvial sheet of outwash deposited by meltwater streams flowing in front of or beyond the terminal moraine of a glacier.

PD-680 (Type I and Type II) - A military specification for petroleum distillate used as a safety cleaning solvent. The primary difference between PD-680 Type I and Type II is the flash point of the material. The flash points are 100°F and 140°F for PD-680 Types I and II, respectively. Currently, only Type II is authorized for use at Air Force installations.

PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

PLAYA - A Spanish term used in the Southwest U.S. for a dried-up, vegetation-free, flat-floored area composed of thin, evenly stratified sheets of fine clay, silt, or sand, and representing the bottom (lowermost or central) part of a shallow completely closed or undrained, desert lake basin in which water accumulates (as after a rain) and is quickly evaporated, usually leaving deposits of soluble salts. It may be hard or soft, and smooth or rough. The term is also applied to the basin containing an expanse of playa.

POTENTIOMETRIC SURFACE - An imaginary surface that represents the static head of ground water and is defined by the level to which water will rise in a cased well.

SOIL HORIZONS -

(A) A-Horizon - The uppermost mineral horizon of a soil; zone of leaching.

(B) B-Horizon - Occurs below the A-Horizon; the mineral horizon of a soil or the zone of accumulation.

(C) C-Horizon - Occurs below the B-Horizon; a mineral horizon of a soil consisting of unconsolidated rock material that is transitional in nature between the parent material below and the more developed horizons above.

SOLUM - Upper part of a soil profile in which soil-forming processes occur; A and B horizons.

STRATA - Plural of stratum.

STRATUM - A single and distinct layer, of homogeneous or gradational sedimentary material (consolidated rock or unconsolidated earth) or any thickness, visually separable from other layers above and below by a discrete change in the character of the material deposited or by a sharp physical break in deposition, or by both.

STRUCTURAL BASIN - A general term for a depressed, sediment-filled area. It may be circular to elliptical or elongate, bordered by faults within an orogenic belt.

TERRACE - Any long, narrow, relatively level or gently inclined surface, generally less broad than a plain, bounded along one edge by a steeper descending slope and along the other by a steeper ascending slope; a large bench or step-like ledge breaking the continuity of a slope.

UNSATURATED ZONE (Vadose Zone or Zone of Aeration) - A subsurface zone containing water under pressure less than that of the atmosphere, including water held by capillarity; and containing air or gases generally under atmospheric pressure. This zone is limited above the land surface and below the surface of the zone of saturation.

UPGRADIENT - A direction that is hydraulically up slope. The upgradient direction can be determined through a potentiometric survey or through the evaluation of existing water level elevations referenced to a common datum (mean sea level).

WATER TABLE - The upper limit of the portion of the ground completely saturated with water.

LIST OF ACRONYMS, ABBREVIATIONS AND SYMBOLS USED IN THE TEXT

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS USED IN THE TEXT

AFB	Air Force Base
AFESC	Air Force Engineering and Services Center
AFFF	Aqueous Film-Forming Foam
AFSC	Air Force Systems Command
AG	Aboveground
AGE	Aerospace Ground Equipment
ATC	Air Training Command
AVGAS	Aviation Gasoline
Bldg.	Building
bls	Below Land Surface
BOD_5	Biochemical Oxygen Demand (5-day)
BX	Base Exchange
°C	Degrees Celsius (Centigrade)
CES	Civil Engineering Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
cm/sec	Centimeters per Second
COD	Chemical Oxygen Demand
CRS	Component Repair Squadron
CSG	Combat Support Group
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DoD	Department of Defense
DPDO	Defense Property Disposal Office
EID	Environmental Improvement Division (State of New Mexico)
EMS	Equipment Maintenance Squadron
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FTD	Field Training Detachment
°F	Degrees Fahrenheit
ft/min	Feet per Minute
gal/yr	Gallons per Year

gpd	Gallons per Day
gpm	Gallons per Minute
HARM	Hazard Assessment Rating Methodology
IRFNA	Inhibited Red Fuming Nitric Acid
IRP	Installation Restoration Program
JEIM	Jet Engine Intermediate Maintenance
JP	Jet Petroleum
kt	Nautical miles per hour
lb	Pounds
lb/yr	Pounds per Year
mg/l	Milligrams per Liter
mgd	Million Gallons per Day
ml	Milliliter
mo.	Month
MOBSS	Mobility Support Squadron
MOGAS	Motor Gasoline
mph	Miles per Hour
msl	Mean Sea Level
NDI	Non-Destructive Inspection
No.	Number
NPDES	National Pollutant Discharge Elimination System
OEHL	Occupational and Environmental Health Laboratory
PCB	Polychlorinated Biphenyls
PMEL	Precision Measurement Equipment Laboratory
POL	Petroleum, Oil, and Lubricants
ppb	Parts per Billion
ppm	Parts per Million
RCRA	Resource Conservation and Recovery Act
SCS	Soil Conservation Service
TAC	Tactical Air Command
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TFW	Tactical Fighter Wing
TOC	Total Organic Carbon
TOX	Total Organic Halogens

TTW	Tactical Training Wing
TSS	Total Suspended Solids
UDMH	Unsymmetrical Dimethylhydrazine
UG	Underground
USAF	United States Air Force
USDA	United Stated Department of Agriculture
µg/l	Micrograms/liter

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REFERENCES

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Appendix A
RESUMES OF TEAM MEMBERS

NORMAN N. HATCH, JR.

Industrial Wastewater and Hazardous Waste Projects Manager

Education

M.S., Environmental Engineering, University of Florida, 1973
M.S., Analytical Chemistry, University of Florida, 1972
B.S., Chemistry, University of New Hampshire, 1969

Experience

Mr. Hatch joined CH2M HILL in 1973 and is currently the Manager of the Industrial Wastewater Reclamation Department. His range of engineering experience includes hazardous waste projects, laboratory and pilot treatability studies, process design of industrial wastewater treatment facilities, and process design of municipal water and wastewater treatment facilities. Examples of his work include:

- Overall responsibility for hazardous materials disposal site records searches for 12 U.S. Air Force installations throughout the United States. The purpose of the records searches is to assess the potential for hazardous contaminant migration from past disposal practices and to recommend follow-up actions.

- Assistance in a comprehensive RCRA compliance program for Gulf Oil Company's Port Arthur Refinery.

- Project manager of a feasibility study for treatment of high nitrogen industrial wastewater from the Air Products and Chemicals, Inc., manufacturing facility in Pensacola, Florida. Treatment technologies investigated included aerated lagoons, oxidation ponds, anaerobic treatment ponds, spray irrigation, activated carbon, and air stripping.

- Project manager of a comprehensive treatability and process selection study for the American Cyanamid Fibers Division plant in Milton, Florida. Investigations included spray irrigation, deep well injection, activated sludge, rotating biological contactors, anerobic contact treatment, activated carbon, ion exhange, and chemical coagulation.

- Project manager for several other treatability and process selection studies for industrial clients including Arizona Chemical Company, Kaiser Agricultural Chemicals, Engelhard Industries, and Production Plating Company.

- Assistance in the negotiation of NPDES permits for Air Products and Chemicals, Inc., American Cyanamid, and Kaiser Agricultural Chemicals.

- Lead engineer on an ozone disinfection feasibility study for the City of Philadelphia's Queen Lane Water Treatment Plant. Also served as chief process engineer for the subsequent design of chemical feed systems at the Queen Lane Plant.

- Process design and design of chemical feed and sludge handling facilities for the Alexander City, Alabama, Water Treatment Plant.
- Process design and design of chemical feed system modifications for the St. Augustine, Florida, Water Treatment Plant
- Project manager for the design of water treatment facilities, including lime softening, zeolite softening, and granular activated carbon adsorption for a sugar mill in south Florida.
- Project manager for development of a comprehensive water system master plan, including raw water supply, treatment, and distribution systems for the Fort Pierce Utilities Authority, Fort Pierce, Florida.
- Project manager for a feasibility study of direct wastewater reuse for potable water for the City of St. Petersburg, Florida.
- Project manager for the planning, supervision, and performance of pilot plant investigations for the removal of hydrogen sulfide from potable water for the Orlando Utilities Commission, Orlando, Florida.
- Cost-effective analysis and process selection for treatment of combined domestic and paper mill wastewater for the City of Harriman, Tennessee.
- Preparation of various segments of 201 facilities plans for Monroe County (Florida Keys); Lake City, Florida; Alachua County, Florida, Puerto Rico; and Live Oak, Florida.

Before joining CH2M HILL, Mr. Hatch was employed with the E.I. du Pont de Nemours Photo Products Plant in Parlin, New Jersey.

Membership in Organizations

Phi Beta Kappa
Phi Kappa Phi
Society of the Sigma Xi
Water Pollution Control Federation

Professional Engineer Registration

Florida
Georgia

THOMAS C. EMENHISER

Education

B.S., Chemistry, University of Florida, 1974

Experience

Mr. Emenhiser is an environmental scientist in CH2M HILL's Water and Wastewater Division. Representative project-related assignments on which he has worked include:

- Characterization and treatability study of industrial wastewaters for Hercules, Incorporated.
- Preparation of wastewater treatment plant operation and maintenance manuals for the Cities of Gainesville, Winter Haven, and St. Petersburg, Florida.
- Water supply study for Florida Power & Light Company's proposed Peace River Nuclear Power Generating Plant.
- Plant evaluations, alternative sludge disposal analyses, and environmental inventories for several 201 facilities plans, including those for St. Augustine, Gainesville, and West Pasco County, Florida.
- Field management for floodwater damage surveys conducted for. the U.S. Army Corps of Engineers, Vicksburg Division.
- Field management for water quality studies in the Everglades Agricultural Area conducted for the Florida Sugar Cane League.

Mr. Emenhiser joined the firm in 1973 as a part-time laboratory technician while attending the University of Florida. After graduation, he initially worked in the Gainesville Office laboratory conducting water and wastewater analyses.

Membership in Organizations

American Society of Oceanography and Limnology
Florida Pollution Control Association

Publications

"Anaerobic-Aerobic Biopond Treatment of Sugarcane Mill Process Wastewaters" (with Earl E. Shannon and J. J. Smith, Jr.). Presented at the 52nd Annual Conference of the Water Pollution Control Federation, Houston, Texas, 1979.

GARY E. EICHLER
Hydrogeologist

Education

M.S., Engineering Geology, University of Florida, 1974
B.S., Construction and Geology, Utica College of Syracuse University, 1972

Experience

Mr. Eichler has been responsible for ground-water projects for both water supply and effluent disposal. Studies have included site selection, well design, construction services, monitoring and testing programs, determination of aquifer characteristics, and well field design. In addition, Mr. Eichler has conducted numerous studies to determine pollution potential of toxic and hazardous wastes. Types of projects for which Mr. Eicher has been directly responsble for include:

- Exploration drilling, testing, and design of well fields for potable water supply with an installed capacity of over 65 mgd.
- Determination of pollutant travel time and direction of movement at hazardous waste disposal sites.
- Geophysical logging and testing programs for deep disposal wells for both municipal and hazardous waste.
- Aquifer modeling studies completed to predict effects of future ground-water withdrawal.
- Determination of saltwater intrusion potential and design of associated monitoring programs.

Prior to joining CH2M HILL in 1976, Mr. Eichler was an engineering geologist with Environmental Science and Engineering, Inc., of Gainesville, Florida. Responsibilities there included project management, soils investigations, siting studies, ground-water and surface-water reports, and Federal and state environmental impact studies. He has professional capabilities in the following areas.

- Hydrogeology. Water supply well location, aquifer testing, well field layout, injection well testing and monitoring program design, and well construction inspection.
- Water resources inventory. Potentiometric mapping, water yield, and availability determinations.
- Site investigations. Determination of subsurface conditions, primarily in soil media. Determination of stratigraphic correlation and associated physical properties for engineering design.
- Environmental permitting. Federal, state, regional, and local permit studies associated with industrial and mining projects.

GARY E. EICHLER

- Clay mineralogy. Clay mineral reactions primarily associated with lime stabilization for highways and other engineering projects. Participated in a Brazilian highway project and developed laboratory analysis for lime-soil reactions.

- Engineering geology. Geologic exploration, soil property determinations for engineering design, and water and earth materials interactions associated with construction.

- Geophysics. Well logging and interpretation.

Mr. Eichler directed the laboratory analysis of tropical soils to determine engineering properties and reaction potential with lime additives for a Brazilian highway project. He also assisted in the preparation and presentation of a seminar on lime stabilization sponsored by the National Lime Association.

Membership in Organizations

American Institute of Professional Geologists
American Water Resources Association
Association of Engineering Geologists
Geological Society of America
Southeastern Geological Society
National Water Well Association

Publications

Engineering Properties and Lime Stabilization of Tropically Weathered Soils. M.S. thesis, Department of Geology, University of Florida. August 1974.

Certifications

Certified Professional Geologist
Certificate No. 4544

RICHARD J. MISHAGA
Ecologist — Wetlands Specialist

Education

Ph.D., Ecology, New Mexico State University, 1977
M.S., Biology, University of Nevada, 1970
B.S., Zoology, Ohio University, 1967

Experience

Dr. Mishaga is CH2M HILL's senior ecologist specializing in terrestrial ecosystem analysis. His responsibilities include design and management of environmental programs that gather baseline information, assess ecological impacts, and develop mitigation measures for industrial operations and municipal facilities. As a senior technical advisor, Dr. Mishaga has provided expert testimony at hearings and has negotiated sensitive mitigation issues involving wetlands, endangered species, and big game. He has directed, administered, or assisted with more than 30 environmental assessments in 11 states. His international experience includes directing and managing studies in Chile and Mexico.

A sample of his field and administrative experience with wetlands includes:

- Terrestrial Project Manager for Chevron's Equivalent Protection Demonstration on San Francisco Bay. The project involves long-term sampling and analysis of saltwater wetlands and wildlife, including endangered wildlife species.

- Terrestrial Task Manager for the City of San Diego's South Bay Ocean Outfall Environmental Assessment. This analysis and evaluation of riparian and saltwater wetlands and wildlife in San Diego County, California, included endangered plant and wildlife species.

- Terrestrial Task Manager for Incline Village's Wetland Enhancement Project. This project involved design and analysis of developing a 700-acre freshwater marsh in the Carson Valley, Nevada, using secondarily treated wastewater effluent.

- Project Manager for the City of Tualatin Wetlands Protection Study. The study described and evaluated freshwater wetlands. Model city ordinances to protect wetlands were developed.

- Terrestrial Technical Advisor for the U.S. Fish and Wildlife Service study of utilization of geothermal effluent to create wetlands. Geothermal resources in seven western states were evaluated to assess the potential for waterfowl wetland habitat development.

- Biological Task Manager for Yakima-Tieton Irrigation District's Rehabilitation Program. The program evaluated project impacts on wildlife riparian habitat and successfully negotiated upland game habitat mitigation with the Washington State Department of Game.

RICHARD J. MISHAGA

- Project Manager for the coastal wetlands evaluation of Point St. George. The report submitted to Del Norte County for California Coastal Commission consideration involves a site of migratory habitat for the endangered Aleutian Canada Goose.

- Wetlands Technical Advisor for coastal wetlands evaluations at Tillamook, Oregon, and Grays Harbor, Washington. The projects included assessments of wildlife habitat in forested wetlands.

- Wetlands Technical Advisor for Alumax Aluminum Reduction facility, Mount Holly, South Carolina. The project involved an assessment of freshwater cypress swamps and evaluation of Federal and state wetlands permitting procedures.

In addition to his CH2M HILL responsibilities, Dr. Mishaga has served on technical advisory boards for endangered species (Mission Bay Least Tern Management Team) and for wetlands (Oregon Wetlands Conservancy). Before joining CH2M HILL, Dr. Mishaga worked in Boston and Denver as an ecologist for Stone & Webster Engineering Corporation, where he provided ecological expertise for a number of power plant, irrigation, and mining projects.

During his graduate research studies, Dr. Mishaga specialized in ecological problems of semiarid ecosystems. He minored in statistics, and is experienced in ecological field sampling and wildlife management techniques.

Membership in Professional Societies

Ecological Society of America
Northwest Scientific Association
American Society of Mammalogists
Cooper Ornithological Society
American Institute of Biological Sciences
Sigma Xi

Publications

Academic papers concerning the ecology of various birds and mammals.

Editor of, or contributor to, numerous industrial and environmental reports, environmental assessments, and permit applications.

Technical papers presented at professional meetings.

Appendix B
OUTSIDE AGENCY CONTACT LIST

Appendix B
OUTSIDE AGENCY CONTACT LIST

1. U.S.D.A. Soil Conservation Service
   Albuquerque, New Mexico
   Mr. George Anderson
   505/766-3277

2. U.S.D.A. Soil Conservation Service
   Mr. Preston Radcliff
   Mr. Gene Cecava
   Alamogordo, New Mexico
   505/437-0231

3. U.S. Fish and Wildlife Service
   Office of Endangered Species
   Mr. Gary Halverson
   Mr. Joel Medlin
   Albuquerque, New Mexico
   505/766-3966

4. U.S. Department of the Interior
   Bureau of Land Management
   District Office
   Mr. Kenneth Holmes
   Las Cruces, New Mexico
   505/524-8551

5. U.S. Department of the Interior
   National Parks Department
   White Sands National Monument
   Mr. Donald R. Harper
   Alamogordo, New Mexico
   505-437-1058

6. U.S. Environmental Protection Agency
   Albuquerque, New Mexico
   Mr. Rick Meyerhein
   505/841-2555

7. U.S. Environmental Protection Agency
   Dallas, Texas
   Ms. Sheryl Fought
   214/767-2850

8. U.S. Environmental Protection Agency
   Dallas, Texas
   Mr. Scott Nicholson
   214/767-2850

9. U.S. Environmental Protection Agency
   Mr. Sam Nott
   Ms. Heven Newman
   Dallas, Texas
   214/767-4075

10. U.S. Geological Survey
    Mr. Brandon Orr
    Las Cruces Office
    Las Cruces, New Mexico
    505/646-1335

11. U.S. Geological Survey
    Water Resources Division
    Mr. Don Hart
    Albuquerque, New Mexico
    505/766-2810

12. New Mexico State University
    Water Resources Research Institute
    Dr. Peter Herman
    Las Cruces, New Mexico
    505/646-4337

13. State of New Mexico
    Bureau of Mines and Mineral Resources
    Mr. W. J. Stone
    Socorro, New Mexico
    505/835-5420

14. New Mexico Department of Fish and Game
    Office of Threatened and Endangered Species
    Mr. Michael Hatch
    Santa Fe, New Mexico
    505/827-7894

15. New Mexico Natural Resources Department
    New Mexico Heritage Program
    Mr. William Isaacs
    Mr. Rex Wahl
    Santa Fe, New Mexico

16. State of New Mexico
    Environmental Improvement Division
    Mr. Jack Ellvinger
    Hazardous Waste Unit
    Santa Fe, New Mexico
    505/984-0020

17. State of New Mexico
    Environmental Improvement Division
    Mr. Randy Hicks
    Santa Fe, New Mexico
    505/984-0020

18. State of New Mexico
Environmental Improvement Division
Solid Waste Unit
Mr. Ray Sisneros
Santa Fe, New Mexico
505/984-0020

19. State of New Mexico
Environmental Improvement Division
Water Pollution Control
Mr. Tony Dry Polcher
Santa Fe, New Mexico
505/984-0020

20. State of New Mexico
State Engineer, Deming Office
Mr. Lewis Putnam
Deming, New Mexico
505/546-2851

21. State of New Mexico
State Engineer, Roswell Office
Mr. Delbert Nelson
Roswell, New Mexico
505/622-6521

22. State of New Mexico
State Engineer, Roswell Office
Mr. Sherman E. Galloway
Roswell, New Mexico
505/622-6942

Appendix C
HOLLOMAN AFB RECORDS SEARCH INTERVIEW LIST

Appendix C
HOLLOMAN AFB RECORDS SEARCH INTERVIEW LIST

Interviewee	Area of Knowledge	Years at Installation
1	Army Air Operations	10
2	Fuels Management	10
3	Army Air Operations	32
4	Army Air Operations	17
5	Environmental/Civil Engineering	3
6	Mobility Support Squadron	1
7	POL Maintenance and LOX Storage	31
8	Refueling Truck Maintenance	31
9	Auditor	3
10	Fuel Systems Maintenance	10
11	Motor Pool	33
12	Motor Pool	32
13	POL Maintenance	2
14	Real Estate	28
15	Fire Department	27
16	Fire Department	3
17	6585th Test Group	25
18	Exterior Electric	9
19	Exterior Electric	23
20	Defense Property Disposal Office	34
21	Fuels Testing	28
22	479th Component Repair Squadron	2
23	479th Component Repair Squadron	5
24	Mobility Support Squadron	10
25	Roads and Grounds	14
26	Roads and Grounds	1
27	Roads and Grounds	5
28	Primate Research	9
29	49th Equipment Maintenance Squadron	3
30	833rd Civil Engineering Squadron	31
31	833rd Civil Engineering Squadron	1
32	833rd Civil Engineering Squadron	3
33	479th Component Repair Squadron	5
34	479th Component Repair Squadron	7
35	479th Component Repair Squadron	4
36	49th Equipment Maintenance Squadron	2
37	Sled Test Track	32
38	Sled Test Track	24
39	Sled Test Track	23
40	Water and Wastewater	30
41	Water and Wastewater	29
42	Entomology	7
43	Explosive Ordnance Disposal	3
44	Bioenvironmental Engineering	1
45	BX Service Station	20
46	El Paso Radar Site	2

Appendix C
HOLLOMAN AFB RECORDS SEARCH INTERVIEW LIST

Interviewee	Area of Knowledge	Years at Installation
47	Silver City Radar Site	2
48	833rd Civil Engineering Squadron	2
49	833rd Transporation Squadron	2
50	833rd Transporattion Squadron	2
51	479th Component Repair Squadron	2
52	6585th Test Group	2
53	6585th Test Group	2
54	6585th Test Group	2

Appendix D
INSTALLATION HISTORY

Appendix D

A. INSTALLATION HISTORY

The history of Holloman Air Force Base, described in the following narrative, was developed from the Tab A-1, Environmental Narrative, Holloman AFB (Reference 41) and Base Fact Sheets, Holloman AFB (Reference 23).

Holloman Air Force Base, formerly known as Alamogordo Army Air Field, was initiated as a wartime temporary facility with construction beginning on February 6, 1942. At the end of World War II, the airfield was briefly inactivated. Because Alamogordo Bombing Range afforded an immediately available area 38 miles wide and 64 miles long, and because of atmospheric conditions and the suitability for photographic instrumentation, it was selected for the Air Force Guided Missile Test Range.

The base was transferred in March 1947 to the Air Material Command with the mission to be: "Provide facilities and accomplish development and testing of pilotless aircraft, guided missiles, and allied equipment in support of the Air Material Command Research and Development Program." A field party arrived at Alamogordo on March 16, 1947 to start the base missile activity and on July 23, 1947 the first missile was launched. In September 1948 the base was renamed Holloman Air Force Base in honor of Colonel George V. Holloman, a pioneer in the guided missile research field. In 1949 construction was begun on a 3,550 foot long high-speed test track at Holloman AFB. It was first used on June 23, 1950 to test the Snark missile. Since that first run, the track has been extended to over 50,000 feet, thousands of test runs have been conducted, and speeds in the area of Mach 7 have been recorded. When the

Air Research and Development Command was formed in 1951, the base was placed under the guidance of the Air Force Missile Test Center at Patrick Air Force Base, Florida. On October 10, 1952 the base was named one of the development centers of the Air Research and Development Command and became Holloman Air Development Center. Five years later, on September 1, 1957, the center was designated as the Air Force Missile Development Center under the Air Force Systems Command (AFSC). On January 1, 1971 the base was transferred from AFSC to TAC with the 49th TFW assuming host responsibilities. In FY 74 the 465th TFTS from Cannon AFB, NM and two detachments from Shaw AFB, SC and Seymour Johnson AFB, NC were transferred to Holloman AFB. On January 1, 1977, the 479th Tactical Training Wing was assigned to Holloman AFB.

1. <u>49th Tactical Fighter Wing</u>

On July 15, 1968, the first aircraft of the 49th Tactical Fighter Wing landed at Holloman Air force Base, N.M. as the unit became the first dual-based Tactical Fighter Wing. Under the dual-basing concept, the 49th spent most of its time training at Holloman Air Force Base, while individual squadrons returned periodically to the European environment for exercises. The entire wing had the capability of deploying to Europe and establishing itself in a fully operational status in minimum time. The wing remained fully committed to the NATO Alliance. While stationed in the United States, the 49th came under the operational control of TAC for training and administration. When deployed to Europe, operational control was transferred to the United State Air Forces in Europe.

In May 1972, the wing was deployed to Southeast Asia for combat action against an aggressor force. The move to SEA by the 49th was the largest of its kind ever attempted by the United States Air Force, and involved the deployment of 2,600 people, almost three million pounds of equipment and supplies, and the movement of four squadrons of F-4 Phantom jets, a distance of 11,000 miles from New Mexico to Takhli Royal Thai Air Force Base, Thailand.

On December 1977, six F-15s flow over Holloman AFB, led by four 49th TFW F-4 aircraft, symbolizing the conversion from the F-4 to the F-15 and marking the arrival of the first operational F-15 squadron at Holloman. This conversion was done with the 49th TFW maintaining its operational capability. On 4 June 1978, the last 49th TFW squadron completed the transition to the F-15 Eagle.

In July 1980, the 49th TFW picked up the commitment as the primary Rapid Deployment Force unit. This tasking, which lasted for a year, required that the wing be prepared to deploy its aircraft, crews, and support personnel on a moments notice. The wing served with the Rapid Deployment Force until July 1981, when the tasking was transferred to the 1st TFW, Langley AFB, Virginia.

The capability to deploy to Europe and effectively fight there was proven in August and September 1981, when units of the 49th TFW were deployed to Europe. One squadron went to Lahr Air Base, Germany, and another to Aalborg air Station, Denmark. These 30-day simultaneous deployments were extremly successful. In May 1982, the wing made its first F-15 deployment to Asia, when 12 aircraft from the 8th TFS deployed to Kwang Ju, Korea.

2. 479th Tactical Training Wing

The 479th Tactical Training Wing (TTW), located at Holloman Air Force Base, New Mexico since January 1, 1977, is known as the "Gateway to the Tactical Air Command" for all United States Air Force pilots and navigators selected to fly tactical fighter aircraft. The wing, a tactical unit within the 833rd Air Division, is also the "Gateway" to the tactical air forces of selected Allied countries which send their officers to the United States for pilot training. The key to the world of tactical aviation is the wing's Lead-In Fighter Training (LIFT) Program.

On January 1, 1977, the 479th TFW was redesignated the 479th Tactical Training Wing and activated at Holloman. The 465th TFTS was redesignated the 465th Tactical Training Squadron, and was reassigned as the academic squadron of the 479th TTW.

Today, the 479th TTW is comprised of: the 416th, 434th, 435th, and 436th Tactical Fighter Training Squadrons: the 465th Tactical Training Squadron; the 479th Headquarters Squadron; the 479th Aircraft Generation Squadron; and the 479th Component Repair Squadron.

3. 4449th Mobility Support Squadron

The 4449th Mobility Support Squadron formed at Holloman on March 1, 1972 and has been based there since that time.

4. <u>833rd Air Division</u>

The mission of the 833rd Air Division is to administer people and units assigned and/or attached to Holloman Air Force Base; manage Holloman resources; provide command supervision of assigned tactical fighter and lead-in fighter training missions, and represent the Tactical Air Command and Twelfth Air Force commanders on Harvest Bare matters. Harvest Bare is a concept in mobility whereby the Air Force can deploy buildings, shelters, and facilities to a "bare base" and have a tactical fighter squadron in place and ready to fly combat operations within 72 hours of arrival of advance personnel.

Organizations subordinate to the 833rd Air Division commander include the 49th Tactical Fighter Wing, 479th Tactical Training Wing, 4449th Mobility Support Squadron, 933rd Combat Support Group, Deputy Commander for Resource Management, and the United States Air Force Hospital at Holloman.

The 833rd Air Division was originally activated in September 1964 and inactivated on December 24, 1969 due to budgetary restrictions. It was under the jurisdiction of Ninth Air Force, Tactical Air Command, and located at Seymour Johnson Air Force Base, N.C. It is currently subordinate to Twelfth Air Force, Bergstrom Air Force Base, Texas, Tactical Air Command.

From October through December 1964, the 833rd served as an intermediate command between Ninth Air Force and tactical wings, monitoring and supervising tactical operations and training. Beginning in 1964, the 833rd supervised tactical operations and training. Beginning in 1964, the 833rd supervised an extensive replacement training program due to heavy demands for replacement aircrews for combat in Southeast Asia. The seizure of the USS Pueblo in January 1968 brought numerous changes within the division, as elements of assigned wings deployed to the Far East, and a number of Air National Guard organizations were called to extended service and incorporated into the division training programs.

The 833rd was reactivated December 1, 1980 at Holloman Air Force Base when Tactical Training Holloman, a tactical training unit since August 1, 1977, was renamed the 833rd Air Division. The change was in name only, and manpower authorizations and the unit's organizational structure did not change.

B. INSTALLATION AND TENANT MISSIONS

The missions of the host and tenant organizations at Holloman AFB are as follows:

1. 833rd Air Division

The 833rd Air Division administers to people and units assigned or attached to the Base, manages Holloman resources, provides command supervision of assigned tactical fighter and lead-in fighter training missions, and represents TAC and 12AF Commanders on "Harvest Bare" matters.

2. 833rd Combat Support Group

Provides support functions and services for all 833rd units and tenant organizations. The Civil Engineering and Security Police Squadrons, Chaplain and Judge Advocate, Operations and Training, Disaster preparedness, and divisions dealing with personnel and services are units under its jurisdiction.

3. <u>49th Tactical Fighter Wing</u>

Maintains combat-ready status and prepares for a flexible, mobile tactical airpower instrument capable of worldwide deployment; maintains a full tactical counter-air capability and it is prepared to deploy, as a combat elements, to ensure air superiority during contingencies and general war; and provides resources for peace-time North American Aerospace Defense Command operations.

4. <u>479th Tactical Training Wing</u>

This unit screens new Tactical Air Force aircrews of the United States Military forces and selected allied services for fighter aptitude while providing basic combat aircrew academic and flight training in the techniques and operations of fighter aircraft and associated equipment. The people also provide upgrade training for instructor pilots, fighter orientation for forward air controllers, and jet recurrency training for pilots who haven't flown for an extended period of time.

5. <u>4449th Mobility Support Squadron</u>

This squadron maintains a constant readiness to deploy, on short notice, to remote locations with support equipment necessary to establish a Tactical Air Force Base of Operations.

6. Resource Management

This unit ensures that the various missions of the 833rd are accomplished with available resources. The organization is comprised of the 833rd Supply and Transportation Squadrons, the Base's Contracting, Resource Plans and Comptroller Divisions.

7. USAF Hospital

The Holloman USAF Hospital administers and supervises all professional and administrative aspects of the base medical services and facilities.

8. Detachment 6--4400th Management Engineering Squadron

Provide base level manpower and organization services which implement Air Force policy guidance to obtain the best mix and use of manpower resources (military, civilian and contract, inhouse) in meeting total workload needs.

Also to provide surveillance in the administration of DoD contracts performed on the Holloman AFB/White Sands Missile Range Complex. Contract Administration Services include the areas of Contract Administration, Property Administration, Quality Assurance and Safety.

9. Detachment 1, Aeronautical Systems Division (AFSC)

Conducts development, test and evaluation of the Advanced Location Strike System, (ALSS), conducts risk reduction testing to assist development of the Precision Location Strike System (PLSS), and supports other system development and test programs, including PAVE MOVER, using the ALSS Ground Beacon Station network. Flight tests are accomplished on White Sands Missile Range. Beacon operating locations include a variety of sites on WSMR plus numerous sites up to 200 miles off range. Activities on HAFB include equipment testing, maintenance, scheduling and weapons build-ups and loading.

10. 6585th Test Group

The mission of the 6585th Test Group is the testing and evaluation of sub-systems for aircraft, missiles and space vehicles and is carried out by five major divisions: Central Inertial Guidance Test Facility (CIGTF), High Speed Test Track, Radar Target Scatter Division (RATSCAT), Aeronautical Test Division, and Computer Science Division. The Test Group sponsors Air Force users of the White Sands Missile Range (WSMR) through its office of the Deputy for Air Force, WSMR, located at White Sands Missile Range, New Mexico. The Test Group is also responsible for other Test Organizations which are administratively assigned.

11. Det 1, Air Force Geophysics Laboratory

To conduct research and development, balloon flights and test programs at Holloman AFB, New Mexico, at selected remote sites. Operates the balloon tracking and plotting center.

12. FTD 532 (ATC)

To provide system, associate, and aircrew familiarization training for:

49th Tactical Fighter wing (TAC)
479th Tactical Training Wing (TAC)
6585th Test Group (AFSC)
Other Tenant Units as required
Provide on-the-Job Training service to all base agencies

13. New Mexico State University

The Primate Research Institute of New Mexico State University conducts research in three major directions: primate breeding and care, drug and chemical safety evaluation, and productive biology.

14. Army Air Operations Directorate

To plan, direct, and provide aviation support for White Sands Missile Range (WSMR). To provide organizational direct support and limited general support maintenance to WSMR aircraft and emergency maintenance to transient and test aircraft at WSMR. To serve as aviation staff for Hq WSMR and advise the Commander on aviation matters.

15. Company B, US Army, WSMR Troop Command

The mission for Company B, United States Army, White Sands Missile Range Troop command is to provide unit administration, training, billeting, and UCMJ for one hundred and fifteen (115) United States Army personnel stationed at Holloman AFB, NM.

16. US Army Corps of Engineers

To serve as the construction agency for Air Force and Army new military construction at Holloman AFB, New Mexico.

17. Holloman Section, White Sands Missile Range Meteorological Team, Atmospheric Sciences Lab

This section is responsible for supplying meteorological support to the 49th Tactical Fighter Wing, 479th Tactical Training Wing and the northern end of the White Sands Missile Range.

18. US Army Communications Command Agency

Provides direct assistance pertaining to telecommunications and data facility use to the mid-White Sands Missile Range area.

Appendix E
BIRDS OF LAKE HOLLOMAN

Appendix E

BIRDS OF LAKE HOLLOMAN[a]

Eared Grebe
Western Grebe
Pied-Billed Grebe
Mallard
Gadwall
Pintail
Green-winged Teal
Mexican Duck
Blue-winged Teal
Cinnamon Teal
American Wigeon
Northern Shoveler
Redhead
Canvasback
Lesser Scaup
Bufflehead
Ruddy Duck
Common Merganser
Red-breasted Merganser
Turkey Vulture
Red-Tailed Hawk
Swainson's Hawk
Marsh Hawk
Peregrine Falcon
American Kestrel
American Coot
Semipalmated Plover
Snowy Plover
Killdeer
Long-billed Curlew
Willet
Least Sandpiper
Long-billed Dowitcher
Western Sandpiper
American Avocet
Wilson's Phalarope
Great Blue Heron
Snowy Egret
Ringneck Duck
Spotted Sandpiper
Lesser Yellowlegs
Greater Yellowlegs
Sanderling
Dunlin
Blacknecked Stilt
Ring-billed Gull
Roadrunner
Franklin's Gull
Ring-billed Gull
Forster's Tern
Black Tern
Mourning Dove
Lesser Nighthawk
Belted Kingfisher
Western Wood Pewee
Tree Swallow
Violet-green Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Cliff Swallow
White-necked Raven
Northern Mockingbird
Loggerhead Shrike
Warbling Vireo
Orange-crowned Warbler
Nashville Warbler
Yellow Warbler
MacGillivray's Warbler
Wilson's Warbler
Yellowthroat
Yellow-headed Blackbird
Red-winged Blackbird
Great-tailed Grackle
Western Tanager
House Finch
Lark Bunting
Lark Sparrow
Chipping Sparrow
Lincoln's Sparrow
Northern Phalarope
Sandhill Crane
Western Kingbird
Cassin's Kingbird
Say's Phoebe
Horned Lark
Common Raven
Rock Wren
Ruby-crowned Kinglet
Water Pipet
Starling
Yellow-rumped Warbler
Eastern Meadowlark

Scott's Oriole
Black-throated Sparrow
Brewer's Sparrow
Swamp Sparrow
Snow Goose
Black Crowned Night Heron
White Pelican
Sharp-shinned Hawk
Black-bellied Plover
Ferruginous Hawk
Western Meadowlark
Brown-headed Cowbird
Gray-headed Junco
White-crowned Sparrow
Song Sparrow
Savannah Sparrow
Green Heron
Chestnut Collared Longspur
Clay Colored Sparrow
White-faced Ibis

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[a]Source: Environmental Assessment, Lake Holloman Actions, Holloman Air Force Base, New Mexico. 1978.

Note: Bird species are listed by common names.

Appendix F
MASTER LIST OF INDUSTRIAL ACTIVITIES

Appendix F--continued
MASTER LIST OF INDUSTRIAL ACTIVITIES

Shop Name	Present Location and Dates (Building No.)	Past Location and Dates (Building No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment Storage/Disposal Methods
479th TTW-CRS					
AGE	282 1977-Present	a	X	X	DPDO
Repair and Reclamation	282 1977-Present	a	X	X	DPDO
Auto Pilot/Instrument	280 1977-Present	a	X		Consumed in Process
Comm./Nav.	280 1977-Present	a	X		Consumed in Process
Corrosion Control	308 1977-Present	a	X	X	DPDO; Oil/Water Sep. to Sanitary Sewer
Degreasing	300 1977-Present	a	X	X	DPDO; Oil/Water Sep. to Sanitary Sewer
Egress	500 1977-Present	a	X		Consumed in Process
Electric	500 1977-Present	a	X	X	DPDO; Neutralization to Sanitary Sewer
Inspection	500 1977-Present	a	X	X	DPDO; Oil/Water Sep. to Sanitary Sewer
Machine Shop	280 1977-Present	a	X	X	DPDO
Armament Systems	284 1977-Present	a	X	X	DPDO
Pneudraulics	500 1977-Present	a	X	X	DPDO
Structural Repair	281 1977-Present	a	X		Consumed in Process
Jet Engine Inspection and Maintenance	300 1977-Present	a	X	X	DPDO; Oil/Water Sep. to Sanitary Sewer
Test Cell	638 1977-Present	a	X		Oil/Water Separator to Sanitary Sewer
Welding	281 1977-Present	a	X	X	DPDO
Environmental Systems	280 1977-Present	a	X	X	DPDO

[a] The 479th TTW became operational at Holloman AFB in 1977.

Appendix F--continued
MASTER LIST OF INDUSTRIAL ACTIVITIES

Shop Name	Present Location and Dates (Building No.)	Past Location and Dates (Building No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment Storage/Disposal Methods
479th TTW-CRS (Continued)					
Camera/Photo	280 1977-Present	a	X		Consumed in Process
Fuel Shop	315 1977-Present	a	X		Consumed In Process
Accessory Repair	300 1977-Present	a			
Small Gas Turbine	282 1977-Present	a	X	X	DPDO
Wheel and Tire	282 1977-Present	a	X	X	DPDO
Transient Alert	571 1977-Present	a	X		Consumed in Process
479th TTS-AGS					
Aircraft Gen. Sq.	299 1977-Present	b			
416, 434, 435, 436 Amu's	297 1977-Present	b	X	X	DPDO
Weapons	299 1977-Present	b			
Base Life Support	1088 1977-Present	b			
49th TFW-AGS					
49th Aircraft-General	868 1968-Present	b			
7, 8, 9, AMU's	819 1968-Present	b			
49th TFW-CRS					
Electric Shop	898 1968-Present	b	X	X	DPDO
Survival Equipment	524 1968-Present	b			
Environmental Systems	851 1968-Present	b	X		Consumed in Process
Machine Shop	816 1968-Present	b	X	X	DPDO

[a] The 479th TTW became operational at Holloman AFB in 1977.

[b] The 49th TFW became operational at Holloman AFB in 1968. Prior to 1968, the major aircraft maintenance shops were located in Building 302 (Hangar 3). Aircraft general maintenance was performed in Building 301 (Hangar 4).

Appendix F--continued
MASTER LIST OF INDUSTRIAL ACTIVITIES

Shop Name	Present Location and Dates (Building No.)	Past Location and Dates (Building No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment Storage/Disposal Methods
49th TFW-CRS (Continued)					
NDI Shop	851 1968-Present	b	X	X	DPDO
Structural Repair	817 1968-Present	b	X		Consumed in Process
Engine/Secondary Power Shop	800 1968-Present	b	X		
Test Cell	807 1977-Present	b	X	X	DPDO
Welding	816 1968-Present	b			
Hydraulics Shop	851 1968-Present	b	X	X	DPDO
Avionics Branch	823 1968-Present	b	X		Consumed in Process
PMEL	839 1968-Present	b	X	X	DPDO
Test Cell/Sound Supressor	807 1977-Present	b			
49th TFW--EMS					
49th EMS	821 1968-Present	b			
Missile Maintenance	1235 1968-Present	b	X		Consumed in Process
Munitions Maintenance	1239 1971-Present	b			
Inspection	1239 1971-Present	b	X		Consumed in Process
Corrosion Control	809 1968-Present	b	X	X	DPDO
Repair and Reclamation	898 1968-Present	b	X		Consumed in Process
AGE	822 1968-Present	b	X	X	DPDO
Fuel Sysetms	315 1968-Present	b	X	X	Storage Tank 2B
Egress	898 1968-Present	b	X		Consumed in Process

[b] The 49th TFW became operational at Holloman AFB in 1968. Prior to 1968, the major aircraft maintenance shops were located in Building 302 (Hangar 3). Aircraft general maintenance was performed in Building 301 (Hangar 4).

Appendix F--continued
MASTER LIST OF INDUSTRIAL ACTIVITIES

Shop Name	Present Location and Dates (Building No.)	Past Location and Dates (Building No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment Storage/Disposal Methods
49th TFW-EMS (Continued)					
Armament	866 1977-Present	b	X		Consumed in Process
Wheels and Tire	898 1968-Present	b	X	X	DPDO
EOD	821 1968-Present	b			
Life Support	811/ 819 1968-Present	b			
ES-85 Mobile Photo Process	821 1968-Present	b			
USAF Hospital					
Hospital	15 1967-Present		X	X	DPDO
Dental Clinic	273 1957-Present				
Hospital General	15 1967-Present				
4449th Mobility Support Squadron					
AGE	901 1976-Present	877 1973-1976	X	X	DPDO
Carpentry	902 1976-Present	877 1973-1976	X		Consumed in Process
Corrosion Control	902 1976-Present	877 1973-1976	X	X	DPDO
Fabric	902 1976-Present	877 1973-1976	X		Consumed in Process
Machine	902 1976-Present	877 1973-1976	X	X	DPDO
Periodic Maintenance	902 1976-Present	877 1973-1976	X		Consumed in Process
Sanitation	901 1976-Present	877 1973-1976	X		Consumed in PRocess Incineration
Transportation	901 1976-Present	877-1973-1976	X	X	DPDO
Welding	902 1976-Present	877 1973-1976	X		Consumed in Process

[b] The 49th TFW became operational at Holloman AFB in 1968. Prior to 1968, the major aircraft maintenance shops were located in Building 302 (Hangar 3). Aircraft general maintenance was performed in Building 301 (Hangar 4).

Appendix F--continued
MASTER LIST OF INDUSTRIAL ACTIVITIES

Shop Name	Present Location and Dates (Building No.)	Past Location and Dates (Building No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment Storage/Disposal Methods
4449th Mobility Support Squadron (Continued)					
Electric	901 1976-Present	877 1973-1976	X		Consumed in Process
Refrigeration	901 1976-Present	877 1973-1976	X	X	DPDO
Power Production	901 1976-Present	877 1973-1976	X	X	DPDO
Heating	901 1976-Present	877 1973-1976	X		Consumed in Process
1877 Communication Squadron	98 1944-Present				
6585th Test Group					
Flight Lines/Weapons	1080 1956-Present		X	X	DPDO
Guidance Test Division	1265 1957-Present		X		Consumed in Process
Machine	824 1953-Present		X	X	DPDO
Metal Processing	823 1952-Present		X	X	DPDO
Plating	835 1954-Present				
Sled Recovery	1166 1960-Present		X		Recycled
Propellant	1176 1959-Present				
Guidance	1263 1957-Present		X		Consumed in Process
NDI	1173 1957-Present		X		Consumed in Process
Carpentry	1170 1962-Present				
Corrosion Control	1178 1954-Present		X	X	DPDO
Environmental Test	1261 1957-Present				
AGE	1080 1956-Present		X	X	Acids Neutralized to Drainfield
Track Readiness	1170 1962-Present		X	X	Storage Tank 28
Track Metal Processing	1178 1954-Present		X	X	DPDO

Appendix F
MASTER LIST OF INDUSTRIAL ACTIVITIES

Shop Name	Present Location and Dates (Building No.)	Past Location and Dates (Building No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment Storage/Disposal Methods
833rd CES					
Exterior Electric	55 1971-Present		X	X	DPDO
Plumbing Shop	55 1971-Present		X		Consumed in Process
Fire Station	305 1971-Present	304 1965-1971	X		Consumed in Process
Heating Shop	55 1972-Present		X	X	Sanitary Sewer
Water Plant	96 1942-Present		X		Consumed in Process
Sewage Plant	752 1959-Present		X		Consumed in Process
Refrigeration Shop	55 1971-Present		X	X	Sanitary Sewer
Entomology	21 1977-Present	67 1968-1977 59 1955-1968	X	X	Batch Disposal to Waste Treatment Lagoons
Paint Shop	55 1971-Present		X	X	DPDO
Power Production/ Barrier Maintenance	181 1951-Present		X	X	DPDO; Neutralization to Sanitary Sewer
Pavements and Grounds	56 1965-Present		X		Consumed in Process
Carpentry Shop	55 1971-Present		X		Consumed in Process
Welding Shop	55 1971-Present		X		Consumed in Process
Liquid Fuels	--				
Interior Electric	67 1942-Present		X		Consumed in Process

Appendix F--continued
MASTER LIST OF INDUSTRIAL ACTIVITIES

Shop Name	Present Location and Dates (Building No.)	Past Location and Dates (Building No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment Storage/Disposal Methods
833rd Transportation Squadron					
General Purpose	198 1953-Present		X	X	DPDO, Neutralization to Saniary Sewer
Packing and Crating	310 1965-Present		X	X	Consumed in Process
Allied Trades	135 unknown		X	X	DPDO
Special Purpose	130 unknown		X	X	DPDO
Fire Truck Maintenance	304 1956-Present		X	X	Consumed in Process
Refueling Maintenance	702 1955-Present		X	X	DPDO
Railroad Operations	80 1959-Present				
Minor Maintenance	198 1953-Present				
833rd Combat Support Group					
Combat Arms	599 1942-Present		X	X	DPDO
Photo Lab	332 1953-Present		X	X	Silver Recovery to Sanitary Sewer
Hobby Shops	231 1971-Present		X	X	Silver Recovery to Sanitary Sewer
Golf Course Maintenance	761 1957-Present		X		Consumed in Process
833rd Supply Squadron					
General Supply	310 1956-Present		X		Consumed in Process
POL	702 1955-Present		X	X	Consumed in Process
Fuels Lab	837 1954-Present		X	X	Neutralization to Septic Tank

Appendix G
INVENTORY OF MAJOR EXISTING POL STORAGE TANKS

Appendix G
INVENTORY OF MAJOR EXISTING POL STORAGE TANKS AT HOLLOMAN AFB

Facility/Location	Type POL	Capacity, Gallons	Aboveground (AG) Belowground (BG)
POL Area	JP-4	840,000	AG
POL Area	JP-4	396,000	AG
POL Area	Diesel	12,000	AG
POL Area	Diesel	12,000	AG
POL Area	AVGAS	12,000	AG
POL Area	AVGAS	12,000	AG
POl Area	MOGAS	12,000	AG
89-105	MC-800	20,000	UG
89-105	Golden Bare	10,000	UG
89-105	Golden Bare	5,000	UG
89-105	Oil	25,000	UG
89-105	Oil	21,000	UG
89-105	Oil	17,700	UG
137	MOGAS	12,000	UG
137	MOGAS	12,000	UG
137	MOGAS	19,000	UG
89-106	Gilsonite	12,000	UG
89-106	MC-5	10,000	UG
18	MOGAS	10,000	UG
15	Diesel	10,000	UG
787	MOGAS	5,000	UG
Main Area Taxiway	Waste Fuels	10,000	UG
298	MOGAS	5,000	UG
298	JP-4	5,000	UG
298	JP-4	3,000	UG
585	Heating Oil	2,000	UG
638	JP-4	5,000	AG
828	MOGAS	3,000	UG
828	JP-4	3,000	UG
828	JP-4	5,000	UG
845	MOGAS	10,000	UG
845	MOGAS	10,000	UG
1159/1160	Diesel	2,270	AG
1254	Diesel	1,800	UG
1256	Diesel	1,800	UG
1119	JP-4	2,250	AG

Appendix H
CURRENT INVENTORY OF OIL/WATER SEPARATOR PRETREATMENT FACILITIES

Appendix H
CURRENT INVENTORY OF OIL/WATER SEPARATOR PRETREATMENT FACILITIES[a]

Area/Bldg.	Activity Source	Capacity (Gallons)
1080	6585 Test Group Vehicle and AGE equipment washing area	1,000
816	Vehicle washing area	200
Taxiway 8	Sound suppressor engine test facility	200
868/869	AGE equipment washrack	500
639	Main area sound suppressor	200
306	T-38 Aircraft washrack	1,000
315	Fuel cell repair shop	500
300	Jet engine repair and cleaning area	1,000
282	479TH AGE wash area	500
283	AGE equipment and helicopter wash area	500
198	Vehicle repair shop	500

[a]All of the listed facilities discharge to the sanitary sewer system.

Appendix I
HAZARD ASSESSMENT RATING METHODOLOGY

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DoD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DoD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with representatives from the USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M HILL. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of

USAF OEHL, AFESC, various major commands, Engineering Science, and CH2M HILL met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DoD program needs.

The model uses data readily obtained during the Record Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DoD properties.

Site scores are developed using the appropriate ranking factors according to the method presented in the flow chart (Figure 1). The site rating form is provided on Figure 2 and the rating factor guidelines are provided in Table 1.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, the potential pathways for waste contaminant migration, and any efforts to contain the contamination. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

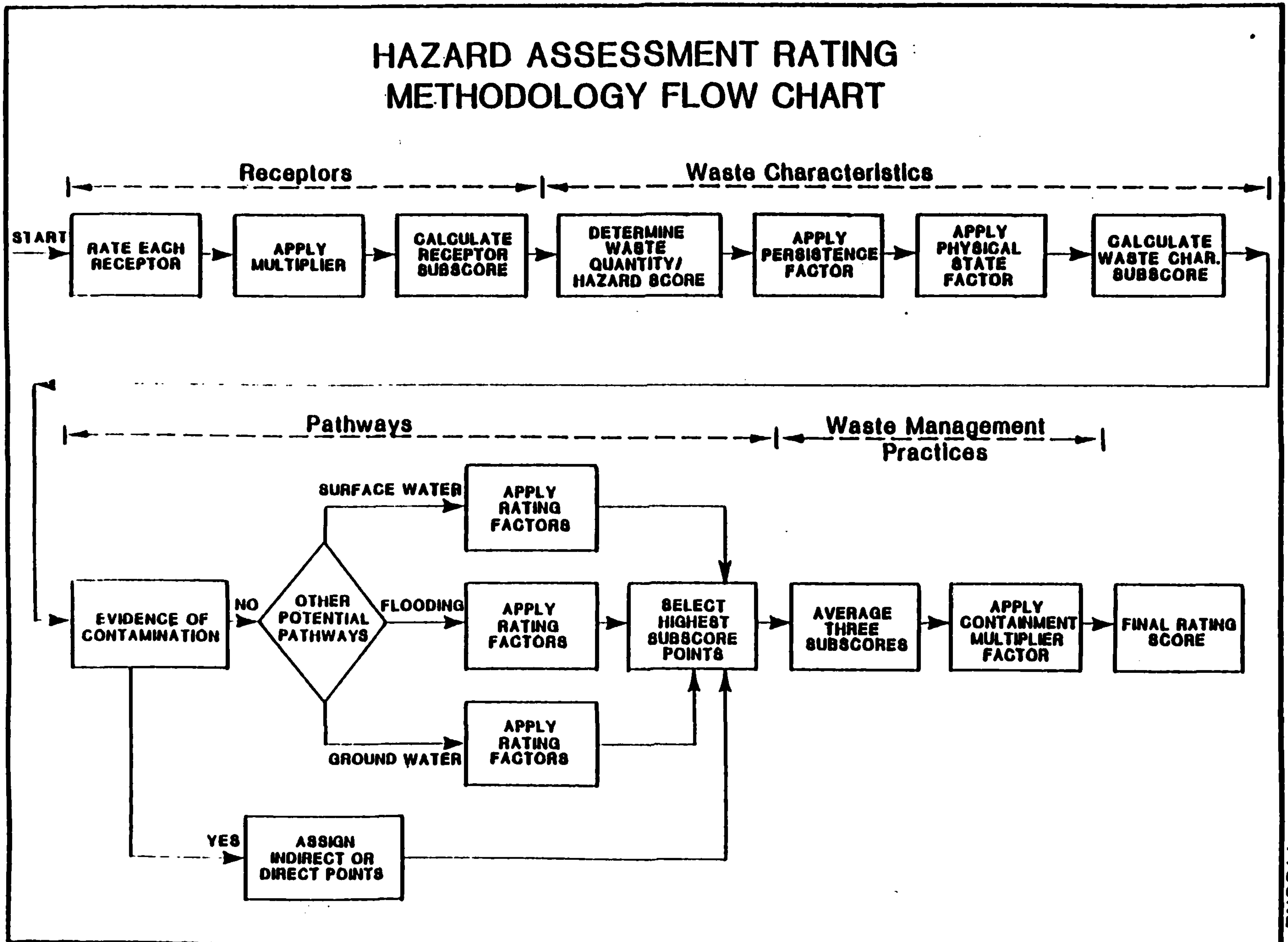
The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant, and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface-water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Scores for sites at which there is no containment are not reduced. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

FIGURE 1



HAZARD ASSESSMENT RATING
METHODOLOGY FLOW CHART
Receptors
Waste Characteristics
START
RATE EACH RECEPTOR
APPLY MULTIPLIER
CALCULATE RECEPTOR SUBSCORE
DETERMINE WASTE QUANTITY/ HAZARD SCORE
APPLY PERSISTENCE FACTOR
APPLY PHYSICAL STATE FACTOR
CALCULATE WASTE CHAR. SUBSCORE
Pathways
Waste Management Practices
EVIDENCE OF CONTAMINATION
NO
OTHER POTENTIAL PATHWAYS
SURFACE WATER
FLOODING
GROUND WATER
APPLY RATING FACTORS
APPLY RATING FACTORS
APPLY RATING FACTORS
YES
ASSIGN INDIRECT OR DIRECT POINTS
SELECT HIGHEST SUBSCORE POINTS
AVERAGE THREE SUBSCORES
APPLY CONTAINMENT MULTIPLIER FACTOR
FINAL RATING SCORE

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE ______________________________

LOCATION ______________________________

DATE OF OPERATION OR OCCURRENCE ______________________________

OWNER/OPERATOR ______________________________

COMMENTS/DESCRIPTION ______________________________

SITE RATED BY ______________________________

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site -		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points : : direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
Subtotals			______	______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
Subtotals			______	______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = [ ]

Table 1
HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1-mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands	10
F. Water quality/use designation of nearest surface water body	Agricultural or Industrial use	Recreation, propagation and management of fish and wildlife	Shellfish propagation and harvesting	Potable water supplies	6
G. Ground-water use of uppermost aquifer	Not used, other sources readily available	Commercial, industrial, or irrigation, very limited other water sources	Drinking water, municipal water available	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1-15	51-1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	Greater than 1,000	6

Table 1--Continued

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records
- o Knowledge of types and quantities of wastes generated by shops and other areas on base

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site

A-3 Hazard Rating

Rating Factors	Rating Scale Levels: 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

Table 1--Continued

II. WASTE CHARACTERISTICS--Continued

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

Waste Hazard Rating
- o Wastes with the same hazard rating can be added.
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

Table 1--Continued

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 Potential for Surface Water Contamination

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($>10^{-6}$ cm/sec)	6
Rainfall intensity based on 1-year 24-hour rainfall	<1.0 inch	1.0 to 2.0 inches	2.1 to 3.0 inches	>3.0 inches	8

B-2 Potential for Flooding

Rating Factors	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1

B-3 Potential for Ground-Water Contamination

Rating Factors	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to + 20 inches	Greater than +20 inches	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8

Table 1--Continued

B-3 Potential for Ground-Water Contamination--Continued

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence, fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. Waste Management Practices Factor

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Protection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1, or III-6-3, then leave blank for calculation of factor score and maximum possible score.

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Appendix J
SITE RATING FORMS

HAZAPDOUS ASSESSMENT RATING FORM

NAME OF SITE: Existing Main Base Landfill (Site No. 1)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1958-Present

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Main base sanitary landfill since the late 1950's

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	31	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 17

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore --

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	3	8	24	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	70	108

Subscore (100 x factor score subtotal/maximum score subtotal) 65

2. Flooding 1

Subscore (100 x factor score/3)

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	NA	8	--	--
		Subtotals	32	66

[a]Reduced multiplier due to brackish ground water.

Subscore (100 x factor score subtotal/maximum score subtotal) 48

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 65

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	17
Waste Characteristics	60
Pathways	65
Total 142 divided by 3 =	47
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

47 x 1.0 47

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: POL Area Spill Site No. 1 (Site No. 2)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1960's-early 1970's

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Periodic overtopping of fuel storage tanks

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	35	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 19

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.8 = 48

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.0 = 48

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	19
Waste Characteristics	48
Pathways	57
Total 124 divided by 3 =	41
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

41 x .95 39

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: POL Tank Sludge Burial Site (Site No. 3)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1955-1975 (Intermittent Use)

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Burial of POL tank cleaning sludge, contains some lead

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	39	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 22

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 0.75 = 45

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore --

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	1	8	8	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108

Subscore (100 x factor score subtotal/maximum score subtotal) 43

2. Flooding 1

Subscore (100 x factor score/3)

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	NA	8	--	--
		Subtotals	32	66

[a]Reduced multiplier due to brackish ground water.

Subscore (100 x factor score subtotal/maximum score subtotal) 48

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	22
Waste Characteristics	45
Pathways	48
Total 115 divided by 3 =	38 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

38 x 1.0 38

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: POL Area Spill Site No. 2 (Site No. 5)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1978

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Overtopping of POL tank 7, 30,000-gallon JP-4 spill, most was recovered

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	35	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 19

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S

2. Confidence level (C = confirmed, S = suspected) C

3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.8 = 48

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.0 = 48

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	19
Waste Characteristics	48
Pathways	57
Total 124 divided by 3 =	41
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

41 x .95 39

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Fuel Line Spill Site (Site No. 6)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1979

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Ruptured fuel line, 8,000 gallons of JP-4, most was recovered

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	35	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 19

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.8 = 48

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.0 = 48

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore --

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108

Subscore (100 x factor score subtotal/maximum score subtotal) 57

2. Flooding 1

Subscore (100 x factor score/3)

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66

[a]Reduced multiplier due to brackish ground water.

Subscore (100 x factor score subtotal/maximum score subtotal) 42

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	19
Waste Characteristics	48
Pathways	57
Total 124 divided by 3 =	41
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

41 x .95 39

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Refuse Collection Truck Washrack (Site No. 8)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1942-present

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Detergents and pesticide rinsings to leach field

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	25	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 14

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	58	108
Subscore (100 x factor score subtotal/maximum score subtotal)				54
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	2	4[a]	8	12
		Subtotals	40	78
Subscore (100 x factor score subtotal/maximum score subtotal)				51

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 54

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	14
Waste Characteristics	60
Pathways	54
Total 128 divided by 3 =	43
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

43 x 1.0 43

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Waste POL Drum Storage/Spill Area (Site No. 9)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1965-1980

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Frequent spills from waste POL drums

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	30	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 17

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	54	108
Subscore (100 x factor score subtotal/maximum score subtotal)				50
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 50

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	17
Waste Characteristics	60
Pathways	50
Total 127 divided by 3 =	42
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

42 x 1.0 42

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Old Main Base Landfill (Site No. 10)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1942-1958

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Main base sanitary landfill from 1942 until late 1950s

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	33	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 18

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	NA	8	--	--
		Subtotals	32	66
Subscore (100 x factor score subtotal/maximum score subtotal)				48

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	16
Waste Characteristics	40
Pathways	57
Total 115 divided by 3 =	38 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

38 x 1.0 38

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Fuel Line Spill Site (Site No. 12)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1975

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Ruptured fuel transport line, 2,000 gallons of JP-4, most was recovered

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface-water body	0	6	0	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
		Subtotals	39	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 22

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.8 = 48

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.0 = 48

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	22
Waste Characteristics	48
Pathways	57
Total 127 divided by 3 =	42
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

42 x .95 40

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Sodium Arsenite Spill Site (Site No. 13)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1979

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Sodium arsenite herbicide spilled in small quantities

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	33	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 18

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	18
Waste Characteristics	60
Pathways	57
Total 135 divided by 3 =	45
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

45 x 1.0 45

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Former Entomology Shop Area (Site No. 14)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1968-1977

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Bldg. 67--former entomology shop, rinsing of pesticide equipment

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	33	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 18

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S

2. Confidence level (C = confirmed, S = suspected) C

3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore --

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108

Subscore (100 x factor score subtotal/maximum score subtotal) 57

2. Flooding 1

Subscore (100 x factor score/3)

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66

[a]Reduced multiplier due to brackish ground water.

Subscore (100 x factor score subtotal/maximum score subtotal) 42

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	18
Waste Characteristics	60
Pathways	57
Total 135 divided by 3 =	45
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

45 x .95 43

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Refrigeration/Heat Shop Washrack (Site No. 15)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1971-1981

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Sulfuric acid rinse water disposed of in leach field

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface-water body	0	6	0	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
		Subtotals	33	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 18

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.4 = 32

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

32 x 1.0 = 32

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	54	108
Subscore (100 x factor score subtotal/maximum score subtotal)				50
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	2	4[a]	8	12
		Subtotals	40	78
Subscore (100 x factor score subtotal/maximum score subtotal)				51

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore **51**

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	18
Waste Characteristics	32
Pathways	51
Total 101 divided by 3 =	34
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

34 x 1.0 **34**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Entomology Shop Area (Site No. 16)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1977-1981

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Pesticide washdown to cavity, Bldg. 21

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	33	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 18

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore --

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	54	108

Subscore (100 x factor score subtotal/maximum score subtotal) 50

2. Flooding 1

Subscore (100 x factor score/3)

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	2	4[a]	8	12
		Subtotals	40	78

[a]Reduced multiplier due to brackish ground water.

Subscore (100 x factor score subtotal/maximum score subtotal) 51

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 51

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	18
Waste Characteristics	60
Pathways	51
Total 129 divided by 3 =	43
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

43 x 1.0 43

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: BX Service Station Fuel Leak Area (Site No. 17)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1981

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Estimated 100,000 to 150,000 gallons of MOGAS leaked into ground

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	33	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 18

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L

2. Confidence level (C = confirmed, S = suspected) C

3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.8 = 80

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. It there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 100

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals		

Subscore (100 x factor score subtotal/maximum score subtotal)

2. Flooding 1

Subscore (100 x factor score/3)

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
		Subtotals		

Subscore (100 x factor score subtotal/maximum score subtotal)

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	18
Waste Characteristics	80
Pathways	100
Total 198 divided by 3 =	66
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

66 x 1.0 66

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Chromic Acid Spill Site (Site No. 18)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1979

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: 500 gallons spilled on ground near Bldg. 281

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	33	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 18

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S

2. Confidence level (C = confirmed, S = suspected) C

3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	18
Waste Characteristics	60
Pathways	57
Total 135 divided by 3 =	45
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

45 x 1.0   45

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Golf Course Landfill (Site No. 19)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: Late 1960's to 1978

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Used mainly for grass clippings, etc.--known small quantity of rodenticides

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	27	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 15

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S

2. Confidence level (C = confirmed, S = suspected) C

3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	54	108
Subscore (100 x factor score subtotal/maximum score subtotal)				50
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	NA	8	--	--
		Subtotals	32	66
Subscore (100 x factor score subtotal/maximum score subtotal)				48

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 50

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	15
Waste Characteristics	60
Pathways	50
Total 110 divided by 3 =	37
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

37 x 1.0 37

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Sewage Treatment Plant Grit Burial Site (Site No. 20)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1942-present

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Grit possibly contaminated with solvents or heavy metals

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
C.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	22	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 12

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 0.75 = 30

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	1	12
Direct access to ground water	NA	8	--	--
		Subtotals	29	66
Subscore (100 x factor score subtotal/maximum score subtotal)				44

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	12
Waste Characteristics	30
Pathways	57
Total 99 divided by 3 =	33
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

33 x 1.0 = 33

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: West Area Landfill No. 2 (Site No. 21)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: Early 1970's (assumed) to 1977

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Rubble and debris--convenient to west area maintenance facility

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	22	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 12

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

Site No. 21

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	54	108
Subscore (100 x factor score subtotal/maximum score subtotal)				50
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	NA	8	--	--
		Subtotals	32	66
Subscore (100 x factor score subtotal/maximum score subtotal)				48

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 50

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	12
Waste Characteristics	40
Pathways	50
Total 102 divided by 3 =	34
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

34 x 1.0 34

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: West Area Landfill No. 1 (Site No. 22)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1974-1978

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Mostly rubble disposal; possibility of some POL waste

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	28	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 16

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	NA	8	--	--
		Subtotals	32	66
Subscore (100 x factor score subtotal/maximum score subtotal)				48

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	16
Waste Characteristics	40
Pathways	57
Total 113 divided by 3 =	38
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

38 x 1.0 38

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: MOBSS Landfill (Site No. 23)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1976-1979

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Cans of diazinon, dibromochloromethane, some unidentified drums

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	24	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 13

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	54	108
Subscore (100 x factor score subtotal/maximum score subtotal)				50
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	NA	8	--	--
		Subtotals	32	66
Subscore (100 x factor score subtotal/maximum score subtotal)				48

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 50

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	13
Waste Characteristics	60
Pathways	50
Total 123 divided by 3 =	41 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

41 x 1.0 41

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Former Equipment Maintenance Area (Site No. 24)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1959 to late 1960's

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Possible disposal of waste oils and solvents to septic tanks

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	22	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 12

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

50 x 1.0 = 50

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

50 x 1.0 = 50

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	2	4[a]	8	12
		Subtotals	40	78
Subscore (100 x factor score subtotal/maximum score subtotal)				51

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore **57**

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	12
Waste Characteristics	50
Pathways	57
Total 119 divided by 3 =	40
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

40 x 1.0 **40**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Possible Drainage Lagoon Disposal Site (Site No. 25)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: Approximately 1977

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Possible disposal of solvents and various chemicals

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	30	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 17

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore --

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108

Subscore (100 x factor score subtotal/maximum score subtotal) 57

2. Flooding 1

Subscore (100 x factor score/3)

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	2	4[a]	8	12
Direct access to ground water	2	4[a]	8	12
		Subtotals	44	78

[a]Reduced multiplier due to brackish ground water.

Subscore (100 x factor score subtotal/maximum score subtotal) 56

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	17
Waste Characteristics	40
Pathways	57
Total 114 divided by 3 =	38
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

38 x 1.0 38

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Possible Missle Fuel Spill Site (Site No. 26)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1976

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Suspect small quantities of missle fuel dumped on ground

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	1	6	6	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	16	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 9

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore --

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	54	108

Subscore (100 x factor score subtotal/maximum score subtotal) 50

2. Flooding 1

Subscore (100 x factor score/3)

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66

[a]Reduced multiplier due to brackish ground water.

Subscore (100 x factor score subtotal/maximum score subtotal) 42

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 50

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	9
Waste Characteristics	40
Pathways	50
Total 99 divided by 3 =	33
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

33 x 1.0 33

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Pad 9 Washrack Area (Site No. 27)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1950's

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Drainage from washrack discharged to ground, possible radiation

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	1	6	6	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	16	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 9

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L

2. Confidence level (C = confirmed, S = suspected) S

3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

50 x 1.0 = 50

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

50 x 1.0 = 50

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	9
Waste Characteristics	50
Pathways	57
Total 116 divided by 3 =	39
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

39 x 1.0 39

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Former North Area Washrack Site (Site No. 28)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1950's

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Washrack drainage and some fuel dumping to ground surface

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	1	6	6	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	16	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 9

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L

2. Confidence level (C = confirmed, S = suspected) S

3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

50 x 1.0 = 50

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

50 x 1.0 = 50

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	54	108
Subscore (100 x factor score subtotal/maximum score subtotal)				50
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 50

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	9
Waste Characteristics	50
Pathways	50
Total 109 divided by 3 =	36
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

36 x 1.0 36

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Grease Trap Disposal Pits (Site No. 30)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1977-1979

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Grease traps, oil/water separator skimmings, pesticides

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	21	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 12

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 70

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

70 x 1.0 = 70

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

70 x 1.0 = 70

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore --

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	1	8	8	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding		1		
		Subscore (100 x factor score/3)		
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	NA	8	--	--
		Subtotals	32	66
Subscore (100 x factor score subtotal/maximum score subtotal)				48

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	12
Waste Characteristics	70
Pathways	48
Total 130 divided by 3 =	43 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

43 x 1.0 43

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Fire Department Training Area (Site No. 31)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1942 (assumed) to present

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Burning of waste oils, solvents and fuels in past; currently fuels

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	21	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 12

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.8 = 64

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 1.0 = 64

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	12
Waste Characteristics	64
Pathways	57
Total 133 divided by 3 =	44
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

44 x 1.0 44

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Collapsed Sewer Lines from Primate Research (Site No. 32)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1960's to 1980

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Small quantities of solvents and radioactive tracers

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	30	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 17

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

Site No. 32

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

			Subscore	--

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		
	Subscore (100 x factor score/3)			

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	NA	8	--	--
		Subtotals	32	66
Subscore (100 x factor score subtotal/maximum score subtotal)				48

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore **57**

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	17
Waste Characteristics	60
Pathways	57
Total 134 divided by 3 =	45
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

45 x 1.0 **45**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Spent Solvent Disposal Area (Site No. 35)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: Possibly intermittent since 1950's

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Suspect only, possible solvents and radioactive tracers--small

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	1	6	6	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	24	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 13

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	1	8	8	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	13
Waste Characteristics	40
Pathways	43
Total 96 divided by 3 =	32 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

32 x 1.0 = 32

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Unconventional Fuels Area Spill Site (Site No. 36)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: Early 1950's to present

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Periodic small spills of unconventional fuels

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	1	6	6	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	16	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 9

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	9
Waste Characteristics	60
Pathways	57
Total 126 divided by 3 =	42
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

42 x 1.0 42

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Early Missle Testing Site (Site No. 37)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1947-1955

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Possible missle fuel spills

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	0	6	0	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	6	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 3

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	4[a]	0	12
Direct access to ground water	NA	8	--	--
		Subtotals	28	66
Subscore (100 x factor score subtotal/maximum score subtotal)				42

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	3
Waste Characteristics	40
Pathways	57
Total 100 divided by 3 =	33
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

33 x 1.0 33

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Test Sled Maintenance Area (Site No. 38)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1951-1979

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Possible solvent disposal to septic tanks

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	26	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 14

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S

2. Confidence level (C = confirmed, S = suspected) S

3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore --

B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108

Subscore (100 x factor score subtotal/maximum score subtotal) 57

2. Flooding 1

Subscore (100 x factor score/3)

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	4[a]	4	12
Direct access to ground water	2	4[a]	8	12
		Subtotals	40	78

[a]Reduced multiplier due to brackish ground water.

Subscore (100 x factor score subtotal/maximum score subtotal) 51

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	14
Waste Characteristics	40
Pathways	57
Total 111 divided by 3 =	37
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

37 x 1.0 37

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Missle Fuel Spill Site (Site No. 39)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1950-1975

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Periodic missle fuel spills including fuming nitric acid, JP-4 and UDMH

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	22	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 12

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	2	4[a]	8	12
Direct access to ground water	2	4[a]	8	12
		Subtotals	44	78
Subscore (100 x factor score subtotal/maximum score subtotal)				56

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore **57**

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	12
Waste Characteristics	60
Pathways	57
Total 129 divided by 3 =	43
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

43 x 1.0 **43**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Coco Block House Bore Hole Disposal Site (Site No. 41)

LOCATION: Holloman AFB

DATE OF OPERATION OR OCCURRENCE: 1960's

OWNER/OPERATOR: Holloman AFB

COMMENTS/DESCRIPTION: Emergency disposal of nitric acid spills, infrequently used

SITE RATED BY: N. Hatch and T. Emenhiser

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	0	10	0	30
C.	Land use/zoning within 1 mile radius	0	3	0	9
D.	Distance to reservation boundary	1	6	6	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface-water body	0	6	0	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	0	6	0	18
			Subtotals	6	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 3

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.4 = 24

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

24 x 1.0 = 24

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	1	8	8	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding		1		
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	3	4[a]	12	12
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	3	4[a]	12	12
Direct access to ground water	3	4[a]	12	12
		Subtotals	52	78
Subscore (100 x factor score subtotal/maximum score subtotal)				67

[a]Reduced multiplier due to brackish ground water.

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	3
Waste Characteristics	24
Pathways	67
Total 94 divided by 3 =	31
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

31 x 1.0 31

Appendix K
GUIDELINES FOR A PHASE II MONITORING
PROGRAM FOR HOLLOMAN AFB

Appendix K
GUIDELINES FOR A PHASE II MONITORING PROGRAM FOR HOLLOMAN AFB

I. INTRODUCTION

The Phase II Installation Restoration Program will generate the field data needed to confirm or rule out the existence of hazardous contaminant migration at the identified sites. If appropriate, these data will be used in developing conceptual engineering remedial action alternatives.

Phase II will proceed in two or three parts (A, B, and C) depending on the findings in the first two parts. A Preliminary Survey is performed in Phase IIA. The purpose of this survey is to define the work plan, to determine the approach to be utilized in accomplishing the requirement of Phase II, and to estimate costs associated with performing the detailed surveys recommended in Phase IIA.

Phase IIB involves actual sampling and analysis to verify the presence and, if possible, the extent of movement of contamination. Following analysis of monitoring well samples, additional monitoring wells or other sampling methodologies may be required. This process may proceed through multiple iterations until sufficient data have been gathered to adequately confirm or deny the contamination and extent of movement. A Phase IIB report shall include the concentration, extent, directions, and rates of migration of the contamination; and, if possible; an assessment of hazards related to the contamination and the need for corrective action.

If the Phase IIB work does not generate adequate data to estimate the concentration extent, and rate of migration of the contamination and assess most of the hazards related to the contamination, the Phase IIB report shall include recommendations for future monitoring wells, samples, etc. Based on the recommendations in the Phase IIB report, USAF OEHL may recommend to MAJCOM additional monitoring, sampling, or the initiation of Phase IIC. Phase IIC would involve additional quantification to define the directions and rates of migration of the contamination from the confirmed sites identified in Phase IIB. Once a final Phase IIC report has been written and approved, required phased follow-on actions can be programmed.

II. SAMPLING LOCATIONS, ANALYSES, AND DATA EVALUATION

The installation of 12 shallow observation wells are recommended for the BX Service Station Fuel Leak Area (Site No. 17) to determine the presence and extent of a free product gasoline lens in this area and to obtain data necessary to determine the feasibility of recovery of the floating gasoline layer. Preliminary observation well locations are shown on Figure 16. Final observation well locations should be determined by the Phase II contractor after a preliminary site visit. The purpose of the preliminary site visit will be to:

- o Establish base contact
- o Observe and record site features
- o Establish approximate areal limits of the site and identify any obstructions.
- o Locate underground utilities and fuel lines and tanks present at the site.

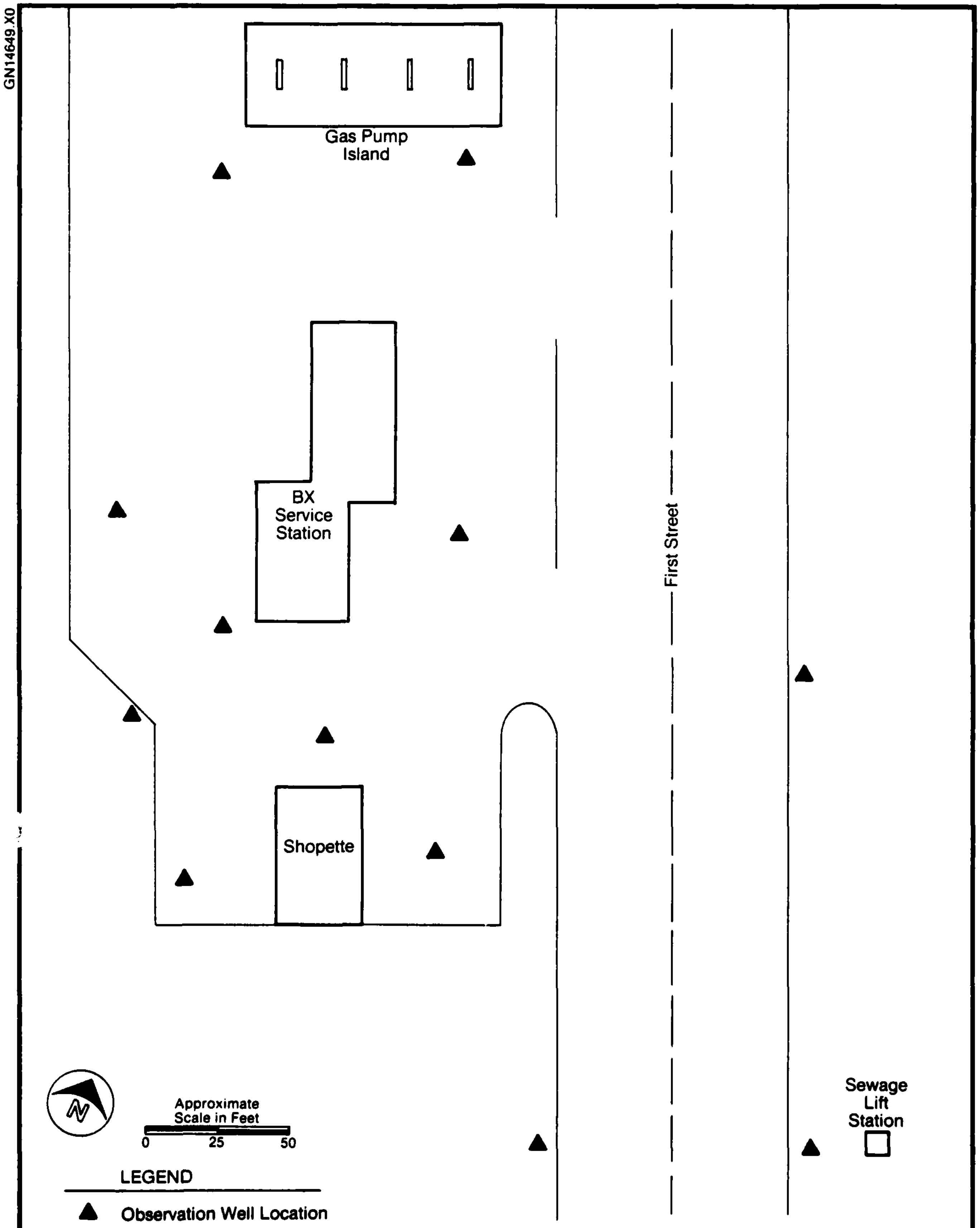

FIGURE 16.
Recommended Preliminary Observation Well Locations for Site No. 17—
BX Service Station Fuel Leak Area.

- o Identify any unusual or potentially hazardous conditions, if any, that could impact well installation or sampling program.

- o Select final observation well locations.

The presence and estimated thickness of a free product gasoline lens (i.e., gasoline floating on the ground water) can be determined by one or more of the following field techniques:

A. Visual observation using steel tape measurements can be taken in each well. The steel tape is covered on one side with a paste which is color sensitive to water, and the other side of the tape is covered with a paste which is color sensitive to gasoline. The tape is lowered into the well and the distance between the two color levels gives an estimate of the thickness of the gasoline lens.

B. Depth conductivity measurements can be used to detect a gasoline/water interface. The conductivity of the free product gasoline lens will be low, while the conductivity of the brackish ground water beneath the site is high. The depth at which a sudden conductivity increase occurs gives an indication of the presence and estimated thickness of a free product gasoline lens. A commercially available conductivity probe device has been developed specifically for gasoline/water applications which will determine both the level and the estimated thickness of a floating gasoline lens.

C. A composite liquid column sampler (Coliwasa) can be used to sample a liquid column containing the gasoline/water interface. The Coliwasa consists of a clear tube (glass or acrylic) with a remotely activated bottom seal. Using this device, a liquid column can be extracted from each observation well for visual observation of the depth and thickness of a floating gasoline lens. Coliwasa devices can be constructed or purchased commercially.

Since the presence and thickness of a free product gasoline lens can be determined by one or more of the above field techniques, no laboratory analyses are recommended. Determination of free product gasoline should be made after allowing the observation wells to reach equilibrium. Field measurements should be taken twice at 2 week and 3 week intervals after well development and permeability testing. If discrepancies exist between the two sets of measurements, then additional field measurements will be necessary.

The data collected should be evaluated to determine (1) the quantity of free product gasoline floating on the ground water beneath the BX Service Station area, (2) the areal extent of the free product gasoline plume (3) the feasibility of recovery of the free product gasoline (4) the optimum recovery techniques to be used and (5) the optimum location or locations for gasoline recovery systems. Possible gasoline recovery systems include interceptor trenches equipped with oil skimmers, and wells equipped with specially designed recovery pumping units.

III. OBSERVATION WELL INSTALLATION

Construction of observation wells during either the initial field investigation or the remedial investigation should proceed according to the procedures described in this appendix. A qualified and experienced geologist or geotechnical engineer should be present with each rig throughout the well drilling to direct progress of the work, log all soil samples, record all pertinent observations, and label all samples. This field representative should also direct the development of the wells and conduct the field permeability tests (aquifer tests).

Soil Sampling and Logging

A soil boring should be made at each proposed observation well location prior to installation of the well casing. The results of the soil boring will be used to confirm the anticipated soil stratification, permeabilities, bedrock depth and type, and ground-water table. Details of the observation well construction may be adjusted appropriately based on these findings, including screened interval, depth of well, gravel-pack gradation, screen slot size, or installation/development methodology. In addition, soil samples will be obtained which may be used to confirm anticipated soil properties such as gradation, plasticity, or permeability by performing appropriate laboratory tests. Visual observations of the soil samples should also be made for evidence of fuel saturation. In addition, soil samples may be submitted for pollutant analysis based upon the discretion of the field representative and any observations of contamination made during the soil sample logging.

The soil borings should be made using a 6" to 8" nominal diameter hollow-stem auger. Disturbed soil samples are to be taken at 5-foot intervals and at other intermediate depths as may be required to adequately describe the subsurface conditions in the judgment of the field representation. Samples may be obtained by using either a 2-inch outside diameter split-spoon sampler or a 3-inch outside diameter thin-walled Shelby tube.

The soils encountered should be classified by the field representative in accordance with the Unified Soil Classification System (ASTM D2488) and in accordance with any specific DoD requirements. The soil description should include the soil name, gradation or plasticity, estimated particle-size distribution, color, moisture content, relative density or consistency, soil structure or minerology, local or geologic name, and the USGS group symbol. Any abnormal behavior encountered during the drilling operations should be noted, such as changes in drilling rates or stratification. After sampling has been completed, the soil borings should be properly sealed to prevent a pathway for contaminant migration.

Well Installation

The recommended construction of each well is shown schematically on Figure 17. In general, the wells should be installed so that the slotted section of the well is located between a depth of 5 feet above to 5 feet below the water table (approximately 5 to 15 feet below the ground surface). Final depth of the well is expected to be approximately 15 to 20 feet below the ground surface.

The wells should be drilled using a mud rotary drill rig at least 8 inches in diameter by reaming the borehole made during the soil boring. Well casings should consist of 4-inch-diameter Schedule 40 PVC pipe with threaded

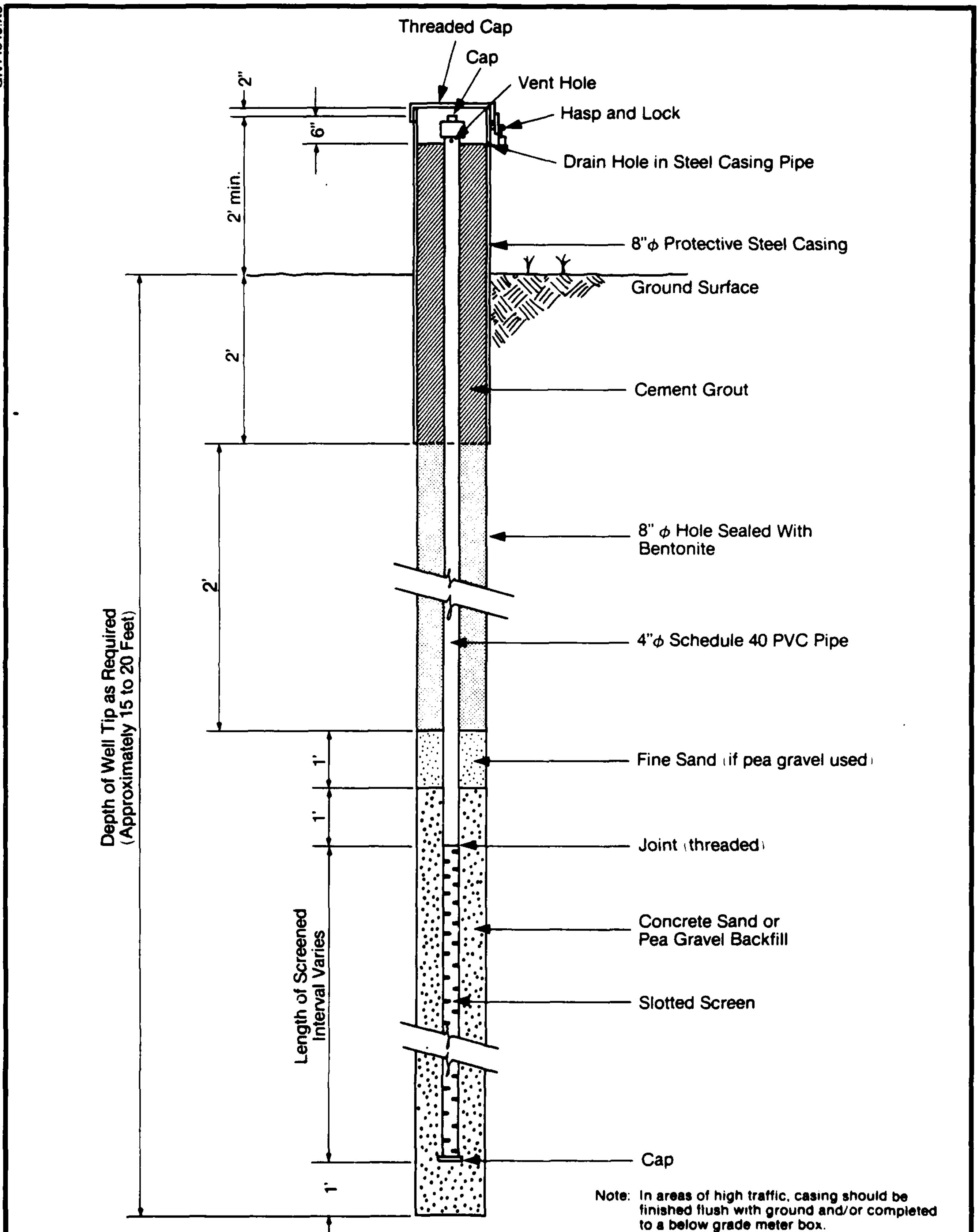

FIGURE 17.
Typical Observation Well Installation.

(screw-type) joints; no adhesive compounds should be used. The well screen will vary in length, depending on the total depth of the well. The screen should consist of factory-fabricated slots between .01 and .04 inches wide.

The well casing and screen should be centered in the 8-inch hole. A washed, medium-grained sand, similar to concrete sand (ASTM C33) should then be placed around the screen and the hole. The Phase II contractor should be responsible for selecting the exact slot size and backfill gradation for the well.

Above the sand or gravel backfill, a 2-foot interval of bentonite clay pellets should be used to seal the well. Neat cement grout, consisting of about 7 gallons of water per 94-pound bag of Portland cement, should be used to fill the annulus above the bentonite at the ground surface.

Each well casing should rise about 2 feet above the ground surface and should be capped with an unthreaded, removable PVC cap. A 8-inch-diameter steel pipe should be placed over the casing and embedded at least 2 feet. A cap should be placed on top of the pipe, with a hasp and key-lock padlock to secure the well.

Well Development

Once a well has been completed, it should be developed by bailing the hole a minimum of 5 times its volume below the water table, or until the resulting water is, in the opinion of the field representative, sufficiently clear to ensure proper functioning of the developed well. Methods of well development that cause reversals of flow, or surging, through the screen may be used. Static water levels should be measured and recorded both prior to and at least 24 hours following well development. Free product gasoline determinations should be made no sooner than 2 weeks after permeability testing is complete.

Aquifer tests consisting of rising head field permeability tests should be performed in each completed and developed well.

Well Survey

Each well should be surveyed to establish horizontal control within about 3 feet; these locations should be shown on existing installation maps. Vertical control should be established within about 0.1 foot with respect to USGS datum (mean sea level) for the ground surface and the top of each PVC well casing.

IV. SAMPLING PROTOCOL GUIDELINES

A sampling protocol is a plan that addresses the steps necessary to ensure the technical adequacy and validity of a sampling program. For this Phase II study, a sampling program should address the following items:

- Sampling procedure
- Record keeping

Since all measurements will be field measurements and no laboratory analyses are required, the remaining components normally included in a sampling protocol i.e., sample bottle preparation, sample preservation and holding times, sample shipping, analytical procedures, and quality assurance will not be required.

Sampling Procedure

Specific field sampling and measurement procedures must be developed. Techniques available to conduct the required field sampling/measurements have been discussed previously ("Sampling Locations, Analysis, and Data Evaluation," pages K-2 and K-3).

Record Keeping

All field data, measurements and observations during the sampling program should be recorded in a designated hard-bound field notebook. Loose-leaf notebooks or individual pieces of paper should not be used to record field data.

V. HEALTH AND SAFETY PLAN

A. The Phase II contractor must take appropriate measures to ensure the health and safety of his employees. The BX Service Station Leak Area (Site No. 17) was visited by the Phase I contractor and, based on his site visits, the following safety considerations are offered for the benefit of personnel involved in the Phase II monitoring program:

1. Safety should be a primary consideration during the observation well installation and sampling program. In working with a flammable gasoline spill, every precaution should be taken to minimize the chance of fire or explosion.

2. During the drilling some of the gasoline encountered may be forced to the surface. Any machinery capable of producing heat or sparks that might ignite flammable gasoline vapors should be kept upwind and as far as possible from the well site.

3. The drilling equipment should be properly grounded to prevent the possibility of sparks produced from static electricity.

4. Air rotary drilling of wells should not be done because the injection of air into the gasoline can produce an extremely flammable mixture.

5. Fire estinquishers approved for use on petroleum fires should be readily available.

6. Combustible gas indicators or vapor explosion meters should be used to detect the presence of potentially explosive gasoline/air mixtures. If flammable or explosive concentrations of gasoline vapor are detected in the air, then the method of drilling or well development being used should be abandoned immediately.

7. Personnel working at the site should be familiar with work involving flammable materials and should be briefed on the proper safety and emergency procedures to be followed.

B. The Phase II contractor should have health and safety plans that address, as a minimum, the following items:

- o Responsibility of employees with regard to safety
- o Pathways of personal physical exposure
- o Initial hazard assessment
- o Emergency treatment
- o Safety and protective equipment

1. Employee Safety

When visiting the sites, employees should use common sense, judgment, and experience. They should have reviewed in advance all existing data on the site to determine if any safety precautions are necessary. Smoking should not be allowed at the site. As a minimum, personnel should wear protective clothing and shoes to protect against accidental abrasion and foot injuries. Optional items for increased personal protection include safety glasses and hard hats.

2. Pathways of Physical Exposure

The Phase I study indicated that free product gasoline wastes may be floating on the water table just beneath the ground surface at the site. Because of the potential for exposure to gasoline or gasoline vapors personnel should be aware of the pathways by which the gasoline can enter their body and how to prevent that entry. There are four (4) pathways:

- o Inhalation
- o Skin absorption
- o Ingestion
- o Eye contact

Inhalation is best prevented by not breathing in direct proximity to the waste or using a respirator appropriate for the type of hazardous material.

To prevent or minimize skin absorption, a combination of gloves, boots, hats, and coveralls should be worn. Although this clothing does not provide absolute protection, it should provide ample protection for personnel working at the site.

To prevent ingestion, do not eat, drink, or smoke during visits to site.

To prevent eye contact, wear safety glasses, chemical goggles, or a face shield (without side perforations); do not rub eyes; and do not wear contact lenses. (Contact lenses cannot be worn with self-contained breathing apparatus or respirators).

3. <u>Initial Site Hazard Assessment</u>

The Phase II contractor should conduct an initial site hazard assessment to determine the hazards that exist at the site. He should review all available information on the site to determine what protective clothing and equipment are required for the site visits.

4. Emergency Treatment

Before entering the site, the field team should know the locations and telephone numbers of the nearest emergency facilities (medical, fire, police, etc.). It is advisable that all field personnel have training in first aid and be prepared to provide emergency treatment for inhalation or ingestion of gasoline and skin exposure to or eye contact with gasoline.

5. Safety and Personnel Protective Equipment

For adequate protection against exposure to gasoline, it is advisable that all employees have available first aid and safety equipment, protective clothing, and optional respiratory equipment. As a minimum, first aid equipment should include a first aid kit and a first aid handbook. Other first aid items include a supply of clean water, a potable eyewash unit, and oxygen bottles. Safety equipment might include an explosivity meter, organic vapor analyzer, and a list of emergency telephone numbers.

Protective clothing that might be needed in the field includes safety glasses, goggles and/or face shield, protective boots, protective gloves, spill-resistant coveralls, or plain coveralls with chemical protective apron worn over them.

Three kinds of respiratory protection devices are available:

- o Self-contained breathing apparatus (SCBA)
- o Supplied air or air line respirator
- o Air-purifying respirator

Determination of the proper type to use and its use requires formal training. The self-contained breathing apparatus provides the most complete breathing protection for periods of time based on the amount of breathing air supplied and the breathing demand of the wearer. Normally, protection is provided for about 20 minutes.

The supplied air device delivers air through a supply hose and is generally used for long-term entry into a hazardous area.

The air-purifying device removes contaminants from the atmosphere to some degree and can be used only in atmospheres containing sufficient oxygen to sustain life.

Should it be determined that respiratory equipment is warranted at the identified study site, the latter would probably be the most applicable device.