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FINAL REPORT

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# 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

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE RESERVE
ROBINS AIR FORCE BASE GEORGIA 31098

REPLY TO ATTN OF: SGPB (Lt Col Hundley, AV 468-6441)

11 JAN 1984

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2. Point of Contact is Lt Col Hundley, AUTOVON 468-6441, Commercial (912) 926-6441. Please forward all comments to this office as soon as possible.

FOR THE COMMANDER

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The Phase II--Field Evaluation of Richards-Gebaur AFB, Missouri, was performed within the context of the Installation Restoration Program. This study implements the recommendations of the Phase I--Records Search.

The specific task was to determine whether environmental contamination of groundwater or surface water had resulted from waste handling and disposal at two landfills (the South Landfill and the Northeast Landfill) near Scope Creek. Environmental samples were collected for each site. Two surface water samples and one leachate sample were collected to monitor the South Landfill, and the Northeast Landfill was monitored by three shallow wells and one sample from Scope Creek. These samples were analyzed for contaminants which could have been produced by the industrial activities reported at Richards-Gebaur AFB in the Phase I--Records Search. One groundwater sample and the leachate sample had phenolics concentrations (4 and 5 ug/L, respectively) which exceeded the Missouri Water Quality Standards for groundwater (1 ug/L).

A limited followup study was recommended involving the installation of two additional wells at the Northeast Landfill and analyses of groundwater and leachate samples.

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 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 $1.0 \times 10^{-6}$ 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

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### 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 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

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[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

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## 4.1 RESULTS OF THE PHASE IIB 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

[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 grouadwater 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)

[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.

## 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 | | | Northeast Landfill | | | | | MISSOURI WATER QUALITY STANDARDS* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Surface Water** | |
| | S-1 | S-2 | L-1 | NE-1 | NE-2 | NE-3 Dup 1 | NE-3 Dup 2 | S-3 | Groundwater | Protection of Aquatic Life | Livestock, Wildlife 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.

***DOC detection limit is 1 mg/l. Other detection limits indicated in table (e.g., <1 ug/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

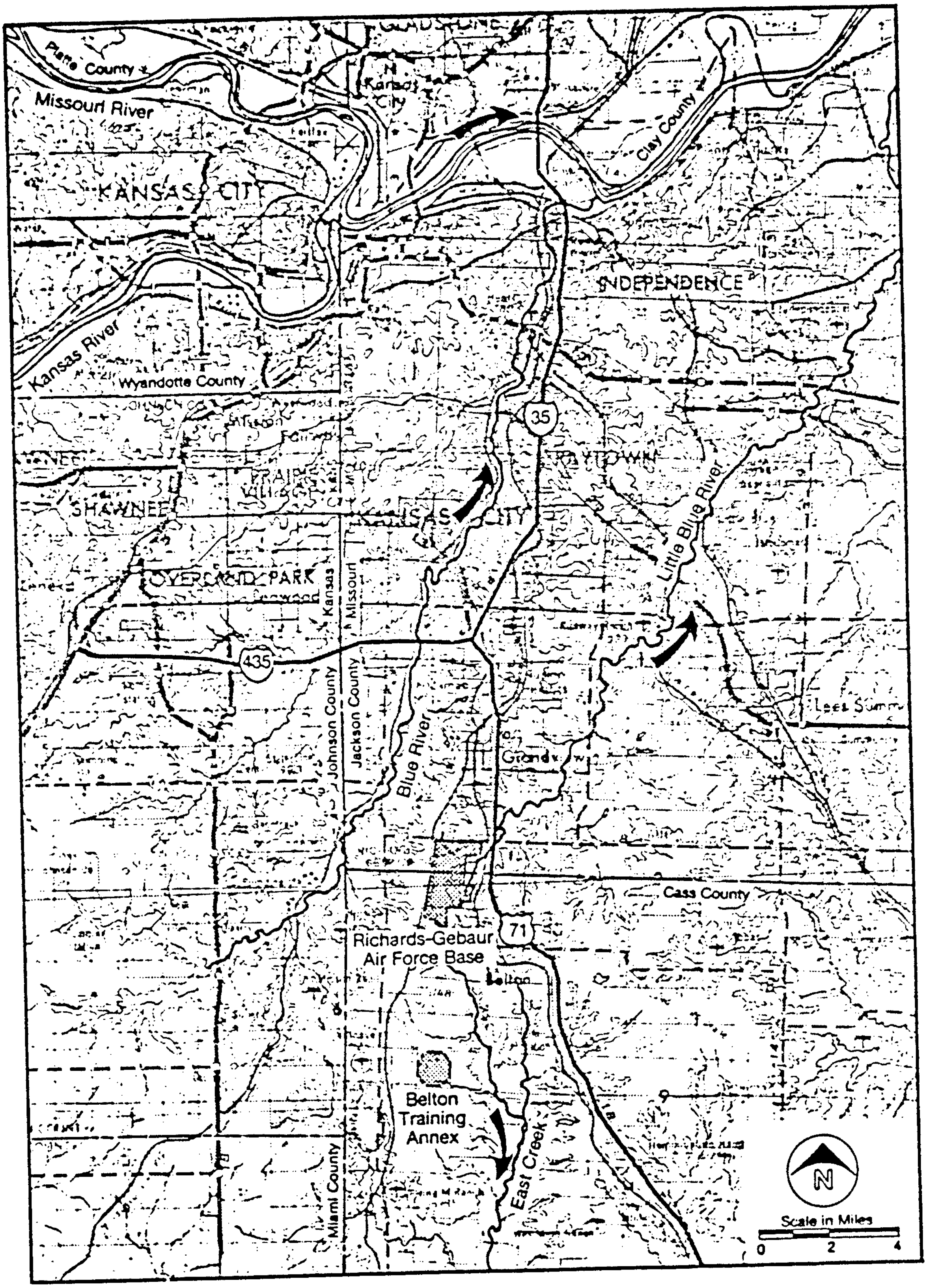


FIGURE 1. Location Map of Richards–Gebaur AFB, Missouri

(After Moccia ETAL., 1983).

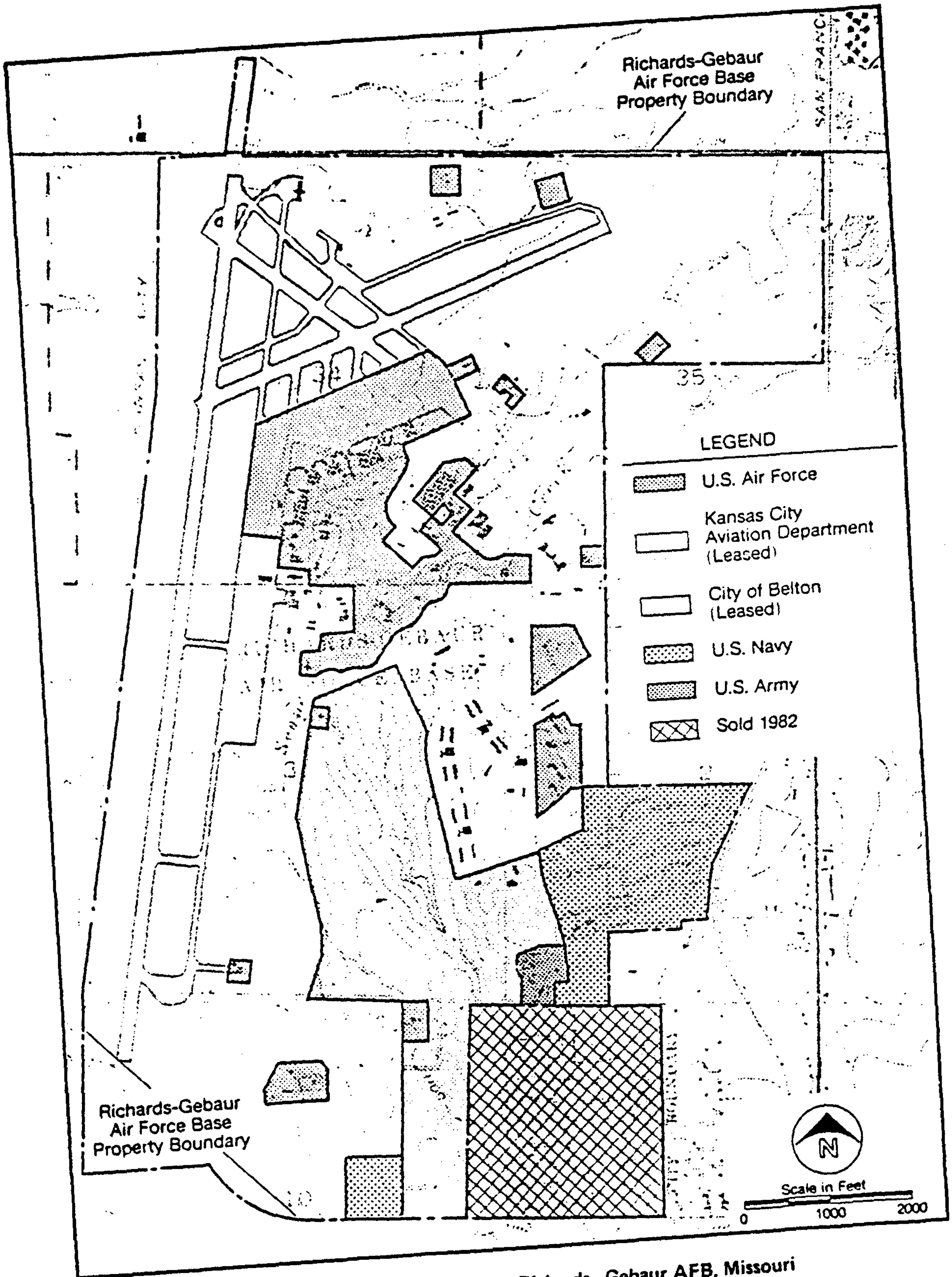


**FIGURE 2. Real Property Areas, Richards–Gebaur AFB, Missouri**

(After Moccia ETAL., 1983).

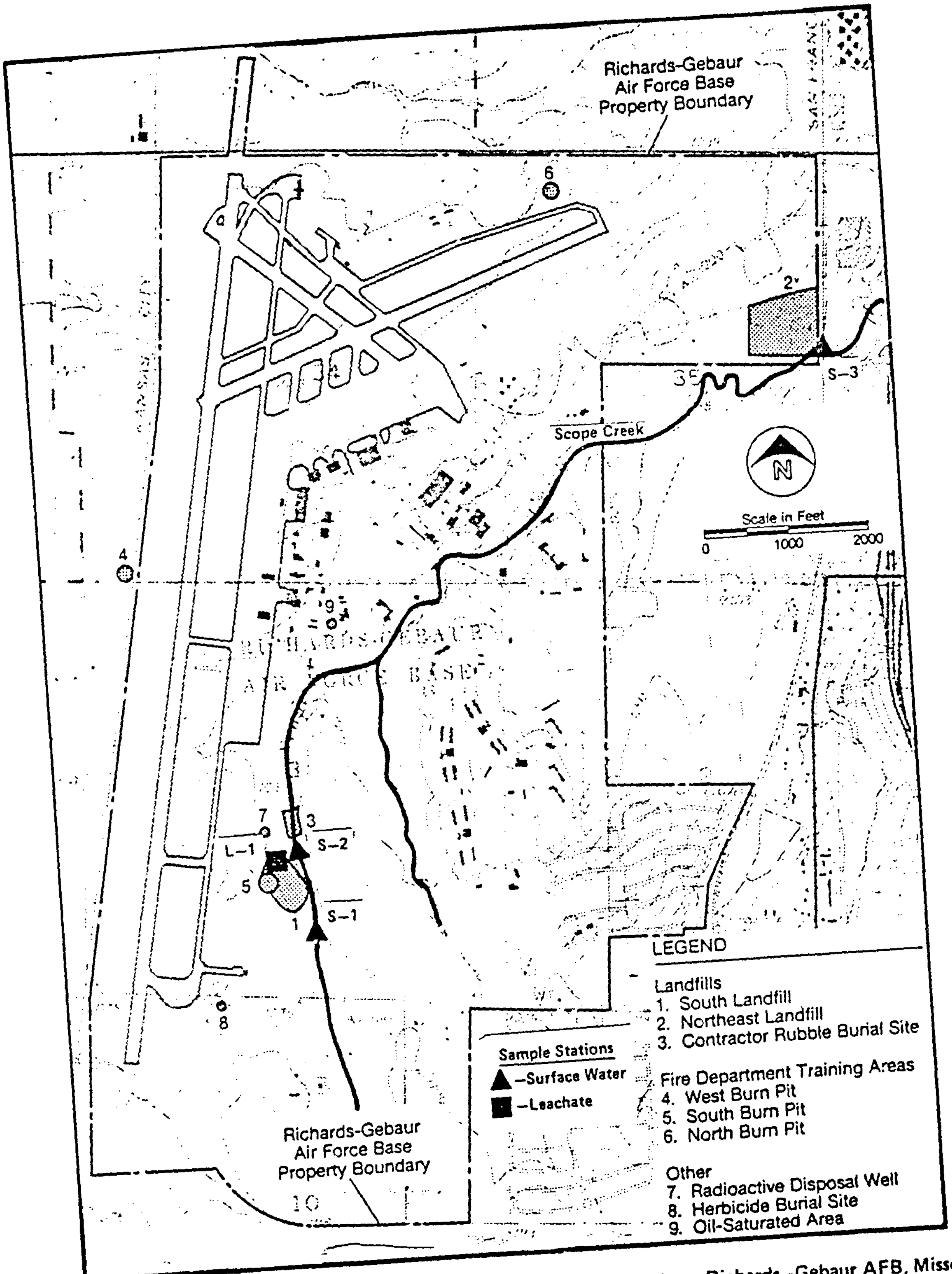


FIGURE 3. Identified Disposal Sites and Surface Water Sampling Stations, Richards–Gebaur AFB, Missouri

(After Moccia ETAL., 1983).

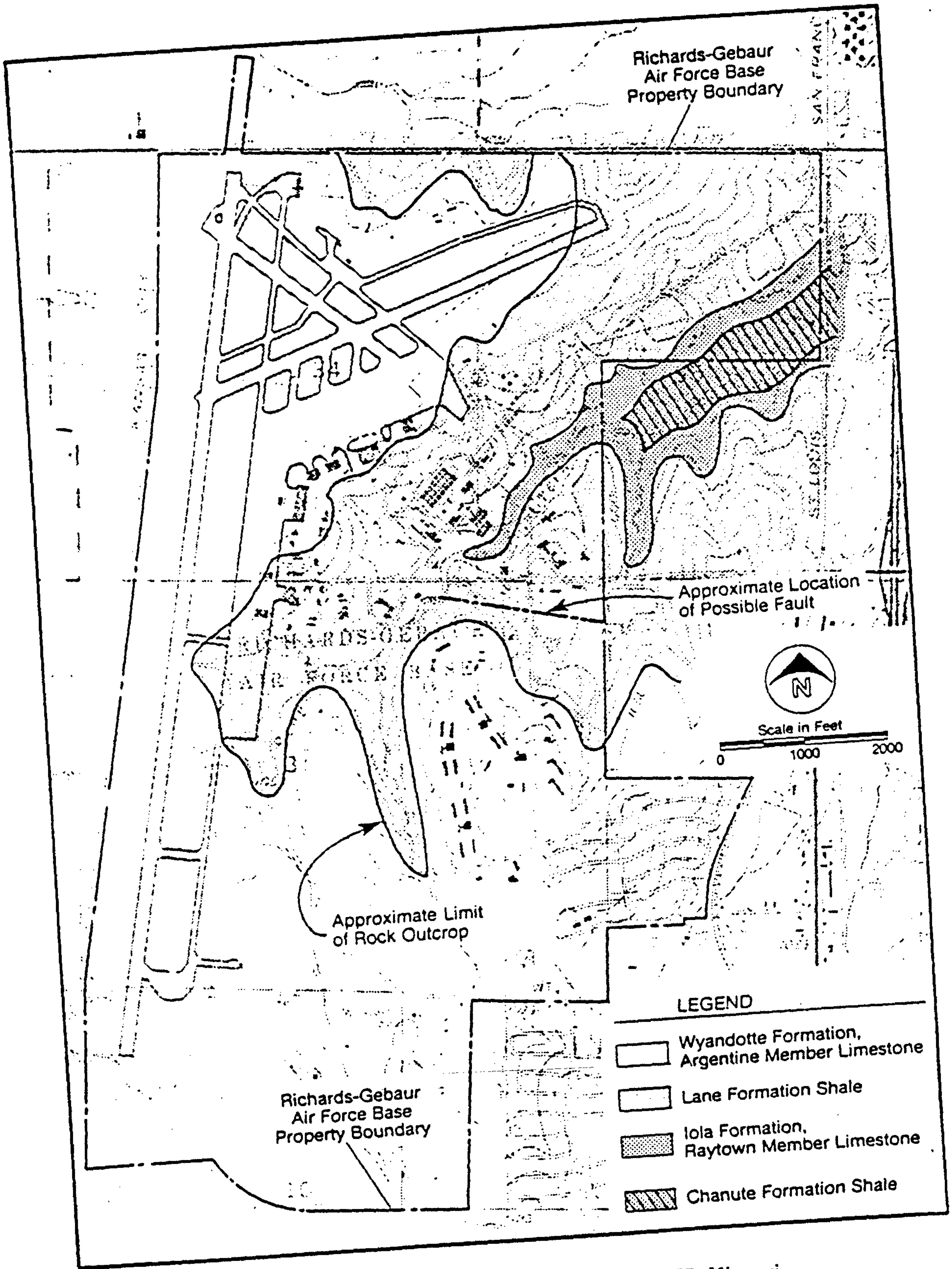


FIGURE 4. Geologic Map of Richards–Gebaur AFB, Missouri

(After Moccia ETAL., 1983).

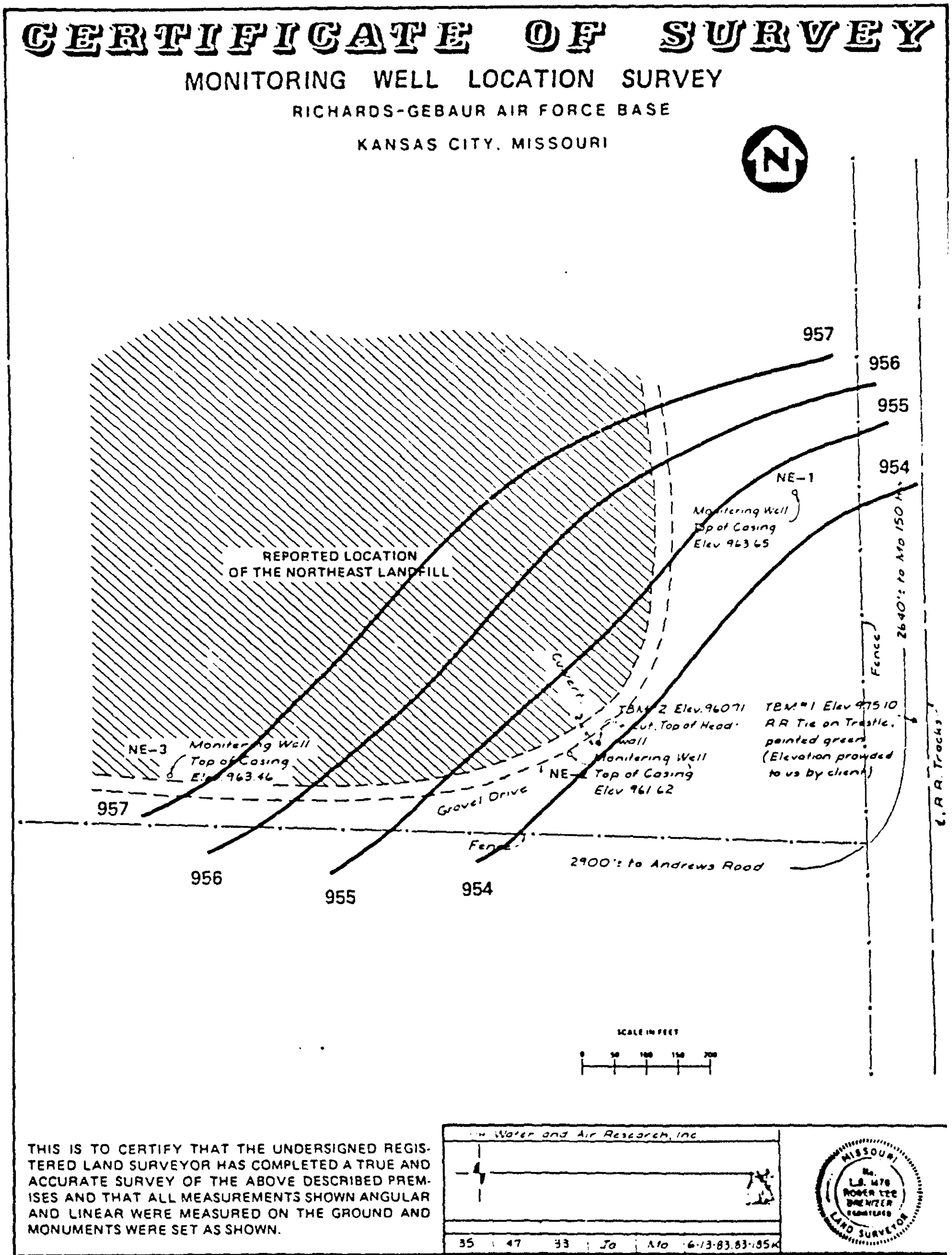


**FIGURE 5.** Well Locations and Water Level Elevations in Soils at the Northeast Landfill, May 1983. (Water level contours by WAR)

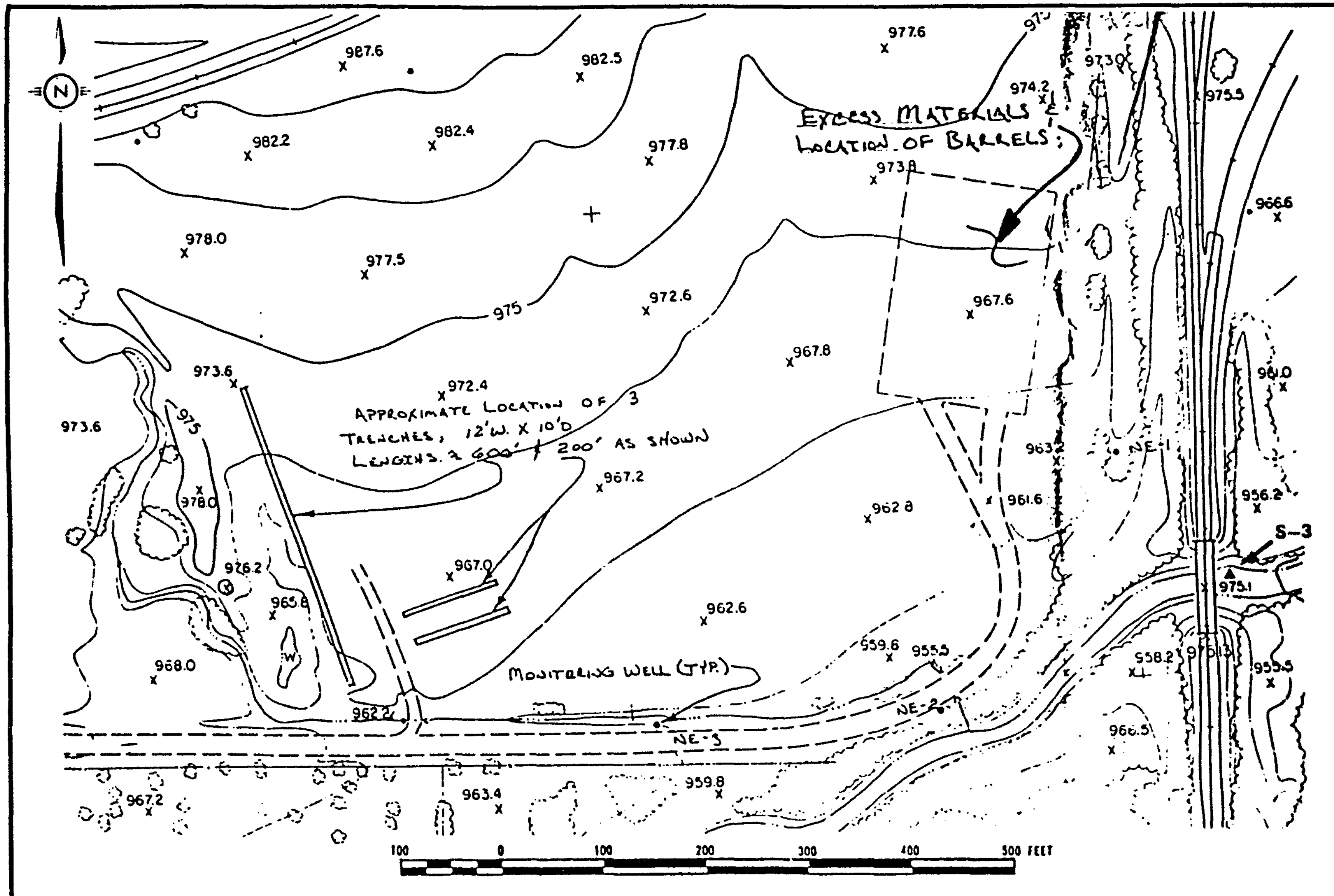


FIGURE 6. Revised Locations of Trenches of the Northeast Landfill

SOURCE: Richards-Gebaur AFB, October, 1983.

## 9.0 REFERENCES

## 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.

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[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.

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

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

[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.

APPENDIX A

WELL LOGS

SHEET 1 OF 1

Boring No. NE-1

Hole Size 12IN x 25.75' Slot 0.10"

Screen Size 4IN x 18.34' Mat'l SCH 40 PVC

Casing Size 4IN 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

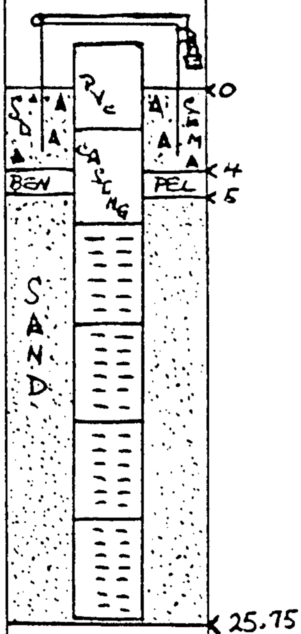
Grout Type SAND CEMENT

Protective Casing 5FT x 6IN IRON

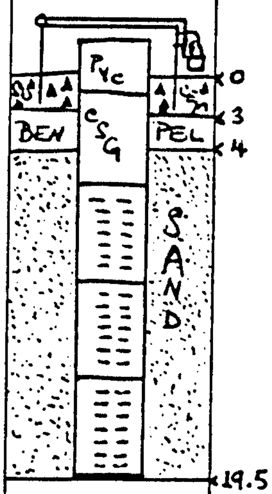
Static Water Level 9.14 FT TOC

Top of Well Elevation 963.65 REL

Drill Type CME-45 c̄ 12IN CFA

| Sketch | Depth (Feet) | Sample | Lithology | USCS | SPT (BL/FT) |
|---|---|---|---|---|---|
|  | | 0 | CLAY, ~5% SLT & VF SD, CL 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 (N 5/). | ROCK | |
| | | 25.75 | SHALE, AS ABOVE | ROCK | RFSL. |

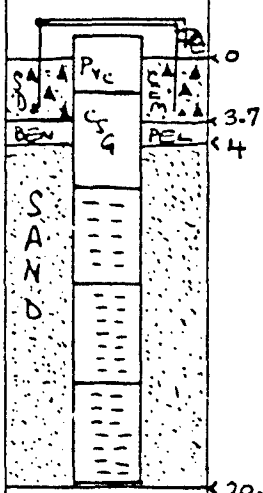
| | |
|---|---|
| Boring No. NE - 2 | Location Coordinates REL LOC |
| Hole Size 12 IN × 19.5' Slot 0.010" | |
| Screen Size 4 IN × 14.19' Mat'l SCH 40 PVC | Filter Materials F-M SAND |
| Casing Size 4 IN × 7.20' Mat'l SCH 40 PVC | Grout Type SAND CEMENT |
| Geologist W. D. ADAMS | Protective Casing 5 FT × 6 IN IRON |
| Date Start 24 MAY 83 Finish 25 MAY 83 | Static Water Level ~7.5 FT TOC |
| Contractor W.A.R. / LAYNE WEST | Top of Well Elevation 961.62 REL |
| Driller O. J. HARPER | Drill Type CME 45 C 12 IN CFA |




| Sketch | Depth (Feet) | Sample | Lithology | USCS | SPT (BL/FT) |
|---|---|---|---|---|---|
| | | Ø | CLAY, ~5% SLT & VF SD, SLT STIFF, MOIST, BLACK. (5Y 2.5/2) | 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 | RFSL |

SHEET 1 OF 1

| | |
|---|---|
| Boring No. NE-3 | Location Coordinates REL LOC. |
| Hole Size 12IN x 20.5' Slot 0.010IN | |
| Screen Size 4IN x 14.22' Mat'l SCH 40 PVC | Filter Materials F-M SAND |
| Casing Size 4IN x 8.46' Mat'l SCH 40 PVC | Grout Type SAND CEMENT |
| Geologist W. D. ADAMS | Protective Casing 5FT x 6IN |
| Date Start 25 MAY 83 Finish 25 MAY 83 | Static Water Level 5.96FT TOC |
| Contractor W.A.R. /LAYNE WEST | Top of Well Elevation 963.46 FT REL |
| Driller O. J. HARPER | Drill Type CME-45 c̄ 12IN CFA |




| Sketch | Depth (Feet) | Sample | Lithology | USCS | SPT (BL/FT) |
|---|---|---|---|---|---|
| | | 0-1½ | 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. HCl 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

# 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: 5/20/83
Time: 1400

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 × 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

# 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: 1515

Sampling Site/Well No.: S2

Sampling Location Description: ______

| Groundwater Samples | | Surface Water and Sediment Samples | |
|---|---|---|---|
| Depth to water surface | | Total Depth | 4 inches |
| Height of water column | | Sample Depth(s) | < surface |
| pH | | pH | 6.4 |
| Sp. cond. | at °C | Sp. cond. | 56 x 10 at 19 °C |

| Container ~~Sample~~ No. | Container | Parameters to be Analyzed | Preservation Method | SAMPLE ~~Container~~ No. |
|---|---|---|---|---|
| | | Water Samples | | |
| G3 | 1 qt. glass | Oil & Grease | HCl to pH<2,4°C | 14188 |
| P4 | 8 oz ~~1 qt.~~ glass | Phenols | $H_3PO_4$ to pH<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

## 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: 5/26/83
Time: 1730 SUNNY

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

| Groundwater Samples | | Surface Water and Sediment Samples | |
|---|---|---|---|
| Depth to water surface | | Total Depth | 2 inches |
| Height of water column | | Sample Depth(s) | surface |
| pH | | pH | 5.9 |
| Sp. cond. ___ at ___ °C | | Sp. cond. | 64 X 10 at 19 °C |

| ~~Sample~~ Container 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 | 8 oz ~~1 qt.~~ glass ✓ | Phenols | $H_3PO_4$ to pH<4 ~~2~~, 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 | |

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)

# 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.: W1

Sampling Location Description: well furthest from gate

| Groundwater Samples | | Surface Water and Sediment Samples | |
|---|---|---|---|
| Depth to water surface | 10' 1 5/8" TOC | ~~Total Depth~~ | |
| Height of water column | | ~~Sample Depth(s)~~ | |
| pH | 5.8 | ~~pH~~ | |
| Sp. cond. | 65 x 10 at 13.1 °C | ~~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<4, 1 gm of $CuSO_4$,4°C | 14190 |
| Y101 | 1 l plastic | Heavy Metals | $HNO_3$ to pH<2,4°C | ↓ |
| J11,18 | 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: ______

# 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: ~~[illegible]~~

Sampling Site/Well No.: W 2

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

# 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. 65×10 at 13.2 °C

**Surface Water and Sediment Samples**

Total Depth

Sample Depth(s)

pH

Sp. cond. 48×10 at 13.2 °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 | 8 oz ~~1 qt.~~ glass | Phenols | $H_3PO_4$ to pH<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:

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<4 ~~2~~, 1 gm of $CuSO_4$,4°C | 14193 |
| Q51 | 1 l plastic | Heavy Metals | $HNO_3$ to pH<2,4°C | |
| J3, J4 | 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
93×10



# 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: 11:30

Sampling Site/Well No.: S-3
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 | | |
| 141944 | 1 qt. glass | Oil & Grease | HCl to pH<2,4°C | G-1 |
| | ~~1 qt. glass~~ 8 oz Amber glass | 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; sampled

APPENDIX E

CHAIN OF CUSTODY FORMS

E.S.E.

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

CHAIN OF CUSTODY RECORD

CLIENT:
PROJECT: 7166-Ø8Ø

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 | | | | Y1Ø1 | | | 1419Ø | Chromium, |
| W-2 | | | | Y14 | | | 14191 | Cadmium |
| W-3 | | | | Y1Ø | | | 14192 | (DISSOLVED) |
| W-3 | | | | G51 | | | 14193 | |
| S-3 | | | | Y12 | | | 14194 | |

ALL SAMPLES FILTERED THRU 0.45 μm MEMBRANE & PRESERVED c̄ CONC $HNO_3$

| | | |
|---|---|---|
| Relinquished by: [signature] Organization: | Received by: Tom Park Organization: ESE | Date/Time 5/27/83 11:[illegible] |
| 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

CH2M Hill

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

## CHAIN OF CUSTODY RECORD

CLIENT:
PROJECT: 7166 - Ø8Ø

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 | [illegible] | | X | | 1.15 | 14187 | T.O.C., Phenolics |
| S-2 | P4, T291 | [illegible] | | | | 1.68 | 14188 | |
| L-1 | P1, T296 | <0.005 | | | | 3.24 | 14189 | |
| W-1 | P8, T282 | <0.001 | | | | 0.58 | 14190 | |
| W-2 | P5, T295 | <0.00 | | | | 1.72 | 14191 | |
| W-3 | P9, C8 | <0.004 | | | | 1.67 | 14192 | |
| W-3 | P3, T288 | 0.007 | | | | 2.52 | 14193 | |
| S-3 | P6, T292 | <0.001 | | | | 3.57 | 14194 | |

TOC mg/l from Marlene by phone 6/8/?? 1714

T.O.C. - Filtered thru 0.45 μm membrane filter before acidification c̄ conc. $H_2SO_4$

Phenolics - Preserved c̄ $CuSO_4$ and conc. $H_3PO_4$

| | | |
|---|---|---|
| Relinquished by:<br>Organization: | Received by: Marlene Bernum<br>Organization: CH2M Hill | Date/Time<br>5/27/80 |
| Relinquished by:<br>Organization: | Received by:<br>Organization: | Date/Time |
| Relinquished by:<br>Organization: | Received by:<br>Organization: | Date/Time |
| Relinquished by:<br>Organization: | Received by:<br>Organization: | Date/Time |
| Relinquished by:<br>Organization: | Received for Laboratory by: | Date/Time |

Method of Shipment: COMPANY COURIER

H.E.&T.

**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: 7166-030

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

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

| Relinquished by / Organization | Received by / Organization | Date/Time |
|---|---|---|
| Relinquished by: Robert D. Baker Jr. Organization: W.A.R. INC. 5/26/93 | Received by: Bruce B Ferguson Organization: Hunter [illegible] | 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.