RICHARDS-GEBAUR AFB MISSOURI

ADMINISTRATIVE RECORD COVER SHEET

AR File Number 310

RICHARDS-GEBAUR AF RESERVE BASE
Operating Location Q

Installation Restoration Program
Superfund Site

Belton, Missouri

ADMINISTRATIVE RECORD

VOLUME I

JULY 1996

REGION VII
SUPERFUND DIVISION
U. S. ENVIRONMENTAL PROTECTION AGENCY

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INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base, Missouri

CAMERA COPY

CH2M HILL

Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

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March 1983

Contract No. FO8637-80-G0010-6S01

NOTICE

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

A. INTRODUCTION

1. CH2M HILL was retained on September 14, 1982, to conduct the Richards-Gebaur Air Force Base (AFB) records search under Contract No. F08637-80-G0010-6S01, with funds provided by the Air Force Reserve (AFRES).

2. DEQPPM 81-5 explains DoD policy which 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 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 contaminant migration.

   Phase III (not part of this contract) consists of a technology base development study 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 Richards-Gebaur AFB records search included a detailed review of pertinent installation records, contacts with 15 government organizations for documents relevant to the records search effort, and an onsite base visit conducted by CH2M HILL during the week of November 15 through 19, 1982. Activities conducted during the onsite base visit included interviews with 27 past and present base employees, ground tours of base facilities, and a detailed search of installation records. The installations addressed in the records search include Richards-Gebaur AFB and the Belton Training Annex.

B. MAJOR FINDINGS

1. The majority of industrial operations at Richards-Gebaur AFB have been in existence since the early 1950s. The major industrial operations have included aerospace ground equipment (AGE), pneudraulics and engine maintenance, and corrosion control. These operations have generated varying quantities of waste oils, fuels, solvents, and cleaners since the base was activated in 1953.

2. The standard procedures for the final disposition of the majority of the waste oils, fuels, and solvents have included off-base contract collection and removal; burning in fire department training exercises; discharge to storm drains with and without oil/water separation; and transferral to DPDO.

3. Interviews with past and present base employees resulted in the identification of 9 past disposal or spill sites at Richards-Gebaur AFB and the

approximate dates that these sites were used (see Figure 6, Section IV, for site locations).

C. CONCLUSIONS

1. No direct evidence was found to indicate that migration of hazardous contaminants exists within or beyond Richards-Gebaur AFB boundaries. Indirect evidence of contamination was found at Site No. 1, the South Landfill, (a small oil sheen on adjacent surface water).

2. Information obtained through interviews with 27 past and present base personnel, base records, shop folders, and field observations indicate that hazardous wastes have been disposed of on Richards-Gebaur AFB property in the past.

3. The potential for migration of hazardous contaminants exists because of the presence of a perched ground-water table with direct discharge to nearby creeks. The presence of low-permeability clays and shales below the ground surface reduces the potential for hazardous contaminant migration vertically into lower ground water aquifers.

4. Table 1 presents a priority listing of the rated sites and their overall scores. The sites designated as areas showing the most significant potential (relative to other Richards-Gebaur sites) for environmental impact were the South Landfill (Site No. 1) and the Northeast Landfill (Site No. 2).

5. The remaining rated sites (Sites No. 3, 4, 5, 6, 7, 8, and 9) are not considered to present significant

Table 1
PRIORITY LISTING OF DISPOSAL SITES

Site No.	Site Description	Overall Score
1	South Landfill	55
2	Northeast Landfill	54
8	Herbicide Burial Site	51
3	Contractor Rubble Burial Site	48
5	South Burn Pit	48
9	Oil-Saturated Area	48
6	North Burn Pit	45
4	West Burn Pit	42
7	Radioactive Disposal Well	4

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environmental concerns and, therefore, no Phase II work is recommended.

6. The records search did not reveal any significant environmental concerns for the Belton Training Annex; therefore, no Phase II work is recommended for this off-base installation.

D. RECOMMENDATIONS

1. A limited Phase II monitoring program is suggested to confirm or rule out the presence and/or migration of hazardous contaminants. This program includes the sampling and analysis of the surface water in Scope Creek upstream and downstream of the South Landfill, and the installation of a shallow monitoring well downgradient of the Northeast Landfill for sampling and analysis of the ground water in the surficial aquifer. Details of the limited Phase II monitoring program are provided in Section VI of this report. The priority for monitoring at Richards-Gebaur AFB is considered moderate, since no imminent hazard has been determined.

2. The final details of the monitoring program, including the exact locations of ground-water monitoring wells, should be finalized as part of the Phase II program.

3. In the event that contaminants are detected, a more extensive field survey program should be implemented to determine the extent of contaminant migration.

4. Other environmental recommendations were made in addition to the Phase II monitoring, and include a survey of abandoned POL storage tanks to determine their status, and an evaluation of various containers at the Northeast Landfill to determine their contents and appropriate disposition. The details of these additional recommendations are also provided in Section VI of this report.

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I. INTRODUCTION

I. INTRODUCTION

A. BACKGROUND

The United States Air Force (USAF), 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 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 3012 and 6003 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.

To assure compliance with these hazardous waste regulations, the Department of Defense (DoD) developed the Installation Restoration Program (IRP). The current 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 material disposal sites and to control hazards to health and welfare that may have resulted from these past operations. The IRP will be the basis for remedial actions on USAF installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and clarified by Executive Order 12316.

To conduct the IRP Hazardous Materials Disposal Sites Records Search for Richards-Gebaur AFB, Missouri, CH2M HILL was retained on September 14, 1982 under Contract No. F08637-80-G0010-6S01.

The records search comprises 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 from the installation. 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 a technology base development study 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.

B. AUTHORITY

The identification of hazardous material 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.

C. PURPOSE OF THE RECORDS SEARCH

The purpose of the Phase I Records Search is to identify and 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 Richards-Gebaur AFB by reviewing the existing information and conducting an analysis of installation records. Pertinent information includes the history of operations, the geological and hydrogeological conditions which may contribute to the migration of contaminants, and the ecological settings which indicate 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 Richards-Gebaur AFB, Missouri, on October 7, 1982. Attendees at this meeting included representatives of the Air Force Engineering and Services Center (AFESC), Air Force Reserve (AFRES), Richards-Gebaur 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 Richards-Gebaur AFB records search.

The onsite base visit was conducted by CH2M HILL from November 15 through 19, 1982. Activities performed during the onsite visit included a detailed search of installation records, ground tours of the installation, and interviews with past and present base personnel. At the conclusion of the onsite base visit, the base commander was briefed on the preliminary findings. The following individuals comprised the CH2M HILL records search team:

1. Mr. David Moccia, Project Manager (B.S. Chemical Engineering, 1971)

2. Mr. Bruce Haas, Assistant Project Manager (M.S. Civil Engineering, 1976)

3. Ms. Elizabeth Dodge, Ecologist (M.S. Environmental Health Engineering, 1978; M.S. Aquatic Biology, 1976)

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

Individuals from the Air Force who assisted in the Richards-Gebaur AFB records search report include the following:

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

2. Capt. Gail Graban, AFESC, Phase I AFESC Program Representative

3. Mr. Larry Garrett, AFRES, Command Program Manager, Phase I

4. Major Kenneth Hundley, AFRES, Command Bioenvironmental Engineer

5. Major Gary Fishburn, USAF OEHL, Program Manager, Phase II

6. Mr. John Hurd, Richards-Gebaur AFB, Civil Engineer

7. Mr. Sam Mitchell, Richards-Gebaur AFB, Base Civil Engineer

8. Major Paul Garcia, AFRCE-CR/ROV Representative

E. METHODOLOGY

The methodology utilized in the Richards-Gebaur AFB records search is shown graphically on Figure 1. First, a review of past and present industrial operations is conducted at the base. Information is 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 is based on their best recollection. A list of the 27 interviewees from Richards-Gebaur AFB, with areas of knowledge and years at the installation, is given in Appendix C.

The next step in the activity review process is 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 is the identification of past landfill sites 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 general ground tour of identified sites is 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 are inspected for any evidence of contamination or leachate migration.

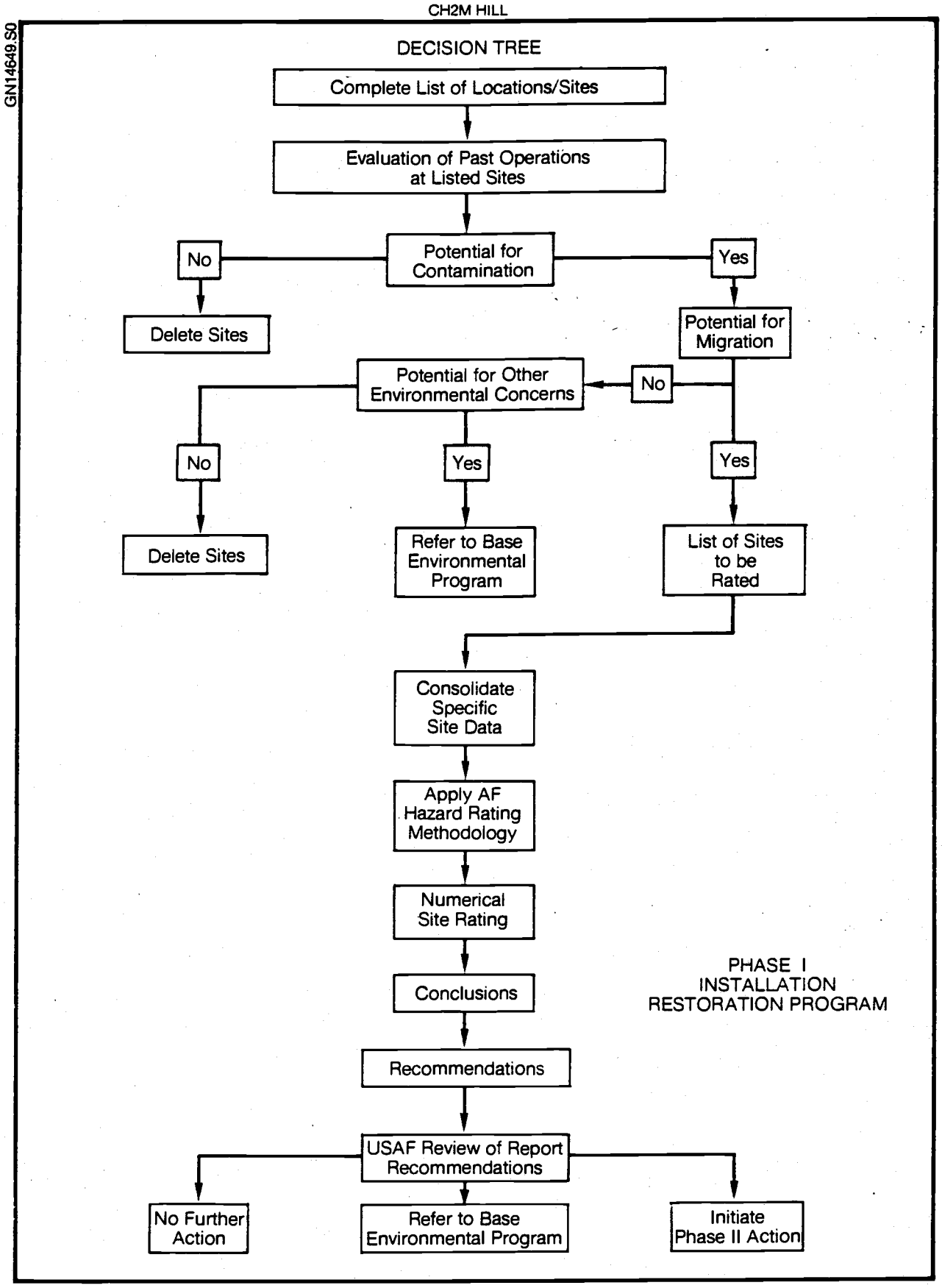

FIGURE 1. Records search methodology.

A decision is then made, based on all of the above information, as to whether a potential exists for hazardous material contamination from any of the identified sites. If not, the site is deleted from further consideration. If minor operations and maintenance deficiencies are noted during the investigations, the condition is reported to the Base Civil Engineer for further action.

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

The site rating indicates the relative potential for environmental impact at each site. For those sites showing a significant potential, recommendations are 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 is recommended.

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II. INSTALLATION DESCRIPTION

II. INSTALLATION DESCRIPTION

A. LOCATION

Richards-Gebaur AFB is located in west-central Missouri, about 2.6 miles from the Kansas state line, as shown on Figure 2. The base is almost equally divided by the Jackson and Cass County line, which runs east-west through the middle of the base. In Cass County, the base is bounded by the City of Belton on the east and south, and in Jackson County, the base is wholly surrounded by Kansas City. Downtown Kansas City is about 18 miles to the north, Grandview is about 3 miles to the northeast, and Belton is about 3 miles to the southeast. The main access to the base is off of U.S. Highway 71.

B. ORGANIZATION AND HISTORY

The area of what is now Richards-Gebaur AFB was acquired by Kansas City in 1941 for use as an auxiliary airport, and was originally named Grandview Airport. In 1952, the Aerospace Defense Command leased the airport from Kansas City for use in air defense operations, and in 1953 the property was formally conveyed to the U.S. Government. The base was redesignated Richards-Gebaur AFB in 1957 in honor of two native Kansans, First Lieutenant John F. Richards and Lieutenant Colonel Arthur W. Gebaur, Jr.

Air Defense Command (ADC) had the primary mission on base until 1970, when the Air Force Communications Command (AFCC) assumed command and relocated its headquarters from Scott AFB, Illinois. In 1977, AFCC moved back to Scott AFB, and Richards-Gebaur AFB came under the Military Airlift Command.

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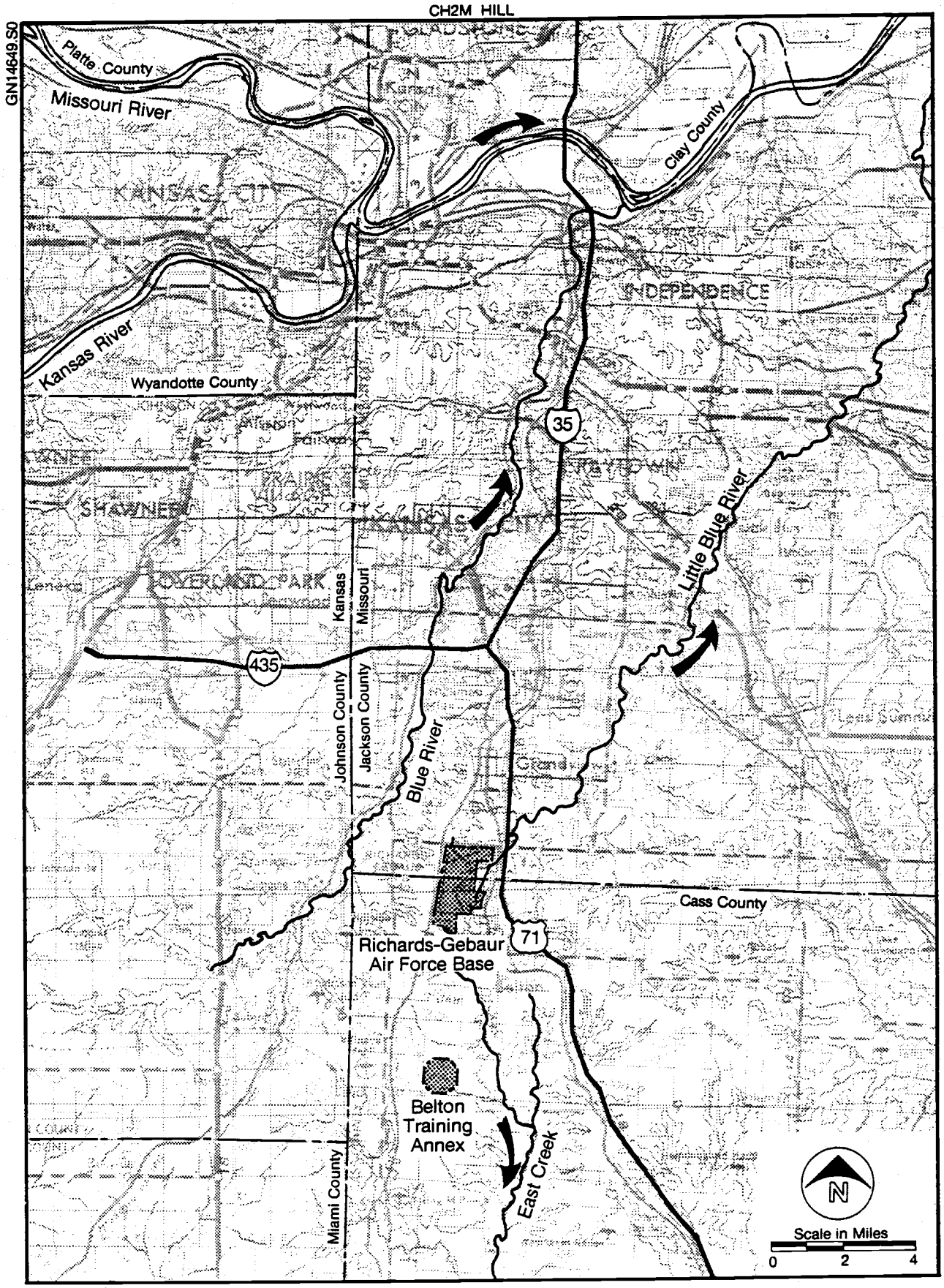

FIGURE 2. Location map of Richards-Gebaur AFB, Missouri.

Between 1977 and 1979 the number of active duty and civilian forces at Richards-Gebaur AFB was drastically reduced from a maximum of about 5,000 personnel during the active years of the base to less than 500 full-time personnel. In September, 1979, the majority of the operating support functions were transferred to a civilian contractor, Talley Services, Inc. AFRES assumed operational control in October, 1980.

The 442nd Tactical Fighter Group (AFRES) currently has the primary mission on-base. The AFRES unit was originally activated in 1949 at Fairfax Field in Kansas City, Kansas, and was relocated to Naval Air Station, Olathe, Kansas, (now Johnson County Industrial Airport) in 1950 before arriving at Richards-Gebaur AFB in April 1955.

Today the 442nd Tactical Fighter Group (TFG) is equipped with 24 A-10 Thunderbolt II aircraft, having previously been equipped with C-130 Hercules aircraft and C-124 reciprocating engine transport aircraft. The collocated AFRES units have an authorized strength of 197 full-time Air Reserve Technicians, 1,073 reservists, and 224 civilian employees.

Active duty support units remaining at Richards-Gebaur AFB include the 1879th Communications Squadron (AFCC) and Operating Location A, Detachment 19, 26th Weather Squadron (MAC). Other federal government agencies presently using base facilities include the U.S. Marine Corps' operation of the former base officer housing area, the U.S. Department of Agriculture's Standardization Division; U.S. Navy Seabee Reserve Mobile Construction Battalion No. 15, 308th Psychological Operations Company, and nine other U.S. Army reserve units, and the General Services Administration (GSA).

In October 1980, the majority of the base facilities and properties were excessed to the GSA and an interim lease and joint use of the airport with Kansas City became effective. Base support facilities are currently shared by AFRES, Kansas City, and Talley Services, Inc.

A more detailed description of the base history and its mission is included in Appendix E.

The Air Force-controlled property at Richards-Gebaur AFB involves a fairly complex arrangement of ownership, permit use, leases, and easements. Figure 3 illustrates the distribution of various land parcels within the base boundaries. Base property at the present time includes about 2,160 acres, of which 375 acres are retained by the Air Force, 1,673 acres are leased to the cities of Kansas City and Belton, 101 acres are being or have been transferred to the Department of the Navy, and 11 acres have been transferred to the Department of the Army. An off-base practice drop zone, the Belton Training Annex, represents another 472 acres of land under the control of Richards-Gebaur AFB.

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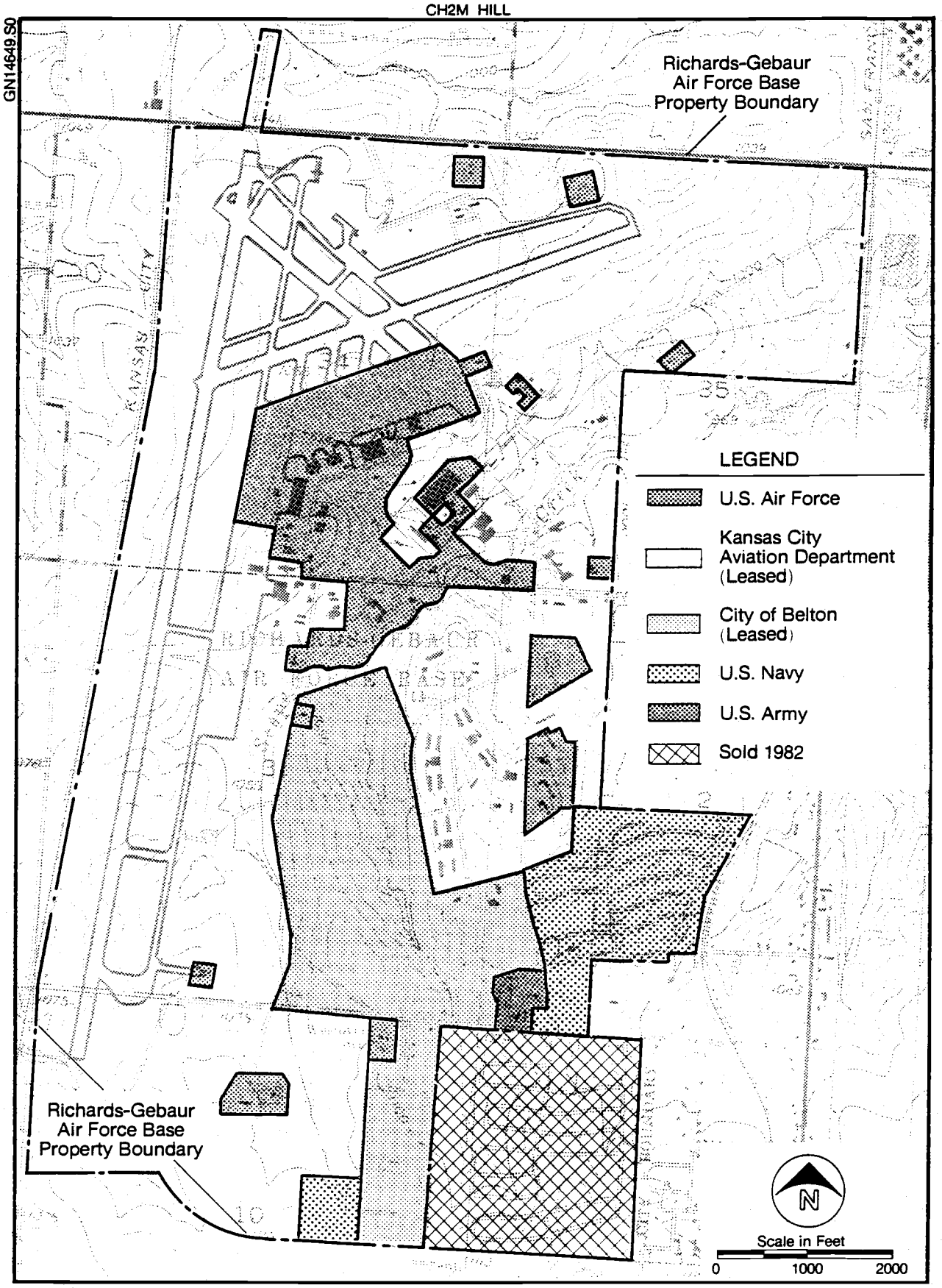

FIGURE 3. Real property areas, Richards-Gebaur AFB, Missouri.

III. ENVIRONMENTAL SETTING

III. Environmental Setting

A. Meteorology

Richards-Gebaur AFB and the surrounding area exhibit a modified continental climate, in which conditions normally expected to prevail at that latitude are often distorted by air currents freely entering from the southeast, the Gulf of Mexico, or other distant areas. Average monthly temperatures range from 26°F in January to 78°F in July, with an average annual temperature of 54°F (Table 2). Most precipitation falls in the late spring and early summer and again in the early fall. Average monthly precipitation ranges from 1.15 inches in February to 5.05 inches in June. Average annual precipitation is 36.8 inches. Maximum and minimum annual precipitation is 63.6 and 28.8 inches, respectively. Pan evaporation and evapotranspiration rates are approximately 60 inches and 42 inches per year, respectively.

Prevailing winds for the base are from the south all year and the mean annual wind speed is nine knots. Due to the base's location and the generally flat topography in surroundings areas, weather changes can be rapid. Tornados and severe thunderstorms are most likely to occur in spring and summer months.

B. GEOLOGY

Richards-Gebaur AFB is located in the Osage Plains region of the Central Lowland physiographic province. This region is characterized by low overall relief; broad, maturely dissected uplands yield to somewhat steeper valley slopes. Prominent escarpments are caused by thick, erosion-resistant limestone.

Table 2
METEOROLOGICAL DATA SUMMARY FOR RICHARDS-GEBAUR AIR FORCE BASE[a]

Parameter	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Temperature (°F)													
Highest	71	82	84	90	95	104	111	107	102	93	84	71	97.9[b]
Average Maxium	34.5	40.3	51.3	65.1	73.8	81.6	87.0	85.9	77.9	67.5	52.3	40.3	63.1
Average	26.2	31.9	42.1	55.3	64.7	72.8	77.9	76.3	68.5	57.6	43.6	32.6	54.1
Average Minimum	17.5	22.9	32.3	45.0	55.1	63.5	68.3	66.3	58.5	47.2	34.2	24.3	44.6
Lowest	-17	-12	-3	16	30	44	46	48	34	22	4	-8	-5.9[b]
Monthly Precipitation (inches)													
Maximum	3.51	3.15	11.48	8.74	7.65	12.57	12.40	7.76	13.54	9.24	5.68	2.79	63.64
Mean	1.50	1.15	2.58	3.40	4.25	5.05	3.78	3.19	4.65	3.62	1.78	1.57	36.83
Minimum	0.13	0.23	0.45	0.72	1.21	1.67	0.20	0.18	0.09	0.18	0.03	0.01	20.82

NOTES: [a]Period of Record: 1954 - 1982

[b]Average Annual Extremes

Source: Department of the Air Force, Richards-Gebaur AFB

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The base facilities are located on a broad plateau, called the Blue Ridge, between the Blue River on the west and the Little Blue River on the east (Figure 2). Land surface elevations range from about 960 feet above mean sea level (msl) on the east to over 1,100 feet (msl) on the south.

Surface soils at Richards-Gebaur AFB consist primarily of very thin loess over residual soils derived from the in-place weathering of the underlying limestone and shale rocks. Soil cover normally varies from 2 to 15 feet. The soils on the upland surfaces belong to the Sharpsburg and Macksburg series and consists of poorly drained silty clay loams. Greenton and Polo series soils are moderately well-drained silty clay and clay soils formed on the eroded convex side slopes. Where shale is exposed along creeks, soils consist of residual clays and silty clays belonging to the Snead and Sampsel series. Moderately well-drained alluvium has filled stream valleys up to a depth of about 50 feet. At Richards-Gebaur AFB, alluvial soils belonging to the Verdigris (Kennebec) series are present in the level bottomland area along Scope Creek. These alluvial soils have a high ground-water table and are subject to occasional flooding.

Permeabilities of the surficial soils are generally low, less than 10^{-6} centimeters per second (cm/sec). Permeability of the Verdigris (Kennebec) alluvial soils is moderate, between 10^{-4} and 10^{-6} cm/sec.

A generalized geologic section of the Osage Plains is given on Table 3. Sedimentary rocks of Pennsylvanian age comprise the uppermost geologic units within Jackson and Cass Counties and achieve a thickness of about 500 to 900 feet. In general, the rock strata dip very gradually toward the northwest at about 10 feet per mile; this general

Table 3
GENERALIZED GEOLOGIC SECTION
AT RICHARDS-GEBAUR AFB[a]

System	Group	Formation	Thickness (Approx.) in Feet	Depth to Top of Unit[b]	Physical Characteristics
Quaternary	Alluvium	--	50	--	
	Loess	--	2	--	
Pennsylvanian	Kansas City	Wyandotte	50	--	Limestone (Argentine)
		Lane	65	0	Shale
		Iola	10	65	Limestone (Raytown)
		Chanute	32	75	Shale
		Drum	2	107	Limestone
		Cherryville	17	109	Shale
		Dennis	15	126	Limestone (Winterset)
		Galesburg	3	141	Shale
		Swope	22	144	Limestone (Bethany Falls)
		Ladore	4	166	Shale
		Hertha	15	170	Limestone
	Pleasanton	--	150	185	Shale, Siltstone, and Sandstone; Gas-bearing, lower units
	Marmaton	--	125	335	Shale, sandstone, limestone, coal, and clay; Gas-bearing
	Cherokee	--	520	460	Sandstone, shale, limestone, siltstone, coal, and clay; Gas-bearing, upper units
Mississippian	Keokuk-Burlington	--	330	980	Limestone
	Chouteau (Kinderhook)	--	115	1,310	Siltstone, limestone, shale
Ordovician	--	Joachim	60	1,425	Dolomite (limestone)
	--	St. Peter	65	1,485	Sandstone
	--	Jefferson City	320	1,550	Dolomite (limestone)
	--	Roubidoux	20	1,870	Sandstone
	--	Gasconade	450	1,890	Dolomite (limestone), sandstone
Cambrian	Undifferentiated	--	150	2,340	Dolomite (limestone), shale
	--	Lamotte	100	2,490	Sandstone
Precambrian	Undifferentiated	--	--	2,590	Granite (igneous rocks)

[a]Composite section from following sources: Master Plan, Richards-Gebaur AFB, Tab C; Missouri Division of Geology, Volume 14; Missouri Division of Geology, Volume 43; Missouri Division of Geology, Vol. 6.

[b]Beneath top of Lane Shale

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regional dip is modified locally by low anticlines, synclines, and domes. Richards-Gebaur AFB is located on the King anticline, a structural rise favorable for oil and gas production and the oldest gas-producing area in Cass County. Gas production ended about 1938; numerous abandoned gas wells are located throughout the base.

Rock units that outcrop at Richards-Gebaur AFB are members of the Kansas City group and include the Chanute Formation, Iola Formation (Raytown member), Lane Formation, and Wyandotte Formation (Argentine member), as shown on Figure 4. These units are basically flat-lying in the area of the base.

The Wyandotte Formation (Argentine member) is the predominant rock unit and caps most of the upland areas. The unit consists of a highly weathered limestone that reaches a maximum thickness of about 50 feet. Weathering has produced enlarged clay-filled vertical joints and layers of soft clay along horizontal bedding planes. Extensive ground-water movement can occur in these joints and planes where conditions are favorable.

The Lane Formation shale underlies the Wyandotte limestone below an elevation of about 1,030 to 1,035 feet (msl). The Lane shale outcrops in the central portion of the base and is about 65 feet thick. The Lane shale is low in permeability and restricts the downward movement of ground water. The Raytown member of the Iola Formation is a thin limestone unit about 10 feet thick that outcrops along the banks of Scope Creek. A 10-foot difference in elevation of the Raytown limestone has been reported just north of the hospital and heating plant, which may indicate the presence of a minor fault or monocline. This fault could serve as a possible pathway for contaminant migration; however, the fault is located where no significant impact can be expected

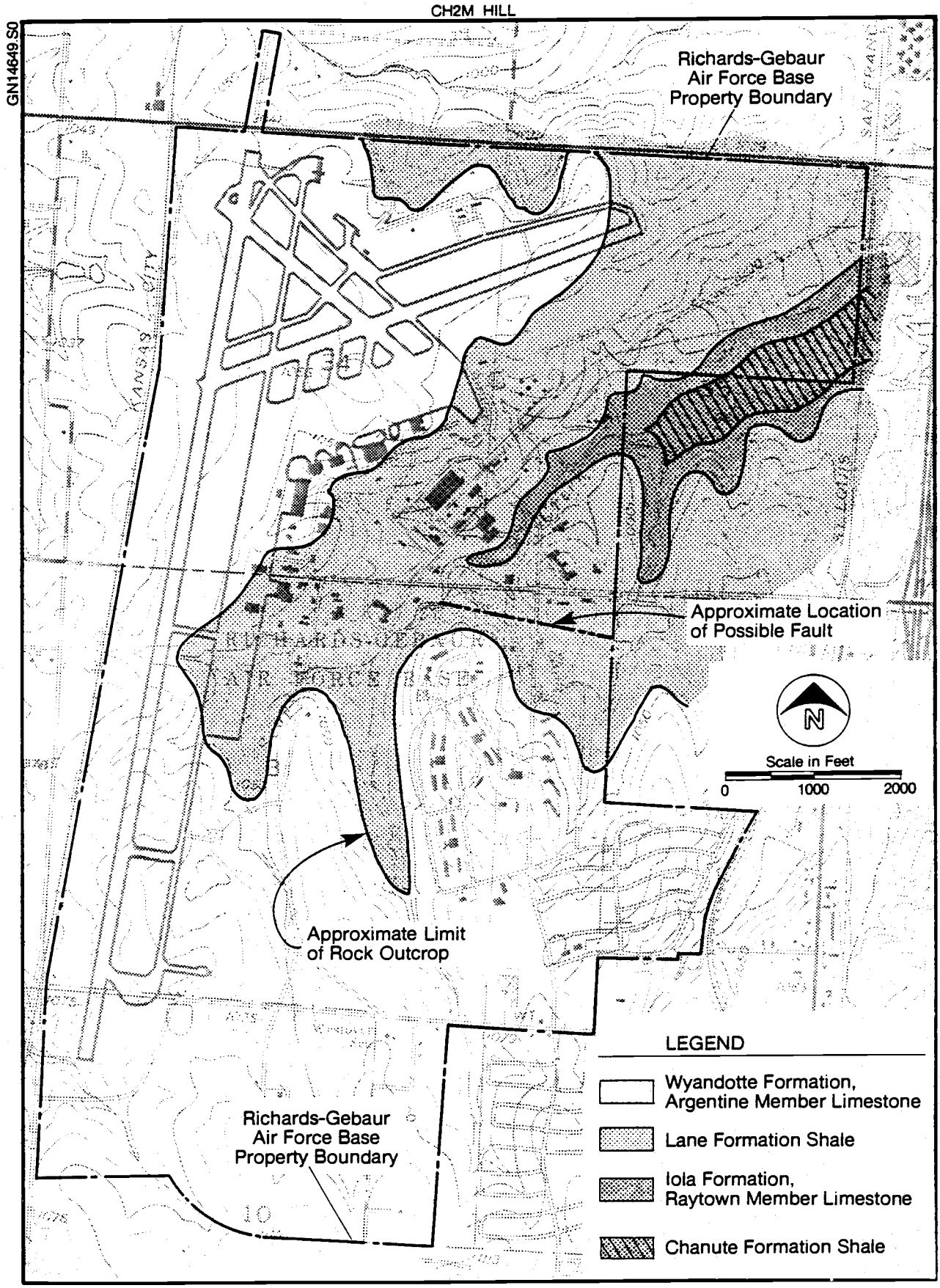

FIGURE 4. Geologic map of Richards-Gebaur AFB, Missouri.

from the identified disposal sites described in Section IV. The Chanute Formation, consisting primarily of shale with interbedded limestone stringers, is present beneath the Raytown limestone and is not exposed at the base, but is covered by alluvial soils along Scope Creek.

Rock units underlying these formations consist of consecutively older sedimentary rocks over a Precambrian granite base rock at a depth of over 2,500 feet.

The principal gas-bearing horizons are found near the base of the Pleasanton Group, the Marmaton Group, and the upper 100 to 300 feet of the Cherokee Group. There are, therefore, about 400 feet of strata in which gas may be encountered, all of which are located in rocks of Pennsylvanian age, primarily sandstone, but occasionally black slaty shale or coal seams.

C. HYDROLOGY

1. Surface Water

The entire drainage of Richards-Gebaur AFB is received indirectly by the Missouri River, which is located about 20 miles north of the base. Nearly all base drainage is located within the drainage basin of the Little Blue River, as shown on Figure 5. The main base creek, Scope Creek, receives discharges from all industrial shop areas along the flightline and from the existing wastewater treatment plant. Flow in Scope Creek above the treatment plant is approximately 900 gallons per minute (gpm) during normal flow and approximately 3,000 gpm following storm events. Scope Creek is an intermittent stream which may be dry during periods of low rainfall, particularly in its upper reaches. Discharges from the wastewater treatment plant

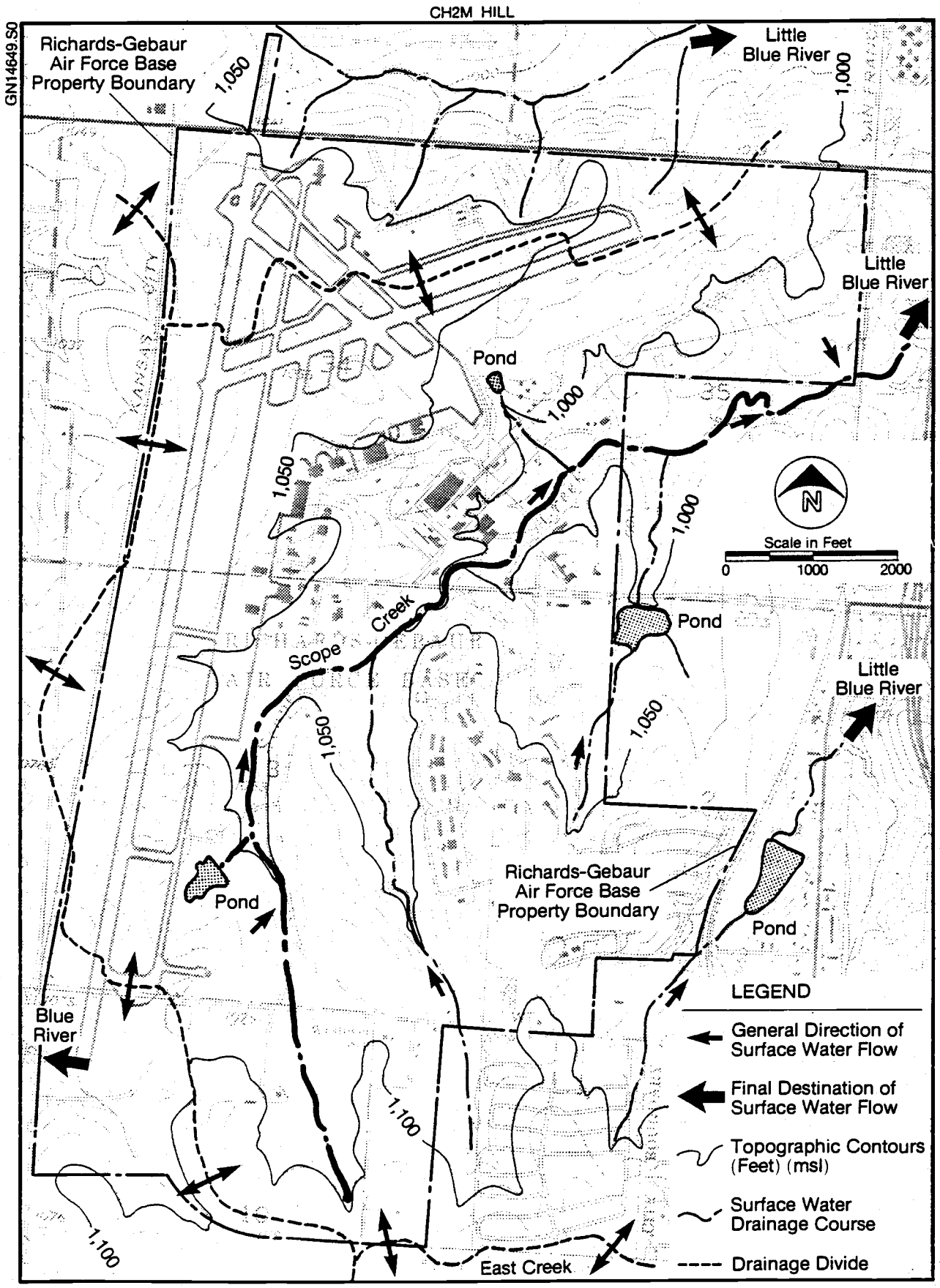

FIGURE 5. Storm water drainage and topographic map, Richards-Gebaur AFB, Missouri.

are currently about 122 gpm, and during times of low flow may contribute the majority of the flow to Scope Creek.

A small area in the southwest corner of the base is located within the Blue River drainage basin. In general, the drainage divide between the Blue River and Little Blue River basins follows the western boundary of the site; the drainage divide between the Little Blue River and East Creek (which flows south away from the base) follows the southern boundary.

There are two stormwater retention reservoirs on the base, as shown on Figure 5. One of these, a 4-acre pond located near the NDI Lab, Building 839, was constructed in the mid-1950s for flood control and fish propagation using rubble from runway demolition to dam an existing drainage swale. The other is a 0.3-acre pond (Facility 943) constructed in 1974 to intercept stormwater and washwater from the flightline for the collection of oils and fuels in an oil/water separator.

Water quality of the surface-water drainages on the base is discussed in Section IV.

Water from the Little Blue River downstream of the base has been used for irrigation only; irrigation use has declined considerably since the base was originally constructed due to extensive urbanization of the watershed. No public water supply intakes are located along the Blue or Little Blue Rivers. The Missouri River is used as a source of water supply for Kansas City. The intake is located upstream of the confluence of the Blue and the Missouri Rivers. Other public water supply intakes along the Missouri River are located more than 50 miles downstream of its confluence with the Little Blue River.

Richards-Gebaur AFB obtains its water from Kansas City, as discussed in Section IV.

2. Ground Water

Richards-Gebaur AFB is located in the saline ground-water province of western Missouri in which the total dissolved solids exceed 1,000 parts per million (ppm) in aquifers capable of yielding adequate water volumes to municipalities or industries. The saline water within the Pennsylvanian strata is probably modified seawater which has been trapped since ancient times. In southwest Jackson County and northwest Cass County, the total dissolved solids may exceed 40,000 ppm. There are therefore no major public ground-water supplies in the area of Richards-Gebaur AFB. Shallow aquifers containing sufficient volumes of fresh ground water to meet municipal, industrial, or domestic needs are present in the alluvium along major rivers and in the glacial drift deposits north of the Missouri River, but not in the area of Richards-Gebaur AFB.

Shallow ground-water aquifers are present in the uppermost limestone formations of Pennsylvanian age. Shallow wells in these aquifers have been used in some areas of Jackson and Cass Counties for domestic supplies, but yields are very low (1 to 3 gpm), quantities are not dependable seasonally, and water quality is often highly mineralized. No water supply wells are known to exist at Richards-Gebaur AFB. The shale rock strata of Pennsylvanian age are low in permeability, thereby impeding ground-water movement both laterally and vertically and providing little opportunity for ground-water recharge to the shallow limestone aquifers. Recharge may occur in some outcrop areas at higher elevations where conditions are favorable, or by percolation through overlying strata where joints, fractures, or faults are present. No significant recharge

areas are known to exist in the area of Richards-Gebaur AFB. Discharge from the shallow limestone aquifers occurs in outcrop areas along the Missouri River and its tributaries, including Scope Creek at the base.

Perched ground water is present in some of the surficial materials on uplands and slopes. These perched water zones are recharged locally by precipitation and discharge to nearby streams in the form of springs or seeps. Water table elevations vary considerably over short distances and are seasonal.

The probable direction of ground-water flow within the perched ground water at the base is vertically downward through the loess, residual clays, and/or limestone caprock to the surface of the relatively impervious Lane Shale or Chanute Shale, then laterally to discharge via springs into Scope Creek. Locally, impervious residual clay layers, fragipan, and intact limestone strata may impede vertical ground-water flow; in these areas perched ground water may flow laterally along the surface of the impervious layer to discharge as springs or seeps.

Perched ground water is also present in the alluvium along Scope Creek. This perched ground water is recharged by direct rainfall infiltration, flow of perched ground water from higher elevations, or from the creek during times of flooding. Discharge is directly into the creek.

D. Environmentally Sensitive Conditions

1. Vegetation

Of the approximately 2,300 acres in the Richards-Gebaur AFB study area, about 700 acres are unimproved. Most

of the unimproved areas consist of annual grassland communities composed of fescue, bluegrass, bromegrass, and clover. Small tracts of trees occur in the more isolated areas of the base. These primarily consist of honey locust, maple, oak and osage-orange. The base is relatively well drained, so no significant wetland areas exist.

2. Wildlife

Because habitat areas are not very diverse, wildlife on the base is correspondingly limited, consisting primarily of small mammals and song birds. Mammals reported include rabbits, squirrels, muskrats, coyotes, opossum, and groundhogs. Birds commonly found on the base are sparrows, cardinals, quail, shrikes, brown thrashers, red-tail hawks, and prarie horn larks. In the Richards-Gebaur Fish and Wildlife Management Plan developed in 1975, 500 acres were identified as suitable for habitat improvement through plantings of trees, crowned vetch, orchard grass, and ladino clover.

3. Aquatic Systems

Aquatic systems on the base consist of a 4-acre man-made pond and 4 miles of a small stream with tributaries which meander through the base. The pond is located southeast of the main runway, from which it receives stormwater runoff. Periodic stocking of the pond has been conducted to enhance recreational fishing. The small stream on the base is part of the headwaters of the Little Blue River. Presently it receives the base's stormwater runoff and effluent from the wastewater treatment plant on the base. A fishkill involving several hundred fish was reported on July 12, 1975 at the "golf course stream," a tributary of Scope Creek. The fishkill was investigated by the Air Force; however, no cause was identified. The fishkill is not

considered the result of any past hazardous material disposal practices.

4. Threatened and Endangered Species

No species designated as endangered by the U.S. Fish and Wildlife Service of the Department of the Interior are known to inhabit the area within a 50-mile radius of Richards-Gebaur AFB. Some migratory endangered species which may rarely occur in the area as transients include the Southern Bald Eagle, American Peregrine Falcon, Indiana Bat, and Ozark Big-Eared Bat. Threatened species resident within a 50-mile radius include the Greater Prarie Chicken, Lake Sturgeon, and Niangua Darter.

The above species are also included on the Missouri Department of Conservation's list of rare and endangered fauna in the state. The Southern Bald Eagle and Ozark Big-Eared Bat are considered extirpated within the state of Missouri. State endangered species are the American Peregrine Falcon, Indiana Bat, Greater Prarie Chicken, and Lake Sturgeon. The Niangua Darter is classified as rare.

5. Environmental Stress

No evidence of significant environmental stress resulting from past disposal of hazardous wastes was observed during the ground tour of Richards-Gebaur AFB. Areas of potential concern are located alongside Scope Creek, where natural woodland environments and flood-prone lowlands are present. When the wastewater treatment plant on-base is taken out of operation (early 1983), effluent discharge to the stream will be eliminated. This will probably cause a noticeable reduction in the base flow of the stream as it leaves the study area.

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IV. FINDINGS

IV. FINDINGS

A. ACTIVITY REVIEW

1. Summary of Industrial Waste Disposal Practices

The major industrial operations at Richards-Gebaur AFB have included aerospace ground equipment (AGE), pneudraulics and engine maintenance, and corrosion control. These operations have generated varying quantities of waste oils, fuels, solvents, and cleaners since the base was activated in 1953.

The total quantity of industrial wastes generated by AFRES is currently between 11,000 and 13,000 gallons per year. Quantities of waste oils, fuels, and solvents have decreased substantially since the A-10 aircraft replaced the C-130s at the base in 1982; approximately half as much industrial waste is currently generated. In addition, industrial waste quantities decreased substantially when the C-124 reciprocating engine aircraft were replaced by the C-130s in 1971; approximately half as much waste oil was generated with the C-130s. The total quantity of industrial wastes generated prior to 1971 was about 26,000 gallons per year more than current waste generation.

Standard procedures for past and present industrial waste disposal at Richards-Gebaur AFB, based on the reports or best recollection of interviewees, are as follows:

- 1953 to 1969: Industrial wastes from most base operations, from both regular Air Force and AFRES, including waste oils, solvents, and paint thinners were placed in drums or bowsers (portable tanks on wheels) for

routine collection and disposal off-base by a private contractor. Waste oils and waste fuels were also accepted by the fire department for use in fire department training exercises. It was also common practice to dispose of small quantities of waste oils down the storm drain; two interviewees reported complaints by farmers, living downstream of the base of oil slicks on cattle in the late 1950s. Some industrial wastes may also have been disposed of at the two base landfills; burning of refuse at the landfills was common practice until 1969.

- 1969 to 1976: In 1969, the fire department no longer accepted waste oil products, although it continued to accept contaminated fuels for use in fire department training exercises. An industrial waste system consisting of oil/water separators and collector drains was installed at several facilities in about 1974. Underground tanks at Buildings 942 and 611 were converted from heating oil tanks to waste oil or waste fuel salvage tanks. In 1969, burning was no longer permitted at the base landfill and in 1971 or 1972, landfilling activity ceased altogether.

  These changes, occurring about the time that operation of the base transferred from ADC to AFCC, resulted in greater control of the disposition of industrial wastes through off-base contract removal. Radium Petroleum was the primary contractor for disposal of industrial wastes during this period.

- 1976 to Present: Since 1976, procedures for disposal of waste fuels, lubricants, and solvents have undergone minor changes in response to functional and operational changes on the base. Waste POL has continued to be collected and disposed of off-base through contract removal, although the locations of tanks for temporary storage of the wastes have changed occasionally. In 1976, separation of synthetic and non-synthetic lubricants was implemented. Synthetic oils were originally placed in a 300-gallon underground tank at Building 927; in 1978 and 1979, synthetic oils were placed in 55-gallon drums for disposal through the Defense Property Disposal Office (DPDO), and recently have been collected in a 500-gallon bowser for disposal through DPDO. Waste non-synthetic POL were placed in each of three underground tanks at Buildings 611, 821, and 966 between 1976 and 1978; since 1978 only the tank at Building 966 has been used.

  Waste halogenated solvents (e.g., trichloroethylene) have been placed in drums and delivered to DPDO for disposal. Waste non-halogenated solvents (e.g., PD-680) have been placed in a 500-gallon bowser at the east end of the flightline for disposal through DPDO. Some PD-680 is also stored in the underground waste POL tank at Building 966 which is periodically emptied with its contents disposed of off-base through contract removal.

Waste oils generated at the Motor Pool, Building 704, were originally stored in 55-gallon drums that were either emptied into the underground waste POL tank at Building 966 or removed directly through off-base contract disposal. Since about 1980, a 500-gallon above-ground tank has been used for storage of waste POL.

Waste fuels generated along the flightline have been accumulated in two 500-gallon bowsers stored at the east end of the flightline. Waste fuels generated at the Motor Pool are accumulated in a 5,000-gallon underground tank at Building 711. Waste fuels are ultimately taken to the 5,000-gallon above-ground tank located at the fire department burn pit and used in fire department training exercises.

2. Industrial Operations

Industrial operations at Richards-Gebaur AFB have been conducted by several different tenant units or organizations under the regular Air Force, AFRES, and the Kansas City Aviation Department. These operations have been primarily involved in the routine maintenance of assigned aircraft and associated ground support equipment. Corrosion control activities have included only minor component and touch-up painting; no stripping or painting of entire aircraft has been conducted at the base, although in October, 1982, Talley Services, Inc., began stripping and overhauling of Army helicopters in Building 1010. Appendix F contains a master list of the industrial operations, and the approximate dates of operation.

A review of base records and interviews with past and present base employees resulted in the identification of the industrial operations in which the majority of industrial chemicals are handled and hazardous wastes are generated. Table 4 summarizes the major industrial operations and indicates the estimated quantities of wastes currently generated as well as the past and present disposition of these wastes, i.e., treatment, storage, and disposal. Appendix F, "Master List of Industrial Activities," provides data on the present location and the past or alternate location along with corresponding dates for the various industrial operations. This information has been obtained from shop files and interviews with shop personnel based on their best recollection. Descriptions of the major activities are included in the following paragraphs.

a. AFRES

i. General Aircraft Maintenance

Currently, most shops involved in general aircraft maintenance, including pneudraulics/environmental, wheel/tire, machine, electric/battery, phase/inspection, sheet metal/welding, and reclamation/repair are located in Building 918. Originally, all shops operated by AFRES were located in Building 940 and those operated by the regular Air Force were located in Building 821. Most Air Force shops moved into Building 918 in 1957, although the wheel/tire shop remained in Building 821 until about 1971. When command of the base was transferred from ADC to AFCC in 1970, the separate Air Force and AFRES shops were gradually combined into common facilities in Building 918.

The active duty and reserve pneudraulics/environmental shops were combined in about

Table 4
MAJOR INDUSTRIAL OPERATIONS SUMMARY

Organization/Shop Name	Present Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods (1950 – 1960 – 1970 – 1980)
AFRES				
Pneudraulics/Environmental	918	PD-680 solvent	40 gal/yr	Aircraft washrack[a] to storm drain; Off-base contract removal
		Hydraulic fluid	240 gal/yr	Fire dept.[b] training; Off-base contract removal
Wheel/Tire	918	PD 680 solvent	100-140 gal/yr	Aircraft washrack to storm drain; Off-base contract removal
		Paint stripper	100-200 gal/yr	Off-base contract removal
Electric/Battery	918	Sulfuric acid	80-100 gal/yr	Neutralized to sanitary sewer
NDI Laboratory	839	Penetrant	50-110 gal/yr	Off-base contract removal
		Emulsifier	25-100 gal/yr	Off-base contract removal; Drainfield
		Developer	50-150 gal/yr	Drainfield
		Fixer	10-40 gal/yr	Base photo for silver recovery; DPDO for silver recovery[c]
		Kerosene	25 gal/yr	Ground surface
Engine/Prop	927	Engine oil	200 gal/yr (1,200 gal/yr prior to 1972)	Fire dept.[b] training; Off-base contract removal

Table 4--Continued

Organization/Shop Name	Present Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods (1950, 1960, 1970, 1980)
		Synthetic oil	60-200 gal/yr	Off-base contract removal; DPDO[c]; Off-base contract removal
		PD 680 solvent	60-120 gal/yr	Aircraft washrack to storm drain[a]
Aerospace Ground Equipment	958	PD 680 solvent	40-160 gal/yr	Aircraft washrack to storm drain[a]; Off-base contract removal
		Engine oils Hydraulic fluid	600 gal/yr (2,800 gal/yr prior to 1976)	Fire dept. training[b]; Off-base contract removal
		Waste fuels	100 gal/yr	Fire dept. training[b]
Active Air Force AGE	822	Engine oil Hydraulic fluid Paint stripper	240-1,200 gal/yr	Fire dept. training[b]; Off-base contract removal
Corrosion Control	948	Paint strippers Paint thinners	55 gal/yr	Off-base contract removal
Operational Maintenance	Flightline	Synthetic oil	800 gal/yr	Off-base contract removal; DPDO[c]; Off-base contract removal
		JP-4 fuel	2,400 gal/yr (12,000 gal/yr prior to 1982)	Fire dept. training[b]

Table 4--Continued

Organization/Shop Name	Present Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods (1950, 1960, 1970, 1980)
		PD-680 solvent	60 gal/yr (2,000 gal/yr prior to 1982)	Aircraft washrack to storm drain[a] → Storm drain[d]
		Alkaline soap	15,000-25,000 gal/yr	
Fuel Cell (Lear Siegler, Inc. since 1977)	966 & 965	JP-4 fuel	2,400 gal/yr (12,000 gal/yr prior to 1982)	Fire dept. training[b]
		Paint sludge	60 gal/yr	Off-base contract removal
Kansas City Aviation Dept.				
Vehicle Maintenance	704 & 711	Engine oil, Hydraulic fluid, Paints and thinners	2,100-2,700 gal/yr	Fire dept. training[b] → Off-base contract removal
		PD-680 Solvent	600 gal/yr	Off-base contract removal
		JP-4 Fuel	600 gal/yr	Fire dept. training[b]
Fixed-Base Operation	821	PD-680 Solvent	180-240 gal/yr	Off-base contract removal
Belton Tool Manufacturing	611 & 612	Waste oils	1,200 gal/yr	Off-base contract removal
Air Defense Command	611 & 612	Waste oils	1,200 gal/yr	Off-base contract removal

[a]Aircraft washrack (Facility No. 945) located at far east end of flightline; wastes washed down storm drain up to 1969, through oil/water separator into storm drain after 1969.

[b]Wastes placed in 55-gallon drums and taken to the fire department training areas for use in training exercises. Some wastes also disposed of off-base through contract removal when not used in training exercises.

[c]Defense Property Disposal Office, Whiteman AFB, Missouri.

[d]Floor drain at Building No. 918; discharges to storm drain without oil/water separator.

1971. The shop includes a 20-gallon cleaning vat containing PD-680 which is emptied every 6 to 12 months. The waste PD-680 is currently stored in a 12,000-gallon underground waste oil tank at Building 966 which is emptied and its contents removed off-base through contract. Prior to about 1980, the waste PD-680 was washed down the former aircraft washrack, Facility 945, which discharged to the storm drain following pretreatment in an oil/water separator installed in 1969. Waste hydraulic fluid generated in the pneudraulics/environmental shop (about 240 gallons per year) has been placed in the waste oil tank at Building 966 since about 1976 for disposal off-base through contract removal. Prior to 1976, the waste hydraulic fluid was typically placed in 55-gallon drums stored at the east end of the flightline near the aircraft washrack for disposal off-base through contract removal. Prior to 1969, these wastes were disposed of by the fire department in training exercises.

The wheel/tire shops were combined in about 1975, although a 100-gallon cleaning vat containing PD-680 remains in Building 940. The vat is seldom used, resulting in about 100 to 140 gallons of waste solvent per year which is stored in a 1,000-gallon aboveground waste solvent tank located at the former aircraft washrack, Facility 945. The waste solvent tank is emptied and its contents removed off-base through contract removal. Prior to about 1976, waste solvents were washed down the washrack drain which discharged to the storm drain following pretreatment in an oil/water separator installed in 1969. Waste paint strippers, between about 100 and 200 gallons per year, are stored in 55-gallon drums prior to removal off-base through contract.

The electric-battery shop disposes of approximately 3 or 4 nickel-cadmium batteries each month which are sent to DPDO at Whiteman AFB for ultimate

disposition. Approximately 7 or 8 lead acid batteries are disposed of each month; the battery acid is neutralized with potassium hydroxide prior to washing down the sanitary sewer.

Other shops within Building 918 do not generate significant quantities of industrial wastes.

ii. Non-Destructive Inspection

The NDI Lab has been located in Building 839 at the south end of the runway since it was built in 1961. Principal wastes generated by the lab are held in a series of 50- to 100-gallon vats that are drained yearly for cleaning. Waste penetrant, approximately 50 to 110 gallons per year, was originally stored in drums for disposal off-base through contract; since about 1980, waste penetrant is placed in the waste oil tank near Building 966 which is then emptied and removed off-base through contract disposal. Waste emulsifier, approximately 25 to 100 gallons per year, was likewise placed in drums and disposed of off-base through contract prior to 1980; since 1980, waste emulsifier has been deposited down the sanitary drain which leads to a drainfield outside Building 839. Waste developer, approximately 50 to 150 gallons per year, has been deposited down the sanitary drain since 1961. Small quantities of waste fixer, approximately 10 to 40 gallons per year, were originally taken to the base photo lab for silver recovery; since 1980, waste fixer has been transferred to the Defense Property Disposal Office (DPDO) at Whiteman AFB, Missouri, for silver recovery. Small quantities of waste kerosene generated at the NDI lab, about 25 gallons per year, have been used as a herbicide to control weed growth around Building 839 since 1961.

iii. Engine/Prop

The regular Air Force moved its Engine/Prop Shop from Building 821 to Building 927 in 1959; AFRES moved its shop from Building 940 to be combined with the Air Force shop in about 1975. Waste synthetic oils (about 60 to 200 gal/yr) have been separated from non-synthetic oils since about 1976. Between 1976 and 1978 the waste synthetic oils were stored in a 300-gallon underground tank at Building 927, which was routinely emptied for disposal off-base through contract removal; between 1978 and 1980 they were placed in 55-gallon drums for disposal through DPDO; and since 1980 have been collected in a 500-gallon portable bowser which is stored at the former aircraft washrack (Facility 945) and disposed of off-base through contract removal.

Prior to about 1972 the Engine/Prop Shop generated approximately 1,200 gallons per year of waste non-synthetic oils. Between 1972 and 1980 the shop generated about 200 gallons per year and since 1980 only minor quantities of waste non-synthetic oils have been generated. Originally, these waste oils were collected in bowsers or drums that were stored at the former aircraft washrack and either used in fire department training exercises or removed off-base through contract disposal when not needed in fire department training exercises. After 1969, the fire department no longer accepted waste oils; all waste oils have since been disposed of off-base through contract removal. Between about 1976 and 1980, the waste oils were collected in the 500-gallon waste oil bowser for disposal off-base through contract removal. Since 1980, minor quantities (less than 10 gallons per year) of waste non-synthetic oil have been stored in the waste oil tank at Building 966 for disposal off-base through contract removal.

About 60 to 120 gallons per year of waste PD-680 solvent were disposed of by the Engine/Prop Shop prior to about 1980; these were washed down the aircraft washrack drain (Facility 945). Minor quantities (less than 10 gallons per year) of waste solvents generated since 1980 are stored in the waste oil tank at Building 966 for disposal off-base through contract removal.

iv. Aerospace Ground Equipment (AGE)

The AFRES AGE Shop has been located in Building 958 since 1963, having been located previously in Building 940. Wastes include about 40 to 160 gallons/year of PD-680 solvent and about 600 gallons/year of waste engine oils and hydraulic fluid, which are both stored in the waste oil tank at Building 966 and disposed of off-base through contract. Prior to 1976 waste solvents were washed down the storm drain at the aircraft washrack and waste oils (which amounted to about 2,800 gallons per year) were collected in 55-gallon drums and either used in fire department training exercises or removed off-base through contract disposal when not needed in fire department training exercises. Waste fuels (less than 100 gal/yr) have been taken to the fire department training area and used in training exercises.

The Air Force AGE Shop was located in Building 822 until the regular Air Force left in 1978. Wastes included about 240 to 1,200 gallons/year of mixed engine oil, hydraulic fluid, and miscellaneous paint thinners and strippers. Between about 1976 and 1978 these wastes were collected in a 15,000-gallon underground storage tank at Building 821 for disposal off-base through contract removal. Between 1969 and 1976 the wastes were placed in 55-gallon drums stored at the former aircraft washrack for disposal off-base through contract removal. Prior to 1969, the drummed wastes were either used in fire department

training exercises or disposed of off-base through contract removal when not needed in fire department training exercises.

v. Corrosion Control

No major corrosion control activities have been conducted at Richards-Gebaur AFB. Between 1957 and 1978, a small paint shop was also located in Building 918; operations were discontinued when the Air Force left in 1978. Minor wastes that were generated were disposed of in conjunction with other paint stripper wastes generated in Building 918. These wastes were included in the estimates given in Table 4 for the Wheel/Tire shop. Minor painting of small parts has been done in Building 948 since 1973. About one 55-gallon drum of waste paint strippers, thinners, and residues is generated each year and is disposed of off-base by contract removal.

vi. Operational Maintenance

Operational maintenance along the flightline includes minor aircraft cleaning and servicing. Since 1976, about 800 gallons of waste synthetic oil has been disposed of each year through off-base contract removal along with waste synthetic oil generated at the Engine/Prop Shop. Waste JP-4 fuel is collected in a 500-gallon portable bowser, and is used in fire department training exercises. Currently, about 200 gallons per month of waste fuel is generated; prior to 1982 the servicing of C-124 and C-130 aircraft resulted in about 1,000 gallons per month of waste fuel being generated.

Aircraft washing activities were located primarily in the same general area at the east end of the flightline (Facility 945) from the early 1950s until 1982.

Air Force and AFRES units used the same washrack. The washrack drains to the storm sewer; an oil/water separator has been in use at the washrack since about 1969. During winter months, infrequent aircraft washing was also performed inside Buildings 940 and 821 from the 1950s to the early 1970s. Since the early 1970s, the north bay of Building 918 has also been used for aircraft washing, and since 1982 has been the only area used for aircraft washing. Floor drains in each of these buildings empty directly to the storm drain. About 2 aircraft per month were serviced at the former washrack (Facility 945); currently about 8 aircraft per week are being serviced in Building 918.

Only small quantities of solvents were used during washing activities. About 5 gallons per aircraft were used on the C-124s; 2 to 3 gallons per aircraft were used on the C-130s; and currently less than 60 gallons per year of solvent is being used on the A-10s. The total quantity of PD-680 solvent used prior to 1982 was generally about 2,000 gallons per year. Although it was common Air Force practice in the past to use trichloroethylene (TCE) in the washing of C-124 aircraft, no direct usage of TCE at Richards-Gebaur AFB was found. Alkaline soap usage has amounted to about 15,000 to 25,000 gallons per year.

b. Lear Siegler, Inc.

Lear Siegler, Inc. (LSI) is a private contractor hired by AFRES primarily to perform fuel cell maintenance. LSI has been operating out of Buildings 965 and 966 since 1977; previously, fuel cell maintenance was performed by the active Air Force. Wastes currently consist of about 200 gallons per month of JP-4 fuel which is drained from the fuel cells into a 500-gallon portable bowser. Before 1982, when C-130s and C-124s were being serviced by

AFRES, up to 1,000 gallons per month of waste fuel was typically generated. The fuel has been disposed of by the fire department in training exercises.

Approximately 60 gallons per year of waste paint sludges are placed in 5-gallon jugs which are tarnsferred to base supply (Talley Services, Inc.) for disposal off-base through contract.

c. Kansas City Aviation Department (KCAD)

i. Vehicle Maintenance

KCAD maintains all motor pool vehicles in Building 704 and refueling vehicles in Building 711. Vehicle maintenance under the Air Force prior to 1980 was also conducted in these buildings since the 1950s. Mixed wastes, including about 2,100 to 2,700 gallons per year of engine oils, hydraulic fluid, paints, and thinners, are currently emptied into either a 500-gallon portable tank or a 300-gallon waste oil tank at Building 704. These tanks are cleaned periodically and the contents are disposed of off-base through contract removal. Between 1969 and 1980, waste oils were typically collected in 55-gallon drums for disposal off-base through contract removal. Prior to 1969, the drummed waste oils were either used in fire department training exercises or disposed of off-base through contract removal when not needed in fire department training exercises.

PD-680 solvent is used at the Motor Pool as a degreaser. The solvent is stored in a 50-gallon vat which is drained about once a month and disposed of off-base through contract.

Waste JP-4 fuel (about 600 gal/yr) is stored in a 5,000-gallon underground waste fuel tank located at Building 711, and disposed of by the fire department in training exercises. Prior to about 1975, waste fuels were stored in 55-gallon drums and disposed of in fire department training exercises.

ii. Fixed-Base Operation (FBO)

Talley Services operates the FBO for light aircraft out of Building 821. Small quantities (less than 60 gallons a year) of waste engine oils and hydraulic fluids are generated; these have been stored in a few 55-gallon drums at Building 821 since Talley began the FBO in 1980 and have not yet been disposed. PD-680 solvent is used in a 15- to 20-gallon vat which is drained once a month for disposal off-base through contract removal.

iii. Other Operations

Kansas City used Building 819 for a few months in 1981 to make structural repairs to a fleet of buses. The operation generated few wastes, although several interviewees reported that when the activity was finished, the floor was covered with oil that was draining out of the building to the ground surface southeast of the building.

Talley Services, Inc. began operating in Building 1010 in October 1982. Talley will be overhauling about 115 Army helicopters. A biodegradable stripper, Custom Chemical Co. AK-2, will be used to strip the helicopters; drainage will flow to the storm drain. No wastes had been generated at the shop at the time of the records search base visit.

Belton Tool Manufacturing (BTM) Company has been operating out of Buildings 611 and 612 since 1980. BTM manufactures special fasteners such as U-bolts and I-bolts. Waste oils (about 100 gal/mo) are stored in a 2,000-gallon underground waste oil tank near Building 611 and are disposed of off-base once a year through contract removal.

Between 1957 and 1970 Buildings 611 and 612 were used by the Air Defense Command. Waste oils were stored in the same underground tank at Building 611, and amounted to about 100 gallons per month. No other wastes were reportedly generated.

3. Fuels

Bulk fuel storage facilities are located at the northern end of the base adjacent to the industrial waste retention reservoir. The facility is diked and consists of six aboveground tanks, two of which have been pickled by filling them with a caustic solution. Two of the remaining four contain JP-4 and have a combined capacity of 397,000 gallons. The other two tanks are 10,000 gallon-capacity each and contain motor gasoline (MOGAS) and diesel fuel. Prior to about 1971 when C-124s were the assigned aircraft, leaded aviation gasoline (AVGAS) was stored in a 304,500-gallon aboveground tank at the bulk fuels storage area.

In the past, tank cleaning was handled by civil engineering personnel using either active Air Force personnel or an independent contractor. The tanks have not been cleaned since Talley Services, Inc., obtained the contract to handle bulk storage (1979). Information was not available on cleaning procedures, dates of last cleaning, or disposition of tank residues (sludges). No evidence was

found and no interviewee reported burial of tank sludges on Richards-Gebaur AFB.

Residual JP-4 drained from aircraft is collected and transported to the AGE shop for reuse. Excess is then taken to the fire department training area to be used in fire department training exercises. JP-4 is also stored in the underground tank at facility 711 (Refueling Vehicle Shop) for eventual use in fire department training exercises.

Other fuel storage tanks containing MOGAS, diesel, and Fuel Oil are located at several areas on the base. An inventory of existing active POL storage tanks is included in Appendix G.

Numerous POL storage tanks are reported to be inactive. However, whether or not these tanks have been deactivated according to standard Air Force procedures is unknown. It is suspected that some have been drained of POLs and filled with water or sand, while others are assumed to contain some residual POLs. An inventory of deactivated POL storage tanks is included in Appendix H.

Two fuel-related accidents were reported at Richards-Gebaur AFB in 1978. One involved a fuel truck at the bulk fuels storage area. Less than 5,000 gallons of aircraft fuel was spilled, ignited, and flowed into a nearby ditch. The burning fuel was contained in the ditch and was apparently consumed. No significant quantities of fuel seeped into the ground.

In another accident the same year, an aircraft fuel cell exploded during refueling of a Navy aircraft. No spill of fuel from the runway area occurred as a result of the incident.

Miscellaneous small spills have occurred on the flightlines due to overtopping of fuel tanks or rupturing of tanks. No other evidence of fuel spills was reported or observed at Richards-Gebaur AFB.

4. Fire Department Training Activities

Fire department training exercises have been conducted at three different locations. From 1954 through about 1969, waste fuels, waste oils, and spent solvents were burned at the training sites. Thereafter, waste fuels collected from fuel cells, and some clean fuels purchased directly from the Fuels Management Branch, were the only combustible liquids consumed in fire training exercises.

Most of the POL wastes would have been consumed in the fires; however, small quantities may have percolated into the ground. Prior to the 1960s protein foam and water were used to extinguish fires. Since then, AFFF (Aqueous Film Forming Foam) has been used for this purpose. AFFF is a non-corrosive, biodegradable fluorocarbon surfactant with foam stabilizers and is not considered to pose a potential for hazardous materials contamination. A description of past and present fire training activities at Richards-Gebaur AFB follows:

- 1954-1955: Initial fire training activities were carried out at a site west of the north-south runway and just north of County Line Road (West Burn Pit). This site was used until 1955 when it was discovered that the site was outside of the base property line. An estimated 550 to 2,300 gal/month of POl waste, consisting of waste oils, spent solvents, and contaminated fuels were sent to the fire department training areas during the

period of 1954 through 1969. Data showing the specific quantities burned at the West Burn Pit were not available. The waste POL was collected in 55-gallon drums at the major shop areas and periodically delivered to the training site for surface burning.

- 1955-1965: The second fire training area (South Burn Pit) was set up at the South Landfill. This site was used until 1965 when a new site was designated at the north end of the base. Sources and quantities of POL wastes burned at the site were about the same as for earlier fire training activities at the West Burn Pit.

- 1965-present: Since 1965, fire training activities have been conducted at a site just north of the closed runway (North Burn Pit). This site is identified by the Air Force as Facility No. 1033. Until about 1969, an estimated 1,800 gal/month of waste POL (oils, hydraulic fluid, some solvents, and contaminated fuels) were delivered to this site and stored there in 55-gallon drums for subsequent training exercises. After 1969, waste oils and solvents were no longer accepted for fire training and only contaminated JP-4 fuel has been accepted since 1969.

  As much as 2,100 gal/month of contaminated JP-4 fuel was burned at the site between 1969 and 1982; higher quantities generally were burned when the regular Air Force was stationed at Richards-Gebaur AFB. Since 1982, after the regular Air Force left and

the A-10 aircraft replaced the C-130s, training activities have consumed less than about 460 gal/month of contaminated JP-4 fuel or approximately 5,500 gallons/year.

This fire department training site originally consisted of an unlined clearing where ground surface burning was practiced. However, in 1969 the site was improved. A concrete lining and retaining curb was installed in the burn pit area, a separator was installed to skim the runoff prior to discharge into an underground drain field, and a 5,000-gallon aboveground tank was installed to receive and store waste fuels prior to burning.

5. Polychlorinated Biphenyls (PCB)

The locations, number, and status of PCB-contaminated transformers at Richards-Gebaur AFB are shown below:

Building Location	Number of Transformers	Current Status	
		Active	Inactive
100	3-6	--	X
221	1	X	--
1,010	3	X	--

There are no PCB storage areas on-base; however, out-of-service transformers are being stored at the north electrical substation (Facility No. 950) adjacent to the bulf fuels storage area. At the time of the records search base visit, approximately 10 to 15 transformers were noted on the ground outside the substation fence. It was not

known whether these transformers held PCB-contaminated oil. There was no indication of leakage from these transformers.

One small spill of PCB-contaminated oil occurred in 1979 in the basement of Building 100. The spill was contained on the concrete floor and cleaned up and removed by an independent contractor. No other spill of PCB-contaminated oil was reported.

6. Pesticides

Pesticides are in use at Richards-Gebaur AFB. Herbicide storage (Building 614) and application is under control of the Kansas City Aviation Department's field maintenance section. Herbicide application at the golf course is by independent contractor through the City of Belton. Pesticide application for control of termites, roaches, ants, rodents, etc., is handled by an independent non-military contractor.

Herbicides in current use on the base include 2,4-D (70 gal/year), Krovar (150 lb/year), Dipel (40 lb/year), Weed-Be-Gone (5 gal/year), Torton 10K pellets (20 lb/year), Round-Up (3 gal/year) and Embark 2S (3 gal/year).

No records were found of past herbicide usage; however, data on types and quantities of pesticides used as late as 1976 were located. Common chemicals in use at that time included Diazinon (36 gal/year), Malathion (220 gal/year), Chlordane (220 gal/year), Dursban (20 gal/year), Pyrethrin (480 cans/year), Diazinon Dust (250 lb/year), Warfarin (50 lb/year), Sevin (400 lb/year), and Vapona (10 cans/year). These pesticides were stored in Building 151 and control of their use was by the 1840th CES Entomology Detachment.

Standard procedures for disposal of empty pesticide containers have been to triple-rinse, crush, and discard the containers in trash receptacles.

The records search did not reveal any evidence of contamination due to present or past usage of pesticides. However, a site was identified at which an unknown herbicide was buried in 1971. The herbicide was reportedly contained in plastic jars and was reported to contain mercury. The site is discussed further in Section IV, B.

7. Wastewater Treatment

Treatment of approximately 176,000 gpd of combined sanitary and industrial wastewaters prior to discharge into Scope Creek (and ultimately into Little Blue River) is provided by a 0.55-mgd trickling filter plant constructed in 1954. The facility consists of a primary clarifier, two trickling filters, a secondary clarifier, two anaerobic digesters, sludge drying beds, and a chlorine contact basin.

From 1954 through 1980, the treatment plant was operated by the Air Force and then the Air Force Reserve. Since 1980, the plant has been supervised, maintained, and operated by the Kansas City Pollution Control Department. Discharge from the plant is authorized and is in compliance with NPDES Permit No. MO-0004961. Table 5 shows the permit limitations on BOD_5 and SS and the average effluent BOD_5 and SS reported during 1982.

Industrial wastewaters are pretreated prior to release into the treatment plant. Oil/water separators installed at major shop areas remove oil prior to wastewater entering the sewer system. Locations of the oil/water separators and installation dates (when available) are included in Appendix I.

Table 5
RICHARDS-GEBAUR AFB TREATED WASTEWATER
CHARACTERISTICS SUMMARY
(January-November, 1982)

Parameter	NPDES Permit Limit	Average	Maximum	Minimum
Flow, gpd	--	176,000	250,000	130,000
BOD_5, mg/l	30	20	30	5
SS, mg/l	30	14	22	6

Source: Kansas City Pollution Control Department (Monthly Reports).

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From 1954 to 1980, anaerobically digested sludge was disposed of through local farmers and other agricultural interests and is not considered a problem. For about 8 to 10 years during the 1960's some sludge was used as a soil/fertilizer supplement in a base nursery operation located at the southeast end of the main runway. Since taking over the wastewater plant operations in 1980, the Kansas City Pollution Control Department has been disposing of the sludge off-base. The sludge is not considered to be hazardous.

At the present time, an interceptor line which will connect Richards-Gebaur AFB to the new Little Blue River regional treatment plant is under construction. When the project is completed (anticipated in early 1983) all sanitary and industrial wastewater from Richards-Gebaur AFB will flow to the new regional plant, and operation of the existing treatment plant will be discontinued.

No evidence was found during the records search to suggest that hazardous material contamination exists from either past or present wastewater treatment operations.

8. Available Water Quality Data

There are no potable water supply wells at Richards-Gebaur AFB, and no known analyses of the shallow ground-water aquifers have been performed. Potable water is supplied by Kansas City.

The base storm drainage system consists primarily of open drainages and creeks with underground pipes primarily in the runway and flightline areas. Almost all of this drainage eventually flows to Scope Creek and exits the base to the east into the Little Blue River. Verbal reports during the records search indicated that farmers living

downstream of the base along the Little Blue River had complained of "oil-slickened" cattle in the 1950s. In 1970, a water and air pollution report prepared by the Air Force indicated that oil scum was visible at times on the open areas of the storm drainage system, and that the water was murky with heavy growth of green algae and water plants within 400 to 500 feet of closed storm drain outlets. That study recommended various operational changes and pollution control measures and eventually resulted in the construction of an industrial waste system, which was completed in 1974. This system consists of a series of collector pipes that discharge to the storm drain following pretreatment in an oil/water separator.

The records search did not reveal analytical data, either past or current, concerning the water quality within the base creeks. Analyses of the storm drainage ditch at the wastewater treatment plant have been completed; however, the sampling locations are not precisely known and it is probable that the water quality data represents wastewater discharge from the treatment plant. At the time of the records search, no oil scum or algae growth was observed in the base storm drainage ditches or Scope Creek.

9. Other Activities

No information was found in the base files or through personnel interviews to indicate past testing or use of chemical or biological warfare agents at Richards-Gebaur AFB.

During the period that ADC was in command (1955-1970), nuclear weapons were stored on the base at the 1200 munitions area. Nuclear weapons were also stored at an off-base munitions storage area currently known as the Belton Training Annex. Nuclear materials or weapons have

not been buried and are no longer stored at the base or at the Belton Training Annex (see Section VII).

Conventional explosive ordnance is sent offsite to Fort Leonardwood, Missouri. No site at Richards-Gebaur AFB has been used for disposal of explosive ordnance or of nuclear materials.

B. DISPOSAL SITES IDENTIFICATION AND EVALUATION

Interviews with past and present base personnel (Appendix C) resulted in the identification of disposal and spill sites at Richards-Gebaur 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, page I-4, based on all of the above information, 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: the waste and its characteristics, potential pathways for waste contaminant migration, the receptors of the contamination, and 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 D. A total of 9 sites were rated. Copies of the completed rating

forms are included in Appendix J, and a summary of the hazard ratings for the 9 sites is given in Table 6.

Shallow wells for domestic supplies are known to exist in Jackson and Cass Counties; however, the exact locations and depths of nearby wells could not be accurately determined. For the purpose of these ratings, it was assumed that the nearest well was between 3,000 feet and 1 mile from each site and that the total population served by all wells within a 3-mile radius is between 50 and 1,000. Due to the nearness of Scope Creek, the ground water in the uppermost limestone aquifers (Wyandotte and Iola Formations) flows laterally directly to the creek. It was therefore assumed in the ratings that the uppermost aquifer is not used as a source of water. No surface-water supplies are known to exist within 3 miles downstream of the base.

The following is a description of each site, including a brief discussion of the rating results. Figure 6 shows the approximate locations of these sites. Figure 7 presents a summary of the approximate dates that the major sites were in use.

1. Landfills

Sanitary landfill sites at Richards-Gebaur AFB were used intermittently since 1954, although off-base contract disposal of most solid waste has been the primary means of disposal since 1956. The three landfill sites are described below.

- Site No. 1, the South Landfill, is located in the southern part of the base near the NDI lab and adjacent to Scope Creek. Between 1954 and 1956 this site was the main sanitary landfill for Richards-Gebaur AFB. In 1956, off-base contract

Table 6
SUMMARY OF DISPOSAL SITE 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	Characteristics	Pathways			
1	South Landfill	38	48	80	1.0	55	J-1
2	Northeast Landfill	42	60	59	1.0	54	J-3
3	Contractor Rubble Burial Site	38	40	67	1.0	48	J-5
4	West Burn Pit	42	32	52	1.0	42	J-7
5	South Burn Pit	38	48	59	1.0	48	J-9
6	North Burn Pit	42	48	52	0.95	45	J-11
7	Radioactive Disposal Well	38	30	59	0.10	4	J-13
8	Herbicide Burial Site	41	60	52	1.0	51	J-15
9	Oil-Saturated Area	43	48	52	1.0	48	J-17

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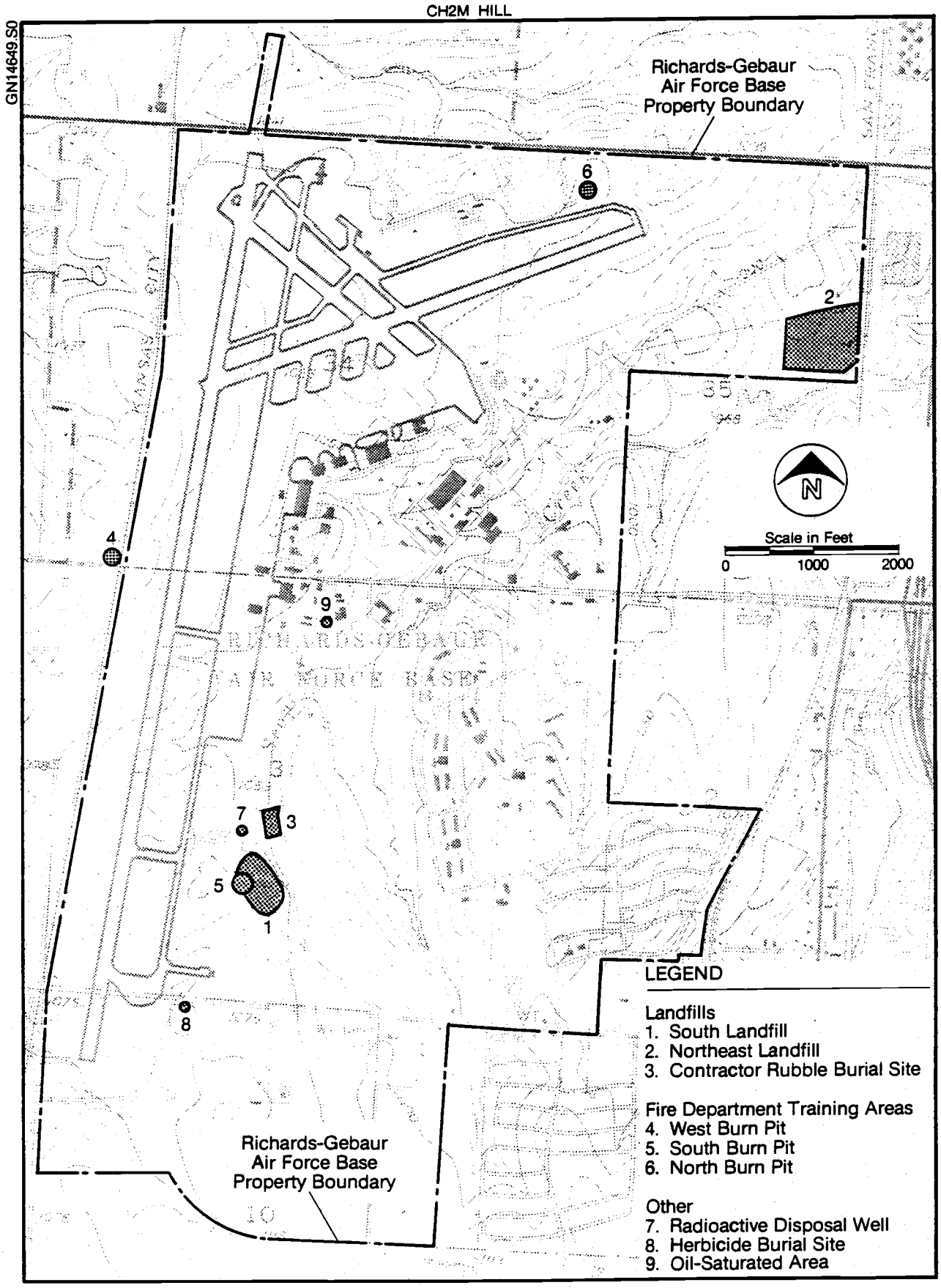

FIGURE 6. Identified disposal sites, Richards-Gebaur AFB, Missouri.

CH2M HILL

GN14649.S0

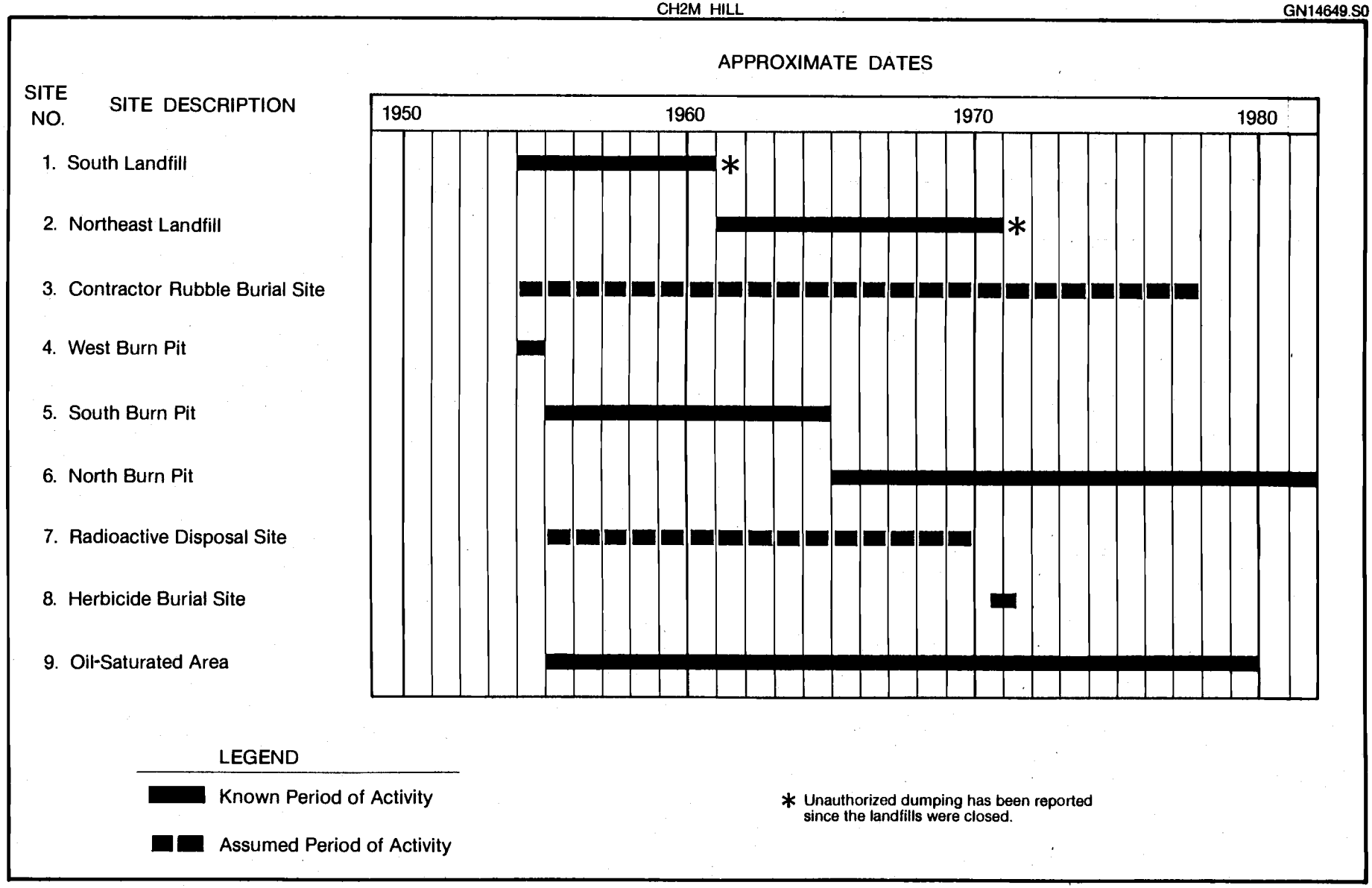

FIGURE 7. Historical summary of activities at major disposal sites.

disposal of most common refuse was begun, although some wastes, including building rubble, yard debris, and waste from some industrial shop areas were actively disposed of at the site until about 1961. Materials which may have been disposed of in the landfill include small quantities of waste paints, thinners, strippers, solvents, and oils, although this was not standard procedure. Operation of the landfill included burning of the wastes disposed. Since 1961, the area has been used only intermittently for unauthorized dumping. Due to recent incidents of unauthorized dumping, including cleaning of tar pots and some household waste dumping, an earthen barricade has been erected at the entrance to the site.

A small section of Scope Creek downstream of the site was observed to have a small oil sheen on the surface of the water, suggesting the presence of leachate; no oil sheen was observed upstream and no evidence of soil contamination was visible on the edges of the landfill. Small quantities of hazardous materials may have been placed in this landfill; however, no significant hazardous waste quantities were reported.

The overall rating score for Site No. 1 was 55. Although the receptors subscore was low due to the lack of critical environments or population near the site, the indirect evidence of migration of hazardous contaminants indicated by possible leachate resulted in a high pathway subscore (80) and raised the overall rating.

- Site No. 2, the Northeast Landfill, is located in the northeast portion of the base alongside Scope

Creek. The site was used between about 1961 and 1971 for the disposal of miscellaneous wastes including building rubble, yard debris, and waste from some industrial shop areas. The wastes were typically burned and buried in trenches. Most of the sanitary wastes at Richards-Gebaur AFB were disposed of off-base through contract removal during this time. One interviewee reported that disposal of waste paints and paint thinners at the site by spreading the wastes on the ground surface had been practiced in the past as late as 1978. The eastern portion of the site has been used for open storage of materials including construction materials, pipes, empty tanks, waste paint and thinners in drums and buckets, and empty 55-gallon drums. Over 400 55-gallon drums are currently stored at the site, most of which are empty, and some of which contain unknown contents.

The site received an overall rating score of 54 due primarily to the known disposal of hazardous wastes and a moderate potential for surface-water migration of contaminants off-base.

- Site No. 3, the Contractor Rubble Burial Site, is also located adjacent to Scope Creek, just west of the golf course alongside Walker Road. The site was used intermittently during the time the regular Air Force was active on the base, between 1954 and 1978. The site was used primarily for disposal of contractor rubble and debris, although household debris was visible in the exposed portions of the landfill. One interviewee indicated that the site was also used as a sanitary landfill in lieu of Site No. 1 prior to 1961. The site has an overall rating score of 48; low subscores in

the receptors and waste characteristics categories were due to the lack of critical environments or population near the site, and the suspected disposal of small quantities of hazardous wastes. A moderate to high pathways subscore (67) was due to the proximity of Scope Creek and the steep banks of the landfill.

2. Fire Department Training Areas

- Site No. 4, the West Burn Pit, is located just north of the Cass County-Jackson County line and just west of the base property. The site was originally used for fire department training between 1954 and 1955, but was abandoned in 1955 when it was discovered that the site was located off-base. No significant quantities of residual hazardous waste materials are suspected at the site, resulting in a low overall score of 42.

- Site No. 5, the South Burn Pit, is located just west of the South Landfill near the NDI Lab and was used for fire department training between 1955 and 1965. Wastes used in training exercises included waste oils, solvents, and fuels. The wastes were stored in drums at the facility until training exercises were begun. The burn pit was unlined and had no oil/water separator. Small quantities of hazardous materials are known to have been disposed of at the site, resulting in a moderate overall score of 48.

- Site No. 6, the North Burn Pit, is located north of the flightline and has been used for fire department training since 1965. The burn pit was unlined and accepted waste oils, solvents, and

fuels until about 1969. In 1969, the area was lined with a concrete slab and an oil/water separator was installed; only contaminated JP-4 fuel has been used in training exercises since 1969. The site received an overall rating score of 45 due to the known disposal of hazardous materials and the partial containment provided by the lined facility.

- Site No. 7, the Radioactive Disposal Well located west of Scope Creek in the southern portion of the base, was used intermittently between 1955 and about 1970 for disposal of low-level radioactive materials, primarily dosimeters. Levels of radioactivity in the vicinity of the well have been measured and found to be at or near background levels. The well has been tested and capped. An overall rating score of 4 is due to the low levels of radioactivity and full containment of small waste quantities.

3. Other Sites

- Site No. 8, the Herbicide Burial Site located at the south end of the runway, is an area where about 4 cases of a mercury-containing herbicide in plastic pint-sized bottles were buried in 1971. An overall score of 51 reflects the known disposal of hazardous materials at the site and a moderate potential for surface water migration; however, the small quantity of herbicide (estimated to be less than 50 pounds) and the low-permeability clay soils indicate a low potential for ground-water contamination or migration.

- Site No. 9, an Oil-saturated Area, is located west of Building 704. The area was previously used for storage of waste POL products by the Motor Pool. When Kansas City took over operations in 1980, the ground was reportedly so soft as a result of the oil saturation that they spread gravel over the ground surface to stabilize it. A small patch of oil-contaminated ground was noted at the ground surface at the edge of the gravel during the records search base visit. The site received a rating of 48 due to the known disposal of small quantities of POL products, and a moderate potential for surface-water migration.

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V. CONCLUSIONS

V. CONCLUSIONS

A. No direct evidence was found to indicate that migration of hazardous contaminants exists within or beyond Richards-Gebaur AFB boundaries. Indirect evidence of contamination was found at Site No. 1, the South Landfill, (a small oil sheen on the adjacent surface water).

B. Information obtained through interviews with 27 past and present base personnel, base records, shop folders, and field observations indicate that hazardous wastes have been disposed of on Richards-Gebaur AFB property in the past.

C. The potential for migration of hazardous contaminants exists because of the presence of a perched ground-water table with direct discharge to nearby creeks. The presence of low-permeability clays and shales below the ground surface reduces the potential for hazardous contaminant migration vertically into the ground water but increases the potential for migration into nearby surface waters.

D. Table 7 presents a priority listing of the rated sites and their overall scores. The following sites were designated as areas showing the most significant potential (relative to other Richards-Gebaur sites) for environmental impact.

1. <u>Site No. 1 (South Landfill)</u>

This site was the main base sanitary landfill--used continuously from 1954 until 1956 and intermittently through 1982. From 1954 until about 1961 wastes, including building rubble, yard

Table 7
PRIORITY LISTING OF DISPOSAL SITES

Site No.	Site Description	Overall Score
1	South Landfill	55
2	Northeast Landfill	54
8	Herbicide Burial Site	51
3	Contractor Rubble Burial Site	48
5	South Burn Pit	48
9	Oil-Saturated Area	48
6	North Burn Pit	45
4	West Burn Pit	42
7	Radioactive Disposal Well	4

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debris, and waste from some industrial shop areas, were actively disposed of at this site. The probable path of migration of contaminants, if present at Site No. 1, is vertically downward to the perched ground-water table, then laterally eastward to discharge into Scope Creek. The relatively thick, impervious Lane Shale underlies the site and effectively restricts vertical movement of ground water. During the site visit a small oil sheen, suggesting the presence of leachate, was observed on the surface of a small area of Scope Creek just downstream of the landfill site; no oil sheen was observed upstream. No visible evidence of soil contamination was observed on the banks of Scope Creek at the edge of the landfill. Scope Creek flows through the base and eventually discharges into the Little Blue River, thereby providing a pathway for any hazardous contaminants in the leachate, if present, to enter surface-water bodies and migrate beyond base property.

2. Site No. 2 (Northeast Landfill)

This site was reportedly used between 1961 and 1971 for disposal of miscellaneous waste, including building rubble, yard debris, and wastes from some industrial shop areas. Reportedly, disposal of some waste paint and thinners by spreading of the liquid wastes onto the ground surface has been practiced at this site. Materials in open storage at the site currently include construction rubble, pipes, empty tanks, waste paints and thinners in drums and buckets, and empty 55-gallon drums. Of over 400 drums currently at the site, some contain unknown contents. The probable path of migration

of contaminants is vertically downward to the perched water table present in the alluvial soils alongside Scope Creek, then laterally southeastward to discharge into Scope Creek. The relatively thick, impervious Chanute Shale underlies the site and effectively restricts vertical movement of ground water. Because of the known disposal of hazardous wastes at the site and the proximity of the site to Scope Creek, there is a moderate potential for migration of hazardous contaminants off-base.

E. The remaining rated sites (Sites No. 3, 4, 5, 6, 7, 8, and 9) are not considered to present significant environmental concerns.

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VI. RECOMMENDATIONS

VI. RECOMMENDATIONS

A. PHASE II PROGRAM

A limited Phase II monitoring program is suggested to confirm or rule out the presence and/or migration of hazardous contaminants. The priority for monitoring at Richards-Gebaur is considered moderate since no imminent hazard has been determined.

Tables 8 and 9 present a summary of recommended monitoring sites, parameters to be measured, and the rationale for the analyses. Specifically, monitoring is recommended for the South Landfill (Site No. 1) and the Northeast Landfill (Site No. 2).

1. South Landfill (Site No. 1)

It is recommended that the adjacent creek (Scope Creek) be monitored upstream and downstream of the site to determine if hazardous contaminants are leaching into the creek. The water samples should be analyzed for the parameters indicated in Table 8. The stream should be sampled on two occasions at least 30 days apart to determine the presence of contaminants.

2. Northeast Landfill (Site No. 2)

It is recommended that one shallow monitoring well be installed downgradient of the site to determine if hazardous contamination is present in the area ground water. The well should be drilled to the depth of the top of the underlying Chanute shale (approximately 30 feet deep at this site) and screened from the top of the shale to within

Table 8
RECOMMENDED ANALYSES

Sample Type	Volatile Organic Compounds (VOC)	Heavy Metals	Pesticides	Phenols	pH, Specific Conductance COD, TOC, and Oil and Grease
Surface Water					
South Landfill (Site No. 1)	X	X	X	X	X
Monitoring Well					
Northeast Landfill (Site No. 2)	X	X	X	X	X

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Table 9
RATIONALE FOR RECOMMENDED ANALYSES

Parameter	Rationale
Volatile Organic Compounds (VOC)	Organic solvents used on-base
Heavy Metals (lead, nickel, chromium, cadmium, and silver)	Potential sources identified (leaded fuel, battery acid, and electrolyte, paint, photographic chemicals)
Pesticides	Commonly used at Richards-Gebaur AFB in the past and empty containers disposed of in landfills
Phenols	Phenolic cleaner and paint stripper used on base
pH, Specific Conductance COD, TOC, and Oil and Grease	Indicators of non-specific contamination

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5 feet of the ground surface. The well should be analyzed for the parameters indicated in Table 8. The well should be sampled on two occasions at least 30 days apart to determine the presence of contaminants.

B. OTHER ENVIRONMENTAL RECOMMENDATIONS

Other recommendations developed as a result of the records search include the following:

1. The status of abandoned POL storage tanks is not clear. Various tanks were reported as abandoned, but information was unclear as to whether the tanks had been deactivated according to procedure or simply abandoned. It is recommended that a survey be made to determine the current status of these tanks, e.g., whether they are empty, filled with water, contain residual POL, or are properly deactivated. Tanks should be locked to prevent unauthorized use.

2. The various containers stored aboveground at the Northeast Landfill should be inspected to determine the nature of their contents (old paints, thinners, POLs, etc.). If verified to contain potentially hazardous contaminants, the contents should be disposed of at an authorized hazardous waste facility.

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VII. OFF-BASE INSTALLATION

VII. OFF-BASE INSTALLATION

The Belton Training Annex is located approximately 5 to 6 miles south of Richards-Gebaur AFB and 1 mile east of Route D. This is a 472-acre land area, octagonal in shape, that covers nearly all of Section 34 in Township 46 North and Range 33 West.

The area was acquired by the Air Defense Command in 1955 for use as an ammunitions storage area from 1955 to 1970. Four ammo bunkers still exist at the site. It was during this time that nuclear armed rockets were stored at the site. There is no ordnance of any type stored or buried at the annex, and the site has not been used for explosive ordnance disposal.

The Annex was inactive after ADC left (1970) and was not in use again until the Air Force Reserve activated it in 1977 as a drop zone for practice drop of equipment and personnel.

The records search did not reveal evidence of any past disposal sites or spills at the Belton Training Annex and, therefore, no Phase II activities are recommended.

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

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

ADC	Air Defense Command
AFB	Air Force Base
AFCC	Air Force Communications Command
AFESC	Air Force Engineering and Services Center
AFFF	Aqueous Film-Forming Foam
AFRCE	Air Force Regional Civil Engineering
AFRES	Air Force Reserve
AG	Aboveground
AGE	Aerospace Ground Equipment
AVGAS	Aviation Gasoline
BG	Belowground
Bldg.	Building
bls	Below Land Surface
BOD_5	Biochemical Oxygen Demand (5-day)
BTM	Belton Tool Manufacturing (Company)
CAMS	Consolidated Aircraft Maintenance Squadron
CE	Civil Engineering
CES	Civil Engineering Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	Centimeter
COD	Chemical Oxygen Demand
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DO	Dissolved Oxygen
DoD	Department of Defense
DPDO	Defense Property Disposal Office
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
°F	Degrees Fahrenheit
FBO	Fixed-Base Operator
ft/day	Feet per Day
ft/ft	Feet per Foot
ft/min	Feet per Minute
gal/mo	Gallons per Month

gal/yr	Gallons per Year
gpd	Gallons per Day
gpm	Gallons per Minute
HARM	Hazard Assessment Rating Methodology
IRP	Installation Restoration Program
JP	Jet Petroleum
KCAD	Kansas City Aviation Department
lb/yr	Pounds per Year
LSI	Lear Siegler, Inc.
Max.	Maximum
mg/l	Milligrams per Liter
mgd	Million Gallons per Day
Min.	Minimum
mo.	Month
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 Biphenyl
POL	Petroleum, Oil, and Lubricants
ppb	Parts per Billion
RCRA	Resource Conservation and Recovery Act
sec	Second
TAC	Tactical Air Command
TCE	Trichloroethylene
TFG	Tactical Fighter Group
TOC	Total Organic Carbon
TOX	Total Organic Halogen
USAF	United States Air Force
USDA	United States Department of Agriculture
µg/l	Microgram per Liter
VOC	Volatile Organic Compound

GLOSSARY OF TERMS

GLOSSARY OF TERMS

1. AFFF (Aqueous Film Forming Foam) - A non-corrosive, biodegradable fluorocarbon surfactant with foam stabilizers used to smother flames.

2. 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.

3. 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.

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

5. 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.

6. DEVELOPER - A chemical used to make images visible on exposed film; typically sodium hydroxide or sodium sulfite.

7. DISCHARGE - The process involved in the draining or seepage of water out of a ground-water aquifer.

8. DOSIMETER - A device for measuring very small quantities of radiation a person has absorbed.

9. DOWNGRADIENT - A direction that is hydraulically down slope; the direction in which ground water flows.

10. EMULSIFIER - A substance used to hold very fine oily or resinous liquid suspended in another liquid; in photography, a suspension of silver salt in gelatin used to coat plates and film.

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

12. FIXER - A solution containing silver used in photography to stabilize images on film.

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

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

15. HAZARDOUS WASTE - 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.

16. INTERMITTENT STREAM - A stream or reach of stream that flows only at certain times of the year and is therefore temporarily or seasonally dry.

17. LEACHATE - A solution resulting from the separation or dissolving of solid or hazardous material by percolation of water through the material.

18. LOESS - An unconsolidated deposit of windblown dust of glacial age, usually calcareous and unstratified and consisting primarily of silt-sized particles.

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

20. NET PRECIPITATION - Mean annual precipitation minus mean annual evapotranspiration.

21. OIL/WATER SEPARATOR - A man-made facility designed to separate by gravity liquids of differing densities; typically to skim oil or grease from a water surface.

22. ORDNANCE - Any form of artillery, weapons, or ammunition used in warfare.

23. OUTCROP - That part of a geologic formation that appears at the surface of the Earth or bedrock that is covered only by surficial deposits such as residual soils, alluvium, or loess.

24. PCB (Polychlorinated Biphenyl) - A chemically and thermally stable toxic organic compound that, when introduced into the environment, persists for long periods of time, is not readily biodegradable, and is biologically accumulative.

25. PD 680 - A petroleum distillate used as a safety cleaning solvent. Two types of PD-680 solvent have been used; Type I, having a flashpoint of 100°F, and Type II, having a flashpoint of 140°F.

26. PENETRANT - A petroleum-based fluorescent dye.

27. PERCHED GROUND WATER - Unconfined ground water separated from an underlying regional ground-water table.

28. 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.

29. 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.

30. RECHARGE - The process involved in the addition or replenishment of water to a ground-water aquifer.

31. SEDIMENTARY ROCK - A rock resulting from the consolidation of loose sediment that has accumulated in layers; typical examples include sandstone, siltstone, limestone, and shale.

32. STRATA - Distinguishable horizontal layers separated vertically from other layers.

33. SURFACE WATER - All water exposed at the ground surface; including streams, rivers, ponds, and lakes.

34. UPGRADIENT - A direction that is hydraulically up slope.

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

36. WETLAND - An area subject to permanent or prolonged inundation or saturation which exhibits plant communities adapted to this environment.

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REFERENCES

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APPENDIXES

Appendix A
RESUMES OF TEAM MEMBERS

DAVID M. MOCCIA

Education

B.S., Chemical Engineering, University of Florida, 1971

Experience

Mr. Moccia joined CH2M HILL in 1971 and is currently the Manager of the Chemical Processes Department. He is responsible for projects involving water treatment in the power industry, energy production, and industrial in-plant reuse/recycle processes. Since joining the firm, Mr. Moccia has participated in a wide variety of projects, including facility evaluations, pilot studies, and conceptual and engineering design for municipal and industrial wastewater treatment facilities.

Examples of Mr. Moccia's project-related experience include the following:

- Project management for design of three poultry process wastewater treatment facilities for Perdue, Inc.
- Project management for design of a biological-chemical wastewater treatment system for a tank car cleaning and maintenance facility for General American Transportation Corporation in Waycross, Georgia.
- Preliminary engineering for a 3.0-mgd reverse-osmosis water treatment plant for the Englewood Water District, Englewood, Florida.
- Process responsibilities for design of a 9.5-mgd activated sludge treatment plant, including sludge thickening and dewatering, for the City of Alexander City, Alabama.
- Preliminary design for a sludge drying and pelletizing facility for the City of Naples, Florida.

Professional Engineer Registration

Florida, Georgia, North Carolina

Membership in Organizations

Florida Engineering Society
Florida Pollution Control Association
National Society of Professional Engineers
Water Pollution Control Federation
Tau Beta Pi

BRUCE JAMES HAAS
Manager, Geotechnical Engineering

Education

M.S., Civil Engineering, University of Wisconsin, 1976
B.S., Civil Engineering, University of Wisconsin, 1975
Studies as exchange student, Technische Universitat, Munich, West Germany, 1974-1975

Experience

Mr. Haas is responsible for field explorations and geotechnical investigations and for general earthwork design projects. His special knowledge of soils, sitework, and construction procedures has been instrumental in developing numerous efficient and economical civil engineering designs. Project experience includes site development, grading and drainage, streets and roadways, marinas, and hazardous waste disposal. Examples of project-related assignments include:

- Lead civil engineer in charge of stormwater management, site development, and geotechnical review for the new 130-mgd West County Wastewater Treatment Plant for the Louisville and Jefferson County Metropolitan Sewage District, Louisville, Kentucky.

- Geotechnical engineer responsible for geohydrologic reviews of various hazardous waste disposal facilities for the Agrico Chemical Company. The project involved assessment of ground-water pollution potential, design of monitoring systems, and preparation of closure and post-closure plans for agricultural chemical plants in Oklahoma, Louisiana, and Florida.

- Design geotechnical engineer and resident inspector for a 6-mgd wastewater treatment plant for the Grand Strand Water and Sewer Authority, Conway, South Carolina. Plant facilities and the 3,000-foot-long effluent pipeline were supported by timber piles.

- Civil and geotechnical engineer for marina improvements at the Oyster Water-Based Recreation Facility located in the tidal marshes of Northampton County, Virginia.

- Resident inspector for stabilization and reconstruction of existing sludge lagoon dikes for the Madison, Wisconsin, Metropolitan Sewerage District. This project involved the use of fabric reinforcement and light-weight wood chip fill for dikes located on highly compressible, low-strength marsh deposits.

Mr. Haas has performed foundation investigations and geotechnical designs for numerous major water and wastewater treatment plants at the following locations:

- Walt Disney World, Florida

- St. Petersburg, Florida

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BRUCE JAMES HAAS

- Suffolk, Virginia
- Howard County, Maryland
- Harriman, Tennessee

These investigations have resulted in safe, economical design of foundation systems involving spread footings, piles, and construction preloads.

Professional Engineer Registration

Florida, Wisconsin

Membership in Organizations

American Society of Civil Engineers

Publications

"Proposed Criteria for Interpreting Stability of Lakeshore Bluffs," Engineering Geology, 1980, with T. B. Edil.

ELIZABETH E. DODGE

Publications

"The Effect of Chemical Speciation on Copper Uptake by *Chironomus tentans*," with T.L. Theis. Environmental Science and Technology. Vol. 13. October 1979. pp. 1287-88.

"A Study of the Relationship Between Phytoplankton Abundance and Trace Metal Concentration in Eutrophic Lake Charles East, Indiana, Using Correlation Techniques," with D.F. Spencer and others. Proceedings of the Indiana Academy of Science. 1977.

ELIZABETH E. DODGE
Environmental Scientist

Education

M.S., Environmental Health Engineering, Notre Dame University, 1978
M.S., Aquatic Biology, Notre Dame University, 1976
B.S., Biology, Mary Washington College, 1974

Experience

Ms. Dodge's responsibilities as an environmental scientist specializing in the areas of water chemistry and aquatic biology include technical and managerial contributions to a variety of projects including:

- Water quality management studies of the Anacostia River watershed, Maryland.
- Dynamic modeling of waste load nitrification effects in the Bush River (Maryland), a subestuary of the Chesapeake Bay.
- Survey and analysis of oxygen demand of macrobenthic invertebrates in the Alabama River, Alabama.
- Environmental assessment of water quality, aquatic biology, and public health impacts of a large project to upgrade the wastewater conveyance and treatment system of Milwaukee, Wisconsin.
- Water quality and biological field sampling and environmental assessment for expansion of an 80 mgd wastewater treatment facility discharging to Lake Michigan.
- Identification and evaluation of hazardous waste disposal sites at MacDill and Avon Park Air Force Bases, Florida.
- Stormwater management surveys of St. Louis, Missouri, streams.
- Statistical analysis of effects of backflows from three Chicago rivers on Lake Michigan water quality.

Prior to joining CH2M HILL, Ms. Dodge contributed to studies on innovative lake reclamation methods. Her graduate research centered on the environmental chemistry and biological effects of toxic substances, particularly heavy metals.

Membership in Organizations

American Association for the Advancement of Science
American Water Resources Association
International Association for Great Lakes Research
Society of Women Engineers

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Appendix B
OUTSIDE AGENCY CONTACT LIST

Appendix B
OUTSIDE AGENCY CONTACT LIST

1. U. S. Army Corps of Engineers
   Kansas City, Missouri
   John Moylan (Chief of Geology)
   816/374-3554

2. U. S. Environmental Protection Agency
   Kansas City, Missouri
   Glen Yager
   816/374-5593

3. U. S. Fish and Wildlife Service
   Kansas City, Missouri
   Lyle Stimmerman 816/374-6166
   Fay Grogan 816/356-2280

4. U. S. Geological Survey
   Kansas City, Missouri
   816/254-5824

5. U. S. Soil Conservation Service
   Cass County, Missouri
   816/884-3391

6. U. S. Soil Conservation Service
   Jackson County, Missouri
   816/254-2040

7. U. S. Weather Bureau
   Kansas City, Missouri
   816/374-3427

8. Missouri Department of Conservation
   Kansas City, Missouri
   David Young
   816/885-5633

9. Missouri Department of Natural Resources
   Division of Geology and Land Survey
   Rolla, Missouri
   Carl Roberts, Oil and Gas Section Chief
   Don Miller, Ground Water Section Chief
   314/364-1752

10. Missouri Department of Natural Resources
    Kansas City, Missouri
    Jim McConathy
    816/274-6675

11. Pollution Control Department
    City of Kansas City, Missouri
    Bob Brown, Chief of Treatment
    816/274-1652

12. Missouri Department of Environmental Quality
    Water Supply Program
    Jefferson City, Missouri
    Jerry Lane
    314/751-3241

13. Jackson County Health Department
    Kansas City, Missouri
    816/881-4424

14. Cass County Health Department
    Cass County, Missouri
    816/884-5100

15. Missouri Division of Health
    Kansas City, Missouri
    Robert Fields
    816/274-6385

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Appendix C
RICHARDS-GEBAUR AFB RECORDS SEARCH
INTERVIEW LIST

Appendix C
RICHARDS-GEBAUR AFB RECORDS SEARCH INTERVIEW LIST

No.	Organization	Area of Knowledge	Years at Installation
1	AFRES	Electrical Shop	29
2	AFRES	Electrical Shop	11
3	AFRES	Avionics	27
4	AFRES	Flightline	23
5	AFRES	AF Aircraft Maintenance	28
6	AFRES	Real Property	22
7	AFRES	Public Affairs	14
8	AFRES	Civil Engineering/Aircraft Maintenance (AF)	23
9	KCAD	Vehicle Maintenance	2
10	KCAD	Field Maintenance	2
11	KCAD	Field Maintenance	2
12	KCAD	Building Maintenance	1½
13	KCAD	Steam Plant	1
14	KCAD	Exterior Electric	2
15	KCAD	Pollution Control	2
16	Air Force	Bioenvironmental Engineering	1½
17	Air Force	Bioenvironmental Engineering	1
18	Air Force	Logistics Planning	4
19	Talley Services, Inc.	Fire Department	7
20	Talley Services, Inc.	Fire Department	31
21	Talley Services, Inc.	Supply	14
22	Talley Services, Inc.	Fuels Management	3
23	Retired	Fuels Management	4
24	Talley Services, Inc.	AF Civil Engineering	23

Appendix C--Continued

No.	Organization	Area of Knowledge	Years at Installation
25	BTM	Tool Manufacturing	2
26	Retired	AF Civil Engieneering	26
27	Transferred	AF Civil Engineering	6

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Appendix D
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.

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FIGURE 1

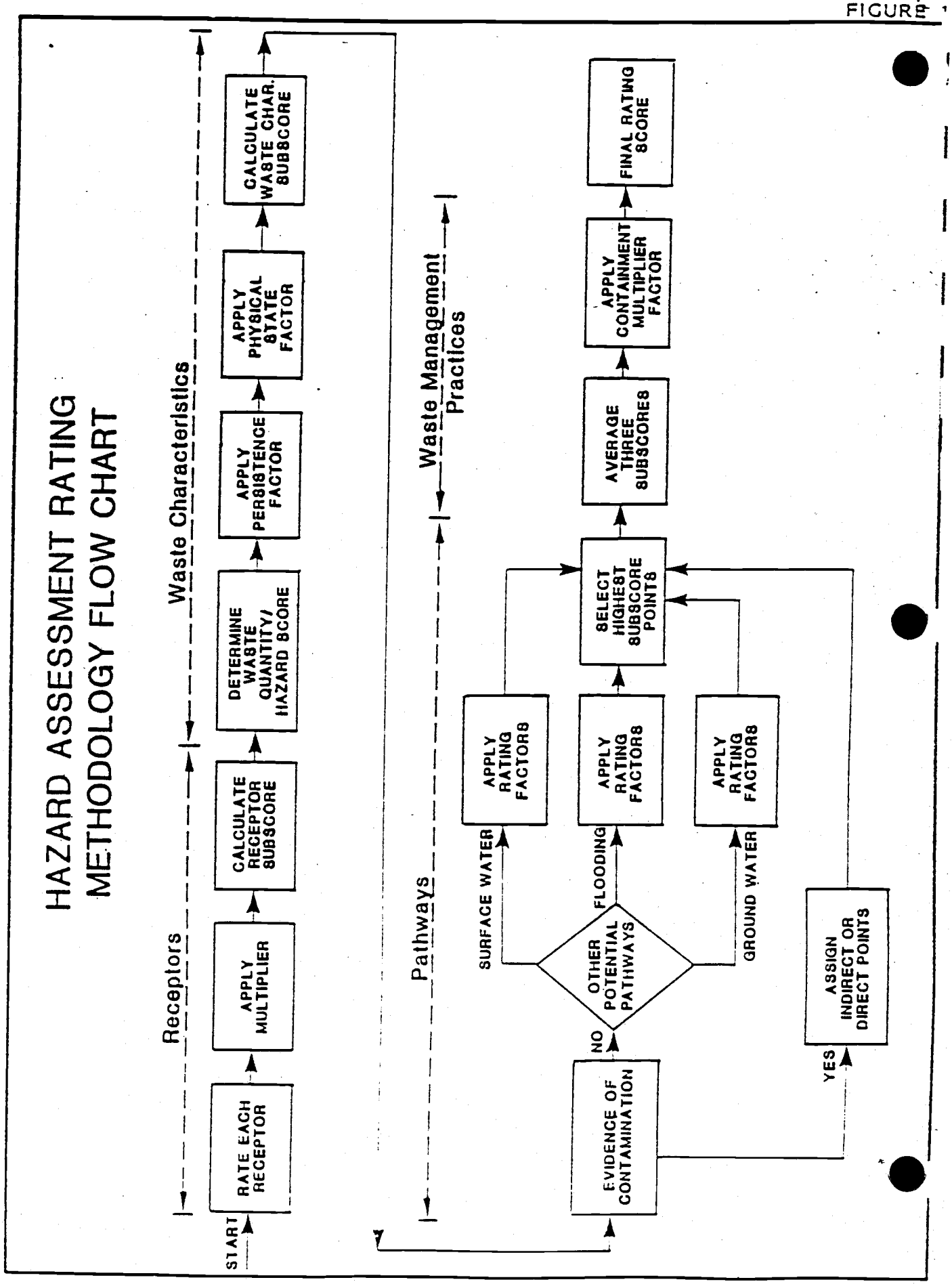
HAZARD ASSESSMENT RATING
METHODOLOGY FLOW CHART
Receptors
Waste Characteristics
Pathways
Waste Management Practices
START
RATE EACH RECEPTOR
APPLY MULTIPLIER
CALCULATE RECEPTOR SUBSCORE
DETERMINE WASTE QUANTITY/ HAZARD SCORE
APPLY PERSISTENCE FACTOR
APPLY PHYSICAL STATE FACTOR
CALCULATE WASTE CHAR. SUBSCORE
EVIDENCE OF CONTAMINATION
NO
YES
OTHER POTENTIAL PATHWAYS
SURFACE WATER
FLOODING
GROUND WATER
APPLY RATING FACTORS
APPLY RATING FACTORS
APPLY RATING FACTORS
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 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 3 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		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

Flooding		1		

Subscore (100 x factor score/3) _____

3. Ground-water migration

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 S

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 of 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	H
50	L	S	M
	L	C	L
	M	S	H
	S	C	H
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	N
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

Multiply Point Rating Persistence Criteria	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 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

Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1

B-3 Potential for Ground-Water Contamination

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 E
INSTALLATION HISTORY AND MISSION

Appendix E
INSTALLATION HISTORY AND MISSION

I. HISTORY

Richards-Gebaur Air Force Base, Missouri, an Air Force Reserve (AFRES) installation, is located 25 miles south of downtown Kansas City, Missouri, with access off U.S. Highway 71 (South).

The history of Richards-Gebaur AFB dates back to 1941 when a group of farms was acquired by Kansas City, Missouri, for use as an auxiliary airport. The acquisition of land totaling 2,400 acres continued until 1952.

During World War II, President Harry S. Truman utilized what was then called Grandview Airport for trips to his native home of Independence, Missouri, and other locations in the greater Kansas City area. During the "Kaw River flood" of 1951 Grandview Airport was used by commercial airlines unable to operate from the Downtown Kansas City Municipal Airport.

In 1952, the Aerospace Defense Command leased the airport from Kansas City for use of air defense operations. In November 1952 the voters of Kansas City approved a charter amendment which authorized the city government to convey Grandview Airport to the United States government.

In January 1953, Kansas City formally conveyed the property deed and title to the United States government; and on November 4, 1955, Headquarters U.S. Air Force issued General Order No. 91, Section V, which proclaimed Grandview Air Force Base a permanent U.S. Air Force installation.

Ceremonies redesignating the base as Richards-Gebaur AFB were held April 27, 1957 for memorializing two native

Kansas Citians, 1st Lt. John F. Richards and Lt. Col. Arthur W. Gebaur, Jr.

Lieutenant Richards joined the Air Service in 1917 and was assigned as a reconnaissance pilot to France, where he was killed September 26, 1918 while on an artillery spotting mission the first day of the Argonne offensive. Colonel Gebaur enlisted in the U.S. Army Air Force five days after Pearl Harbor and served as an instructor pilot during World War II. Recalled to active duty during the Korean Conflict, he qualified for jet aircraft and was killed August 29, 1952 over North Korea on his 99th F-84 mission.

The Aerospace Defense Command had the primary mission on-base until inactivation of 10th Air Force and the Western Region, North American Air Defense Command.

On July 1, 1970 the Air Force Communications Command (AFCC) assumed command of Richards-Gebaur AFB and relocated its headquarters from Scott AFB, Illinois. With reestablishment of Headquarters AFCC at Scott AFB, and inactivation of the host 1840th Air Base Wing, Richards-Gebaur became a Military Airlift Command base on October 1, 1977 with the 1607th Air Base Group as the host active duty unit.

A drastic reduction in the active duty and civilian forces on-base resulted in the host unit being redesignated the 1607th Air Base Squadron (ABS), which provided base operating support until a majority of those functions were assumed September 1, 1979 by a civilian contractor, Talley Services, Inc.

AFRES assumed operational control October 1, 1980 of Richards-Gebaur with the commander, 442nd Combat Support Squadron, also functioning as base commander. The 442 Tactical Fighter Group currently has the primary mission

on the base. The remaining active duty support units are the 1879th Communications Squadron (AFCC) and Operating Location A, Detachment 19, 26th Weather Squadron (MAC).

An interim lease for a majority of the excessed base facilities and properties, and joint-use of the airport facility, both with Kansas City, Missouri, also became effective October 1, 1980. Identified base support functions are shared by Talley Services, Inc., and the City of Kansas City.

The 13 collocated AFRES units on-base have an authorized strength of 197 full-time Department of Air Force (DAF) civilian employees/reservists (Air Reserve Technicians), and 1,073 reservists. Other authorized DAF civilians include 98 for support of the primary AFRES mission, and 126 for other Air Force functions on-base, including the Consolidated Open Mess and billeting.

Other federal government agencies presently using base facilities include the U.S. Marine Corps (operation of the 241-unit former base officer housing area as an all-services, active duty, enlisted and officer housing area); U.S. Department of Agriculture's standardization division (use of the former base hospital); U.S. Navy Seabee Reserve Mobile Construction Battalion No. 15; 308th Psychological Operations Company and nine other U.S. Army Reserve units, in the former base exchange building; and the General Services Administration.

II. MISSION

The primary mission of the active duty Air Force, Talley Services, and Kansas City personnel is to provide base operating support for the AFRES 442nd Tactical Fighter Group which, equipped with 24 A-10 Thunderbolt II aircraft,

has the primary mission on-base. Detailed mission statements for the various active Air Force and Air Force Reserve organizations are given below:

442 Tactical Fighter Group (TFG)

The mission of the 442 TFG is to:

- Sustain a combat-ready posture capable of world-wide deployment.
- Conduct close air support at forward operation locations with minimum support facilities.
- Engage in joint antiarmor operations, battlefield interdiction, search and rescue missions.
- Employ conventional munitions, including AGM-65 Maverick, against surface targets.

442 Consolidated Aircraft Maintenance Squadron (CAMS)

The mission of the 442 CAMS is to accomplish organizational and field level maintenance for 24 unit-assigned A-10 aircraft. In addition, the 442 CAMS also accomplished C-130 fuel cell rework as a central repair facility for all AFRES-assigned C-130 aircraft and other C-130 aircraft modification as dictated by command priorities. At the present time, the 442 CAMS is also supporting a Depot Field Team which is performing aircraft modification on all AFRES-assigned A-10 aircraft.

442 Weapons Systems Security Flight (WSSF)

The mission of 442 WSSF is to train Air Force Reserve personnel in the proper procedures regarding Aircraft Security and Limited Air Base Ground Defense.

442 Combat Support Squadron (CSS)

The mission of the 442 CSS is to support and train personnel of the 442 Tactical Fighter Group, and other collocated Air Force Reserve units, enabling individuals and units to be fully mission-ready if mobilized and deployed in support of the nation's Total Force.

442 Communications Flight (CF)

The 442 CF has both a peacetime and a wartime mission.

The peacetime mission is to provide normal Communications Electronics staff support to the 442 TFG Commander and to provide the Group with required communications services. These services include:

a. Managing the Group's COMSEC Education Programs.

b. Providing customer education in communications services.

c. Maintaining intrabase radio equipment, air to ground radio systems, public address and intercom systems, and tactical telephone systems.

d. Operating tactical fixed-station and tactical record communications systems.

The wartime mission of the 442nd Communications Flight is to operate and maintain telecommunications equipment at collocated operating bases (COBs) in Europe. The equipment is prepositional and maintained in "ready" status by AFCC readiness teams.

442 Tactical Hospital (TAC HOSP)

The mission of the 442 TAC HOSP is to provide immediate first aid and triage treatment, transportation of casualties, and coordination of private ambulance service.

935 Civil Engineering Squadron (CES)

The mission of the 935 CES is to:

- Develop and maintain a highly skilled, mobile military combat engineering force capable of rapid response for contingency operations worldwide.

- Develop and maintain a highly skilled, in-place military engineering force for direct combat support of CONUS and theater forces directly tasked in operations plans.

- Provide supplementary training to ensure that military personnel are capable of performing direct combat tasks.

- Develop and maintain USAFR Civil Engineering forces to complement active duty forces for direct combat support.

36 Aeromedical Evacuation Flight (AEF)

The mission of the 36th AEF is to provide aeromedical evacuation crew members that are trained and equipped to provide inflight medical care around the clock in intra-theater tactical airlift aircraft which have been reconfigured for patient movement. The 36th AEF also provides a direct communication link and immediate coordination between the user service originating patients for aeromedical evacuation and the tactical aeromedical evacuation system. The flight is Military Airlift Command gained.

77/78 Mobile Aerial Port Squadrons (MAPS)

The mission of the 77/78 MAPS(s) is to provide mobile terminal facilities in support of airlift forces. Mobile terminal operations include functions necessary to prepare cargo for aerial delivery and terminal services associated with airland operations at an airhead.

41 Aerial Port Squadron (APS)

The mission of the 41 APS is to operate fixed air terminal facilities at MAC aerial ports, to operate mobile terminal facilities as required to support MAC airlift operations, and to manage commercial transportation facilities. Fixed terminal facilities operations include all services required for effective movement of passengers, mail, and cargo by military or military contract aircraft. Mobile terminal operations include functions required to prepare cargo for aerial delivery modes and the terminal services associated with airlanded operations in an airhead.

1879 Communications Squadron (CS)

The mission of the 1879 CS is to manage, operate, and maintain the ground Communications-Electronics and Air Traffic Control services/facilities in support of the 442 Tactical Fighter Group at Richards-Gebaur AFB.

Operating Location A, Detachment 19, 26th Weather Squadron (WS)

The mission of OL-A, DET 19, 26 WS is to perform a basic weather watch in a limited-duty weather station; make visual and instrumental observations of weather conditions; evaluate, record, and transmit observations over teletype and electrowriter; issue observed met watches; disseminate centrally prepared weather warnings and terminal forecasts to on-base agencies; and assist assigned and transit aircrews with current and forecast conditions.

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Appendix F
MASTER LIST OF INDUSTRIAL ACTIVITIES

Appendix F
MASTER LIST OF INDUSTRIAL ACTIVITIES

Organization/Shop Name	Present Location and Dates (Bldg. No.)	Past or Alternate Location and Dates (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal Method
AFRES					
Pneudraulics/Environmental	918 1957-Pres.	940 1955-1971 821 1954-1957	X	X	Holding tank/contract disposal
Wheel/Tire	918 1971-Pres.	940 1955-Pres. 821 1954-1971	X	X	Drums to holding tank/contract disposal
Machine	918 1957-Pres.	940 1955-1971 821 1954-1957			
Electric/Battery	918 1957-Pres.	940 1955-1971 821 1954-1957	X		Neutralized; to sanitary sewer
Docks & Inspection	918 1957-Pres.	940 1955-1971 821 1954-1957			
Sheet Metal/Welding	918 1957-Pres.	940 1955-1971 821 1954-1957			
Reclamation and Repair	918 1957-Pres.	940 1955-1975 821 1954-1957			
NDI Lab	839 1961-Pres.		X	X	Drums to DPDO
Parachute and Fabric	801 1954-Pres.				
Engine/Prop	927 1959-Pres.	940 1955-1975 821 1954-1959	X	X	Bowser/contract disposal
Avionics	930 1961-Pres.	940 1955-1974 821 1954-1961			
Instrument/Auto Pilot	930 1961-Pres.	940 1955-1971 821 1954-1961			
Aerospace Ground Equipment	958 1963-Pres.	940 1955-1963 822 1960-1978	X	X	Holding tank/contract disposal
Corrosion Control	948 1973-Pres.	918 1957-1978	X	X	Drums/contract disposal
Fuel Systems	948 1963-Pres.	940 1955-1963			
Munitions	1202 1982-Pres.	1202 1961-1971			
Gun Shop	828 1982-Pres.	828 1958-1971			
Loading	940 1982-Pres.				
Photo Lab	106 1954-1980				
Lear Siegler, Inc.					
Fuel Cell	940 1982-Pres.				
Fuel Cell	965 1966-Pres.		X	X	Bowser/fire department training
Fuel Cell	966 1966-Pres.		X	X	Bowser/fire department training
Talley Services, Inc.					
PME Lab	925 1962-Pres.				
Hobby Shop	426 1965-Pres.				
Golf Course	354 1966-Pres.				
Liquid Fuels	1015 1952-Pres.				
Fuels Lab	1015 1952-Pres.				
Fire Department	900 1954-Pres.	1021 1951-1954			
Supply	610 1953-Pres.				

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Appendix F--Continued

Organization/Shop Name	Present Location and Dates (Bldg. No.)	Past or Alternate Location and Dates (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal Method
Kansas City Aviation Dept.					
Carpenter Shop	605 1953-Pres.				
Interior and Exterior Heat	605 1953-Pres.				
Paint	605 1953-Pres.				
Pest Control	614 1980-Pres.	151 1954-1980			
Plumbing	605 1953-Pres.				
Refrigeration	605 1953-Pres.				
Roads and Grounds	605 1953-Pres.				
Sanitation	605 1953-Pres.				
Sheet Metal	605 1953-Pres.				
Steam	514 1954-Pres.	942 1955-1975 948 1963-1975 821 1954-1975 965 1966-1975			
Vehicle Maintenance	704 1954-Pres.		X	X	Holding tank/contract disposal
Refueling Vehicle Maintenance	711 1968-Pres.		X	X	Holding tank/contract disposal
Belton Tool Manufacturing Co.	612 1980-Pres.				
Former (ADC, AFCC)		612 1957-1970			
442 MAPS					
Mobile Aerial Port Squadron	940 1978-Pres.				
303 TFS					
Life Support	710 1954-Pres.				
1879 Communications Squadron	105 1954-Pres. 901 1954-Pres. 925 1962-Pres.				
U.S. Navy Seabces	1980-Pres.				
U.S. Army	330 1980-Pres.				
U.S. Dept. of Agriculture	221 1980-Pres.				

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Appendix G
INVENTORY OF EXISTING
POL STORAGE TANKS

Appendix G
INVENTORY OF EXISTING POL STORAGE TANKS AT
RICHARDS-GEBAUR AFB, MISSOURI

Facility/ Location	Type POL	Capacity (gal)	Aboveground (AG) Belowground (BG)
151	Diesel	1,500	AG
330	Diesel	5,000	Unknown
514	Fuel Oil	50,000 (4 each)	BG
	Fuel Oil	50,450 (2 each)	BG
611	Waste Oil	2,000	BG
702	MOGAS	10,000 (2 each)	BG
711	Waste JP-4	5,000	BG
	Waste Oil	1,000	BG
821	Waste Oil	15,000	BG
828	Fuel Oil	1,500	Unknown
831	MOGAS	1,000 (2 each)	Unknown
839	Diesel	4,000	BG
921	Diesel	1,000	AG
945	JP-4	500 (2 each)	AG
	Waste PD 680,	1,000 (2 each)	AG
	paint thinner, misc. POLs		AG
955	JP-4	187,000	AG
957	JP-4	210,000	AG
958	Waste PD 680, paint thinner, misc. POLs	500	AG
963	MOGAS	500	Unknown
964	MOGAS	500	Unknown
966	Waste Oil	1,000	BG
	Waste Oil	12,000	BG
1010	Fuel Oil	2,500	BG
	MOGAS	500	BG
1014	MOGAS	500	BG
1016	Fuel Oil	1,000	Unknown
1020	Fuel Oil	2,000	Unknown
1025	Fuel Oil	1,000	BG
	MOGAS	275	BG
1030	Diesel	500	BG
1033	Waste JP-4	5,000	AG
1100	Fuel Oil	500	Unknown
1106	Fuel Oil	1,000	Unknown
1201	Fuel Oil	3,000	BG
1202	Fuel Oil	1,500	BG
1301	Fuel Oil	4,000	BG
9610	MOGAS	10,000	AG
	Diesel	10,000	AG

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Appendix H
INVENTORY OF DEACTIVATED
POL STORAGE TANKS

Appendix H
INVENTORY OF DEACTIVATED POL STORAGE TANKS
AT RICHARDS-GEBAUR AFB, MISSOURI

Facility/ Location	Type POL Previously Stored in Tank	Capacity (gal)	Aboveground (AG) Belowground (BG)	Comments
125	MOGAS MOGAS	4,000 3,000 (4 each)	BG BG	Deactivation procedures not verified.
611	Diesel Fuel Oil	30,000 (5 each) 30,000	BG BG	Tanks reported as abandoned; however, deactivation procedures not verified.
901	Jet Fuel	25,000 (4 each)	BG	Reportedly abandoned in mid-1970s; however, deactivation procedures not verified.
927	Waste Oil	300	BG	Deactivation procedures not verified.
942	Fuel Oil	15,000 (2 each)	BG	Reported abandoned in 1976; however, deactivation procedures not verified.
948	Fuel Oil	6,000	BG	Reportedly abandoned and locked (1976).
954	Fuel Oil	260,000	AG	Reportedly has been "pickled."
956	AVGAS	304,500	AG	Reportedly has been "pickled."
1015	AVGAS	1,000	BG	Reportedly has been deactivated and filled with water.

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Appendix I
INVENTORY OF OIL/WATER SEPARATORS

Appendix I
INVENTORY OF OIL/WATER SEPARATORS

Facility No.	Facility Identification	Date Facility Constructed	Date of Separator Installation	Discharge
704	Motor Pool	1954	1973	Sanitary Sewer
711	Refueling Vehicle Maintenance	1968	1968	Sanitary Sewer
821	Fixed Base Operation	1954	1973	Sanitary Sewer
822	Former USAF AGE Shop (Vacant)	1960	1973	Sanitary Sewer
920	Vehicle Wash Rack	1955	1955	Sanitary Sewer
9470	Industrial Oil/Water Separator and Oil Storage Tank	1974	1974	Industrial Sewer
1033	Industrial Oil/Water Separator and Storage Tank at Fire Training Facility	1965	1969	Drainfield

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Appendix J
SITE RATING FORMS

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: 1. South Landfill

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Continuous 1954-1961; Intermittent 1961-1982

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Primarily rubble; possible domestic refuse; oil/tar dumps

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

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	2	10	20	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	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	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	2	6	12	18
			Subtotals	69	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 38

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	80
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	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	N/A	8	--	--
		Subtotals	30	90
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore

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

Pathways Subscore 80

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	38
Waste Characteristics	48
Pathways	80
Total 166 divided by 3 =	55
Gross Total Score	

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

55 x 1.0 = 55

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: 2. Northeast Landfill

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Continuous 1961-1971; intermittent 1971-1982

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Reported rubble burial, land applied paint thinners; trash; visible druns with unknown contents

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

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	2	10	20	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	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	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	2	6	12	18
			Subtotals	75	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 42

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	0
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	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	30	90
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore

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

Pathways Subscore 59

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	42
Waste Characteristics	60
Pathways	59
Total 161 divided by 3 =	54
Gross Total Score	

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

54 x 1.0 = 54

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: 3. Contractor Rubble Burial Site

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Interim 1954-1978

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Contractor's rubble; household debris

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

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	2	10	20	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	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	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	2	6	12	18
			Subtotals	69	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 38

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 3
Page

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	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	72	108
Subscore (100 x factor score subtotal/maximum score subtotal)				67
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	30	90
Subscore (100 x factor score subtotal/maximum score subtotal)				33

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	38
Waste Characteristics	40
Pathways	67
Total 145 divided by 3 =	48
Gross Total Score	

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

48 x 1.0 = 48

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: 4. West Burn Pit

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: 1954-1955

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Fire Training Area 1954-1955

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

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	2	10	20	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	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	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	2	6	12	18
			Subtotals	76	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 42

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 0.8 = 32

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

32 x 1.0 = 32

Site 4
Page

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	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	56	108
Subscore (100 x factor score subtotal/maximum score subtotal)				52
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	22	90
Subscore (100 x factor score subtotal/maximum score subtotal)				24

C. Highest pathway subscore

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

Pathways Subscore 52

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	42
Waste Characteristics	32
Pathways	52
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: 5. South Burn Pit

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: 1955-1965

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Fire Training Area, 1955-1965

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

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	2	10	20	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	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	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	2	6	12	18
			Subtotals	69	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 38

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	0
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	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	N/A
		Subtotals	22	90
Subscore (100 x factor score subtotal/maximum score subtotal)				24

C. Highest pathway subscore

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

Pathways Subscore 59

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	38
Waste Characteristics	48
Pathways	59
Total 145 divided by 3 =	48
Gross Total Score	

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

48 x 1.0 = 48

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: 6. North Burn Pit

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: 1965 - present

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Fire Training Area 1965 - present (modified in 1970)

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

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	2	10	20	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	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	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	2	6	12	18
			Subtotals	75	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 42

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

Site 6
Page

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	0
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	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	56	108
Subscore (100 x factor score subtotal/maximum score subtotal)				52
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	22	90
Subscore (100 x factor score subtotal/maximum score subtotal)				24

C. Highest pathway subscore

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

Pathways Subscore 52

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	42
Waste Characteristics	48
Pathways	52
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 0.95 = 45

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: 7. Radioactive Disposal Well

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Constructed 1955; intermittent to present

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Disposal well for solid radioactive materials

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

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	2	10	20	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	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	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	2	6	12	18
			Subtotals	69	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 38

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) L

Factor Subscore A (from 20 to 100 based on factor score matrix) 30

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

30 x 1.0 = 30

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

30 x 0.5 = 15

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	0
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	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	3	8	24	24
Direct access to ground water	N/A	8	N/A	N/A
		Subtotals	46	90
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 59

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	38
Waste Characteristics	15
Pathways	59
Total 112 divided by 3 =	37
Gross Total Scor	

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

37 x 0.10 = 4

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: 8. Herbicide Burial Site

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: August, 1971

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Unused herbicide (reportedly contained mercury) buried

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

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	2	10	20	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	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	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	2	6	12	18
			Subtotals	73	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 41

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	0
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	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	56	108
Subscore (100 x factor score subtotal/maximum score subtotal)				52
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	22	90
Subscore (100 x factor score subtotal/maximum score subtotal)				24

C. Highest pathway subscore

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

Pathways Subscore 52

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	41
Waste Characteristics	60
Pathways	52
Total 153 divided by 3 =	51
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

51 x 1.0 = 51

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: 9. Oil Saturated Area

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: 1954-1980

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Storage of open drums containing waste oils; ground reportedly saturated with oil.

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

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	2	10	20	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	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	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	2	6	12	18
			Subtotals	77	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 43

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 0

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	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	56	108

Subscore (100 x factor score subtotal/maximum score subtotal) 52

2. Flooding 0 1 0 3

Subscore (100 x factor score/3)

3. Ground-water migration

Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	22	90

Subscore (100 x factor score subtotal/maximum score subtotal) 24

C. Highest pathway subscore

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

Pathways Subscore 52

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	43
Waste Characteristics	48
Pathways	52
Total 143 divided by 3 =	48
Gross Total Score	

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

48 x 1.0 = 48

The Star-Herald
VOLUME 91 NO. 45
ESTABLISHED 1892 • BELTON, MISSOURI
THURSDAY, MARCH 31, 1983

Suggest Further Testing For R-G Waste Sites

By STEVE PORTER

Only further testing will determine whether two former landfill sites at Richards-Gebaur, in which hazardous wastes have been dumped, pose a danger significant enough to warrant a cleanup, according to a government-ordered report made public last week.

The study, conducted last fall by CH2M Hill Southeast Inc. of Gainesville, Fla. for the U.S. Air Force, noted that the south and northeast landfills show the most significant potential for "environmental impact." However, the report characterized the situation as moderate priority, saying "no imminent hazard has been determined."

Since the air base was activated in 1953, engine maintenance, painting and corrosion control have generated waste oils, fuels, solvents and cleaners which have been disposed of in a variety of methods, the report stated.

After interviews with 27 former and current base personnel, information gleaned from records and through observation, researchers have concluded that hazardous wastes have been disposed of at the base.

No direct evidence of the migration of hazardous materials from the landfills has been determined, but indirect evidence at the south landfill led researchers to suggest further study. They based their recommendation after observing " a small oil sheen" on surface water in a ditch adjacent to the south site.

Run-off of contaminants into nearby creeks is possible, the report states, but the thick clay and shale which lies beneath the ground surface reduces the potential for contamination of underground water.

The report recommends monitoring the two sites, taking samples from each a month apart to determine what the contaminants are, how much is present, and whether the material is migrating.

At the south site, located just northeast of the south end of the airport taxiway, the study recommends sampling water from the Scope Creek tributary both upsteam and downstream of the landfill. At the northeast site, which is west of the Burlington-Northern Railroad tracks and near the north boundary line of the base, installation of a shallow monitoring well is recommended. Also at the northeast site are various containers which should be sampled and analyzed to determine the contents, according to the report.

In evaluating the priority of nine possible disposal sites at the base, only two, the south and northeast landfills, scored high enough to warrant secondary study.

The base civil engineer, Samuel P. Mitchell, indicated that points were assessed against these two locations because of the possibility of the existence of a portable ground well within three miles of the sites. He stressed that no wells are actually known to exist within that radius.

"In that respect, they were trying to cover themselves in case the worst possible situation had occurred," Mitchell said, adding that he thought it was a good idea to be overly cautious just to be on the safe side.

Mitchell felt the results of the report were commendable, considering no government regulations existed in the first 15 years of the base's operations.

File: P.M.E. 2/14

1283

Toxins at Richards-Gebaur?

Report cites potentially hazardous dumps

By Dick Larsen
staff writer

Two potentially hazardous waste dumps are located at Richards-Gebaur Air Force Base on property earmarked for Kansas City, a federal report shows.

The report, prepared for the U.S. Air Force by a three-member team from a private engineering firm in Gainesville, Fla., evaluated nine sites at the base where hazardous materials had been dumped over three decades.

Based on interviews and documents, the report describes the types of wastes generated at Richards-Gebaur but did not include results from any sampling of soil or buried material.

The study found that Air Force Reserve operations at the base generate 11,000 to 13,000 gallons of industrial wastes yearly. Before 1971 the figure was 26,000 gallons a year higher.

The engineering firm, CH2M Hill Southeast Inc., recommended samples be taken at two sites, located on land designated to be donated to Kansas City under the Federal Property Review Board's proposal to sell and donate surplus property at the base.

Kansas City has not accepted the property proposal.

Delbert Karmeier, Kansas City Avaition director, said Saturday that he had known about possible problems at one site but had been unaware of potential problems at the second site. Mr. Karmeier, reached at home, said he had not seen the report.

"We are about to begin negotiations with GSA (the federal General Services Administration) to get the land and we will want to know what's out there. It may affect the value of the property," he said.

Floyd Pinkston, a public affairs officer at the base, said Saturday, "It is my understanding that if an isolated area is found to contain a hazardous material, that area will be decontaminated before it is conveyed for public use."

Both sites had ratings above 50 on a scale of 0-100 used to indicate the severity of potential hazardous waste problems under a federal program to evaluate past hazardous waste disposal sites at military bases.

A site is not ranked unless investigators find a potential that hazardous wastes are present in sufficient quantities to create a risk of contamination or migration.

One of the landfills, located along Scope Creek in the southern part of the base, scored 55. The report concluded there was indirect evidence of hazardous contaminants in runoff from the site.

The site was used from 1961 to 1971 to dispose of wastes from industrial shops. The report says that spreading of waste paints and thinners on the ground had been practiced there as late as 1978.

The other landfill, near the creek in the northeast part of the base, received a score of 54. It was used to dispose of building rubble, paint thinners and other debris. The report notes that more than 400 drums are at the site, some with unknown contents.

The report cites no evidence of present or past contamination due to use of pesticides, and says no evidence exists that chemical or biological warfare agents ever were tested or used at the base.

It says nuclear weapons were stored at the base and at an off-base site in Cass County called the Belton Training Annex, but that no such weapons were buried and that nuclear weapons no longer are stored at the base.

The report said investigators found no evidence of environmental problems at the Belton Training Annex.

The report was based on searches through base records and interviews with 27 present and former employees at the base.

Richards-Gebaur is one of 66 of the nation's 144 bases being searched for past hazardous waste practices.

Eventually, all U.S. bases will be studied. Richards-Gebaur was among the first because of the possible transfer of land to Kansas City.

CONVERSATION RECORD

TIME

DATE 4/1/83

TYPE

☐ VISIT ☐ CONFERENCE XX ☐ TELEPHONE

☐ INCOMING

☐ OUTGOING

ROUTING NAME/SYMBOL

Location of Visit/Conference:

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU	ORGANIZATION (Office, dept., bureau, etc.)	TELEPHONE NO.
Alan Thomas	KC, Mo. He. . Dept.,	Env. He 274-1247

SUBJECT

Richards Gebaur AFB, Belton, Mo.

SUMMARY Both Mr. Thomas & I saw the newspaper article in sunday's paper about the t waste problem at the AFB. Thomas had called to find out if EPA was aware of and e uating this site. Thomas works in the Environmental Health Division of the City He Dept. The City's interest in this site is that the Air Force had planned to give t land back to the city of KC. In lihgt of the alledged problems with toxic wastes a the site the city is not sure they want the land.

Thomas said he had called the AFB & spke with the base engineer: Sam Mitchell (348 2076). Mitchell confirmed that the Air Force had hired an engineering contractor t study their toxic/hazardous waste problems & that the firm had completed phse I o that study. Phase I was thought to consist primarily of an inventory & history of waste management of the site & some background on geology, etc. Thomas was told that Phase II which was being planned would consits of environmental sampling to determine the extent of any contamination. Groundwater monitoring was discussed as past of Phase II.

Thomas said that he had also spoken with Bill Keffer of ENSV/EP&R about this site. I did not ascertain the full extent of their conversation but it appears probably that Keffer referred Thomas to SPFD for the requested information. Thomas said tha Mitchell had agreed to send both Thomas & Keffer a copy of the consultant's report

I then explained what little I knew about the site. I told him the Air Force had submitted a Superfund (103c) Notification on this site reporting the disposal spillage of chemicals or wastes. I explained to him that the role of lead agency evaluating these site had been divided between EPA & the state agencies. I explai that MDNR was the lead agency on this site. I said he would probably have to call the MDNR Waste Enforcement Program in Jefferson City to get any additioanl inform about this site. Thomas indicated that either EPA SPFD or MDNR could probabl a copy of the consutant's report by calling Mr. MIthhell.

ACTION REQUIRED

I told Mr. Thomas that I would provide the information he had given to me to MDNR they are the lead agency on this site.

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
DAve Crawford SPFD		

Site: Richards-Gebaur
ID #: MO9571824092
Break: 1.1
Other:
4-1-83

ACTION TAKEN

CC Allen Turner Katie Biggs

SIGNATURE	TITLE	DATE

Research firm to monitor water near waste dumps at air base

By Dick Larsen
staff writer

A private research firm last week completed installation of three wells that will be used to monitor water near two potentially hazardous waste dumps at Richards-Gebaur Air Force Base.

The dumps are located on property earmarked for Kansas City as part of a General Services Administration plan to dispose of surplus base property.

Engineers from Water and Air Research Inc., a company in Gainesville, Fla., also took samples from some of the 435 barrels that had been stored at the northeast landfill. About 100 of the barrels still contained liquid.

Initial findings indicate that the barrels contained rusty water, used oil and solvents, base officials said. The landfill had been used since 1955 to dispose of drums, paint cans, wood, pipes and old boilers.

A recent study found that Air Force Reserve operations at the base generate 11,000 to 13,000 gallons of industrial waste yearly.

Samples also were taken from Scope Creek, which runs about 50 yards from the two sites. The creek eventually runs into the Little Blue River.

"We want to intercept the ground water to see if anything has leached into the stream. Recent rains created a water flow which might move any contaminants which may be in the ground," said Sam Mitchell, civil engineer for the base.

Engineers for the research firm also took samples from Scope Creek at the site of the base's south landfill, which base officials said was used mainly as a trash dump. Engineers took samples because oil was found on the creek.

Engineers told base officials that they could not determine the source of the oil.

Engineers and geologists from the Gainesville firm will return to the base in a month and take additional samples at the two sites. After the second set of samples is analyzed, engineers will write a report on whether hazardous wastes are present.

"The two sites go back to 1955 when rules didn't prohibit what was done. We don't want to sweep anything under the rug. We're trying to be responsible and honest in finding out what's out there," Mr. Mitchell said.

Referring to the planned giveaway of the land to Kansas City, Mr. Mitchell said, "We can't give bad property away."

Identification of the two sites was the result of a search through base records and interviews with 27 present and former employees to determine past hazardous waste practices.

Richards-Gebaur was among the first of the nation's 144 bases studied for hazardous waste, because of the possible transfer of land to Kansas City.

6 JUN 1983

P.M.E. 17A-2

ORDER NO. 006

06

ADMINISTRATIVE RECORD COPY

DECEMBER 1983
FINAL REPORT

INSTALLATION RESTORATION PROGRAM

For

RICHARDS–GEBAUR A. F. B.

PHASE II — FIELD EVALUATION

Prepared For
UNITED STATES AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
AEROSPACE MEDICAL DIVISION (AFSC)
BROOKS AFB, TEXAS 78235

Water and Air Research, Inc.
Consulting Environmental Engineers and Scientists

File: 17H
P.M.E.

RICHARDS-GEBAUR AF RESERVE BASE MISSOURI

INFORMATION REPOSITORY COVER SHEET

IR File Number 06

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER
33615-81-D-4007-006

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
Installation Restoration Program for
Richards-Gebaur Air Force Base
Phase II--Field Evaluation

5. TYPE OF REPORT & PERIOD COVERED
Final Report
May - December 1983

6. PERFORMING ORG. REPORT NUMBER
7166-080

7. AUTHOR(s)
W.D. Adams, J.H. Sullivan, W.G. Thiess,
J.A. Steinberg, R.D. Baker, and C.R. Fellows

8. CONTRACT OR GRANT NUMBER(s)
33615-81-D-4007

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Water and Air Research, Inc.
P.O. Box 1121
Gainesville, FL 32602

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
United States Air Force
Occupational and Environmental Health Laboratory
Aerospace Medical Division (AFSC)

12. REPORT DATE
December 1983

13. NUMBER OF PAGES

14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)
Brooks Air Force Base, Texas 78235

15. SECURITY CLASS. (of this report)
Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)
Approved for public release: distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
groundwater
Installation Restoration Program
phenolics
Richards-Gebaur AFB
surface water

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

(see over)

INSTALLATION RESTORATION PROGRAM FOR RICHARDS-GEBAUR AFB, MISSOURI PHASE II--FIELD EVALUATION

FINAL REPORT

Prepared for

UNITED STATES AIR FORCE
Occupational and Environmental Health Laboratory
Aerospace Medical Division
Brooks AFB, Texas 78235

Prepared by:

WATER AND AIR RESEARCH, INC.
Gainesville, Florida

December 1983

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1.0 INTRODUCTION

1.0 INTRODUCTION

The U.S. Air Force (USAF) Occupational and Environmental Health Laboratory (OEHL) assigned Water and Air Research, Inc. (WAR) the task of determining whether environmental contamination of groundwater and surface water had resulted from waste handling and disposal at two landfills on Richards-Gebaur Air Force Base (AFB), Missouri (Figure 1). Related tasks were to estimate the magnitude of contamination if contaminants were found and to identify potential environmental consequences of migrating pollutants. This study was performed within the context of the Installation Restoration Program (IRP) as the Phase IIB Field Investigation. The Phase I Records Search for Richards-Gebaur AFB was published in March 1983 (Moccia et al., 1983)[1].

WAR performed all field work during 22-27 May 1983. Field work included well installation and development and collection of samples of groundwater, surface water, and leachate. Laboratory analyses were completed by 13 June 1983.

1.1 HISTORICAL SUMMARY

Richards-Gebaur AFB has served a variety of functions since it was originally built as an auxiliary airport by Kansas City in 1941 (Moccia et al., 1983). The Aerospace Defense Command (ADC) leased the airport in 1952 and the following year Kansas City transferred the property to the U.S. Government. Since that time, Richards-Gebaur AFB has successively been under the command of the ADC, the Air Force Communications Command (AFCC), the Military Airlift Command (MAC), and the Air Force Reserve (AFRES). Transfer of control of many of the airport functions to Kansas City and a civilian contractor (Talley Services, Inc.) began in 1979. At the time of the Phase I report, most of the real property had been leased or sold (Figure 2).

During the USAF tenure at Richards-Gebaur AFB, industrial activity consisted of maintaining aircraft and ground support equipment. Wastes

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[1]Moccia, D.M. et al., 1983. Installation Restoration Program Records Search for Richards-Gebaur AFB, Missouri. Prepared for U.S. Air Force AFESC/DEV, Tyndall AFB, Florida. Contract No. F08637-80-G0010-6S01.

generated and disposed of as a result of this activity included oils, fuels, solvents, cleaners, paint, photo chemicals, and pesticides.

Wastes generated at Richards-Gebaur AFB have been disposed of both in on-base landfills and through the services of off-base contractors. The two on-base landfills considered in this study were the South Landfill and the Northeast Landfill (Figure 3). According to the Phase I report, the South Landfill was the main sanitary landfill from 1954 to 1956. Authorized use of the South Landfill continued until 1961, and intermittent, unauthorized use continued after 1961. Hazardous wastes which may have been disposed of at the South Landfill in small quantities include paint, thinners, strippers, solvents, and oils.

The Northeast Landfill was used continuously from 1961 to 1971, and intermittent, unauthorized use continued after 1971. Wastes were typically burned and buried in trenches; although disposal of waste paints and thinners by spreading on the land surface was also reported. At present (Moccia et al., 1983), the Northeast Landfill has been closed by burial, but a portion of it is in use for open storage of construction materials, empty tanks, and over 400 containers (55, 30, and 5 gallon sizes). According to a May 1983 USAF OEHL survey, 61% of the containers were empty, and the remainder contained waste oil, hydraulic fluid, paint solvent, and alkaline cleaners. Detailed results of this survey will be published separately.

1.2 ANALYTICAL PARAMETERS

Constituents selected for analysis were based on information given in the Phase I report for potentially hazardous wastes disposed of at the two sites. At the South Landfill these wastes are: waste paint, thinners, strippers, solvents, oils, and tar pot clean-out. At the Northeast Landfill these wastes are: waste paint, thinners, and scrap metal. This information was supplemented by information received from base personnel which indicated possible disposal of nickel-cadmium batteries at one or both sites.

The following is a list of constituents selected for analysis which includes the basis for selection:

1. General groundwater contamination indicators (GWCI): pH, specific conductance, dissolved organic carbon (DOC), and total organic halogen (TOX). These are indicators of nonspecific groundwater contamination. DOC and TOX can also be used to indicate presence of chlorinated solvents and/or thinners.
2. Phenolics: these can be components of strippers and tars.
3. Dissolved heavy metals: cadmium, chromium, copper, lead, and nickel. These can be components of paint pigments and batteries.
4. Oil and grease: this is an indicator of contamination from waste oils.
5. Purgeable organics: these can be components of waste solvents, thinners, and strippers.

Dissolved organic carbon (DOC) and dissolved heavy metals were specified to evaluate dissolved species which are more likely to migrate from a site. The U.S. EPA (1983, p. xiv)[2] considers water to contain dissolved species after it has been filtered through a 0.45 micron membrane filter. Filtration excludes the analysis of metallic ions or organic molecules that have been adsorbed by colloidal particles.

1.3 PHASE II STAGE 2 STUDY TEAM

The following employees of WAR participated in the investigation of the two landfills at Richards-Gebaur AFB:

W.D. Adams, M.S., Project Manager and Hydrogeologist

J.H. Sullivan, Ph.D., Environmental Engineer

W.G. Thiess, M.S., Environmental Engineer

J.A. Steinberg, Ph.D., Environmental Engineer

R.D. Baker, B.S., Chemist

C.R. Fellows, M.S., Chemist

---

[2]U.S. EPA. 1983. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020. Cincinnati, Ohio.

Individuals from the Air Force who provided assistance to WAR during this study were:

Major Gary Fishburn, USAF OEHL, Program Manager, Phase II

Captain Robert J. Sarvaideo, USAF OEHL

Mr. Sam Mitchell, Richards-Gebaur AFB, Base Civil Engineer

Mr. John Hurd, Richards-Gebaur AFB, Civil Engineer

2.0 ENVIRONMENTAL SETTING

2.0 ENVIRONMENTAL SETTING

Moccia et al. (1983) described the natural environment of Richards-Gebaur AFB in some detail in the Phase I report. This section contains excerpts from that report on the climate, topography, geology, hydrology, and hydrogeology.

2.1 CLIMATE

Climate in the Richards-Gebaur AFB area is influenced by latitude and inland location, modified by the inflow of warmer air from the southeast and the Gulf of Mexico. Prevailing winds are from the south with a mean annual wind speed of 9 knots. Average monthly temperatures range from 26°F in January to 78°F in July. Most precipitation falls in late spring, early summer, and early fall; usually late fall and winter is the driest period of the year. Average annual precipitation is almost 37 inches. Evapotranspiration is approximately 5 inches greater than the average annual precipitation.

2.2 TOPOGRAPHY AND PHYSIOGRAPHY

The study area is within the Osage Plains section of the central lowlands physiographic province. It is an area of gently rolling terrain with low overall relief. Land surface elevations at Richards-Gebaur AFB vary from over 1,100 feet above mean sea level (msl) in the south to approximately 960 feet msl in the northeast.

2.3 GEOLOGY

Four formations outcrop at Richards-Gebaur AFB (Figure 4). From oldest to youngest they are the Chanute Formation (shale), Iola Formation (limestone), Lane Formation (shale), and Wyandotte Formation (limestone). These are the four uppermost formations of the Pennsylvanian Kansas City Group, a total of 11 formations which are alternately composed of limestone or shale. The sedimentary sequence beneath the Kansas City Group consists of consecutively older sedimentary rocks which rest upon a Precambrian granite base at a depth exceeding 2,500 feet.

Surface soils at Richards-Gebaur AFB consist chiefly of a thin layer of loess over residuum derived from in-place weathering of underlying limestone and shale. The veneer of loess, where present, is the result of the deposition of windborne silt. Residual soils on the base are predominantly clay and silty clay whose permeabilities are generally low, on the order of 1.0×10^{-6} centimeters per second (cm/sec) or less. Soil thickness varies from 2 to 15 feet. At the well sites downgradient of the Northeast Landfill, the residual clay soils varied from 12.5 to 15.5 feet thick (Appendix A).

2.4 HYDROLOGY

2.4.1 Surface Water

Scope Creek is the main surface water feature at Richards-Gebaur AFB; it receives drainage from both the South Landfill and the Northeast Landfill (Figure 3). Scope Creek flows into Little Blue River which, in turn, empties into the Missouri River about 20 miles north of the base (Figure 1). Normal flow in Scope Creek is approximately 900 gallons per minute (gpm) upstream of the wastewater treatment plant, but peak flows during storm events may reach 3,000 gpm. During periods of low rainfall, Scope Creek may be dry in its upper reaches.

Surface water from Scope Creek and Little Blue River is not used for public water supply, but Scope Creek at the railroad bridge northeast of the base is popular with local children as a swimming area. Kansas City draws its water from the Missouri River at a point well upstream of the confluence of the Little Blue and Missouri Rivers. Other public water supply intakes along the Missouri River are more than 50 miles downstream of its confluence with the Little Blue River.

2.4.2 Groundwater

Groundwater in the Pennsylvanian strata beneath the base is highly mineralized and contains 40,000 parts per million (ppm) or more total dissolved solids. This saline water is probably ancient seawater (connate water) incorporated in the sediments when they were deposited.

Rainfall which seeps into the residual soils on the base may percolate downward as far as the first low permeability rock boundary, at which point the flow is directed downslope toward a line of discharge to the nearest stream or pond. As discussed in Section 4.2, the present study's data support this model of flow for the Northeast Landfill.

3.0 FIELD PROGRAM

3.0 FIELD PROGRAM

3.1 DESIGN

The field program for the Phase II study was designed to collect for analysis water samples that would indicate whether contaminants were migrating from the South Landfill or the Northeast Landfill. At each site, the direction of both surface and subsurface flow was assumed to be toward Scope Creek, the nearest downslope body of surface water (Figure 3).

Fill materials at the South Landfill extend to the wooded floodplain of Scope Creek; therefore, groundwater containing contaminants leached from the South Landfill were expected to discharge to Scope Creek very close to the edge of the landfill itself. It was thus possible to monitor discharge from the South Landfill by sampling Scope Creek adjacent to the landfill, and well installation in this area was unnecessary for this study. Two surface water stations on Scope Creek were selected for this site. One (S-1) was upstream of the site (for background data) and the other (S-2) was downstream of the landfill. Since the Phase I report mentioned a seep at the South Landfill, provision was also made for collecting a leachate sample from the seep (L-1) (Figure 3).

Sampling stations at the Northeast Landfill included three monitoring wells (NE-1, NE-2, and NE-3) (Figures 5 and 6), a surface water sample from Scope Creek (S-3) (Figures 3 and 6), and provision for a leachate sample if a seep were observed during the site visit. The monitoring wells were included to sample groundwater flowing from the landfill toward Scope Creek. The surface water sample station was selected downstream of the Northeast Landfill at the base boundary.

3.2 IMPLEMENTATION

3.2.1 Monitor Well Installation

Monitor wells at the Northeast Landfill consisted of 4-inch [inside-diameter (I.D.)] PVC casing and slotted pipe installed in boreholes which penetrated the upper portion of the ~~Chanute~~ Vulcaite Formation. Flush-joint,

threaded PVC casing and slotted pipe was used to avoid the necessity of using PVC solvent cement. Well installation proceeded as follows:

1. A pilot-hole was drilled with 6-inch hollow-stem augers. Split-spoon samples were taken every 5-feet;
2. The pilot-hole was reamed with solid, continuous-flight, 12-inch augers;
3. Flush-joint, threaded PVC casing and slotted pipe were placed in the borehole after the augers were removed. Slotted pipe extended from approximately 5-feet below land surface (BLS) to the bottom of the borehole;
4. The annular space was filled with fine-to-medium sand to above the top of the slotted pipe, followed by approximately 1 foot of bentonite pellets, and then by a sand-cement grout;
5. An iron protective casing (5-foot by 6-inches) was embedded in the grout before it cured; and
6. Three well volumes were bailed from each well before sampling to ensure that the sample was representative of water in the soil surrounding each well and to ensure that the hydraulic connection between the well and the soil would permit future sampling, if any. WAR did not employ more elaborate well development techniques since past experiences (Keirn, et al., 1980, p. 2-4)[3] has demonstrated the futility of extensive development of wells installed in clay soils. One may expect that the well will produce water, but it is unrealistic to expect clear water.

Monitor well construction details are in Appendix A; monitor well locations are shown in Figures 5 and 6.

3.2.2 Sample Collection and Preservation

Groundwater samples were collected from each well after the wells had been purged three times. A three-well-volume purge was selected because of the slow recharge characteristics of wells NE-1 and NE-2. Samples

[3]Keirn, M.A., et al., 1980. Environmental Survey of Alabama Army Ammunition Plant. U.S. Army Toxic and Hazardous Materials Agency Report No. DRXTH-FS-CR-81104. Aberdeen Proving Ground, Maryland.

were collected with a PVC bailer in which no solvent cement was used. The bailer was thoroughly rinsed with deionized water between wells. However, the bailer was not given a solvent rinse between wells since this practice could liberate plasticizers from the PVC and consequently contaminate later samples. Each sample fraction was carefully decanted from the bailer into an appropriate container and then chilled. Table 1 details sample volume and container type for the various analyses.

Surface water samples were collected from three stations on Scope Creek as planned. However only one leachate sample was collected, since no seep was observed at the Northeast Landfill. At each surface water or leachate sampling station the water was less than 1 foot deep; consequently, these samples were collected by filling the sample container for each fraction directly from the stream or seep while taking care to exclude floating debris. The samples were chilled following collection.

The various sample fractions were preserved according to the instructions summarized in the QA/QC Plan (Appendix C), packed in ice, and transported to WAR's Gainesville, Florida laboratory. Metals and organic carbon samples were filtered through a 0.45-micron filter before acidification to ensure that the analytical results would represent dissolved species only. A duplicate set of samples was taken from well NE-3 for quality control purposes.

Some data were taken in the field and recorded on field data sheets (Appendix D). These data included pH, specific conductance, and temperature of the sample collected at each station. Depth to water from the top of the PVC well casing was recorded for groundwater samples. In the case of surface water and leachate samples, the depth of the water column and sample depths were recorded. Chain of custody forms (Appendix E) were maintained for samples shipped to subcontractor laboratories.

4.0 RESULTS AND SIGNIFICANCE OF FINDINGS

4.0 RESULTS AND SIGNIFICANCE OF FINDINGS

4.1 RESULTS OF THE PHASE II STUDY

Table 2 summarizes the results of the analysis of samples collected at Richards-Gebaur AFB during this study. These results may be compared to Missouri Water Quality Standards which are also included in Table 2. Scope Creek is not classified by the Missouri Water Quality Standards; consequently, only the General Criteria (10 CSR 20-7.031 (3)] apply to Scope Creek[4]. These general criteria are stated as follows:

> "General Criteria: The following water quality criteria shall be applicable to all waters of the state at all times. The Clean Water Commission will require all necessary and reasonable measures to prevent water quality from being less than these minimum standards. The waters of the state shall be:
>
> A. Free from substances that will cause the formation of putrescent or otherwise objectionable bottom deposits;
>
> B. Free from oil, scum, and floating debris in sufficient amounts to be unsightly or deleterious;
>
> C. Free from materials that cause color, odor, or other conditions in such degree as to create a nuisance.
>
> D. Free from substances or conditions that have a harmful effect on human, animal, or aquatic life."

Numeric criteria for the Little Blue River downstream of Scope Creek have been included in Table 2 for comparison purposes. Only the parameters studied in this report were excerpted.

Groundwater standards were included in Table 2 since Mr. Gordon Ackley[4] of the Missouri DNR indicated that the residual clay soils at Richards-Gebaur AFB would probably be considered an aquifer as defined by Missouri regulations [10 CSR 20-7.031(1)] which state:

> "Aquifer: A subsurface water-bearing bed or stratum of sand, gravel, or bedrock which stores or transmits water in recoverable quantities."

---

[4]Ackley, G. 1983. Personal Communication, Missouri Department of Natural Resources, Jefferson City, Missouri.

It was Mr. Ackley's opinion that the state would consider any quantity of groundwater in the study area a "recoverable quantity" since useable sources of groundwater are scarce near Richards-Gebaur AFB.

Specific conductance is an indicator of the amount of dissolved, ionic material in water. In 1962, the U.S. Public Health Service recommended limit for dissolved solids in drinking water was 500 mg/l (American Water Works Association, Inc., 1971, p. 41)[5]. Specific conductance of waters containing 500 mg/l might be expected to range from 550 to 900 umho/cm. The values of specific conductance in wells NE-1 through NE-3 are relatively high (840 to 1,210 umho/cm) for freshwater and are indicative of ionic constituents of landfill leachate other than the five metals examined in this study. These ionic constituents are not necessarily hazardous. For example, sodium, chloride, calcium, and sulfate ions typically make up a large proportion of the ionic constituents of sanitary landfill leachate (Fenn, et al., 1977, p. 197)[6].

Duplicate samples from Well NE-3 were used as a means of checking the accuracy of the laboratory analyses. These samples were not identified as duplicates to the analytical laboratories. Comparison of the analytical results for these samples shows good precision (Table 2).

4.2 SIGNIFICANCE OF THE FINDINGS

The results of the analyses of water samples collected during this study do not indicate the presence of significant environmental contamination at either the Northeast Landfill or the South Landfill. However, the concentrations of phenolics in the samples from L-1 and NE-3 exceed the Missouri groundwater standards and may require some additional study

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[5]American Water Works Association, Inc. 1971. Water Quality and Treatment, A Handbook of Public Water Supplies. McGraw-Hill Book Company.

[6]Fenn, D., et al., 1977. Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities. U.S. Environmental Protection Agency Publication No. EPA/530/SW-611.

(Table 2). The test for phenolics measures an entire class of compounds without differentiating among the members of this class. Some phenolics occur naturally (Buikema, et al., 1979)[7]; whereas others (the 11 acid extractable compounds) are among the compounds on the EPA priority pollutant list (Table 3) and are primarily industrial contaminants.

Groundwater from all three wells at the Northeast Landfill are slightly more acidic than Missouri state standards (Table 2); however, a pH of 5.8 to 6.0 is not at all unusual for groundwater from a water table aquifer.

Field observations and measurements made in this study indicate that groundwater in the residual clay soils at the Norhteast Landfill flows horizontally toward Scope Creek. The sequence of materials (Appendix A) there consists of unsaturated but moist soils overlying saturated soils which in turn rest upon dry shale. The hydraulic gradient is downslope toward Scope Creek as depicted in Figure 5.

The average linear velocity of groundwater at the Northeast Landfill is generally low and may be estimated by an application of Darcy's Law (Freeze and Cherry, 1979)[8] in the form of:

$$q = (K \times I) / p$$

where: q = average linear velocity (M/SEC)

K = hydraulic conductivity (M/SEC)*

I = hydraulic gradient (dimensionless)

P = porosity (dimensionless).

By assuming: $K = 1 \times 10^{-8}$ M/SEC (Moccia et al., 1983)

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[7]Buikema, A.L., Jr. et al., 1979. Phenolics in Aquatic Ecosystems: A Selected Review of Recent Literature. Marine Environmental Research. 2:87-179.

[8]Freeze, R.A. and J.A. Cherry. 1979. Groundwater. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 604 pp.

*In older texts, K is sometimes called the coefficient of permeability.

I = 0.0078 (Dervied from Figure 5)

p = 0.40 (Davis, 1969)[9],

the average linear velocity of groundwater in soils at the Northeast Landfill may be estimated as 6 millimeters per year. This, of course, is remarkably slow, and it does not account for zones of higher permeability like that encountered at well NE-3. At that well, a 6-inch zone of chert fragments in a silty clay matrix enhanced the recovery of well NE-3 such that it would recover within 1-hour after being bailed dry. Wells NE-1 and NE-2 took approximately 12 to 24 hours to recover after being bailed dry. Even so, it is unlikely that such zones would have a significant rate of flow. As an example, the flow rate would have to increase by a factor of 167 to exceed 1 meter per year; therefore, the given data indicate that the overall rate of leachate migration at the Northeast Landfill is much less than 1 meter per year.

4.3 NEW INFORMATION CONCERNING THE LOCATION OF THE NORTHEAST LANDFILL

In October 1983, Mr. John Hurd of the Richards-Gebaur AFB Civil Engineering office provided USAS OEHL additional information regarding the location of the trenches at the Northeast Landfill (Figure 6). The trench locations in Figure 6 are based upon interviews with two older employees. According to Mr. Hurd[10], these employees told him that the Northeast Landfill consists solely of the three trenches depicted in Figure 6 and that it is not as large as Moccia, et al. (1983) reported (Figures 3 and 5).

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[9]Davis, S.N. 1969. Porosity and permeability of natural materials. In: R.J.M. DeWeist, ed. Flow Through Porous Media. Academic Press. New York. pp. 53-89.

[10]Hurd, J. 1983. Personal Communication. Richards-Gebaur AFB, Missouri.

5.0 ALTERNATIVE MEASURES

5.0 ALTERNATIVE MEASURES

Three alternatives are possible for the sites investigated: (1) correct the contamination; (2) conduct further monitoring to determine the need, if any, of clean up; or (3) take no further action.

Alternative 1 is appropriate where there is clear indication that present or future human or environmental problems will exist. The priority for actions would depend on the magnitude of the threat and whether that threat was current or future.

Alternative 2 is appropriate where insufficient evidence exists to place a site in either the Alternative 1 or 3 categories. This alternative should be utilized with care since there is some risk that delay could allow contamination to spread and worsen the problem. The goal should be to gather enough evidence in a timely manner to resolve the question of whether or not the site should be cleaned up.

Alternative 3 is appropriate for sites where there is little, if any, evidence to indicate that the site is or will ever be a source of significant contamination. This is a difficult decision in that one can never be absolutely sure that no problem will ever exist at a site. However, reasonable judgements must be made so that resources can be allocated to sites that have the highest potential for environmental insult.

Data of the present study do not reveal the degree of contamination at either site that would necessitate Alternative 1 actions. Since the Air Force is in the process of returning portions of Richards-Gebaur AFB to civilian control through lease or transfer, a limited program of further monitoring (Alternative 2) is warranted. The primary goal of follow-up monitoring should be to clarify the nature of the phenolics detected at stations L-1 (5 ug/l) and NE-3 (4 ug/l) and to monitor groundwater in the residual clays adjacent to the trenches shown in Figure 6. This would require the installation of at least two additional wells at the Northeast Landfill; these wells would be sampled for the same analyses

performed in this study (Table 2). A lower priority in the followup work would be to: (1) conduct additional testing at all sites to increase the level of confidence in the technical data and (2) increase somewhat the constituents included in the analytical testing to assure that the elevated levels of specific conductance are not indicative of toxic materials not analyzed for in the present study (e.g., other priority pollutant metals).

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

There is evidence of low-level contamination of the groundwater and surface water of Richards-Gebaur AFB at the two landfills examined in this study. However, this evidence is based upon parameters (phenolics and specific conductance) which do not yield contaminant-specific information. The test for phenolics measures these compounds as a group without determining specific compounds. Some phenolics occur naturally and are not of particular concern. However, 11 man-made phenolics are included in the EPA list of priority pollutants (Table 3). Some of these were used in maintenance activities at Richards-Gebaur AFB (phenolic cleaners and paint strippers) (Moccia et al., 1983). Specific conductance measures the ability of a sample of water to conduct an electric current and consequently is an indirect measure of the amount of dissolved materials in the sample. Specific conductance does not differentiate between hazardous and nonhazardous dissolved species.

6.2 RECOMMENDATIONS

WAR recommends the following additional sampling and analyses program:

1. Resample stations L-1 and NE-3, and if the colorimetric test [EPA Method 420.2 (Table B-1)] for phenolics is positive, analyze these samples for the 11 specific phenolics compounds on the priority pollutant list. This will clarify the origin (natural or industrial) of the phenolics at these two stations. If phenolics of concern are detected, additional study should be conducted to define the quantity and rate at which these materials are or will be entering Scope Creek.
2. Install two additional monitor wells adjacent to the trenches shown in Figure 6. These wells should be constructed following the procedures outlined in Section 3.2.1 after field verifying the trench locations. Groundwater from these wells should be analyzed for the parameters listed in Table 2.

NE LANDFILL

7.0 TABLES

Table 1. Preservation Methods for Water Samples Collected at Richards-Gebaur AFB, Missouri

Parameter	Phase	Container	Preservation
TOX	Water	4 oz Amber-glass	Chill to 4°C; no headspace
Oil and Grease	Water	4 oz Amber-glass	HCl to pH<2; Chill to 4°C
Phenolics	Water	4 oz Amber-glass	Filter, then; H_3PO_4 to pH<2; 1 gm $CuSO_4$; Chill to 4°C
Heavy Metals	Water	1 Plastic	Filter, then HNO_3 to pH<2; Chill to 4°C
Organic Carbon	Water	2 oz Plastic	H_2SO_4 to pH<2; Chill to 4°C
Purgeable Organics	Water	2 oz Amber-glass	Chill to 4°C; no headspace

Table 2. Results of Analyses of Environmental Samples Collected at Richards-Gebaur AFB, May 1983 and Missouri Water Quality Standards

Parameter	South Landfill S-1	South Landfill S-2	South Landfill L-1	Northeast Landfill NE-1	Northeast Landfill NE-2	Northeast Landfill NE-3 Dup 1	Northeast Landfill NE-3 Dup 2	Northeast Landfill S-3	Groundwater	MISSOURI WATER QUALITY STANDARDS* Surface Water** Protection of Aquatic Life	MISSOURI WATER QUALITY STANDARDS* Surface Water** Livestock, Wil life Watering
pH	6.4	6.4	5.9	5.8	6.0	5.8	5.8	6.0	6.5-9.0	--	--
Temp. °C	16.5	19	19	13	13	13	13	17.5			
Sp. Cond. (umhos/cm)	660	630	720	840	1,210	840	840	320			
DOC (mg/L)***	1	2	3	1	2	2	3	4			
TOX (mg Cl/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			
Phenolics (ug/L)	<1	<1	5	<1	<1	4	4	<1	1	--	--
Cadmium (ug/L)	<3	<3	<3	<3	<3	<3	<3	<3	10	12	--
Chromium (ug/L)	<3	<3	<3	<3	<3	<3	<3	<3	50	100	--
Copper (ug/L)	<3	<3	<3	<3	<3	<3	<3	<3	20	20	500
Lead (ug/L)	<21	<21	<21	33	<21	<21	30	26	50	50 or 100†	--
Nickel (ug/L)	<6	<6	<6	9	10	6	6	<6	100	100	200
Oil & grease (mg/L)	<2	<2	NA	NA	NA	NA	NA	<2			
Purgeable organics (ug/L)	NA	NA	<10	NA	NA	<10	<10	NA			

NOTES: N.A. = Not analyzed.
Specific conductance values are corrected to 25°C.
All metals values are ug/L, dissolved.
S = Surface water
L = Seepage
NE = Groundwater
Dup 1 and Dup 2 are duplicate samples.

*Source: Missouri Code of State Regulations, Title 10, Department of Natural Resources, Division 20, Clean Water Commission, Chapter 7-Water Quality.

**These standards do not apply to Scope Creek but do apply to the Little Blue River downstream of Scope Creek. They are included for reference only.

***D[illegible] detection limit is 1 mg/l. Other detection limits indicated [illegible]able (e.g., <1 ug/l).

†Higher value is applicable if total hardness exceeds 300 mg/l.

Table 3. EPA List of 129 Priority Pollutants and the Relative Frequency of these Materials in Industrial Wastewaters[11]

Percent of Samples*	Number of Industrial Categories**	
31 are purgeable organics		
1.2	5	Acrolein
2.7	10	Acrylonitrile
29.1	25	Benzene
29.3	28	Toluene
16.7	24	Ethylbenzene
7.7	14	Carbon tetrachloride
5.0	10	Chlorobenzene
6.5	16	1,2-Dichloroethane
10.2	25	1,1,1-Trichloroethane
1.4	8	1,1-Dichloroethane
7.7	17	1,1-Dichloroethylene
1.9	12	1,1,2-Trichloroethane
4.2	13	1,1,2,2-Tetrachloroethane
0.4	2	Chloroethane
1.5	1	2-Chloroethyl vinyl ether
40.2	28	Chloroform
2.1	5	1,2-Dichloropropane
1.0	5	1,3-Dichloropropene
34.2	25	Methylene chloride
1.9	6	Methyl chloride
0.1	1	Methyl bromide
1.9	12	Bromoform
4.3	17	Dichlorobromomethane
6.8	11	Trichlorofluoromethane
0.3	4	Dichlorodifluoromethane
2.5	15	Chlorodibromomethane
10.2	19	Tetrachloroethylene
10.5	21	Trichloroethylene
0.2	2	Vinyl chloride
7.7	18	1,2-trans-Dichloroethylene
0.1	2	bis (Chloromethyl) ether
46 are base/neutral extractable organic compounds		
		1,2-Dichlorobenzene
6.0	9	1,3-Dichlorobenzene
		1,4-Dichlorobenzene
0.5	5	Hexachloroethane
0.2	1	Hexachlorobutadiene

Table 3. EPA List of 129 Priority Pollutants and the Relative Frequency of these Materials in Industrial Wastewaters[11]
(Continued, Page 2 of 4)

Percent of Samples*	Number of Industrial Categories**	
1.1	7	Hexachlorobenzene
1.0	6	1,2,4-Trichlorobenzene
0.4	3	bis (2-Chloroethoxy) methane
10.6	18	Naphthalene
0.9	9	2-Chloronaphthalene
1.5	13	Isophorone
1.8	9	Nitrobenzene
1.1	3	2,4-Dinitrotoluene
1.5	9	2,6-Dinitrotoluene
0.04	1	4-Bromophenyl phenyl ether
41.9	29	bis (2-Ethylhexyl) phthalate
6.4	12	Di-n-octyl phthalate
5.8	15	Dimethyl phthalate
7.6	20	Diethyl phthalate
18.9	23	Di-n-butyl phthalate
5.7	11	Fluorene
7.2	12	Fluoranthene
5.1	9	Chrysene
7.8	14	Pyrene
10.6	16	Phenanthrene
		Anthracene
2.3	6	Benzo(a)anthracene
1.6	6	Benzo(b)fluoranthene
1.8	6	Benzo(k)fluoranthene
3.2	8	Benzo(a)pyrene
0.8	4	Indeno(1,2,3-c,d)pyrene
0.2	4	Dibenzo(a,h)anthracene
0.6	7	Benzo(g,h,i)perylene.
0.1	2	4-Chlorophenyl phenyl ether
0	0	3,3'-Dichlorobenzidine
0.2	4	Benzidine
1.1	4	bis(2-Chloroethyl) ether
0.8	7	1,2-Diphenylhydrazine
0.1	1	Hexachlorocyclopentadiene
1.2	5	N-Nitrosodiphenylamine
4.5	12	Acenaphthylene
4.2	14	Acenaphthene
8.5	13	Butyl benzyl phthalate

Table 3. EPA List of 129 Priority Pollutants and the Relative Frequency of these Materials in Industrial Wastewaters[11] (Continued, Page 3 of 4)

Percent of Samples*	Number of Industrial Categories**	
0.1	1	N-Nitrosodimethylamine
0.1	2	N-Nitrosodi-n-propylamine
1.4	6	bis(2-Chloroisopropyl) ether
11 are acid extractable organic compounds		
26.1	25	Phenol
2.3	11	2-Nitrophenol
2.2	9	4-Nitrophenol
1.6	6	2,4-Dinitrophenol
1.1	6	4,6-Dinitro-o-cresol
6.9	18	Pentachlorophenol
1.9	8	p-Chloro-m-cresol
2.3	10	2-Chlorophenol
3.3	12	2,4-Dichlorophenol
4.6	12	2,4,6-Trichlorophenol
5.2	15	2,4-Dimethylphenol
26 are pesticides/PCBs		
0.3	3	-Endosulfan
0.4	4	-Endosulfan
0.2	2	Endosulfan sulfate
0.6	4	-BHC
0.8	6	-BHC
0.2	4	-BHC
0.5	3	-BHC
0.5	5	Aldrin
0.1	3	Dieldrin
0.04	1	4,4'-DDE
0.1	2	4,4'-DDD
0.2	2	4,4'-DDT
0.2	3	Endrin
0.2	2	Endrin aldehyde
0.3	3	Heptachlor
0.1	1	Heptachlor epoxide
0.2	4	Chlordane
0.2	2	Toxaphene
0.6	2	Arochlor 1016

Table 3. EPA List of 129 Priority Pollutants and the Relative Frequency of these Materials in Industrial Wastewaters[11] (Continued, Page 4 of 4)

Percent of Samples*	Number of Industrial Categories**	
0.5	1	Aroclor 1221
0.9	2	Aroclor 1232
0.8	3	Aroclor 1242
0.6	2	Aroclor 1248
0.6	3	Aroclor 1254
0.5	1	Aroclor 1260
---	--	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
13 are metals		
18.1	20	Antimony
19.9	19	Arsenic
14.1	18	Beryllium
30.7	25	Cadmium
53.7	28	Chromium
55.5	28	Copper
43.8	27	Lead
16.5	20	Mercury
34.7	27	Nickel
18.9	21	Selenium
22.9	25	Silver
19.2	19	Thallium
54.6	28	Zinc
Miscellaneous		
33.4	19	Total cyanides
Not available		Asbestos (fibrous)
Not available		Total phenols

[11] NRDC Consent Agreement and Committee Print 95-30. 1977. Data Relating to H.R. 3199 (Clean Water Act of 1977). Committee on Public Works and Transportation, 95th Congress, 1st Session. Government Printing Office.

*The percent of samples represents the number of times this compound was found in all samples in which it was analyzed for divided by the total as of 31 August 1978. Numbers of samples ranged from 2532 to 2998 with the average being 2617.

**A total of 32 industrial categories and subcategories were analyzed for organics and 28 for metals as of 31 August 1978.

8.0 FIGURES

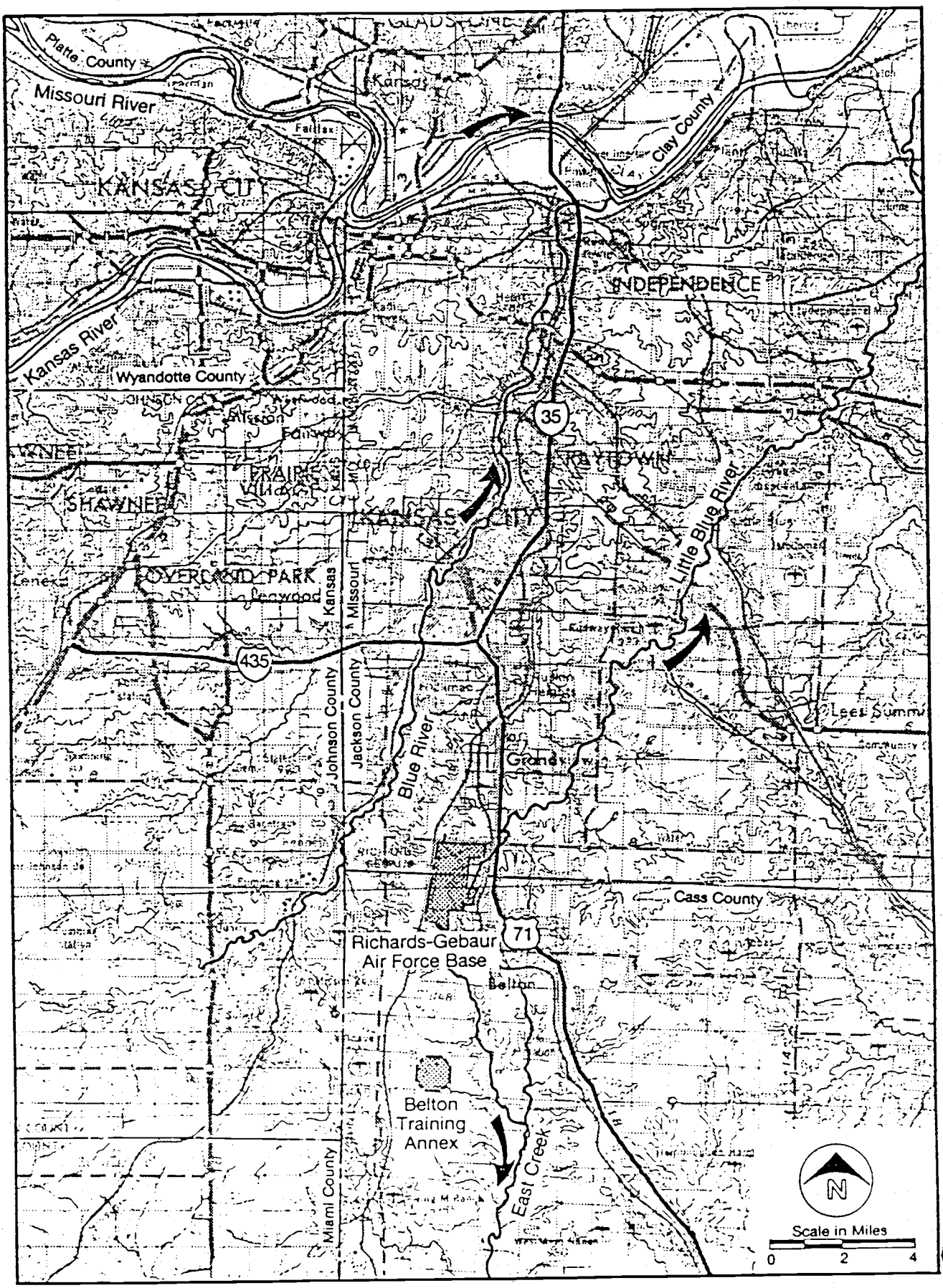


FIGURE 1. Location Map of Richards–Gebaur AFB, Missouri

(After Moccia ETAL., 1983).

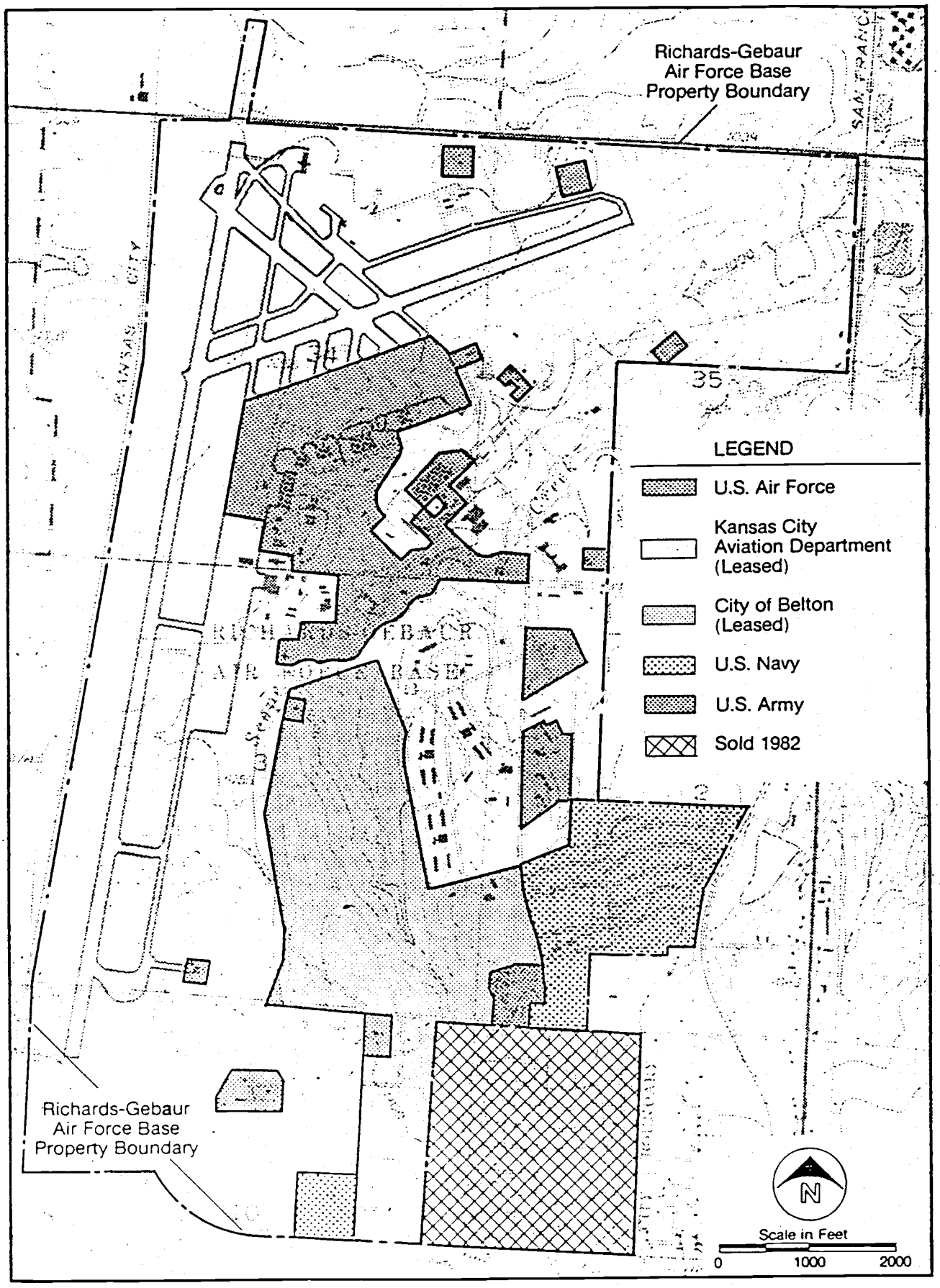


FIGURE 2. Real Property Areas, Richards—Gebaur AFB, Missouri

(After Moccia ETAL., 1983).

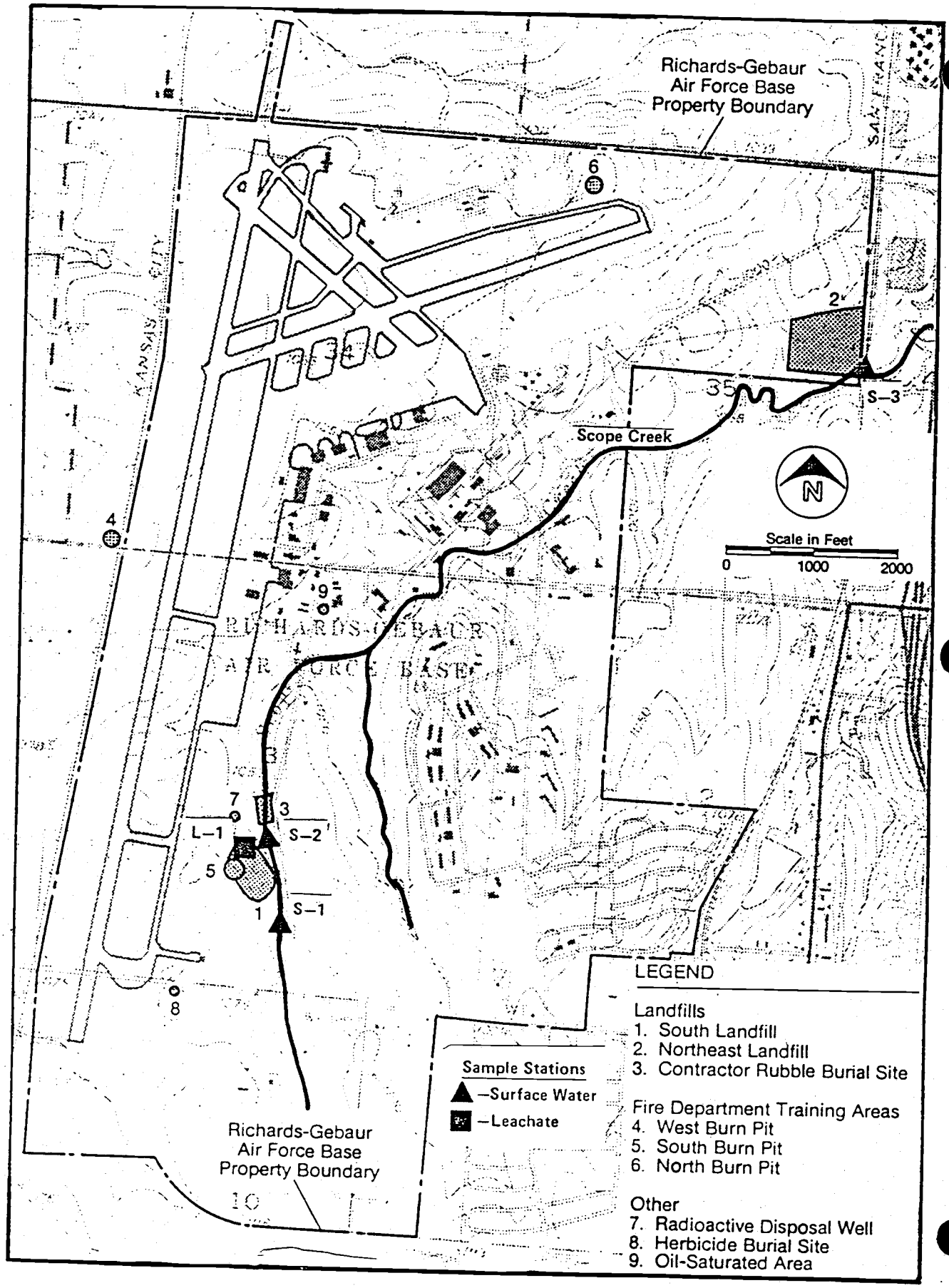


FIGURE 3. Identified Disposal Sites and Surface Water Sampling Stations, Richards–Gebaur AFB, Missouri

(After Moccia ETAL., 1983).

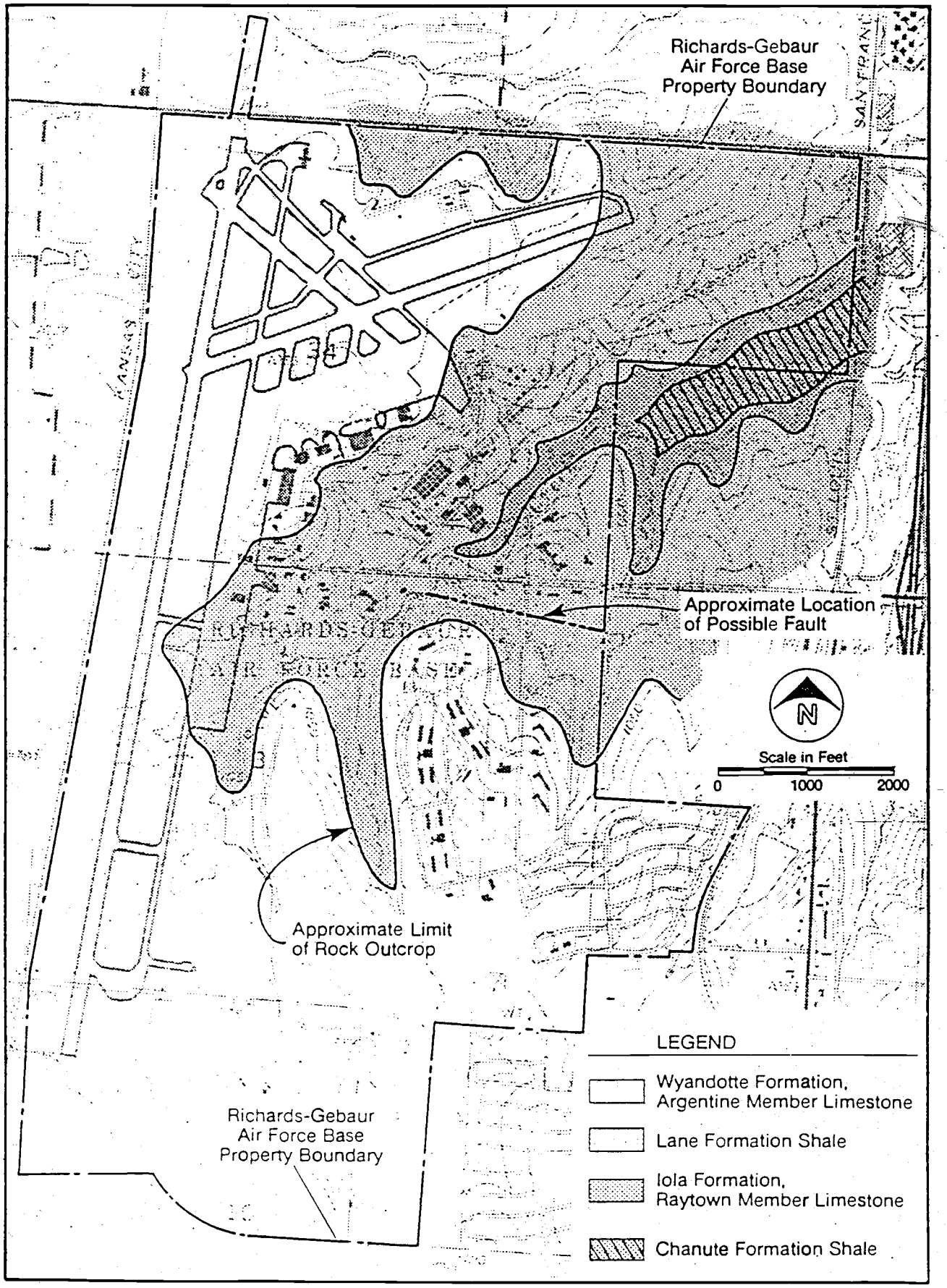


FIGURE 4. Geologic Map of Richards—Gebaur AFB, Missouri

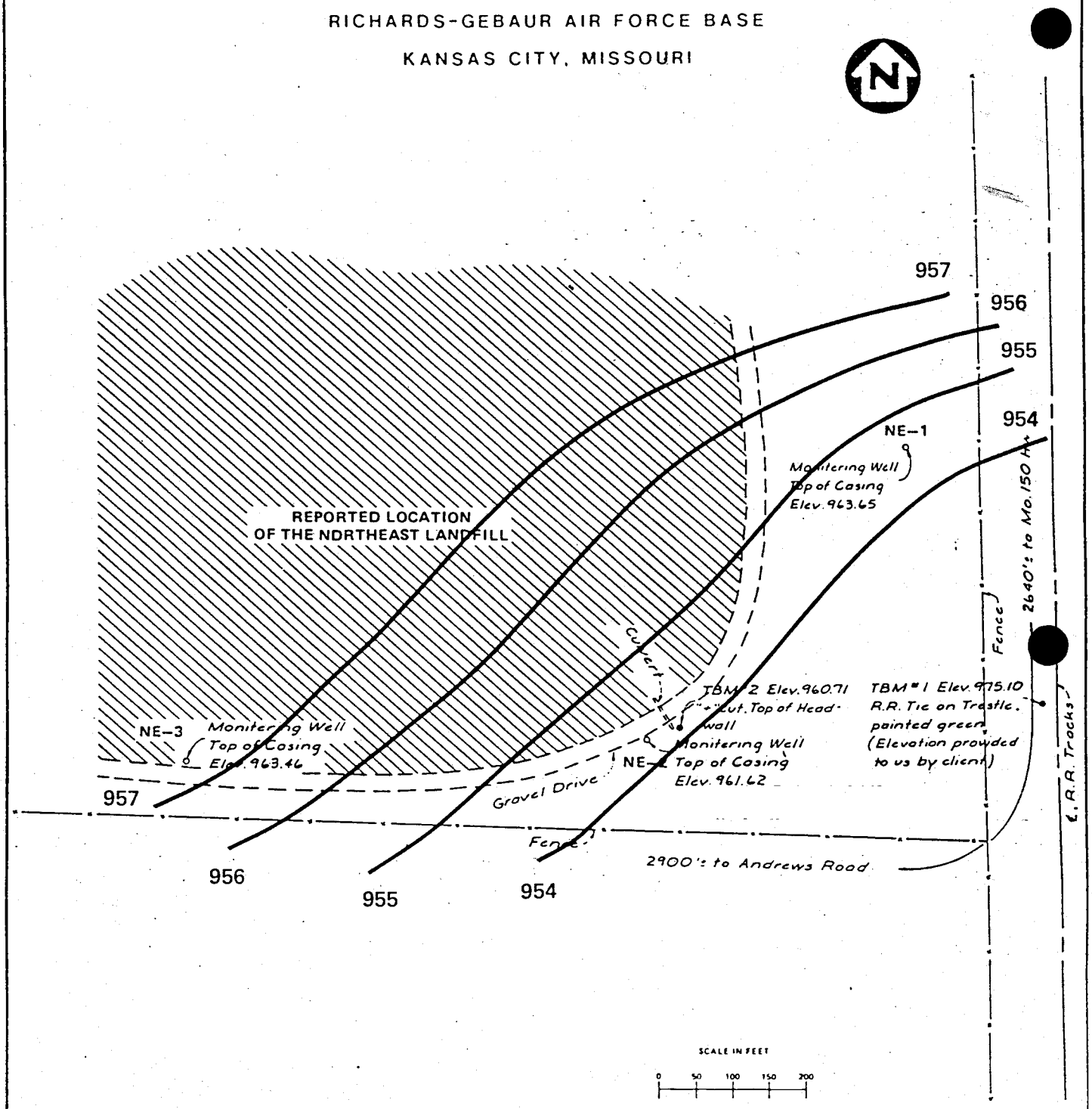
(After Moccia ETAL., 1983).

CERTIFICATE OF SURVEY

MONITORING WELL LOCATION SURVEY

RICHARDS-GEBAUR AIR FORCE BASE

KANSAS CITY, MISSOURI



THIS IS TO CERTIFY THAT THE UNDERSIGNED REGISTERED LAND SURVEYOR HAS COMPLETED A TRUE AND ACCURATE SURVEY OF THE ABOVE DESCRIBED PREMISES AND THAT ALL MEASUREMENTS SHOWN ANGULAR AND LINEAR WERE MEASURED ON THE GROUND AND MONUMENTS WERE SET AS SHOWN.

Water and Air Research, Inc

35	47	33	Jo	Mo	6-13-83; 83-185K

MISSOURI No. L.S. 1478 ROGER LEE BRENIZER REGISTERED LAND SURVEYOR

FIGURE 5. Well Locations and Water Level Elevations in Soils at the Northeast Landfill, May 1983. (Water level contours by WAR)

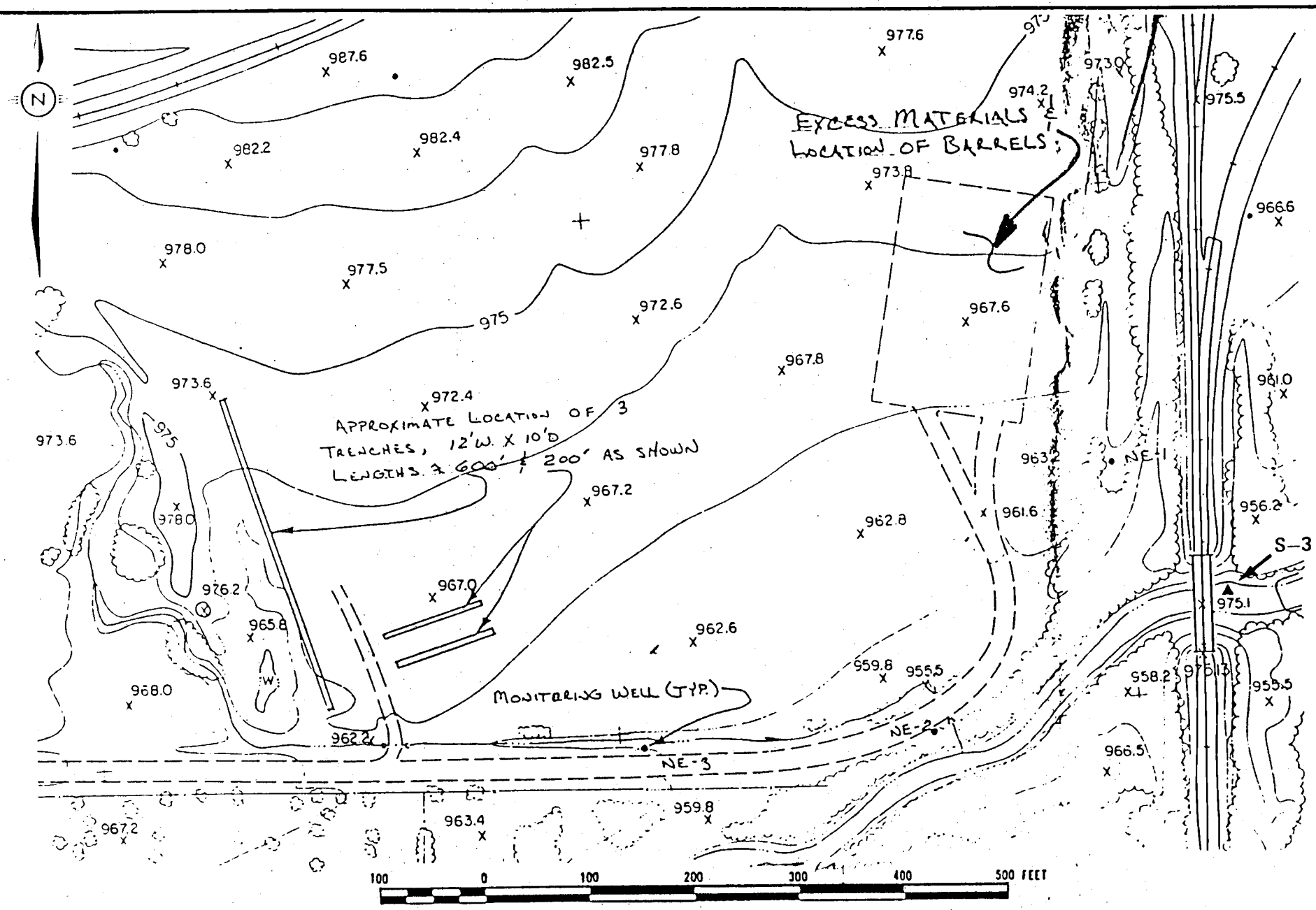


FIGURE 6. Revised Locations of Trenches of the Northeast Landfill

SOURCE: Richards–Gebaur AFB, October, 1983.

9.0 REFERENCES

[1]Moccia, D.M. et al., 1983. Installation Restoration Program Records Search for Richards-Gebaur AFB, Missouri. Prepared for U.S. Air Force AFESC/DEV, Tyndall AFB, Florida. Contract No. F08637-80-G0010-6S01.

[2]U.S. EPA. 1983. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020. Cincinnati, Ohio.

[3]Keirn, M.A., et al., 1980. Environmental Survey of Alabama Army Ammunition Plant. U.S. Army Toxic and Hazardous Materials Agency Report No. DRXTH-PS-CR-81104. Aberdeen Proving Ground, Maryland.

[4]Ackley, G. 1983. Personal Communication, Missouri Department of Natural Resources, Jefferson City, Missouri.

[5]American Water Works Association, Inc. 1971. Water Quality and Treatment, A Handbook of Public Water Supplies. McGraw-Hill Book Company. p. 41.

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[9]Davis, S.N. 1969. Porosity and permeability of natural materials. In: R.J.M. DeWeist, ed. Flow Through Porous Media. Academic Press. New York. pp. 53-89.

[10]Hurd, J. 1983. Personal Communication. Richards-Gebaur AFB, Missouri.

[11]NRDC Consent Agreement and Committee Print 95-30. 1977. Data Relating to H.R. 3199 (Clean Water Act of 1977). Committee on Public Works and Transportation, 95th Congress, 1st Session. Government Printing Office.

SHEET 1 OF 1

Boring No. NE-1

Hole Size 12 IN x 25.75' Slot 0.. 10"

Screen Size 4 IN x 18.84' Mat'l SCH 40 PVC

Casing Size 4 IN x 8.33' Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 23 MAY 83 Finish 24 MAY 83

Contractor W.A.R. / LAYNE WEST.

Driller O.J. HARPER

Location Coordinates REL. LOC.

Filter Materials F-M SAND

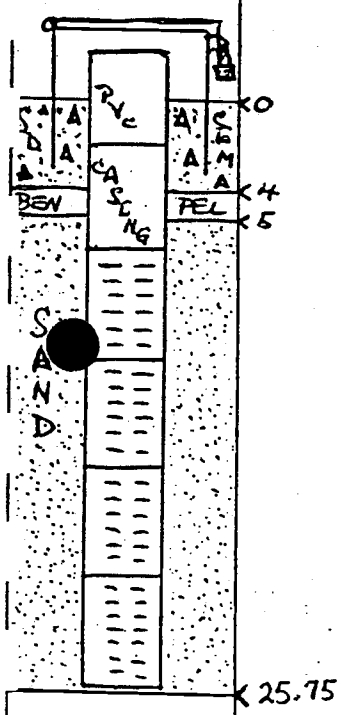
Grout Type SAND CEMENT

Protective Casing 5 FT x 6 IN IRON

Static Water Level 9.14 FT TOC

Top of Well Elevation 963.65 REL

Drill Type CME-45 & 12 IN CFA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	CLAY, ~5% SLT & VF SD, SL STIFF, MOIST, BLACK (10YR 2/1)	CL	N/A
		5-6½	CLAY, ~5% SLT & VF SD, V. STIFF, MOIST, DK BRN (10YR 4/3)	CL	8
		10-11½	CLAY, AS ABOVE, BRN (10YR 5/3)	CL	11
		15-15½	CLAY, AS ABOVE.	CL	RFSL
		15½-15¾	SHALE, SANDY, FISSILE, DRY, GRAY (N5/).	ROCK	
		25.75	SHALE, AS ABOVE	ROCK	RFSL.

SHEET 1 OF 1

Boring No. NE-2

Hole Size 12 IN x 19.5' Slot 0.010"

Screen Size 4 IN x 14.19' Mat'l SCH 40 PVC

Casing Size 4 IN x 7.20' Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 24 MAY 83 Finish 25 MAY 83

Contractor W. A.R. / LAYNE WEST.

Driller O. J. HARPER

Location Coordinates REL LOC

Filter Materials F-M SAND

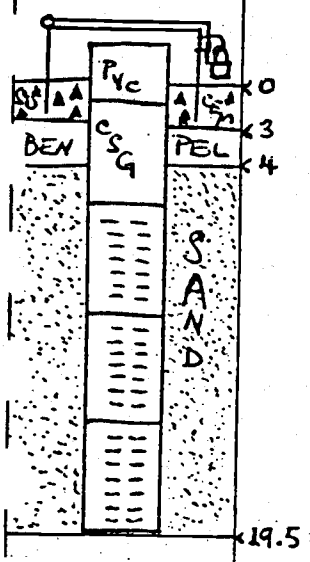
Grout Type SAND CEMENT

Protective Casing 5 FT x 6 IN IRON

Static Water Level ~7.5 FT TOC

Top of Well Elevation 961.62 REL

Drill Type CME 45 C 12 IN CFA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		⊗	CLAY, ~5% SLT & VF SD, SLT STIFF, MOIST, BLACK. (5Y 2½/2)	CL	NA
		5-6½	CLAY, AS ABOVE, SLT STIFF TO SOFT, V. DK GRAY (5Y 3/1	CL	8
		10-11½	CLAY, AS ABOVE TO ~11¼ LS & CLAY TO ~11½.	CL	11
		12½-20	SHALE, SANDY, DRY, NON-FISSILE LT GRAY. (7.5YR N7/	ROCK	REFUSAL

SHEET 1 OF 1

Boring No. NE-3

Hole Size 12 IN x 20.5' Slot 0.010 IN

Screen Size 4 IN x 14.22' Mat'l SCH 40 PVC

Casing Size 4 IN x 8.46' Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 25 MAY 83 Finish 25 MAY 83

Contractor W.A.R. / LAYNE WEST

Driller O. J. HARPER

Location Coordinates REL LOC.

Filter Materials F-M SAND

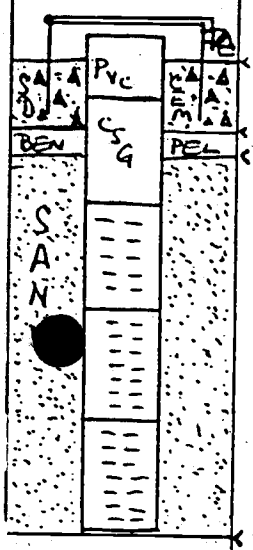
Grout Type SAND CEMENT

Protective Casing 5 FT x 6 IN

Static Water Level 5.96 FT TOC

Top of Well Elevation 963.46 FT REL

Drill Type CME-45 & 12 IN CFA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		Q-1½	ROAD MATERIALS. CLAY & GRAVEL	NA	NA
		1½	CLAY, ~5% SLT & VF SD, SOFT, MOIST, BLACK (5Y 2.5/1)	CL	
		5-6½	CLAY, AS ABOVE, STIFF, MOIST, GR BRN (2.5Y 5/2) MOTT BR YEL (10YR 5/7)	CL	8
		10-11½	10-10½ CLAY, AS ABOVE, ~~SATURATED~~ MOIST.	CL	12
			10½-11 CLAY, ~5% SLT & V.F. SD, ~10% CHERT FRAGS, SOFT, SATURATED, (10YR 4/2)	CL	
			11-11½ CLAY, ~5% SLT & VF SD V. STIFF, ~~SATURATED~~, DRY, BL GRAY & RED BRN.	CL-CH	RFSL
		15-15½	CLAY, ~5% SLT & VF SD, CHERT FRAGS, SOFT, SATURATED, GRADING TO: SHALE, SANDY, NON-FISSILE GRADING TO FISSILE, DRY, LT GRAY (7.5YR N7/)	N/A	RFSL
		20-21½	SHALE, SANDY, FISSILE, DRY, LT. GRAY. (7.5YR N 7/)		

APPENDIX B
LABORATORY METHODS

APPENDIX B
LABORATORY METHODS

B.1 ANALYTICAL RATIONALE

Table B-1 cites methods used to obtain chemical data during this investigation. All methods used in this study were U.S. Environmental Protection Agency (EPA) approved methods. Quality assurance and quality control (QA/QC) techniques are described in Appendix C.

Table B-1. Analytical Chemistry Methods for Water Samples, Richards-Gebaur AFB, Missouri

Parameter	Method	Reference
pH*	EPA 150.1	1
Specific Conductance*	EPA 120.1	1
Temperature*	EPA 170.1	1
Organic Carbon	EPA 415.1	1
Total Organic Halide	EPA 450.1	2
Oil and Grease	EPA 413.1	1
Phenolics**	EPA 420.2	1
Cadmium	EPA 213.2	1
Chromium	EPA 218.2	1
Copper	EPA 220.2	1
Lead	EPA 239.2	1
Nickel	EPA 249.2	1
Purgeable organics***	EPA 624	3

[1]EPA "Methods for Chemical Analysis of Water and Wastes," March 1979-Method number.

[2]Interim Method, November 1980, EMSL, Physical and Chemical Methods Branch, Cincinnati, Ohio 45268.

[3]EPA "Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater," July 1982-Method number.

*Performed at the time of sample collection.

**EPA Method 420.2 will not detect 2,4-dinitrophenol, 2-methyl-4, 6-dinitrophenol, or 4-nitrophenol. This method may or may not detect 2,4-dimethylphenol.

***Of the 31 purgeable organics covered by this method, a detection limit of <10 ug/l has been determined for all except bromomethane, chloroethane, 2-chloroethylvinyl ether, chloromethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, cis-1,3-dichloropropane, trichlorofluoromethane, and vinyl chloride. Section 14, Method Performance, states in 14.3, "The U.S.E.P.A. is in the process of conducting an interlaboratory method study to fully define the performance of this method."

APPENDIX C

QA/QC PLAN

APPENDIX C
QA/QC PLAN

C.1 ANALYTICAL QUALITY CONTROL

Accuracy of analytical techniques is assured by strict adherence to the referenced methods (see Table B-1). Integrity and representativeness of the sample is assured by the sampling procedures described in Section C-2, below. A check on analytical quality control is provided for by duplicating a minimum of 10 percent of the samples in each analysis lot. This was accomplished at Richards-Gebaur AFB by sampling one of the seven stations (Well NE-3) in duplicate and duplicating analyses for that station. Duplicate samples are labelled in such a way that the analytical laboratory cannot identify them. Results of duplicate analyses are shown in Table 2.

C.2 SAMPLING INSTRUCTIONS FOR RICHARDS-GEBAUR AFB

C.2.1 Metals

Metal samples from the wells should be from the first bailer (1L). Bottle should be filled to very top if dissolved metals are desired and filtration is not performed immediately.

Filtration should be as follows:

1. Glass fiber filter should be rinsed with 20-30 ml of 0.5 N HNO_3 after being placed in suction apparatus. Discard rinse.
2. Rinse filter with 20-30 ml of sample. Discard rinse.
3. Filter sample and return to bottle after the bottle has been rinsed with de-ionized water.
4. For membrane filtration, place filter in apparatus with gridded side up and follow steps 1-3. Preserve with conc. HNO_3 afterwards.
5. Samples must be filtered through the 0.45u filter for analytes to be considered dissolved. Filtration through a glass fiber filter reduces "binding" of the membrane filter but may not be needed for samples with little turbidity.

Preserve metal samples with 2 ml of HNO_3 per liter (after filtration for dissolved metals), mix and check pH by pouring small amount on pH test strip. pH should be less than 2; add more HNO_3 if necessary. Refrigeration is not necessary.

C.2.2 Oil and Grease

Sample bottle should be filled to bottom of threaded neck or close to it. Do not fill to top. Bottles are clear glass Mason jars, marked "G". Preserved with conc. HCI and refrigeration ($\leq 4°C$).

C.2.3 Purgeable Organics

This sample should come from the first aliquot of a bailer. Try to prevent excess turbulence (e.g., bubbling) when filling these bottles, as the analytes will be volatilized and lost. Angle bottle and pour water down the side. Fill bottle to an inverted meniscus and cap immediately. A small dimple (corvex) in the top of the septum indicates that the bottle is properly filled. There should be no air bubbles present in the bottle. The caps to these bottles are rather weak, but don't be afraid to crank them down tight, as extra caps have been provided. Bottles are amber glass, marked "V". Preservation is by refrigeration.

C.2.4 TOX

The same procedure as for purgeable organics, except caps are polypropylene-lined and there will be no septum with a dimple. Bottles are amber glass, marked "J". Refrigerate.

C.2.5 Phenolics

Bottles should be filled leaving 5-10 ml space in neck for spiking purposes. Bottles are amber glass, marked "P". Preserve with 1 ml of $CuSO_4$ solution. Disposable glass pipets provided are 2 ml volume, so use about half the volume of the pipet. Preserve also with conc. H_3PO_4 using disposable glass pipets. Refrigerate.

C.2.6 TOC

Bottle may be completely filled, as it will be subsequently filtered for dissolved organic carbon. Follow same procedure as for the metals samples, except final preservation is with conc. H_2SO_4 and refrigeration. Bottles are 8 oz. plastic.

APPENDIX D

FIELD DATA SHEETS

[RICH-GEB/AFB.1]FLD/SAMP.1
5/12/83

RICHARDS-GEBAUR AFB FIELD SAMPLE SHEET WGT, JAS

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: _____
Project No.: _____
Contract No.: _____
Date: 5/24/83
Time: 1500

Sampling Site/Well No.: S-1

Sampling Location Description: _____

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. _____ at _____ °C

Surface Water and Sediment Samples

Total Depth 3 inches

Sample Depth(s) surface

pH 6.4

Sp. cond. 55 x 10 at 16.5 °C

Container ~~Sample~~ No.	Container	Parameters to be Analyzed	Preservation Method	SAMPLE ~~Container~~ No.
		Water Samples		
G4	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	14187
P2	8 oz ~~1 qt.~~ glass	Phenols	H_3PO_4 to pH<~~2~~4 1 gm of $CuSO_4$,4°C	
Q24	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
J14, J15	8 oz. glass (2)	TOX	Chill to 4°C	
T298	8 oz. plastic	TOC	Chill to 4°C H_2SO_4 to pH<2	
	2 oz. glass	Purgeables	Chill to 4°C	

Comments and additional observations: low flow (<1 cfs), heavy algal growth on bottom

[RICH-GEB/AFB.1]FLD/SAMP.1
5/12/83

RICHARDS-GEBAUR AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: _____
Project No.: _____
Contract No.: _____
Date: 5/24/83
Time: 1915

Sampling Site/Well No.: S2

Sampling Location Description: _____

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. _____ at _____ °C

Surface Water and Sediment Samples

Total Depth 4 inches

Sample Depth(s) surface

pH 6.4

Sp. cond. 56 x 10 at 19 °C

~~Sample~~ Container No.	Container	Parameters to be Analyzed	Preservation Method	~~Container~~ SAMPLE No.
		Water Samples		
G3	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	14188
P4	~~1 qt.~~ 8 oz glass	Phenols	H_3PO_4 to pH<~~2~~ 4, 1 gm of $CuSO_4$,4°C	
Y-11	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
J13, J16	8 oz. glass (2)	TOX	Chill to 4°C	
T291	8 oz. plastic	TOC	Chill to 4°C H_2SO_4 to pH<2	
	2 oz. glass	Purgeables	Chill to 4°C	

Comments and additional observations: Same general appearance as at Station S1

[RICH-GEB/AFB.1]FLD/SAMP.1
5/12/83

RICHARDS-GEBAUR AFB FIELD SAMPLE SHEET WGT, JAS

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: _____
Project No.: _____
Contract No.: _____
Date: 5/24/83
Time: 1730 SUNNY

Sampling Site/Well No.: L-1
Sampling Location Description: SOUTH LANDFILL — LEACHATE

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ at _____ °C

Surface Water and Sediment Samples

Total Depth 2 inches
Sample Depth(s) surface
pH 5.9
Sp. cond. 64 X 10 at 19 °C

Container ~~Sample~~ No.	Container	Parameters to be Analyzed	Preservation Method	SAMPLE ~~Container~~ No.
		Water Samples		
	1 qt. glass ✓	Oil & Grease	HCl to pH<2,4°C	
P-1	~~1 qt.~~ 8 oz. glass ✓	Phenols	H_3PO_4 to pH<~~2~~ 4, 1 gm of $CuSO_4$,4°C	14189
Y-15	1 l plastic ✓	Heavy Metals	HNO_3 to pH<2,4°C	
J17, J18	8 oz. glass (2) ✓	TOX	Chill to 4°C	
T296	8 oz. plastic ✓	TOC	Chill to 4°C H_2SO_4 to pH<2	
V1	2 oz. glass ✓	Purgeables	Chill to 4°C	Y

Comments and additional observations: Calibrated pH meter @ 9.0 and 4.0. Instrument slow to respond & stabilize. Registered 4.1 in 4.0 solution but probably would have reached 4.0 if we gave it more time (reached 9.0 after 2-3 min)

[RICH-GEB/AFB.1]FLD/SAMP.1
5/12/83

RICHARDS-GEBAUR AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: _____
Project No.: _____
Contract No.: _____
Date: 5/25/83
Time: _____

Sampling Site/Well No.: W 1

Sampling Location Description: Well furthest from gate

Groundwater Samples

Depth to water surface 10' 1 5/8" TOC

Height of water column _____

pH 5.8

Sp. cond. 65 x 10 at 13.1 °C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____ at _____ °C

Container # ~~Sample No.~~	Container	Parameters to be Analyzed	Preservation Method	SAMPLE ~~Container~~ No.
		Water Samples		
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
P8	8 oz ~~1 qt.~~ glass	Phenols	H_3PO_4 to pH<~~2~~ 4, 1 gm of $CuSO_4$,4°C	14190
Y101	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
J1,18	8 oz. glass (2)	TOX	Chill to 4°C	
T282	8 oz. plastic	TOC	Chill to 4°C H_2SO_4 to pH<2	
	2 oz. glass	Purgeables	Chill to 4°C	

Comments and additional observations: _____

[RICH-GEB/AFB.1]FLD/SAMP.1
5/12/83

RICHARDS-GEBAUR AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: _____
Project No.: _____
Contract No.: _____
Date: 5/25/83
Time: ~~1615~~

Sampling Site/Well No.: W2

Sampling Location Description: Middle Well

Groundwater Samples

Depth to water surface 18'10" TOC *

Height of water column _____

pH 6.0

Sp. cond. 93 x 10 at 12.9 °C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____ at _____ °C

Container ~~Sample~~ No.	Container	Parameters to be Analyzed	Preservation Method	SAMPLE ~~Container~~ No.
		Water Samples		
[illegible]	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
P5	8 oz ~~1 qt.~~ glass	Phenols	H_3PO_4 to pH<2,4 1 gm of $CuSO_4$,4°C	14191
Y14	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
J7,J9	8 oz. glass (2)	TOX	Chill to 4°C	
T295	8 oz. plastic	TOC	Chill to 4°C H_2SO_4 TO pH<2	
	2 oz. glass	Purgeables	Chill to 4°C	

Comments and additional observations: * Well had not fully recovered from late morning bailing

[RICH-GEB/AFB.1]FLD/SAMP.1
5/12/83

RICHARDS-GEBAUR AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: _____
Project No.: _____
Contract No.: _____
Date: 5/25/83
Time: 1550

Sampling Site/Well No.: W3

Sampling Location Description: Well nearest gate

Groundwater Samples

Depth to water surface 5' 11½" TOC

Height of water column _____

pH 5.8

Sp. cond. 65 x 10 at 13.2 °C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____ at _____ °C

Container ~~Sample~~ No.	Container	Parameters to be Analyzed	Preservation Method	SAMPLE ~~Container~~ No.
		Water Samples		
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
P9	~~1 qt.~~ 8 oz glass	Phenols	H_3PO_4 to pH<~~2~~ 4, 1 gm of $CuSO_4$,4°C	14192
Y10	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
J5, J6	8 oz. glass (2)	TOX	Chill to 4°C	
C8	8 oz. plastic	TOC	Chill to 4°C H_2SO_4 to pH<2	
V5, V6	2 oz. glass	Purgeables	Chill to 4°C	

Comments and additional observations: _____

[RICH-GEB/AFB.1]FLD/SAMP.1
5/12/83

RICHARDS-GEBAUR AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: _____
Project No.: _____
Contract No.: _____
Date: 5/25/83
Time: 1550

Sampling Site/Well No.: W3 Dup

Sampling Location Description: Well nearest gate

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. _____ at ____ °C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____ at ____ °C

Container ~~Sample~~ No.	Container	Parameters to be Analyzed	Preservation Method	SAMPLE ~~Container~~ No.
		Water Samples		
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
P3	8 oz ~~1 qt~~. glass	Phenols	H_3PO_4 to pH<~~2~~ 4, 1 gm of $CuSO_4$,4°C	14193
Q51	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
U3, U4	8 oz. glass (2)	TOX	Chill to 4°C	
T288	8 oz. plastic	TOC	Chill to 4°C H_2SO_4 to pH<2	
V2, V3	2 oz. glass	Purgeables	Chill to 4°C	

Comments and additional observations: _____

12.9
93x10

[RICH-GEB/AFB.1]FLD/SAMP.1
5/12/83

RICHARDS-GEBAUR AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: _____
Project No.: _____
Contract No.: _____
Date: _____
Time: 1130

Sampling Site/Well No.: S3

Sampling Location Description: Under RR bridge

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. _____ at _____ °C

Surface Water and Sediment Samples

Total Depth 4 inches

Sample Depth(s) surface

pH 6.0

Sp. cond. 275 at 17.5 °C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
14194	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	G-1
	~~1 qt. glass~~ ~~Amber~~ 8 oz	Phenols	H_3PO_4 to pH<4, 1 gm of $CuSO_4$,4°C	P-6
	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	Y 12
	8 oz. glass (2)	TOX	Chill to 4°C	J-19, J-2
	8 oz. plastic	TOC	Chill to 4°C H_2SO_4 to pH<2	T 292
	2 oz. glass	Purgeables	Chill to 4°C	N/A

Comments and additional observations: pH Meter calibrated - pH 4.0 buffer = 4.0; 7.0 buffer = 6.95; 9.0 buffer = 9.0; standardized

APPENDIX E

CHAIN OF CUSTODY FORMS

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT:
PROJECT: 7166-080

SAMPLERS: (Signature) W.A.R., INC.

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required
S-1				Q24			14187	Nickel,
S-2				Y11			14188	Copper,
S.L.-L.				Y15			14189	Lead,
W-1				Y101			14190	Chromium,
W-2				Y14			14191	Cadmium
W-3				Y10			14192	(DISSOLVED)
W-3				Q51			14193	↓
S-3				Y12			14194	↓
	ALL SAMPLES FILTERED THRU 0.45 μm MEMBRANE & PRESERVED @ CONC. HNO_3							

Relinquished by: [signature] Organization:	Received by: Tom Parke Organization: ESE	Date/Time 5/27/83 11:20
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received for Laboratory by:	Date/Time

Method of Shipment: COMPANY COURIER

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT:
PROJECT: 7166 - 080

SAMPLERS: (Signature) W.A.R., INC.

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required
S-1	P2, T298	<0.001		X		1.15	14187	T.O.C.
S-2	P4, T291	<0.001				1.68	14188	Phenolics
L-1	P1, T296	0.005				3.24	14189	
W-1	P8, T282	<0.001				0.58	14190	
W-2	P5, T295	<0.001				1.72	14191	
W-3	P9, C8	0.004				1.67	14192	
W-3	P3, T288	0.004				2.52	14193	
S-3	P6, T292	<0.001				3.57	14194	
						TOC mg/l		from Marlene by phone
								6/8/93 1714
	T.O.C. - Filtered thru 0.45 μm membrane filter							
	before acidification w/ conc. H_2SO_4							
	Phenolics - Preserved w/ $CuSO_4$ and conc. H_3PO_4							

Relinquished by:	Received by:	Date/Time
Organization:	Organization: Marlene Brown CH2M Hill	5/27/93
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received for Laboratory by:	Date/Time

Method of Shipment: COMPANY COURIER

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

RICHARDS-GEBAUR AFB

CLIENT:
PROJECT: 7166-080

SAMPLERS: (Signature) W.A.R. INC.

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required
S-1	J14 J15			X			14187	T.O.X.
S-2	J13 J16			↓			14188	↓
S.L.-L.	J17 J18			↓			14189	↓
W-1	J1 J8			↓			14190	↓
W-2	J7 J9			↓			14191	↓
W-3	J5 J6			↓			14192	↓
W-~~4~~3	J3 J4			↓			14193	↓
S-3	J2 J19			↓			14194	↓

Relinquished by: Robert D. Baker Jr. Organization: W.A.R. INC. 5/26/83	Received by: Bruce B Ferguson Organization: Hanna Engineer	Date/Time 5/27 1500
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received for Laboratory by:	Date/Time

Method of Shipment: BUS

APPENDIX F

SAFETY PLAN

APPENDIX F
SAFETY PLAN

F.1 GENERAL

The safety plan presented herein gives guidelines for basic safety procedures and equipment utilized by Water and Air Research, Inc. (WAR) during the course of IRP Phase II surveys. Samples collected during Phase II surveys are typically environmental water and sediment samples as opposed to hazardous waste samples, and normally do not require unusual levels of personnel protection. Detailed procedures and equipment required to minimize exposure to specific hazardous wastes or conditions requiring higher levels of protection are beyond the scope of this plan. References are provided from which waste-specific information on equipment and procedures can be obtained on a case-by-case basis.

F.2 INFORMATION REVIEW

Prior to initiating Phase II survey field work, the Phase I records search is reviewed in detail to identify hazardous wastes or conditions that may be encountered at each site. Available toxilogical data on materials suspected of being present at the sites is reviewed to determine if the base level of personnel protection outlined in Section 4.0 is adequate. Hazards such as the presence of highly toxic or incompatible chemicals, toxic gases, radioactive material, or explosives may require more extensive precautionary measures than the base level of protection. Safety hazards requiring special attention are addressed on an individual basis using appropriate assessment methodology, and equipment and procedure recommendations given in the EPA Field Health and Safety Manual (EPA, 1980) and the EPA Safety Manual for Hazardous Waste Site Investigations (EPA, 1979). Hazardous conditions can be clarified or confirmed on preliminary site visits.

F.3 MEDICAL MONITORING PROGRAM

The person responsible for Phase II survey field work will determine whether a medical monitoring program is necessary, based on results of the information review. If hazard levels are judged high enough to

warant this procedure, all field personnel will participate in a medical monitoring program. Guidelines for the program are given in Appendix I of the EPA Field Health and Safety Manual (EPA, 1980).

F.4 FIELD PERSONNEL INDOCTRINATION

All field personnel will be informed by the project field supervisor of required safety equipment and procedures prior to on-site work. Subjects covered will include personal safety gear, general and site-specific safety procedures, and incident notification procedures.

F.5 PERSONNEL PROTECTION GEAR

The following items will be provided on-site for all field personnel:

- o Tyvek® Disposable Coveralls
- o Rubber Boots
- o Rubber Gloves
- o Hard Hats
- o Eye Protection (safety glasses or face shields)

Hearing protection (disposable ear plugs) will be provided for all work in vicinity of the flight line or other noise hazards. Cartridge-type respirators will be available on-site for protection against inhalation of dust or vapors. If strong vapors are encountered, respirators will be utilized to facilitate evacuation of personnel and equipment from the site until the situation can be assessed or corrected.

Personnel equipment described above will offer adequate protection for most situations encountered during the course of Phase II survey field work. When conditions are identified that require a higher level of personell protection, the EPA Safety Manual for Hazardous Waste Site Investigations will be referred to for guidance.

F.6 SAFETY PROCEDURES

Hard hats and eye protection will be worn when appropriate, as directed by the project field supervisor. Protective clothing (boots, gloves,

and coveralls) will be worn at all times while working on site. Coveralls will be changed a minimum of once daily.

The project field supervisor will consult with the Base Environmental Coordinator or other responsible contact regarding site-specific hazards prior to entering sites. Special procedures for entering and working at particular sites will be clarified and conveyed to all field personnel. Examples of areas requiring strict procedures are active runways or taxiways, fuel handling or storage areas, and secure areas.

Prior to any drilling or digging on the sites, USAF Form 103 must be routed to all applicable base organizations for a clearance review. Circulation of this form is required to avoid contact with underground or overhead utilities, conflict with base activities, or breaches of security.

Additional safety procedures will be implemented if warranted by the information review or conditions encountered at the site. Site-specific safety procedures will be based on guidelines given in the EPA Field Health and Safety Manual and the EPA Safety Manual for Hazardous Waste Site Investigations.

F.7 INCIDENT/ACCIDENT NOTIFICATION PROCEDURES

As a minimum, the following emergency phone numbers should be avaiable on-site:

1. Ambulance or medical assistance,
2. Base fire department (or other if off-site), and
3. USAF contact for project.

After contacting appropriate emergency services, or in non-emergency incidents, the USAF project contact should be notified of the incident or accident so that it can be dealt with according to base policies and procedures.

APPENDIX G

AGENCY CONTACT LIST

APPENDIX G - AGENCY CONTACT LIST

Mr. Gordon Ackley, Missouri Department of Natural Resources, Jefferson City, Missouri. Telephone (314) 751-3241.

Mr. Rich George, Missouri Department of Natural Resources, Jefferson City, Missouri. Telephone (314) 751-3241.

Mr. John Howland, Missouri Department of Natural Resources, Jefferson City, Missouri. Telephone (314) 751-3241.

INSTALLATION RESTORATION PROGRAM
PHASE II - SCOPE OF WORK AND COST ESTIMATE (STAGE 1)

FOR

RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI

SITE 1, SOUTH LAND FILL

SITE 2, NORTHEAST LANDFILL

Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403

AND

AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

Prepared by

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7201 N.W. 11th Place
Gainesville, Florida

March, 1983

Contract No. FO8637-80-G0010-6S01

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I. INTRODUCTION

A. BACKGROUND

The United States Air Force (USAF), 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 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 3012 and 6003 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.

To assure compliance with these hazardous waste regulations, the Department of Defense (DoD) developed the Installation Restoration Program (IRP). The current 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 material disposal sites and to control hazards to health and welfare that may have resulted from these past operations. The IRP will be the basis for remedial actions on USAF installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and clarified by Executive Order 12316.

C. PURPOSE AND SCOPE

DoD policy is to identify and fully evaluate suspected problems associated with past hazardous materials disposal sites and spill sites on DoD facilities and to control hazards to health or welfare that may have resulted from these past operations. The existence and potential for migration of hazardous material contaminants were evaluated at Richards-Gebaur AFB during the Phase I Records Search by reviewing the existing information and installation records.

The purpose of this statement of work and cost estimate is to describe the overall Phase II effort including sampling, safety, and well drilling considerations and the Phase II confirmation/quantification strategy for each site, and to provide a breakdown of estimated costs for each segment of the Phase II effort. Phase II of the Installation Restoration Program will generate the field data needed to confirm or rule out the presence and/or migration of contaminants.

The scope of this work included a review of the environmental setting and site evaluations presented in the Phase I Records Search report, and development of this statement of work and cost estimate based on the recommended field investigations. An onsite base visit was conducted by CH2M HILL from November 15 through 19, 1982, as part of the Phase I effort, and included a reconnaissance of the identified sites.

D. METHODOLOGY

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

II. SITE DESCRIPTION

A. INSTALLATION DESCRIPTION

Richards-Gebaur AFB is located in Jackson and Cass Counties, Missouri, about 18 miles south of downtown Kansas City. The base is situated on a topographic ridge separating the drainage basins of the Blue River to the west, the Little Blue River to the east, and East Creek to the south. Most of the base drainage enters Scope Creek, a tributary of the Little Blue River.

Surface soils at the base consist of a thin layer of loess on the upland areas over low-permeability residual clays. Soil cover normally varies from 2 to 15 feet. In the creek valleys, moderately well-drained alluvial soils up to 50 feet thick are present, which have a higher ground-water table and are subject to occasional flooding.

Bedrock consists of alternating layers of limestone and shale that are essentially flat-lying. Perched ground water is present in the limestone strata which discharges directly to adjacent streams. Shallow wells in these perched ground-water zones are used for private water supplies, especially in the rural districts around Richards-Gebaur AFB, although yields are low. No public ground-water supplies are located within 3 miles of the base because highly saline conditions occur in aquifers capable of yielding sufficient volumes of ground water.

Most of the base and surrounding land area is developed. There are no known sensitive environmental habitats in the area, although natural woodland areas are present along Scope Creek.

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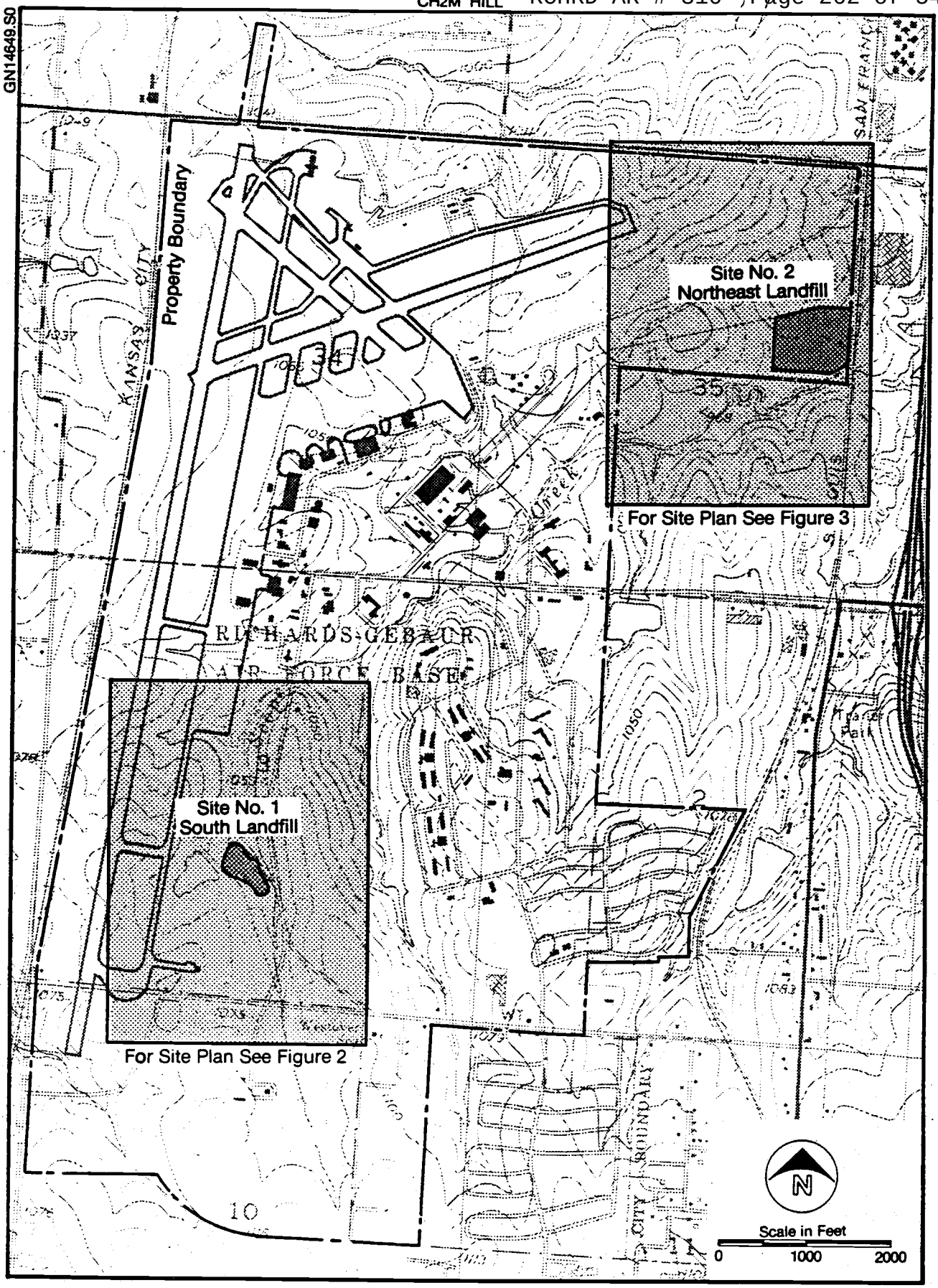

FIGURE 1. Location map of identified sites.

permeable loamy soils with little or no vegetative cover. A black, oily residue is present at the surface of the ground on a portion of the site; piles of yard trash and demolition debris are exposed on the site perimeter along Scope Creek. The site is at approximately elevation 1,060 to 1,065 feet above mean sea level (msl) and is essentially flat before dropping abruptly about 15 feet at the edge of Scope Creek.

The site is probably underlain by a thin layer of residual clay soil over porous limestone below an elevation of about 1,050 feet (msl). A relatively impervious shale underlies the limestone at about elevation 1,035 feet (msl), which is about 5 to 10 feet below the water level in Scope Creek. Perched ground water within the limestone stratum probably flows east beneath the site to discharge via seeps into Scope Creek. Perched ground-water levels are expected to be highly variable seasonally; at times there will probably be no perched ground water.

The Phase I report recommended sampling the water in Scope Creek both upstream and downstream of the site at least twice and analyzing the samples for volatile organic compounds, heavy metals, pesticides, phenols, pH, specific conductance, COD, TOC, and oil and grease. Details of the recommended sampling are described in Section III, Work Plan.

2. Site No. 2, the Northeast Landfill, is also located alongside Scope Creek on the far eastern side of the base. The site was reportedly used between about 1961 and 1971 for the disposal of

The Phase I report recommended installation of a ground-water monitoring well downgradient of the site between the landfill area and Scope Creek, sampling of the well, and analyzing the samples for volatile organic compounds, heavy metals, pesticides, phenols, pH, specific conductance, COD, TOC, and oil and grease.

Details of the recommended well installation and sampling are described in Section III, Work Plan.

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III. WORK PLAN

This section presents the nine tasks which comprise the Phase II work plan.

A. DATA COLLECTION AND REVIEW

Collect and review all data pertinent to the two identified study sites. These data should include information on geology, subsurface conditions, and types and quantities of waste materials disposed of at the study sites as summarized and referenced in the Phase I IRP Report (Installation Restoration Program Records Search for Richards-Gebaur AFB, Missouri, March 1983). In addition, applicable water quality standards or criteria for both ground and surface waters should be obtained and reviewed. If water quality standards or criteria are not available for some of the parameters, then it is suggested that toxicological information be used, e.g., 10^{-5} cancer risk level for specific volatile organic compounds, which is available from EPA.

B. PRELIMINARY SITE VISIT

Conduct a preliminary site visit to Richards-Gebaur AFB and the study sites. The purpose of the visit will be to:

- Establish base contact.
- Observe and record site features.
- Establish approximate areal limits of the sites.
- Locate utilities present at sites (e.g., new interceptor line through Site No. 2).

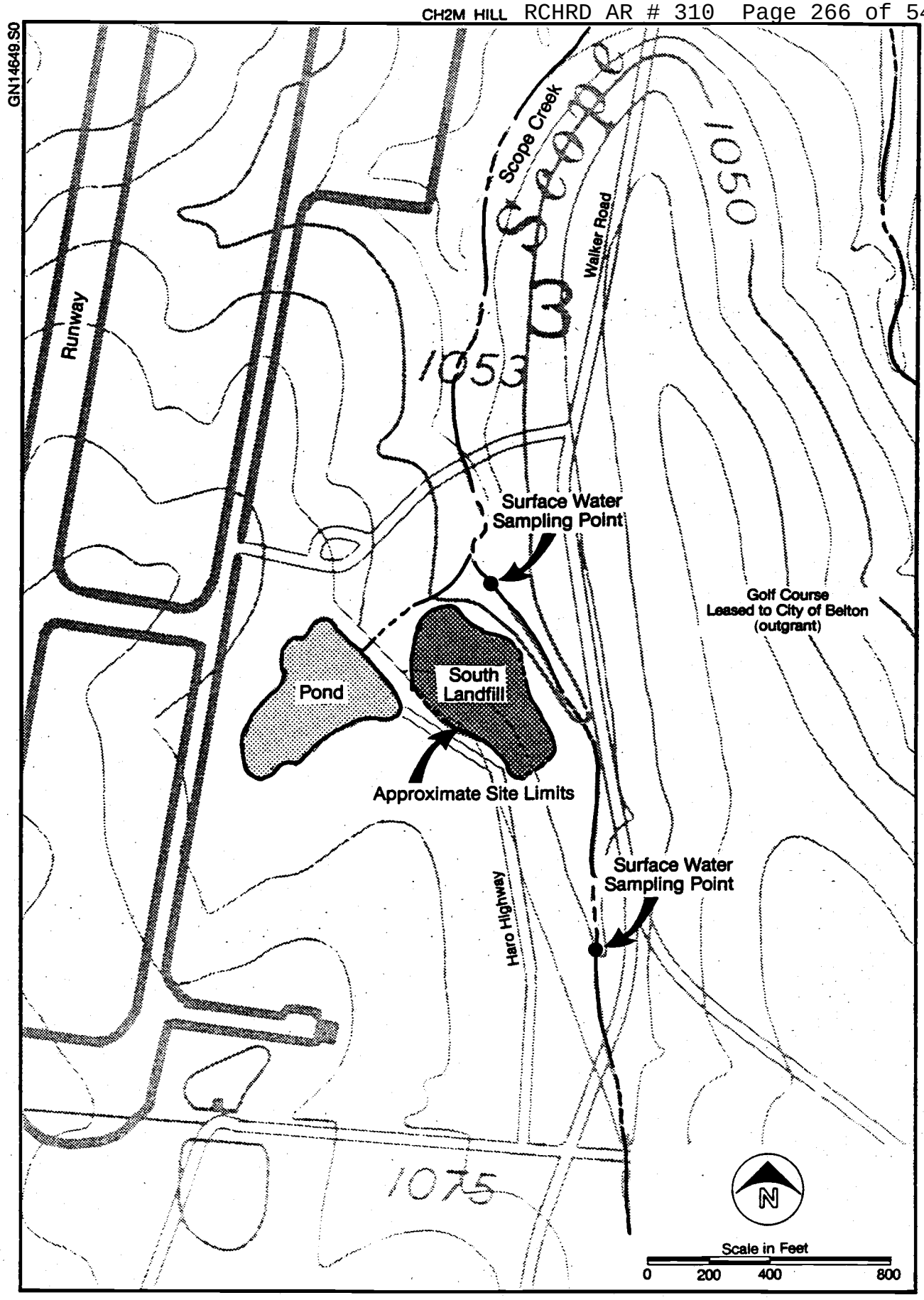

FIGURE 2. Sampling locations, Site No. 1—South Landfill.

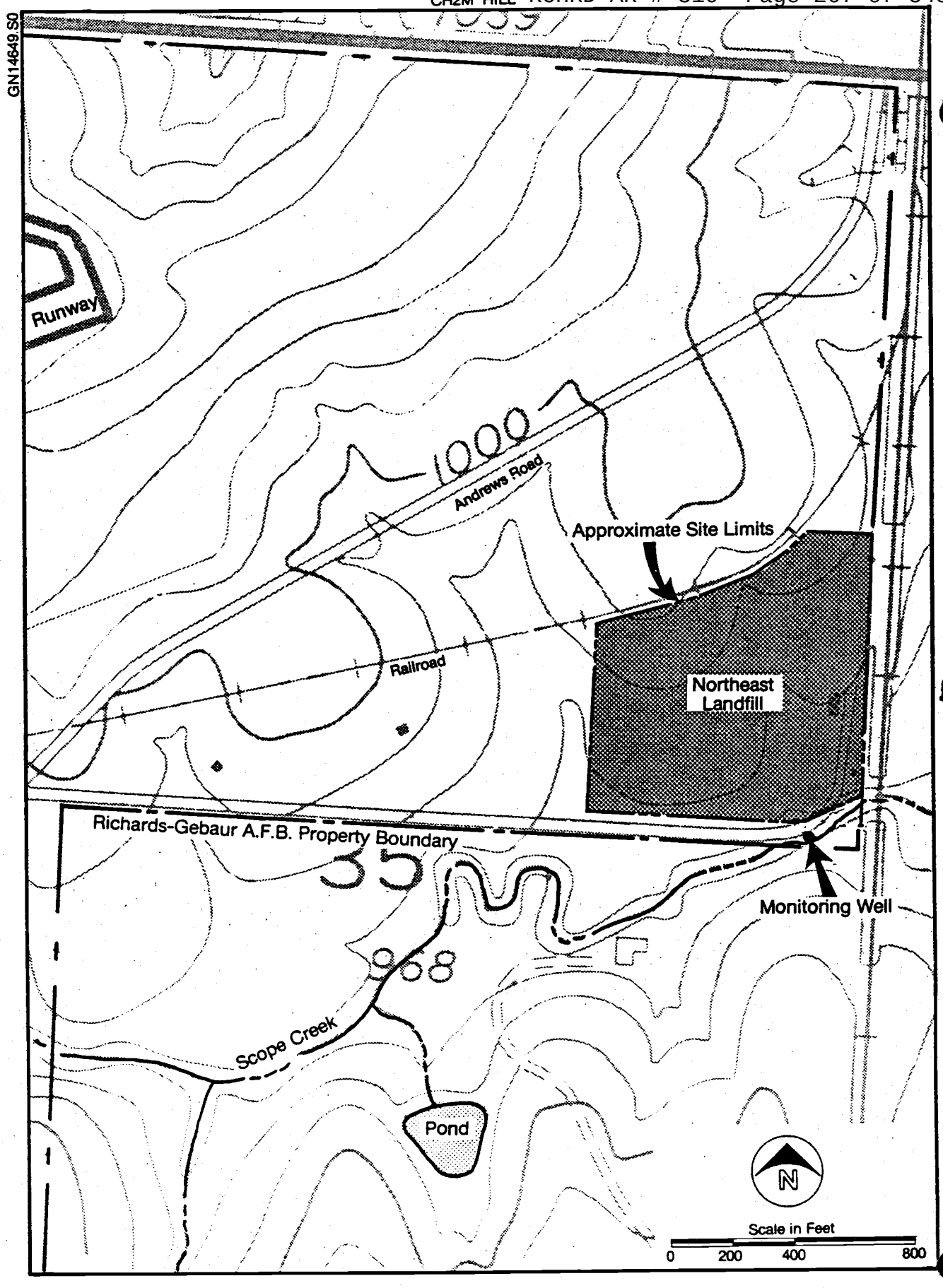

FIGURE 3. Monitoring well location, Site No. 2—Northeast Landfill.

exist during or shortly after a rainfall event, or during low flow conditions when the creek may be nearly dry.

2. Monitoring Well Specifications (Site No. 2)

Develop detailed monitoring well specifications for Site No. 2 in accordance with the guidelines given in Appendix B. Specifications should address:

- Pipe size and material
- Screen length and slot size
- Backfill gradation
- Materials and proportions for bentonite seal
- Procedures for handling and disposing of well drilling wastes
- Well development procedures
- Well protection or security details
- Soil sampling and laboratory testing

3. Monitoring Well Installation (Site No. 2)

Install the monitoring well at Site No. 2 in accordance with the detailed specifications. Installation of the well includes the soil boring; installation of casing pipe, well screen, backfill, and bentonite sealing; well development; installation of protective casing; and survey. The well should be installed at the location selected during the preliminary site visit (Task B). Figure 3 shows the suggested approximate location for the well.

Case 2: Both samples indicate pollutants are present and at levels higher than the recommended water quality standards or criteria or the recommended levels based on toxicological information.

Case 3: One of the two samples shows the presence of pollutants at levels higher than the recommended water quality standards or criteria or the recommended levels based on toxicological information.

Suggested actions for dealing with each case are given below:

Case 1 Action--If none of the analyzed pollutants are detected, delete the study site from further consideration. If one or more pollutants are detected but at levels lower than the recommended levels, then based upon an evaluation of the number, type, and concentrations of pollutants found, consideration should be given to continued monitoring or deleting the site from further action.

Case 2 Action--Develop a program to determine the extent of contaminant migration. As a minimum, the following would be applicable at both study sites:

- Confirm ground-water flow direction.
- Establish background ground-water quality.
- Define local extent of leachate plume.
- Define the rock profile, soil material types, and distribution.

initial field investigations. The report will include recommendations for each study site. Recommendations could range from deleting the study site from further consideration, to performing remedial investigations to determine the extent of contamination. Any recommendations for remedial investigations will include a detailed scope of work, schedule for completing the work, and cost estimates. After Air Force review and applicable report revisions, a final interim report will be prepared.

If remedial investigations are warranted, then the following additional tasks will be required to complete the Phase II program.

G. REMEDIAL INVESTIGATIONS

Conduct remedial investigations in accordance with the approved interim report.

H. DATA EVALUATION AND DEVELOPMENT OF CONCEPTUAL REMEDIAL ACTION ALTERNATIVES

Evaluate the results of the remedial and initial investigations to determine the nature and extent of contamination. Based on this evaluation, a list of viable alternatives for control or elimination of contaminant migration will be developed. Conceptual-level descriptions and order-of-magnitude capital and operating cost estimates will be developed for each of the alternatives. Based on a comparison of estimated costs and benefits, the alternatives will be ranked according to their cost-effectiveness.

IV. COST ESTIMATE

A cost estimate has been prepared based on the technical scope of work presented in Section III, Work Plan. Table 1 presents a summary of the estimated labor and expenses categorized by tasks and specific study sites. Table 2 presents labor costs for each study site distributed according to labor classification and tasks. Tables 3 and 4 itemize the anticipated expense items for Site No. 1 and Site No. 2, respectively.

The estimated cost, based on February, 1983 dollars, for Tasks A through F is $35,500.00. If the migration of hazardous contaminants is confirmed, then the estimated cost, based on February, 1983 dollars, for Tasks A through I is $107,030.00.

Critical assumptions made by CH2M HILL in order to develop these cost estimates are as follows:

1. A third sampling event at each site will be required during the initial field investigation (Task D).

2. Remedial investigations will be conducted at each study site (Task G).

3. Remedial investigations will require installation of four monitoring wells at Site No. 1 and five additional monitoring wells at Site No. 2 (Task G).

4. Remedial investigations will require three separate sampling events at each site, and analytical requirements per sample will be similar to those of the initial field investigation (Task G).

Table 2
SUMMARY OF ESTIMATED LABOR COSTS[a]

Task[b]	Site No. 1 Labor Classification						Site No. 2 Labor Classification						Total Labor Classification					
	EIV	EIII	EII	TII	TI	Subtotal	EIV	EIII	EII	TII	TI	Subtotal	EIV	EIII	EII	TII	TI	Total
A	$ 220	--	$ 350	--	--	$ 570	$ 220	--	$ 350	--	--	$ 570	$ 440	--	$ 700	--	--	$ 1,140
B	770	--	610	--	--	1,380	770	--	610	--	--	1,380	1,540	--	1,220	--	--	2,760
C	450	--	--	--	--	450	450	--	--	--	--	450	900	--	--	--	--	900
D	220	--	1,640	--	$ 810	2,670	660	--	3,020	--	$1,240	4,920	880	--	4,660	--	$2,050	7,590
E	440	$ 200	290	--	--	930	440	$ 200	290	--	--	930	880	$ 400	580	--	--	1,860
F	1,100	250	430	310	--	2,090	1,100	250	430	310	--	2,090	2,200	500	860	620	--	4,180
G	220	1,140	4,330	--	1,510	7,200	220	--	4,330	--	1,510	6,060	440	1,140	8,660	--	3,020	13,260
H	1,540	1,930	1,040	250	--	4,760	1,540	1,930	1,040	250	--	4,760	3,080	3,860	2,080	500	--	9,520
I	1,320	970	520	370	--	3,180	1,320	970	520	370	--	3,180	2,640	1,940	1,040	740	--	6,360
	$6,280	$4,490	$9,210	$930	$2,320	$23,230	$6,720	$3,350	$10,590	$930	$2,750	$24,340	$13,000	$7,840	$19,800	$1,860	$5,070	$47,570

[a]Labor costs based on the following labor rates:

Engineer IV	$55.02/hour
Engineer III	$48.30/hour
Engineer II	$43.17/hour
Technician II	$31.11/hour
Technician I	$27.00/hour

[b]Task Descriptions:

Task A Data Collection and Review
Task B Preliminary Site Visit
Task C Health and Safety Plans
Task D Sampling and Analyses
Task E Data Evaluation and Confirmation/Quantification Strategy
Task F Interim Report
Task G Remedial Investigations
Task H Data Evaluation and Development of Conceptual Remedial Action Alternatives
Task I Final Report

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Table 4
SUMMARY OF ESTIMATED EXPENSES[a]
SITE NO. 2

Task[b]	Miscellaneous[c]	Travel[d]	Office[e]	Drilling[f]	Analyses	Total
A	$ 30	$ --	$ 10	$ --	$ --	$ 40
B	20	760	--	--	--	780
C	30	--	110	--	--	140
D	170	1,970	320	2,000	1,420	5,880
E	30	--	50	--	--	80
F	120	680	1,200	--	--	2,000
G	500	4,810	130	8,000	7,240	20,680
H	20	--	50	--	--	70
I	120	680	1,200	--	--	2,000
	$1,040	$8,900	$3,070	$10,000	$8,660	$31,670

[a]Costs are based on February, 1983 dollars.

[b]Task Descriptions:

Task A Data Collection and Review
Task B Preliminary Site Visit
Task C Health and Safety Plans
Task D Sampling and Analyses
Task E Data Evaluation and Confirmation/Quantification Strategy
Task F Interim Report
Task G Remedial Investigations
Task H Data Evaluation and Development of Conceptual Remedial Action Alternatives
Task I Final Report

[c]Miscellaneous expenses include telephone, postage, freight, and supplies.
[d]Travel expenses include air fare, automobile rental or mileage, lodging, and meals.
[e]Office expenses include word processing, printing, photocopying, and computer charges.
[f]Drilling expenses include soil boring, well installation, and soil laboratory testing.

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A. The Phase II contractor must take appropriate measures to ensure the health and safety of his employees. Each of the study sites was visited by the Phase I contractor and, based on his visits, the sites do not appear to pose a significant hazard to visiting personnel. The samples that will be collected at each site are environmental water samples as opposed to "hazardous waste" samples and no need for unusual levels of personal protection are anticipated. Nonetheless, the Phase II contractor will have the final responsibility for determining the necessary health and safety measures.

B. The Phase II contractor should have health and safety plans that address, as a minimum, the following items:

- Responsibility of employees with regard to safety
- Pathways of personal physical exposure
- Initial hazard assessment
- Emergency treatment
- Safety and protective equipment

1. <u>Employee Safety</u>

When visiting the sites, employees should use common sense, judgement, and experience. They should have reviewed in advance all existing data on the site to determine if any safety precautions are necessary. Both sites are past landfills containing such items as empty and partially full

To prevent ingestion, do not eat, drink, or smoke during visits to either 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. Initial Site Hazard Assessment

Although the Phase I contractor has visited both study sites and perceives no imminent hazard associated with either site, the Phase II contractor should satisfy himself that hazards do not exist at the sites. He should review all available information on the sites and toxicological data on any materials suspected of being present at the sites to determine what protective clothing and equipment are required for the site visits. He should satisfy himself that fire, explosion, high levels of air contaminants, and nuclear radiation hazards are not present prior to entering either site.

4. Emergency Treatment

Before entering either 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 hazardous materials and skin

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 either study site, the latter would probably be the most applicable device.

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Appendix B
MONITORING WELL INSTALLATION

Construction of monitoring 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 inspector 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 monitoring 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 monitoring 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.

The soil borings should be made using a 4- to 6-inch 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 inspector. 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.

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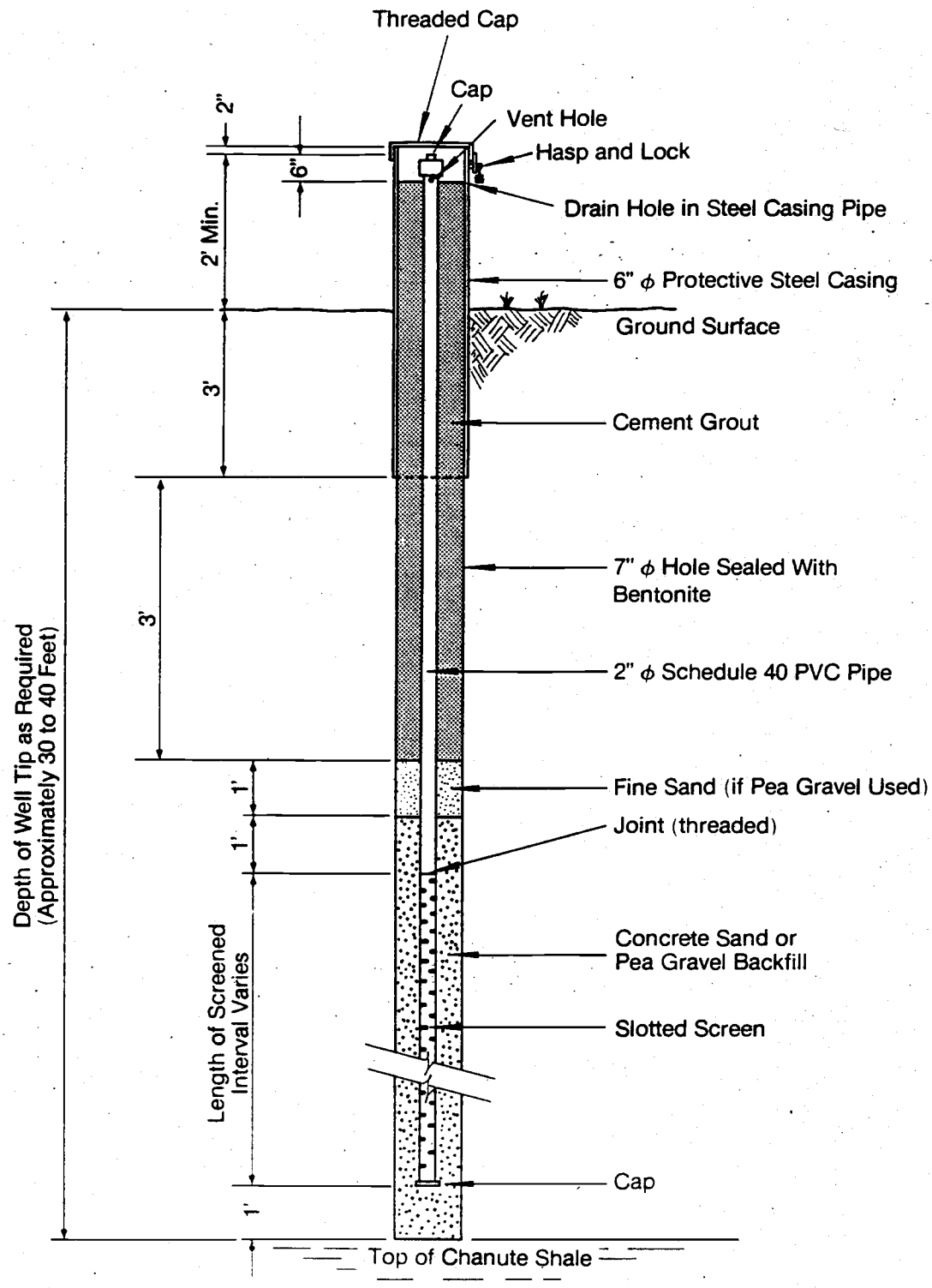


FIGURE 4. Typical monitoring well installation.

concrete sand (ASTM C33) should then be placed around the screen while slowly withdrawing the auger to a point 1 foot above the screened interval. The Phase II contractor should be responsible for selecting the exact slot size and backfill gradation for the well. Wells installed into the Argentine Limestone may require a larger diameter gravel pack around the well casing to prevent washout of the well backfill.

Above the sand or gravel backfill, a 3-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 6-inch-diameter iron pipe should be placed over the casing and embedded at least 3 feet. A threaded cap should be placed on top of the iron 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 inspector, 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.

Appendix C
SAMPLING PROTOCOL GUIDELINES

A sampling protocol is a plan that addresses the steps necessary to ensure the technical adequacy and validity of a sampling and analysis program. A sampling program should address the following items:

- Sample bottle preparation
- Sampling procedure
- Sample preservation and holding times
- Sample shipping
- Record keeping
- Analytical procedures
- Quality assurance

SAMPLE BOTTLE PREPARATION

Sample bottle preparation includes selecting the type and size container and the proper cleaning procedure to protect against sample contamination. All three items are dependent upon the parameter to be tested for. EPA-recommended procedures for sample bottle preparation should be followed.

SAMPLING PROCEDURE

Specific sampling procedures must be developed. These procedures are dependent on the nature of the sampling location (i.e., well, surface stream, etc.), the size of sample required, and any special techniques necessary due to the nature of the parameter or parameters to be tested.

SAMPLE PRESERVATION AND HOLDING TIMES

Requirements for sample preservation and holding times are specific to the parameters being tested. Typical preservation techniques may include adding a chemical

samples spiked with a known quantity of the constituent to be tested should occasionally be submitted for analysis. Another technique to verify laboratory accuracy involves splitting samples between the prime lab and one or more other labs.

GNR70B

A3

Site: Richards Gebaur
ID #: MO9571824292
Break: 1.5
Other:
7-A-84
84 SEP REC'D ERRIS

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
Mo.	M09571824292

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site)	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER				
Richards - Gebaur Air Force Base	422 CSS/DEE				
03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE	08 CONG DIST
	Mo.	64030	Cass/Jackson	037/089	04
09 COORDINATES LATITUDE	LONGITUDE				
38 50 49 .6	09 4 33 27.2				

10 DIRECTIONS TO SITE (Starting from nearest public road)
From South U.S. Highway 71 (Belton) take the 155th Street Exit. Go west approximately 1.5 miles.

III. RESPONSIBLE PARTIES

01 OWNER (if known)	02 STREET (Business mailing address)			
United States Air Force	422 CSS/DEE			
03 CITY	04 STATE	05 ZIP CODE	06 TELEPHONE NUMBER	
	Mo.	64030	816 348-2076	
07 OPERATOR (if known and different from owner)	08 STREET (Business mailing address)			
09 CITY	10 STATE	11 ZIP CODE	12 TELEPHONE NUMBER	
			( )	

13 TYPE OF OWNERSHIP (Check one)
☐ A PRIVATE X B FEDERAL U. S. Air Force (Agency name) ☐ C STATE ☐ D COUNTY ☐ E MUNICIPAL
☐ F OTHER _____ (Specify) ☐ G UNKNOWN

14 OWNER/OPERATOR NOTIFICATION ON FILE (Check all that apply)
☐ A RCRA 3001 DATE RECEIVED ___/___/___ (Month Day Year) ☐ B UNCONTROLLED WASTE SITE (CERCLA 103 c) DATE RECEIVED ___/___/___ (Month Day Year) ☐ C NONE

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 ON SITE INSPECTION
X YES DATE 07 18 84 (Month Day Year)
☐ NO

BY (Check all that apply)
☐ A EPA ☐ B EPA CONTRACTOR X C STATE ☐ D OTHER CONTRACTOR
☐ E LOCAL HEALTH OFFICIAL ☐ F OTHER _____ (Specify)
CONTRACTOR NAME(S) _____

02 SITE STATUS (Check one)
X A ACTIVE ☐ B INACTIVE ☐ C UNKNOWN

03 YEARS OF OPERATION
1952 (Beginning year) | Present (Ending year) ☐ UNKNOWN

04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN OR ALLEGED
Solvents, thinners, waste paints, oils, fuels, herbicides, radioactive waste (low level).

05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION
Unknown quantities of solvents, thinners, waste paints and oils may have been disposed in or on the two landfills located at the site. There is a potential for ground and surface water contamination.

V. PRIORITY ASSESSMENT

01 PRIORITY FOR INSPECTION (Check one. If high or medium is checked, complete Part 2 - Waste Information and Part 3 - Description of Hazardous Conditions and Incidents)
☐ A HIGH (Inspection required promptly) X B MEDIUM (Inspection required) ☐ C LOW (Inspection on time available basis) ☐ D NONE (No further action needed, complete current disposition form)

VI. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)		03 TELEPHONE NUMBER
Mr. John Hurd	Richards - Gebaur AFB/Engineering		816 348-2076
04 PERSON RESPONSIBLE FOR ASSESSMENT	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NUMBER	08 DATE
John Schofield	Mo. DNR	DEQ	314 574-6675	7/19/84

EPA FORM 2070-12 (7-81)

SUPERFUND

SEP 28 1984
SITE LOG

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
Mo.	M09571824292

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

X A SOLID
B POWDER, FINES
X C SLUDGE
D OTHER ____ (Specify)
E SLURRY
X F LIQUID
G GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS ____
CUBIC YARDS Unknown
NO OF DRUMS ____

03 WASTE CHARACTERISTICS (Check all that apply)

A TOXIC
B CORROSIVE
X C RADIOACTIVE
D PERSISTENT
E SOLUBLE
F INFECTIOUS
X G FLAMMABLE
X H IGNITABLE
I HIGHLY VOLATILE
J EXPLOSIVE
K REACTIVE
L INCOMPATIBLE
M NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION

V. FEEDSTOCKS (See Appendix for most frequently cited CAS Numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

John Hurd, Environmental Coordinator/DEE, Richards - Gebaur AFB
Installation Restoration Program Records search for Richards - Gebaur AFB, Mo. March 1983; Installation Restoration Program for Richards-Gebaur AFB, Mo. - Phase II, Field Evaluation, December 1983.

EPA FORM 2070-12 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
State: Mo. | Site Number: MO957182429 2

II. HAZARDOUS CONDITIONS AND INCIDENTS

X 01 A. GROUNDWATER CONTAMINATION — 02 OBSERVED (DATE) May 1983 — POTENTIAL — ALLEGED
03 POPULATION POTENTIALLY AFFECTED — 04 NARRATIVE DESCRIPTION

Ground water monitoring wells around northeast landfill indicate ground water may be contaminated with phenolic compounds.

X 01 B. SURFACE WATER CONTAMINATION — 02 OBSERVED (DATE) November 1982 — POTENTIAL — ALLEGED
03 POPULATION POTENTIALLY AFFECTED — 04 NARRATIVE DESCRIPTION

Preliminary investigation by an Air Force Contractor observed oil sheen on Scope Creek which runs along south landfill. Investigation indicated source of oil sheen could be the landfill.

01 C. CONTAMINATION OF AIR — 02 OBSERVED (DATE) — POTENTIAL — ALLEGED
03 POPULATION POTENTIALLY AFFECTED — 04 NARRATIVE DESCRIPTION

Not Observed

01 D. FIRE/EXPLOSIVE CONDITIONS — 02 OBSERVED (DATE) — POTENTIAL — ALLEGED
03 POPULATION POTENTIALLY AFFECTED — 04 NARRATIVE DESCRIPTION

Not observed

01 E. DIRECT CONTACT — 02 OBSERVED (DATE) — POTENTIAL — ALLEGED
03 POPULATION POTENTIALLY AFFECTED — 04 NARRATIVE DESCRIPTION

Not observed

01 F. CONTAMINATION OF SOIL — 02 OBSERVED (DATE) July 18, 1984 — POTENTIAL — ALLEGED
03 AREA POTENTIALLY AFFECTED — 04 NARRATIVE DESCRIPTION

Surface areas of northeast landfill show indications of oil and/or solvent type substances contamination.

01 G. DRINKING WATER CONTAMINATION — 02 OBSERVED (DATE) — POTENTIAL — ALLEGED
03 POPULATION POTENTIALLY AFFECTED — 04 NARRATIVE DESCRIPTION

Not observed

01 H. WORKER EXPOSURE/INJURY — 02 OBSERVED (DATE) — POTENTIAL — ALLEGED
03 WORKERS POTENTIALLY AFFECTED — 04 NARRATIVE DESCRIPTION

Not observed

01 I. POPULATION EXPOSURE/INJURY — 02 OBSERVED (DATE) — POTENTIAL — ALLEGED
03 POPULATION POTENTIALLY AFFECTED — 04 NARRATIVE DESCRIPTION

Not observed

EPA FORM 2070-12 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: Mo. 02 SITE NUMBER: M09571824292

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE July 1984) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
Small areas of northeast landfill lack little or any vegetative cover. These areas appear to be contaminated wil either oil and/or solvent type substances.

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (Include number of species.)
Not observed

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
Not observed

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES (Spills, runoff, standing liquids, leaking drums) — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION
Not observed

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
Not observed

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
Not observed

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
Not observed

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS
Not observed

III. TOTAL POPULATION POTENTIALLY AFFECTED: _____

IV. COMMENTS

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Field Investigation, July 18, 1984
Installation Restoration Program Records Search for Richards-Gebaur AFB, Mo. March, 1983.;Installation Program for Richards- Gebaur AFB, Mo. - Phase II Field Evaluation, December 1983

EPA FORM 2070-12 (7-81)

RCHRD AR # 310 Page 288 of 548

Site: Richards Gebaur
Other: 11-23-84

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 7
25 FUNSTON ROAD
KANSAS CITY, KANSAS 66115

November 23, 1984

MEMORANDUM

SUBJECT: Trip Report to Richards Gebaur Air Base

FROM: Gary B. Snodgrass, Chemist
FIRE/EP&R/ENSV

TO: Robert Morby
Chief, ARWM

THRU: Ron McCutchéon, Chief
FIRE/EP&R/ENSV

William J. Keffer
Chief, EP&R/ENSV

John C. Wicklund
Director, ENSV

EP, NOV 28 1984 Region VII K.C

EP&R received a report via the Regional Emergency Spill Telephone System that there were numerous drums of hazardous wastes stored in a facility at Richards Gebaur Air Force Base. In August 1984, EP&R received the report, an anonymous call, and immediately passed the information to MDNR and the Kansas City Missouri Health Department for action. The November 1, 1984, activity was a result of a followup inspection by the Kansas City, Missouri Health Department.

On November 1, 1984, Mr. Allan Thomas, Kansas City Health Department called EP&R and asked that EP&R accompany him for a brief inspection at the facility. EP&R inspectors, Gary Snodgrass and Ken Lawver, met Mr. Thomas at Richards Gebaur at 1300 hours, November 2, 1984.

Initially, there was some confusion about ownership of the storage facility at the base. However Mr. Wayne Sievers, Director of Aviation for the City at Richards Gebaur, reported that the facility is unquestionably owned by the Air Force and has been maintained and used by the City of Kansas City Department of Aviation. Mr. Shawn Ryan of Kansas City, Missouri Aviation met with EP&R and the Health Department at the facility which is Building 903 located at the east end of the base. Mr. Ryan stated that although the facility, an automobile service station, has been maintained and used by the City, numerous drums of various oils and chemicals located at the south end of the compound were generated by the Air Force.

Upon inspection of the area EP&R counted 63 55-gallon drums. Most appeared to be oil or oily wastes and some appeared to be paint or paint product wastes. At least two open and rusting drums were labeled "PHENOXY HERBICIDE - DED-WEED - THOMPSON HAYWARD". No other markings could be seen. There was some residue on one of the phenoxy herbicide drums. That residue had the same color (dark reddish brown to black) as 2,4-D[1]. The possibility exists that the mixture could contain 2,4,5-T[1]. Photographs were taken at the facility on November 2, 1984.

Mr. Sievers of the Kansas City, Missouri Aviation Department notified the Air Force that there was an inspection at the facility.

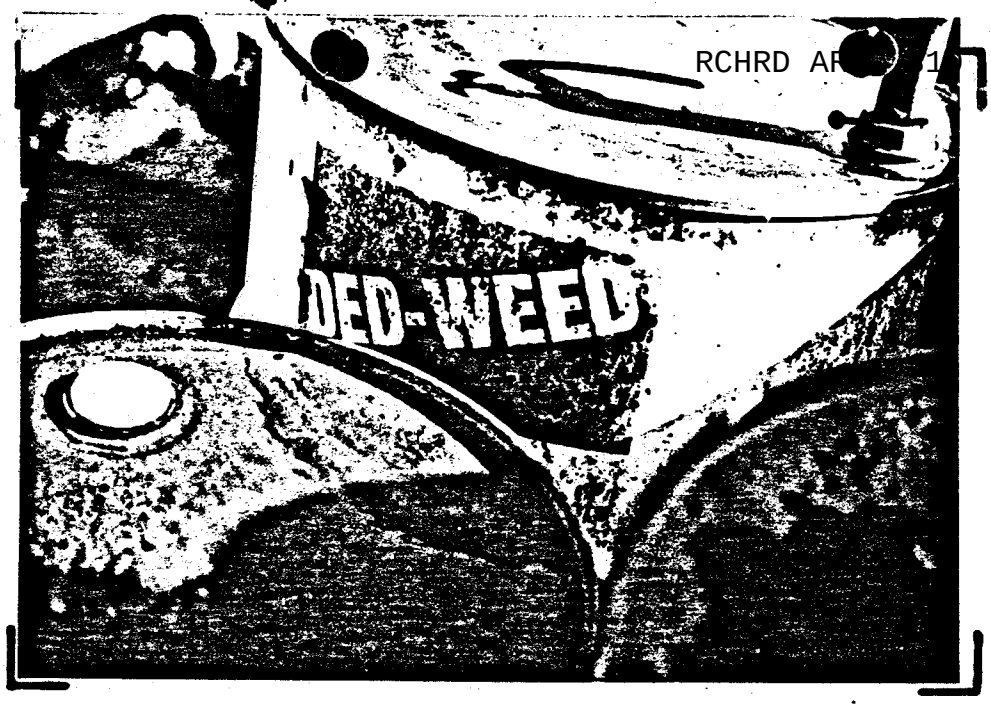
On Friday, November 16, 1984, EP&R was contacted by Captain Bradford, of the Department of Defense, who is representing the Air Force regarding the site. Captain Bradford stated that the Air Force will take immediate action to eliminate a potential hazard to the public or the environment at the Richards Gebaur facility. This will be accomplished by restricted access to the facility which is already a locked compound. Additionally, the Air Force will investigate the nature and origin of all materials at the facility. Sampling will be done on the drums if the indication is that agent orange is present at the facility. If "orange" is present, dioxin[2] analysis will be done and soil sampling will be accomplished. EPA will be kept informed of actions at the site.

A copy of this report will be forwarded by either Glen Yager or Diane Bailey, who are the Federal Facilities Coordinators for the Region, to Captain Bradford of the Air Force.

cc: David Wagoner, ARWM
Diane Bailey, ARWM
Glen Yager, PLMG
Paul Doherty, EP&R/ENSV

1. 2,4-D is the abbreviation for 2,4-dichlorophenoxyacetic acid. 2,4,5-T is the abbreviation for 2,4,5-trichlorophenoxyacetic acid. A mixture of both is commonly called agent orange.

2. 2,3,7,8-tetraclorodibenzo-pan-dioxin.



No. _____ Subject: _____

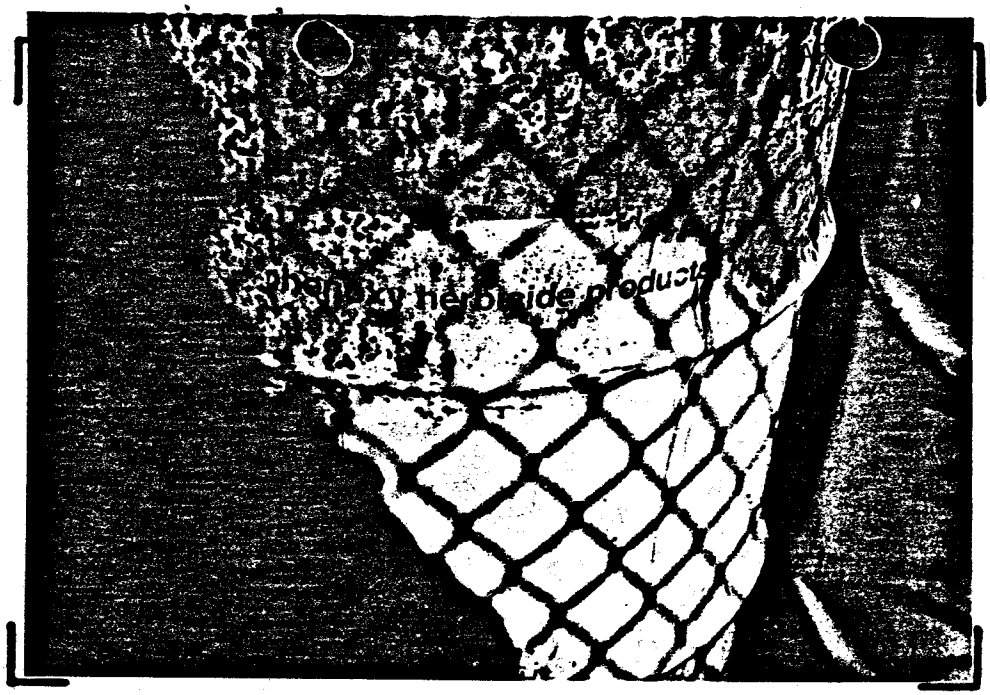
DRUM LABELLED " DED-WEED". DRUM ALSO HAS "THOMPSON-HAYWARD CHEMICAL COMPANY" AND "PHENOXY HERBICIDE" LABELS. GBS 11/2/84

Facility: RICHARDS GEBAUR AIR FORCE BASE

No. _____ Subject: _____

DRUM LABELLED "THOMPSON HAYWARD CHEMICAL COMPANY". DRUM ALSO HAS ABOVE LABELS(ABOVE PHOTOGRAPH)

Facility: RICHARDS GEBAUR AIR FORCE BASE



No. _____ Subject: _____

CORRODED DRUM OF PHENOXY HERBICIDE
GBS NOVEMBER 2, 1984

Facility: RICHARDS GEBAUR AIR FORCE BASE

No. _____ Subject: _____

DRUM LABELLED PHENOXY"HERBICIDES"
GBS NOVEMBER 2, 1984

Facility: RICHARDS GEBAUR AIR FORCE BASE

No. _____ Subject: _____

OILY STAINS ON PAVEMENT IN DRUM STORAGE COMPOUND.

GBS NOVEMBER 2, 1984

Facility: RICHARDS GEBAUR AIR FORCE BASE

No. _____ Subject: _____

OILY STAINS IN DRUM STORAGE COMPOUND.

GBS NOVEMBER 2, 1984

Facility: RICHARDS GEBAUR AIR FORCE BASE

No. _____ Subject: _____

STACKED DRUMS IN COMPOUND AT BASE. SOME DRUMS ARE OPEN AND SOME ARE CORRODED.

Facility: RICHARS GEBAUR AIR FORCE BASE

No. _____ Subject: _____

STACKED DRUMS IN STORAGE COMPOUND. SPILLED OIL OR CHEMICALS AT BOTTOM OF PHOTOGRAPH. GBS NOV. 2, 1984

Facility: RICHARDS GEBAUR AIR FORCE BASE

No. _____ Subject: _____

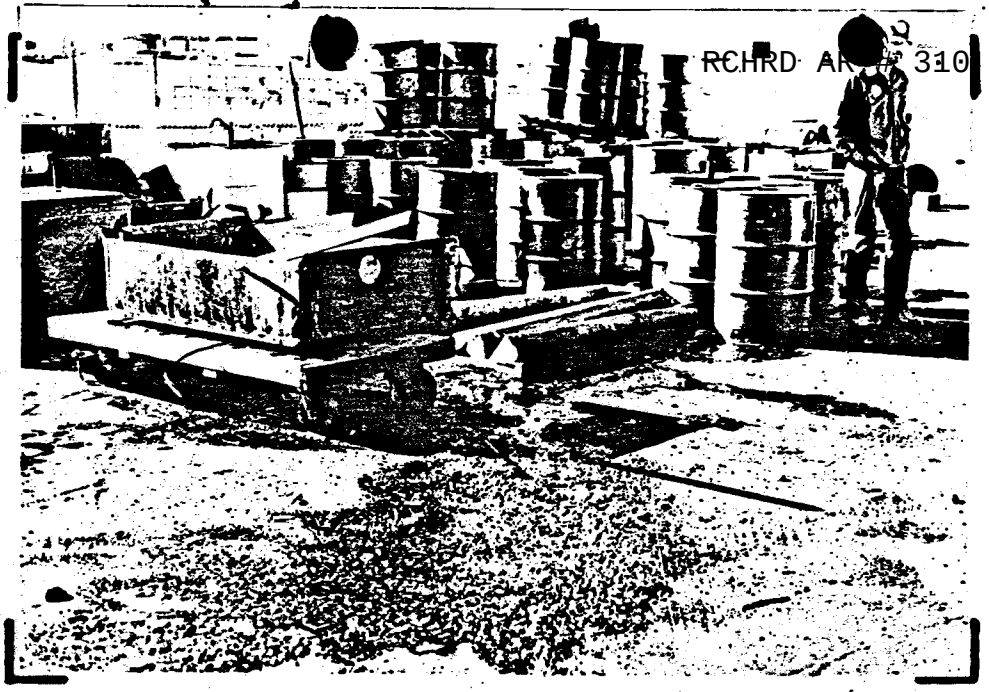
STACKS OF DRUMS IN STORAGE COMPOUND. PHENOXY HERBICIDE DRUMS ARE WHITE DRUMS AT BOTTOM OF PHOTOGRAPH GBS 11/2/84

Facility: RICHARDS GEBAUR AIR FORCE BASE

No. _____ Subject: _____

STACKS OF DRUMS IN STORAGE COMPOUND. DRUMS OF "PHENOXY HERBICIDES" ARE AT TOP LEFT. GBS 11/2/84

Facility: RICHARDS GEBAUR AIR FORCE BASE



No. _____ Subject: _____

OILY STAINS IN DRUM STORAGE COMPOUND. "PHENOXY HERBICIDE" DRUMS ARE WHITE DRUMS AT TOP LEFT. GBS 11/2/84

Facility: RICHARDS GEBAUR AIR FORCE BASE

No. _____ Subject: _____

lity: _____

CONVERSATION RECORD

TIME

DATE November 26, 1984

TYPE ☐ VISIT ☐ CONFERENCE ☒ TELEPHONE ☒ INCOMING ☐ OUTGOING

Location of Visit/Conference:

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU	ORGANIZATION (Office, dept., bureau, etc.)	TELEPHONE NO.
Captation Don Bradford	U.S. Air Force	

ROUTING NAME/SYMBOL	INT
Vest	ECV
Koke	BR
File	

SUBJECT

SUMMARY

Received telephone call from Don Bradford, U.S. Air Force Regional Civil Engineer, concerning the leaking and potentially hazardous wastes drums stored at Richards Gebaur AFB. He requested a trip report be sent to him regarding EPA's inspection of the facility on November 2, 1984.

I told him the report would be sent once I received it from Gary Snodgrass, EP&R. (Report received on 11/28/84 and sent on same day).

I told him that about 60 drums (55-gallon) were found stored on the government property with the majority appearing to be oil wastes and paint product wastes. There is the possibility that some of the drums may contain dioxin according to Gary Snodgrass. EPA has asked the facility to restrict access to the affected area and ask the Air Force to sample and investigate the nature of and origin of these stored substances.

ACTION REQUIRED

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
Glen Yager	Glen Yager	12/6/84

ACTION TAKEN

Site: Richards Gebaur
ID #: MO9571824292
Break: 61
Other:
DATE 12-6-84

SIGNATURE	TITLE

50271-101 ✪U.S. G.P.O. 1983-381-526/8346 CONVERSATION RECORD OPTIONAL FORM 271 (12-76) DEPARTMENT OF DEFENSE

CONVERSATION RECORD

TIME

DATE November 26, 1984

TYPE

☐ VISIT ☐ CONFERENCE ☒ TELEPHONE

☒ INCOMING
☐ OUTGOING

Location of Visit/Conference:

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU	ORGANIZATION (Office, dept., bureau, etc.)	TELEPHONE NO:
Capt. Don Bradford (Continued)		

ROUTING	
NAME/SYMBOL	INT

SUBJECT

SUMMARY

Captain Bradford said he would investigate the matter immediately and keep us informed of their actions at the site.

ACTION REQUIRED

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE

ACTION TAKEN

SIGNATURE	TITLE	DATE

Brodie

Kate Yeager

DEPARTMENT OF THE AIR FORCE
442 COMBAT SUPPORT GROUP (AFRES)
RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI 64030-5000

REPLY TO ATTN OF: SGPB(2144)

22 Apr 85

SUBJECT: Installation Restoration Program (IRP) Phase II, Stage 2 Presurvey Meeting

Site: Richards-Gebaur
ID #: MO9571824292
Break: 1.1
Other: 4-22-85

TO Mr. Morris Kaye (Regional Administrator)
United States Environmental Protection Agency
726 Minnesota Avenue
Kansas City, KS 66101

1. The IRP Phase II Stage 2 presurvey meeting will be held at Richards-Gebaur AFB, MO, 16 May 1985, Bldg. 926 Conference Room from 0830-1630.

2. The attached copies of the task description is provide you with pre-meeting information. Request you coordinate any billeting requirements with Ms. Benson, R.N.. AV 463-2144 or (816) 348-2144.

FOR THE COMMANDER

Felipita B. Benson

FELIPITA B. BENSON, R.N.
Occupational Health Nurse

1 Atch
Task Description

Cy to: HQ AFRES/SGPB
OEHL/TSS
w/o Atch

RECEIVED
MAY 01 1985
REMD SECTION

RECEIVED
APR 25 1985
EIS/404 BRANCH

11 Mar 85

PRESURVEY FOR PHASE II STAGE 2
INSTALLATION RESTORATION PROGRAM
RICHARDS-GEBAUR AFB, MISSOURI

I. TASK DESCRIPTION

The effort required by this task is an integral part of the survey task to be issued subsequently.

The purpose of this task is to define the work plan, and to determine the approach to be used in accomplishing the requirements of Phase II Stage 2 of the installation Restoration Program (IRP) for Richards-Gebaur AFB. The following steps shall be accomplished:

A. As background information, review the Phase II Stage 1 Report and comments on the report, to obtain a complete understanding of the recommendations made by the authors of the Stage 1 Report and regulatory issues associated with these sites. The report and comments will be provided under separate cover.

B. Visit Richards-Gebaur AFB and discuss the Stage 1 IRP report, the requirements of Attachment 1, and any additional requirements identified by government officials at the time of the visit to insure a complete understanding of the necessary work. The Base Civil Engineering office (BCE) will turn over the following information to the contractor at the time of the presurvey meeting:

1. Well logs and other pertinent well records and information available.

2. Results from any previous water analysis conducted on base production and observation wells.

C. Tour all sites identified in Attachment 1.

D. Prepare a presurvey report as specified in Item VI below. The report shall include the following:

1. The contractor's specific Quality Assurance/Quality Control (QA/QC) protocols and procedures which shall be utilized in the proposed sampling and analysis. The QA/QC protocol shall include split sample procedures for all proposed groundwater and soil samples. One sample shall be analyzed by the contractor. The other sample shall be forwarded through overnight delivery to the Air Force laboratory listed below:

USAF OEHL/SA
Bldg. 140
Brooks AFB, TX 78235-5000

The sample sent to the USAF OEHL/SA shall be accompanied by the following information:

6. The contractor shall develop a detailed technical field operation plan and include in the appendix to the presurvey report (Sequence 2, Item VI below). The plan shall be explicit with regards to field procedures for the sites under investigation. It shall include but is not limited to field decontamination operations, health and safety procedures, sampling protocol, QA/QC field procedures, updated field schedule, etc. This technical operation plan (TOP) shall be bound separately from presurvey report.

II. SITE LOCATION AND DATE:

Richards-Gebaur AFB, MO
Building and time to be established.

III. BASE SUPPORT: None

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

Dr. John K. Yu
USAF OEHL/TSS
Brooks AFB, TX 78235-5000
(512) 536-2158
AV 240-2158

Ms. Felipita B. Benson, R.N.
442 CSG/SGPB
Richards-Gebaur AFB, MO 64030-5000
(816) 348-2144
AV 463-2144

Maj. Victor E. Hiatt
HQ AFRES/SGPB
Robins AFB, GA 31098-5300
(912) 926-6441
AV 468-6441

VI. DELIVERABLE REQUIREMENTS:

In addition to sequence numbers 1, 5, and 11 which are listed in Attachment 1 to the contract, and are applicable to all contracts, the sequence number listed below is applicable. Also shown are data applicable to this order:

Sequence No.	Block 10	Block 11	Block 12	Block 13	Block 14
2	O/Time	30 May 85	30 Jun 85	---	5

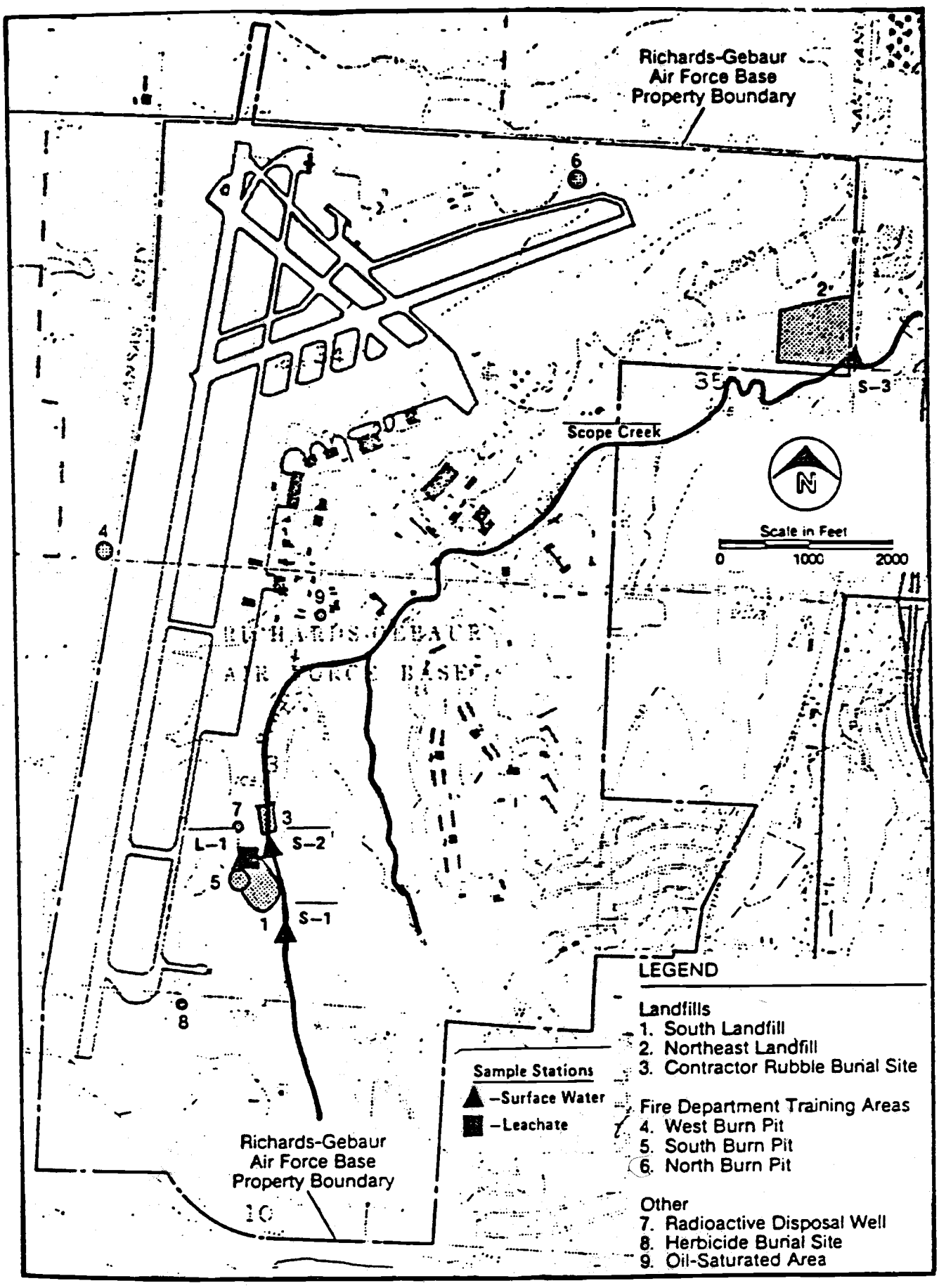


FIGURE 3. Identified Disposal Sites and Surface Water Sampling Stations, Richards-Gebaur AFB, Missou

RCHRD AR # 310 Site: Richards-Gebaur
ID #: MO9571824292
Break: 6.1
Other: 6-10-85

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

June 10, 1985

Ms. Kitty Nichols
General Services Administration (7PD)
819 Taylor Street
Fort Worth, Texas 76102

Dear Ms. Nichols:

It is our understanding that your office is responsible for the selling and/or transferring of the property located at the Richards-Gebaur Air Force Base in Kansas City, Missouri. I am providing your office information pertaining to the waste disposal practices at this facility so that the buyers of these properties are aware of potential waste contamination problems.

The Department of Defense has included the Richards-Gebaur Air Force Base facility in their Installation Restoration (IR) program. The Department of Defense IR programs have completed Phase I for the Richards-Gebaur Air Force Base. Phase I included a record search and a preliminary identification of potential problems. Preliminary findings indicate contamination does exist at the facility. Phase II of the IR program is underway to determine the extent and magnitude of the contamination problem. Once completed, the results of this study can be obtained from John Hurd, Environmental Coordinator at the Base.

If you have any questions regarding this matter, please let me know. My phone number is (913) 236-2823.

Sincerely yours,

John G. Yager

John G. Yager
Federal Facility Coordinator

cc: John Hurd, Richards-Gebaur

File:
FM.E.

DF-4900-D990

ADMINISTRATIVE
RECORD COPY

TECHNICAL OPERATIONS PLAN
PHASE II, STAGE 2 CONFIRMATION STUDY
INSTALLATION RESTORATION PROGRAM
RICHARDS-GEBAUR AFB, MISSOURI

September 19, 1986

Prepared for:

UNITED STATES AIR FORCE
Occupational and Environmental
Health Laboratory
Technical Services Division
Brooks Air Force Base, Texas 78235

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International Specialists in the Environment

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1. INTRODUCTION

Ecology and Environment, Inc., (E & E) has prepared this Technical Operations Plan for studies at Richards-Gebaur Air Force Base (AFB), Belton, Missouri. The plan presents the site-specific work plans to be used to satisfy the requirements set forth in the delivery order to the Survey--Phase II Installation Restoration Program (IRP).

This document is the result of an evaluation of the Phase I--Records Search Report, an evaluation of the Phase II--Confirmation Report for the two landfills on the base, participation in a presurvey meeting and tour of the sites on the base, and additional information agreed to during the presurvey meeting with Dr. John K. Yu (OEHL/TSS) and participating personnel. The work plans for each site are designed to address the scope of activities described for either Stage 1 or Stage 2 of the Phase II program depending upon whether or not the site has been previously investigated. The current delivery order identifies this investigation as a Stage 2 investigation, which consists of the quantification of data on sites deemed as needing additional work in the Stage 1 report.

The field investigation procedures to be followed are consistent with rules and regulations set forth by the United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), Nuclear Regulatory Commission (NRC), and the Department of Transportation (DOT). Investigations will also be conducted in accordance with provisions of the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

2. PROPOSED WORK PLANS FOR STAGE 2 SITE INVESTIGATIONS

The work plans were developed to accomplish those tasks designated under directive F33615-83-D-4003, Proposed Order 13, Phase II, Stage 2 investigation of Richards-Gebaur AFB, Belton, Missouri. These tasks are described in Section 1 of the directive and consist of:

- Determining the presence or absence of contaminated substances within the specified areas of investigation;

- If contamination exists, determining its magnitude and extent and the potential for migration of these contaminants in the various environmental media;

- Assessing the potential environmental and health risks associated with contaminants in the local environment. This assessment will be based on applicable local, state, and/or federal standards only.

- Delineating additional investigations required beyond the present investigation stage to accomplish Phase II objectives.

To accomplish these goals, several field investigation techniques will be used, including:

- Geophysical surveys to determine the perimeter of the various landfill sites and to characterize buried metal, drums, and unique subsurface features, including contaminant plumes;

Table 2-1

I.D. Number	Chemical Test Category
1	Trihalomethanes
2	Heavy Metals--Primary
3	Heavy Metals--Secondary
4	Oil and Grease
5	Total Organic Carbon (TOC)
6	Polychlorinated Biphenyls (PCBs)
7	Chlorinated Hydrocarbons (Pesticides)
8	Herbicides
9	Priority Pollutants (GC/MS Confirmation)
10	Purgeable Organics
11	Base/Neutral Extractables
12	Acid Extractables
13	Primary Drinking Water Standards
14	Secondary Drinking Water Standards

Investigation

Borings. To determine the presence or absence or contamination and to augment the Stage 1 investigation, one soil boring is proposed in order to determine if contaminants have moved vertically in the soil column. This boring will be drilled to a depth of 15 feet and three split-spoon soil samples will be retrieved.

All drill cuttings will be drummed and staged until the analytical results are known. Richards-Gebaur AFB will provide a secure area for the drums and will be responsible for assigning the ultimate disposal points for the contaminated cuttings and groundwater.

Soil/Sediment Samples. A total of seven soil/sediment samples will be taken. Three will come from the shallow boring and three from discrete locations along the perimeter of the landfill along the creek. The last sample will be located further upstream along Scope Creek to serve as a background standard.

Water Samples. A total of five water samples also will be taken. One sample will be taken from the shallow boring, if groundwater is present; and three from Scope Creek or any leachate seeps that are detected. One sample will be taken from Scope Creek upgradient from the landfill.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons and volatile organics (EPA 8010/8020). The water samples will be analyzed for volatile organics (EPA 601/602), total dissolved solids (TDS), priority pollutant metals, extractable priority pollutants (EPA 625), common anions, and phenols.

2.2 NORTHEAST LANDFILL (SITE 2)

Setting

The Northeast Landfill (Figure 2-1, Number 2) was vaguely identified in the Phase I report and investigated as such during Phase II Stage 1 work. The Stage 1 final report does indicate that additional information on the landfill was provided which identifies three

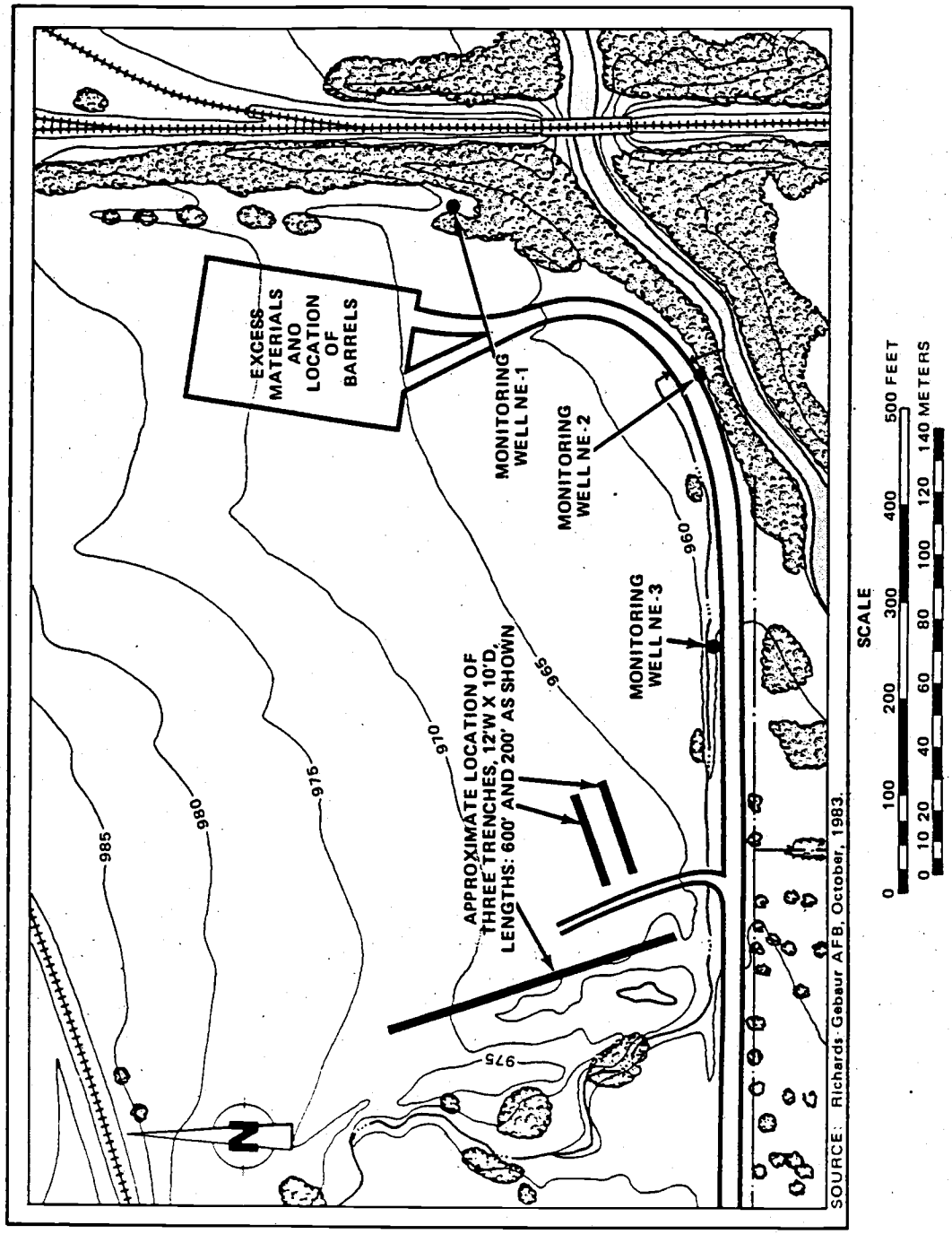


Figure 2–2 POSSIBLE LOCATIONS OF TRENCHES AT NORTHEAST LANDFILL

Investigation

Soil Gas Survey. A soil gas survey will be performed using a maximum of 30 probes to characterize contamination at the site.

Borings. A total of three soil borings to a depth of 15 feet each will be drilled. They will be located along the perimeter so as best to identify any vertical contamination at the site.

Monitoring Wells. Three monitoring wells will be installed, two downgradient of the site and one upgradient. The wells will be sampled once, for a total of three groundwater samples.

Soil/Sediment Samples. Fifteen soil samples will be taken: nine from the three boreholes and six composite surface samples covering the area of overflow and along the surface drainage pathway. A composite sample will consist of no more than six aliquots within a radius of one meter around a central reference point. Aliquots will be taken from the top 12 inches of soil.

Water Samples. If water is encountered in the boreholes, three water samples will be taken. One surface water sample also is allocated at this time for any ponded water in the drainage pathways. Three groundwater samples will be taken.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons and volatile organics (EPA 8010/8020). The water samples will be analyzed for petroleum hydrocarbons, TDS, and volatile organics (EPA 601/602).

2.4 HERBICIDE BURIAL AREA (SITE 8)

Setting

The Herbicide Burial Site (Figure 2-1 Number 8) is located just east and adjacent to the main flightline in the southwest part of the base. The site was active only from mid-1970 to mid-1971. The activities included the burial of small amounts of pesticides in small

Soil/Sediment Samples. Nine soil/sediment samples will be taken at this site: three from the borehole, and six composite surficial samples from the area draining the oil-saturated zone.

Water Samples. Two water samples will be taken: one from the borehole, should groundwater be encountered; and one from the surface water drainage pathway downgradient from the site.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons, lead, and volatile organics (EPA 8010/8020). The water samples will be analyzed for petroleum hydrocarbons, lead, TDS, and volatile organics (EPA 601/602).

2.6 HAZARDOUS WASTE DRUM STORAGE AREA--BLDG. 923 (SITE 10)

Setting

The compound around Building 923 (Figure 2-1, Number 10) has been used as a repository for hazardous materials for an as-yet undetermined number of years. The compound is partially surfaced in asphalt and tarmac but the runoff from the stained area flows into a grassy drainage ditch. The handling and characterization of these drummed wastes is an ongoing operation. During the presurvey field visit, all of the drums were stored on wooden flats and categorized according to their contents. A drum overpacking operation was in progress in one of the Quonset huts in the compound. The area where the drums had been stored outside was noticably stained, indicating leakage from the drums. A list of the contents of 46 of the 69 barrels was prepared by General Testing Laboratories of Kansas City, Missouri, in January 1985. This report lists the pH, water miscibility, and flash points of the sampled barrels. The report was presented to E & E prior to the presurvey.

Investigation

Borings. One shallow soil boring will be drilled inside the compound near the stained area to determine if any hazardous compounds have migrated vertically in the soil column. The maximum depth of the

Investigation

Borings. Because of safety and access problems, hand augers will be employed to sample the subsurface of the fuel spill in the storage tank enclosure. Three borings will be made and a maximum of three split-spoon samples collected from each boring.

Monitoring Well. A downgradient monitoring well will be completed outside the confines of the compound. Twenty linear feet have been allocated to complete this well.

Soil/Sediment Samples. A total of 11 soil/sediment samples are proposed: nine from the hand auger locations, and two near the outfall of drains from Building 953.

Water Samples. A total of four water samples are proposed: one from the monitoring well, two from the stream draining the POL tank area, and one from the drain outfall from Building 953.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons and aromatic volatile organics (EPA 8020). The four water samples will be analyzed for petroleum hydrocarbons, TDS, and aromatic volatile organics (EPA 602).

3. FIELD SET-UP

Following approval of the proposed project plan, E & E will be responsible for ordering, acquiring, and mobilizing all required personnel and equipment to the facility.

The Air Force will be requested to supply a secure building on the facility to which equipment and supplies can be directly sent and stored prior to and during the project. This building will also be used as a central field and equipment maintenance office, and as a sample handling and storage area.

In addition to the building, a secure fenced-in area preferably adjacent to or near the building will be required for storage of the drilling rig and its equipment when not in use.

During the on-site work, equipment and supplies will be staged at the central location prior to being moved to the specific site under investigation. Following the day's activities, all equipment will be returned to the secured storage areas. No equipment will be left unattended at an investigation site.

The actual in-field set-up of equipment at an investigation site will follow E & E's established procedures. Figure 3-1 shows the basic concept of the standard field set-up. Site-specific considerations will probably necessitate some variations. All entry to an immediate work area will be controlled at all times during field activities in order to minimize the potential health and safety risk to both in-field personnel and any observers.

Prior to the start-up of work, a detailed work plan and a site safety plan will be prepared. The site safety plan will include the

level of personal protection required by on-site personnel. Based on existing information concerning the sites at the facility, Level C presently is planned. However, if necessary, the site safety officer (see Section 15) may upgrade or downgrade the level of protection based on new or changing observations of site conditions. This would result in a cost increase or decrease, respectively. The Health and Safety Plan is presented in Appendix A.

E & E will utilize qualified local subcontractors to support the field investigation, as required. All subcontracted work will be overseen by the E & E project manager to insure compliance with the Statement of Work specified in the delivery order to the Phase II Survey of the IRP.

4. CALIBRATION OF FIELD EQUIPMENT

All field equipment should have been calibrated prior to delivery to the site. However, because of shock received during shipping and handling, the instruments may require either recalibration or an operational check prior to field use. The method and frequency of calibration for each instrument is generally based on such factors as the type of equipment, extent of use, degree of accuracy required, and manufacturer's specifications. Instrument calibration should be certified by documented standards of accuracy, whether performed at E & E headquarters or by outside calibration or repair services. E & E requires that records of calibration dates and standards be maintained for each instrument subject to calibration.

Each piece of equipment requiring periodic calibration or calibration prior to each use must be accompanied by a bound logbook. The logbook will note the instrument's current calibration status with regard to the date last calibrated, instrument settings during calibration, and the initials of the person performing the calibration.

All instruments are to be stored, transported, and handled with care to preserve the equipment's accuracy. Equipment found to be damaged prior to or during use must be taken out of service immediately and cannot be used again until a qualified technician repairs and recalibrates the equipment in question.

5. PREVENTATIVE MAINTENANCE OF FIELD EQUIPMENT

All equipment used by E & E in the field is subject to standard preventative maintenance schedules established by corporate equipment protocols. All equipment is inspected at least twice daily, once before start-up in the morning and again at the end of the work shift prior to overnight storage or return to the charging rack. Regular maintenance such as cleaning lenses, replacement of in-line filters, and removal of accumulated dust is to be conducted according to manufacturer's recommendations and in-field need, whichever is appropriate. All preventative maintenance performed will be entered in the individual equipment's logbook and the site safety logbook.

In addition to preventative maintenance procedures, daily calibration checks will be performed at least once a day in the morning prior to use and duly recorded in the respective logbooks. Additional calibration checks will be performed as required.

All logbooks will become part of either the permanent site file or the permanent equipment file.

6. FIELD ANALYTICAL PROCEDURES AND DATA REPORTING

All field analytical procedures and sampling at a facility or from the environment may become physical evidence in a legal action. An essential part of E & E's protocols is that the analysis or sample be controlled at all times and thoroughly documented. E & E maintains serialized field data records (FDRs) in the form of individual sheets or bound logbooks. Company analysts record all on-site measurements and field observations in the FDRs, including all pertinent information necessary to explain and reconstruct site operations. Each page of the FDR is dated and signed by all individuals making entries on that page. The leader of the field team on duty is responsible for insuring that the FDR is used during all activities and is stored safely to avoid possible tampering.

In addition to individual field sheets and daily logbooks, project managers must complete weekly summary sheets delineating the past week's activities. All data sheets, logbooks, and weekly summary sheets become part of the permanent site/project file. Figures 6-1 through 6-5 are examples of the weekly summary sheets that will be used.

6.1 CHEMICAL DATA

Chemical field analyses are generally limited to preliminary testing of pH and conductivity and surveying for organic vapors or other hazardous emissions (i.e., HCN, H_2S, and contaminated dust). All findings are recorded in the site logbook, site safety logbook,

ecology and environment, inc.

DRILLING
WEEKLY PROGRESS REPORT

Work Site: _____ E & E Job No.: _____ Week Ending: _____

Driller: _____ Driller's Helper: _____ Geologist: _____

Number of Drill Holes Drilled and Completed: _____ Average Feet/Day: _____

Drill Hole Information:

1. Hole Designation: _____ Total Depth: _____ Static Water Level: _____

   How Hole was Drilled and Equipment Used: _____

   Was Hole Cased? _____ Type and Amount of Casing Used: _____ Screened Interval: _____

   Type and Size of Well Screen: _____

   Amount of Sand, Gravel or Cement Used: _____

   Was Hole Developed? _____

   Problems Encountered: _____

2. Hole Designation: _____ Total Depth: _____ Static Water Level: _____

   How Hole was Drilled and Equipment Used: _____

   Was Hole Cased? _____ Type and Amount of Casing Used: _____ Screened Interval: _____

   Type and Size of Well Screen: _____

   Amount of Sand, Gravel or Cement Used: _____

   Was Hole Developed? _____

   Problems Encountered: _____

3. Hole Designation: _____ Total Depth: _____ Static Water Level: _____

   How Hole was Drilled and Equipment Used: _____

   Was Hole Cased? _____ Type and Amount of Casing Used: _____ Screened Interval: _____

   Type and Size of Well Screen: _____

   Amount of Sand, Gravel or Cement Used: _____

   Was Hole Developed? _____

   Problems Encountered: _____

_____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 4A8025

Figure 6–2 DRILLING ACTIVITIES WEEKLY PROGRESS REPORT

ecology and environment, inc.

WATER SAMPLING
WEEKLY PROGRESS REPORT

Work Site: _____ E & E Job No.: _____ Week Ending: _____

Total Number of Samples Taken: _____ Average Samples/Day: _____

Procedures and Types of Equipment for Sampling: _____

Comments: _____

A. Sample I.D. and Location: _____

Type of Sample: _____

How Sample was Taken: _____

Comments: _____

B. Sample I.D. and Location: _____

Type of Sample: _____

How Sample was Taken: _____

Comments: _____

C. Sample I.D. and Location: _____

Type of Sample: _____

How Sample was Taken: _____

Comments: _____

D. Sample I.D. and Location: _____

Type of Sample: _____

How Sample was Taken: _____

Comments: _____

E. Sample I.D. and Location: _____

Type of Sample: _____

How Sample was Taken: _____

Comments: _____

F. Sample I.D. and Location: _____

Type of Sample: _____

How Sample was Taken: _____

Comments: _____

_____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 444025

Figure 6—4 WATER SAMPLING WEEKLY PROGRESS REPORT

and field data sheets, if appropriate. Any further chemical analysis conducted in the field would be recorded using the procedures stated above.

6.2 HYDRAULIC DATA

Several techniques are employed in hydrological investigations. These may be employed separately or two or more may be combined, depending on the client's needs and the nature of a particular study. The contract scope of work normally details the procedures to be followed, describes the facilities, and identifies the equipment required to conduct the hydrologic investigations. The degree of calibration necessary and the exact method of documentation are site/project-specific.

Detailed procedures to be used in hydrologic studies during the Phase II Confirmation Study at this facility may include:

- Water sample collection, preparation, and shipment;
- Pump testing;
- Swabbing;
- Surging;
- Limited field analysis of groundwater samples; and
- Determination of water levels.

All data gathered during hydrologic investigations will be maintained in serialized field logbooks or on individual sheets as previously stated. Figures 6-6 through 6-9 are examples of field data sheets which may be used by E & E field personnel.

6.3 SOIL BORING DATA

For each boring and well installation, a field log must be completed by the geohydrologist supervising the operation. The completed log describes the operation, identifies any analyses conducted with findings, and provides a graphic description of the geohydrological environment encountered. The field logs become part of the permanent site file and must be kept in a secure location. Figures 6-10 and 6-11 are examples of the typical field log sheets used by E & E personnel.

MONITORING EQUIPMENT

Well: _____

Date: _____

Time: _____ (Time Reference)

Name of Operator: _____

I.D. of logging equipment (vehicle) and/or cable reel No. _____

Serial Number of transducer: _____

Range of transducer: 0 to _____ (Units)

Calibration of transducer: _____ (mv/ft or mv/m)

Voltage to transducer (measured at power supply output with transducer attached): _____

Millivolts or volts as related to barometric pressure (ie. barometric pressure may be 26.73 but is printed on data acquisition system as 2.67v. Therefore entry would be 2.67v = 26.73 inches of Mercury: _____

Other equipment used (type, Serial Number, when calibrated) _____

TRANSDUCER CALIBRATION POINTS

FT/M 1/	UP	MV	MV Change 2/

1/ Indicate which units

2/ Per interval or per unit

Figure 6–7 MONITORING EQUIPMENT FIELD LOG SHEET

Swabbing-bailing test form _____ Hole _____ Area

Observed by: _____ Date: _____

Hole depth _____ diameter _____ Cased interval _____

Perforated intervals _____ Tested interval _____

Water levels measured with _____

Measuring point is _____ which is _____ below land surface.

Static water level _____ below measuring point.

BAILING TESTS

Type of bailer _____ length _____ diameter (ID) _____

capacity

SWABBING TESTS

Method of measurement (barrel, tank, etc.) _____

Tank dimensions: Width _____ length _____ height _____

Capacity: 1 = _____ 0.1 = _____ 0.01 = _____

Measuring point _____

_____

Depth Casing set _____ Depth swabbing from _____

Weight of fluid at end of cleanout _____ _____ ft.

Time	Bailer or swab trip no.	Water removed	Depth to water below MP	t', time since discharge stopped	Remarks (temperature, color, specific conductance, etc. of sample)

Figure 6—9 SWABBING-BAILING TEST FIELD LOG SHEET

E & E Drilling and Testing Co., Inc.
FIELD LOG OF BORING
AND WELL INSTALLATION

DEPTH (FT)	GRAPHIC LOG	DEPTH TO WATER TABLE	SCREENED INTERVAL	BACKFILL MATERIAL	PROJECT NUMBER AND NAME: / DESCRIPTION	BORING/WELL NO.:	SAMPLE NUMBER AND INTERVAL	BLOW COUNTS/6 IN.	DEPTH (FT)

Figure 6–11 FIELD LOG OF BORING AND WELL INSTALLATION (Form 2)

7. SAMPLE NUMBERING SYSTEM

7.1 PROJECT IDENTIFICATION

Project management is a complex and demanding process that requires an established framework to track a project's progress. E & E has established a Work Breakdown Structure (WBS) management plan which is at the heart of project cost control and tracks a project's progress through the identification of discrete tasks or elements, each with its own specific identification number. The overall project will have a six-digit alphanumeric code called the project number sequentially followed by specific task and subtask codes. All work performed or expenses incurred for the project will be attributed to one of the specific task or subtask codes, thereby enabling easy tracking of the project's progress and cost.

For this facility, specific task and subtask codes will be assigned for the different work segments (i.e., drilling of monitoring wells, sampling of groundwater, etc.) following approval of the work plan and receipt of an authorization to proceed from the Air Force.

7.2 SITE IDENTIFICATION

All environmental monitoring and sampling sites will be identified using the Air Force's standard format of a nine-digit, alphanumeric code consistent with that required for completion of AF Form 2752. The identifier will be made up of the installation code, followed by the sampling site type code and site location number. All documentation for a specific site will include the site identification code for ease of tracking.

manager and the ASC manager, and they will decide to qualify or reject data taking into consideration all factors in a sampling and analysis project. It is possible to design blanks to monitor each and every stage of a sampling exercise: bottle cleaning, sample equipment cleaning, sample collection, transfer to bottles, bottle decontamination, packing, and shipping. Usually, only two types of blanks are used: the transport blank and the field equipment blank (sometimes called the transfer blank or rinsate blank). Field staff may add blanks if field circumstances are such that they consider normal procedures are not sufficient to prevent or control sample contamination, or at the direction of the project manager. Rigorous documentation of all blanks in the site logbooks is mandatory.

Transport Blanks

Transport blanks are blank samples designed to demonstrate that the transport of sample bottles to and from the field does not result in sample contamination. One of each type of the prepared bottles to be used during sample collection is filled with pure water, capped, and labelled. The project manager may or may not inform the laboratory that this sample is a blank. If the laboratory is not informed, it is permissible to put false identifying information on the label. If this is done, then the project manager must be responsible for preparation of the final report to the client or agency so that the information on that blank does not show up as a mysterious additional sample. Full documentation must be made in the site logbook.

The blank sample is transported to the site, unpacked, carried into the sampling area, labelled, decontaminated, packed, and shipped back to the laboratory. As far as possible, it should receive the same treatment as a real sample except that the bottle is not opened at any time.

Field Equipment Blanks

Field equipment blanks are blank samples (sometimes called transfer blanks or rinsate blanks) designed to demonstrate that sampling equipment has been properly prepared and cleaned before field use, and that cleaning procedures between samples are sufficient to minimize cross contamination. If a sampling team is familiar with a

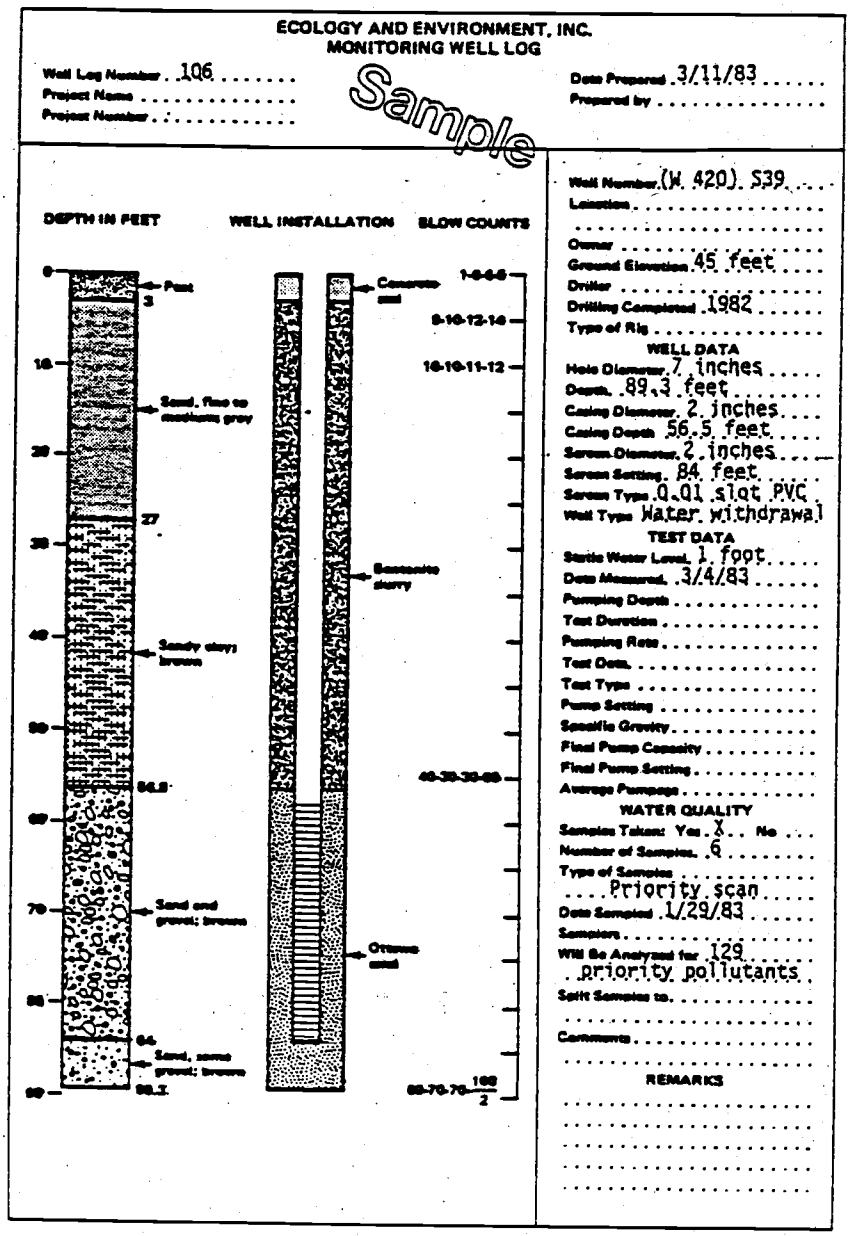
8. DRILLING AND INSTALLATION OF GROUNDWATER MONITORING WELLS

8.1 DRILLING

E & E employs a wide range of soil and rock boring techniques, including those using drive casing; both solid- and hollow-stem augers; water, air, and mud rotary and reverse rotary drills; and cable tools. The data requirements for a given well dictate the size and depth of the well, the materials to be used in its construction, and, ultimately, the method of its installation. Table 8-1 lists some available drilling methods and their limitations.

E & E's approach to well drilling and boring design will depend on the specific nature of the past operation, the present data needs, the current environmental setting at each site, and any projected remedial actions. The drilling program will have detailed specifications of procedures and techniques for well and boring location, type, and design; sample collection, preservation, and transportation; analytical procedures; and chain-of-custody control. The use of such specifications will avoid the "hit-or-miss" approach that is typical of less sophisticated programs and will eliminate hidden costs.

Soil samples will be taken every 5 feet (unless otherwise specified by the Air Force) and at every change in strata by driving a 2-inch outside diameter, 2-foot-long split-spoon sampler. Samples will be inspected in the field by a qualified hydrogeologist who will establish site stratigraphy and geologic trends. All field data will be documented in a well log (Figure 8-1) that will be presented to the Air Force. The driller will be required to keep a similar log to serve as a cross-check of the accuracy of the field notes. Representative portions of each sample will be retained in labeled jars.



ECOLOGY AND ENVIRONMENT, INC.
MONITORING WELL LOG

Well Log Number 106
Project Name
Project Number

Date Prepared 3/11/83
Prepared by

Sample

DEPTH IN FEET | WELL INSTALLATION | BLOW COUNTS

Well Number (W 420) S39
Location
Owner
Ground Elevation 45 feet
Driller
Drilling Completed 1982
Type of Rig

WELL DATA
Hole Diameter 7 inches
Depth 89.3 feet
Casing Diameter 2 inches
Casing Depth 56.5 feet
Screen Diameter 2 inches
Screen Setting 84 feet
Screen Type 0.01 slot PVC
Well Type Water withdrawal

TEST DATA
Static Water Level 1 foot
Date Measured 3/4/83
Pumping Depth
Test Duration
Pumping Rate
Test Date
Test Type
Pump Setting
Specific Gravity
Final Pump Capacity
Final Pump Setting
Average Pumpage

WATER QUALITY
Samples Taken: Yes X No
Number of Samples 6
Type of Samples
Priority scan
Date Sampled 1/29/83
Samplers
Will Be Analyzed for 129 priority pollutants
Split Samples to
Comments

REMARKS

Figure 8—1 SAMPLE MONITORING WELL LOG

Each containerized soil sample to be used in a composite will be sieved through a No. 8 mesh screen to remove stones and debris. Screening will be accomplished using a Teflon scraper to force material through the screen. This insures that the sample weight is not distorted by stones and debris with respect to any compound that may be present. The screened sample will then be weighed and returned to its original container for storage until all soil samples have been screened. The weight of the screened samples will be recorded for future use.

A portion of each screened sample will then be weighed to provide equal portions for the homogenization step. The weighed portions will be mixed thoroughly in a prepared 16-ounce sample bottle using a spatula. A homogeneous mixture will be attained by stirring the sample at least 10 to 15 times. The mixed sample will then be placed on a Teflon sheet and shaped into a rectangular form of even thickness. The rectangle will then be quartered: two diagonal quarters will be combined as the client composite; the alternate diagonal quarters will be combined as a storage composite. For storage, the composites will be placed in prepared containers, sealed, and accompanied by appropriate sample control records. The storage composites will be held at the ASC in a secured storage area until the project is complete.

The soil composites for volatile organic analysis will be prepared in the following manner. During field operations, a portion of each soil sample will be placed in a 40-mL borosilicate vial. Equal portions of soil will be removed from each vial and placed in the composite vial. The composite samples will then be mixed quickly and the vial sealed.

More detailed soil contamination data will be required if soils contaminated with hazardous materials are to be excavated and removed to approved disposal facilities. For this type of investigation, the surface of the disposal site will be surveyed and gridded into areas of approximately 1,000 square feet. (Grid size may vary, depending on the nature of the site and underlying soils.) A borehole will be installed at the center of each grid square; soil samples will be taken at the ground surface and at 5-foot intervals until the appropriate depth has been reached. This depth may vary from as

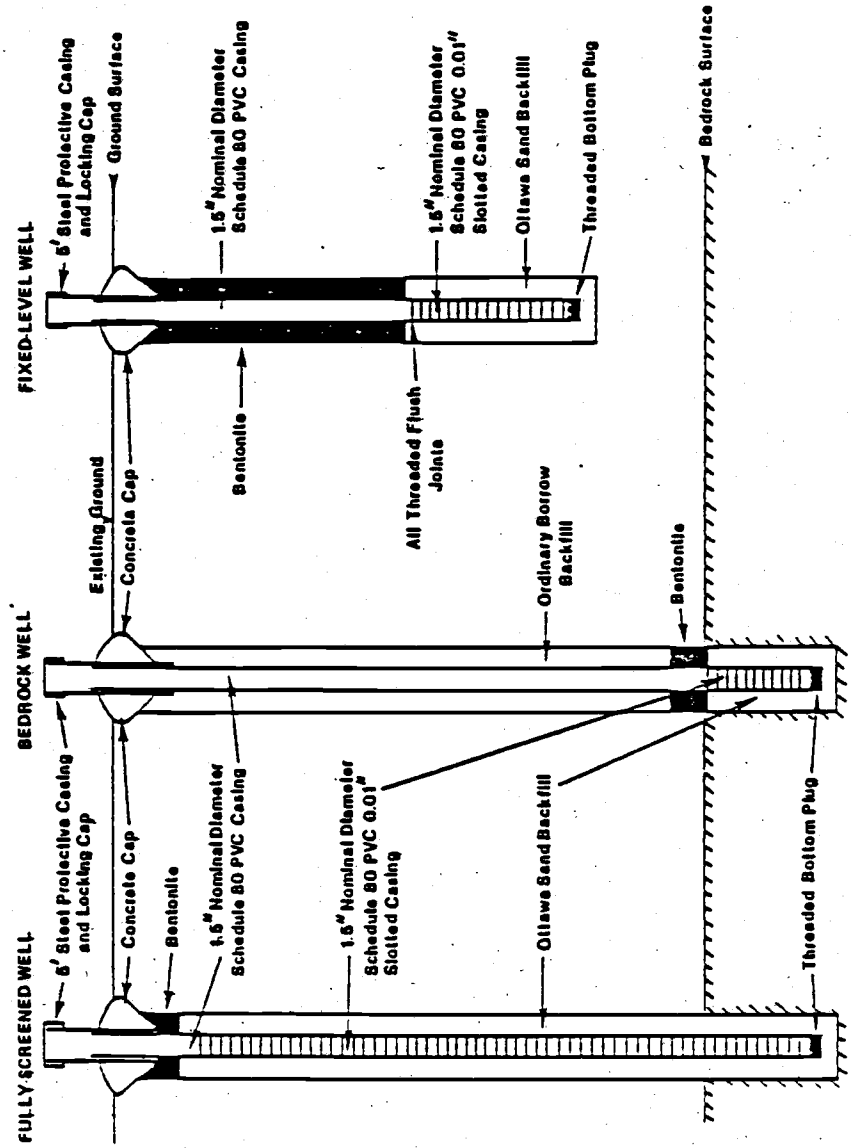


Figure 8–2 TYPICAL DETAIL OF MONITORING WELLS

8.4 WELL DEVELOPMENT

At least 48 hours after internal mortar placement, the monitoring wells will be developed according to procedures prescribed below. Well development will be conducted using either a submersible pump, airlift methods, or a bottom discharge bailer, with or without a surge block. The wells will be drilled without the use of drilling fluid and a minimum of five times the amount of the standing water volume in the well, including the well screen, casing, and saturated annulus (assuming 30% porosity), will be removed. Wells will be developed until the well water is clear to the unaided eye, the sediment thickness remaining in the well is less than 5% of the screen length, and the five well volumes (described above) have been removed.

Well development also will include washing the entire well cap and the interior of the well casing above the water table using only water from that well. The result of this operation will be a well casing that is free of extraneous material (grout, bentonite, sand, etc.) inside the riser, well cap, and blank casing between the top of the well casing and the water table. This washing will be conducted before and/or during development, not after development.

The following data will be recorded as part of well development:

- Well designation;
- Date(s) of well installation;
- Date(s) and time of well development;
- Static water level from top of well casing before 24 hours after development;
- Quantity of water lost:
  - During drilling and
  - During fluid purging;

8.5 GEOPHYSICAL LOGGING

All boreholes for monitoring wells will be geophysically logged for the purpose of cataloging and correlating lithology and stratigraphy. Because the boreholes will be drilled without the use of drilling fluids, it is recommended that calibrated nuclear logs, such as neutron and gamma-gamma, along with natural gamma logs, be used. Electric logs, such as spontaneous potential and resistivity, cannot be run due to the lack of drilling mud and, although there may be some water in the drill hole, it is not anticipated that the water height will be sufficient to allow meaningful surveys to be performed. Nuclear logs will supply information pertaining to lithology, stratigraphy, total porosity or bulk density, and moisture content. The advantage of these logs is that they can be used in either cased or uncased boreholes. As a cost-saving benefit, E & E recommends that all geophysical logging be performed upon completion of all well construction, to minimize standby costs.

Table 8-2 contains a summary of log applications that may be used for this project, and the types of information that may be obtained from each.

9. AQUIFER TESTING

The movement of groundwater and any associated contaminant plume through an aquifer is controlled by the physical characteristics of the medium and the hydraulic head gradient. Changes in the potentiometric surface caused by the pumping of local wells can be evaluated to determine formation permeabilities, specific yield, drawdown, and extent of cones of depression. All of these properties are important in assessing the potential impact of a contaminant plume on local groundwater quality. Artificial changes in the hydraulic head caused by withdrawing water from the aquifer can locally distort the potentiometric surface and alter the flow direction of a contaminant plume. Proper placement of a pumping well may locally lower the water table, effectively isolating a potential source of contamination from contact with the groundwater. A pumping well situated in a contaminant plume can be incorporated into a remedial action plan to remove the contaminated water for treatment purposes. A pumping well also can be used as a diagnostic tool to determine the hydraulic connection between adjacent aquifers in order to aid in the siting of proposed landfills, lagoons, and waste storage sites.

By interpreting the aquifer response to any of a variety of field tests, E & E hydrogeologists infer data pertaining to transmissivity, storativity, and boundary conditions, as well as data pertinent to the movement and extent of contaminant plumes.

Existing wells will be used whenever possible to reduce project costs. Generally, a well diameter of at least four inches will be needed. Three or more observation wells usually will be specified.

data and derive a permeability number is the method of Hvorslev*, which uses time/head-change data to graphically calculate a factor, T_0, "basic time lag." Then, for a piezometer screen length of L, a sandpack radius of R, and a well casing radius of r, the permeability, K, is defined as:

$$K = \frac{r^2 \text{in } (L/R)}{2L\ T_0}$$

The computation of K for each piezometer allows a hydrogeologist to compute the actual rate at which the groundwater (and thus contaminants) leaves the site by applying the following version of the common Darcy equation for groundwater flow:

$$Q = KiA,$$

where Q is groundwater discharge; K is permeability; i is hydraulic gradient (derived from piezometer water levels); and A is cross-sectional area perpendicular to flow.

A typical aquifer test will include collection of background data for siting purposes, installation of a discharge well and three observation wells, monitoring to establish background conditions, performance of a 72-hour pump test, and interpretation of the results.

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*Hvorslev, M.J., 1951, "Time Lag and Soil Permeability in Groundwater Observations," United States Army Corps of Engineers, Waterways Experiment Station Bulletin 36, Vicksburg, Mississippi.

10. GROUNDWATER MONITORING AND SAMPLING

10.1 GROUNDWATER LEVEL MEASUREMENT

Water levels will be measured at all monitoring wells and surface water staff gaging stations on a monthly basis. Work will be performed in accordance with established safety requirements by either contractor or subcontractor personnel. All measurements will be taken to within 0.01 foot.

The top of the interior casing of all monitoring wells will be marked at one point, which will be surveyed to determine its elevation. The depth of the water table below the top of the casing will be determined by a steel tape or electric water level indicator. All equipment will be decontaminated between wells to prevent cross- contamination.

10.2 SURVEYING OF WELLS

Following completion of the installation of the final well, each installed well location will be surveyed to determine map coordinates (Univeral Transverse Mercator, State Planar, or latitude/longitude) to within one meter and entered onto a site map. Elevations of both the ground surface and the top of the well riser will be surveyed to within 0.01 foot (± 0.005 foot if possible) using the National Geodata Vertical Datum of 1929. These data will become part of the permanent site file.

10.3 ON-SITE ANALYSIS

Groundwater sampling and analysis will involve the following steps:

purging and the water samples for organic vapors in order to determine the potential health hazards.

10.4 SAMPLING FOR OFF-SITE ANALYSIS

Sampling of groundwater for off-site analysis is conducted in the same manner as sampling for on-site analysis as described in Section 10.3, with the addition that the water samples are containerized and shipped to an outside laboratory for analysis as described in Sections 12 and 13.

11. DECONTAMINATION PROCEDURES

Decontamination of personnel and equipment is an important element of site safety operations. Proper decontamination prevents sample cross-contamination and contamination of personnel, vehicles, and the public; moreover, it supports quality control. Decontamination at the site involves the use of field decontamination stations for personnel, equipment, and clothing.

The decontamination process is designed to control the spread of contaminants to clean areas by physically removing or chemically neutralizing the contaminants. The following subsections delineate the basic decontamination processes for various pieces of field equipment and describe a sample personnel decontamination set-up for a Level B or C site. The actual decontamination layout is generally site-specific but would include most, if not all, of the described stations. A Level D site would involve less protective clothing and fewer stations.

Decontamination procedures normally take place in the contamination reduction area (see Figure 11-1). In this area, all equipment which entered the site is cleaned prior to moving off-site and outside of the contamination control line. Table 11-1 identifies various decontamination wash solutions which can be used depending on the site-specific hazards encountered.

11.1 DRILLING, SOIL SAMPLING, AND MONITORING WELL INSTALLATION

Prior to use in the field, and between sampling locations, all equipment, including the full auger rig and all auger flights, will be

Table 11-1

USE OF GENERAL PURPOSE DECONTAMINATION SOLUTIONS

Decon Solution	Mixing Solutions	Uses/Remarks
A. An aqueous solution containing a low-sudsing detergent	Follow the mixing instructions written on the particular product label	Generally has the widest range of use; best choice on sites where contaminant is unknown or a wide range of contaminants exists
B. An aqueous solution containing 5% sodium carbonate (Na_2CO_3) washing soda	To 10 gallons of water, add four pounds of sodium carbonate	Decon solution of choice for base labile compounds such as the organophosphate pesticides; effective in neutralizing inorganic acids; since sodium carbonate is a water softening agent, this characteristic is an aid in physical removal of contaminants.
C. An aqueous solution containing 5% sodium bicarbonate ($NaHCO_3$) baking soda	To 10 gallons of water, add four pounds of sodium bicarbonate	Sodium bicarbonate is amphoteric and can be used to neutralize either base or acid contaminants; good decon for base labile compounds
D. An aqueous solution containing 2% trisodium phosphate (Na_3PO_4) (TSP)	To 10 gallons of water, add approximately two pounds of trisodium phosphate	See uses/remarks for decon solution B above
E. An aqueous solution containing 10% calcium hypochlorite ($CaCl_2O_2$) (HTH)	To 10 gallons of water, add eight pounds of calcium hypochlorite	Cyanide salts
F. Ethylenediaminetetra-acetic acid (EDTA, versene, sesquestrene)	Commercial product; follow product label	EDTA is a chelating agent and is the decon solution of choice for heavy metal contaminants
G. An aqueous solution containing 3 to 5% citric, tartaric, oxalic acids or their respective sodium salts	To 10 gallons of water, add four pounds citric, tartaric, or oxalic acid	These compounds are chelating agents and are the decon solution of choice for heavy metal contaminants

Following completion of well development and aquifer testing at each well, the equipment removed from the well will be considered as contaminated and subject to the same decontamination process or discarded prior to use in another well.

11.3 WATER LEVEL MEASUREMENTS

Water level measurements will generally be taken using a steel tape or electronic water level indicator. All equipment entering the well will be washed and rinsed prior to insertion into the well according to the procedures specified in Section 11.1. Upon completion of the measurement at each well, the equipment will be subjected to the same decontamination process prior to use on any additional wells in order to prevent cross-contamination.

11.4 WATER SAMPLING

Water sampling equipment (pumps, bailers, glass sampling jars, etc.) will be cleaned prior to use in any sampling work according to the procedures described in Section 11.1. Following completion of sampling at a specific point, all equipment will be subjected to the same decontamination process to prevent cross-contamination between sampling points.

11.5 SEDIMENT SAMPLING

Sediment sampling equipment such as stainless steel scoops, sieves, augers, split spoons, and dredges will be subjected to the same decontamination procedures as other field equipment both prior to and immediately following use at each sampling site.

11.6 PERSONNEL DECONTAMINATION

Avoidance of contamination is the first and best method for preventing the spread of contamination from a hazardous site. Every effort should be made to prevent direct contact with the contaminant. Careful planning, knowledge of the contaminant, and attention to where one puts one's hands and feet are all important. Simple common-sense rules of contamination avoidance include not sitting down, not leaning against drums or debris, and not putting equipment on the ground.

- Topography;
- Levels of protection selected; and
- Availability of equipment and supplies.

This section describes the layout of a PDS for personnel dressed in Levels B and C protection.

Set-up for Levels B and C Decontamination

Figure 11-2 illustrates a PDS designed to support personnel working in Level B or Level C protection. The following is a description of the PDS layout by station.

- Station A - Equipment Drop: A plastic ground sheet on which field equipment is placed by returning members of the work party.

- Station B - Decontamination of Outer Garments: A wash tub filled with the appropriate decontamination solution.

- Station C - Rinse of Outer Garments: A wash tub filled with a water rinse.

- Station D - Boot Removal: A bench or stool for personnel to sit on during removal of the boot covers; and a plastic-lined container for disposal of booties.

- Station E - Glove Decontamination and Rinse: A portable table containing a small bucket of decontamination solution and water rinse.

- Station F - Boot Decontamination and Rinse: A small bench or stool for personnel to sit on during decontamination; a wash tub containing the appropriate decontamination solution; a wash tub containing a water rinse; and a small can for disposal of masking tape.

- Station G - Boot and Outer Garment Removal: A bench or stool to sit on during removal of boots, aprons, and gloves; and three 32-gallon plastic-lined containers for segregating boots, aprons, and gloves.

- Station H - Removal of Respirator: A portable table approximately 30 meters upwind from Station G on which the self- contained breathing apparatus or air-purifying respirators are placed.

- Station I - Removal of Cotton Garments: A 32-gallon plastic-lined container for disposal of all cotton garments.

- Station J - Field Shower (Optional): A field shower set-up. If impractical or not available, a wash point (container of water, soap, and paper towels) should be provided.

- Station K - Redress and First Aid (Optional): A location to redress and render first aid as necessary. This station separates the contamination reduction area from the support (clean) area.

Levels B and C Decontamination Equipment and Procedures

Station A. Equipment such as instrumentation, sample jars, and sampling devices removed from the hazardous site should be placed on the equipment drop at this station. The plastic sheet used for this purpose is positioned on the downwind side of the hot line just inside the exclusion area. Equipment should be decontaminated by PDS operators only after all work party members have been processed through the PDS. Gross contamination can be removed from equipment either by carefully stripping off protective covers such as plastic bags or through a wash process using an appropriate decontamination solution and water. Protective covers which are removed from the equipment can be placed in the same container as the disposable booties at Station D. Equipment should be thoroughly decontaminated before taking it across the hot line.

Station K. After showering, work party members will redress into clean clothes and receive first aid (e.g., treatment of minor cuts and bruises), if required. The individual then leaves the PDS and moves into the support area.

11.6.2 Preparation of Decontamination Solutions

Ideally, the decontamination solution used should react with and chemically neutralize the contaminants found at a hazardous substance site. However, since the contaminants on a particular site will be unknown in most cases, a decontaminant is more often chosen based on its ability to physically remove (dissolve or suspend) the contaminant in question.

In all decontamination operations water is a recommended solvent. Organic solvents dry the skin and are often more toxic than the hazard one is trying to eliminate. These solvents also accelerate the deterioration and penetration of protective clothing. Water, on the other hand, does not damage protective clothing and does not contribute to secondary contamination.

It must be recognized that there are no universal decontaminants and the project team leader will often be required to make a professional judgment regarding this matter. Table 11-1 lists chemical mixtures suggested as readily available general-purpose decontaminants. Their application and instructions for preparation are also presented in the table.

11.6.3 Closure of the PDS

When the PDS is no longer needed, it should be closed down by the PDS operators. All disposable clothing and plastic sheeting used during the operation should be double-bagged and either contained on-site or removed to an approved off-site disposal facility. Decon and rinse solution could be discarded on-site or also removed to an approved disposal facility. Reusable rubber clothing should be dried and prepared for future use. (If gross contamination has occurred, additional decontamination of these items may be required.) Cloth items should be bagged and removed from the site for final cleaning. All wash tubs, pails, containers, etc., should be thoroughly washed, rinsed, and dried prior to removal from the site.

12. SAMPLE HANDLING AND PACKING

12.1 SPLIT SAMPLE PROCEDURES

When split samples are requested, identical sample tags will be attached by E & E personnel to the two (or more) containers. The E & E sample will be clearly marked as such and treated in accordance with normal procedures. Any other split samples will remain subject to chain-of-custody procedures until they are relinquished to the person requesting them. E & E personnel also may be required to comply with the custodial procedures preferred by the person requesting the split samples; these procedures will be complied with on a case-by-case basis. All split samples will be documented in the site logbook.

12.2 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

In order to preserve sample integrity either for physical, chemical, or biological analyses as well as to have a sufficient volume of each sample for analysis, all samples will be collected in the appropriate containers, preserved when required, and stored at the appropriate temperature. Various sample containers (e.g., glass, plastic) and container sizes will be used, depending on the specific analyses required. Table 12-1 lists the sample containers, preservatives, and holding times to be used to analyze for the priority pollutants listed in 40 Code of Federal Regulations (CFR) Part 136. Table 12-2 lists the sample bottles to be used, the volumes, the preservatives, and the holding times for biological parameters, physical parameters, metals, inorganic and nonmetallic compounds, and organic compounds. All of the listed sample containers, preservatives, and holding times in the tables are approved and/or recommended by EPA.

Table 12-2

RECOMMENDED SAMPLE STORAGE, PRESERVATION, AND HOLDING TIMES ACCORDING TO MEASUREMENT[1]

Parameter	Minimum Volume Required (mL)	Container[2]	Preservative	Holding Time[3]
Biological Parameters				
Fecal coliform	100	Autoclaved P,G	Cool, 4°C	6 hours
Total coliform	100	P,G	Cool, 4°C	6 hours
Fecal streptococci	100	P,G	Cool, 4°C	6 hours
Standard plate count	100	P,G	Cool, 4°C	6 hours
Benthos (macrobenthic invertebrates)	—	P,G	Formalin/ Glycerine	6 months
Chlorophyll-a	1,000	P,G	Filter on-site Freeze immediately	3 months
Phytoplankton	250	P,G	2 mL Lugol's Solution	6 months (darkness)
Zooplankton	250	P,G	Formalin/ Glycerine	4 months
Physical Parameters				
Color	50	P,G	Cool, 4°C	24 hours
Conductance	100	P,G	Cool, 4°C	24 hours[4]
Hardness	100	P,G	Cool, 4°C HNO_3 to pH <2	6 months[5]
Odor	200	G only	Cool, 4°C	24 hours
pH	25	P,G	*In situ*	6 hours
Residue				
Filterable	100	P,G	Cool, 4°C	7 days
Nonfilterable	100	P,G	Cool, 4°C	7 days
Total	100	P,G	Cool, 4°C	7 days
Volatile	100	P,G	Cool, 4°C	7 days
Settleable matter	1,000	P,G	None required	2 days
Temperature	1,000	P,G	*In situ*	No holding
Turbidity	100	P,G	Cool, 4°C	48 hours

Table 12-2 (Cont.)

Parameter	Minimum Volume Required (mL)	Container[2]	Preservative	Holding Time[3]
Inorganics, Nonmetallics (Cont.)				
Nitrate plus nitrite	100	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Nitrate	100	P,G	Cool, 4°C	24 hours
Nitrite	50	P,G	Cool, 4°C	48 hours
Phosphorus, ortho-phosphate, dissolved	50	P,G	Filter on-site Cool, 4°C	24 hours
Hydrolyzable	50	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Total	50	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Total dissolved	50	P,G	Filter on-site Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Silica	50	P only	Cool, 4°C	7 days
Sulfate	50	P,G	Cool, 4°C	7 days
Sulfide	500	P,G	2 mL zinc acetate & NaOH	7 days
Sulfite	50	P,G	Determined on-site	No holding
Organics				
BOD	1,000	P,G	Cool, 4°C	24 hours
COD	50	P,G	H_2SO_4 to pH <2	7 days[6]
Methylene blue active substance (MBAS)	250	P,G	Cool, 4°C	24 hours
Nitrilotriacetic acid (NTA)	50	P,G	Cool, 4°C	24 hours
Oil and grease	1,000	G only	Cool, 4°C H_2SO_4 or HCl to pH <2	24 hours
Organic carbon	25	P,G	Cool, 4°C H_2SO_4 or HCl to pH <2	24 hours
Phenolics	500	G only	Cool, 4°C H_2SO_4 to pH <4 1.0 g $CuSO_4$/l	24 hours

12.3 SAMPLE HANDLING AND DECONTAMINATION

E & E will identify all samples using a sample tag or other appropriate identification attached to or folded around the sample. The tag will provide the sample identification number; the date, time, and location of collection; designation of the sample as a grab or composite; notation of the type of sample and preservative; any remarks; and the signature of the sampler. E & E also will record this information in the appropriate logbook, along with any pertinent on-site measurement data and field observations.

After collection and identification, the sample will be preserved and maintained under the chain-of-custody procedures discussed below. In a similar fashion, all tags on blank or duplicate samples will be marked "Blank" or "Duplicate," respectively. Field blind duplicates will be coded and identified as such only in the field logbook.

Chain-of-Custody Procedures

Air Force chain-of-custody requirements for this program will be clarified and incorporated in E & E's standard operating procedures. E & E will require that the possession of samples be traceable from the time the samples are collected until they are disposed of through established chain-of-custody procedures. The major elements of these E & E procedures include the following.

Sample Custody. A sample will be considered in custody if:

- It is in the individual's actual possession; or
- It is in the individual's view, after being in his/her physical possession; or
- It was in the individual's physical possession and then he/she locked it up to prevent tampering; or
- It is in a designated secure area.

Sample Decontamination

All sampler containers will be considered as contaminated and subject to standard decontamination procedures prior to packaging in preparation for storage and/or shipment to laboratories for analysis. Decontamination procedures will include washing the container in a cleaning solution containing Alconox on TSP, followed by a thorough rinse with clean water. The samples will be immediately placed into a protective plastic wrap to prevent further possible contamination.

12.4 PROCEDURES FOR PACKING LOW CONCENTRATION SAMPLES

All samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements must be followed:

- Sample bottle lids are never to be mixed. All sample lids must stay with the original containers. Custody seals must be affixed.

- The sample volume level can be marked by placing the top of the label at the appropriate sample height, or with grease pencil. This procedure will help the laboratory to determine if any leakage occurred during shipment. The label should not cover any bottle preparation QA/QC marks.

- Unless otherwise specified, all sample bottles must be secured with a custody seal and placed in a plastic bag to minimize the potential for vermiculite contamination.

- Shipping coolers must be filled initially with approximately three inches of vermiculite or zonolite.

- The secured sample bottles must be placed in the cooler in such a way as to ensure that they do not touch one another.

- Low hazard samples (i.e., defined as environmental or less than 10 ppm of any single constituent) are to be cooled.

13. SAMPLE CUSTODY AND DOCUMENTATION

13.1 SAMPLE IDENTIFICATION DOCUMENTS

All field personnel must verify the sampling methods to be used during sample collection by making proper reference to the project plans. Prior to sampling, the field sampling personnel must ensure that all sample containers are in his physical possession or in his view at all times, or ensure that the containers are stored in a locked place at all times, so as to maintain proper custody. All sample gathering activities must be recorded in the site logbook; all sample transfers must be documented in the chain-of-custody record; all samples are to be identified with sample tags, labels, or other appropriate means of identification (hereinafter referred to as sample tags); and all sample bottles are to be sealed with custody seals. All information is to be recorded in waterproof ink. All E & E field personnel are personally responsible for sample collection and the care and custody of collected samples until the samples are transferred or properly dispatched.

13.2 CHAIN-OF-CUSTODY RECORDS

The custody record must be fully completed in duplicate, using black carbon paper where possible, by the field technician who has been designated by the project manager as being responsible for sample shipment to the appropriate laboratory for analysis. The information specified on the chain-of-custody record will contain the same level of detail found in the site logbook, with the exception that the on-site measurement data need not be recorded. The custody record

13.3 FIELD LOG BOOKS

Site logbook(s) must be maintained for each project. All site logbooks must be bound, contain numbered pages, and be waterproof. The following documentation is to be recorded in the site logbooks: sampling locations, station numbers, dates, times, sampler's name, designation of the sample as a grab or composite, notation of the type of sample (e.g., groundwater, soil boring, etc.), preservatives used, on-site measurement data, and other field observations and remarks. Each series of site logbook entries for a particular sampling effort must be initialed by the person recording the information and, where appropriate, summary entries that organize and/or clarify data presented in the logbook are to be prepared by the person recording the information. After reviewing the entries, the field team leader must sign each page of the site logbook on the top and the bottom.

As with all data logbooks, no pages will be removed for any reason. If corrections are necessary, these must be made by drawing a single line through the original entry (in such a manner that the original entry can still be read) and writing the corrected entry alongside. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

The site logbook is the prime repository of information of actual site conditions and as such is an important link in the analytical chain. Any details which may be relevant to the analysis or integrity of samples must be recorded. Preliminary sample descriptions are helpful. Any unusual circumstances should be noted, e.g., heavy rain or difficulty in pH meter calibration. At the completion of the sampling exercise, the logbook must be retained by and/or returned to the project manager and is to be made part of the permanent project file. To the extent that any information contained in the logbook is relevant to sample analysis to be performed, such data are to be made available to the laboratory performing said analyses by the project manager.

13.4 CORRECTIONS TO DOCUMENTATION

As with data logbooks, if corrections to any site documentation are necessary, these must be made by drawing a single line through the original entry (in such a manner that the original entry can still be

Sample Tags

E & E field personnel will properly identify all samples taken in the field by using a sample tag attached to or affixed around the sample container. The sample tag must contain the field identification number; the date, time, and location of sample collection; designation of the sample as a grab or composite; notation of the type of sample (e.g., groundwater, soil boring, etc.); identification of preservatives used; any remarks; and the signature of the sampler. The sample tags are to be placed on the bottles so as not to obscure any QA/QC data on the bottles. Sample information must be printed in a legible manner using waterproof ink. Field identification must be sufficient to enable cross-reference with the site logbook.

Custody Seals

Custody seals are preprinted adhesive-backed seals with security slots designed to break if they are disturbed. Individual sample bottles are sealed over the cap by the sampling technician. Sample shipping containers (coolers, cardboard boxes, etc., as appropriate) are sealed in as many places as necessary to ensure security. Seals are signed and dated before use. On receipt at the laboratory, the custodian will check (and certify, by completing logbook entries) that seals on boxes and bottles are intact.

13.6 SHIPPING OF SAMPLES

Environmental and hazardous samples will be properly packaged and labelled for shipment and dispatched to the appropriate laboratory for analysis. A separate chain-of-custody record must be prepared for each laboratory. The following requirements for shipping containers must be followed:

- United States Department of Transportation (DOT) regulations covering the transport of hazardous materials are contained in 49 CFR Parts 170-179.

- Shipping containers must be padlocked or custody-sealed for shipment, as appropriate. The package custody seal is to consist of filament tape wrapped around the package at least

14. SITE CLEAN-UP

The objective of site clean-up is to leave the areas of investigation essentially as they were found, except of course for the physical addition of monitoring wells and guard posts. Site clean-up also includes close coordination with base personnel to insure that clean-up operations are in accordance with overall management of base operations.

E & E has responsibility for assuring the safe and proper conduct of subcontractors in this work and the associated equipment. Decontamination procedures will be conducted to insure that potential contamination remains on-site. General cleanup of equipment and vehicles will be conducted consistent with accepted facility practices and in close coordination with the Base Engineer (BE).

Drill cuttings and investigation-derived wastes (e.g., expendables such as Tyvek over-suits) become the property of the facility. These materials will be labeled and staged in the secure area (with assistance from the BE) pending the results of analyses that will determine whether these wastes can be generally disposed or must be disposed as contaminated or hazardous waste.

15. FIELD TEAM ORGANIZATION AND RESPONSIBILITIES

Once the strategy and objectives of the work plan have been developed, a team must be organized to implement the plan. The specific techniques described in the work plan are likely to include: environmental sampling, sampling of hazardous substances, drilling operations, mapping, hazardous substance inventory, etc.

Hazardous substance sites present many hazards, physical conditions, and situations that require a wide variety of expertise and scientific support to insure safe entry and data collection. It is impractical to design a standard site entry team given the significant differences among sites. Therefore, each site requires a team tailored to the potential hazards and objectives of each specific site. The field investigation team will likely consist of individuals with various technical backgrounds, i.e., chemist, engineer, hydrogeologist, who will also fill field positions such as site safety officer or command post supervisor.

A team entering a hazardous substance site is organized for mutual support and safety. Hazardous site investigations require a complete respect for safety by all team members to prevent injury or loss of life.

15.1 ORGANIZATION AND RESPONSIBILITIES

There are eight roles which may be required for a field investigation team. These roles are dictated by the potential site hazards. Dual role assignments are not encouraged but may be acceptable when

- Coordinating with the field team leader to complete the work plan;

- Completing final reports and preparation of the evidentiary file; and

- Insuring that safety and equipment requirements are complete.

Field Team Leader

The field team leader is responsible for the overall operation and safety of the field team. As mentioned, this role can be filled by the project team leader or his designated representative. The field team leader may join the work party. He is responsible for:

- Safety and safety procedure enforcement;

- Field operations management;

- Public relations/state and federal liaison;

- Site control;

- Compliance of field documentation and sampling methods with evidence collection procedures;

- Execution of the site work plan; and

- Determination of the level of personal protection required (in conjunction with the site safety officer).

Site Safety Officer

The site safety officer has primary responsibility for all safety procedures and operations on-site. Ideally, the site safety officer will report to the person responsible for safety in the organization rather than to the field team leader or project team leader. This allows two separate lines of authority. It also allows decisions based on safety to be represented on an equal basis with decisions

- Providing emergency medical care and first aid as necessary on-site. The site safety officer has the ultimate responsibility to stop any operation that threatens the health or safety of the team or surrounding populace.

PDS Operator/Equipment Specialist

The PDS operator/equipment specialist functions in two roles that do not require concurrent attention. As the equipment specialist, he is charged with:

- Insuring that all equipment is poperly maintained and operating;
- Inspecting all equipment before and after use;
- Insuring that all required equipment is available; and
- Decontaminating all personnel, samples, and equipment returning from the exclusion area.

The PDS operator/equipment specialist is responsible for design and setup of the PDS and for preparing the necessary decontamination solutions to insure that chemical contamination is not transported into the clean area by inspection equipment, samples, protective clothing, or personnel. Failure to properly execute these duties reduces the effectiveness of the protective equipment and threatens the rest of the field team. The PDS operator/equipment specialist also manages the mechanics of removing contaminated clothing from the work party and the proper disposal of discarded contaminated clothing and decontamination solutions.

Command Post Supervisor

The command post supervisor functions as the clearinghouse for communications. He does not enter the exclusion area to assist the work party except for certain emergency situations. Should an emergency arise, the command post supervisor notifies emergency support personnel by phone, radio, etc., to respond to the situation.

exit the exclusion area alone. The work party consists of a minimum of two individuals, and any work party should follow this buddy system. Besides the safety considerations, it is much easier for two persons dressed in protective clothing to perform such tasks as note-taking, photographing, and sampling.

Emergency Response Team

Extensive assignments requiring long hours and large work parties (more than five) necessitate the use of a standby emergency response team. The emergency response team is half-dressed in protective gear so that it can quickly enter the exclusion area in the event of an emergency. This team is particularly valuable at dangerous sites where protective equipment produces stress and heat loads on the work party.

15.2 TEAM SIZE

The size of a team employed in an investigation is determined by two sometimes contradictory requirements: the need for a team large enough to maximize safety versus the desire for economy. Team size is dependent upon site organization, levels of protection, work objectives, and site hazards. Additional team members can always be added according to the roles required.

Two-Person Team

The two-person team is the minimum for a hazardous substance site investigation, but is very limited. Such a team should never enter an inactive hazardous substance site. The two-person team is best suited for off-site surveys and inspections or obtaining environmental (non-hazardous, off-site) samples. Ground truthing of aerial photographic surveys, inspection of files, or interviews can all be accomplished by the two-person team.

Three-Person Team

The three-person team can be employed on sites requiring Level C protection and, in some cases, on sites requiring Level B protection. This team is composed of field team leader; an individual fulfilling the combined functions of PDS operator/equipment specialist, site

of historical information. The site hazards that require Level B protection, combined with the limitations and stresses placed on personnel by wearing Level B protection, generally necessitate a full-time PDS operator/equipment specialist who can also serve in emergency response. In the event of a serious emergency such as a fire, explosion, or acutely toxic release, both the site safety officer and PDS operator/equipment specialist may need to enter the exclusion area dressed in Level B gear. The command post supervisor remains in the support area to direct outside help to the site and then assume the functions of PDS operator/equipment specialist.

Teams of Seven or More

Certain hazardous substance sites requiring sampling operations necessitate larger or alternating work parties and additional support personnel in the contamination reduction area. The seven-person team employs the basic five-person structure plus an additional work party for alternating work loads. The eight-person team includes an additional PDS operator/equipment specialist to assist in the continuous decontamination tasks involved with alternating work parties, and to decontaminate and pack samples as they are received.

It is not unusual to employ larger teams where such tasks as drum opening may require three work parties downrange working concurrently or may require a team to work under rigorous safety procedures. Larger teams can be designed with additional work parties and support personnel to safely gather the site data and insure communication and site control.

15.3 TRAINING

Although trained and experienced personnel are assigned, training is essential to successful project completion.

Mobilization Meeting

Before mobilization begins, a team training meeting is held to discuss assignments and the needs of the work, including equipment and health and safety requirements.

16. SCHEDULE

A project milestone chart is presented in Table 16-1 to illustrate the sequence of tasks as approximated at the beginning of the project. Field conditions may impose minor variations in the schedule.

APPENDIX A

SITE SAFETY PLAN

C. HAZARD EVALUATION
(Use Supplemental Sheets if Necessary)

Summary (attach copy of available chemical information from Saxs, Merck, Index, Chmtads, etc.): Non-specific organic compounds

General industrial solvents: Trichloroethylene
Perchloroethylene

Heavy Metals: Lead
Mercury

Non-specific herbicide (Containing Mercury circa 1971)

See attachments for hazard evaluation and data sheets

D. SITE SAFETY WORK PLAN

PERIMETER ESTABLISHMENT: Map/Sketch Attached? Yes Site Secured? Yes
Perimeter Identified? NO Zone(s) of Contamination Identified? NO
This task will identify the perimeters and extent of contamination. Borings to be made outside of contaminated material.

PERSONAL PROTECTION:

Level of Protection: A ____ B ____ C X D X

Modifications: Upgrade to Level C for samples with positive HNU readings. Level C for monitoring all drilling.

Surveillance Equipment and Materials: HNU with 10.2 eV probe.
tape) TLD Badge
Rad mini particle counter

recycled paper

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SPECIAL SITE CONSIDERATIONS: See Hazard Evaluation for specific areas of site and the associated hazards.

DECONTAMINATION PROCEDURES:

Personal: Wash boot and gloves with soap and water. Launder coveralls upon return from the field. All Personnel should shower immediately upon return home.

Equipment: Detergent wash, water rinse

INVESTIGATION - DERIVED MATERIAL DISPOSAL: (Note - If material is proposed to be left on site, written authorization is to be received by the Project Team Leader prior to the initiation of on site activities): Disposable material will be double bagged and left on the base. Suspected contaminated soils will be drummed and stored at the base.

SITE ENTRY PROCEDURES: Coordination with base security.
Safety meeting each morning.
No special proceedures required.

Team Member	Responsibility
Paul Kopsick	Co-Project Mgr./Team Leader
James Jackson	Co-Project Mgr./Admin.
Mark Mayo	Field Tech./SSC
Joe Chandler	Field Tech./SSC
Mila Michalowski	Field Tech.
John Cook	Field Tech.
Sharon Martin	Geophysics

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Attachment 3:

Site Safety Briefing Forms

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ON-SITE SAFETY MEETING

Project _____

Date _____ Time _____ Job No. _____

Address _____

Specific Location _____

Type of Work _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment _____

Chemical Hazards _____

Physical Hazards _____

Emergency Procedures _____

Hospital/Clinic _____ Phone _____

Hospital Address _____

Special Equipment _____

Other _____

ATTENDEES

Name Printed	Signature

Meeting Conducted By: _____

Name Printed

Site Safety Officer _____

Signature

Team Leader _____

376103

F. EQUIPMENT CHECKLIST

PROTECTIVE GEAR

LEVEL A

SCBA	___
SPARE AIR TANKS	___
ENCAPSULATED SUIT	___
SURGICAL GLOVES	___
NEOPRENE SAFETY BOOTS	___
BOOTIES	___
GLOVES (TYPE ___)	___
OUTER WORK GLOVES	___
HARD HAT	___
CASCADE SYSTEM	___
___	___
___	___
___	___
___	___

LEVEL B

SCBA	___
SPARE AIR TANKS	___
CHEMICAL RESISTANT COVERALLS	___
PROTECTIVE COVERALL (TYPE ___)	___
RAIN SUIT	___
BUTYL APRON	___
SURGICAL GLOVES	___
GLOVES (TYPE ___)	___
OUTER WORK GLOVES	___
NEOPRENE SAFETY BOOTS	
BOOTIES	
HARD HAT WITH FACE SHIELD	___
CASCADE SYSTEM	___
MANIFOLD SYSTEM	___

LEVEL C

ULTRATWIN RESPIRATOR	X
POWER AIR PURIFYING RESPIRATOR	___
CARTRIDGES (TYPE GMC-H)	X
ROBERTSHAW ESCAPE MASK	___
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE Tyvek/Saranex)	X
RAIN SUIT	___
BUTYL APRON	___
SURGICAL GLOVES	X
GLOVES (TYPE Nitrile/Butyl)	X
OUTER WORK GLOVES	___
NEOPRENE SAFETY BOOTS	X
HARD HAT WITH FACE SHIELD	X
Booties	X

LEVEL D

ULTRA-TWIN RESPIRATOR (AVAILABLE)	X
CARTRIDGES (TYPE GMC-H)	X
ROBERTSHAW ESCAPE MASK (AVAILABLE)	___
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE Tyvek/Saranex)	X
RAIN SUIT	___
NEOPRENE SAFETY BOOTS	X
BOOTIES	X
WORK GLOVES	___
HARD HAT WITH FACE SHIELD	X
SAFETY GLASSES	X
___	___
___	___

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APPENDIX A
STATEMENT OF MEDICAL FITNESS

This is to confirm that the following employees may be engaged in field activities at _____ (name of site) in connection with the Subcontract Agreement between E & E and _____, dated _____, 19__, and that all of said employees are medically fit both to perform required field activities and to utilize respiratory equipment in accordance with 29 CFR, Part 1910 and "USEPA Standard Operating Safety Guides," 1984.

_____

_____

_____

_____

_____

_____
Authorized Subcontractor Representative

Medtox Hotline

1. Twenty-four hour answering service - (501) 370-8263

What to Report:

- State: "This is an emergency."
- Your name, region, and site.
- Telephone number to reach you.
- Your location.
- Name of person injured or exposed.
- Nature of emergency.
- Action taken.

One of three toxicologists (Drs. Raymond Harbison, Richard Freeman, or Robert James) will contact you. Repeat the information given to the answering service.

If a toxicologist does not return your call within 15 minutes, call the following persons in order until contact is made:

E & E Corporate Headquarters (EST 0830-1700) - (716) 632-4491

a. Twenty-four hour line - (716) 631-9530

b. Corporate Safety Director - Paul Johnmaire (home - (716) 655-1260)

c. Assistant Corporate Safety Officer - Steve Sherman (home - (716) 688-0084)

FIELD SAFETY DATA SHEET

Chemical Name: Mercury Compounds (Inorganic)

(* 1)CAS NO: 7439-97-6 M.W.: _____ Phys. State Solids
(* 1)TLV 0.05 Mg/m3 (ppm or MG/M3)(*)Ceiling Limit _____ (ppm or MG/M3)

APPEARANCE:
(*)Pure: _____
(*)Soil: _____
(*)Water: _____

ODOR:
(*)Odor Threshold _____ (ppm or MG/M3)
(*)Odor Description No odor expected

DETECTION:
(*)HNU Detection Efficiency: 0 (10.2 EV Probe) Assumed
(*)OVA Detection Effiency: 0 Assumed
(*)Other Detection Methods: Mini ram particle counter for sites where Environmental concentrations are less than 15,000 PPM

COMMENTS: _____

PROTECTIVE EQUIPMENT: Mg/m3
(*) 0 TO 0.005 Level-D
(*) .005 TO 0.05 Level-C (Cartridge GMC-H) AP-3
(*) ____ TO ____ Level-B
(*) Above ____ Level-A

Action Levels can be Changed by the RSC to reflect the maximum anticipated concentrations

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(* 2)Acute Effects: Kidney damage anorexia, Muscle tremors, Neurotic disorders
(* 2)Chronic Effects: Digestive + Nervous system Ailments, Gingivitis

Other Hazards: Ignit no Flam no Oxid no Corr Yes
Explosive possible Toxic YES Carcin NO Radio NO
Terat _____ Repro _____ Muta _____

(*)Vapor Density > air (*) B.P. _____ (*) LEL NA
(*)Soluble (H20) YES (*) Specif. Grav. _____ (*) UEL NA

DECONTAMINATION: _____

(*) FIRST AID: _____

REFERENCE SECTION:
1). ACGIH TLVs 1983-1984
2). ILO Encyclopedia of Occupational Health + Safety
3).
4).
5).
6).
7).
8).
9).
10).

FIELD SAFETY DATA SHEET

Chemical Name: ORGANIC VAPORS NOS

(*)CAS NO: N/a M.W.: Phys. State
(*)TLV (ppm or MG/M3)(*)Ceiling Limit (ppm or MG/M3)

APPEARANCE:
(*)Pure:
(*)Soil:
(*)Water:

ODOR:
(*)Odor Threshold (ppm or MG/M3)
(*)Odor Description

DETECTION:
(*)HNU Detection Efficiency: 30-50% assumed (10.2 EV Probe)
(*)OVA Detection Effiency: 50% assumed
(*)Other Detection Methods:

COMMENTS:

PROTECTIVE EQUIPMENT:
(*1) 0 TO 1 ppm Level-D
(*1) 1 TO 5 ppm Level-C (Cartridge combination organic/ high efficiency filter
(*) TO ppm Level-B
(*) Above ppm Level-A

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion
(*2)Acute Effects: nausea unknown, headache, eye, nose & throat irritation
(*)Chronic Effects:

Other Hazards: Ignit yes Flam yes Oxid no Corr no
Explosive no Toxic yes Carcin yes Radio no
Terat yes Repro yes Muta yes

(*)Vapor Density (*) B.P. (*) LEL
(*)Soluble (H20) (*) Specif. Grav. (*) UEL

DECONTAMINATION: Soap & water wash, water rinse. Assumes properties similar to the most common solvents.

(*) FIRST AID: no special actions.

REFERENCE SECTION:
1). Corporate guidelines
2). other values are assumed based upon the solvent properties
3). most often encountered in field work.
4).
5).
6).
7).
8).
9).
10).

CHEMSAFE™

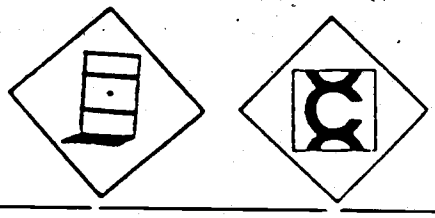
MATERIAL SAFETY DATA SHEET

I IDENTIFICATION

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO
ADDRESS (Number, Street, City, State, and ZIP Code)	CAS NUMBER 000 079 01E
CHEMICAL NAME AND SYNONYMS Trichloroethylene	TRADE NAME AND SYNONYMS
CHEMICAL FAMILY Chlorinated Alkene	FORMULA $ClHCCCl_2$

II CHEMSAFE™ INSTRUCTIONAL* CLASSIFICATION

Affix Appropriate Chemsafe™ Instructional Classification Label



*Refer to CHEMSAFE™ instructional booklets for data regarding the properties, appropriate safe use and storage, and emergency response for this class of substance.

III HAZARDOUS INGREDIENTS

INGREDIENT NAME	%	TLV AND SOURCE (units)	INGREDIENT NAME	%	TLV AND SOURCE (units)
1. Trichloroethylene	100	50 ppm TWA	4.		
2		ACGIH	5		
3.		1982	6.		

IV PHYSICAL DATA

Boiling Point at 760 mm Hg 1 atm, deg F (C)	188 (87)	Specific Gravity (H_2O = 1) 20 C	1.45-1.47*
Vapor Pressure (mm Hg at 20 °C) mm Hg	58	Percent Volatile By Volume (%)	ca 100
Vapor Density (Air = 1)	4.54	Evaporation Rate (Butyl Acetate = 1) (CCl_4=1)	-0.69
Solubility In Water (% by Weight) @ 25°C, %	0.1	Melting Point (°F.)	NA

Appearance and Odor: Colorless, mobile liquid with a characteristic, sweet, ether-like odor whose recognition threshold is 21.4 ppm in air (unfatigued, 100% of test panel). *Depends on stabilizer & level used.

V FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used) None	Flammable Limits in Air (% by Volume)	Lower (LEL)	Upper (UEL)

Extinguishing Media: Use that which is appropriate for surrounding fire. Trichloroethylene is normally considered noncombustible. However, when 15% vapor in air at 33C is exposed to intense heat (electric arc) or to ordinary flame at vapor-air temps. excess in 50C, it can be made to burn mildly. Combustibility increases in O_2 enriched air.

Fire Fighting Procedures: Self-contained breathing apparatus should be used for protection against TCE vapors & their toxic & corrosive decomposition products in a fire situation.

Fire and Explosion Hazards

VI LOCATIONS USED AND STORED (Completed By User)

Locations Used

Locations Stored

While Springborn Regulatory Services, Inc. (SRS) believes that the data contained herein are factual and believes that the opinions expressed are those of qualified experts, the data are not to be taken as a warranty or representation for which SRS assumes legal responsibility. They are offered solely for your consideration, investigation, and verification. Any use of this data and information must be determined by the user to be in accordance with applicable federal, state and local laws and regulations.

CHEMSAFE™ FORM 32

(Continued on reverse side)

HAZARD EVALUATION:

This project has several phases. The phases include surface soil sampling, subsurface soil sampling, sediment sampling , surface water sampling and groundwater sampling. The subsurface sampling efforts will include subcontractors to drill borings and/or install monitoring wells.

Hazards Present:
volatile organic compounds: Inhalation hazard
- paint thinners and solvents
  - generally a mixture of aliphatic organics and aromatic compounds
- degreaser and solvents for the removal of paint
  - generally chlorinated volatile organic compounds such as trichloroethene, methylene chloride, 1,1,1-trichloroethane.

Non-volatile organics:
- direct contact hazard
  - generally petroleum products for vehicle fuels, lubrication although they can be considered to be direct contact hazards, they generally have low toxicity.

Pesticides: direct contact hazard
- The pesticides which are reported to have been disposed of on this site are limited to a mercury containing compound which was used as a herbicide. No other description of the herbicide was made. It is assumed that the compound will be toxic by direct contact only and will probably not be an acetocholinesterase inhibitor since the mercury compounds are not associated with organophosphate or organocarbamate pesticides.

  Other pesticides are in use on the air base at the present time but are not believed to be in the landfill areas. The present pesticides include several of the acetanilide derivatives, and organophosphates and organochlorine compounds. One of the named compounds was Silvex. Silvex is a 2,4,5-T formulation and has the potential for TCDD contamination.

  At this time, no PCBs or Dioxins are known to be or thought to be on the site in the areas of investigation.

Physical hazards:
- The physical hazards associated with this site will be greatest around the drill rig operation. All utility lines pipes etc. will be located prior to the start of drilling. At least two people will be present at the drill rig while it is in operation. The route to the nearest hospital will be explained to the drillers and/or an E&E person familiar with the route will be present.
- constant monitoring of the breathing zone will be performed during the drilling operations. Additional monitoring will be done to detect potentially high concentrations which could reach the breathing zone.

Site Number one:

The only anticipated wastes which are hazardous are:
paints
paint thinner
  alcohol
  aliphatic organics
  turpentine
Strippers
  chlorinated hydrocarbons such as
    TCE
    Carbon tetrachloride
    1,1,1-Trichloroethane

The quantities are reportedly very small. This is partly due to the practise of burning the solvents rather than just landfilling them.

ACTION LEVELS:
1 PPM organic vapors goto Level-c protection
5 PPM organic vapors withdraw from the site area
Above Background Radiation: Withdraw from the area and report the situation to the RSO.

Site Number 2 (The Northeast Landfill)

Hazardous wastes are present in very small quantities. The volatiles which were disposed of were not containerized. Waste paint and thinners were spread on the ground surface until 1978. Since no concentrated wastes are known to be containerized in the disposal area, high concentrations of vapors are very unlikely.

Action Levels: Same as for site NO.1

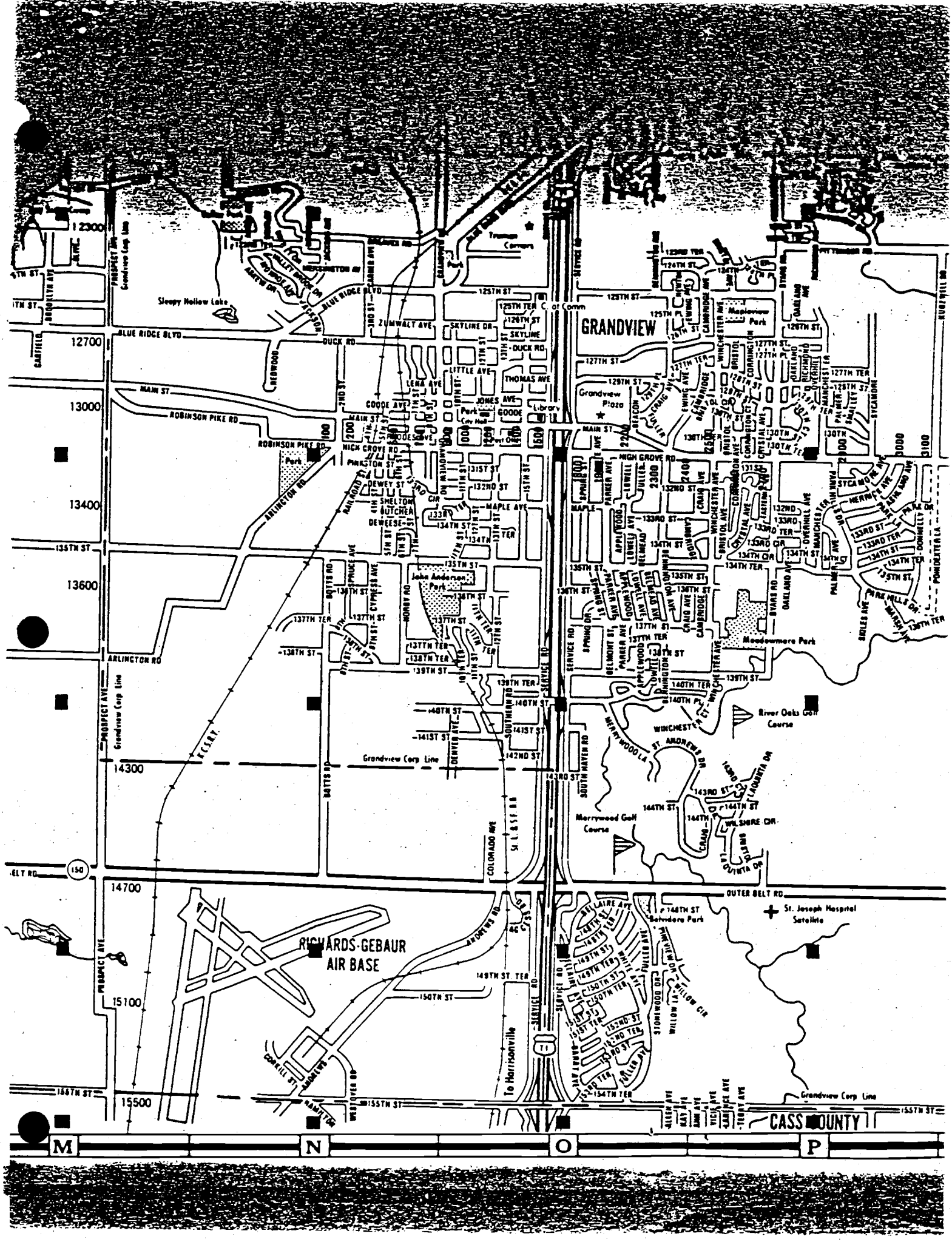
Note: Over 400 55-gallon drums are stored at the site. Most of the drums are empty, but some of the drums have unknown contents. If the wind direction places the site downgradient of the drums, there is potential for exposures through leakage and other releases. Inform the team/drillers of that potential and withdraw if unexpected odors occur or if there is irritation of mucus membranes such as in the nose or throat. Eye irritation or headaches are also common signs of exposure.

Richards-Gebaur AFB (continued)

Site Number 9, An Oil Saturated Area

An oil contaminated area is located in an area which was previously used for storage of petroleum products such as fuels, oils and greases.

This area is reported to have been heavily contaminated by relatively non-toxic materials. Due to the nature of the contaminants, and the fact that the site is in an open area, respiratory protection will not be required. Respiratory protection is optional at organic vapor concentrations which reach 5 PPM.


GRANDVIEW
Sleepy Hollow Lake
Grandview Plaza
Library
Park
City Hall
John Anderson Park
Meadowmere Park
River Oaks Golf Course
Merrywood Golf Course
RICHARDS-GEBAUR AIR BASE
St. Joseph Hospital Satellite
Grandview Corp Line
OUTER BELT RD
ARLINGTON RD
ROBINSON PIKE RD
BLUE RIDGE BLVD
MAIN ST
SERVICE RD
PROSPECT AVE
BATTS RD
MORRY RD
SOUTHERN RD
SOUTH MAYER RD
DENVER AVE
COLORADO AVE
ANDREWS RD
DORSILL ST
WESTOVER RD
HAMILTON
To Harrisonville
CASS COUNTY
M
N
O
P

APPENDIX B

CONTRACT DESCRIPTION OF WORK

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION (STAGE 2)
RICHARDS-GEBAUR AFB MO

I. DESCRIPTION OF WORK

The overall objective of the Installation Restoration Program (IRP) Phase II investigation is to assess potential contamination at past hazardous waste disposal and spill sites on Air Force installations. A series of staged field investigations may be required to meet this objective.

The intention of this staged investigation is to undertake a field and laboratory study at Richards-Gebaur AFB MO to: (1) confirm the presence or absence of contamination within the specified areas of investigation; (2) if possible, determine the extent and degree of contamination and the potential for migration of those contaminants in the various environmental media; (3) identify public health and environmental hazards of migrating pollutants based on state or Federal standards for those contaminants; and (4) delineate additional investigations required beyond this stage to reach the Phase II objectives.

The IRP Phase I Report and Phase II Stage 1 Report (mailed under separate cover) incorporate the background and description of the sites/zones for this task. To accomplish this survey effort, the contractor shall take the following actions:

A. General Requirements

1. Conduct a literature search of local hydrogeologic conditions to complement the Phase I and Phase II Reports (mailed under separate cover). Include the pertinent literature search information in an appendix of the Final Report. Develop the literature search data using the following guideline:

a. Topographic data

b. Geologic data

(1) Structure

(2) Stratigraphy

(3) Lithology

c. Hydrogeologic data

(1) Location of all existing and abandoned wells, observation wells, springs, ponds (natural and artificial) and seepages, that occur on or off the installation within a one-mile radius of sites to be investigated

f. Climatic data

(1) Precipitation (total and net)

(2) Evapotranspiration

2. Determine the areal extent of the sites by reviewing historical and current panchromatic and infrared aerial photography.

B. Technical Operations Plan

Immediately after the Notice To Proceed (NTP) for the delivery order, develop a Technical Operations Plan (TOP) based on the technical requirements specified in this task description. (See Sequence No. 19, Item VI below). Follow the TOP format (mailed under separate cover). Provide the TOP to the USAFOEHL within two weeks of the NTP.

C. Health and Safety

Comply with USAF, OSHA, EPA, state and local health and safety regulations regarding the proposed work effort. Use EPA guidelines for designating the appropriate levels of protection needed at the study sites. Prepare a written Health and Safety Plan for the proposed work effort and coordinate it directly with applicable regulatory agencies prior to commencing field operations. Provide an information copy of the Health and Safety Plan to the USAFOEHL after coordination with regulatory agencies. The Health and Safety Plan is specified in Sequence No. 7, Item VI below.

D. Drilling and Soils Work

1. Determine the exact location of all monitor wells, soil borings, and test pits during the planning/mobilization phase of the field investigation. Consult with base personnel to minimize disruption of base activities, to properly position wells with respect to exact site locations, and to avoid underground utilities. Direct the drilling and sampling and maintain a detailed log of the conditions and materials penetrated during the course of the work. Do not drill boreholes into or position wells in actual landfill areas, install wells at the landfill perimeter.

2. Monitor the ambient air during all well drilling, soil boring and test pit work with a photoionization meter or equivalent organic vapor detector to identify the generation of potentially hazardous and/or toxic vapors or gases. Include air monitoring results in the boring logs. If soil encountered during borehole drilling or test pit work is suspected to be hazardous because of abnormal discoloration, odor or air monitoring levels, containerize the soil cuttings in new, unused drums. Enter into the boring logs the depth(s) from which suspected contaminated soil cuttings were collected for containerization. Collect a maximum of 10 composite samples, one from the contents of each drum. Test each composite sample for EP Toxicity (metals). Use RCRA criteria to determine if soil cuttings must be classified as hazardous waste (40 CFR 261.24).

(6) Complete all monitoring wells using the following specifications:

(a) Once the casing is installed, allow the soil formation to collapse around the well screen. Supplement the natural gravel-pack with washed and bagged rounded silica sand or gravel with a grain size distribution compatible with the screen and soil formation. Place the pack from the bottom of the borehole to two feet above the top of the screen. Tremie a five foot bentonite seal (granulated or pellets) above the sand/gravel pack. Ensure the bentonite forms a complete seal. Grout the remainder of the annulus to the land surface with a Type I Portland cement/bentonite slurry.

(b) Check with the Base point of contact (POC) to determine whether wells shall be completed flush or project above the ground surface.

1 If well stick-up is of concern in an area, complete the well flush with the land surface. Cut the casing two to three inches below land surface, and install a protective locking lid consisting of a cast-iron valve box assembly. Center the lid assembly in a three foot diameter concrete pad sloped away from the valve box. Ensure that free drainage is maintained within the valve box. Also, provide a screw-type casing cap to prevent infiltration of surface water. Maintain a minimum of one foot clearance between the casing top and the bottom of the valve box. Clearly mark the well number on the valve box lid.

2 If an above-ground-surface completion is used, extend the well casing two or three feet above land surface. Provide an end-plug or casing cap for each well. Shield the extended casing with a steel guard pipe which is placed over the casing and cap, and seated in a two-foot by two-foot by four-inch concrete surface pad. Slope the pad away from the well sleeve. Install a lockable cap or lid on the guard pipe. Install three, three-inch diameter steel guard posts if the Base POC determines the well is in an area which needs such protection. The guard posts shall be five feet in total length and installed radially from each wellhead. Recess the guard posts approximately two feet into the ground. Do not install the guard posts in the concrete pad placed at the well base. Paint the protective steel sleeve and clearly number the well on the sleeve exterior.

3 Provide locks for both flush and above-ground well assemblies. Turn over the lock keys to the Base POC following completion of the field effort.

(c) Develop each well as soon as practical after completion with a submersible pump, bailer, and/or airlift method. Continue well development until the discharge water is clear and free of sediment to the fullest extent possible. Measure the rate of water produced, the pH, specific conductance and water temperature during well development and include this information in the Final Report.

(d) Determine by survey the elevation of all newly installed monitoring wells to an accuracy of 0.01 foot. Notch the top of the

g. Perform a maximum of three shallow soil augerings using a hand auger. Total footage shall not exceed 50 feet.

5. Well and Borehole Cleanup

Remove all well/borehole cuttings and clean the general area following the completion of each well/borehole. Containerize and store cuttings suspected to be contaminated according to paragraph I.D.2. of this task order. Transport these drums to a location within the installation boundary designated by the Base POC. The base is responsible for ultimate disposal of contaminated soils using base resources.

E. Decontamination Procedures

1. Decontaminate all sampling equipment, including internal components, prior to use and between samples to avoid cross-contamination. Wash equipment with a laboratory-grade detergent followed by drinking quality water, solvent (methanol), and distilled water rinses. Allow sufficient time for the solvent to evaporate and the equipment to dry completely before reuse.

2. Dedicate for each well the monofilament line or steel wire used to lower sampling equipment into the well; do not use a line in more than one well. Decontaminate the calibrated water level probe for measuring well volume and water level elevation before use in each well.

3. Thoroughly clean and decontaminate the drilling rig and tools before initial use and after each borehole completion. As a minimum, steam clean drill bits after each borehole is installed. Drill from the "least" to the "most" contaminated sites, if possible.

F. Field Sampling

1. Strictly comply with the sampling techniques, maximum holding times, and sample preservation as specified in the following references: Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985), pages 37-44; ASTM, Section 11, Water and Environmental Technology; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 2nd Edition (USEPA, 1984); Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pages xiii to xix (1983); and the Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA Document 600/4-82-029 (1982).

2. Groundwater Monitoring Wells

a. After development, allow wells to stabilize for a minimum of seven days before sampling.

b. Prior to purging the wells, examine the surface of the water table for the presence of hydrocarbons and take water level measurements to the nearest 0.01 foot with respect to the established survey point on top of the well casing. If applicable, measure the thickness of the hydrocarbon layer.

d. Sample number

e. Source/location and depth of sample

f. Contract Task Numbers and Title of Project

g. Method of collection (bailer, suction pump, air-lift pump, etc.)

h. Volumes removed before sample taken (well samples only)

i. Special conditions (use of surrogate standard, etc.)

j. Preservatives used

k. Collector's name or initials

In addition, label each sample container with a permanent ink pen (water-proof laundry marker) to reflect the data in a, b, c, d, j and k above.

6. For every 10 field samples collected, take at least one additional sample (a field duplicate) for quality control purposes. Table 1 provides a 10% allowance for these additional analyses. Duplicates shall be indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are duplicates.

7. For every 20 field water samples collected, prepare and submit for analysis one field blank for all parameters analyzed in water. A minimum of one field blank for each parameter is required. Allowances for these additional analyses are included in Table 1.

8. Maintain chain-of-custody records for all samples, field blanks, and quality control samples.

G. Chemical Analyses

1. Analyze water and soil samples collected as specified in Section H below, Specific Site Work. The analytical parameters are summarized in Table 1 along with the required methods.

2. All analyses shall meet the required limits of detection for the applicable method identified in Table 1.

3. For those methods which employ gas chromatography (GC) as the analytical technique (SW8010, SW8020, E601, E602, E604, etc.) positive confirmation of identity is required for all analytes having concentrations higher than the Method Detection Limit (MDL). Conduct positive confirmation by second-column GC; however, gas chromatography/mass spectroscopy (GC/MS) can be used for positive confirmation if the quantity of each analyte to be confirmed is above the detection level of the GC/MS instrument. Analytes which cannot be confirmed will be reported as "Not Detected" in the body of

2. Northeast Landfill (Site 2)

a. Locate and review any available new information dealing with the Northeast Landfill and nearby sewer lines. Locate and interpret any aerial photographs of the site when it was in operation.

b. Perform a magnetometer and an electromagnetic survey of the site.

c. Perform six soil borings each approximately 20 feet deep, three borings for the west trench and three borings for the double trench. Obtain a maximum of 3 soil samples per boring (a maximum of 18 total soil samples). Select the soil samples based on OVA or HNU meter readings, discoloration, odor or other signs of contamination. Obtain a water sample from each boring if water is encountered (a maximum of 5 water samples (Note: One boring will be coverted to a well).

d. Convert one boring into a monitoring well immediately downgradient of the newly discovered trench areas in the west part of the landfill. Install one background monitoring well immediately north of the landfill. Collect a water sample from each well.

e. Collect water samples from the three existing monitoring wells at the site.

f. Collect water samples from Scope Creek upgradient and downgradient of this landfill (2 samples).

g. Analyze soil samples for petroleum hydrocarbons, aromatic volatile organics, and halogenated volatile organics.

h. Analyze water samples for petroleum hydrocarbons, TDS, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols.

3. North Burn Area (Site 6)

a. Perform soil gas analysis with a maximum of 30 holes/probes to characterize contamination from the site. Siting of borings and wells will be based on the results of the soil gas survey.

b. Perform three soil borings each approximately 15 feet deep along the perimeter of the pit. Obtain a maximum of 9 soil samples from the boreholes based on OVA/HNU meter readings, discoloration, odor, or other indications of contamination. Collect a water sample from each borehole if water is encountered for a maximum of three water samples.

c. Install 3 wells. Two of the wells shall be installed downgradient of the site and the other upgradient. Each well shall be sampled once for a total of three water samples.

c. Collect a maximum of two surface water samples from the surface drainage pathway, one upgradient and one downgradient from the stained area. The surface drainage pathway will only be sampled if water is present during fieldwork.

d. Analyze soil samples for petroleum hydrocarabons, EP toxicity (metals), and halogenated and aromatic volatile organics.

e. Analyze water samples for petroleum hydrocarbons, TDS, priority pollutant metals, barium, mercury and halogenated and aromatic volatile organics.

7. POL Storage Area (Site 12)

a. Hand auger three borings at locations selected in the field for a maximum of 30 feet of hand augering. Collect a maximum of 3 soil samples from each boring. Selection of samples will be based on indications of contamination detected in the field.

b. Install one downgradient well to an approximate depth of 20 feet. Collect one water sample from the well.

c. Collect two soil/sediment samples, one from each of the outfall drains from Bldg 953.

d. Collect three surface water samples, two from the stream draining the POL tank area and one from the drain outfall from Bldg 953.

e. Analyze the four water samples for petroleum hydrocarbons, TDS, and aromatic volatile organics.

f. Analyze soil samples for petroleum hydrocarbons and aromatic volatile organics.

I. Data Review

1. Tabulate field and analytical laboratory results, including field and laboratory parameters and QA/QC data, as they become available and incorporate them into the next monthly R&D Status Report (Sequence No.1, Item VI below) forwarded to the USAFOEHL. In addition to the results, report the following:

a. the time and dates of sample collection, extraction (if applicable) and analysis;

b. the method used and Method Detection Limits achieved;

c. the chain-of-custody forms;

d. a cross-reference of laboratory sample numbers and field sample numbers; and

consequences of the discovered contaminants based upon state or Federal standards.

5. Plot and map all field data collected for each site according to surveyed positions.

6. In the Recommendation section, address each site and list them by category:

a. Category I consists of sites where no further action (including remedial action) is required. Data for these sites are considered sufficient to rule out unacceptable public health or environmental hazards.

b. Category II sites are those requiring an additional Phase II effort to determine the direction, magnitude, rate of movement and extent of detected contaminants. Identify potential environmental consequences of discovered contamination.

c. Category III sites are those that will require remedial action (ready for IRP Phase IV). In the recommendations for Category III sites, include a discussion of any possible influence on sites in Categories I and/or II due to their connection with the same hydrological system. Clearly state any dependency between sites in different categories. Include a list of candidate remedial action alternatives, including long term monitoring (LTM) as remedial action, and the corresponding rationale that should be considered in selecting the remedial action for a given site. List all alternatives that could potentially bring the site into compliance with environmental standards. For contaminants that do not have standards, EPA-recommended safe levels for noncarcinogens (Health Advisory or Suggested-No-Adverse-Response Levels) and target levels for carcinogens (1×10^{-6} cancer risk level) may be used. Unless specifically requested, do not perform any cost analyses, or cost/benefit review for remedial action alternatives. However, in those situations where field survey data indicate immediate corrective action is necessary, present specific, detailed recommendations.

7. For each category above, summarize the results of field data, environmental or regulatory criteria, or other pertinent information supporting conclusions and recommendations. Reduce this summary information into a table (or tables) and insert it (them) into the text and the Executive Summary.

8. Provide cost estimates by line item for future efforts recommended for Category II sites and LTM Category III sites. Submit these estimates concurrently with the approved Final Report in a separate document. Only the cost requirements outlined in Sequence No. 2, Item VI, need be submitted.

a. For Category II sites, develop detailed site-specific estimates using prioritized costing format (i.e., cost of conducting the required work on: the highest priority site only; the first two highest priority sites only; the first three highest priority sites only; etc., until all required work is discretely costed) for the proposed work effort. The Air Force determines the priority of sites from contractor recommendations.

more monitoring wells, and other investigations that may be required in performance of this investigation.

F. Base personnel will designate a staging area on base for the contractor's drilling equipment and supplies. An area will also be designated where the contractor can decontaminate his drilling equipment between wells.

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

1. USAFOEHL Technical Program Manager
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USAFOEHL/TSS
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AUTOVON 240-2158/2159
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2. Base Point of Contact (POC)
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Richards-Gebaur AFB MO 64030-5000
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3. MAJCOM Monitor
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HQ AFRes/SGPB
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AUTOVON 468-6441
(912) 926-6441

4. Base Civil Engineer POC
Mr John Hurd
422 Combat Support Grup (AFRes)
Richards-Gebaur AFB MO 64030-5000
(816) 348-2076

VI. In addition to sequence numbers 1, 5 and 11 listed in Attachment 1 to the contract, which apply to all orders, the sequence numbers listed below are applicable to this order. Also shown are dates applicable to this order.

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
19 (TOP)*	I.B.	OTIME	19SEP86	19SEP86		15
7 (Health & Safety)	I.C.	OTIME	19SEP86	19SEP86		3
3 (Prelim Data)	I.I.2	OTIME	**	**		3
4 (Tech. Rpt)	I.J.	ONE/R	4MAR87	18MAR87	16SEP87	***
2 (cost data)	I.J.8.	OTIME	2SEP87	16SEP87		****
14		MONTHLY	12SEP86	12SEP86	*****	3
15		MONTHLY	12SEP86	12SEP86	*****	3

Table 1

Analytical Methods, Detection Limits, and Number of Samples

Parameter	Method	Detection Limit	No. of Samples	QA	Total Samples
Halogenated Volatile Organics	SW5030/SW8010	a	58 soil	6 soil	96 soil[d]
	EPA 601	a	29 water	4 water	50 water[e]
Aromatic Volatile Organics	SW5030/8020	a	69 soil	7 soil	114 soil[f]
	EPA 602	a	33 water	5 water	57 water[g]
Extractable Priority Pollutants (GC/MS)	EPA 625	a	17 water	3 water	20 water
Phenols	E604	a	17 water	3 water	30 water[h]
Petroleum hydrocarbons	EPA 418.1 modified for soils	1 mg/Kg	69 soil	7 soil	76 soil
	EPA 418.1	1 mg/L, water	33 water	6 water	39 water
Total Dissolved Solids (TDS)	EPA 160.1	10 mg/L, water	34 water	6 water	40 water
Priority Pollutant Metals (13 ea)	EPA 200.7	a	20 water	3 water	23 water
	EPA 245.1(Hg)	1.0 µg/L	20 water	3 water	23 water
	EPA 206.2(As)	1.0 µg/L	20 water	3 water	23 water
	EPA 270.2(Se)	2.0 µg/L	20 water	3 water	23 water
Arsenic	EPA 206.2 SW 3050/SW7060	1.0 µg/L 0.1 mg/Kg	1 water 4 soil	0 water 1 soil	1 water 5 soil
Barium	EPA 200.7	a	3 water	2 water	5 water
Lead	EPA 239.2 SW3050/7420	a a	2 water 9 soil	1 water 1 soil	1 water 10 soil
Mercury	EPA 245.1 SW 7471	1.0 µg/L 0.1 mg/Kg	4 water 4 soil	1 water 1 soil	5 water 5 soil

ATTACHMENT 1
SAMPLING AND ANALYTICAL REQUIREMENTS

SOIL

ITE	Halogenated Volatile Organics	Aromatic Volatile Organics	Nonhalogenated Volatile Organics	Extractable Priority Pollutants (GC/MS)	Petroleum Hydrocarbons	Total Dissolved Solids	Priority Pollutant Metals (13 ea)	Lead	Herbicide, As, Hg	EP Toxicity (Metals)				
ite 1	7	7			7									
ite 2	18	18			18									
ite 6	15	15			15									
e 8									4					
ite 9	9	9			9			9						
ite 10	9	9			9					9				
ite 12		11			11									
	58	69			69			9	4	9				

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E21

RCHRD AR # 310

Site ID #: M0957182 4292
Break: 6.1

RECORD OF COMMUNICATION

☒ PHONE CALL ☐ DISCUSSION ☐ FIELD TRIP ☐ CONFERENCE
☐ OTHER (SPECIFY)
(Record of item checked above)

TO:	FROM:	DATE
Larry McGee, Env. Coord. Richards-Gebaur AFB	Greg McCabe	6/20/88
		TIME 10:30 am

SUBJECT: Status of IRP Sites

SUMMARY OF COMMUNICATION

I contacted Richards-Gebaur AFB to determine the status of the 4 sites where KCMO had refused access for the Phase II, Stage 2 investigation - i.e., #3, 5, 7, 11. Mr. McGee was not aware of the status of those 4 sites, specifically. He reported that 11 sites were scheduled to receive additional work. Seven of those sites are no longer owned by DOD, and will be investigated by the COE through the DERP program. The other 4 will continue to be investigated by the AF contractors, though transfer of those 4 sites to the COE may be a possibility. Those 4 sites are #6, 9, 10, and the storage area by Bldg. 923. The AF did eventually get access to the West Burn Pit and the Herbicide Burial Area. A meeting at the base is to be held this afternoon with the COE and AFRCE to discuss the COE sites.

CONCLUSIONS, ACTION TAKEN OR REQUIRED

INFORMATION COPIES TO: file

R6-123 (2-84)

Site: Richards Gebaur
ID #: MO 9571824292
Break: 1.1
Other:

RECORD OF COMMUNICATION

☒ PHONE CALL ☐ DISCUSSION ☐ FIELD TRIP ☐ CONFERENCE
☐ OTHER (SPECIFY)

(Record of item checked above)

TO: Linda Houston, COE

FROM: Greg McCabe, PLEB

DATE 6/21/88

TIME 11:00 am

SUBJECT: Status of IRP progress

SUMMARY OF COMMUNICATION

I contacted Ms. Houston to determine the status of the 4 sites at which the City of KCMO had reportedly refused access. Ms. Houston is the COE project officer at Richards Gebaur. Based on this conversation with Ms. Houston, the information I obtained yesterday from the facility is incorrect. According to Ms. Houston, the AF is not planning to conduct additional investigation at Sites 1 and 2. The COE has been asked by the AF to conduct additional investigations at Sites 6, 9, 10, 12, and 13. These 6 sites are located on currently owned AF property. The COE is not investigating the sites not on currently owned AF property; i.e., sites 3, 4, 5, 7, 8, and 11. At this point in time, the sites are undergoing the COE's inventory check under the DERP program, and no investigation is expected until at least next year following completion of the inventory report and acquisition of funding.

CONCLUSIONS, ACTION TAKEN OR REQUIRED

INFORMATION COPIES TO: file

R6-123 (2-84)

File:
P.M.E.

10

INSTALLATION RESTORATION PROGRAM

PHASE II
CONFIRMATION/QUANTIFICATION

STAGE 2

RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086

July 1988

ADMINISTRATIVE
RECORD COPY

FINAL REPORT
(September 1986 to November 1987)

VOLUME 1: TEXT

Approved for Public Release:
Distribution is Unlimited

Prepared for:

UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE
Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)
Brooks Air Force Base, Texas 78235-5501

DF-4900-D1529

INSTALLATION RESTORATION PROGRAM PHASE II
CONFIRMATION/QUANTIFICATION
STAGE 2

FINAL REPORT
FOR
RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI

UNITED STATES AIR FORCE
HEADQUARTERS AIR FORCE RESERVE (HQ AFRES/SGPB)
ROBINS AIR FORCE BASE, GEORGIA 31098-6001

July 1988

Prepared by:

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USAF CONTRACT NO. F33615-83-D-4003, DELIVERY ORDER NO. 13
CONTRACTOR CONTRACT NO. F33615-83-D-4003, DELIVERY ORDER NO. 13

Approved for Public Release;
Distribution is Unlimited

USAFOEHL TECHNICAL PROGRAM MANAGER
CAPTAIN PATRICK N. JOHNSON
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TX

Prepared for:

UNITED STATES AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH
LABORATORY/TECHNICAL SERVICES DIVISION (USAFOEHL/TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

NOTICE

This report has been prepared for the United States Air Force by Ecology and Environment, Inc., for the purpose of aiding in the implementation of the Air Force Installation Restoration Program (IRP). 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, or the Department of Defense.

Copies of this report may be purchased from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

REPORT DOCUMENTATION PAGE

1a REPORT SECURITY CLASSIFICATION Unclassified	1b RESTRICTIVE MARKINGS N/A
2a SECURITY CLASSIFICATION AUTHORITY N/A	3 DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution is unlimited
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE N/A	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) N/A	5. MONITORING ORGANIZATION REPORT NUMBER(S) N/A
6a. NAME OF PERFORMING ORGANIZATION Ecology and Environment, Inc. 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION USAFOEHL/TS
6c. ADDRESS (City, State, and ZIP Code) 368 Pleasantview Drive Lancaster, New York 14086	7b ADDRESS (City, State, and ZIP Code) Brooks Air Force Base, Texas 78235-5501
8a. NAME OF FUNDING / SPONSORING ORGANIZATION Same as 7a 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F33615-83-D-4003/0013
8c. ADDRESS (City, State, and ZIP Code) Same as 7b	10 SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO / PROJECT NO / TASK NO / WORK UNIT ACCESSION NO

11 TITLE (Include Security Classification)

Installation Restoration Program; Phase II, Stage 2, Richards-Gebaur AFB, Missouri

12. PERSONAL AUTHOR(S)

Ecology and Environment, Inc.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Final	FROM 9/86 TO 11/87	July 1988	148

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Installation Restoration Program; Richards-Gebaur AFB; Superfund; CERCLA; Hazardous Waste; Groundwater

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Ecology and Environment, Inc., was retained by the USAFOEHL/TS to provide technical and analytical services in support of the Air Force Installation Restoration Program (IRP). These services were applied to the Phase II, Stage 2 investigation at Richards-Gebaur AFB. The field investigation was conducted between September 1986 and November 1986, and involved work at sites at the base. The investigation included records searches, geophysical studies, and sampling of surface and subsurface soils and groundwater. Samples were analyzed for various parameters including volatile organics, oil and grease, base/neutrals and acid extractable compounds, and heavy metals. Results of the investigation indicated that past waste handling and disposal practices had caused various degrees of soil and groundwater contamination at six of the seven sites. Follow-up (Stage 3) work has been recommended at three sites to better define the extent of contamination. One site was judged to require no follow-up action, and three sites are recommended for the next stage of the IRP. One site requires additional investigation and remedial action.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL Capt. Patrick N. Johnson	22b. TELEPHONE (Include Area Code) (512) 536-2158 22c. OFFICE SYMBOL USAFOEHL/TS

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PREFACE

The purpose of this report is to document the Phase II Stage 2 investigation of the United States Air Force (USAF) Installation Restoration Program (IRP) at Richards-Gebaur Air Force Base, Missouri. This work was conducted by Ecology and Environment, Inc., (E & E) under Contract No. F33615-83-D-4003, Task Order 13.

Mr. Gerald Strobel is Program Manager for this Contract. The Task Order was managed by Mr. Paul R. Kopsick. Laboratory analyses were accomplished at E & E's Analytical Services Center in Buffalo, New York, under the supervision of Mr. Andrew Clifton and Ms. Cathy Syracuse.

This work was accomplished during the period from September 1986 to November 1986. Captain Patrick N. Johnson, USAF, Technical Services Division, USAF Occupational and Environmental Health Laboratory (USAFOEHL/TS), was the Technical Program Manager.

Approved

Gerald Strobel

Gerald Strobel
Program Manager

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EXECUTIVE SUMMARY

Ecology and Environment, Inc., (E & E) was retained by the United States Air Force Occupational and Environmental Health Laboratory (USAFOEHL) under Contract No. F33615-83-D-4003, Task Order 13, to provide technical and analytical services in support of the Air Force Installation Restoration Program (IRP). This report concerns the Phase II Stage 2 investigation of Richards-Gebaur Air Force Base (AFB), Missouri.

The Phase II Stage 2 Presurvey (June 7, 1985) listed 13 sites where the potential for environmental problems existed. A total of seven sites were selected for additional investigation. Table 1 lists all 13 sites and denotes the seven sites investigated during this Stage. Figure 1 shows the locations of all 13 sites at Richards-Gebaur AFB.

SUMMARY OF FIELD PROGRAM

The fieldwork began on 2 October and ended on 4 November 1986. Twenty-seven surface soil samples were collected from the seven sites. A total of 38 subsurface soil samples were collected from 14 boreholes. Thirteen surface water samples were collected, along with nine groundwater samples. A total of six new monitoring wells were installed, bringing the current number of wells at the base to nine.

Two concurrent geophysical surveys (magnetometer and electromagnetic conductivity) were performed at Site 2, the Northeast Landfill, to help define the locations of burial trenches. At Site 6, the North Burn Pit Area, a soil gas survey was performed to help delineate the area of volatile organics contamination and to aid in the siting of monitoring wells and soil borings. Available aerial photographs were

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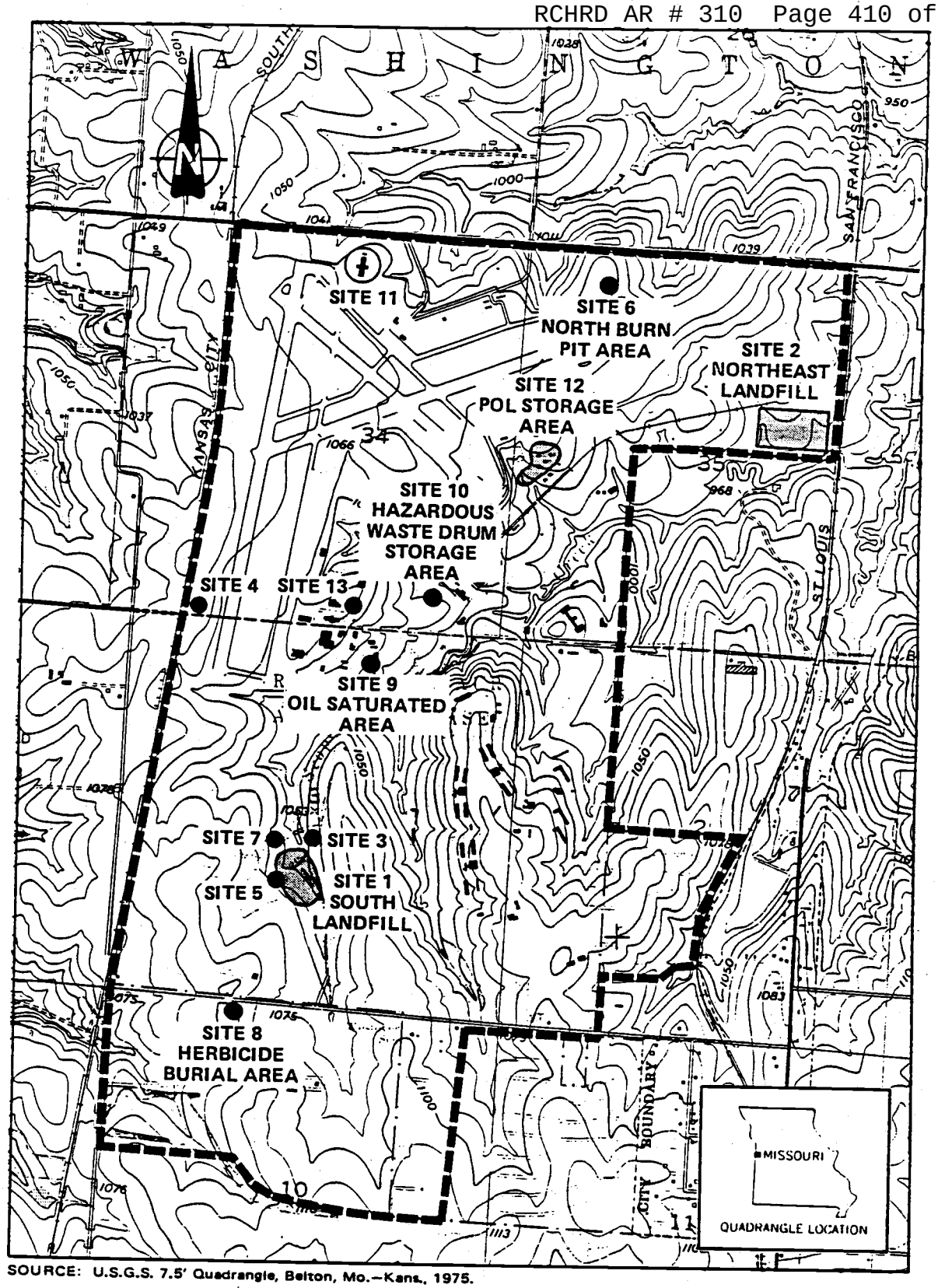

SOURCE: U.S.G.S. 7.5' Quadrangle, Belton, Mo.–Kans., 1975.

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Figure 1 RICHARDS–GEBAUR AIR FORCE BASE IRP SITES

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Table 1

SUMMARY OF SITES - PHASE II STAGE 2 INVESTIGATION

Site Number	Site Name	Investigated During this Stage
Site 1	South Landfill	Yes
Site 2	Northeast Landfill	Yes
Site 3	Contractor Rubble Burial Area	No
Site 4	West Burn Area	No
Site 5	South Burn Area	No
Site 6	North Burn Pit Area	Yes
Site 7	Radioactive Disposal Well	No
Site 8	Herbicide Burial Area	Yes
Site 9	Oil-Saturated Area	Yes
Site 10	Hazardous Waste Drum Storage Area	Yes
Site 11	Paint Stripper Hangar	No
Site 12	POL Storage Yard	Yes
Site 13	Hazardous Material Storage Area	No

Table 2

SUMMARY OF FIELDWORK/ANALYSES PERFORMED

Site	Fieldwork Performed	Analyses Performed
Site 1, South Landfill	• 1 borehole drilled • 7 soil samples collected • 4 surface water samples collected	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols.
Site 2, Northeast Landfill	• geophysical survey • 4 boreholes drilled • 2 monitoring wells installed • 10 soil samples collected • 5 groundwater samples collected • 3 surface water samples collected	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols
Site 6, North Burn Pit Area	• soil gas survey • 3 boreholes drilled • 3 monitoring wells installed • 15 soil samples collected • 3 groundwater sample collected • 1 surface water sample collected	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, VOC.
Site 8, Herbicide Burial Area	• 4 soil samples collected • 1 surface water sample collected	Soils: pesticides, arsenic, mercury. Waters: TDS, pesticides, arsenic, mercury.
Site 9, Oil-Saturated Area	• 1 borehole drilled • 8 soil samples collected • 1 surface water sample collected	Soils: petroleum hydrocarbons, VOC, lead. Waters: petroleum hydrocarbons, TDS, VOC, lead.
Site 10, Hazardous Waste Drum Storage Area	• 1 borehole drilled • 9 soil samples collected • 1 surface water sample collected	Soils: petroleum hydrocarbons, VOC, EP TOX metals. Waters: petroleum hydrocarbons, TDS, priority pollutant metals, barium.
Site 12, POL Storage Yard	• 3 boreholes augered • 1 monitoring well installed • 1 soil sample collected • 4 groundwater samples collected • 2 surface water samples collected	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC.

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reviewed to define waste disposal practices and disposal area boundaries. Field and analytical activities at each site are listed in Table 2.

Findings

One site has been classified as Category I (No Further Action Recommended). Three sites have been classified as Category III (remedial action) sites. Two of these sites can proceed to the cleanup phase based on current information and one is recommended for long-term monitoring. One site has been classified as a Category III and Category II (additional site assessment) and is recommended for long-term monitoring with additional site assessment. Three sites are classified as Category II sites to determine the extent and magnitude of identified contamination. The following discussion summarizes the findings and their significance for each site. Table 3 presents a summary of the recommendations for future work at each of the sites along with corresponding rationale.

Site 1, South Landfill

Located in the south-central portion of the base, Site 1 was used as a sanitary landfill from 1954 to 1956. Construction rubble, yard waste, and some industrial waste were disposed of in the landfill until 1961. Waste paints, thinners, strippers, solvents, and oils were all known to have been disposed of at this site, although significant quantities were not reported.

Results of soil samples analyses showed relatively low levels of petroleum hydrocarbons (1.2 to 16 mg/kg). No contamination was found to be leaving the site via surface migration into adjacent Scope Creek. Therefore, no further work is recommended.

Site 2, Northeast Landfill

Site 2 is located in the northeast part of the base, adjacent to Scope Creek. The site was used as a demolition and industrial waste landfill from 1961 to 1972. Waste paints and thinners were reportedly dumped on the ground at this site.

The water samples showed detectable concentrations of common anions; however, only sulfate, at 280 mg/L, exceeded EPA secondary drinking water standards. No detectable levels of organics or metals were found in the water samples. For soils, concentrations of petroleum hydrocarbons were detected up to a maximum of 440 mg/kg, indicating the need for further characterization.

Site 4, West Burn Area

The West Burn Area was used for 1 year in 1955 for fire training. Jet fuel, solvents, and oil were all believed to have been burned on-site.

The West Burn Area was not investigated because the site was believed to be off base. However, since the investigation began, new aerial photographic data indicate the site may actually be located east of the railroad tracks. During a tour of the site on August 12, 1987, a material believed to be tank sludge was found in an area just north of the county line and just east of the railroad tracks. Additional investigation at this site is recommended. This site is on property which is either leased or owned by the City of Kansas City, Missouri. New access agreements must be agreed to by the City prior to further investigation.

Site 6, North Burn Pit Area

The North Burn Area is located north of the flight line and was constructed in 1965. This facility is currently used for fire training. The same materials used at the West Burn Area are used at this site.

Several organics (chloroform--0.50 to 0.61 µg/L, tetrachloroethylene--0.41 to 0.71 µg/L, methylene chloride--37 µg/L) were found above detection limits in the water samples at this site. The concentrations found, however, were well below EPA standards. For soils, low levels of petroleum hydrocarbons were detected (up to 5.7 mg/kg). A single surface sample had a value of 34 mg/kg. In order to better characterize the organic contamination in the groundwater, additional groundwater testing has been recommended.

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Table 3

SUMMARY OF RECOMMENDATIONS

Site	Recommendation	Rationale
Site 1, South Landfill	Category I. No further action.	No significant contamination was found during the Stage 2 investigation.
Site 2, Northeast Landfill	Category III. Biannual monitoring for 2 years. Collect and analyze groundwater samples from five existing monitoring wells twice yearly.	To determine changes in groundwater quality because elevated sulphate concentrations were the only indicators of contamination above acceptable limits.
Site 4, West Burn Area	Category II. Perform a soil gas survey and geophysical survey. Install three monitoring wells and collect and analyze groundwater samples. Collect subsurface and surface soil samples.	To determine the exact location of the site and determine if hazardous constituents have migrated from the site.
Site 6, North Burn Pit Area	Category III and II. Biannual monitoring for 2 years. Install two more monitoring wells. Collect and analyze groundwater samples from five monitoring wells twice yearly.	To better characterize the organic contamination of the groundwater.
Site 8, Herbicide Burial Area	Category II. Additional geophysical surveys. Drill four boreholes and collect two soil samples from each borehole.	To determine exact location of trench and analyze soil from within the trench.
Site 9, Oil-Saturated Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact to soils contaminated with petroleum hydrocarbons and lead.
Site 10, Hazardous Waste Drum Storage Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact petroleum hydrocarbons.
Site 12, POL Storage Yard	Category II. Install four monitoring wells. Collect and analyze groundwater samples twice yearly.	To determine if volatile organic compound contamination has migrated from the site.

Site 10, Hazardous Waste Drum Storage Area

The Hazardous Waste Drum Storage Area was located at the southwest corner of Building 923. This area, which is fenced and paved, was used for an undetermined number of years for storage of drummed waste prior to disposal.

Contaminants found in the soils from this area were limited to petroleum hydrocarbons (ND to 1900 mg/kg). Lead and barium were detected in the surface water; however, the levels were well below EPA's Maximum Contaminant Limit (MCL), RMCL and Health Advisories (HA) for these compounds. Petroleum hydrocarbons and volatile organics were not detected in the surface water samples.

Site 12, Petroleum, Oil, and Lubricants (POL) Storage Yard

The POL Storage Yard is an aboveground tank farm located east of the flight line. One major and several minor fuel spills have occurred in this area. Also, the integrity of the floor drain system inside the pump houses is in question.

Water samples from this site showed no contamination above detection limits. Soil samples showed contamination with petroleum hydrocarbons. Five of the samples contained concentrations of 6.9 to 44 mg/kg. The remaining seven samples ranged from 67 to 2,800 mg/kg. Removal of soils with the higher concentrations is recommended. Additional contamination found in soil samples indicated spills of JP4 or some other petroleum hydrocarbon around one of the buildings at this site. This, however, is to be expected at an active storage facility. The installation of monitoring wells to determine if contaminants are moving from the site is recommended.

Four sites identified in the Phase I investigation or the Phase II, Stage 1 Presurvey Report are located on land now owned or leased by the City of Kansas City, Missouri, and were not included in this study. These sites are:

- Site 3, Contractor Rubble Burial Site;
- Site 5, South Burn Area;

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Site 8, Herbicide Burial Area

The Herbicide Burial Area is reportedly located near the south end of the runway. A stressed vegetation area, located in this general area, is believed to be the site. About four cases of pint-sized plastic bottles of a herbicide containing mercury were buried at this site.

No detectable concentrations of any contaminants were reported in the water sample from this site and values of metals in the soil samples were within the range of normal concentrations for western Missouri soils. In addition, no organic contamination was detected in the soil. However, the exact location of the trench could not be determined. Therefore, it is recommended that further investigations focus on locating the trench using geophysics. The general area where the trench was to have been dug is indicated in a Air Force document which was made available during the Phase II Stage 2 investigation. Following confirmation of the trench location, sampling has been recommended to characterize any potential contamination.

Site 9, Oil-Saturated Area

In the southwest corner of the Motor Pool Compound (Building 704) is an area that is saturated with waste oil and possibly hydraulic fluids and solvents. The area is covered with gravel, but there is evidence of recurring oil discharge at the Motor Pool fence line.

Results of soil sample analyses indicate lead and petroleum hydrocarbon contamination in the 0- to 1-foot depth. Lead levels ranged from 9.22 mg/kg to 169 mg/kg. The potential for direct contact by humans with these soils warrants consideration of removal. A cleanup level of 160 mg/kg has been derived based on a conservative potential health risk scenario using the EPA Recommended Maximum Contaminant Level (RMCL) for lead. Six of the nine samples contained less than 9 mg/kg of petroleum hydrocarbons; however, three samples had concentrations ranging from 670 to 3,800 mg/kg. This indicates possible spill areas, for which removal of the surficial soils should be considered.

1. INTRODUCTION

The Installation Restoration Program (IRP) was initiated by the Department of Defense (DOD) to investigate environmental contamination that may be present at DOD facilities as the result of past operations and waste disposal activities. Following passage of the Resource Conservation and Recovery Act (RCRA) of 1976 and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980, DOD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 in June 1980. DEQPPM 80-6 mandated that hazardous waste disposal sites on DOD facilities be identified. The United States Air Force (USAF) implemented DEQPPM 80-6 in December 1980. DOD revised and expanded existing IRP directives through DEQPPM 81-5 in 1981, and the USAF implemented it in January 1982. The IRP was developed as a four-phase program as follows:

- Phase I - Records Search;
- Phase II - Confirmation and Quantification;
- Phase III - Technology Base Development; and
- Phase IV - Corrective Action.

This report documents work performed by Ecology and Environment, Inc., (E & E) for the USAF at Richards-Gebaur Air Force Base (Richards-Gebaur AFB), Missouri. The work was done as part of Phase II Stage 2 of the IRP under Contract No. F33615-83-D-4003, Task Order 13. The purpose of Phase II Stage 2 work was:

- To determine the presence or absence of contamination at specified areas;

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- Site 7, Radioactive Disposal Well; and
- Site 11, Paint Stripper Hangars.

Access to these sites was not granted by the City, based on the recommendations of the Phase II Stage 1 report (see Appendix B of this report).

An additional site (Site 13, Hazardous Material Storage Building 927) was not included in the "Description of Work" for this investigation.

E & E recommends that Sites 3, 11, and 13 be included in any future RI/FS investigations at Richards-Gebaur AFB for the following reasons:

- Site 3 was investigated in Phase I, but no samples were taken. It is recommended that sampling be conducted to confirm the conclusions drawn from the records search.
- Site 11 was not identified in earlier work. It was included in Phase II Stage 2, but access was not granted by the City of Kansas City.
- Site 13 was recommended for further investigation in the Phase II Stage 1 report, but was not included in Stage 2. It was noted at the pre-survey meeting that a milky-white-colored discharge was observed at the site.

- Site 12, Petroleum, Oils, and Lubricants (POL) Storage Yard, and
- Site 13, Hazardous Material Storage--Building 927.

Based on this report and after review by state and federal offices, the USAF contracted Phase II Stage 2 investigation of the following sites:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 6, North Burn Pit Area,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area, and
- Site 12, POL Storage Yard.

1.1 LOCATION AND HISTORY OF OPERATIONS

The primary source of historical information on the base was the Phase I report by CH2M Hill (1983). The information was confirmed and updated by E & E as part of the Phase II Stage 2 investigation.

Richards-Gebaur AFB is located in west-central Missouri, 2.6 miles from the Kansas-Missouri state line (see Figure 1-1). The Jackson County and Cass County line runs east-west through the middle of the base. The base is bounded on the north by the City of Grandview, on the north and west by Kansas City, and on the south and east by the City of Belton. The base is about 18 miles southeast of downtown Kansas City. Access to the base is via U.S. Highway 71.

The legal description of the base includes the following ranges and townships:

Range	Township	Sections
R46N	T33W	2, 3, 10, 11
R47N	T33W	34, 35

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- To define the magnitude and potential of contaminant migration, if possible; and
- To identify potential health and/or environmental hazards based on state or federal standards.

A Phase I Initial Records Search had been conducted by CH2M Hill as outlined in a report dated March 1983. The Phase I report identified sites with potential contamination problems and made recommendations for Phase II investigation. Based on these recommendations, a Phase II Stage 1 investigation was performed on the two sites, Site 1, the South Landfill, and Site 2, the Northeast Landfill, which ranked above 50 on the USAF Hazard Assessment Rating Methodology (HARM) scale ranking system. Preliminary investigation was performed by Water and Air Research, Inc. The results of this investigation were finalized in a report dated December 1983.

In 1985, Richards-Gebaur AFB was scheduled to be reevaluated under the IRP. A presurvey meeting was arranged and all past and current potential sites were visited and evaluated. The presurvey was conducted by E & E and their recommendations were provided in a Presurvey Report dated June 1985.

The sites included in that survey are:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 3, Contractor Rubble Burial Area,
- Site 4, West Burn Area,
- Site 5, South Burn Area,
- Site 6, North Burn Area,
- Site 7, Radioactive Disposal Well,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area,
- Site 11, Paint Stripper Hangar,

The base has undergone a number of changes since the Phase I and Phase II Stage 1 surveys and the 1985 Phase II Stage 2 presurvey. The changes regard the turning over of large portions of the original installation to several new landlords. These landlords include the City of Belton and Kansas City Aviation Department, which operates air service out of Richards-Gebaur Airport. Other portions of the base are now used by various branches of the military.

The area which is now Richards-Gebaur AFB was acquired by Kansas City in 1941 for use as an auxiliary airport, which was then called Grandview Airport. In 1952, the Air Defense Command (ADC) leased the airport from the city for use in air defense operations, and in 1953 the property was formally conveyed to the U.S. Government. The base was redesignated Richards-Gebaur AFB in 1957 in honor of two Kansans, First Lieutenant John F. Richards and Lieutenant Colonel Arthur W. Gebaur, Jr.

ADC had the primary mission on the base until 1970, when the Air Force Communications Command (AFCC) assumed command and relocated its headquarters from Scott AFB, Illinois. In 1977, AFCC moved back to Scott AFB, and Richards-Gebaur AFB came under the Military Airlift Command.

Between 1977 and 1979, the number of active duty and civilian forces at Richards-Gebaur AFB was drastically reduced from a maximum of about 5,000 personnel during the active years of the base to less than 500 full-time personnel. In September 1979, the majority of the operating support functions were transferred to a civilian contractor, Talley Services, Inc.

The 442nd Tactical Fighter Wing currently has the primary mission on the base. The Air Force Reserves (AFRES) unit was originally activated in 1949 at Fairfax Field in Kansas City, Kansas, and was relocated to Naval Air Station (now Johnson County Industrial Airport), Olathe, Kansas, in 1950 before arriving at Richards-Gebaur AFB in 1955. The co-located AFRES units have an authorized strength of 197 full-time Air Reserve technicians, 1,073 reservists, and 224 civilian employees.

Active duty support units remaining at Richards-Gebaur AFB include the 1879th Communications Squadron (AFCC) and Operating Location A, Detachment 19, 26th Weather Squadron (MAC). Other federal government agencies presently using base facilities include U.S. Marine Corps

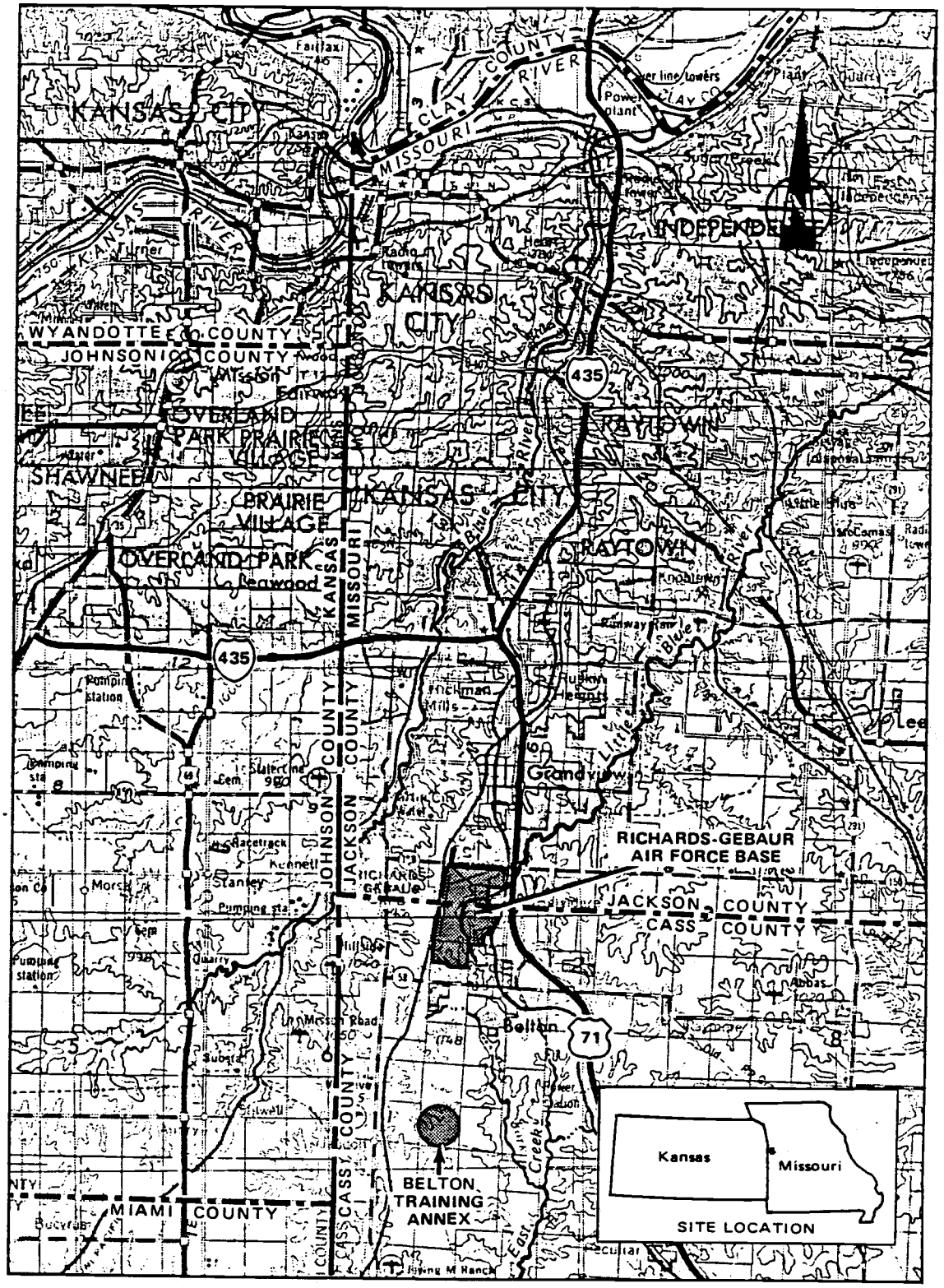

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Figure 1–1 LOCATION MAP OF RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI

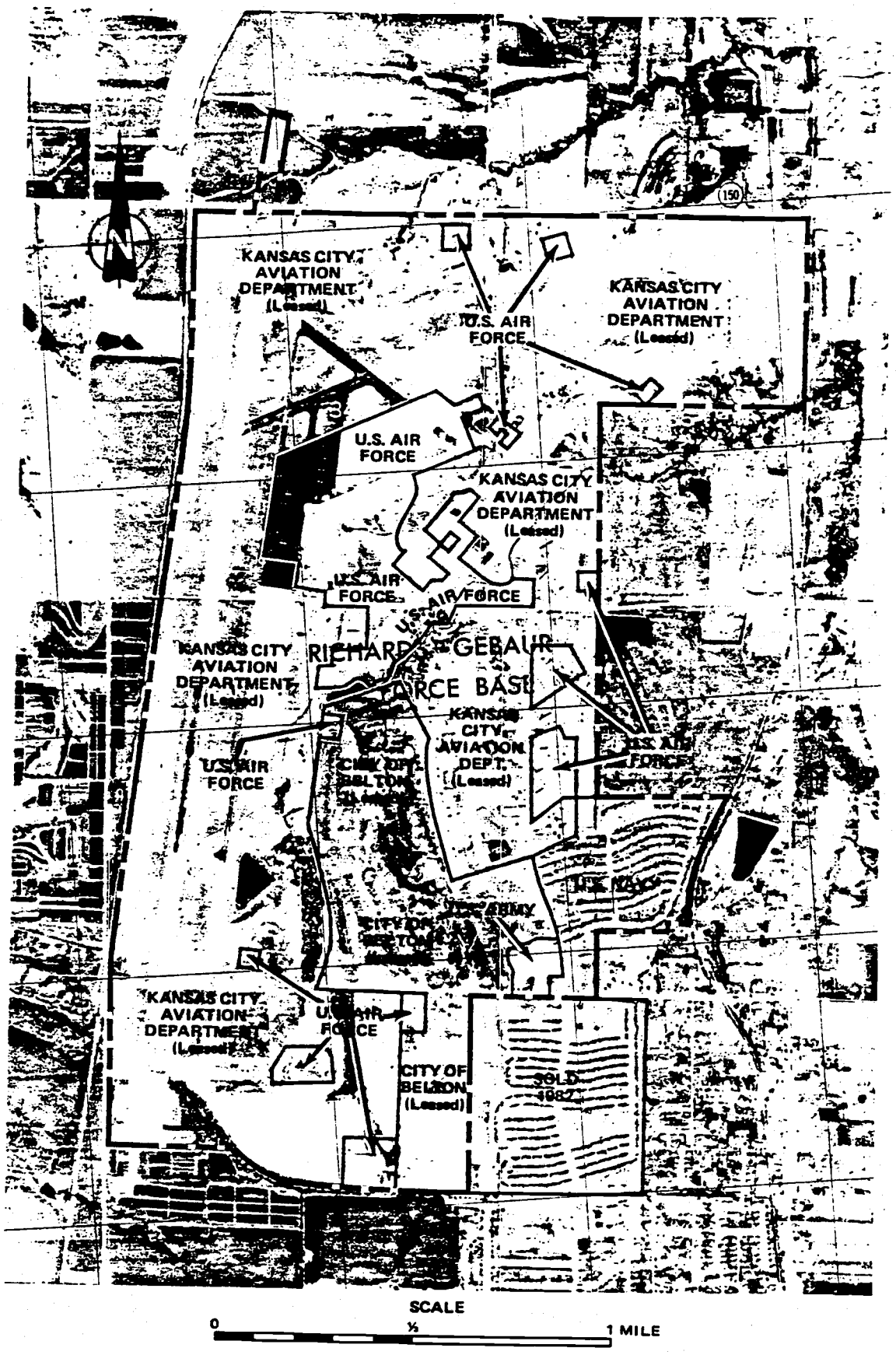

Figure 1–2 REAL PROPERTY AREAS, RICHARDS-GEBAUR AFB, MISSOURI

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occupation of the former base officer housing area; the U.S. Department of Agriculture Standardization Division; the U.S. Navy Seabee Reserve Mobile Construction Battalion No. 15; 308th Psychological Operations Company; nine U.S. Army reserve units; and the General Services Administration (GSA).

In October 1980, the majority of the base facilities and properties were accessed to the GSA in an interim lease, and joint use of the airport with Kansas City became effective. Base support facilities are currently shared by AFRES, Kansas City, and Talley Services, Inc.

A more detailed description of the base history and its mission can be found in the Phase I Records Search Report.

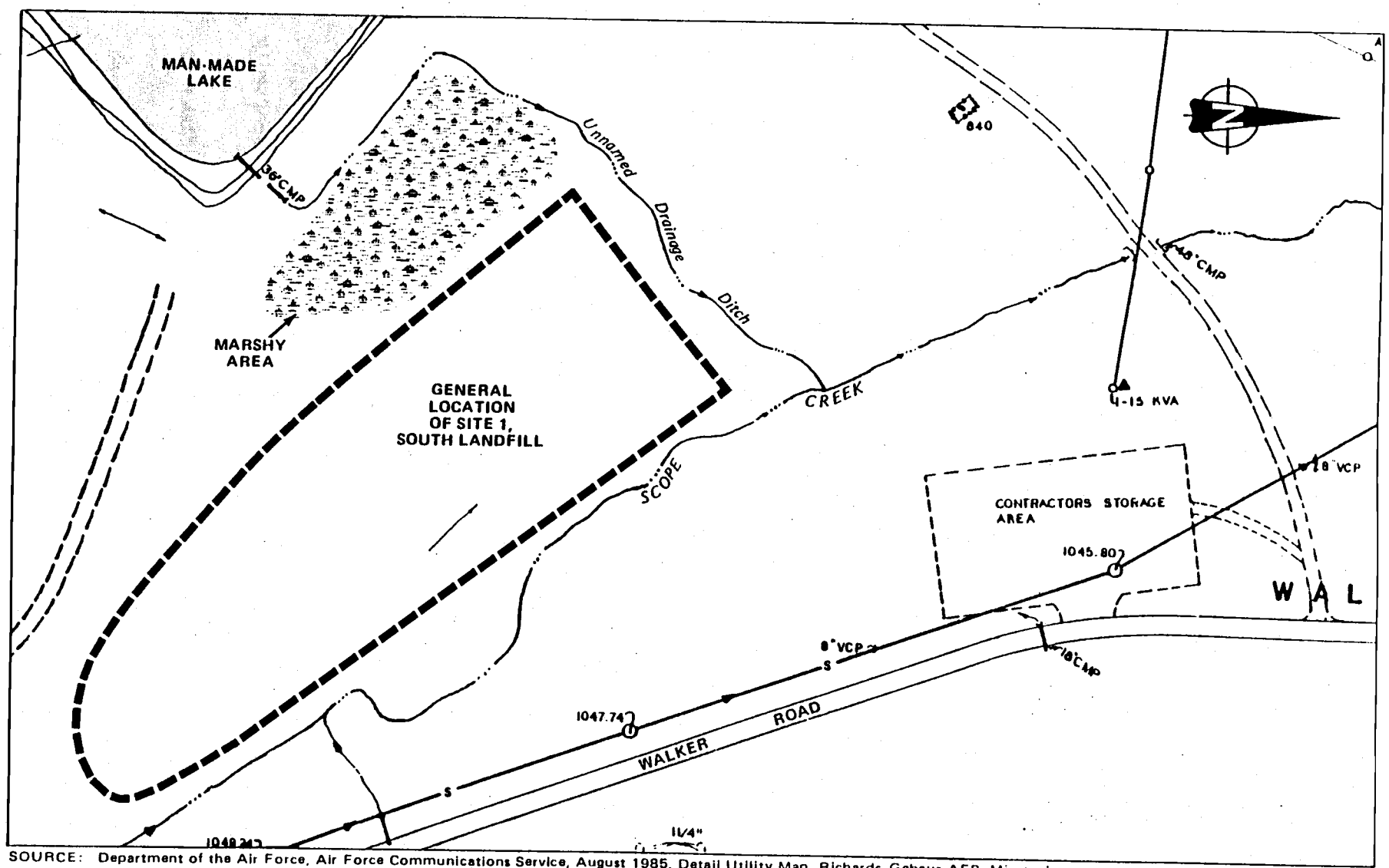
The Air Force controlled property at Richards-Gebaur AFB involves a fairly complex arrangement of ownership, permit use, leases, and easements. Figure 1-2 illustrates the current distribution of various land parcels within the base boundaries. Base property at the present time includes about 2,160 acres, of which 375 acres are retained by the USAF; 1,673 acres are leased to Kansas City and the City of Belton; 101 acres are being transferred to the Department of the Navy; and 11 acres have been transferred to the Department of the Army. An off-base drop zone, the Belton Training Annex, represents another 472 acres of land under the control of Richards-Gebaur AFB.

1.2 SITE DESCRIPTIONS

The primary source of information on the following site descriptions was the Phase I report prepared by CH2M Hill. The information was confirmed and updated by E & E as part of the Phase II Stage 2 investigation. The locations of the sites are shown on Figure 1-3.

1.2.1 Site 1, South Landfill

The South Landfill is located in the south-central part of the base near the nondestructive inspection (NDI) laboratory and adjacent to Scope Creek (see Figure 1-4). Between 1954 and 1956, this site was the main sanitary landfill for Richards-Gebaur AFB. In 1956, contract off-base disposal of most common refuse was begun, although some wastes, including building rubble, yard debris, and waste from some industrial shop areas, were disposed of at the site until about 1961. Materials

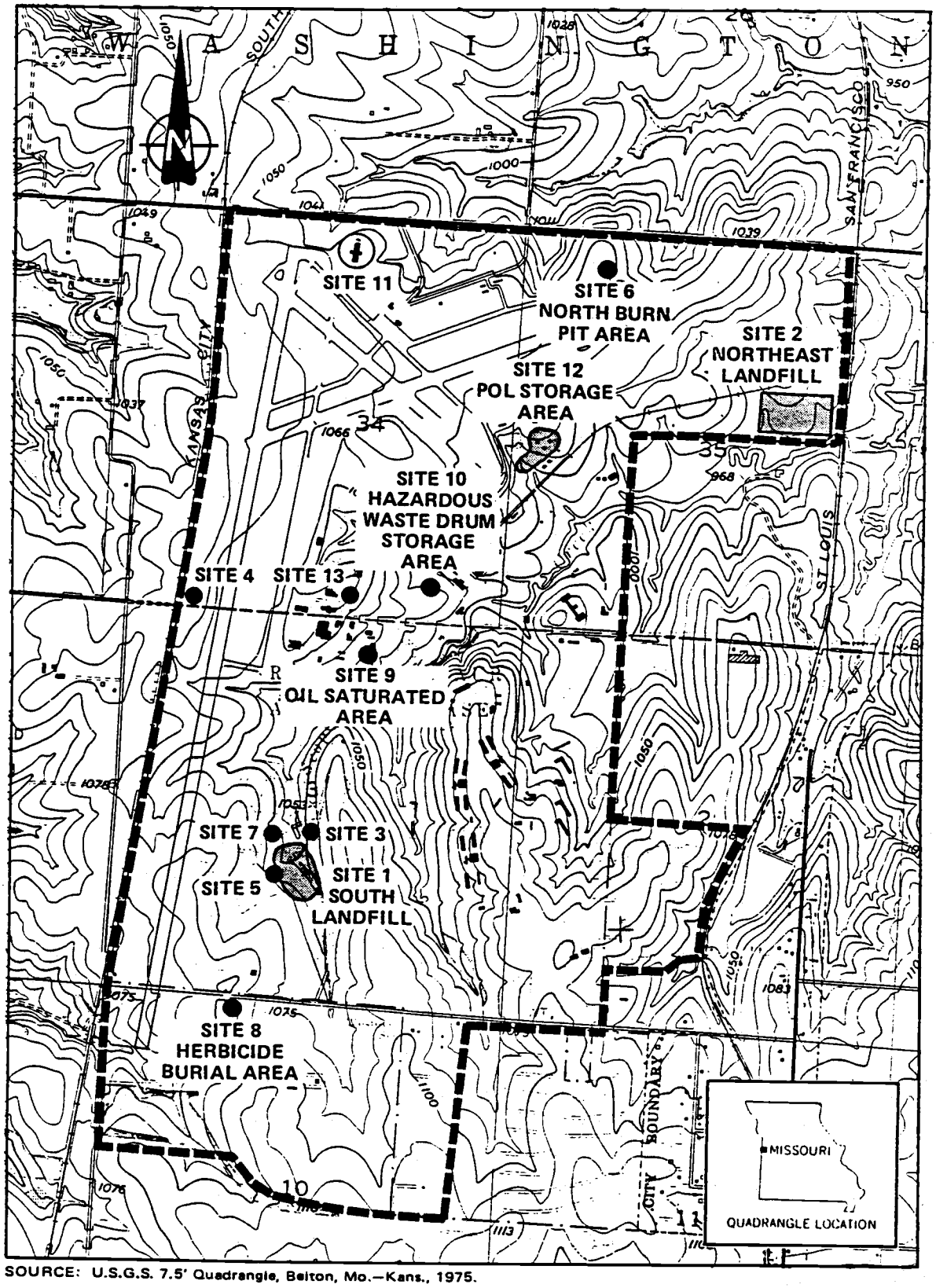


SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY: Site Boundary; Surface Runoff Direction

SCALE 0 50 100 200 300 FEET

Figure 1–4 SITE 1, SOUTH LANDFILL LOCATION MAP

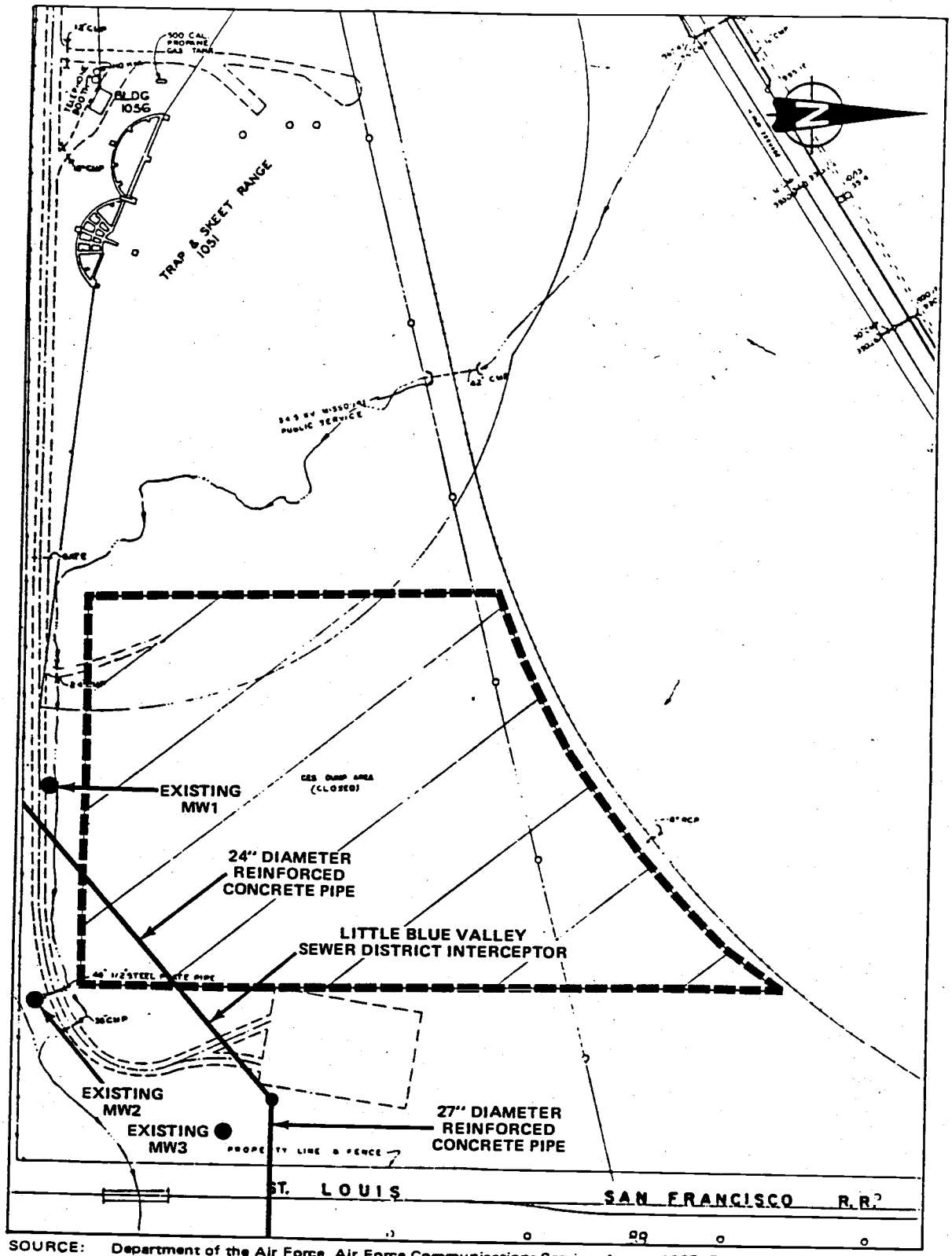


SOURCE: U.S.G.S. 7.5' Quadrangle, Belton, Mo.—Kans., 1975.

SCALE

0 ½ 1 MILE

Figure 1–3 RICHARDS–GEBAUR AIR FORCE BASE IRP SITES



SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY: Site Boundary — Surface Runoff Direction

SCALE
0 100 200 300 400 FEET

Figure 1–5 SITE 2, NORTHEAST LANDFILL LOCATION MAP

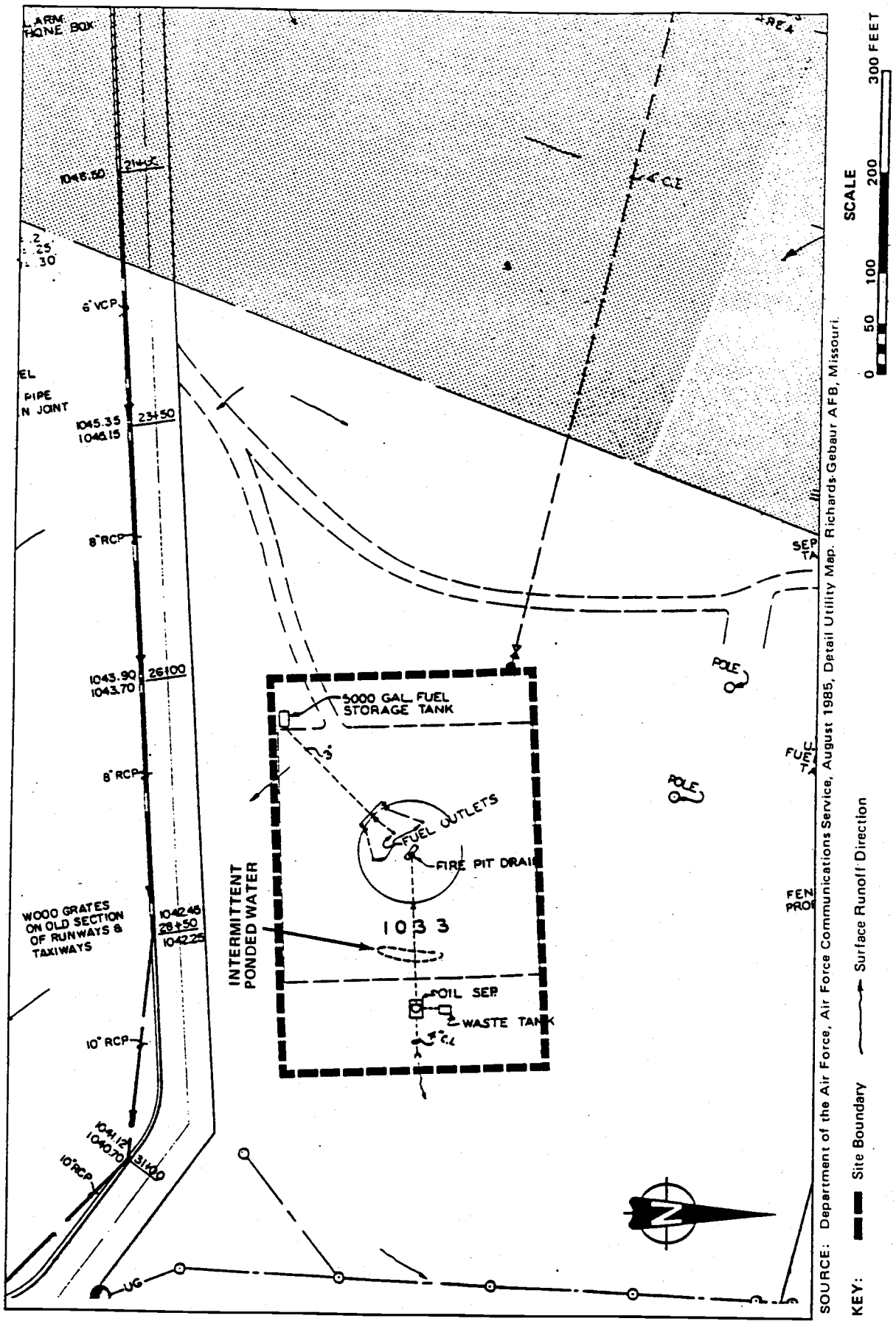
which may have been disposed of in the South Landfill include small quantities of waste paints, thinners, strippers, solvents, and oils, although it was not standard procedure to dispose of such materials here. Operation of the landfill included burning of the disposed wastes. Since 1961, the area has been used only intermittently for unauthorized dumping, including residues from tar pots and some household wastes. Small quantities of hazardous wastes may have been placed in this landfill; however, no significant hazardous waste quantities were reported. An earthen barricade has been erected at the entrance to the site, and current access to the site is through a locked road gate.

Scope Creek runs along the eastern edge of the landfill and there is a small man-made lake directly west of and upgradient from the landfill. The northwest area of the landfill is marshy due to this lake, and seeps were observed in this area. Scope Creek empties into Little Blue River, which drains most of eastern Jackson County. The Little Blue River empties into the Missouri River.

1.2.2 Site 2, Northeast Landfill

The Northeast Landfill is located in the northeasternmost portion of the base adjacent to Scope Creek (see Figure 1-5). The site was used between 1961 and 1972 for the disposal of miscellaneous wastes, including building rubble, yard debris, and wastes from some industrial shop areas. The eastern portion of Site 2 was used for open storage of materials, including construction materials, pipes, empty tanks, waste paint and thinners in drums and buckets, and empty 55-gallon drums. As many as 400 drums were located in this area at one time. Less than 20 drums, mostly empty, were on-site as of 1986. The wastes were typically burned and buried in trenches. Most of the sanitary wastes at Richards-Gebaur AFB during this time were disposed of off-base through contract removal. Waste paints and thinners at the base were reportedly disposed of on the ground surface as late as 1978.

The Little Blue Valley Sewer District installed a 24-inch diameter reinforced concrete pipe (RCP) interceptor sewer line through the southeast corner of Site 2 in 1983. There was no indication that trash or other landfill material was encountered during construction. The



SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map. Richards-Gebaur AFB, Missouri.

KEY: Site Boundary; Surface Runoff Direction

Figure 1–6 SITE 6, NORTH BURN PIT AREA LOCATION MAP

average depth of the line is 15 feet and the excavation width at the surface was 90 to 100 feet. Figure 1-5 shows the location of the interceptor.

1.2.3 Site 6, North Burn Pit Area

Site 6, the North Burn Pit Area, is located north of the flight line, just below the northern boundary of the base (see Figure 1-6). It was built in 1965 and is used for fire department training. A recent improvement to the facility is a 6-inch concrete rim around a concrete-lined burn pit, which is a circle with a radius of 50 feet. The drain that carries runoff from the pit is equipped with an oil-water separator. At least one incident of failure of the separator has been noted. In 1985-86, a chain-link fence was constructed around this facility. A slight depression was formed on the east side of the site as a result of the fence addition. During wet weather, some water is ponded in this area.

Fuel for the fire department training fires consisted of waste oils and possibly solvents, mixed with JP-4 fuel. An aboveground fuel storage tank is located in the southwest corner of the facility near the access gate. Reportedly, small quantities of fuel have been spilled during fuel transfer.

1.2.4 Site 8, Herbicide Burial Area

In 1971, about four cases of herbicide, reportedly containing mercury, in plastic pint-sized bottles, were reportedly buried in a trench near the south end of the runway (see Figure 1-7). Previous studies located this site in the general area of the south end and approximately 1,000 feet east of the original north-south runway. Since the city of Kansas City took over the air field, this runway has been extended approximately 3,000 feet. Vegetation stress was noted in the area at the time of the presurvey meeting. A small pond is located about 150 feet southeast of the supposed burial area.

1.2.5 Site 9, Oil-Saturated Area

Site 9, the Oil-Saturated Area, is located in the southwest corner of the Motor Pool Compound (Building 704) (see Figure 1-8). This

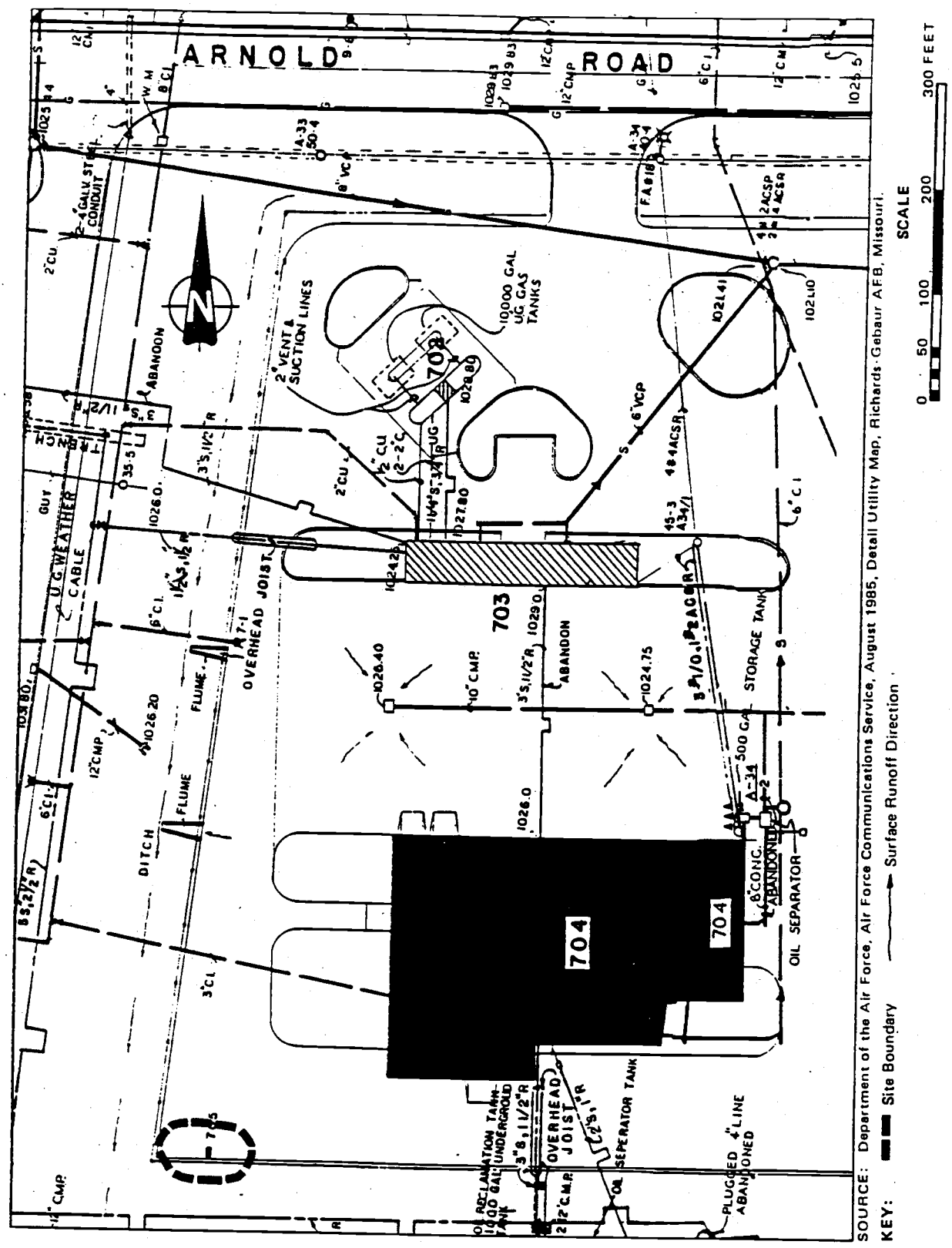


Figure 1–8 SITE 9, OIL SATURATED AREA LOCATION MAP

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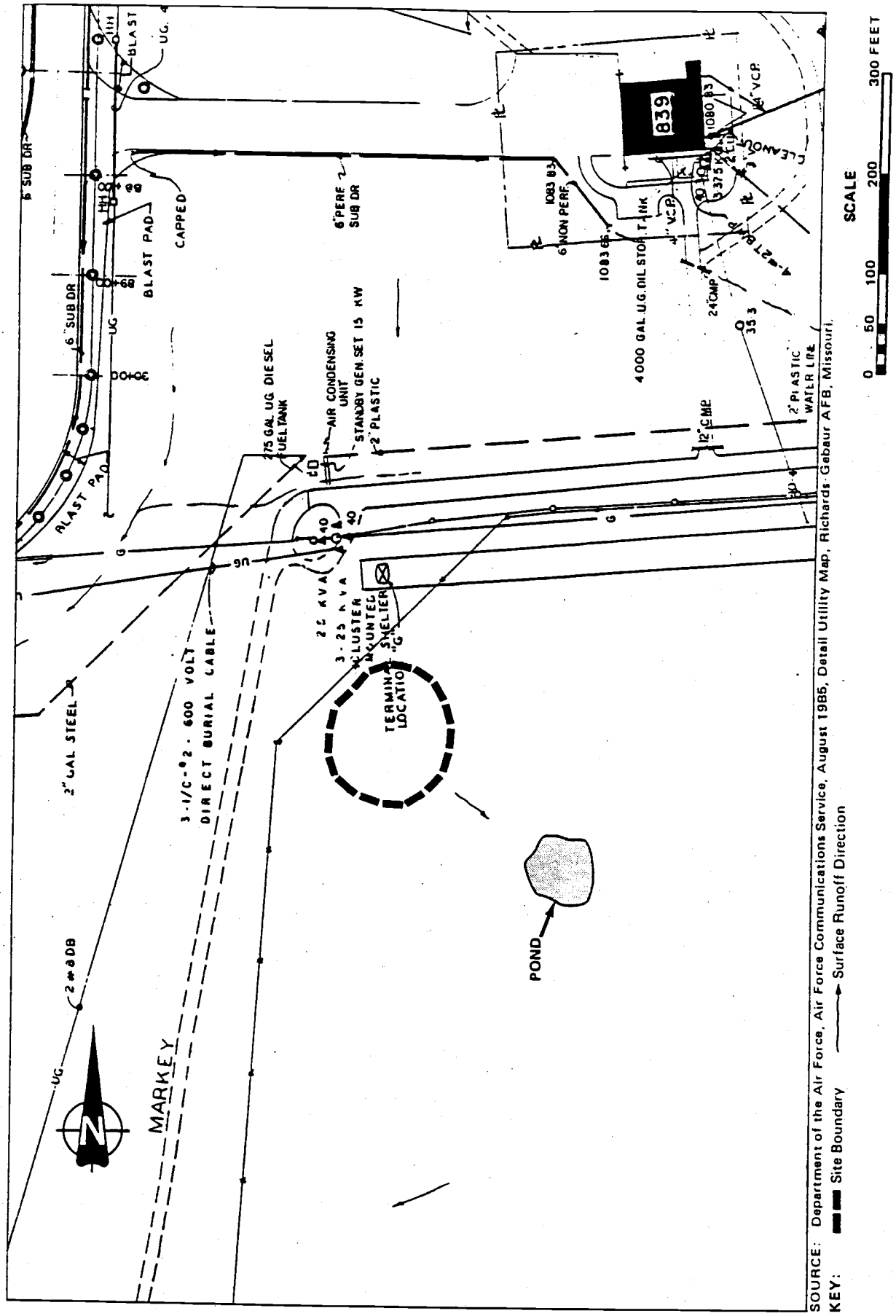


Figure 1–7 SITE 8, HERBICIDE BURIAL AREA LOCATION MAP

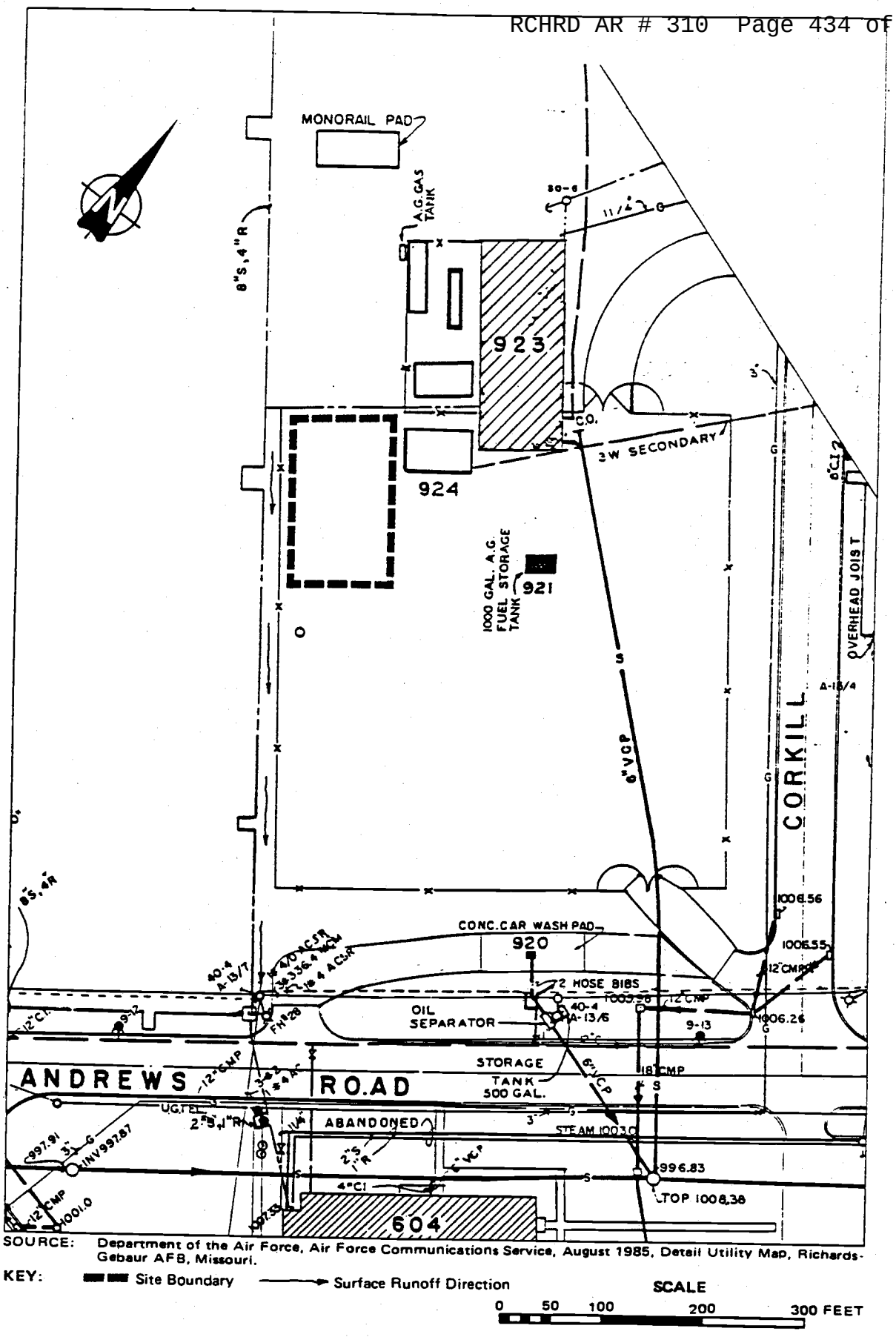


Figure 1–9 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA LOCATION MAP

maintenance and storage area has been in operation since the mid-1950s. It is adjacent to a fuel-handling area to the north and recreation fields to the south. The site showed evidence of long-term saturation with waste oil and possibly hydraulic fluids and solvents. The area has been covered with gravel on several occasions, but there is evidence of recurring discharges of oil at the fence line in this area.

1.2.6 Site 10, Hazardous Waste Drum Storage Area

Site 10, the Hazardous Waste Drum Storage Area, was located along the southwest corner of Building 923 (see Figure 1-9). This fenced-in area was used for an undetermined number of years for storage of drums of waste prior to disposal. No hazardous materials are currently stored in this area. The area is partially surfaced with asphalt and tarmac, but surface water runoff flows unchecked into a grassy drainage ditch to the west of the area. During the 1985 Presurvey meeting, Site 6 and an adjacent Quonset hut were being used for categorization and overpacking of the drummed hazardous material which was still present on the site. This site was not part of the Phase I or Phase II Stage 1 investigations. The site is currently a staging area for contract groundskeepers.

1.2.7 Site 12, POL Storage Yard

Site 12, the POL Storage Yard, is a compound which contains several pump houses and four aboveground fuel storage tanks (see Figure 1-10). It is located east of the flight lines, downgradient from a small man-made pond and approximately 500 feet northwest and upgradient from the sewage treatment facility. Seepage from the pond feeds a marshy area west of the site and drains into a system of culverts. An iridescent sheen was noted on the marshy area during the presurvey site visit. One major and several minor spills have occurred in this compound. There is also concern regarding the integrity of floor drains inside the pump houses. The tanks are bermed, but the berms are weathered and cracked.

1.3 SITES NOT INVESTIGATED DURING STAGE 2

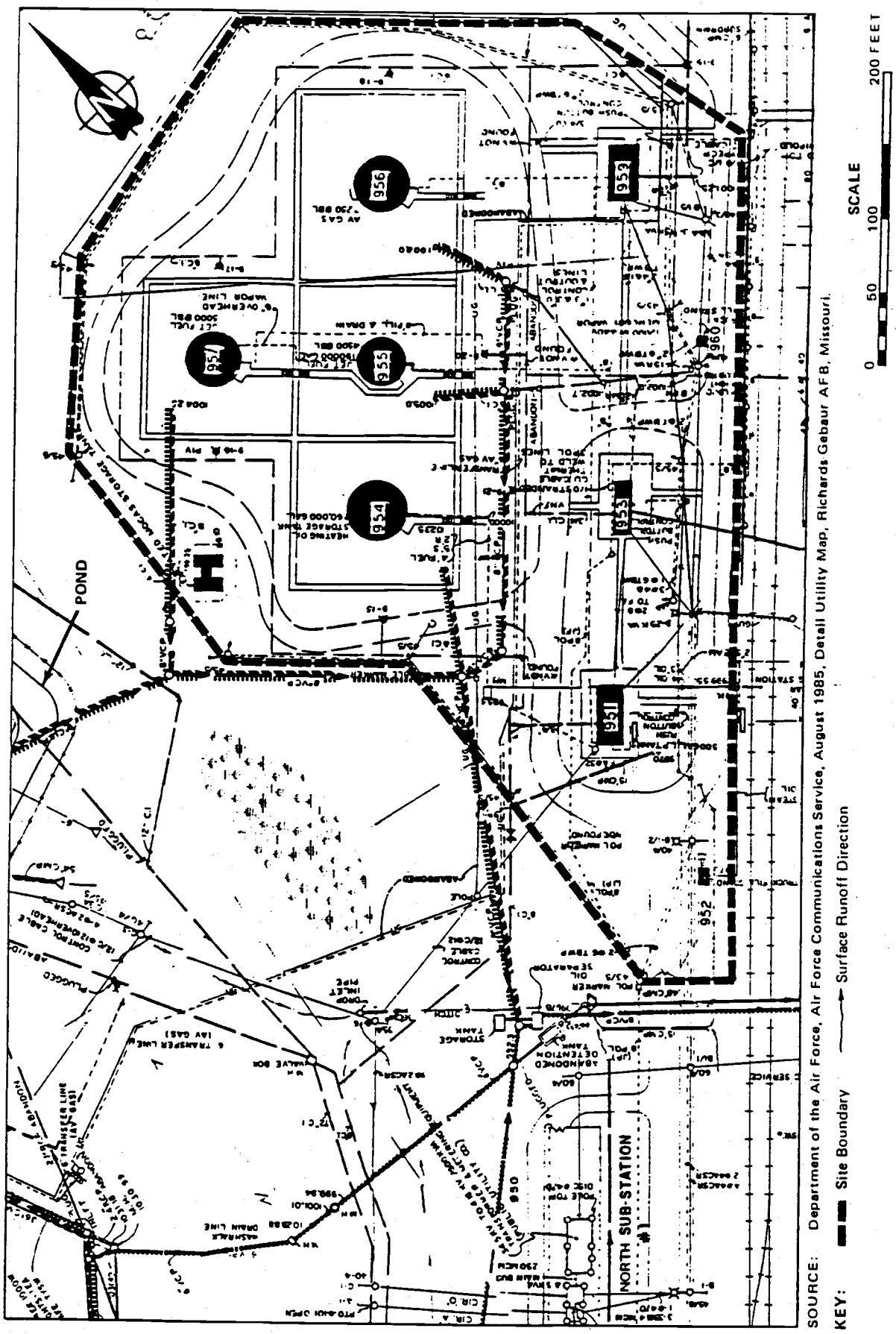
Several sites were not investigated during the Stage 2 program. The sites were deleted because they either could not be located or they were located on property leased to the Kansas City Aviation Department, which denied access to all sites on Kansas City Aviation land, except the South and Northeast landfills. Access was not granted because the Phase II Field Evaluation Report, dated December 1983, recommended no further action. The letters denying access to sites 3, 5, 7, and 11 are found in Appendix B. The reason Site 13 was not investigated is unknown. This site was not listed in the Description of Work. The following is a discussion of those sites.

Site 3, Contractor Rubble Burial Site

The Rubble Burial Site is located on the east bank of Scope Creek in the south-central part of the base. It reportedly was in operation from 1954 through 1978. The area is not posted or fenced and appears to have been used more recently than 1978. The area is fairly level and most of the debris is discharged over the bank at the treeline. During the presurvey visit, construction materials, including wood, concrete, masonry, and metal, were observed; however, dense foliage prevented a more thorough investigation. A 5-gallon sealed plastic container of an unidentified liquid was discovered at the base of the fill and brought to the attention of the Richards-Gebaur AFB civil engineer. This area is on land either sold or leased to the City of Kansas City. The Kansas City Aviation Department did not grant access to this site.

Site 4, West Burn Area

The West Burn Area was tentatively identified as being located off the base to the west on the west side of the railroad track and north of the Jackson County line. During the presurvey fieldwork, no evidence of this site could be found. Since the West Burn Area was in operation for only 1 year (1955) approximately 30 years ago, it was thought that there was no physical evidence of this site. However, since the Phase II Stage 2 Field Investigation, aerial photographs not previously available indicate the site may actually be located east of the railroad. During a familiarization tour on August 12, 1987, a material believed to be



SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards Gebaur AFB, Missouri.

KEY: Site Boundary; Surface Runoff Direction

Figure 1–10 SITE 12, POL STORAGE YARD LOCATION MAP

Site 11, Paint Stripper Hangars--Building 1010

This site was not identified in either the Phase I or II reports nor was it included in the 15 April 1985 memorandum listing additional sites for confirmation. This site was visited during the presurvey meeting and was included in this stage of the investigation by Dr. John Yu (OEHL). The building consists of a set of four hangars, parts of which had been used in the past to strip paint from helicopters. One of the hangars continues to operate in this manner, but as a nonmilitary operation. Records indicate that while the site was under the control of the Kansas City Aviation Department, a spill of a commercial paint stripper contaminated the surface ditches draining this facility. Two metal drum sumps are located outside of two of the hangars and overflow into the surface ditches.

Building 1010 is located on land owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation.

Site 13, Hazardous Material Storage--Building 927

This site was listed in the 15 April 1985 memorandum for inclusion in the confirmation stage of this investigation. The building is an engine and propeller maintenance shop using a number of degreasers, solvents, oils, and lubricants--all of which are stored in metal barrels on racks outside the back of the shop. The slope behind this shop gives indications of vegetation stress and minor runoff from the storage platform. The drainage from this building exits via an oil/water separator out to the surface, at the southeast corner of the compound. A milky-white colored discharge was observed flowing from this pipe during the presurvey site inspection. One floor drain in this building bypasses the oil/water separator and discharges directly to the surface.

This site was not addressed during this effort, but should be included in any future RI/FS efforts at Richards-Gebaur AFB.

1.4 TYPES OF CONTAMINANTS INVESTIGATED

The investigation was designed to determine the presence or absence of contamination in surface waters and groundwaters, sediments, and

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tank sludge was found in an area just north of the county line and just east of the railroad tracks. At the time of the fieldwork, the site location was unknown and believed to be off base. Therefore, the site was not investigated.

Any impact that this site might have had will have to take into account the presence of the Knoche oil field 3,000 feet to the southeast. The uplands here are fairly level and the area of the site currently is farmed in corn. A tree nursery is located across the county line to the south.

This site should be investigated further if Kansas City will grant access.

Site 5, South Burn Area

The South Burn Area tentatively has been identified as being located to the southwest of the South Landfill (Site 1). During the presurvey fieldwork, no evidence of this site could be found. Since the South Burn Area was in operation for 10 years (1955 to 1965) approximately 20 years ago, it is possible that there will be no physical evidence of this site at all. Because of its proximity to the South Landfill, any environmental contamination detected at this site will be reviewed in light of findings from the South Landfill investigation. This site is believed to be on land either owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation.

Site 7, Radioactive Disposal Well

The Radioactive Disposal Well is located north of the South Landfill and east of the major flight line. It is believed to have been operated from 1955 to 1970. Discussion during the presurvey visit indicated that low-level radioactive material, typically radium dials, were disposed into this cased well. The site currently is behind a locked gate in an open field. The well itself is very visible, standing 4 to 5 feet high and painted red. This well is located on land owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation. Therefore, no work was performed at this site.

Table 1-1

SAMPLE ANALYSES PERFORMED AT RICHARDS-GEBAUR AFB

Parameter	Site 1	Site 2	Site 6	Site 8	Site 9	Site 10	Site 12
Halogenated Volatile Organics	Sd, S, W	Sd, S, W	Sd, S, W	--	Sd, S, W	Sd, S, W	Sd, S, W
Aromatic Volatile Organics	Sd, S, W	Sd, S, W	Sd, S, W	--	Sd, S, W	Sd, S, W	Sd, S, W
Base/Neutral/Acid Extractables	W	W	--	--	--	--	--
Pesticides	--	--	--	W	--	--	--
Herbicides	--	--	--	S, W	--	--	--
Petroleum Hydrocarbons	Sd, S, W	Sd, S, W	Sd, S, W*	--	Sd, S, W	Sd, S, W	Sd, S, W
Phenols	W	W	--	--	--	--	--
Primary Metals	W	W	--	--	--	W	--
EP TOX Metals	--	--	--	--	--	S	--
Arsenic	--	--	--	S, W,	--	--	--
Barium	--	--	--	--	--	W	--
Mercury	--	--	--	S, W	--	W	--
Lead	--	--	--	--	S, W	--	--
Common Anions	W	W	--	--	--	--	--
Total Dissolved Solids	W	W	W	W	W	W	W*

Key: Sd = Sediment
S = Soil
W = Water

*Scheduled but not analyzed

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subsurface soils at the defined sites of interest. Table 1-1 shows the analysis performed for each environmental matrix at each site.

Volatile Organics

Halogenated and aromatic hydrocarbons were analyzed using EPA Methods 601 and 602 for water samples and EPA Methods 8010 and 8020 for soil samples. A listing of the compounds detected by these methods and the corresponding detection limits (DL) are presented in Table 1-2.

Pesticides, Herbicides, and PCBs

Soil samples analyzed for organochlorine pesticides and PCBs were extracted using EPA Method 3550. EPA Method 8080 was used to analyze for organochlorine pesticides and PCBs in soil samples. EPA Method 8150 was used to analyze for chlorinated herbicides in soil samples. EPA Method 608 was used to analyze for organochlorine pesticides and PCBs in water samples. Standard Method 509B was used to analyze for chlorinated herbicides in water samples. A listing of the compounds detected by these methods and the corresponding DLs are presented in Table 1-2.

Base/Neutral/Acids (BNAs) - Extractable Organics

Water samples were analyzed using EPA Method 625. A listing of the compounds detected by these methods and the corresponding DLs are presented in Table 1-2.

Petroleum Hydrocarbons

Soil samples analyzed for petroleum hydrocarbons were extracted using EPA Method 3550, and analyzed using EPA Method 418.1. The DL for this method was 1.0 mg/kg. Water samples were analyzed using EPA Method 418.1. The DL for this method was 1.0 mg/L.

Phenols

Water samples were analyzed using EPA Method 604 (see Table 1-2). A listing of the compounds detected by this method and the corresponding DLs are presented in Table 1-2.

Table 1-2 (Cont.)

Parameter	DL* Soil	DL* Water
Pesticides, Herbicides, PCB Compounds (Methods 608, 8080, 8150, and 509)		
Aldrin	1.0	0.05
a-BHC	1.0	0.05
b-BHC	1.0	0.05
g-BHC	1.0	0.05
d-BHC	1.0	0.05
Chlordane	1.0	0.50
4,4'-DDD	1.0	0.10
4,4'-DDE	1.0	0.10
4,4'-DDT	1.0	0.10
Dieldrin	1.0	0.10
Endosulfan I	1.0	0.05
Endosulfan II	1.0	0.10
Endosulfan sulfate	1.0	0.10
Endrin	1.0	0.10
Endrin aldehyde	1.0	0.10
Heptachlor	1.0	0.05
Heptachlor epoxide	1.0	0.05
Toxaphene	1.0	1.0
2,4-D	1.0	0.5
2,4,5-TP (Silvex)	1.0	0.05
2,4,5-T	1.0	0.05
2,4-DB	1.0	--
Dicamba	1.0	--
Dalapon	1.0	--
PCB-1016	1.0	0.50
PCB-1221	1.0	0.50
PCB-1232	1.0	0.50
PCB-1242	1.0	0.50
PCB-1248	1.0	0.50
PCB-1254	1.0	1.0
PCB-1260	1.0	1.0
Priority Pollutant Metals (Methods 200.7, 245.1, 206.2, 270.2		
Antimony	--	60
Arsenic	--	5
Beryllium	--	5
Cadmium	--	5
Chromium	--	10
Copper	--	10
Lead	--	5
Mercury	--	0.2
Nickel	--	15
Selenium	--	5
Silver	--	10
Thallium	--	5
Zinc	--	10

Table 1-2

ANALYTICAL PARAMETERS AND DETECTION LIMITS
USED FOR RICHARDS-GEBAUR AFB INVESTIGATION

Parameter	DL* Soil	DL* Water
Purgeable Halogenated Hyrdrocarbons (Methods 601 and 8010)		
Bromodichloromethane	1.0	0.10
Bromoform	1.0	0.20
Bromomethane	1.0	1.18
Carbon tetrachloride	1.0	0.12
Chlorobenzene	1.0	0.2
Chloroethane	1.0	0.52
2-Chloroethylvinyl ether	1.0	0.13
Chloroform	1.0	0.05
Chloromethane	1.0	0.08
Dibromochloromethane	1.0	0.09
1,2-Dichlorobenzene	1.0	0.4
1,3-Dichlorobenzene	1.0	0.4
1,4-Dichlorobenzene	1.0	0.3
Dichlorodifluoromethane	1.0	1.81
1,1-Dichloroethane	1.0	0.07
1,2-Dichloroethane	1.0	0.03
1,1-Dichloroethene	1.0	0.13
trans-1,2,Dichloroethene	1.0	0.10
1,2-Dichloropropane	1.0	0.04
cis-1,3-Dichloropropene	1.0	0.20
trans-1,3-Dichloropropene	1.0	0.34
Methylene chloride	1.0	0.25
1,1,2,2-Tetrachloroethane	1.0	0.03
Tetrachloroethene	1.0	0.03
1,1,1-Trichloroethane	1.0	0.03
1,1,2-Trichloroethane	1.0	0.02
Trichloroethene	1.0	0.12
Trichlorofluoromethane	1.0	2.0
Vinyl chloride	1.0	0.18
Purgeable Aromatics (Methods 602 and 8020)		
Benzene	1.0	0.2
Chlorobenzene	1.0	0.2
1,2-Dichlorobenzene	1.0	0.4
1,3-Dichlorobenzene	1.0	0.4
1,4-Dichlorobenzene	1.0	0.3
Ethylbenzene	1.0	0.2
Toluene	1.0	0.2
Xylenes (Total)	1.0	1.0
Phenolic Compounds (Method 604)		
4-Chloro-3-methylphenol	--	5.0
2-Chlorophenol	--	5.0
2,4-Dichlorophenol	--	5.0
2,4-Dimethylphenol	--	5.0
2,4-Dinitrophenol	--	13.0
2-Methyl-4,6-dinitrophenol	--	16.0
2-Nitrophenol	--	5.0
4-Nitrophenol	--	5.0
Pentachlorophenol	--	7.4
Phenol	--	5.0
2,4,6-Trichlorophenol	--	5.0

Table 1-2 (Cont.)

Parameter	DL* Soil	DL* Water
Other Parameters		
Petroleum Hydrocarbons (using IR)	1.0	1.0 mg/L
EP Toxicity (SW 846-1310)	a**	--
Barium (Method 200.7)	—	0.05

*Detection limits (DLs) are provided for soil in mg/kg and for water in ug/L, except where noted otherwise.

**Key:

a Metal	ug/L of leaching solution
As	500
Ba	5000
Cd	100
Cr	500
Pb	500
Hg	0.8
Se	500
Ag	500

Table 1-2 (Cont.)

Parameter	DL* Soil	DL* Water
Base Neutral/Acid Extractable Organics (Methods 625 and 8270)		
1,3-Dichlorobenzene	--	10
1,4-Dichlorobenzene	--	10
Hexachloroethane	--	10
Bis(2-chloroethyl)ether	--	10
1,2-Dichlorobenzene	--	10
Bis(2-chloroisopropyl)ether	--	10
Nitrobenzene	--	10
Hexachlorobutadiene	--	10
1,2,4-Trichlorobenzene	--	10
Isophorone	--	10
Naphthalene	--	10
Bis(2-chloroethoxy)methane	--	10
Hexachlorocyclopentadiene	--	10
2-Chloronaphthalene	--	10
Acenaphthylene	--	10
Acenaphthene	--	10
Dimethyl phthalate	--	10
2,6-Dinitrotoluene	--	10
Fluorene	--	10
4-Chlorophenyl phenyl ether	--	10
2,4-Dinitrotoluene	--	10
Diethylphthalate	--	10
N-Nitrosodiphenylamine	--	10
Hexachlorobenzene	--	10
4-Bromophenyl phenyl ether	--	10
Phenanthrene	--	10
Anthracene	--	10
di-butyl phthalate	--	10
Fluoranthene	--	10
Pyrene	--	10
Benzidine	--	50
Butyl benzyl phthalate	--	10
Bis(2-ethylhexyl)phthalate	--	10
Chrysene	--	10
Benzo(a)anthracene	--	10
3,3'-Dichlorobenzidine	--	30
Di-n-octylphthalate	--	10
Benzo(b)fluoranthene	--	10
Benzo(k)fluoranthene	--	10
Benzo(a)pyrene	--	10
Indeno(1,2-c,d)pyrene	--	10
Dibenzo(a,h)anthracene	--	10
Benzo(ghi)perylene	--	10
phenol	--	10
2-chlorophenol	--	10
2-nitrophenol	--	10
2,4-dimethylphenol	--	10
2-4-dichlorophenol	--	10
4-chloro-3-methylphenol	--	10
2,4,6-trichlorophenol	--	10
2-4-dinitriphenol	--	30
4-nitrophenol	--	10
4,6-dinitro-2-methylphenol	--	30
pentachlorophenol	--	30

- M. Maniaci - Driller, Decontamination; and
- D. Meyer - Driller's Helper, Decontamination.

Total Dissolved Solids

Total dissolved solids in water samples were determined using EPA Method 160.1. The detection limit was 1 mg/L.

Arsenic, Barium, Mercury, Lead

Soil samples for these metals were extracted using EPA Method 3050. Analysis was done using the EPA methods and DLs listed in Table 1-2.

pH

The pH of the water samples was determined using EPA Method 150.1.

EP Toxicity (Metals)

EP toxicity on soil samples was determined using the methods in SW846. DLs are listed in Table 1-2.

1.5 FIELD PERSONNEL

E & E field personnel participating in this project and their responsibilities were:

- P. Kopsick - Project Manager, Chief Geologist;
- W. Kwoka - Soil Gas Survey Manager;
- J. Chandler - Health and Safety Officer;
- M. Mayo - Environmental Specialist;
- S. Martin - Geophysical Survey Manager;
- M. Michalowski - Environmental Specialist;
- J. Cook - Environmental Specialist, Geophysics Crew; and
- T. Faile - Assistant Geophysical Survey Manager.

1.6 SUBCONTRACTORS

Geotechnology, Inc., of St. Louis, Missouri, provided drilling, drum handling, well installation, and well purging services. Field personnel from Geotechnology were:

- L. Rosen - Field Supervisor, Decontamination;

2. ENVIRONMENTAL SETTING

2.1 GEOGRAPHIC SETTING

2.1.1 Physiography

Richards-Gebaur AFB is located in the Osage Plains region of the Central Lowlands physiographic province (see Figure 2-1). This region is characterized by low overall relief; broad, maturely dissected uplands yield to somewhat steeper valley slopes. Prominent escarpments have resulted from the presence of thick erosion-resistant limestone.

2.1.2 Topography

The base is located on a broad plateau called the Blue Ridge, between the Blue River on the west and the Little Blue River on the east. Land surface elevations range from about 960 feet above mean sea level (AMSL) on the east to over 1,100 feet AMSL on the south.

2.2 GEOLOGY

2.2.1 Geologic Setting

Richards-Gebaur AFB is located near the Kansas-Missouri border in an area of gently to steeply rolling upland that forms part of the Scarped Plain, a province of the Interior Lowland Region of the United States (Hinds and Green 1915).

Unconsolidated late Pleistocene-Holocene surficial deposits consist of residual clay mixed with sand and chert on the uplands and slope areas, and thin alluvial deposits on the larger streams. A thin blanket of loess overlies the bedrock in much of the upland area.

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2.2.2 Soils

The surface soils at Richards-Gebaur AFB consist primarily of very thin loess deposits over residual soil derived from the in situ weathering of the underlying limestone and shale bedrock. Soil cover normally varies from 2 to 15 feet in thickness. The soils on the upland surfaces belong to the Sharpsburg and Macksburg series and consist of poorly drained silty clay loams. Greenton and Polo series are moderately well-drained silty clay and clay soils formed on the eroded convex side slopes. Where shale is exposed along creeks, soils consist of residual clays and silty clays belonging to the Snead and Sampsel series. Moderately well-drained alluvium has filled stream valleys to a depth of about 50 feet. Alluvial soils belonging to the Verdigris (Kennebec) series are present in the level bottomland area along Scope Creek. These alluvial soils have a high groundwater table and are subject to occasional flooding.

Permeabilities of the surficial soils are generally low, less than 10^{-6} centimeters per second (cm/s). Permeability of the Verdigris (Kennebec) alluvial soils is moderate, approximately 10^{-3} to 10^{-6} cm/s. A summary of soil characteristics is presented in Table 2-1.

2.2.3 Stratigraphy

The exposed bedrock, Pennsylvanian in age, averages about 250 feet thick. It consists of relatively thin interbedded deposits, predominantly limestone and shale with isolated lenticular bodies of sandstone belonging to the Douglas Group, the Lansing Group, and the upper part of the Kansas City Group, Missourian Series (see Figure 2-2).

The subsurface Pennsylvanian rocks, averaging about 675 feet thick, include, in descending order, the Missourian, Desmoinesian, and Atokan series. The Missourian Series includes the Kansas City and Pleasanton groups. The lower part of the Kansas City Group, consisting of approximately 75 feet of relatively thick beds of limestone interbedded with shale, is present in the subsurface but does not crop out on the base. Lithologically, the Kansas City Group contrasts with the underlying, predominantly shale with channel-filled sandstones, 90- to 150-foot-thick sequence of beds forming the Pleasanton Group. The

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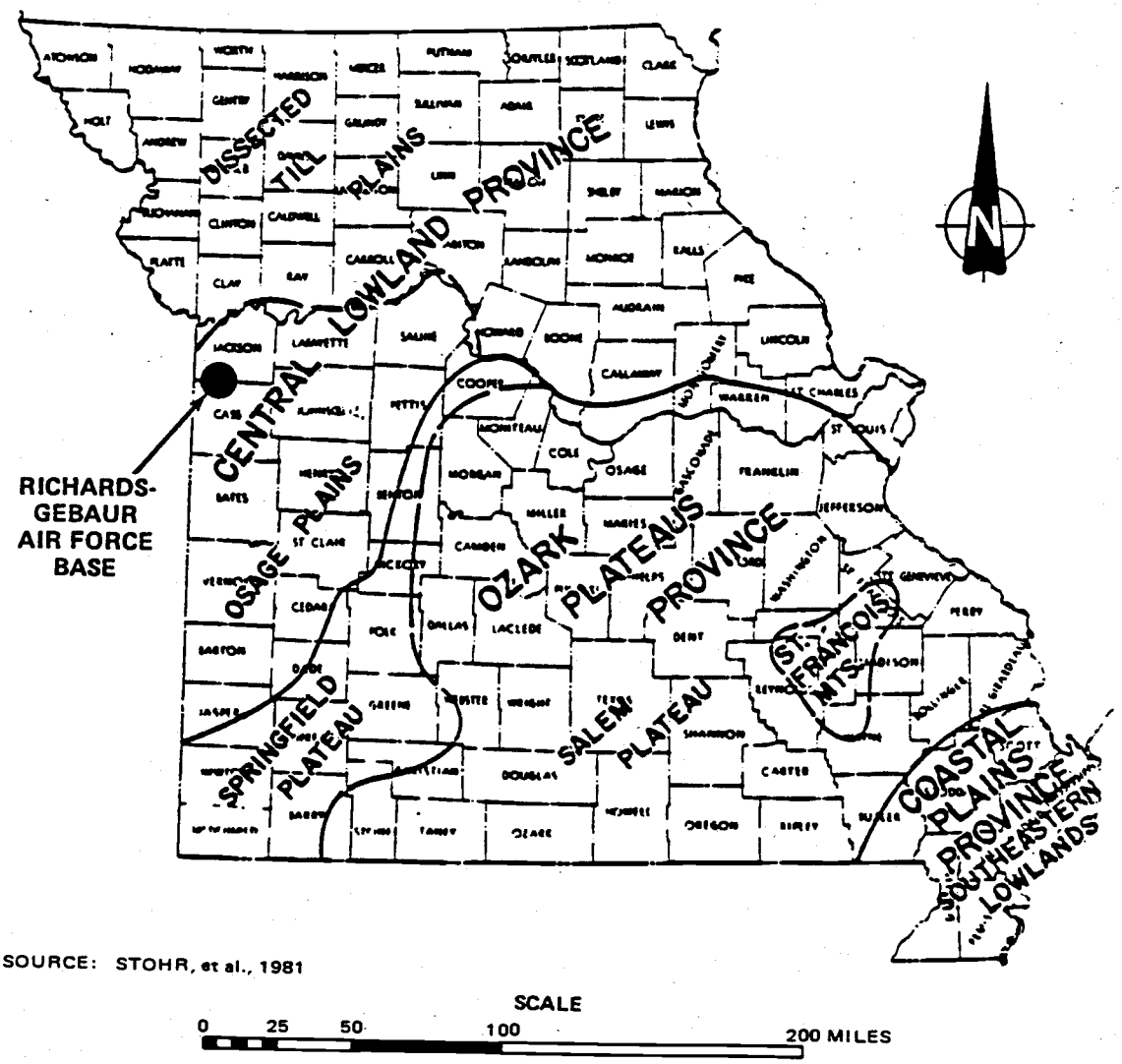
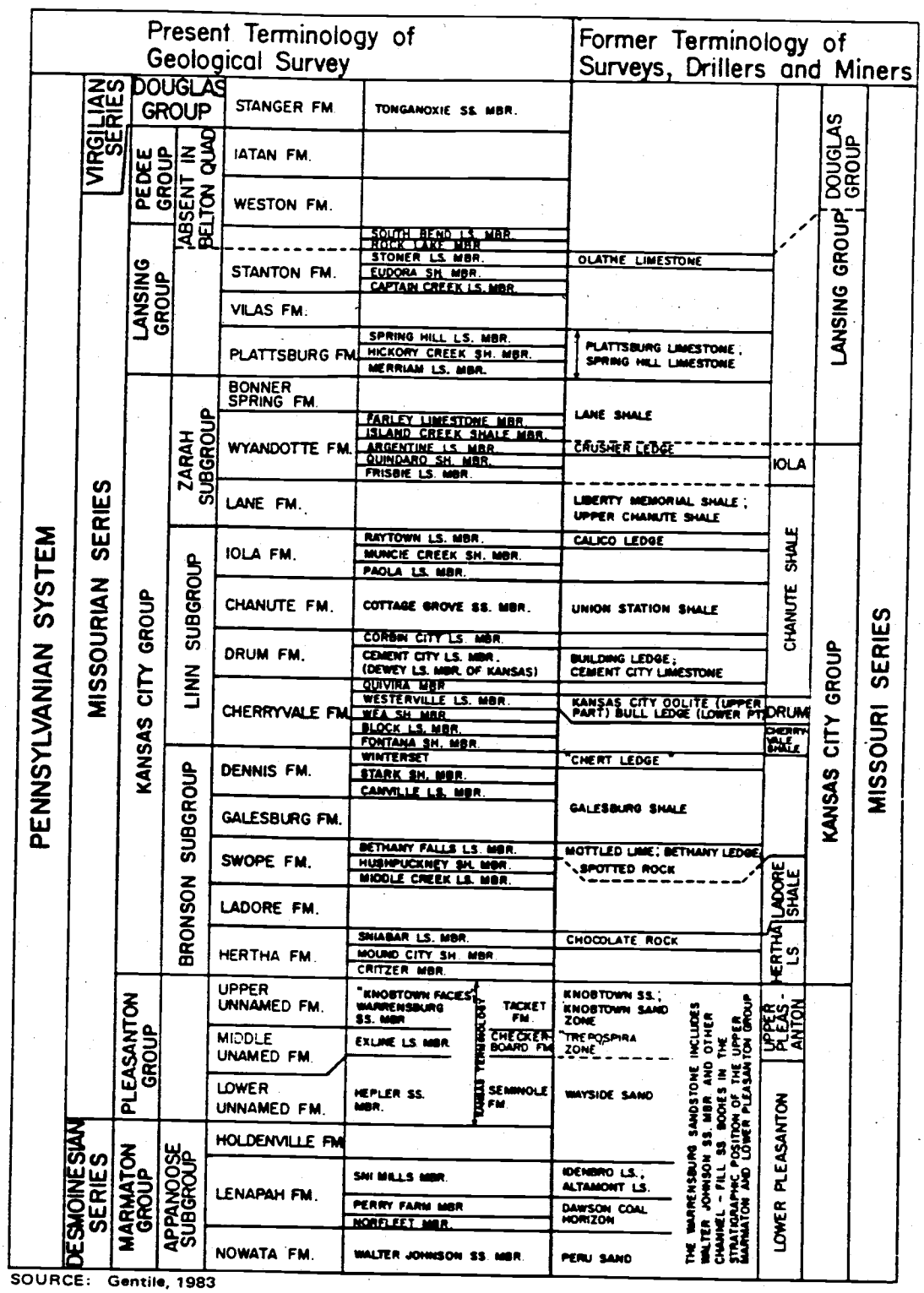


Figure 2–1 STUDY AREA PHYSIOGRAPHIC PROVINCES



SOURCE: Gentile, 1983

Figure 2–2 STRATIGRAPHIC SUCCESSION OF BEDROCK UNITS

Table 2-1

SOIL CHARACTERISTICS ON RICHARDS-GEBAUR AFB

Soil Name and Slopes	Depth (in)	Permeability (in/hr)	Description
Sharpsburg	0 - 13	0.6 - 2.0	Silt loam
	13 - 55	0.2 - 0.6	Silty clay loam, silty clay
	55 - 60	0.6 - 2.0	Silty clay loam, silt loam
Greenton	0 - 16	0.2 - 0.6	Silty clay loam
	16 - 46	0.06 - 0.2	Silty clay loam, silty clay
	46 - 60	0.06 - 0.2	Silty clay, clay
Macksburg	0 - 16	0.6 - 2.0	Silt loam, silty clay loam
	16 - 43	0.2 - 0.6	Silty clay loam, silty clay
	43 - 54	0.6 - 2.0	Silty clay loam
	54 - 60	0.6 - 2.0	Silty clay loam
Polo	0 - 14	0.6 - 2.0	Silt loam
	14 - 19	0.6 - 2.0	Silty clay loam
	19 - 45	0.6 - 2.0	Silty clay, silty clay loam
	45 - 60	0.6 - 2.0	Silty clay, shaly silty clay
Verdigris (Kennebec)	0 - 19	0.6 - 2.0	Silt loam
	19 - 60	0.6 - 2.0	Silt loam, silty clay loam

Source: USDA Soil Surveys for Jackson and Clay Counties.

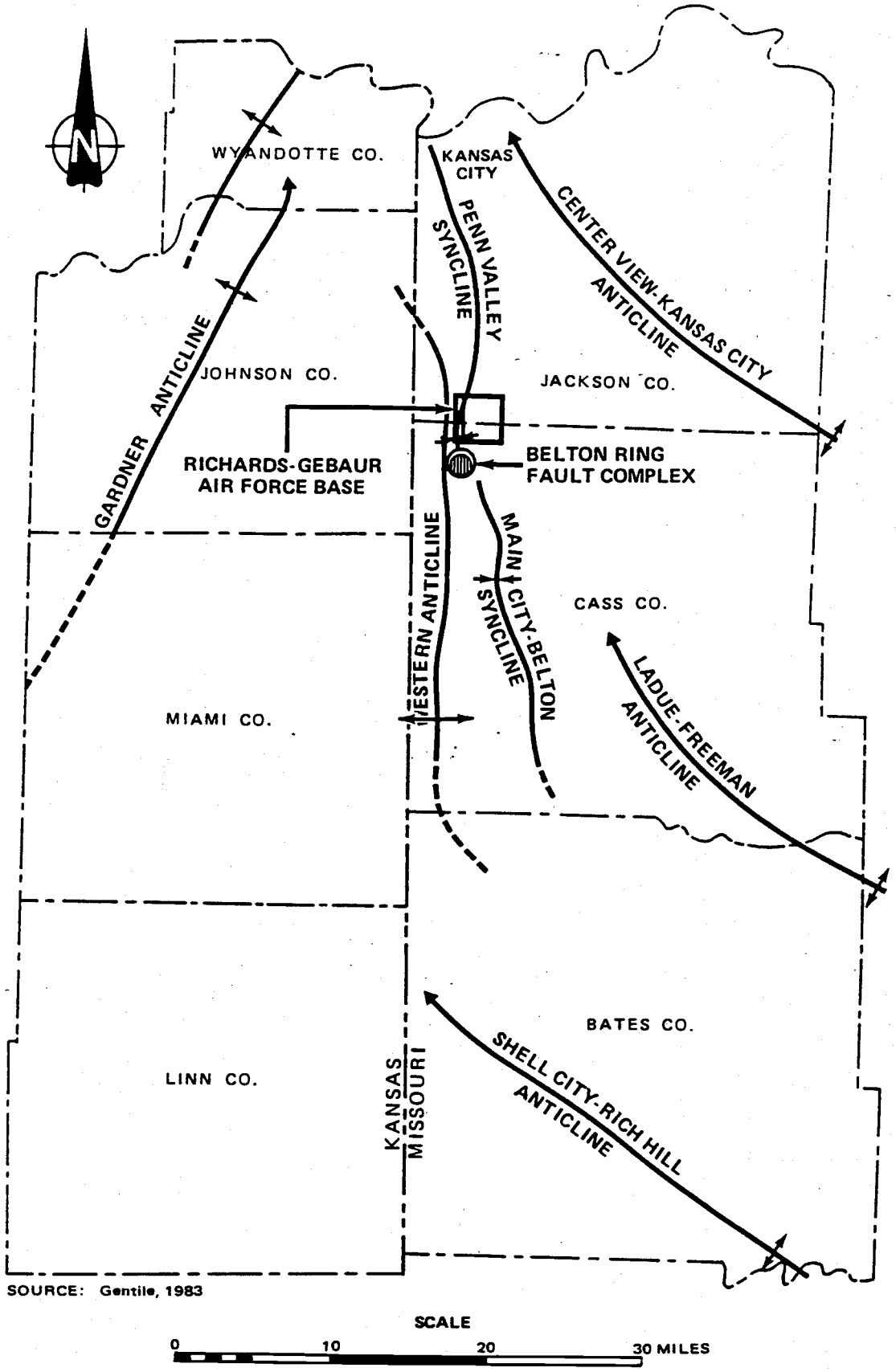


Figure 2–3 STRUCTURAL FEATURES OF BEDROCK IN STUDY AREA

Desmoinesian Series includes the Marmaton and Cherokee groups. The Marmaton is 125 to 200 feet thick, consisting predominantly of limestone and shale and including thick bodies of channel fill, cross-bedded sandstone, and conglomerate. The Cherokee Group is a clastic sequence of beds with numerous thin coal beds; its average thickness is 325 feet. Rocks tentatively assigned to the Atokan Series are lithologically similar to those of the Cherokee Group but are limited in areal extent and are up to 75 feet thick. Below the Pennsylvanian rocks and above the Precambrian igneous and metamorphic complex are about 1,500 feet of Mississippian, Devonian, Ordovician, and Cambrian sedimentary rocks.

Several small oil fields are located adjacent to the base. They produce low-gravity oil from wells averaging a few barrels a day. The major production is from the upper Cherokee and lower Marmaton sandstone beds 450 to 650 feet below the surface.

2.2.4 Structure

A mile south of the base, the normally flat-lying Pennsylvanian rocks are fractured and broken by a circular fault complex called the Belton Ring Fault Complex. This structure has no real bearing on the geology of the base and only the hydrology south of the base is affected by this feature (see Figure 2-3). The Western Anticline (also known as the Walton Nose) runs to the west of the base. The Penn Valley Syncline (also known as the Jost Syncline) is very nearly below the north-south runway. These structures generally have little effect on the groundwater, which is normally influenced by surface topography.

2.3 HYDROLOGY AND WATER USE

2.3.1 Surface Water

Except for a portion of the western edge of the north-south flight line, and the extreme southwest corner of the base, all surface runoff is eventually channeled into Scope Creek or other smaller tributaries of the Little Blue River. Scope Creek flows north and northeast through the center of the base and runs adjacent to both Site 2, the Northeast Landfill, and Site 1, the South Landfill. Two man-made ponds are found on the base, one above Site 7, the POL Storage Yard, and another near the south end of the flight line, west of Site 1, the South

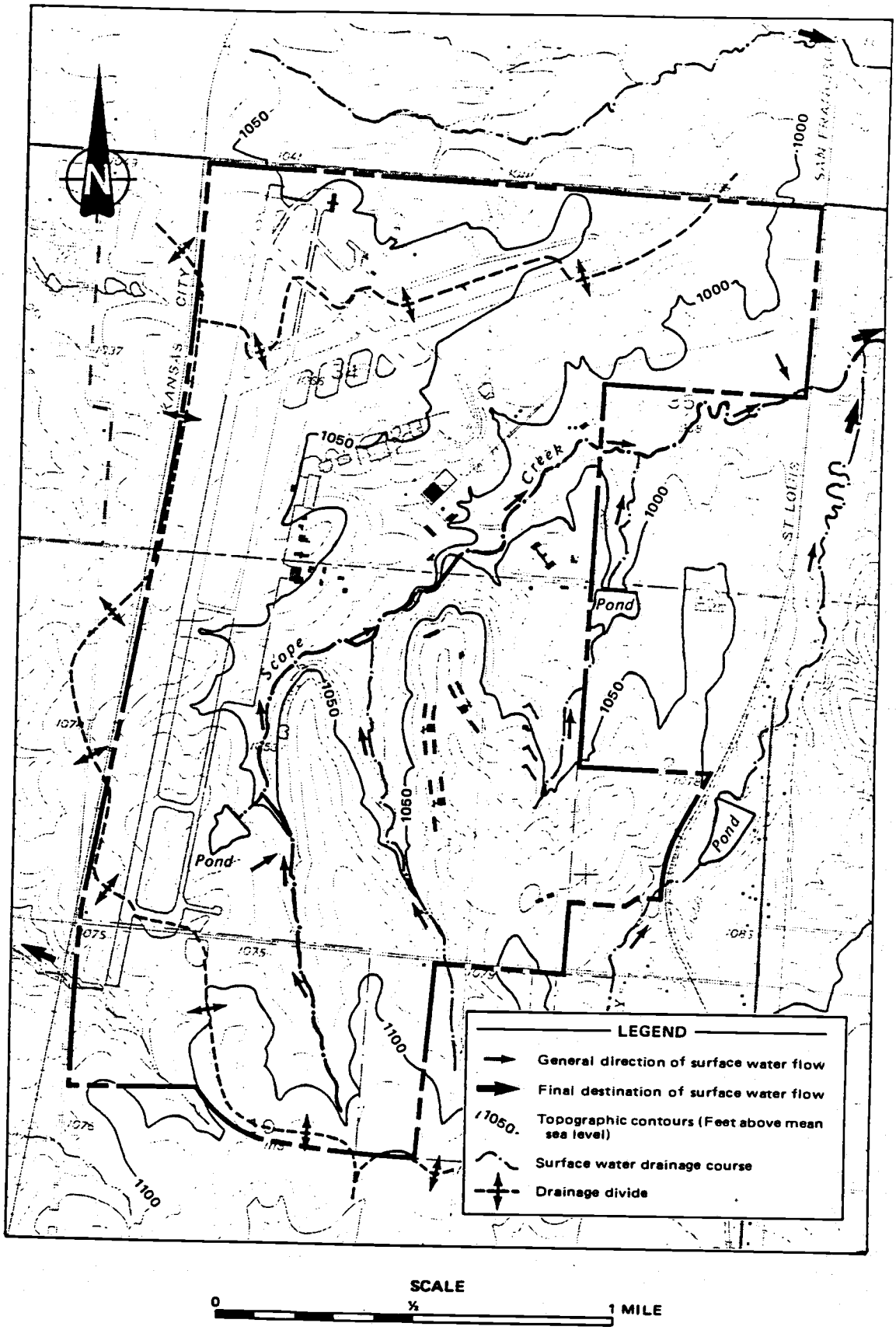


Figure 2–4 STORM WATER DRAINAGE AND TOPOGRAPHIC MAP, RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI

Landfill. Neither pond is used for recreation. Scope Creek is largely intermittent in its headlands, but becomes perennial in the northeast part of the base, where it joins the Little Blue River. Scope Creek is used by assorted wildlife as well as farm animals. Surface water drainage pathways are shown in Figure 2-4.

2.3.2 Hydrogeology

Groundwater resources in the area are very limited. Water is supplied to the base and the City of Belton in pipelines from the Missouri River. Several older water wells are located within a mile of the base. These wells have yields ranging from 1 to 20 gallons per minute (gpm). These wells are typically less than 250 feet deep and draw mineralized waters from Pennsylvanian shales and lenticular sandstone bodies. The Pennsylvanian rocks are generally too thick and too barren of water to provide water for single-family homes, particularly given the accessibility of cheap hook-ups to the Missouri River water system. Two wells were still in use in a City of Belton mobile home park a half mile southeast of the base until about 10 years ago. One of the wells produced 17 gpm, the other 8 gpm. Production was from a system of vertical joints in a black fissile shale of the Hushpuckney Shale member, at a depth of 275 feet. Currently, there is only one well in use within 1 mile of the base. It is used to irrigate a private garden plot only during extremely dry conditions. All known well locations were verified, but samples were not taken since the wells were inactive during the time the fieldwork was conducted. Additional data on wells within 1 mile of the base given in Appendix P.

Locally, there may be some older farmsteads where shallow, hand-dug wells are still used. These wells would draw water from the valley of Scope Creek and at the intersection of the unconsolidated deposits and the weathered bedrock.

2.4 CLIMATE

Richards-Gebaur AFB and the surrounding area exhibit a modified continental climate in which conditions normally expected to prevail at that latitude are often distorted by air currents freely entering from the southeast, the Gulf of Mexico, or other distant areas. Average

Table 2-2

TEMPERATURE AND PRECIPITATION DATA
FOR RICHARDS-GEBAUR AFB

	Temperature			Precipitation			Snowfall
	Daily/Monthly			Monthly			Monthly
Month	Maximum	Minimum	Average	Maximum	Minimum	Average	Average
January	37.8	19.8	28.8	1.87	0.28	1.17	6.9
February	43.5	25.1	34.3	1.88	0.57	1.28	4.1
March	52.7	32.8	42.8	3.65	1.19	2.51	5.1
April	66.6	45.7	56.2	4.58	1.94	3.34	0.7
May	76.6	56.8	66.7	5.25	2.89	4.12	0.0
June	85.0	66.3	75.7	7.30	2.77	5.18	0.0
July	89.2	70.8	80.0	6.80	1.54	4.42	0.0
August	88.5	69.2	78.9	5.62	1.37	5.62	0.0
September	81.2	60.7	71.0	6.42	1.17	4.08	0.0
October	70.3	49.5	59.9	4.71	0.94	3.20	0.0
November	54.8	35.9	45.4	2.54	0.26	1.56	0.9
December	42.8	26.2	34.5	2.12	0.48	1.38	4.5
Annual	65.8	46.6	56.2				

Note: Period of Record: 1954 - 1982.

Source: Department of the Air Force, Richards-Gebaur AFB.

monthly temperatures range from 26°F in January to 78°F in July, with an average mean temperature of 54°F (see Table 2-2). Most precipitation falls in the late spring and early summer and in the early fall. Average monthly precipitation ranges from 1.15 inches in February to 5.05 inches in June. Average annual precipitation is 36.8 inches. Maximum and minimum precipitation is 63.6 and 28.8 inches, respectively. Pan evaporation and lake evaporation rates are approximately 60 inches and 42 inches, respectively.

Prevailing winds at the base are from the south all year, and the mean annual windspeed is 9 knots. Weather changes can be rapid. Tornadoes and severe thunderstorms are most likely to occur in the spring and summer.

3. FIELD PROGRAM

3.1 PROGRAM DEVELOPMENT

A field program for the Phase II Stage 2 Confirmation/Quantification investigation was developed by E & E and presented in the Presurvey Report submitted on 7 June 1985. The program was reviewed and modified by the Air Force and set forth in the Description of Work for Contract F33615-83-D-4003, Task Order 13.

Elements of the field program included: a soil gas survey, a geophysical survey, sediment sampling, subsurface soil sampling, surface water sampling, installation of groundwater monitoring wells, and groundwater sampling. Various combinations of these program elements were performed at the various sites. Table 3-1 outlines the types of work conducted at each site. By site, the objectives of the fieldwork were:

Site 1 - South Landfill

- Determine if contaminated leachate from the landfill is entering Scope Creek.
- Evaluate potential for vertical migration of contamination.

Site 2 - Northeast Landfill

- Determine past disposal practices at the landfill.
- Delineate the locations of several suspected waste disposal trenches and determine if contamination has resulted.
- Expand monitoring well network to investigate migration of groundwater contamination from possible leaching of landfilled materials.

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Site 6 - North Burn Pit Area

- Determine occurrence of contamination from the site using a soil gas survey.
- Determine occurrence of subsurface soil contamination.
- Determine whether groundwater contamination has occurred.

Site 8 - Herbicide Burial Area

- Identify actual burial area by examining available background information.
- Identify any contaminants in soil in the vicinity of the burial area.
- Evaluate extent of migration of any contaminants via surface drainage pathway.

Site 9 - Oil-Saturated Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Determine if contaminants are migrating via surface drainage pathway.

Site 10 - Hazardous Waste Drum Storage Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Evaluate potential migration of contaminants via surface drainage pathway.

Site 12 - POL Storage Yard

- Determine the extent of any subsurface soil contamination.
- Evaluate extent of migration of contaminants via buried drain lines and surface drainage pathways.
- Determine whether groundwater contamination has occurred and evaluate extent of contamination.

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3.2 FIELD INVESTIGATION

The field investigation consisted of:

- Literature and aerial photograph records search;
- A magnetometer and electromagnetic (EM) terrain conductivity survey;
- A soil gas survey;
- The drilling of 10 boreholes;
- The installation of six monitoring wells; and
- Collection and analysis of 27 surface soil and sediment samples, 38 subsurface soil samples, 13 surface water samples, and 9 groundwater samples.

3.2.1 Schedule of Field Activities

Field activities were scheduled so as to optimize the utilization of manpower and resources. Field activities were coordinated with the USAFOEHL, the base Point of Contact (POC), and subcontractors to minimize delays and potential problems.

Throughout the course of the field activities, daily contact was maintained with the designated base personnel. The principal contact was Ms. Felipita Benson, R.N. Additional coordination was through Mr. John Hurd, Base Civil Engineer.

The fieldwork was completed during the period from 6 October 1986 to 4 November 1986. Table 3-2 provides the sequence of major field activities.

Health and safety protocols, as outlined in the Health and Safety Plan (see Appendix N), were followed throughout the project. Modifications of specific elements of the Health and Safety Plan were based on field conditions and executed only after discussion with E & E's Health and Safety Coordinator.

3.2.2 Records Search

During the course of the Phase II Stage 2 investigation, discussions were held with personnel from the Base Environmental Engineering Staff and the Base Civil Engineering Staff regarding past waste disposal practices and likely contaminants. Historical aerial photographs were

Table 3-2

SCHEDULE OF MAJOR FIELD ACTIVITIES

(October to November 1986)

6 October	Fieldwork begins with a reconnaissance of all sites and collection of surface soil samples.
6-8 October	Geophysical survey at Site 2, Northeast Landfill.
7-9 October	Soil gas survey at Site 6, North Burn Pit Area.
14 October	Drillers on site, set-up decontamination areas at Site 6, North Burn Pit Area and vehicle wash racks.
15 October	Three soil borings drilled, sampled, and grouted at Site 6, North Burn Pit Area.
16 October	Six monitoring wells drilled, pipe set, soil samples collected, and wells completed; three are at Site 6, North Burn Pit; two at Site 2, Northeast Landfill; and one at Site 12, POL Storage Yard. One well at Site 6, North Burn Pit Area was a borehole completed as a well.
17 October	Six soil borings drilled, samples collected, and the holes grouted, one at the Motor Pool Compound; one at the former hazardous waste storage yard; one at Site 1, South Landfill; and three at Site 2, Northeast Landfill.
18 October	Development of new wells and cleanup of drilling and staging areas.
21 October	Wells purged and groundwater samples collected.
23 October	The remaining surface soil and surface water samples collected from Site 2, Northeast Landfill; and Site 1, South Landfill.
28 October, 4 November	Hand-auger borings at Site 12, POL Storage Yard.
4 November	End of sampling.

examined to provide information on waste disposal practices at the base. Aerial photos were helpful in locating and delineating several sites which were not clearly visible during the Presurvey field trip. Table 3-3 lists the photos which were available for review.

3.2.3 Geophysical Survey Procedures

Magnetometer and EM surveys were performed concurrently at Site 2, Northeast Landfill, in an effort to locate what were thought to be discrete landfill trenches at this site, preliminary to placing groundwater monitoring wells. The magnetometer survey is designed to locate magnetically conductive materials in landfills, which are generally more conductive than the surrounding soils. Anomalies in magnetic flux are measured by the magnetometer and recorded in the field notebook. The EM conductivity survey measures the conductivity of the soil or any variations in the conductivity of the soil. Excavations for landfills change the natural conductivity by changing the porosity and density of the soils and altering the normal values of conducting fluids in the soils. Presumed locations of the trenches were delineated in a map provided by the Base Civil Engineer.

A Geometrics Model G-846 proton procession magnetometer with a sensitivity of 0.1 gammas and a Geonics Model EM-31 terrain conductivity meter with an effective exploration depth of 6 meters were used.

3.2.4 Soil Gas Sampling

A soil gas survey was performed at Site 6, the North Burn Pit Area, in an effort to identify potential residual contamination from the burning and handling of flammable liquids. The soil gas data were used to aid in locating the groundwater monitoring wells. The survey was performed by hand-driving perforated pipes in and around the compound. After capping each pipe and allowing it to stand for 15 minutes, the hole was monitored using an Organic Vapor Analyzer (OVA) to determine the presence or absence of volatile compounds.

3.2.5 Soil, Sediment, and Water Sampling

Soil, sediment, and water sampling protocols were followed as outlined in the Technical Operations Plan (Appendix N), except for

Table 3-3

SUMMARY OF HISTORIC AERIAL PHOTOGRAPHS
FOR AREA AROUND RICHARDS-GEBAUR AFB

Year	Scale	Source	Availability
1936	1:20,000	NARS	--
1940	1:20,000	MARC	--
1948	1:17,000	EROS, USGS	--
1950	1:70,000	EROS, USA	--
1953	1:20,000	ASCS	--
1955	1:13,000	EROS, USGS, USAF (shows West Burn Pit)	Reviewed
1957	1:20,000	ASCS	--
1959	1:12,000	COE	--
1960*	1:12,000	City of Grandview (shows borrow pits north of Northeast Landfill)	Reviewed
1963	1:18,000	USGS	Reviewed
1963	1:20,000	ASCS	--
1970	1:24,015	EORS	--
1972*	1:12,000	City of Grandview (shows active Northeast Landfill)	Reviewed
1975	1:40,000	EROS	--
1978	1:72,500	EROS	--
1980	1:80,000	EROS	--
1982	1:58,000	EROS	--
1982	1:80,000	EROS	--

Key: EROS = EROS Data Center, SD
MARC = Mid America Regional Council, MO
ASCA = American Soil Conservation Agency
CDOE = Army Corps of Engineers
USGS = United States Geological Survey
USA = United States Army
NARS = National Archives

*Not on federal archive list; does not cover south half of base.

samples collected for volatile organic analysis (VOAs). These were discrete samples collected prior to homogenization (blended to result in a more uniform sample). The portion of the sample collected for VOAs was cut from the center of the sample and placed directly into 40-ml vials.

All samples were split in the field when enough sample material was available. Split samples were delivered to the base POC. The POC determined those splits which were to be submitted to OEHL/SA for analysis. The split samples for analysis were provided by the POC to E & E for shipment to OEHL/SA.

Sediment Sampling

Sediment sampling was conducted in association with Site 1, South Landfill; Site 6, North Burn Pit Area; Site 8, Herbicide Burial Area; Site 9, Oil-Saturated Area; Site 10, Hazardous Waste Drum Storage Area; and Site 12, POL Storage Yard. A total of 27 samples were collected and submitted for chemical analysis. Table 3-4 presents a summary of the samples collected.

Sediment samples were collected using shovels to loosen an 8-inch cube of sediment from which a vertical column was removed using a stainless steel spoon. The soil column was homogenized in a disposable aluminum pan and then splits were placed in two sampling containers. Spoons were decontaminated and all pans were disposed of after sample collection from each location.

Subsurface Soil Sampling

Subsurface soil samples were collected from 5-foot-long split-spoon samplers during the drilling of the boreholes and monitoring wells. Borehole and monitoring well drilling was performed by Geotechnology, Inc., of St. Louis, Missouri. Table 3-5 provides a summary of borehole depths.

Ten boreholes were drilled and 28 subsurface soil samples were collected and submitted for analysis. Boreholes were drilled for the specific purpose of obtaining subsurface soil samples; however, one borehole (Boring 4) was scheduled to be completed as a monitoring well. A total of 186.5 linear feet of drilling was accomplished using a Mobile

Table 3-4

SUMMARY OF SURFACE SOIL SAMPLING

Site No.	Field Sample No.	Sample Location and Description
1	DF4067	Scope Creek - Background at Markey and Bates
	DF4069	Scope Creek - Downstream of South Landfill
	DF4070	Scope Creek - Seep 1 east of South Landfill
	DF4077	Scope Creek - Seep 2 northeast of South Landfill
6	DF4001	North Burn - 100 feet east of eastern fence center
	DF4002	North Burn - 200 feet east of eastern fence center
	DF4003	North Burn - 100 feet north of northern fence drainage
	DF4004	North Burn - Southeast corner fence, 200-300 feet
	DF4005	North Burn - 25 feet south of southwestern corner of fence
	DF4014	North Burn - 100 feet northwest of northwest corner of fence
8	DF4015	Herbicide Burial Area - 300 feet south of Markey
	DF4016	Herbicide Burial Area - 25 feet east of DF4015
	DF4017	Herbicide Burial Area - 25 feet east of DF4016
	DF4018	Herbicide Burial Area - 100 feet south of Markey
9	DF4007	Oil-Saturated Area - Southwest corner of Motor Pool
	DF4008	Oil-Saturated Area - Southwest corner +25 feet
	DF4009	Oil-Saturated Area - Southwest corner +50 feet
	DF4010	Oil-Saturated Area - Outside southwest corner, 0-100 feet
	DF4011	Oil-Saturated Area - Outside southwest corner, 100-200 feet
	DF4012	Oil-Saturated Area - Outside southwest corner, 200-300 feet
10	DF4019	Hazardous Waste Drum Storage Area - Background from athletic field
	DF4020	Hazardous Waste Drum Storage Area - North of gate to compound
	DF4021	Hazardous Waste Drum Storage Area - West corner of fence, 0-26 feet
	DF4022	Hazardous Waste Drum Storage Area - West corner of fence, 26-60 feet
	DF4023	Hazardous Waste Drum Storage Area - West corner of fence, 60-120 feet
	DF4024	Hazardous Waste Drum Storage Area - South corner +25 feet
12	DF4088	POL Storage Yard - Culvert at Bldg. 952

Table 3-5

SUMMARY OF SOIL BORINGS

Site No.	Boring Designation	Total Depth (feet)
1	Boring #7	7.1
2	Boring #4	9.8
	Boring #8	7.9
	Boring #9	13.0
	Boring #10	8.5
3	Boring #1	12.9
	Boring #2	13.0
	Boring #3	14.5
5	Boring #5	16.5
6	Boring #6	15.0
7	Hand Boring #1	6.0
	Hand Boring #2	6.0
	Hand Boring #3	6.0
12	Hand Boring #4	6.0

CME-55 rig equipped with continuous-flight hollow-stem augers. Samples were collected using a 5-foot continuous CME tube sampler with a 3 3/4-inch inside diameter. Boreholes were scheduled to be completed at 15 or 20 feet. Most borings encountered bedrock within 10 to 15 feet. Refusal was defined as the point when unweathered bedrock was hit.

Samples from the boreholes were collected at 5-foot intervals. Percent recovery from the long sampling tubes was generally 100%. This method of drilling allowed for a continuous sample of the subsurface and direct observation of the entire stratigraphic sequence of the borehole. Cores were laid out next to one another and then logged. From observations of the cores and after scanning with an OVA, samples were taken from depths where positive readings were recorded on the OVA or where there were indications of contamination or breaks in stratigraphy. Table 3-6 summarizes the subsurface soil sampling.

Upon completion of the drilling and sampling of the boreholes, each borehole was grouted to the surface using a cement/bentonite slurry.

Sampling equipment was decontaminated between each sample; three 5-foot CME sampling tools were available at all times. This allowed a 15-foot-deep boring to be sampled before decontamination was necessary. The decontamination stations were set up at the North Burn Pit Area and at the vehicle wash rack area of the base. Decontamination procedures followed those outlined in the Technical Operations Plan (see Appendix N), except for samples collected for VOAs. These were discrete samples collected prior to homogenization.

No subsurface soil samples were scheduled to be taken from any of the borings slated to be monitoring wells. However, three samples were collected from Boring 4 at Site 2, the Northeast Landfill, which was completed as a monitoring well. To save time in retooling the drill rig, the CME continuous sampler was also used for the drilling of the monitoring wells. This provided the added benefit of allowing observation of the continuous stratigraphy at the monitoring well locations.

Hand-Auger Boring

The investigation of Site 12, the POL Storage Yard, required the use of hand-powered subsurface sampling within the berms of the POL

Table 3-6

SUMMARY OF SUBSURFACE SOIL SAMPLING

Site No.	Boring No.	Sample No.	Sample Depth (ft)
1	Boring #7	DF4047	1.0 - 2.0
		DF4048	4.0 - 5.0
		DF4049	6.0 - 7.0
2	Boring #4	DF4036	1.0 - 2.0
		DF4037	6.0 - 7.0
		DF4038	8.0 - 8.5
	Boring #8	DF4050	7.0 - 7.9
	Boring #9	DF4051	4.0 - 5.0
		DF4052*	6.0 - 7.0
		DF4053	9.0 - 10.0
	Boring #10	DF4054	1.0 - 2.0
		DF4055	4.0 - 5.0
		DF4056	7.0 - 8.0
6	Boring #1	DF4027	3.5 - 4.5
		DF4028	7.0 - 8.0
		DF4029	12.0 - 12.4
	Boring #2	DF4030	2.0 - 3.0
		DF4031	5.0 - 6.0
		DF4032*	11.0 - 12.0
	Boring #3	DF4033	2.0 - 3.0
		DF4034	5.0 - 6.0
		DF4035	11.0 - 12.0
9	Boring #5	DF4039	3.0 - 4.0
		DF4040	8.0 - 9.0
		DF4041	15.5 - 16.5
10	Boring #6	DF4042	0.5 - 1.5
		DF4043	9.0 - 10.5
		DF4044	4.5 - 5.5
12	Hand Boring #1 Tank 955	DF4079	1.0
		DF4080	2.10
		DF4081	6.0
	Hand Boring #2 Tank 957	DF4082	1.0
		DF4083	2.8
		DF4084	6.0
	Hand Boring #3 Tank 954	DF4085	1.0
		DF4086	3.0
		DF4087*	6.0
	Hand Boring #4 Outside Building 953	DF4089	3.0

*Duplicate sample

tanks. Mechanized equipment could not be utilized in these areas due to fire safety regulations and the lack of access into the tank berms. A single stainless steel soil bucket auger with extensions was used and advanced to a depth of 6 feet. The tightness of the soils and the depths to which sampling was required made sampling difficult. The hand auger was decontaminated between each sampling location by washing with a sodium triphosphate solution, and rinsing with distilled deionized water and methanol. Table 3-6 includes summary information on hand-auger sampling.

Surface Water Sampling

Surface water samples were collected from creeks, drainageways, and impoundments at all seven sites. Surface water samples were collected only once during the field investigation. Table 3-7 provides a summary of the surface water sampling.

Surface water samples were collected by immersing the sampling container into the water. VOAs were collected by immersing the VOA vials directly into the water and capping the submerged bottle before removing it from the water. At each sampling location, a 1-liter glass bottle was used to fill 80-ounce jugs for other parameters. The 1-liter bottles were also used as sample containers for certain analytical parameters. Filtering, when needed, was provided in the field. All samples were prepared and preserved according to the analytical methods outlined in the Description of Work.

Monitoring Well Installation and Groundwater Sampling

Six monitoring wells were installed at three sites on the base, two at Site 2, Northeast Landfill, three at Site 6, North Burn Pit Area, and one outside Site 12, POL Storage Yard. The monitoring well screens and casings were 2-inch outside diameter (O.D.) Schedule 40 polyvinyl chloride (PVC). Table 3-8 summarizes well construction data. Well construction diagrams and borehole logs are presented in Appendix D. In general, the screens and casings were set in an 8-inch diameter borehole. The annular space was then filled with clean, coarse sand to an average height of 2 feet above the top of the screen. A minimum of 2 feet of bentonite pellets were placed above the sand pack. The

Table 3-7

SUMMARY OF SURFACE WATER SAMPLING

Site No.	Field Sample No.	Sample Location Description
1	DF4066	Scope Creek - Background
	DF4068	Scope Creek - Downstream from South Landfill
	DF4071	Seep 1 adjacent to Scope Creek
	DF4076	Seep 2 adjacent to Scope Creek
2	DF4073	Tributary draining Northeast Landfill
	DF4074	Scope Creek - Downstream from Northeast Landfill
	DF4075	Scope Creek - Upstream from Northeast Landfill
3	DF4006	Local impoundment by east fence line
4	DF4027*	Local impoundment - Small pond
5	DF4013	Drainage ditch - Lateral to stain area
6	DF4025	Drainage ditch - Downgradient
7	DF4045	Drainage ditch - Upstream
	DF4046	Drainage ditch - Downstream

*Sample number repeated in field by mistake. Correct laboratory number was assigned.

Table 3-8

SUMMARY OF MONITORING WELL CONSTRUCTION DETAILS

(Schedule 40 PVC, 2-inch O.D.)

Site	Well No.	Total Depth (ft)	Screened Interval (ft)	Filtered Interval (ft)	Bentonite Interval* (ft)
2	6-MW #6**	13.1	6.1 - 11.1	5.6 - 13.1	3.0 - 5.0
	5-MW #5	17.1	7.1 - 17.1	5.0 - 17.1	2.0 - 5.0
6	1-NBA-NEMW	20.0	10 - 20.0	7.0 - 20.0	2.0 - 7.0
	2-NBA-NWMW	10.5	6.5 - 10.5	5.0 - 10.5	2.0 - 5.0
	3-NBA-SWMW	7.5	5 - 7.5	4.0 - 7.5	2.0 - 4.0
12	4-POL-DMW	9.8	5.8 - 9.8	4.8 - 9.8	2.5 - 4.8

*All wells were grouted to surface and finished with a metal locking well cap set in a concrete pad.
**Boring 4 was completed as Monitoring Well 6.

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remaining annular space to the ground surface was grouted with a powdered bentonite/cement slurry grout. Well protection was provided by a locking steel well casing set into the 2-foot by 2-foot cement pad. Wells located in active areas or areas that are mowed were also fitted with protective posts set outside the concrete pad. The locations of the wells and survey data are given in Appendix O.

Three monitoring wells were already in existence at Site 2, Northeast Landfill. The integrity of these wells was confirmed during the field investigation. The locking caps were still intact. The locks were then cut and replaced with similarly keyed locks.

The groundwater wells were sampled once during the field investigation. A total of nine groundwater samples were collected, although two of the wells did not recharge enough to provide sufficient water for all the requested chemical analysis. Table 3-9 summarizes the groundwater sampling. Prior to sampling of the monitoring wells, each well was purged of three well volumes of fluid. Purging and sampling was done by hand, using 1.5-inch PVC bailers. Sampling and decontamination followed standard procedures, as outlined in the Technical Operations Plan (see Appendix N).

Groundwater samples were allotted for each of the boreholes, in case water was found in any of the borings. Only the borehole at Site 1, South Landfill, gave any indication of groundwater. However, recharge was not sufficient for sampling.

3.2.6 Handling of Investigation-Derived Waste

Drill cuttings and development and purge waters were screened in the field visually and with an OVA. Based on visual and OVA screening of the cuttings, only the cuttings from Site 6, North Burn Pit Area, and Site 10, Hazardous Waste Drum Storage Area, were containerized. The materials from these borings were placed in 55-gallon drums lined with plastic bags. The drums were sealed, labeled, and dated, and then stored inside the fenced area of Site 6, North Burn Pit Area, pending the results of chemical analyses of subsurface samples from those borings. The results of these analyses indicated that the cuttings are not contaminated and the material can be safely disposed of or,

Table 3-9

SUMMARY OF GROUNDWATER SAMPLING

Site	Well No.	Sample No.	Descriptions
2	0-MW #1	DF4063	Phase II Stage 2 well #1
	0-MW #2	DF4064	Phase II Stage 2 well #2
	0-MW #3	DF4065	Phase II Stage 2 well #3
	6-MW #6*	DF4062	Perimeter well at entrance gate
	5-MW #5	DF4061	Background well north of Northeast Landfill
6	1-NBA-NEMW	DF4058	Northeast corner monitoring well
	2-NBA-NWMW	DF4057	Northwest corner monitoring well
	3-NBA-SWMW	DF4059	Southeast corner monitoring well
12	4-POL-DMW	DF4060	Downgradient monitoring well

*Boring 4 was completed as Monitoring Well 6.

alternatively, dispersed in Site 6, North Burn Pit Area. Development and purge waters were placed in the North Burn Pit to evaporate.

3.2.7 Site-Specific Investigation Activities

As discussed above, fieldwork at each site consisted of some combination of geophysics, soil boring, subsurface soil sampling, and groundwater sampling. Activities at the individual sites are discussed below.

Site 1, South Landfill

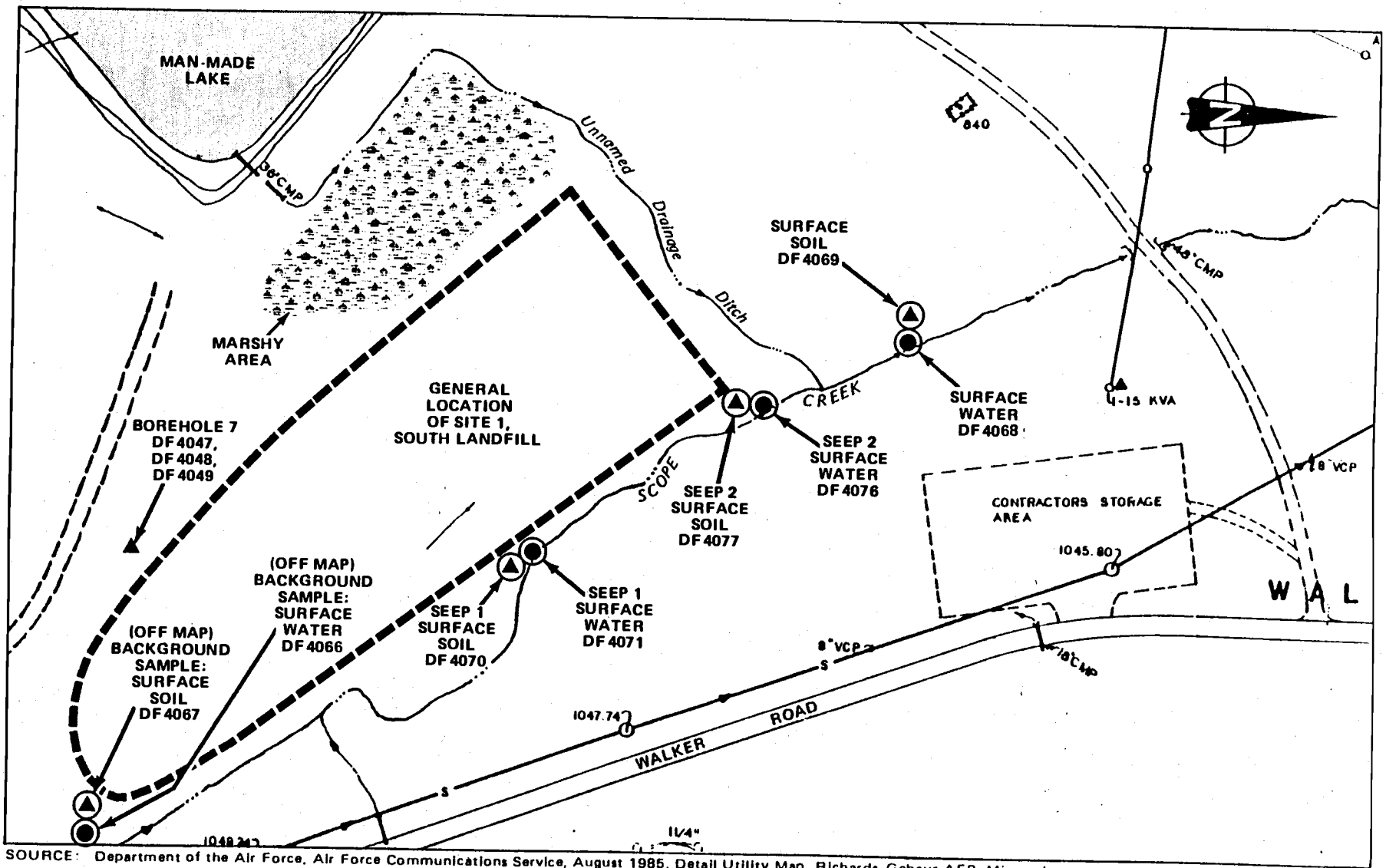
A single upgradient soil boring was drilled southwest of the landfill (Boring 7) and three subsurface soil samples collected. The actual eastern boundary of the landfill is the west bank of Scope Creek. Therefore, it was impossible to drill a boring downgradient without penetrating the waste and jeopardizing the integrity of the landfill. Four surface soil samples were collected: a background sample adjacent to Scope Creek upstream of the landfill; one at Seep 1 where the seep enters Scope Creek; one at Seep 2 where the seep enters Scope Creek; and one adjacent to Scope Creek downstream from the landfill. Four surface water samples were collected: from Seep 1 and Seep 2 where the seeps enter Scope Creek, and from Scope Creek at the upstream (background) and downstream sampling points.

Figure 3-1 shows the sampling locations for this site.

The four water samples were analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols. The soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 2, Northeast Landfill

Magnetometer and conductivity surveys were performed at this site to locate what were originally believed to be three discrete trenches. A grid system was staked over the survey area. The grid extended beyond the expected landfill boundaries in order to define the boundaries. The grid sections were 100 by 100 feet. Every 25 feet along each grid line, three readings were taken with the magnetometer and averaged, and one



SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY: Site Boundary; Surface Runoff Direction; Subsurface Soil Sampling Location; Surface Soil Sampling Location; Groundwater Sampling Location; Surface Water Sampling Location

SCALE: 0 50 100 200 300 FEET

Figure 3–1 SAMPLING LOCATIONS AT SITE 1, SOUTH LANDFILL

reading was taken with the EM-31. Background readings were taken periodically in an undisturbed area of the base. The geophysical survey revealed, rather than the three discrete landfill trenches, that the entire survey area had been landfilled. Additional historical aerial photos revealed landfill operations throughout the area delineated in Figure 3-2. The drilling program was modified based on this new understanding of Site 2 . Four boreholes were drilled in areas adjacent to the presumed boundary of the landfill. Boring 4 was located near the southwest corner of the landfill. Borings 8 and 9 were located near the southeast corner of the site, downgradient from the landfill; and Boring 10 was located upgradient, across the railroad tracks to the north.

Three subsurface soil samples were collected from Borings 4, 9, and 10, and one was collected from Boring 8.

In addition to the three existing monitoring wells (MW1, directly south of the site; MW2, south of the site near the southeast corner; and MW3, east of the site, near the southeast corner), two new monitoring wells were installed: MW6, a completion of Boring 4, and MW5, in the northeast corner of the site. One groundwater sample was collected from each of the five wells.

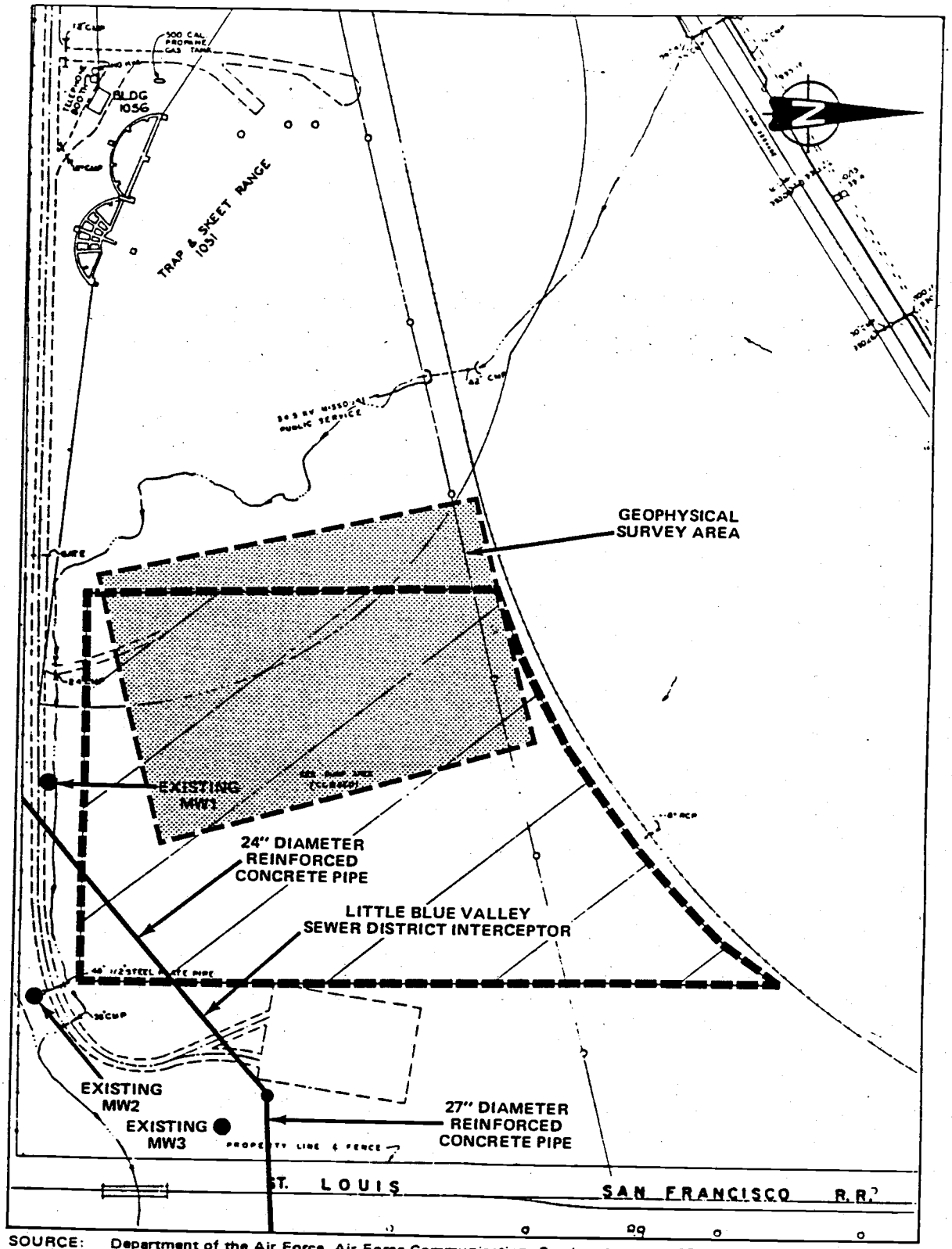
Three surface water samples were collected. One from the surface drainage flowing off the landfill near the southeast corner of the landfill, and two from Scope Creek, one upstream of the landfill and one downstream.

Figure 3-3 shows the sampling locations for this site and the location of the geologic cross section. The cross section is presented in Appendix D.

The eight water samples were analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols. The soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 6, North Burn Pit Area

A soil gas survey was performed at this site to determine if organic vapor contamination exists in the subsoil and to delineate the extent of contamination in order to determine the placement of boreholes

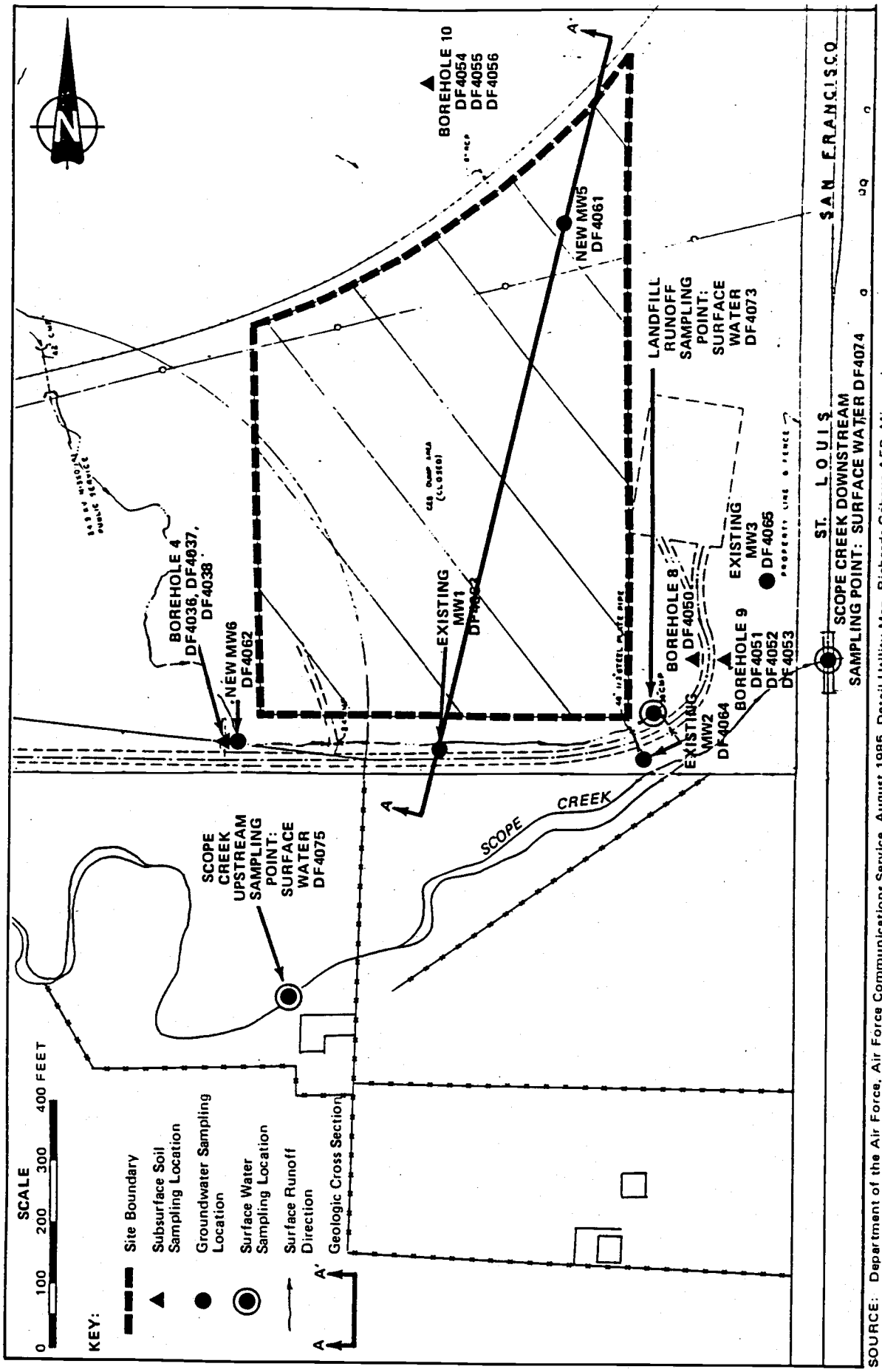


SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY: Site Boundary; Surface Runoff Direction; Boundary Geophysical Survey Area

SCALE 0 100 200 300 400 FEET

Figure 3–2 SITE 2, NORTHEAST LANDFILL, GEOPHYSICAL SURVEY AREA



SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

Figure 3–3 SAMPLING LOCATIONS AT SITE 2, NORTHEAST LANDFILL

and monitoring wells and soil and water sampling points. Twenty-seven soil gas probe locations were tested with an OVA. Figure 3-4 shows the location of the soil gas sampling points.

Based on the results of the soil gas sampling and previous data on the site, three soil boreholes were drilled outside the perimeter of the concrete burn pit; three subsurface soil samples were collected from each borehole; and three monitoring wells were installed within the fenced area. One groundwater sample was taken from each monitoring well, although only MW1, the only well which did not reach bedrock, had sufficient recharge for all the proposed analyses. MW2 and MW3 yielded only one 40-mL sample each.

Six surface soil samples were collected from outside the burn area. One surface water sample was collected from an area of standing water inside the fence line. OVA readings were also taken during the drilling of the boreholes and monitoring wells.

Figure 3-5 shows the sampling locations for this site and the location of the geologic cross section. The cross section is located in Appendix D.

The surface water sample and the groundwater sample from MW1 were analyzed for halogenated and aromatic volatile organics. The surface water sample was also analyzed for petroleum hydrocarbons. The groundwater samples from MW2 and MW3, which yielded only small amounts of water, were analyzed only for volatile organic compounds. The 15 soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 8, Herbicide Burial Area

Air Force Civil Engineer's Construction Permit (AF 103), dated 6 August 1971, documents the location of a burial pit 6 feet long by 6 feet wide by 6 feet deep 100 yards south of a weather station at the south end of the runway. The weather station (known as Facility 847) no longer exists. However, a concrete foundation near the south end of the runway is thought to be the remains of the weather station.

A broad, shallow depression was observed in the area of the suspected trench location based on AF 103.

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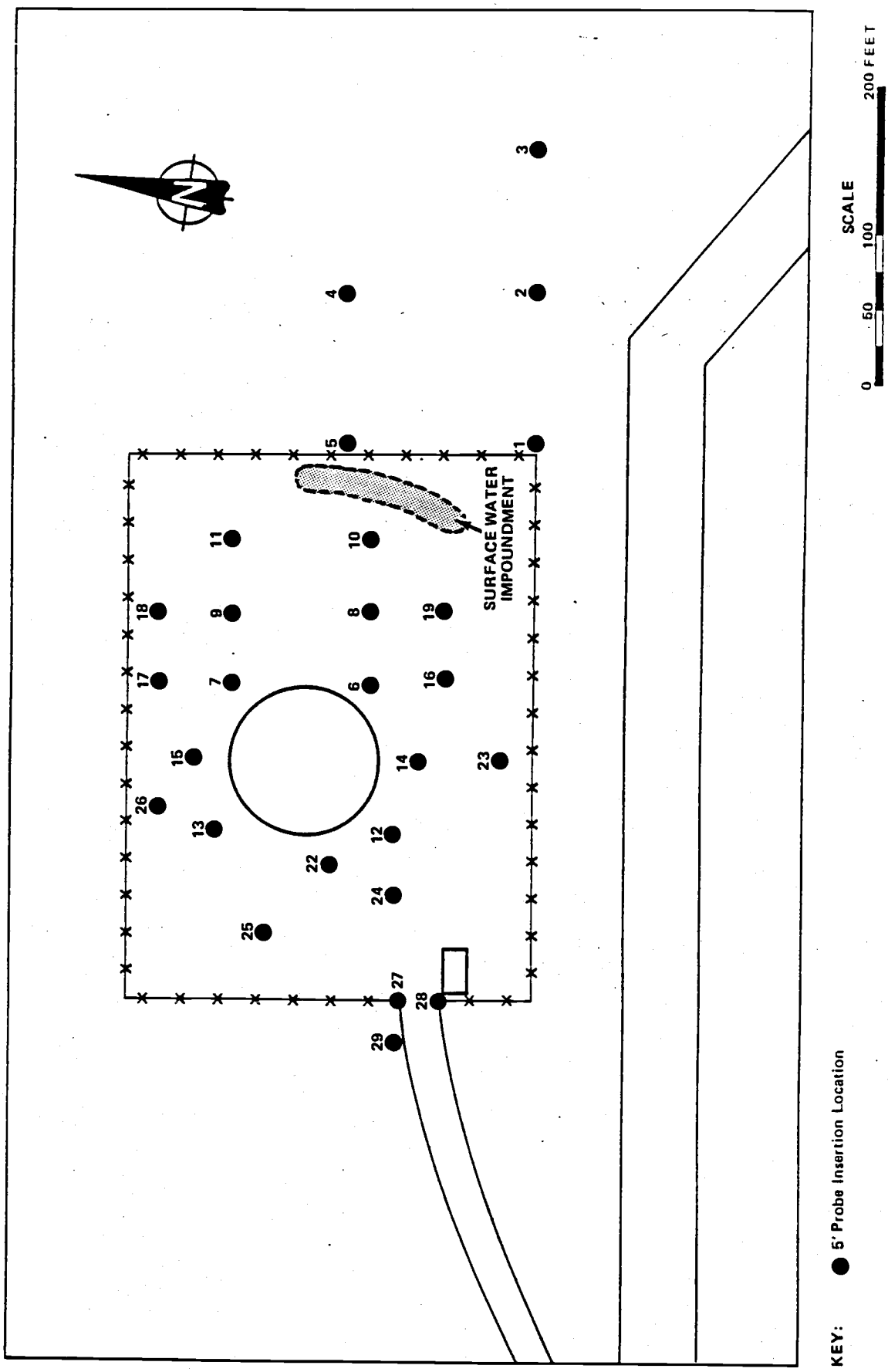


Figure 3–4 SITE 6, NORTH BURN PIT AREA, SOIL GAS SURVEY LOCATIONS

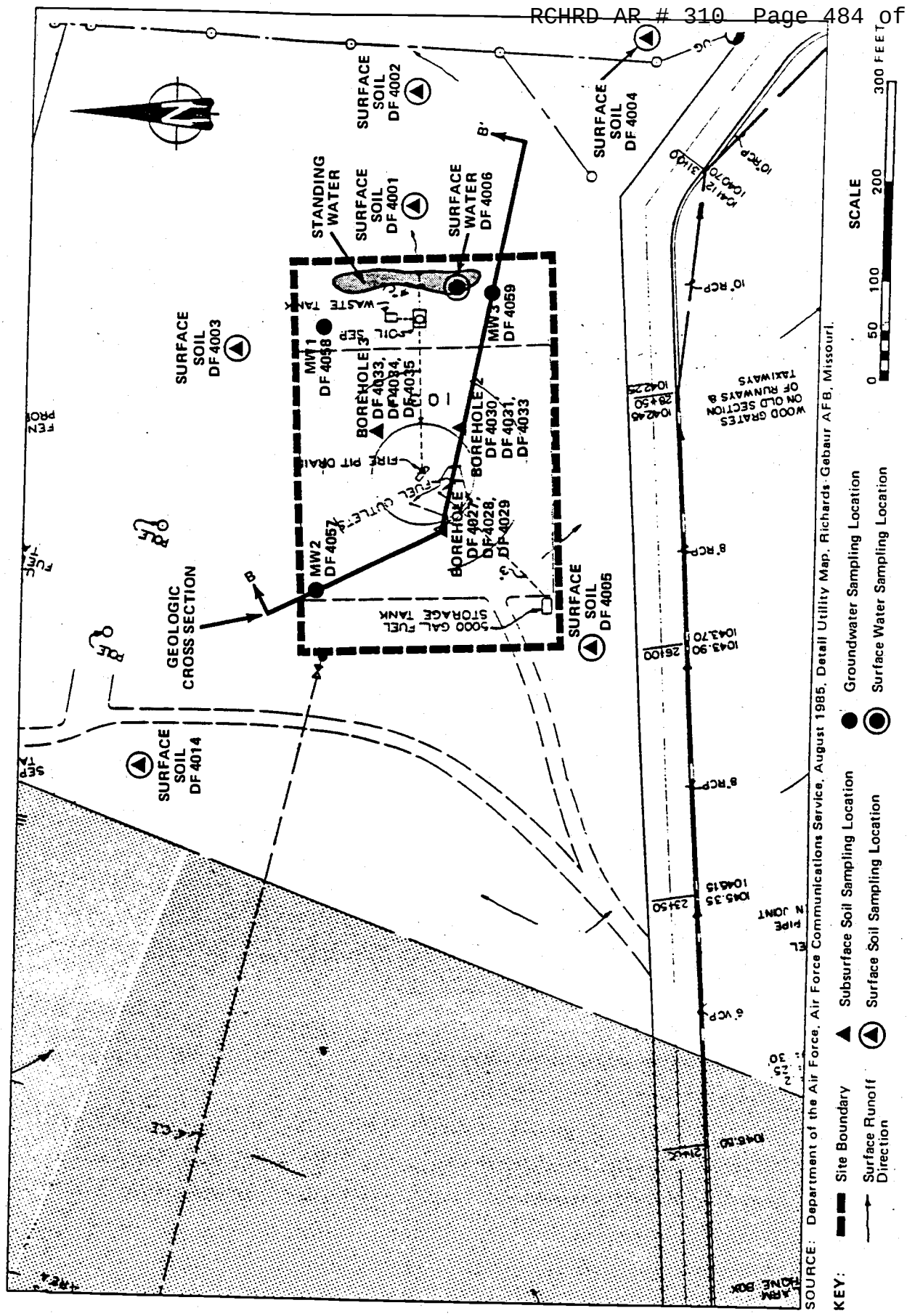


Figure 3–5 SAMPLING LOCATIONS AT SITE 6, NORTH BURN PIT AREA

Four composite surface soil samples were collected from the area where the burial pit is thought to be located based on AF 103 and previous evidence of vegetation stress. A single surface water sample was collected from a small pond located downgradient from the soil sampling area.

Figure 3-6 shows the sampling locations for this site.

The water sample was analyzed for total dissolved solids, arsenic, mercury, pesticides, and herbicides. The soil samples were analyzed for herbicides, arsenic, and mercury.

Site 9, Oil-Saturated Area

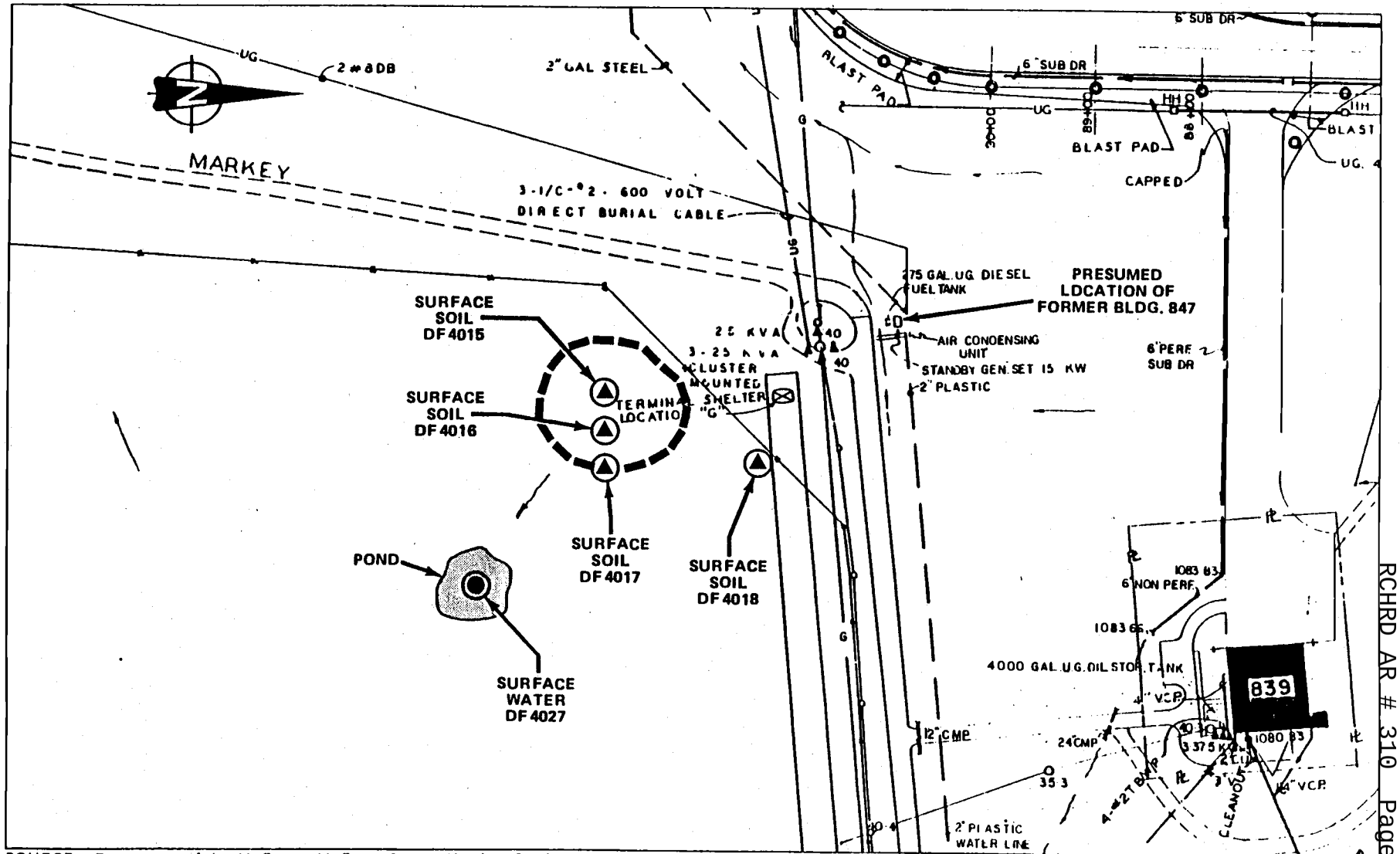
A single soil boring was drilled immediately adjacent to the stained area, to the northeast. Three subsurface soil samples were collected from this borehole. No sample was taken from the top 3 feet of the borehole, however, because of the presence of coarse fill and gravel. Six surface soil samples were collected downgradient from the oil-saturated area of the motor pool complex. Three of these surface soil samples were taken from the natural drainage path to the south of the area. One surface water sample was collected from the drainage ditch adjacent to a stained area. Two surface water samples were allocated for this site, however, there was only one small pool of standing water available to be sampled at the time of the field investigation.

Figure 3-7 shows sampling locations for this site.

The surface water sample was analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, and lead. The soil samples were analyzed for halogenated and aromatic organics, petroleum hydrocarbons, and lead.

Site 10, Hazardous Waste Drum Storage Area

A single soil boring was drilled outside the site. The boring location was determined to be the most likely to be contaminated due to natural drainage patterns in the area. Three subsurface soil samples were collected from this borehole. Six surface soil samples were collected at and downgradient from the site. One surface water sample was collected from the drainage ditch downgradient of the site.



SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY:
- Site Boundary
- Surface Runoff Direction
- Subsurface Soil Sampling Location
- Surface Soil Sampling Location
- Groundwater Sampling Location
- Surface Water Sampling Location

SCALE: 0, 50, 100, 200, 300 FEET

Figure 3–6 SAMPLING LOCATIONS AT SITE 8, HERBICIDE BURIAL AREA

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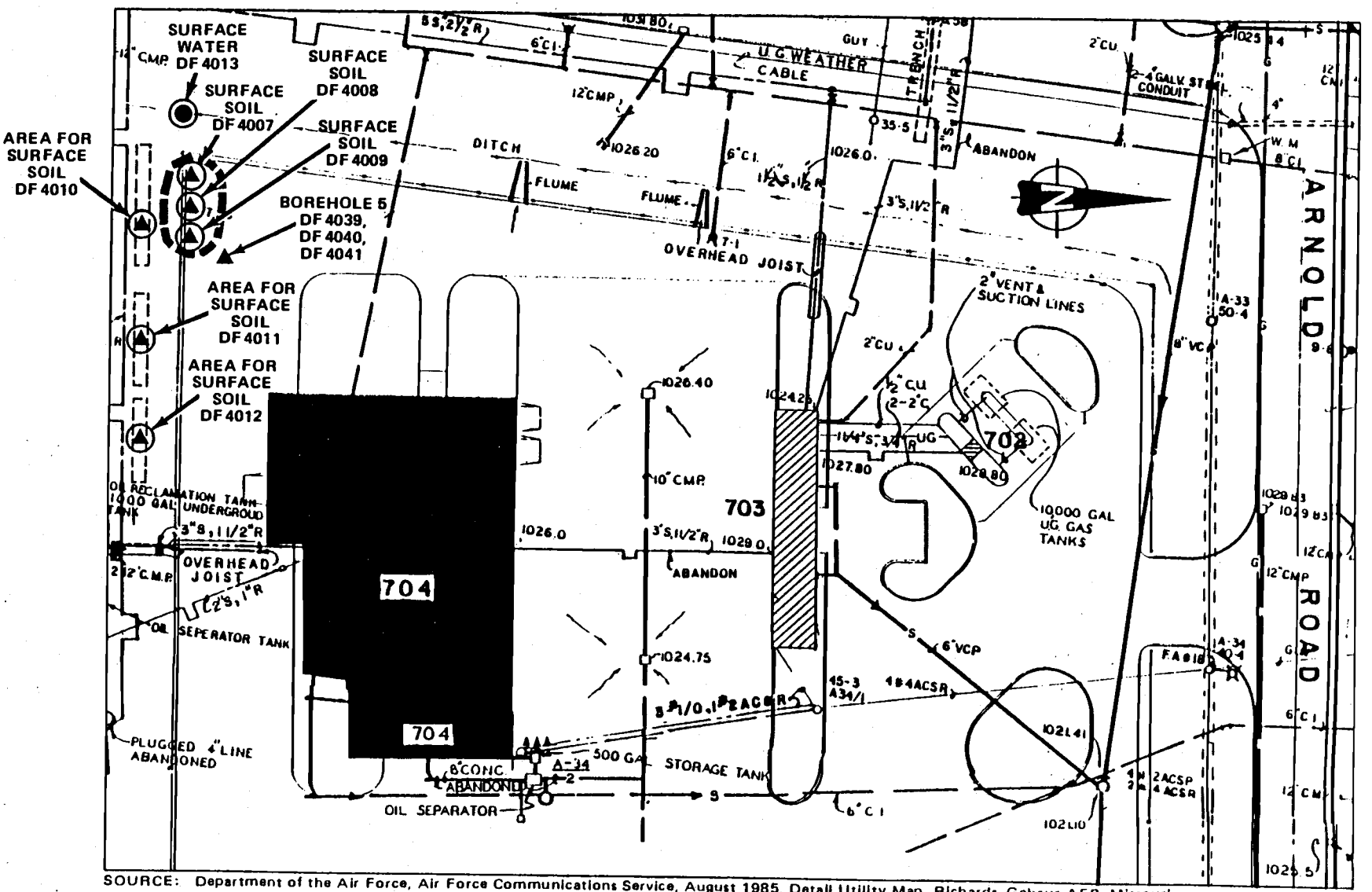

SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY:
- Site Boundary
- Surface Runoff Direction
- Subsurface Soil Sampling Location
- Surface Soil Sampling Location
- Groundwater Sampling Location
- Surface Water Sampling Location

SCALE: 0 50 100 200 300 FEET

Figure 3–7 SAMPLING LOCATIONS AT SITE 9, OIL-SATURATED AREA

Figure 3-8 shows the sampling locations for this site.

The surface water sample was analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, and barium. The nine soil samples were analyzed for halogenated and aromatic organics, petroleum hydrocarbons, and EP Toxicity metals.

Site 12, POL Storage Yard

Authorization could not be obtained for drilling inside Site 12, the POL Storage Yard, so a single downgradient monitoring well was installed outside the perimeter of the yard; one groundwater sample was collected and analyzed. Two surface water samples were collected from the drainage ditch west of the site, one from an upstream location and one from a downstream location.

Six-foot hand-augered boreholes were drilled inside three of the four bermed areas and three soil samples were taken from each boring. One subsurface soil sample was collected at a depth of 3 feet outside Building 953. One surface soil sample was collected outside Building 951.

Figure 3-9 shows the sampling locations for this site.

The three water samples were analyzed for petroleum hydrocarbons, total dissolved solids, and halogenated and aromatic volatile organics. The 11 soil samples were analyzed for aromatic halocarbons and petroleum hydrocarbons.

3.2.8 Laboratory Program

All samples where sufficient matrix was retrievable were split in the field, and the split samples submitted to the base POC. When sufficient numbers of samples were generated, 10% of the samples were returned to E & E for processing and shipment to OEHL/SA at Brooks Air Force Base, Texas. Field collection, preservation, packaging, and shipping protocols were followed as specified in the Technical Operations Plan (see Appendix N).

Copies of the chain-of-custody forms for the samples are provided in Appendix E. Information on detection limits for the analytical parameters is given in Table 1-2. Additional information on holding

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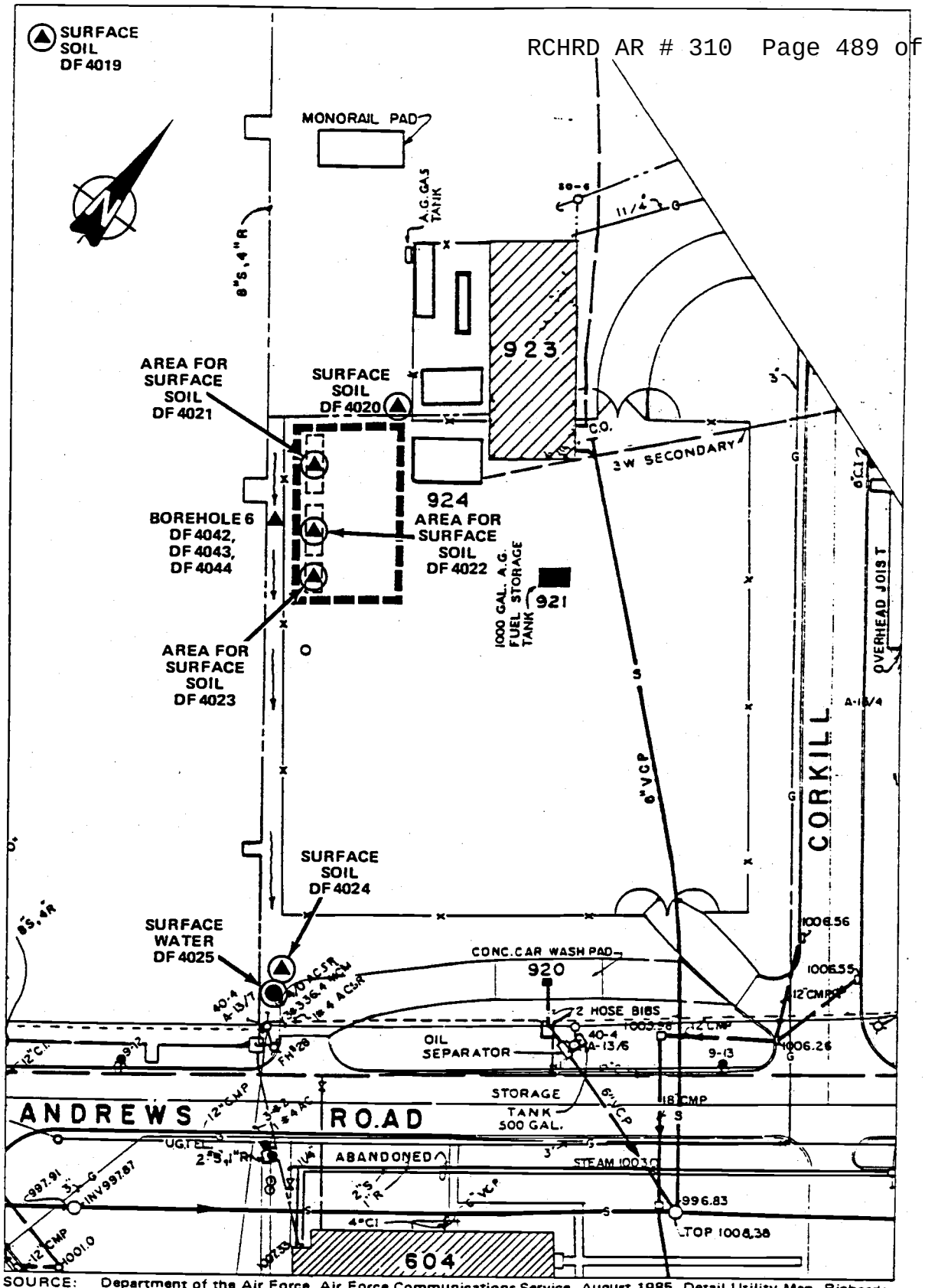

SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY:
- Site Boundary
- Surface Runoff Direction
- Subsurface Soil Sampling Location
- Surface Soil Sampling Location
- Groundwater Sampling Location
- Surface Water Sampling Location

SCALE: 0 50 100 200 300 FEET

Figure 3–8 SAMPLING LOCATIONS AT SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA

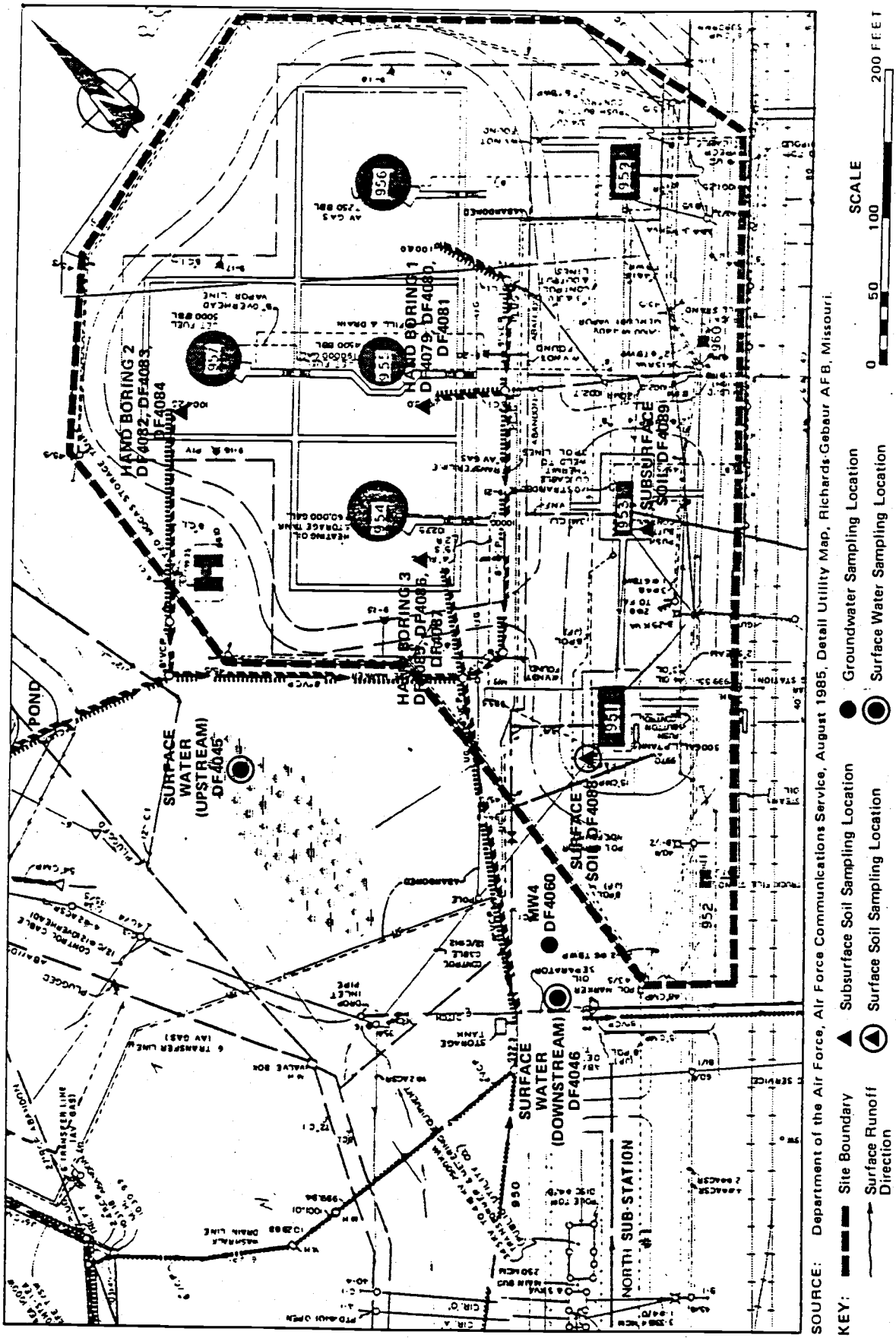

Figure 3–9 SAMPLING LOCATIONS AT SITE 12, POL STORAGE YARD

times is provided in Appendix H. All samples were shipped to the E & E Analytical Services Center (ASC) or to OEHL/SA by overnight Federal Express. Analytical protocols are discussed in Appendix N.

3.2.9 Variations from Description of Work

During the execution of the fieldwork, several changes from the Description of Work were implemented due to field conditions and findings. Changes were implemented after discussion with and concurrence of the OEHL project manager. A site-specific summary of the variations follows.

All Sites

Subsurface soil borings were taken using a CME continuous sampler. This unit is essentially a 5-foot-long split-spoon soil sampler that is advanced ahead of the hollow-stem auger. It provides a continuous undisturbed sample of the sediment column.

Optional water samples, allocated in case groundwater was intersected during the borehole drilling for subsurface soil samples, were not utilized as no appreciable amounts of groundwater were observed in any boreholes.

Site 1, South Landfill

No modifications in the proposed scope of work occurred at this site.

Site 2, Northeast Landfill

The geophysical surveys were adjusted in the field to cover areas adjacent to the targeted area, based on instrument readings which indicated the entire targeted area as landfill. This was later corroborated based on aerial photographs.

Boring 7 was aborted after encountering the apparent edge of the landfill. Only one of the three scheduled soil samples from this borehole was collected.

An additional surface water sample was collected, from a flowing tributary to Scope Creek just before it enters the creek. This sample represented runoff from the landfill prior to dilution in Scope Creek.

The sample replaced a water sample which could not be taken at Site 6, where no water was encountered.

Site 6, North Burn Pit Area

Due to the absence of any appreciable amounts of water in two of the three monitoring wells at the site, analyses could only be performed for halogenated and aromatic organics. Petroleum hydrocarbons had to be omitted. Two additional attempts to collect sufficient sample volumes also failed.

No determination could be made as to upgradient versus downgradient with respect to monitoring wells. The facility is situated on the top of a ridge.

Site 8, Herbicide Burial Area

No modifications in the proposed scope of work were made at this site.

Site 9, Oil-Saturated Area

No modifications in the proposed scope of work occurred at this site.

Site 10, Hazardous Waste Drum Storage Area

An upstream surface water sample could not be obtained since no water was encountered.

Site 12, POL Storage Yard

A surface water sample from the outfall drain from Building 953 was allocated. However, there was no outfall from this building, and so no sample was collected.

Due to errors in sample labeling in the field, two analytical parameters listed in the Description of Work were inadvertently omitted. These errors affected the proposed analytical program as follows:

- Sample DF4045 - No TDS analysis was performed on this sample.

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- Sample DF4046 - No TDS analysis was performed on this sample.

4. RESULTS AND SIGNIFICANCE OF FINDINGS

4.1 INTRODUCTION

Water and soil samples were analyzed by E & E's Analytical Services Center (ASC) in Buffalo, New York. Analytical results, together with the QA/QC data for each job number, are included in Appendix H. Results are grouped in Appendix H corresponding to sample sets received by the ASC (in many cases, results from several sites are included under one job number, i.e., one laboratory data report). Soils data are wet weight values. To facilitate locating data in Appendix H, a "Sample Identification Cross Reference" is presented at the beginning of the appendix.

Methods of Evaluating Chemical Data

The Phase II Stage 2 investigation of Richards-Gebaur AFB involved the analysis of 64 soil samples and 25 water samples. The results section (Section 4.2) provides two data tables for each site, one containing soils results and one containing groundwater and/or surface water results. The concentrations of contaminants found at each site are compared to applicable and relevant federal standards, health criteria, and natural background concentrations. Specific procedures have been used for evaluating the soil, groundwater, and surface water data, as described below.

For soils, there are no mandatory federal standards or health criteria. Consequently, concentrations of trace metals found in the samples were compared to background levels reported as normal by the United States Geological Survey (USGS) for western Missouri (Connor and Shacklette 1975) (see Table 4-1). Only those metal concentrations found above background are reported in the results tables in Section

Table 4-1

THRESHOLD VALUES APPLIED TO
SOIL CONCENTRATIONS FOR
SAMPLES FROM RICHARDS-GEBAUR AFB
AS COMPARED WITH LITERATURE VALUES
FOR WESTERN MISSOURI

(mg/kg)

	Literature Value*	
	Mean	Normal Range
Arsenic	8.3	3 - 13
Cadmium	<1	<1 - 2.5
Chromium, Total	66	50 - 100
Copper	18	10 - 30
Lead	15	10 - 20
Mercury	0.035	<0.01-0.06
Nickel	22	15 - 30
Zinc	61	37 - 90

*Source: Connor, J.J., and H.T. Shacklette 1975.

4.2. Organic compounds detected in soils are listed individually in the results tables. In general, most organic chemicals reported in the soils are not natural soil constituents, and therefore should not be attributed to natural sources. In the absence of background data, it is assumed that all organic contamination not attributable to laboratory contamination should be considered to be related to site activities.

For organics and inorganics in groundwater and surface water, individual contaminant concentrations detected are reported in the results tables. The principal concern is the potential adverse health hazard related to human drinking water consumption. Therefore, concentrations found were compared to EPA drinking water standards and criteria [Recommended Maximum Contamination Limits (RMCLs), Maximum Contamination Limits (MCLs), or lifetime Health Advisories (HAs)]. These standards and criteria were selected for use because they represent mandatory drinking water limits or criteria for protection of human health.

Laboratory Quality Assurance/Quality Control (QA/QC)

The laboratory quality control (QC) activities followed throughout this project support the accuracy of the technical data generated. These activities included analysis of calibration standards, duplicates, matrix spikes, surrogate spikes, standard reference materials, and method blanks.

Duplicate results and spike recoveries were judged in comparison to historical laboratory quality assurance (QA) data, or where applicable, EPA guidelines. Of the samples whose surrogate spike recoveries did not fall within EPA guidelines, a representative number were re-extracted and reanalyzed to confirm a sample matrix effect.

Method blanks were analyzed to assess possible laboratory contamination. Common laboratory solvents, such as methylene chloride, and common phthalate esters were identified and reported in some method blanks. Levels up to five times the detection limit for these contaminants are considered to have no negative impact upon data quality. EPA has determined from its CLP program that most, if not all, labs have a problem with low levels of common lab solvents and phthalate esters in lab blanks (USEPA CLP Contract 1985). Sample results with

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levels of these compounds five times the detection limit should be considered suspect. Low levels of common solvents or common phthalates reported in site samples should be viewed with caution. Results of 10 to 20 µg/L in water samples are often attributable to laboratory contamination. Similarly, levels of 1 to 3 mg/kg in soil or sediment samples may not reflect site contamination.

4.2 RESULTS

4.2.1 Site 1, South Landfill

Geology

Based on published maps and observations made in the field during the Phase II Stage 2 investigation, Site 1, the South Landfill, is situated on a thin cover of unconsolidated silts and clays overlying Pennsylvanian age rocks of the Zarah subgroup. The unconsolidated deposit is less than 8 feet thick and thins to disappearance along the banks of Scope Creek. A single boring was made into this material. The sediments were similar to those found in other upland soil borings. Typically, the sediments are silts and clays which have weathered for a long time, as indicated by the well-developed soil structures (peds) and oxidized colors (reddish browns). Another key indicator to the history of these sediments is the occurrence of a layer of chert at some depth in the profile. In the boring, a chert gravel layer was observed at 4 feet below the ground surface. The chert layer acted as a permeable layer through which minor amounts of perched water could flow.

Hydrogeology

The hydrology at the site is relatively complex. The site is located adjacent to an intermittent stream (Scope Creek) and is down-gradient from a man-made lake which creates a hydraulic head west of the site and feeds a marshy area west of the landfill and east of the lake. This situation causes numerous seeps to flow from the northeast corner of the landfill. The lake also serves to recharge the permeable layers at and above the interface of the unconsolidated sediments with local bedrock units.

Several intermittent streams were observed on the east side of the landfill adjacent to Scope Creek. Most of them were dry and were probably surface water drainage pathways rather than individual seeps. Two of the seeps were flowing, allowing water samples to be taken before entering the creek. The creek was not flowing at the time of sampling, even though rainfalls of 0.41 and 0.24 inches were recorded at the base on the day before and the day of surface water sampling. Upstream and downstream samples were taken of pooled water. The month of October 1986 was wetter than normal. During the month, 6.03 inches of rain fell, which was more than 2 inches above normal. The south part of the base is very near the headwaters and drainage divide for Scope Creek and the Little Blue River.

Chemical Results

The four water samples collected at the site were analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols. The seven surface and subsurface soil samples were analyzed for volatile organics and petroleum hydrocarbons.

The four water samples did not show any contamination for the parameters tested. The extractable organic compound di-n-butyl phthalate (DBP) was present in all four samples but at concentrations below the method detection limit (30 µg/L). It was also found to be present in the method blank (<10 µg/L). Therefore, the low concentrations of this compound have been attributed to laboratory contamination. In addition, four anions were reported for the most part minimally above detectable limits. The concentrations for two of the three anions subject to EPA secondary (non-mandatory) drinking water standards, fluoride and sulfate, were significantly below these standards. For the third, chloride, concentrations were below the World Health Organization criterion for aesthetic purposes. The values for total dissolved solids (TDS) range from 290 mg/L upstream to 400 mg/L downstream. Table 4-2 summarizes the results of the water analyses.

The soil samples were not contaminated for the parameters tested, with the exception of petroleum hydrocarbons. A low concentration (1.2

Table 4-2

RESULTS OF WATER SAMPLE ANALYSES FOR SITE 1, SOUTH LANDFILL

(ug/L, unless otherwise specified)

Parameter	EPA Drinking Water Standards and Health Advisories*				Surface Water			
	EPA MCL	EPA RMCL	EPA HA	Date Sampled: Location: Field Sample No.: Lab Sample No.:	10/21 Background DF4066 9085	10/21 Downstream DF4068 9086	10/21 Seep 1 DF4071 9087	10/23 Seep 2 DF4076 9233
Petroleum Hydrocarbons (mg/L)	--	--	--		ND	ND	ND	ND
Halogenated Volatile Organics	--	--	--		ND	ND	ND	ND
Aromatic Volatile Organics	--	--	--		ND	ND	ND	ND
Priority Pollutant Metals	--	--	--		ND	ND	ND	ND
Extractables: di-n-butyl phthalate**	--	--	--		<30	<30	<30	<30
Total Dissolved Solids (mg/L)	--	--	--		290	390	400	380
Common Anions (mg/L)								
Flouride	4	--	--		0.64	0.75	0.74	0.65
Chloride	--	--	250†		4.6	29	32	5.2
Nitrite	--	1(p)	--		ND	ND	ND	ND
Phosphate	--	--	--		ND	ND	ND	ND
Nitrate	--	10(p)	--		ND	2.4	2.7	ND
Bromide	--	--	--		ND	ND	ND	0.24
Sulfate	250 (secondary standard)	--	--		36	35	28	18
Phenols	--	--	--		ND	ND	ND	ND

*Key: MCL = Maximum Contaminant Limit.
RMCL = Recommended Maximum Contaminant Limit.
HA = Lifetime Health Advisories developed by EPA for noncarcinogenic effects.
(p) = Proposed.
ND = Not Detected.
**Detected in the method blank, therefore attributed to [illegible]ratory contamination.
†World Health Organization criterion for aesthetic qual[illegible]

NOTE: The values for di-n-butyl phthalat[illegible] li[illegible] as [illegible] which [illegible] as t[illegible] impo[illegible] pr[illegible] but [illegible]

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mg/kg) of petroleum hydrocarbons detected near the bottom of the borehole was thought to be associated with the permeable chert layer. A higher concentration (16 mg/kg) was found in a surface soil sample taken at Seep 2. This is not really a seep, however. The water is surface runoff from the upgradient lake and marshy area located along the west flank of the landfill. This area is adjacent to the runway and air traffic. It is possible that runoff from runway operations contributed to the higher concentration of petroleum hydrocarbons detected in the surface soil sample taken at Seep 2. Table 4-3 summarizes the results of the soil analyses.

4.2.2 Site 2, Northeast Landfill

Geophysics

A previous report (CH2M Hill 1985) showed Site 2, the Northeast Landfill, as consisting of three discrete trenches. In order to locate these trenches precisely, magnetometer and EMC geophysical surveys were conducted. No discrete trenches could be delineated from the geophysical data. Instead, the data indicated wide anomalies over the entire survey area. A historical aerial photograph was also found which showed the location of trenches as of 1970. This photo, like the geophysical survey data, contradicted the theory of three discrete trenches. The photo showed the Northeast Landfill in 1970 to be a series of trenches oriented north-south and east-west.

Based on the geophysical surveys and the aerial photo, the area delineated in Figure 4-1 was considered to have been trenched and landfilled. Further investigation, including the drilling of four boreholes, installation of two monitoring wells, and collection and analysis of soil samples and water samples, was based on the understanding of the trenched and landfilled area as delineated in Figure 4-1.

Geology

Based on published maps and observations made in the field during the Phase II investigation, Site 2, the Northeast Landfill, is situated on a thin cover of unconsolidated silts and clays overlying a gray to

Table 4-3

RESULTS OF SOIL SAMPLE ANALYSES
FOR SITE 1, SOUTH LANDFILL

(mg/kg; all soil concentrations
expressed on an as received basis)

Parameter	Date Sampled: Boring: Depth: Field No.: Lab No.:	10/17 7 1-2' DF4047 8972	10/17 7 4-5' DF4048 8973	10/17 7 6-7' DF4049 8974	10/21 Upstream 0 - 6" DF4067 9090	10/21 Downstream 0 - 6" DF4069 9091	10/21 Seep 1 0 - 6" DF4070 9092	10/21 Seep 2 0 - 6" DF4077 9236
Volatile Organic Compounds		ND	ND	ND	ND	ND	ND	ND
Petroleum Hydrocarbons		ND	ND	1.2	ND	ND	1.9	16

ND = Not Detected

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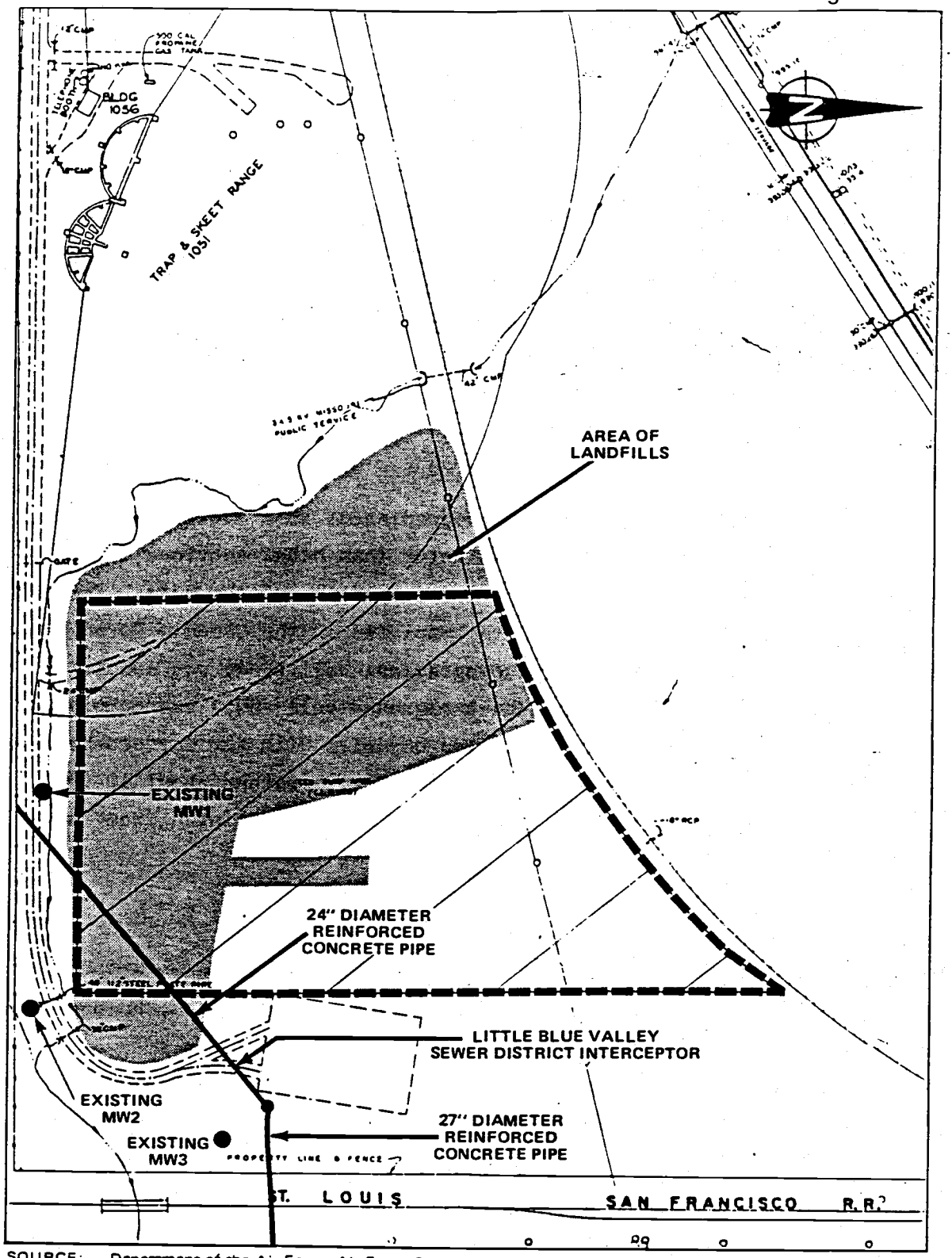

SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY: Site Boundary
Surface Runoff Direction

SCALE
0 100 200 300 400 FEET

Figure 4–1 LOCATION OF SITE 2, NORTHEAST LANDFILL, BASED ON GEOPHYSICAL SURVEY AND HISTORICAL AERIAL PHOTOGRAPHS (3/19/77)

green shale which averages 22 feet in thickness. The unconsolidated deposit is less than 8 feet thick, and thins to disappearance along the banks of Scope Creek. Four borings were made into this material. Drilling logs are presented in Appendix D. The soils were similar to those found in other soil borings on the base, in that they consist of silts and clays but are darker than soils from borings on upland surfaces, which are reddish-brown in color. A chert layer was found at the base of borings just above the bedrock. The chert acts as a permeable layer through which minor amounts of groundwater could flow. Boring 4 was completed as a monitoring well and designated MW6. The log for this boring is given in Appendix D and is referred to as MW6.

Hydrogeology

The Northeast Landfill is located adjacent to a section of Scope Creek that more frequently contains water than other sections of the creek. The site is located in the lowest portion of the base. The three existing monitoring wells are completed in the Chanute Formation, a shale. Of the new wells, the downgradient well (MW4) was completed at the top of the Chanute shale. The background well (MW5) was completed at the interface of the unconsolidated deposits with the Raytown Member of the Iola Formation. The Raytown is a gray limestone about 10 feet thick. Sufficient quantities of groundwater were retrieved from each well for analytical purposes.

Chemical Results

The eight water samples (3 surface water and 5 groundwater) were analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols. The soil samples were analyzed for volatile organics and petroleum hydrocarbons.

Generally, the water samples showed no contamination for most of the parameters tested. The extractable organic compound DBP was present in the surface water samples at concentrations below the method detection limit (39 µg/L). It was detected in the method blank at 13 µg/L. DBP was also found to be present in the groundwater samples at

concentrations below the method detection limit (30 µg/L). It was detected in the method blank at <10 µg/L. Because DBP was detected in the method blanks, its presence in the samples has been attributed to laboratory contamination. Five anions, fluoride, chloride, nitrate, bromide, and sulfate, were reported above detectable limits. Only one sample for sulfate (280 µg/L) minimally exceeded the EPA secondary drinking water standard (250 µg/L). The TDS values for the monitoring wells (380 to 940 mg/L) are 2 to 4 times greater than for the creek (250 to 470 mg/L). The highest TDS value came from new MW6 (940 mg/L). The surface water collected from runoff from the landfill before it enters Scope Creek had a TDS value of 420 mg/L. Table 4-4 summarizes the results of the water analyses.

The soil samples showed no organic contamination, with the exception of petroleum hydrocarbons. Petroleum hydrocarbons were detected at a high concentration (440 mg/kg) in the uppermost sample and a lower concentration (19 mg/kg) at a lower depth, from Boring 4. Table 4-5 summarizes the results of the soil analyses.

4.2.3 Site 6, North Burn Pit Area

Geology

Based on published maps and field observations made during the Phase II Stage 2 investigation, Site 6, the North Burn Pit Area, is situated on a thin cover of unconsolidated silts and clays overlying Pennsylvanian age rocks of the Zarah subgroup. These rock units are primarily limestones and shales, with the thickest member being the Argentine, a gray limestone with abundant chert nodules. The Argentine is one of the more resistant bedrock units in the area and is found at the tops of most of the hills in southern Jackson County and northern Cass County. The unconsolidated deposit is less than 8 feet thick and thins to disappearance along the flanks of the hills. Three soil borings and three monitoring wells were drilled into this material. Drilling logs are presented in Appendix D. The soils were similar to those found in other borings at the base. Typically, the soils are silts and clays which have weathered for a long time, as indicated by

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Table 4-4

RESULTS OF WATER SAMPLE ANALYSES FOR SITE 2, NORTHEAST LANDFILL

(ug/L, unless otherwise specified)

Parameter	EPA Drinking Water Quality Standards and Health Advisories*				Groundwater					Surface Water		
	EPA MCL	EPA RMCL	EPA HA	Well No.: / Date Sampled: / Field Sample No.: / Lab Sample No.:	MW5 10/21 DF4061 9080	MW6 10/21 -62 9081	P21 10/21 -63 9082	P22 10/21 -64 9083	P23 10/21 -65 9084	NELFC 10/23 -73 9230	NELFD 10/23 -74 9231	NEFLU 10/23 -75 9232
Petroleum Hydrocarbons (mg/L)	--	--	--		ND	ND	ND	ND	ND	ND	ND	ND
Halogenated Volatile Organics	--	--	--		ND	ND	ND	ND	ND	ND	ND	ND
Aromatic Volatile Organics	--	--	--		ND	ND	ND	ND	ND	ND	ND	ND
Priority Pollutant Metals (mg/L)	--	--	--		ND	ND	ND	ND	ND	ND	ND	ND
Extractables di-n-butyl phthalate**	--	--	--		<30	<30	<30	<30	<30	<39	<39	<39
Total Dissolved Solids (mg/L)	--	--	--		380	940	430	650	510	470	250	260
Common Anions (mg/L)												
Flouride	4	--	--		1.0	2.7	0.79	3.2	1.2	0.81	0.49	0.53
Chloride	--	--	250†		4.3	47	22	22	41	54	16	16
Nitrite	--	1(p)	--		ND	ND	ND	ND	ND	ND	ND	ND
Phosphate	--	--	--		ND	ND	ND	ND	ND	ND	ND	ND
Nitrate	--	10(p)	--		2.2	ND	6.7	0.24	0.60	0.15	2.7	2.5
Bromide	--	--	--		ND	0.25	ND	0.20	0.24	0.15	0.16	0.11
Sulfate	250	--	--		61	280	110	60	91	64	28	25
Phenols	--	--	--		ND	ND	ND	ND	ND	ND	ND	ND
Lead (mg/L)	0.05	0.02	--		0.008	0.005	0.005	0.008	<0.005	<0.005	<0.005	<0.005

*Key: MCL = Msximum Contaminsnt Limit.
RMCL = Recommended Maximum Contaminant Limit.
HA = Lifetime Health Advisories developed by EPA for noncarcinogenic effects.
(p) = Proposed.
ND = Not Detected.
†World Health Organization recommended criterion for aesthetic quality.
**Detected in the method blank, therefore attributed to laboratory contamination.

NOTE: The values for di-n-butyl phthalates are listed as "<" which means the compound is present but below method detection limit.

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Table 4-5

RESULTS OF SOIL SAMPLE ANALYSES
FOR SITE 2, NORTHEAST LANDFILL

(mg/kg; all concentrations expressed on an as received basis.)

Parameter	Date Sampled: / Boring: / Depth: / Field No.: / Lab No.:	10/16 NELFB4 1-2' DF4036 8963	10/16 NELFB4 6-7' DF4037 8964	10/16 NELFB4 8-8.5' DF4038 8965	10/17 NELFB8 7-7.9' DF4050 8975	10/17 NELFB9 4-5' DF4051 8976	10/17 NELFB9 6-7' DF4052 8977	10/17 NELFB9 6-7' DF4052D 8978	10/17 NELFB9 9-10' DF4053 8979	10/17 NELFB10 1-2' DF4054 8980	10/17 NELFB10 4-5' DF4055 8981	10/17 NELFB10 7-8' DF4056 8982
Volatile Organics Compounds		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Petroleum Hydrocarbons		440	19	ND	ND	ND	ND	ND	ND	ND	ND	1.0

ND = Not Detected

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the well-developed soil structures (peds) and oxidized colors (reddish-browns). A chert layer was observed in the three borings at various subsurface depths. The chert layer could act as a permeable layer through which minor amounts of perched water could flow.

Soil Gas Survey

Twenty-seven soil gas stations were monitored at Site 6. The survey helped delineate the extent of organic vapor contamination in the soils around the burn pit. The contamination appears to be contained within the fenced area. The highest concentrations were recorded adjacent to the burn pit. At progressive distances away from the pit, the values dropped off dramatically and could not be detected outside the compound. Based on this information, the three monitoring wells were located within the compound, and all borehole and well cuttings were containerized at the site pending the results of soil analysis for volatile organic compounds. The laboratory analysis showed no volatile organic contamination in any of the soil samples. Results of the soil gas survey are shown on Figure 4-2.

Hydrogeology

A permeable layer of chert was encountered at depths which varied between 6 and 9 feet below ground surface. Small quantities of water are perched and seep through this chert layer. Only MW1 yielded sufficient water for all proposed analyses. The reason for this may have been due to the presence of recharge from the surface impoundment in the vicinity of the well.

Chemical Results

No contaminants were detected in the surface water. Volatile organics were detected in each of the three monitoring wells. Wells MW2 and MW3, which were completed at the bedrock interface, showed minor contamination with chloroform (0.50 and 0.61 µg/L, respectively) and tetrachlorethylene (0.71 and 0.41 µg/L). The deeper well, MW1, had no trace of these compounds, but had methylene chloride (37 µg/L) at a concentration below the EPA lifetime drinking water advisory of 350 µg/L. Table 4-6 summarizes the results of the water analyses.

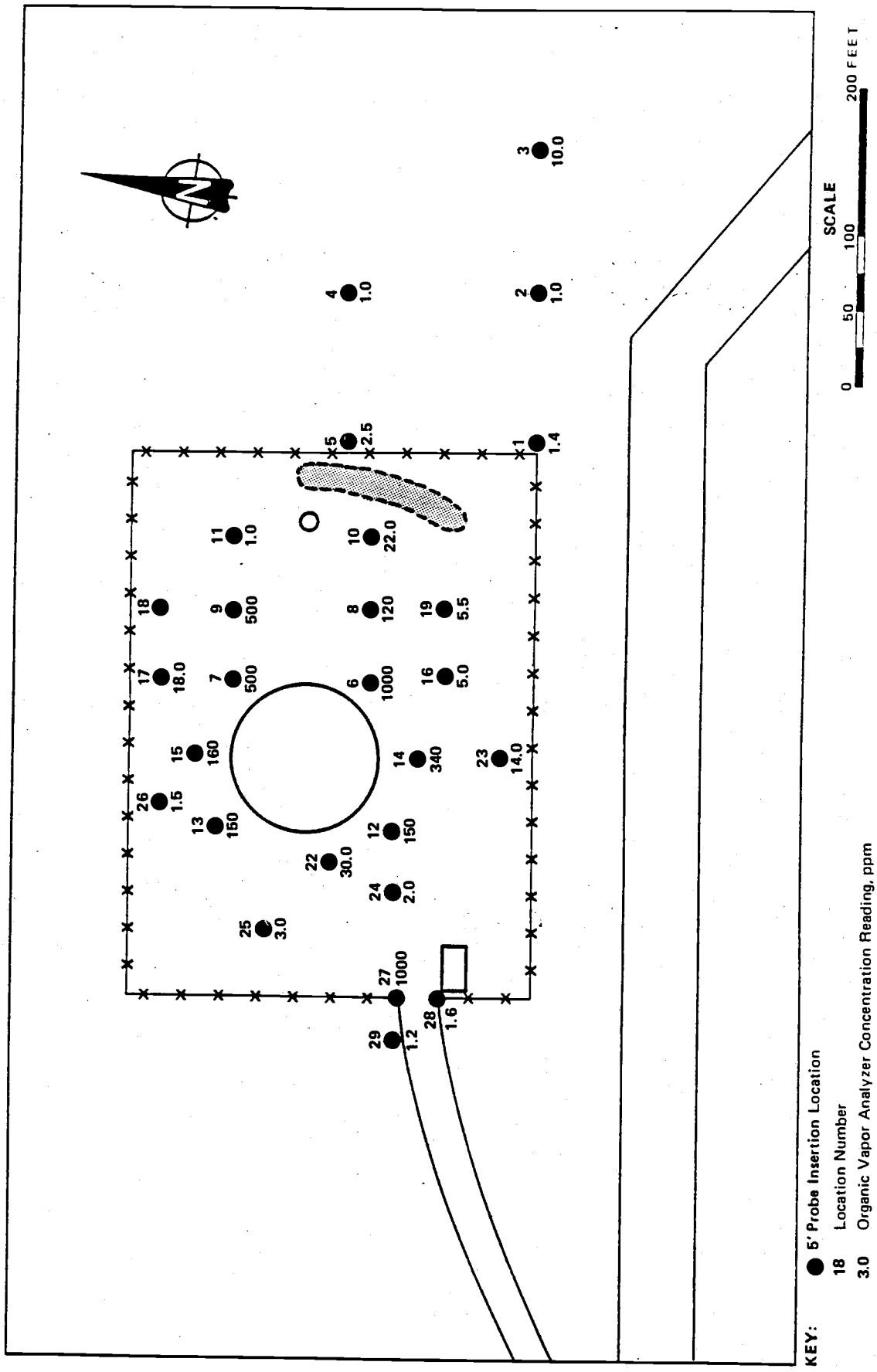

Figure 4–2 SUMMARY OF SOIL GAS SURVEY LOCATIONS AND CONCENTRATIONS AT SITE 6, NORTH BURN PIT AREA

Table 4-6

RESULTS OF WATER SAMPLE ANALYSES FOR SITE 6, NORTH BURN PIT AREA

(ug/L, unless otherwise specified)

Parameter	EPA Drinking Water Standards and Health Advisories*				Surface Water	Groundwater		
	EPA MCL	EPA RMCL	EPA HA	Well No.:	NBW1	NWMW	NEMW	SEMW
				Date Sampled:	10/9	10/21	10/21	10/21
				Field Sample No.:	DF4006	DF4057	DF4058	DF4059
				Lab Sample No.:	8776 (9088)	9076	9077	9078
Petroleum Hydrocarbons (mg/L)	--	--	--		ND	NR	NR	NR
Halogenated Volatile Organics								
Chloroform	100	--	--		ND	0.50	ND	0.61
Methylene Chloride	--	--	350**		ND	ND	37	ND
Tetrachloroethylene	--	--	680**		ND	0.71	ND	0.41
Aromatic Volatile Organics	--	--	--		ND	ND	ND	ND

*Key: MCL = Maximum Contaminant Limit
RMCL = Recommended Maximum Contaminant Limit
HA = Lifetime Health Advisories developed by EPA for noncarcinogenic effects
ND = Not Detected
NR = Not run due to insufficient sample volume

**EPA is currently reviewing the potential carcinogenicity of this chemical. If the agency concludes the chemical ought to be regulated as a carcinogen in drinking water, the agency will establish a health advisory significantly lower than the current HA.

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Nearly all Organic Vapor Analyzer (OVA) readings were positive. The laboratory analyses indicated that none of the nine subsurface samples was contaminated with volatile organics. The probable explanation for the positive result in the soil gas survey and the negative result in the subsurface soil samples is that the OVA was detecting methane, which would not be detected in the soil samples. The fact that OVA readings remained constant when using a carbon filter further supports this conclusion.

The values for petroleum were also low and consistent among the samples (ND to 5.7 mg/kg), with the exception of sample DF4001, collected 100 feet east of the southeast corner of the fence line, which contained 34 mg/kg. Table 4-7 summarizes the results of the soil analyses.

4.2.4 Site 8, Herbicide Burial Area

Geology

Site 8, the Herbicide Burial Area, is similar in setting to Site 6, the North Burn Pit Area, and the Site 1, the South Landfill. The site is on an upland surface where silts and clays cover a weathered limestone bedrock. The original topography of the base has been modified by construction and extension of the major north-south runway. The area is nearly level, with broad shallow depressions and a small pond downgradient to the south.

A broad shallow depression was observed in the area of the suspected trench location based on AF 103. Water had ponded in this area and drained east into other wet areas. It is not known if the shallow depression was caused by possible subsidence of the 1971 trench or is due to construction activities since that date.

Hydrogeology

Based on observations made on other upland sites on the base, it can be assumed that the thickness of the unconsolidated deposits above the bedrock at this site is less than 7 feet. The burial trench was projected to be 6 feet in depth, which places the bottom of the trench very close to, if not directly on, the weathered bedrock surface. The hydrological implication is that the material that was buried, and

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Table 4-7

RESULTS OF SOIL SAMPLE ANALYSES FOR SITE 6, NORTH BURN PIT AREA

(mg/kg, all concentrations on an as received basis.)

Parameter	Date Sampled:	10/9	10/9	10/9	10/9	10/9	10/10	10/15	10/15	10/15	10/15	10/15	10/15	10/15	10/15	10/15	10/15
	Boring:	NBAS-1	NBAS-2	NBAS-3	NBAS-4	NBAS-5	NBAS-6	NBAB-1	NBAB-1	BNAB-1	NBAB-2	NBAB-2	NBAB-2	NBAB-2	NBAB-3	NBAB-3	BNAB-3
	Depth:	0-1'	0-1'	0-1'	0-1'	0-1'	0-1'	3.5-4.5'	7-8'	12-12.4'	2-3'	5-6'	11-12'	11-12'	2-3'	5-6'	11-12'
	Field No.:	DF4001	DF4002	DF4003	DF4004	DF4005	DF4014	DF4027	DF4028	DF4029	DF4030	DF4031	DF4032	DF4032D	DF4033	DF4034	DF4035
	Lab No.:	8765	8766	8767	8768	8769	8795	8894	8895	8896	8897	8898	8899	8900	8901	8902	8903
Volatile Organics Compounds		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Petroleum Hydrocarbons		34	1.4	5.4	2.8	5.7	2.8	ND	3.8	3.8	1.9	1.6	2.0	1.4	ND	ND	ND

ND = Not Detected

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probably compacted, is either contained in generally impermeable silts and clays, or, if bedrock was shallower, has breached containment and entered the permeable weathered zone located at the bedrock/sediment interface.

Chemical Results

The surface water sample from the downgradient pond showed no contamination for the parameters tested (see Table 4-8). No pesticide or mercury contamination was detected in any of the four surface soil samples (see Table 4-9). Arsenic was detected in three of the four surface soil samples in concentrations ranging from 1.8 to 5.0 mg/kg. Samples DF4015 and DF4016, located closest to the suspected location of the trench, had arsenic values of 1.8 mg/kg and 5.0 mg/kg, respectively, whereas sample DF4017, from a point 25 feet further downgradient, showed no arsenic. Sample DF4018, more than 200 feet from the suspected trench area, had an arsenic value of 4.5 mg/kg. All soil concentrations for arsenic fell within the normal range for area soils (3 to 13 mg/kg).

4.2.5 Site 9, Oil-Saturated Area

Geology

The single 15-foot boring drilled at this site did not intersect bedrock. Based on previous information, the bedrock below this site is a gray shale (Lane Formation). This shale can be sandy in its upper parts and is generally 30 feet or more in thickness.

Hydrogeology

No groundwater was encountered in the borehole from this site. Storm runoff is channeled through a ditch across the southwest corner of the compound. No seeps or traces of petroleum were observed flowing from the oil-stained area into the storm water runoff.

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Table 4-8

RESULTS OF WATER SAMPLE ANALYSES FOR
SITE 8, HERBICIDE BURIAL AREA

(ug/L, unless otherwise specified)

Parameter	EPA Drinking Water Standards and Health Advisories*				Surface Water
	EPA MCL	EPA RMCL	EPA HA	Well No.:	HBAW-1
				Date Sampled:	10/10
				Field Sample No.:	DF4027
				Lab Sample No.:	8807
Pesticides	—	—	—		ND
Arsenic	50	50	50		ND
Mercury	2	3	3		ND
TDS (mg/L)	—	—	—		110

*Key: MCL = Maximum Contaminant Limit
RMCL = Recommended Maximum Contaminant Limit
HA = Lifetime Health Advisories developed by EPA for noncarcinogenic effects

ND = Not Detected

Table 4-9

RESULTS OF SOIL SAMPLE ANALYSES FOR
SITE 8, HERBICIDE BURIAL AREA

(mg/kg; all soil concentrations on an as received basis)

Parameter	Date Sampled: Boring#: Depth: Field No.: Lab No.:	10/10 HBAS-1 0-1' DF4015 8796	10/10 HBAS-2 0-1' DF4016 8797	10/10 HBAS-3 0-1' DF4017 8798	10/10 HBAS-4 0-1' DF4018 8799
Herbicides		ND	ND	ND	ND
Arsenic		1.83	5.0	ND	4.53
Mercury		ND	ND	ND	ND

ND = Not Detected

Chemical Results

The surface water sample showed no chemical contamination for the parameters tested. TDS was also low (270 mg/L). Results are provided in Table 4-10.

No VOCs were detected in any of the soil samples. Lead was detected in all nine soil samples in concentrations ranging from 9.22 to 343 mg/kg. Three of the nine, all in surface soils, greatly exceed the normal range for lead in loess soils from Missouri (10 to 20 mg/kg). The highest lead value (343 mg/kg) was observed from along the south fence line. Petroleum hydrocarbons were detected at high concentrations ranging from 670 to 3,800 mg/kg. Results of soil analyses are provided in Table 4-11.

4.2.6 Site 10, Hazardous Waste Drum Storage

Geology

Site 10, the Hazardous Waste Drum Storage Area, is located on the slopes of the valley of Scope Creek, where the sediments can be thicker than on the uplands. The single soil boring at this site was drilled to 15 feet without encountering bedrock or water. A chert layer was recorded at 11.5 feet. The bedrock below this site is either a portion of the Lane Formation (a shale) or the Raytown Member of the Iola Formation (a limestone).

Hydrogeology

No groundwater was found at this site. However, a grassy surface water runoff path was found along the southwest flank of the site. Surface water was found downgradient but not upgradient of the site.

Chemical Results

Barium (85 µg/L) and lead (5 µg/L) were the only compounds detected in the single surface water sample. The values are slightly above the detection limits. Results are provided in Table 4-12.

No metals were detected in soils in the EP toxicity analysis. No VOCs were detected. Petroleum hydrocarbon values fluctuated for the subsurface samples, with values ranging from a relatively low value of

Table 4-10

RESULTS OF WATER SAMPLE ANALYSES FOR
SITE 9, OIL-SATURATED AREA

(ug/L, unless otherwise specified)

Parameter	Water Quality Standards and Health Advisories*				Surface Water
	EPA MCL	EPA RMCL	EPA HA	Well No.:	HBAW-1
				Date Sampled:	10/09
				Field Sample No.:	DF4013
				Lab Sample No.:	8777
Petroleum Hydrocarbons (mg/L)	--	--	--		ND
Volatile Organic Compounds	--	--	--		ND
Lead	50	20	20		ND
TDS (mg/L)	--	--	--		270

*Key: MCL = Maximum Contaminant Limit
RMCL = Recommended Maximum Contaminant Limit
HA = Lifetime Health Advisories developed by EPA for non-carcinogenic effects

ND = Not Detected

Table 4-11

RESULTS OF SOIL SAMPLE ANALYSES FOR
SITE 9, OIL-SATURATED AREA

(mg/kg; all concentrations on an as received basis)

Parameter	Date Sampled: / Boring: / Depth: / Field No.: / Lab No.:	10/9 OSAS-1 0-1' DF4007 8770	10/9 OSAS-2 0-1' DF4008 8771	10/9 OSAS-3 0-1' DF4009 8772	10/9 OSAS-4 0-1' DF4010 8773	10/9 OSAS-5 0-1' DF4011 8774	10/10 OSAS-6 0-1' DF4012 8775	10/17 OSAB-1 3-4' DF4039 8966	10/17 OSAB-1 8-9' DF4040 8967	10/17 BNAB-1 15.5-16.5' DF4041 8968
Volatile Organic Compounds		ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead		169	117	343	14.1	14.8	18.5	20.2	9.22	10.2
Petroleum Hydrocarbon		2000	3800	670	ND	2	3	9.0	ND	ND

ND = Not Detected

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Table 4-12

RESULTS OF WATER SAMPLE ANALYSES FOR
SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA

(ug/L, unless otherwise specified)

Parameter	Water Quality Standards and Health Advisories*				Surface Water
	EPA MCL	EPA RMCL	EPA HA	Station No.:	HWDSAW-1
				Date Sampled:	10/10
				Field Sample No.:	DF4025
				Lab Sample No.:	8806
Petroleum Hydrocarbons (mg/L)	—	—	—		ND
Volatile Organic Compounds	—	—	—		ND
Lead**	50	20	20		5
Mercury	2	3	3		ND
Barium	1,000	—	—		85
TDS (mg/L)	—	—	—		180

*Key: MCL = Maximum Contaminant Limit
RMCL = Recommended Maximum Contaminant Limit
HA = Lifetime Health Advisories developed by EPA for noncarcinogenic effects

ND = Not Detected

**Analyzed as part of a priority pollutants scan

1.2 mg/kg to a very high value of 1,900 mg/kg for the area directly outside the fence where the drums were stored. No contamination was reported in the surface soil samples. This portion of the compound is now used to store equipment. The results of the soils analyses are provided in Table 4-13.

4.2.7 Site 12, POL Storage Yard

Geology

Site 12, the POL Storage Yard, is situated on the slopes of the valley of Scope Creek. The MW4 well log indicates bedrock at 10 feet. This bedrock unit is probably the Raytown Member of the Iola Formation. A chert layer was encountered several feet above the bedrock. Groundwater was encountered at the base of the well.

Hydrogeology

The POL storage tanks are situated on a leveled, compacted hillside, and are connected by underground transfer lines. Northwest and upgradient of the site is a man-made pond several acres in extent. Seepage from this pond feeds a marshy area directly northwest of the site and drains into a system of culverts next to the groundwater monitoring well.

Chemical Results

The groundwater and surface water samples show no contamination for the parameters tested. Results of water sample analyses are provided in Table 4-14.

The soil samples from the three hand-auger borings inside the bermed areas show varying amounts of petroleum hydrocarbons but no metals or volatile organics. Soil sample results are provided in Table 4-15. Sample DF4089 was collected from the area of the drain pipe for Building 953, from a depth of 3 feet. This sample showed volatile organic contamination with three purgeable aromatic compounds: benzene (1.25 mg/kg), total xylenes (2.25 mg/kg), and ethylbenzene (6.25 mg/kg).

Table 4-13

RESULTS OF SOIL SAMPLE ANALYSES FOR
SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA

(mg/kg; all concentrations on an as received basis)

Parameter	Date Sampled: Station No.: Depth: Field No.: Lab No.:	10/10 HWDSAS-1 0-6" DF4019 8800	10/10 HWDSAS-2 0-6" DF4020 8801	10/10 HWDSAS-3 0-6" DF4021 8802	10/10 HWDSAS-4 0-6" DF4022 8803	10/10 HWDSAS-5 0-6" DF4023 8804	10/10 HWDSAS-6 0-6" DF4024 8805	10/17 HWDSAB-1 0.5-1.5' DF4042 8969	10/17 HWDSAB-1 9-10' DF4043 8970	10/17 HWDSAB-1 4.5-5.5' DF4044 8971
Volatile Organic Compounds		ND	ND	ND	ND	ND	ND	ND	ND	ND
EP TOX Metals		ND	ND	ND	ND	ND	ND	ND	ND	ND
Petroleum Hydrocarbons		ND	1900	55	46	140	2.9	ND	ND	1.2

ND = Not Detected

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Table 4-14

RESULTS OF WATER SAMPLE ANALYSES FOR
SITE 12, POL STORAGE YARD

(ug/L, unless otherwise specified)

Parameter	Water Quality Standards and Health Advisories*				Ground-Water	Surface Water	
	EPA MCL	EPA RMCL	EPA HA	Well No.:	POLW-1	POLUP	POLDN
				Date Sampled:	10/21	10/17	10/17
				Field Sample No.:	DF4060	DF4045	DF4046
				Lab Sample No.:	8979	8983	8984
Petroleum Hydrocarbons	--	--	--		ND	ND	ND
Volatile Organic Compounds	--	--	--		ND	ND	ND
TDS (mg/L)	--	--	--		540	NR**	NR**

*Key: MCL = Maximum Contaminant Limit
RMCL = Recommended Maximum Contaminant Limit
HA = Lifetime Health Advisories developed by EPA for noncarcinogenic effects

ND = Not Detected

**Not run due to error in field sheets.

Table 4-15

RESULTS OF SOIL SAMPLE ANALYSES FOR
SITE 12, POL STORAGE YARD

(mg/kg; all concentrations on an as received basis)

Parameter	Date Sampled: / Station No.: / Depth: / Field No.: / Lab No.:	10/28 POLHB-1 1.0' DF4079 9343	10/28 POLHB-1 2.1' DF4080 9344	10/28 POLHB-1 6.0' DF4081 9345	10/28 POLHB-2 1.0' DF4082 9346	10/28 POLHB-2 2.8' DF4083 9347	10/28 POLHB-2 6.0' DF4084 9348	10/28 POLHB-3 1.0' DF4085 9349	10/28 POLHB-3 3.0' DF4086 9350	10/28 POLHB-3 5.0' DF4087 9351	10/28 POLHB-3 5.0' DF4087D 9352	10/28 POLS-1 0.5' DF4088 9353	10/28 POLS-2 3.0' DF4089 9596
Volatile Organic Compounds													
• Benzene		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.25
• Total Xylenes		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.25
• Ethylbenzene		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.25
EP TOX Metals		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Petroleum Hydrocarbons		93	390	6.9	67	270	44	9.9	1500	11	28	2800	100

ND = Not Detected

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4.3 SIGNIFICANCE OF FINDINGS

4.3.1 Site 1, South Landfill

No contamination was detected leaving this site via surface migration into Scope Creek, based on the analyses of surface soil and water samples. Relatively low concentrations of petroleum hydrocarbons (1.2 mg/kg, 16 mg/kg) were detected in the subsurface soils. The extractable organic compound DBP, the only organic compound detected, was at low concentrations (10 to 16 µg/L), but it also appeared in the method blank (below 10 µg/L). Consequently, DBP has been attributed to laboratory contaminants.

4.3.2 Site 2, Northeast Landfill

With the exception of the extractable DBP, no organic chemicals or metals were reported in any water samples taken at the site. Because DBP was reported in concentrations (14 to 17 µg/L) minimally above sample blank value (13 µg/L), the presence of this chemical has been attributed to laboratory contamination.

Five anions were reported above detection limits. Only a single sample of sulfate at 280 µg/L exceeded a standard or criterion. Since this is a non-mandatory secondary standard set for aesthetic (taste and odor) considerations, the relatively minor exceedance, and the fact that there is no drinking water well nearby, should not represent any material threat to human health.

For soils, no metals exceeded normal ranges for western Missouri soils. The only detectable contaminant was petroleum hydrocarbons, reported at concentrations ranging from non-detectable to 440 mg/kg.

4.3.3 Site 6, North Burn Pit Area

Only three organics (chloroform, tetrachloroethylene, and methylene chloride) were detected in water samples from Site 6. Concentrations of two of the organics (below 1 µg/L) were significantly below EPA HAs. The third, methylene chloride, detected in a single groundwater sample, was well below the EPA HA.

No metals were reported above normal ranges for western Missouri soils. The only organic contaminant reported in soils above detection

limits was petroleum hydrocarbons. Concentrations of petroleum hydrocarbons in 14 of the 15 samples taken at various depths ranged from non-detectable to 5.4 mg/kg. A single surface sample had a value of 34 mg/kg. In summary, the low concentrations found at the site indicate no undue risk to human health or the environment.

4.3.4 Site 8, Herbicide Burial Area

No detectable concentrations of any contaminant were reported in the single surface water sample taken at Site 8. Concentrations of metals in the four surface soil samples did not exceed the normal range of concentrations reported in western Missouri soils. In addition, no organic contamination was detected in the soil samples. Consequently, the data do not indicate that Site 8 presents an undue risk to human health or the environment.

4.3.5 Site 9, Oil-Saturated Area

No contaminants were detected in the single surface water sample at Site 9.

Results of the soil sample analyses indicate significant lead and petroleum hydrocarbon contamination of site soils. In six of nine samples, concentrations of lead fell within the normal range for western Missouri soils. In the same samples, petroleum hydrocarbon concentrations were relatively low (non-detectable to 9 mg/kg). In the remaining three samples, however, lead concentrations (117 to 343 mg/kg) greatly exceeded the normal range (10 to 20 mg/kg). In these same samples, petroleum hydrocarbons were also high (670 to 3,000 mg/kg). As these were samples taken from the surface (0- to 1-foot depth), humans would be subject to direct contact with high concentrations of lead from the site, warranting consideration of removal.

For the purpose of analyzing the potential human health risk related to lead exposure, it is assumed that humans ingest a maximum of 1 gram of soil daily during activities at the site. This number is extremely conservative (health protective), as it is based on the soil intake for small children--that segment of the population with highest soil intake as estimated by the Agency for Toxic Substances and Disease Registry (ATSDR 1986). Assuming 100% absorption of soil contaminants in

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1 gram of soil, these intakes attributable to ingestion of onsite soils are then compared to the daily intake of lead regarded by EPA as acceptable as demonstrated by the current use of this limit in developing the RMCL of 20 µg/L for lead.

An Acceptable Daily Intake (ADI) for adults related to soil lead ingestion has been derived based on the EPA proposed RMCL of 20 µg/L and the following assumptions:

- Ingestion of 2 liters per day (L/day) for a 70-kg adult.
- Twenty percent of the ADI is contributed by water ingestion. This assumption is based on methodologies used to estimate revised drinking water standards (EPA 1985a).
- Intake of lead except by ingestion of drinking water and by the soil-related pathways is minimal.
  For an adult:

  20 µg/L x 2 L/day = 40 µg/day from ingestion of water

  40 µg/day ÷ 0.2 = 200 µg/day from all sources

  200 µg/day - 40 µg/day = 160 µg/day from all sources excluding water ingestion, which is the Adjusted Acceptable Daily Intake (AADI) for soil for adults

In order that the AADI not be exceeded, the corresponding soil concentration must be no higher than 160 mg/kg.

4.3.6 Site 10, Hazardous Waste Drum Storage Area

The storage of hazardous waste drums in this compound does not appear to have contaminated the surface and subsurface soils. The only contaminants in soil were petroleum hydrocarbons, with concentrations ranging from non-detectable to 1,900 mg/kg. In six of the nine samples, concentrations were low (less than 9 mg/kg). However, concentrations were high (670 to 3,000 mg/kg) in three samples taken at 0- to 1-foot intervals, and removal of soils from these areas should be considered. The single surface water sample contained barium (85 µg/L) and lead (5 µg/L) significantly below the EPA standards or criteria. No other contaminants were detected in the sample. It appears that the remedial efforts undertaken at this site have cleaned up any problems that may

have been associated with the storage of drummed hazardous materials here. These efforts included: overpacking drums, removal of stained soil, and scraping the asphalt surface. These efforts were undertaken as a result of a Notice of Violation issued by EPA.

4.3.7 Site 12, POL Storage Yard

The one groundwater and two surface water samples taken at Site 12, the POL Storage Yard, revealed no contamination above detection limits. In the 12 soil samples, petroleum hydrocarbon concentrations were relatively low (6.9 to 44 mg/kg). Removal of soils in the areas of the seven samples with higher concentrations (67 to 2,800 mg/kg) should be considered. In addition, a single sample collected near the drain pipe outlet for Building 953 at a depth of 3 feet contained concentrations of benzene (1.25 mg/kg), total xylenes (2.25 mg/kg), and ethylbenzene (6.25 mg/kg), indicative of contamination by gasoline or a similar petroleum hydrocarbon.

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5. ALTERNATIVE MEASURES

This section discusses the alternative measures that can be taken at each of the seven sites. The alternatives have been devised based on the results of the Phase II Stage 2 investigations. A "no-action" alternative is considered for each site. Recommendations as to the most appropriate alternatives are presented in Section 6.

5.1 SITE 1, SOUTH LANDFILL

No significant contamination of surface water, surface soils, or subsurface soils was found at this site. Minor amounts of petroleum hydrocarbons (less than 16 mg/kg) were detected in one of the surface runoff pathways and at the base of the borehole. No monitoring wells exist on this site.

Alternatives for this site include:

- No action. This alternative is applicable should it be decided that the levels of contaminants detected in the samples do not require further action.

- Long-term monitoring. Seasonal fluctuations in groundwater and rainfall could have accounted for the minor amount of seepage found in the Phase II Stage 2 investigation. Under this alternative, areas of the two known seeps would be resampled periodically and searches would be made for additional seeps.

- Installation of upgradient monitoring wells. Two wells could be installed in association with this landfill, one to the west and one to the south. The west well would test the marshy area which is the source for Seep 2; the south well would determine if sufficient recharge for water samples to be taken could be developed from the area of Borehole 7. This borehole showed a small amount of water and traces of hydrocarbons near its base. The south well

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might also indicate whether contaminants have migrated from the South Burn Pit Area, an area that was never clearly located and was not part of the Phase II Stage 2 investigation. The South Burn Pit Area was believed to be located south of the South Landfill.

5.2 SITE 2, NORTHEAST LANDFILL

No significant contamination was detected in association with this site. The utilization of the site for landfilling operations is much more extensive than was previously thought. A soil sample taken from below the fill material indicates that the liquids in the landfill are not penetrating into underlying soil. In two samples at the 1- to 2-foot depth, petroleum hydrocarbons were reported at 78 and 440 mg/kg. This landfill, no longer USAF property, is leased to Kansas City Aviation Company and is being used to store excess property and large refuse items. The USAF should survey the perimeter of the landfill area and present this information to the current property owner and include it in the deed to the property. This will alert the owner as to any limitations on future uses of the land, including future construction and improvements. Already, a sewer line has been cut through the south edge of the landfill. It is not known what effect the intersection with the landfill will have on the integrity of that sewer system in the years to come.

Alternatives for this site include:

- No action. If it is determined that there is no threat to the surrounding environment, no further action would be necessary.
- Long-term monitoring. As part of the base groundwater sampling plan, the five wells at the landfill could be sampled to monitor the continued integrity of the landfill and as a check on the area groundwater quality.

5.3 SITE 6, NORTH BURN PIT AREA

Three volatile organics were detected in perched groundwater at this site--chloroform and tetrachloroethylene at concentrations significantly below drinking water standards or criteria, and methylene chloride in a single sample at a concentration of 37 µg/L, an order of magnitude below the EPA drinking water health advisory. There is very little groundwater, and no deep aquifers are threatened. Soil gas

readings indicated that organic vapor contamination is confined within the perimeter of the site. Soil contamination was limited to low concentrations of petroleum hydrocarbons, which were not found in any water sample.

Alternatives for this site include:

- No action. This alternative would be applicable if it is decided that the levels of contaminants detected in these samples do not warrant action. The concentrations observed have been below federal drinking water standards and there are no receptors.

- Long-term monitoring. Seasonal rainfall could recharge the two wells on this site which were essentially dry at the time of the Phase II Stage 2 investigation. The wells could be monitored for evidence of a contaminant plume by sampling for organic contamination.

- Installation of additional monitoring wells. The northeast monitoring well could be nested with a deeper well (drilled to bedrock) to determine if the organic contamination observed in the shallow wells is migrating along the weathered bedrock interface. A monitoring well could be installed outside the compound to the east, near the outfall from the oil-water separator. This would provide a check on the efficiency of this unit and could aid in locating seeps from lower stratigraphic units.

5.4 SITE 8, HERBICIDE BURIAL AREA

There is no conclusive data on the location of the trench or the characterization of this site. No soil borings were made and so no subsurface soil samples were collected.

Alternatives for this site include:

- No action. If it is determined on the basis of present information that the amounts of herbicides buried at this site and the mode of containment do not constitute an environmental problem, no further action would be necessary.

- Additional investigation. Additional effort to locate the trench should include locating and examining aerial photographs not previously available and performing a ground conductivity survey over the suspected area. Once the trench is located, testing and sampling could begin by drilling a series of 10-foot boreholes in the four corners of the trench area. Also, a sediment sample could be taken from the pond downgradient of the trench.

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5.5 SITE 9, OIL-SATURATED AREA

Surface soil was found to be contaminated with petroleum hydrocarbons and lead. Levels of lead exceeded 160 mg/kg, the criterion derived for protection of human health (see Section 4.3.5). In addition, concentrations of petroleum hydrocarbons in three of the nine soil samples in the 0- to 1-foot depth were very high. Access to the site, and therefore to these materials, is limited.

Alternatives for this site include:

- No action. Since there is little chance of direct contact, it may be determined that the levels of contaminants detected do not warrant further action.
- Preparation for Phase IV actions. This action would require the removal of contaminated soils and gravel, after identifying the volume to be removed.

5.6 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA

Only minor contamination of surface water was detected in association with this site. The concentrations of the two contaminants detected, lead and barium, were below drinking water standards. Petroleum hydrocarbon values were high (up to 1,900 mg/kg) along the south fence line. The sources may include spillage, dripping from the numerous heavy vehicles and smaller vehicles (grass mowers) now present in this compound. Storage of drums containing petroleum products in the compound may also have been a source.

Alternatives for this site include:

- No action. Due to the absence of detectable contamination resulting from the storage of hazardous waste drums at this site, no further action is warranted.
- Identification of petroleum hydrocarbon hot spots. This option would require delineating the areas of high petroleum hydrocarbon contamination, in preparation for removal actions (Phase IV).

5.7 SITE 12, POL STORAGE YARD

Site 12, the POL Storage Yard, is the distribution center for all fuels and propellants on the base. The groundwater south of the

facility is free from contamination. Soils inside the tank berms indicate significant petroleum hydrocarbon accumulations (concentrations ranged upwards to 2,800 mg/kg). Volatile organic contamination was detected in the subsurface outside of Building 953, a pumphouse. Additional pumphouses are present, but were not sampled. The contaminated soil sample came from an area where a broken drain pipe from the pumphouse is thought to be located.

Alternatives for this site include:

- No action. If the levels of contaminants identified are determined not to be excessive for present operation of the site, then no further action is warranted.
- Long-term monitoring. After the installation of a monitoring well during Phase II Stage 2, sampling and analysis of this well on a periodic basis would serve to monitor groundwater conditions at this site.
- Additional subsurface soil sampling. The area of greatest environmental concern is located east of the pumphouses. A series of shallow hand-auger borings could be taken in a grid pattern to determine the extent of organic contamination in the soil.

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6. RECOMMENDATIONS

The recommendations presented in this section are based on the results of the Phase II Stage 2 investigation. Each of the sites investigated has also been listed by category (I, II, or III) based on requirements for work (see Table 6-1). Category I sites, where sufficient data exist to rule out public health or environmental hazards, require no further action. Category II sites require additional investigations to better quantify or assess the extent of contamination. Category III sites require remedial actions as part of the next stage of the IRP. Such actions may include long-term monitoring. Several of the sites fall within more than one category. The site-specific recommendations presented in this section were selected as the most appropriate of the alternatives presented in Section 5. Table 6-2 summarizes the recommendations. Table 6-3 lists the methods of analysis.

6.1 SITE 1, SOUTH LANDFILL - CATEGORY I

No further action is recommended for this site since no contamination was found except for very low concentrations of petroleum hydrocarbons in the subsurface soil samples. The presence of petroleum hydrocarbons may be attributed to major oil production at locations just west of the site. Groundwater at the site could not be monitored due to the proximity of the landfill to Scope Creek. The surface water samples in the creek should have detected groundwater contamination, if present, as this is the most likely migration route of contamination.

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Table 6-1

LIST OF SITES BY CATEGORY

Category I - No Further Action Recommended

- Site 1: South Landfill

Category II - Additional Site Assessment Recommended

- Site 4: West Burn Area
- Site 6: North Burn Pit Area
- Site 8: Herbicide Burial Area
- Site 12: POL Storage Yard

Category III - Remedial Action Recommended

- Site 2: Northeast Landfill
- Site 6: North Burn Pit Area
- Site 9: Oil-Saturated Area
- Site 10: Hazardous Waste Drum Storage Area

Table 6-2

SUMMARY OF RECOMMENDATIONS

Site 1 - South Landfill

- No further action.

Site 2 - Northeast Landfill

- Monitor five monitoring wells biannually for 2 years.
- Monitor land use at landfill biannually for 2 years.

Site 4 - West Burn Area

- Perform a soil gas survey to locate the site.
- Install three monitoring wells.
- Sample the surface and subsurface soils.

Site 6 - North Burn Pit Area

- Install two additional monitoring wells, a second well in northeast corner of site, well to be drilled to bedrock or 30 feet, and one outside the compound to the east (20 feet).
- Monitor five wells biannually for 2 years.

Site 8 - Herbicide Burial Area

- Locate the burial trench using aerial photos and a ground conductivity survey. Drill four shallow borings (10 feet) and sample soil for pesticides, mercury, and arsenic.
- Excavate and remove buried pesticides from trench.

Site 9 - Oil-Saturated Area

- Remove oil-contaminated sediments from along the fence line.

Site 10 - Hazardous Waste Drum Storage Area

- Remove oil-contaminated surficial soils.

Site 12 - POL Storage Yard

- Install four monitoring wells to bedrock.
- Monitor wells.

Table 6-3

METHODS OF ANALYSIS FOR RECOMMENDED SAMPLES

Parameter	Methods	
	Soil	Water
Halogenated Volatile Organics	SW 5030/8240	SW 5030/8010
Aromatic Volatile, plus xylenes	SW 5030/8240	SW 5030/8020
Semi-Volatile Organics	SW 3550/8270	SW 3510/8270
Pesticides	SW 3550/8080	SW 3510/8080
Herbicides	SW 8150	SW 8150
Petroleum Hydrocarbons	SW 3550/E418.1	EPA 418.1
Phenols	SW 8270	EPA 625
Metals		
Arsenic	SW 3050/6010	SW 7060
Cadmium	SW 3050/6010	SW 3005/6010
Chromium	SW 3050/6010	SW 3005/6010
Copper	SW 3050/6010	SW 3005/6010
Lead	SW 3050/7421	SW 3005/7421
Mercury	SW 7471	SW 7470
Nickel	SW 3050/6010	SW 3005/6010
Zinc	SW 3050/6010	SW 3005/6010
Soil Moisture Content	EPA 160.3	

6.2 SITE 2, NORTHEAST LANDFILL - CATEGORY III

Long-term monitoring is recommended for this site to detect changes in groundwater quality. Sampling of the five wells twice each year is recommended. One sampling period should occur during peak seasonal recharge (May-June). The second sampling period should occur six months later (January-February) during the dry season. Water samples should be tested in the field for pH, conductivity, and temperature. Laboratory analysis should be performed for: VOAs plus xylenes, metals, and petroleum hydrocarbons. The results should be compared for two years. If no contamination is observed, monitoring can be eliminated and the wells removed.

If sampling results indicate contamination, resampling should be performed more frequently to determine if concentrations change throughout the year. The results of the sampling would be used to develop additional alternative measures.

Long-term monitoring would also provide a check on the general status of the landfill.

A detailed survey of the landfill should be made and provided to the landowner for inclusion with the deed to the property. The landfill was found to be much more extensive than originally thought.

6.3 SITE 4, WEST BURN AREA

A soil gas and geophysical survey is recommended to more precisely locate this site and to help determine the locations for soil borings. Also, aerial photographic analysis should be performed to determine the location and the approximate period of operation.

Three soil borings should be drilled around the site. Soil and groundwater samples should be collected from the borings and analyzed for volatile organics and petroleum hydrocarbons. If contamination is found, wells should be installed to determine the extent of contamination.

This site is located on land owned or leased by the City of Kansas City. Access to the site must be granted by the Kansas City Aviation Department.

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6.4 SITE 6, NORTH BURN PIT AREA - CATEGORIES II and III

Two additional wells and long-term monitoring are recommended for this site to detect changes in groundwater quality and to confirm concentrations of volatile organics and methylene chloride. One 20-foot well would be located outside the east boundary of the site near the outfall for the oil-water separator, and the other would be nested with the existing well in the northeast corner of the compound (see Figure 6-1). The nested well would be drilled to bedrock (or 30 feet) and would be used to determine if the volatile organic compounds detected in the two shallow wells are traveling along the soil/bedrock interface. Resampling of the three existing wells is recommended, since so little water was available for sampling during October, even though a major rainfall event had recently occurred. Sampling of the five wells twice each year is recommended. One sampling period should occur during peak seasonal recharge (May-June). The second sampling period should occur six months later (January-February) during the dry season. Water samples should be analyzed in the field for pH, conductivity, and temperature. Laboratory analyses should be performed for VOAs plus xylenes, metals, and petroleum hydrocarbons. The results for two years should be compared. If no contamination is observed, monitoring can be eliminated and the wells abandoned.

If sampling results continue to indicate contamination, resampling should be done more frequently to determine if concentrations change throughout the year. If no contamination is detected or if concentrations are so low as not to present any environmental problems, this would allow for recategorization of the site to Category I status. If contamination is found, the results of the samplings would be used to determine additional alternative measures.

6.5 SITE 8, HERBICIDE BURIAL AREA - CATEGORY II

Since there is no direct evidence of the location of Site 8, the Herbicide Burial Area, additional investigations are recommended. During the presurvey investigation information was sketchy about the amounts of herbicide buried and dimensions of the burial area. with currently available information, it is recommended that a soil conductivity survey be run over a grid pattern designed to precisely locate

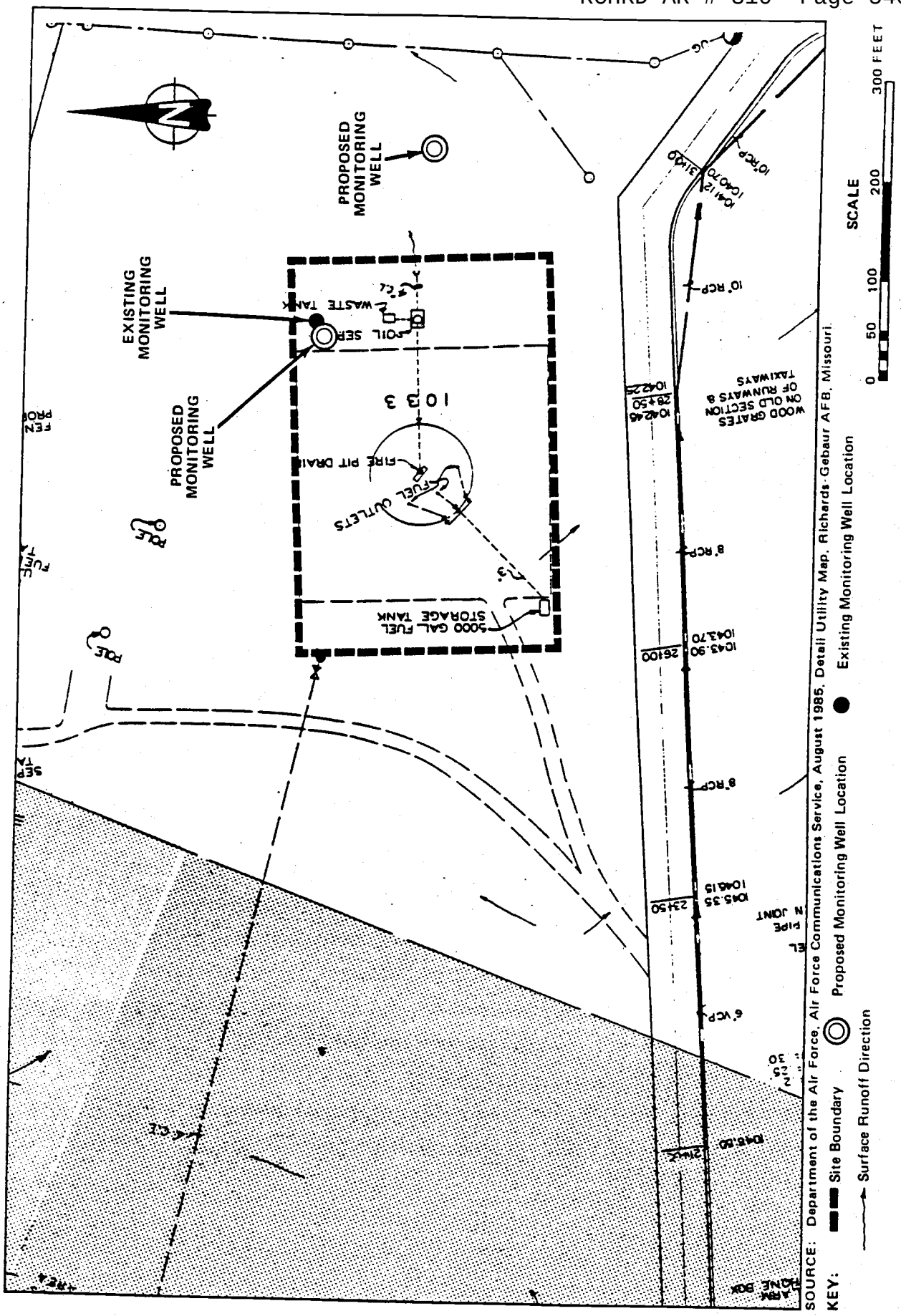


Figure 6–1 PROPOSED LOCATIONS OF MONITORING WELLS AT SITE 6, NORTH BURN PIT AREA

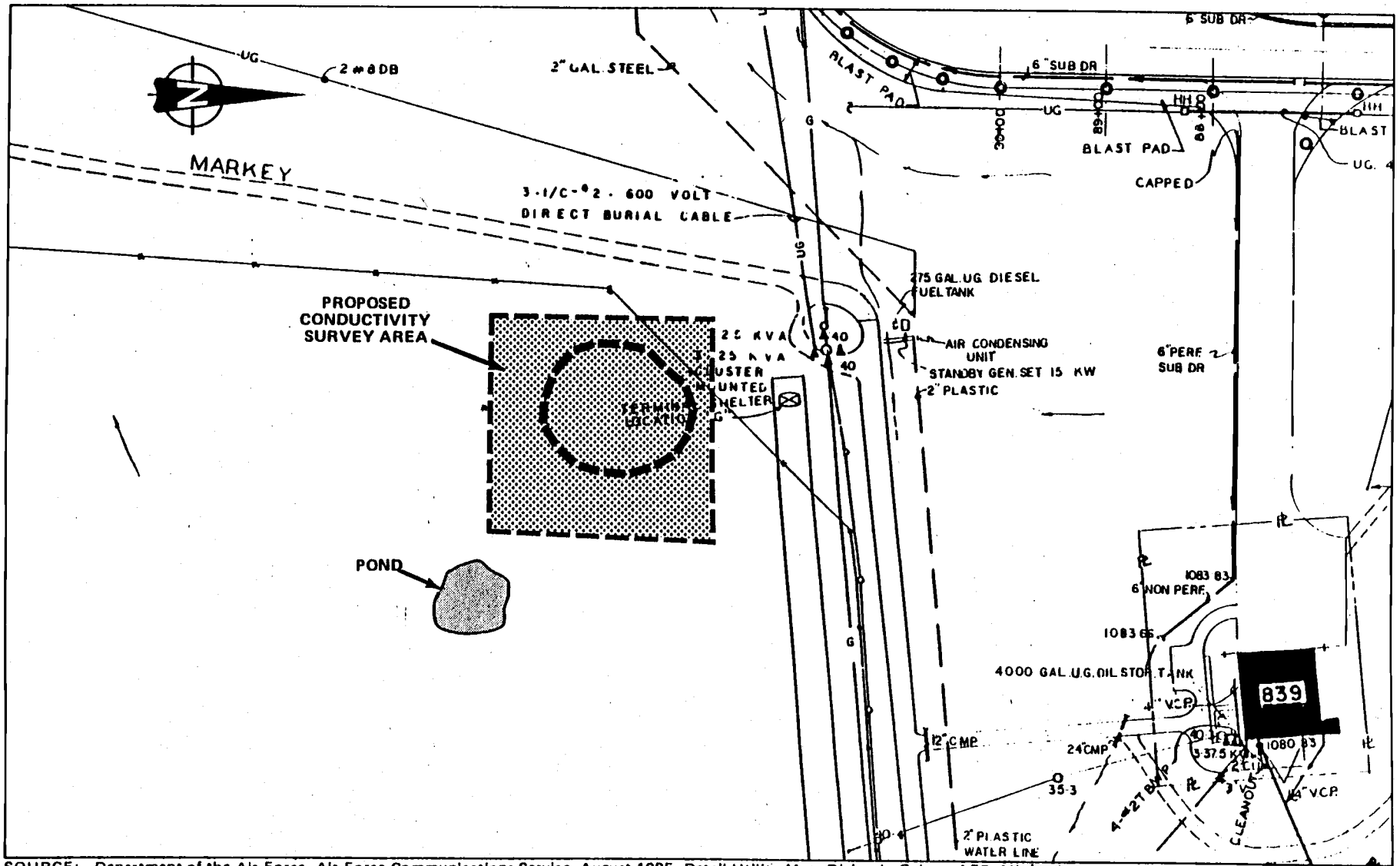
a 10- by 10-foot trench (see Figure 6-2). If additional aerial photos can be found, they should be reviewed. When the trench is located, four shallow soil borings (10 feet deep) should be drilled downgradient of the trench area. Two soil samples should be taken from the borings and tested for herbicides, mercury, and arsenic. If no contamination is detected, a decision should be made whether to leave the material in place or remove it from the soil. If contamination is detected, install two monitoring wells into the chert layer, downgradient of the site.

6.6 SITE 9, OIL-SATURATED AREA - CATEGORY III

Although access to the site is limited, the concentrations of lead and petroleum hydrocarbons are considered unacceptable, and a remedial cleanup of the southwest corner of the fence line can be undertaken. Based on samples taken during the field investigation, the greatest contamination occurs at the fence line. An unknown amount of fill has been used at the site to level the ground surface. As much as 3 feet of fill was observed in the borehole. It is not known for certain if the high concentrations along the fence line are due to disposal of waste oil at the fence line or if contamination is due to oil leaks associated with vehicle maintenance in the parking lot which drains to the southwest corner of the fence line. No sample could be taken of the fill material in the top few feet of the borehole. Judging from the thickness of the fill material, this corner of the compound has apparently been resurfaced or regraded several times.

To remove the oil-contaminated material, as much as 56 cubic yards of material might have to be removed (see Figure 6-3) from an area 50 feet long by 10 feet wide by 3 feet deep. This amount can be cut by two-thirds if the contamination is limited to an area near the fence line. Limited cleanup could be performed to reduce hydrocarbon and lead values to an acceptable level. Confirmatory sampling should be conducted prior to backfilling.

Since the contamination is restricted to ditches and behind the fence, users of the field adjacent to the site are not at risk.



SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY: Site Boundary; Boundary of Proposed Conductivity Survey; Surface Runoff Direction

SCALE: 0 50 100 200 300 FEET

Figure 6–2 PROPOSED LOCATION OF CONDUCTIVITY SURVEY AT SITE 8, HERBICIDE BURIAL AREA

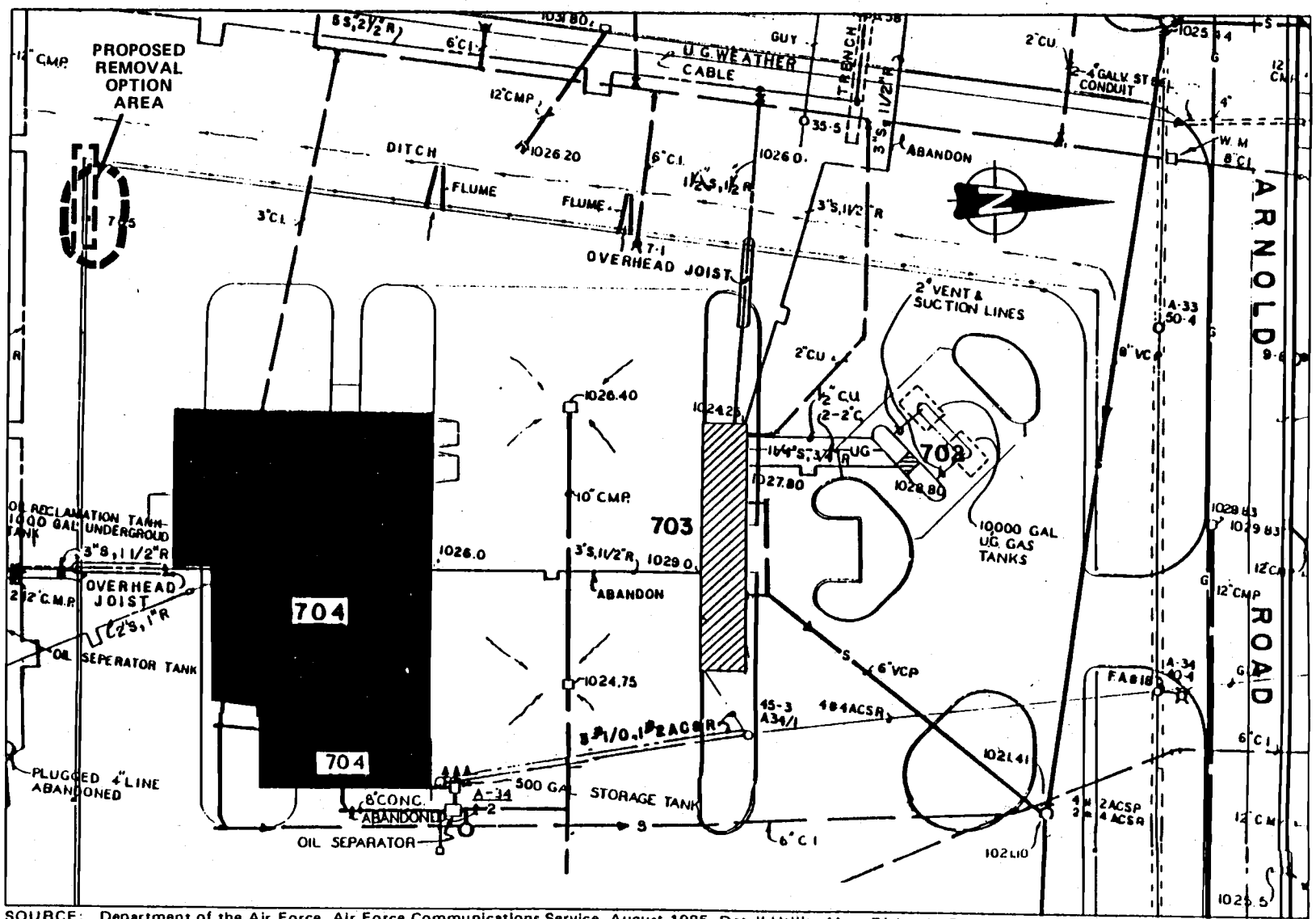


Figure 6–3 PROPOSED LOCATION OF REMOVAL OPTION AT SITE 9, OIL SATURATED AREA

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6.7 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA - CATEGORY III

Removal of the surficial soils containing high levels of petroleum hydrocarbons is recommended for this site. No evidence of contamination associated with the storage of hazardous waste drums was found in surface water samples or surface and subsurface soil samples. Analyses for semi-volatiles are recommended as part of the monitoring program during the removal process.

6.8 SITE 12, POL STORAGE YARD - CATEGORY II

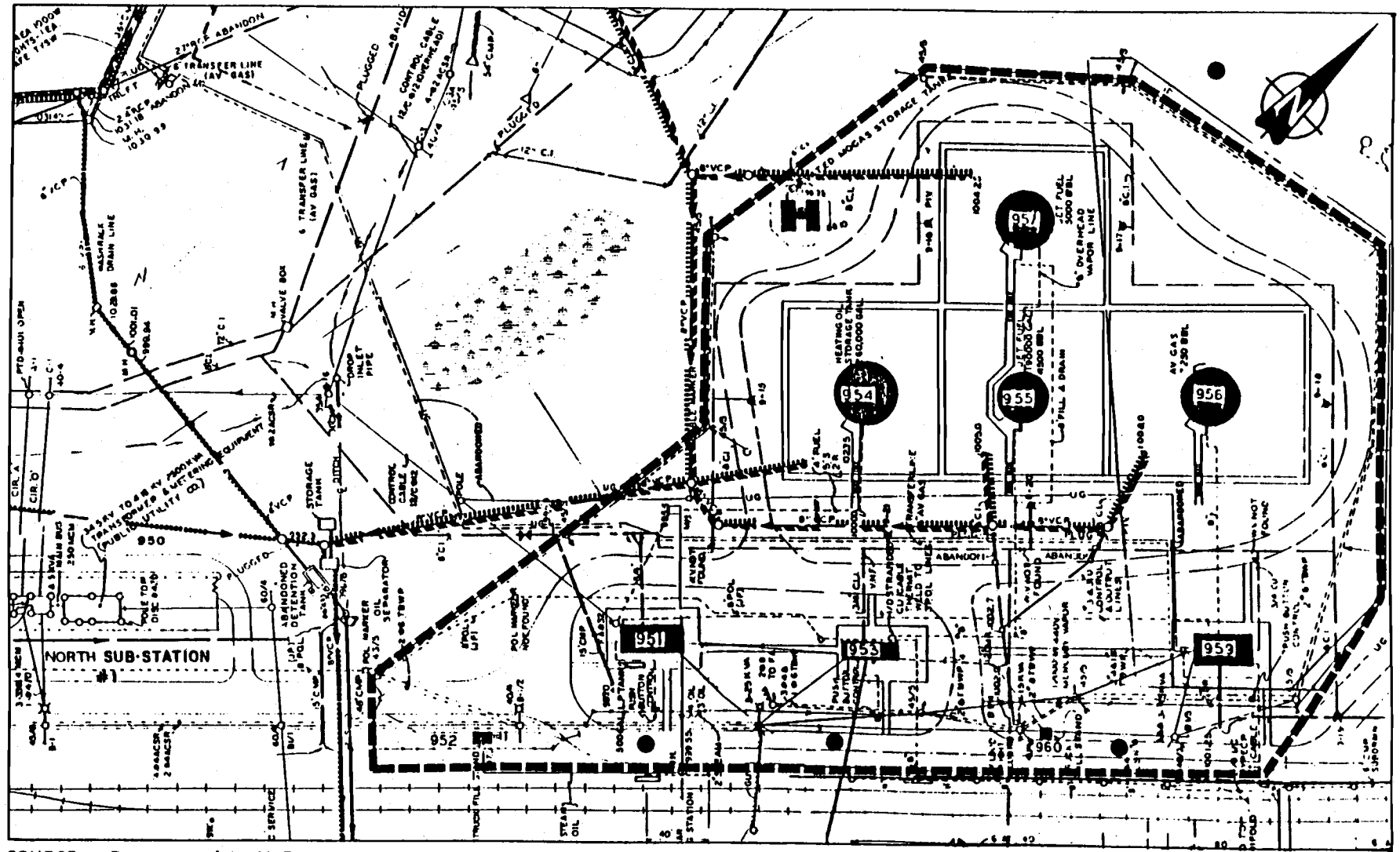
Because the POL Storage Yard is an active fuel storage area, spills of petroleum products are to be expected and contaminated soil within the yard is not unusual. It is necessary to determine if contaminants are migrating from the yard. Installation of four monitoring wells is proposed to monitor the site. The upgradient well would be located along the road on the north side of the yard. Three downgradient wells would be located along the road southeast of the yard. Piping diagrams of the area will be studied and geophysical methods employed in order to determine the exact location of these wells prior to drilling. Figure 6-4 shows the locations of the proposed wells.

The monitoring wells would be sampled during the peak recharge season (May and June) and again during the dry season (January and February). Water samples should be analyzed in the field for pH, conductivity, and temperature. Laboratory analysers should be performed for VOAs plus xylenes, metals, and petroleum hydrocarbons. If no contamination is observed, monitoring can be eliminated and the wells removed.

If sampling results indicate contamination, resampling should be performed more frequently during the year. These results would be used to determine additional alternative measures.

6.9 WELL ABANDONMENT

Currently, there are no wells to be abandoned; however, after additional sampling, some sites may require no further action. At these sites the monitoring wells which may have been installed should be properly abandoned.



SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY: Site Boundary ● Proposed Well Locations → Surface Runoff Direction

SCALE 0 50 100 200 FEET

Figure 6–4 LOCATION OF PROPOSED WELL LOCATIONS AT SITE 12, POL STORAGE YARD

In accordance with Missouri Department of Natural Resources, Division of Geology and Land Survey requirements for well abandonment, E & E recommends that the outer steel casing be removed and the inner PVC casing be cut off below the ground surface. The remaining well casing should be filled with a neat cement grout to within 3 feet of the surface and the remainder filled with native soil. The surface soil should be mounded slightly, so that runoff does not collect around the abandoned well.

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