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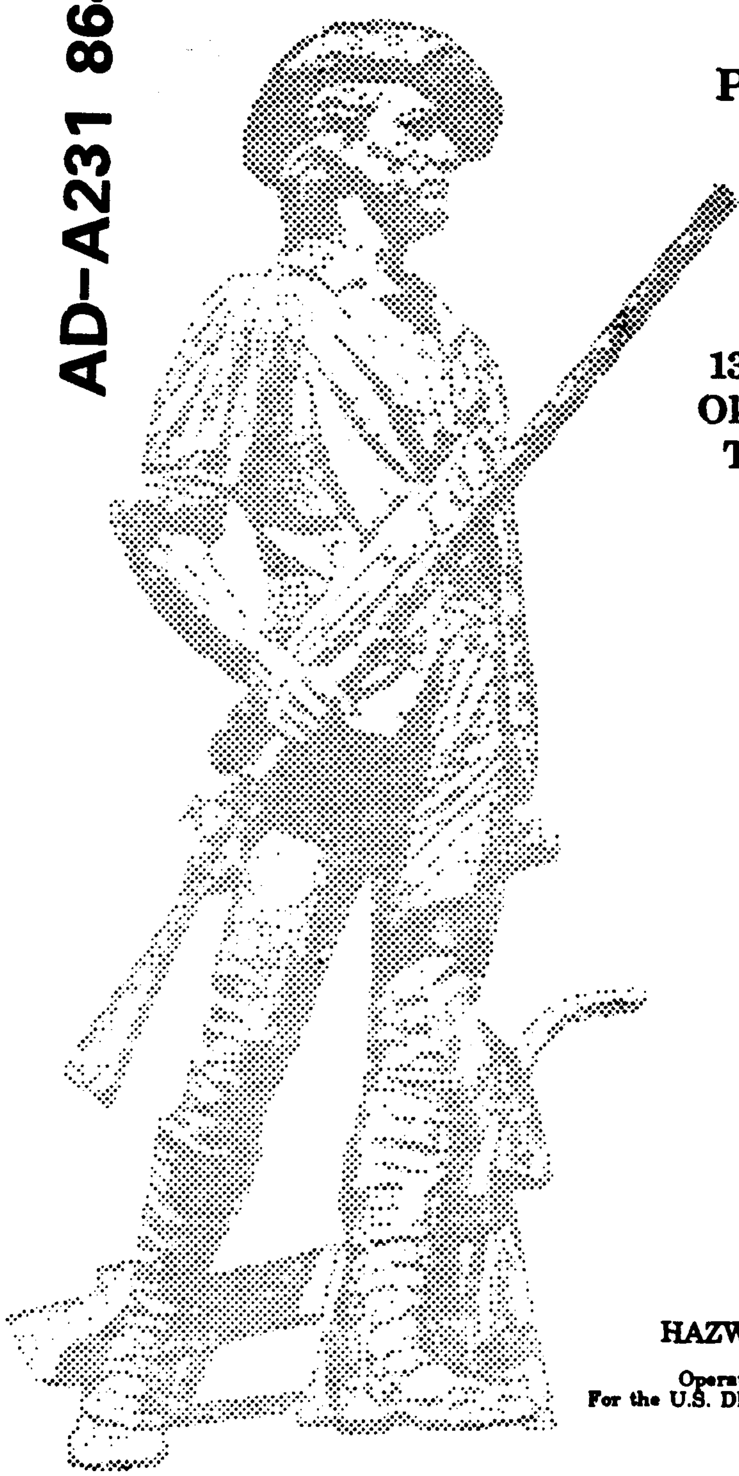

Preliminary Assessment

138th Tactical Fighter Group
Oklahoma Air National Guard
Tulsa International Airport
Tulsa, Oklahoma

November 1989

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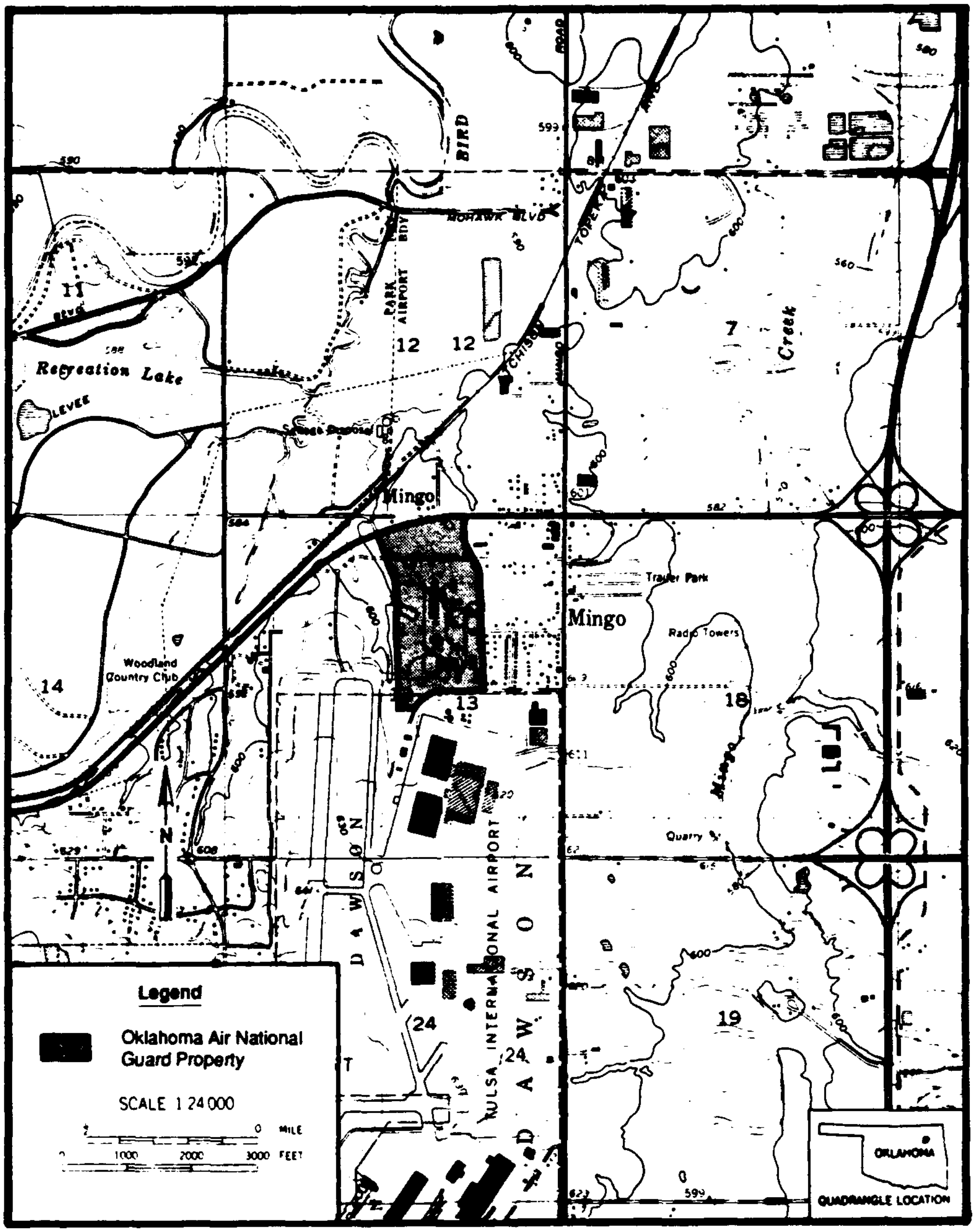

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PRELIMINARY ASSESSMENT

138th TACTICAL FIGHTER GROUP
OKLAHOMA AIR NATIONAL GUARD
TULSA INTERNATIONAL AIRPORT
TULSA, OKLAHOMA

November 1989

Prepared for

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LIST OF TABLES

ACRONYM LIST

AGE	-	Aerospace Ground Equipment
ANG	-	Air National Guard
DEQPPM	-	Defense Environmental Quality Program Policy Memorandum
DoD	-	Department of Defense
DRMO	-	Defense Reutilization and Marketing Office
FEMA	-	Federal Emergency Management Agency
FR	-	Federal Register
HARM	-	Hazard Assessment Rating Methodology
HAS	-	Hazard Assessment Score
HM/HW	-	Hazardous Materials/Hazardous Wastes
HMTC	-	Hazardous Materials Technical Center
IRP	-	Installation Restoration Program
MEK	-	Methyl Ethyl Ketone
MIBK	-	Methyl Isobutyl Ketone
NDI	-	Nondestructive Inspection
NOAA	-	National Oceanic and Atmospheric Administration
NPDES	-	National Pollutant Discharge Elimination System
OWS	-	Oil Water Separator
PA	-	Preliminary Assessment
PE	-	Professional Engineer
PG	-	Professional Geologist
POC	-	Point of Contact
RD & D	-	Research, Development, and Demonstration
RD/RA	-	Remedial Design/Remedial Action
SI/RI/FS	-	Site Investigation/Remedial Investigation/ Feasibility Study
TFG	-	Tactical Fighter Group
USAF	-	United States Air Force
USDA	-	United States Department of Agriculture
USGS	-	United States Geological Survey
UST	-	Underground Storage Tank
UTA	-	Unit Training Assembly

FOREWORD

This Preliminary Assessment (PA) document was originally prepared for the National Guard Bureau (NGB) by the Hazardous Materials Technical Center (HMTC), operated by the Dynamac Corporation. HMTC's contract for conducting PAs ended prior to completion of the final PA document. Subsequently, the NGB requested completion of this PA under an existing contract with the Hazardous Waste Remedial Actions Program (HAZWRAP) Support Contractor Office, operated by Martin Marietta Energy Systems, Inc. for the U.S. Department of Energy. In turn, HAZWRAP subcontracted with Science and Technology, Inc. for completion of the PA document. Science and Technology, Inc. successfully completed this document in November 1989.

Science and Technology, Inc. produced the final document primarily by addressing comments generated by the NGB through review of HMTC draft documents. Since HMTC conducted the PA and prepared the original PA manuscript, the content of this document is principally a reflection of HMTC's efforts.

EXECUTIVE SUMMARY

A. Introduction

The Hazardous Materials Technical Center (HMTC) was retained in August 1988 to conduct the Installation Restoration Program (IRP) Preliminary Assessment (PA) of the 138th Tactical Fighter Group, Oklahoma Air National Guard, Tulsa International Airport, Tulsa, Oklahoma, (hereinafter referred to as the Base).

The Preliminary Assessment included:

- o an on-site visit, including interviews with 30 past and present Base employees, conducted by HMTC personnel during August 8-12, 1988;
- o the acquisition and analysis of pertinent information and records on hazardous material use and hazardous waste generation and disposal at the Base;
- o the acquisition and analysis of available geologic, hydrologic, meteorologic, and environmental data from pertinent Federal, State, and local agencies; and
- o the identification of sites on the Base that are potentially contaminated with hazardous materials/hazardous wastes (HM/HW).

B. Major Findings

Past Base operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. Base shops that used and disposed of HM/HW include Civil Engineering; Nondestructive Inspection (NDI); Aircraft Maintenance; Aerospace Ground Equipment (AGE) Maintenance; Motor Pool; Engine Shop; and Fire Department. Waste solvents, oils, fuels, thinners, photographic chemicals, and inspection chemicals were generated by these shops.

Interviews with past and present Base personnel and a field survey resulted in the identification of one disposal and/or spill site at the Base that is potentially contaminated with HM/HW. This site was assigned a Hazard Assessment Score (HAS) according to the U.S. Air Force Hazard Assessment Rating Methodology (HARM). The following is a brief description of the potential site:

Site No. 1 - Building 304

Since 1981 the Army National Guard has been leasing Building 304 (Nose Dock) from the Air National Guard and using it for helicopter maintenance and equipment storage. The contents of an oil water separator (OWS) located outside of the building have reportedly backed up during heavy peri ls of rain into the building's trench drain and floor joints. Evidence of oil stains can be seen splattered on the wall section near the outlet of the trench drain. This OWS has a 175 gallon holding capacity.

Army personnel have used solvents to clean up the oil, leaving a solvent and waste oil mixture in the floor drain and floor joints and possibly under the building. Paints and paint solvents may have been poured directly into the OWS. There is a potential for migration of these wastes through the floor joints and into the underlying soil and groundwater.

The water table at the Base occurs at depths ranging from 16 to 18 feet. The groundwater in the vicinity of the Base is not used as a source of potable water.

The OWS discharges into the storm sewer to Bird Creek. Discharges of surface water runoff to local waterways may degrade surface water quality.

C. Conclusions

Information obtained through interviews with past and present Base personnel resulted in the identification of one area on the Base where a potential exists for contamination with HM/HW. At Site No. 1 - Building 304, the potential exists for contamination of soils, surface water, or groundwater and subsequent contaminant migration. This site was therefore assigned a HAS according to HARM.

D. Recommendations

Further IRP investigation is recommended for Site No. 1 - Building 304.

I. INTRODUCTION

A. Background

The 138th Tactical Fighter Group, Oklahoma Air National Guard, is located at the Tulsa International Airport, Tulsa, Oklahoma. Past operations at the Base involved the use and disposal of materials and wastes that subsequently were categorized as hazardous. Consequently, the National Guard Bureau has implemented its Installation Restoration Program (IRP). The IRP consists of the following:

- Preliminary Assessment (PA) - to identify past spill or disposal sites posing a potential and/or actual hazard to public health or the environment.

- Site Investigation/Remedial Investigation/ Feasibility Study (SI/RI/FS) - to acquire data via field studies for the confirmation and quantification of environmental contamination that may have an adverse impact on public health or the environment and to select a remedial action through preparation of a feasibility study.

- Research, Development, and Demonstration (RD & D) - if needed, to develop new technology for accomplishment of remediation.

- Remedial Design/Remedial Action (RD/RA) - to prepare designs and specifications and to implement site remedial action.

B. Purpose

The purpose of this Preliminary Assessment is to identify and evaluate suspected problems associated with past hazardous waste handling procedures, disposal sites, and spill sites on the Base. Personnel from the Hazardous Materials Technical Center (HMTC) visited the Base, reviewed existing environmental information, analyzed Base records concerning the use and generation of hazardous materials/hazardous wastes (HM/HW), and conducted interviews with past and present Base personnel familiar with past hazardous materials management activities. A physical inspection was made of the various facilities and of the potential site. Relevant information collected and analyzed as a part of the Preliminary Assessment included the history of the Base, local geologic, hydrologic, and meteorologic conditions that may affect migration of contaminants; local land use and utilities that could affect the potential for exposure to contaminants; and the ecologic settings that indicate environmentally sensitive habitats or evidence of environmental stress.

C. Scope

The scope of this Preliminary Assessment is limited to operations at the Base and includes:

- An on-site visit;
- The acquisition of pertinent information and records on hazardous materials use, hazardous wastes generation, and disposal practices at the Base;
- The acquisition of available geologic, hydrologic, meteorologic, land use, critical habitat, and utility data from various Federal, State, and local agencies;
- A review and analysis of all information obtained; and
- The preparation of a report to include recommendations for further actions.

The on-site visit and interviews with past and present Base personnel were conducted during the period of August 8-12, 1988. The Preliminary Assessment was conducted by Ms. Grace Hill, Task Manager/Environmental Scientist; Ms. Natasha Brock, Environmental Scientist; and Mr. Dev Murali, PG (Hydrogeologist). Other HMTC personnel who assisted with the Preliminary Assessment include Mr. Raymond Clark, PE (Department Manager) and Mr. Mark Johnson, PG (Program Manager) [Appendix A]. Personnel from the Air National Guard Support Center who assisted in the Preliminary Assessment included Mr. Don Williams, Project Officer. The Point of Contact (POC) at the Base was Major Charles Andrle, Base Civil Engineer.

D. Methodology

A flow chart of the Preliminary Assessment Methodology is presented in Figure 1. This methodology ensures a comprehensive collection and review of pertinent, site-specific information and is used in the identification and assessment of potentially contaminated hazardous waste spill/disposal sites.

The Preliminary Assessment begins with a site visit to the Base to identify all shop operations or activities on the installation that may use hazardous materials or generate hazardous wastes. Next, an evaluation of both past and present HM/HW handling procedures is made to determine if any environmental contamination has occurred. The evaluation of past HM/HW handling practices is facilitated by extensive interviews with past and present employees familiar with the various operating procedures at the Base. These interviews also define the areas on the Base where any HM/HW, either intentionally or inadvertently, may have been used, spilled, stored, disposed of, or otherwise released into the environment.

Historic records contained in the Base files are collected and reviewed to supplement the information obtained from interviews. Using this information, a list of past HM/HW spill/disposal sites on the Base is developed. A general survey tour of the identified sites, the Base, and the surrounding area is conducted to determine the presence of visible contamination and to help assess the potential for contaminant migration. Particular attention is given to locating nearby drainage ditches, surface water bodies, residences, and wells.

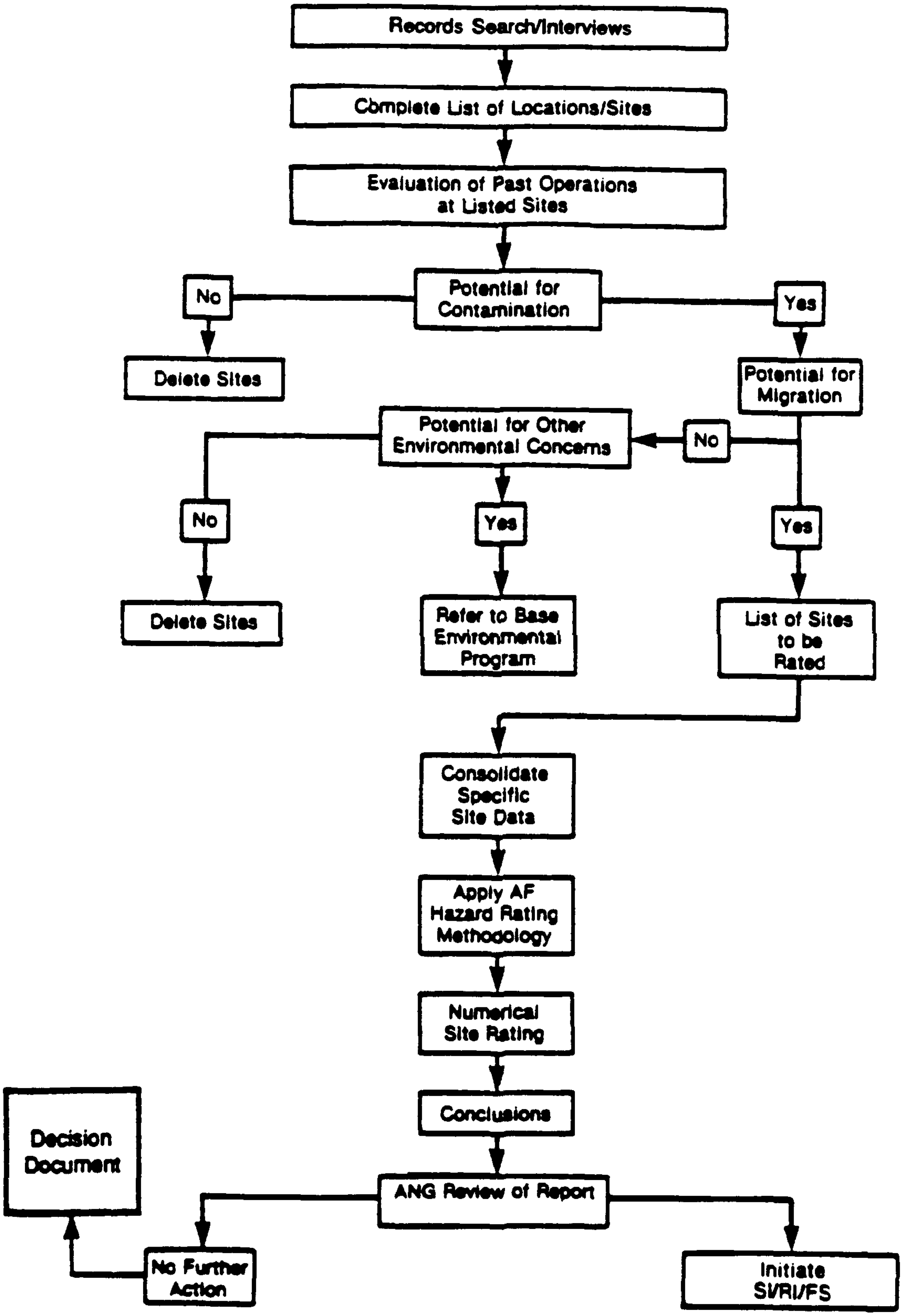
Detailed geologic, hydrologic, meteorologic, land use, and environmental data for the area of study are also obtained from the POC and from appropriate Federal, State, and local agencies. A list of outside agencies contacted is in Appendix B. Following a detailed analysis of all the information obtained, areas are identified as suspect where HM/HW disposal and/or spills may have occurred. Where sufficient information is available, potential sites are assigned a Hazard Assessment Score (HAS) using the U.S. Air Force Hazard Assessment Rating Methodology (HARM) [Appendix C]. However, the absence of a HAS does not necessarily negate a recommendation for

HMTC PRELIMINARY ASSESSMENT INSTALLATION RESTORATION PROGRAM

Figure 1.

Preliminary Assessment Methodology Flow Chart.

DECISION TREE



further IRP investigation but may indicate a lack of data. The HAS is computed from the data included in the Factor Rating Criteria (Appendix D).

II. INSTALLATION DESCRIPTION

A. Location

The Base is located on the northeast side of the Tulsa International Airport, which is located in Tulsa County within the northeast portion of Tulsa, Oklahoma. It is in Section 13 of Township 20 North, Range 13 East. The airport is bordered by Mingo Creek to the east. To the northwest of the airport are Mohawk Park, Recreation Lake, and the Mohawk Park Sanitary Landfill. Further northwest about three miles is Lake Yahola.

A very small number of commercial/industrial establishments, including the Tulsa International Airport, are located within a 1-mile radius of the Base. The area directly east of the Base is residential. The residential population within a 1-mile radius of the Base is calculated by using the Tulsa, Oklahoma and Mingo, Oklahoma Quadrangle Topographic Maps, 1982; by counting residential property; and by assuming each dwelling unit has 3.8 residents (47 FR 31233). The residential population is 874. The full-time, weekday employee population of the Base is 350. The Base population increases to 1112 personnel on Unit Training Assembly (UTA) weekends. American Airlines facilities within a 1-mile radius of the Base employ 8252 persons. The total population within a 1-mile radius of the Base is estimated at 10,238. Figure 2 shows the location and boundary of the Base covered in this Preliminary Assessment.

B. History of Base

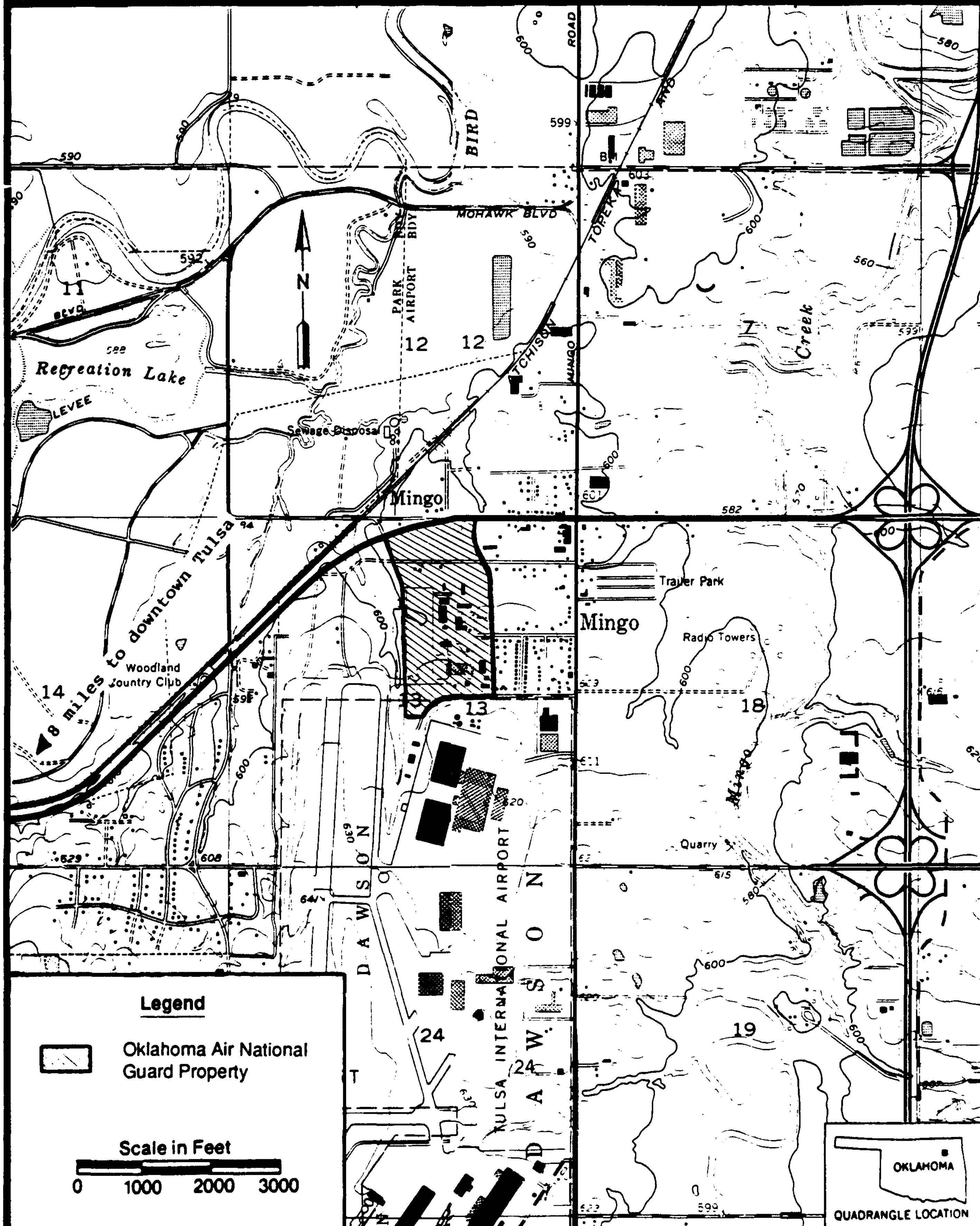
The first Air National Guard Unit in Oklahoma was organized as the 125th Observation Squadron, Oklahoma National Guard, Tulsa, Oklahoma, in December of 1940. It was Federally reorganized January 31, 1941. The squadron was ordered into active military service as the 125th Observation Squadron at Tulsa on September 15, 1941 and moved to Fort Sill, Oklahoma on September 20, 1941.

Overseas duty was the next assignment for the 125th. The unit arrived at Liverpool, England on D-Day in 1944 and was attached to the Ninth Army for Liaison and Messenger Duty Missions until being returned to State control on July 15, 1945.

HMTC

Source: U.S.G.S. Map
7.5 minute series
Tulsa Quadrangle, 1982
Mingo Quadrangle, 1982

Figure 2.
Location Map of the 138th TFG, Oklahoma Air National Guard, Tulsa International Airport, Tulsa, Oklahoma



The squadron was reorganized as the 125th Fighter Squadron on February 15, 1947. The unit mission aircraft at the time of reorganization was the F-51. The Squadron was redesignated as the 125th Fighter Bomber Squadron (Jet) on March 15, 1950 with the F-84 as the mission aircraft. During the Korean conflict, the squadron was ordered into active military service from October 10, 1950 to July 10, 1952. After returning to State control, the unit was gradually converted to the F-80 aircraft.

On August 1, 1957, the 125th Fighter Bomber Squadron became part of a larger Air National Guard unit organized at Tulsa. This larger unit was known as the 138th Fighter Group (AD) flying F-86 aircraft.

In January 1960, a complete change of mission resulted from the decision of United States Air Force and Air National Guard to assign C-97 aircraft to the Air National Guard with the object of supporting the military air transport service with its strategic airlift. The 125th Fighter Squadron converted to an Air Transport Squadron on January 15, 1960, and the remainder of the units were converted to Air Transport Units on September 1, 1960. In August 1961, the 138th Air Transport Group (H) was reassigned to the 146th Air Transport Wing (H), ANG, Van Nuys, California. During the Berlin crisis, the 138th Group was ordered into active military service on October 1, 1961. The Group was based at Tulsa, Oklahoma and was assigned to the 146th Air Transport Wing (H) (MATS). The Tulsa unit provided airlift support for the Western Transport Air Force (MATS) until relieved from active duty on August 31, 1962.

The unit converted from C-97 aircraft to C-124 aircraft in February 1968 and resumed its role as a Tactical Fighter Unit in October 1972 with the assignment of T-33 aircraft in preparation for the F-100 conversion. It was Federally reorganized as the 138th Tactical Fighter Group on January 25, 1973. In April 1978, the unit converted to A-7D aircraft receiving the first one that month.

Changes in aircraft and mission are responsible for many operational changes, including changes in quantities, types, and methods of disposal of hazardous materials. An aircraft conversion is often accompanied by variations in routine maintenance. Changing the engine oil, testing the engine, lubricating the plane, and washing the aircraft are just a few maintenance operations that could change.

Operational changes also occur because of changes in policies, standards, personnel, and technology. Liquid and solid wastes that were once disposed of in the environment are now recycled or disposed of by contractors. Oil water separators have greatly reduced the amount of liquid wastes released into the environment. Also, the awareness of hazardous materials has further reduced environmental impacts, as has the introduction of substances such as biodegradable compounds. The majority of hazardous wastes are now collected and disposed of through contractors or the Defense Reutilization and Marketing Office (DRMO).

III. ENVIRONMENTAL SETTING

A. Meteorology

The meteorological data in this section was compiled for the Tulsa, Oklahoma area by the National Oceanic and Atmospheric Administration (NOAA). The climate of this area is one of mild winters and long, hot summers.

The average annual temperature is 50 degrees. Temperatures in the summer months average in the high 80s, and during the winter months, they average in the mid 30s.

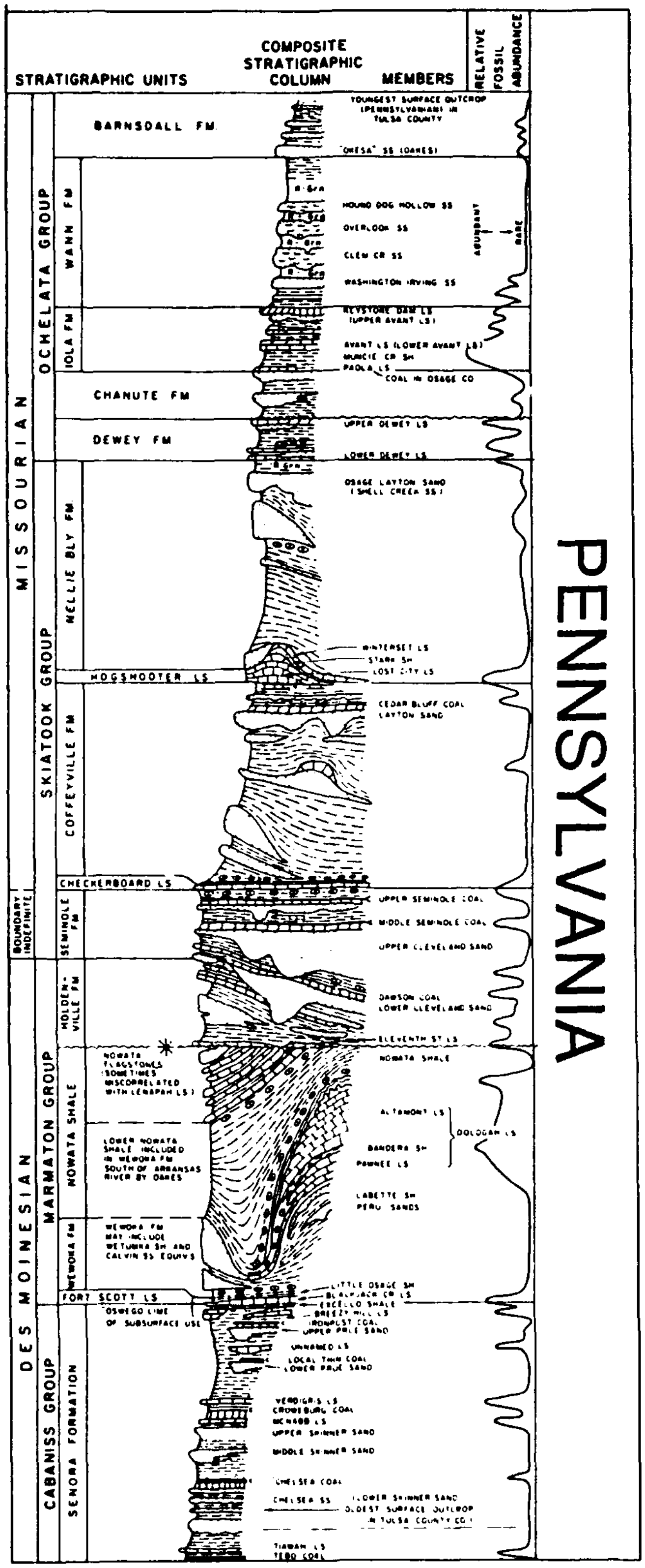
The annual precipitation averages 39 inches in the Tulsa area. Net precipitation is calculated by subtracting the mean annual lake evaporation from the average annual precipitation (47 FR 31227). Mean annual lake evaporation for the Tulsa area is 52 inches (47 FR 31227) and the net precipitation, therefore, is negative 13 inches per year. Maximum rainfall intensity, based on a 1-year, 24-hour rainfall, is 3 inches (47 FR 31235).

B. Geology

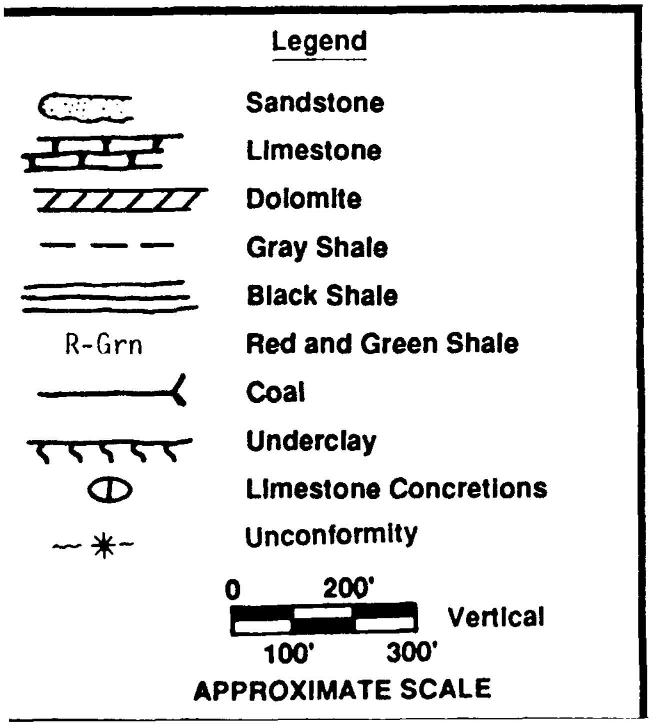
Regional Geology/Geography

Information for this section was obtained from Tulsa's Physical Environment (Bennison et al 1972). All of Tulsa County is underlain by rocks of Pennsylvanian age, although these rocks may be locally covered by as much as 100 feet of relatively young Pleistocene and Recent river deposits and wind blown sands, mainly along the valley of the Arkansas River. The sequence of bedrock in Tulsa County is composed of indurated marine sediments. This sequence includes sandstone, limestone, dolomite, and shale (Figure 3).

During Pennsylvanian time, the sea bottoms, mud flats, and coal swamps, alternately occupying the Tulsa area were intermittently tilted to the south and east and inundated by current-swept masses of sands and silts eroded from the rising mountain ranges of eastern and southern Oklahoma. These sands and silts were washed back and forth by strong currents as a result of the constantly changing shoreline geography on the northeastern Oklahoma Shelf. Towards the end of Pennsylvanian time, the shelf and basin relationship was



STRATIGRAPHIC UNITS
COMPOSITE STRATIGRAPHIC COLUMN
MEMBERS
RELATIVE FOSSIL ABUNDANCE
MISSOURIAN
DES MOINESIAN
BOUNDARY INDEFINITE
OCHELATA GROUP
SKIATOOK GROUP
MARMATON GROUP
CABANISS GROUP
BARNSDALL FM.
WANN FM
IOLA FM
CHANUTE FM
DEWEY FM
NELLIE BLY FM
HOGSHOOTER LS
COFFEYVILLE FM
CHECKERBOARD LS
SEMINOLE FM
HOLDENVILLE FM
NOWATA SHALE
WEWOKA FM
FORT SCOTT LS
SENORA FORMATION
PENNSYLVANIA



Legend
Sandstone
Limestone
Dolomite
Gray Shale
Black Shale
R-Grn
Red and Green Shale
Coal
Underclay
Limestone Concretions
Unconformity
0
200'
100'
300'
Vertical
APPROXIMATE SCALE

largely obliterated by extensive uplifts in southern Oklahoma.

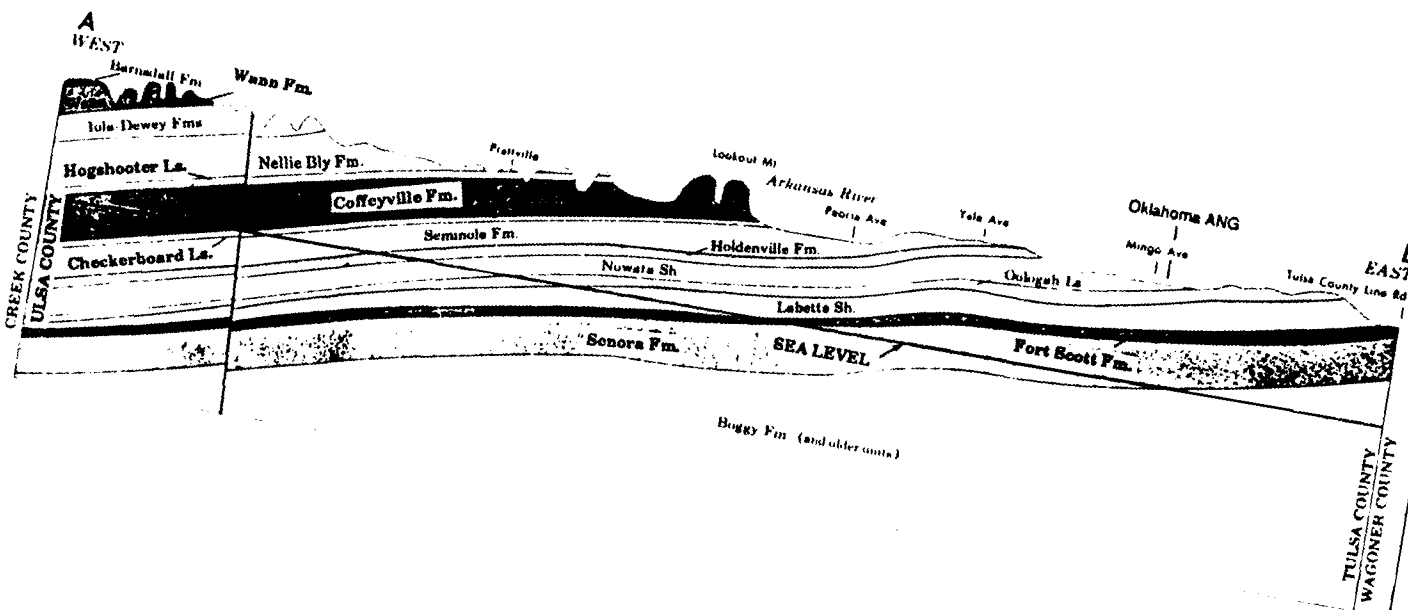
In a manner similar to the more recent Pleistocene glacial and interglacial activity, the Pennsylvanian era was also marked by periodic glacial episodes. The lowering and rising of sea level were the main reasons for the numerous repetitive sandstone, coal, shale, and limestone sequences that are the identifying features of Pennsylvanian age rocks in northeastern Oklahoma. Figure 4 is a geological cross section showing the formations discussed in this section.

The Senora Formation is a 500-foot thick sequence of shale and sandstone. This unit is the oldest exposed bedrock formation in the county. Subsurface data show the Senora Formation thinning northward from 380 to 220 feet in Tulsa County with much of this thinning taking place in the lower portion of the formation below the Verdigris Limestone. This intraformational thinning results from successive onlap deposition that occurred as the rising sea level slowly inundated the northeast shelf and as additional sediments were deposited on formerly dry land.

The Fort Scott Limestone is a 30-foot-thick sequence of limestone and shale named for an exposure near Fort Scott, Kansas. The rocks of the 700-feet-thick Wewoka Formation are massive marine sandstones and shale. The resistant Oologah Formation forms the broad, moderately high, east facing escarpments from north of Broken Arrow to Owasso in eastern Tulsa County. The Nowata Shale overlies the Oologah Formation and forms a wide outcrop belt of marine, gray, clay-rich shales with sandstone lenses and silty limestones. The Holdenville Shale crops out in a narrow, discontinuous belt trending north to northeast across Tulsa County. South of Bird Creek and Mohawk Park, this shale supports much of the lower slope of the 50 to 100-foot escarpment that is capped by the massive, basal Seminole Sandstone.

The Seminole Formation of Tulsa County contains three distinct coal cycles with the lower (Dawson) coal being the youngest commercial coal in this part of Oklahoma. The Seminole Formation is overlain by the Checkerboard limestone.

The Checkerboard Limestone is a light-gray, massive fossiliferous limestone. It is also the thinnest rock



Legend

A–B Cross Section Along 31st Street South Tulsa, Oklahoma.
Scale: Horizontal, 1" = 4 miles
Vertical, 1" = 1.5k feet

unit, measuring two to three feet thick. The Checkerboard Formation is overlain by the Coffeyville Formation. Shale units and thin, ripple bedded sandstones, thinning to the north, characterize this formation throughout its extent in Tulsa County. The Coffeyville Formation is overlain by the Hogshooter Limestone Formation. The Hogshooter Limestone Formation is of erratic distribution in Tulsa County. Outcrops are found in four separate areas: in the low hills northeast of Skiatook, at Turley Mountain, in the Sand Springs area, and in the Chandler Park-Prattville area. The Hogshooter Limestone Formation is overlain by the Nellie Bly Formation.

The Nellie Bly Formation is almost a twin to the Coffeyville Formation in thickness and in lithology, except for the lack of a basal black shale. Similar massive sandstones are present in the uppermost part of the formation, but no thin coal beds are associated. The Nellie Bly Formation is succeeded by the Dewey and Chanute Formations. The Dewey Formation changes from a shelf type limestone bank to a predominantly deeper water clay shale with thin dolomite limestones and calcareous sandstones restricted largely to the uppermost and lowermost beds.

Overlying the Dewey Formation is the Chanute Formation. Within Tulsa County, the sequence of shales and sandstones correlated with the Chanute Formation has a cyclic aspect resembling that of the Coffeyville and Nellie Bly Formations, but with some minor differences. The lower shale section is much thinner and the upper sandstone bears many fossil impressions of *Nuculana*.

Overlying the Chanute Formation is the Iola Formation, which was deposited when the sea advanced again over the marshland and shore sands of the Chanute terrain. The total thickness of the Iola Formation in Tulsa County is 85 feet.

The Iola shell banks, which indicate an abundance of sea-life during this time, were smothered by gray marine clays of the Wann Formation as the cycle of sea advances and retreats proceeded. The Wann outcrop terrain constitutes an irregular belt about 3 miles wide. This belt narrows to the south.

The Wann Formation was succeeded by the Barnsdall Formation as sea level continued to rise during later Pennsylvanian time in northeast Oklahoma. This formation is the youngest bedrock outcrop in Tulsa County. Tulsa County's southwest corner is largely composed of upper Barnsdall shale.

Local Geology

As Figure 5 demonstrates, the Pennsylvanian age Holdenville and Nowata Formations underlie the region incorporating the Base. Below the Base, these bedrock units are greater than 500 feet thick.

The Nowata Formation is exposed as a low relief belt extending southward from Owasso along the Mingo Creek Valley into southeast Tulsa County. South of the city of Tulsa, this low relief belt is replaced by terrace deposits and Recent alluvium of the Arkansas River Valley. Streams along the Nowata outcrop belt, especially along Mingo Creek, tend to overflow frequently and disastrously because of the low infiltration rates associated with the Nowata shale.

The Holdenville Shale crops out in a narrow, discontinuous belt trending north to northeast across Tulsa County from its southwest corner near Mounds to its northeast corner near Collinsville. South of Bird Creek, the Holdenville Shale tends to increase in thickness from about 40 to more than 150 feet because of an increase of sandstone lenses and a southward-thickening wedge of flaggy, silty limestone resembling that reported in the underlying Nowata Shale.

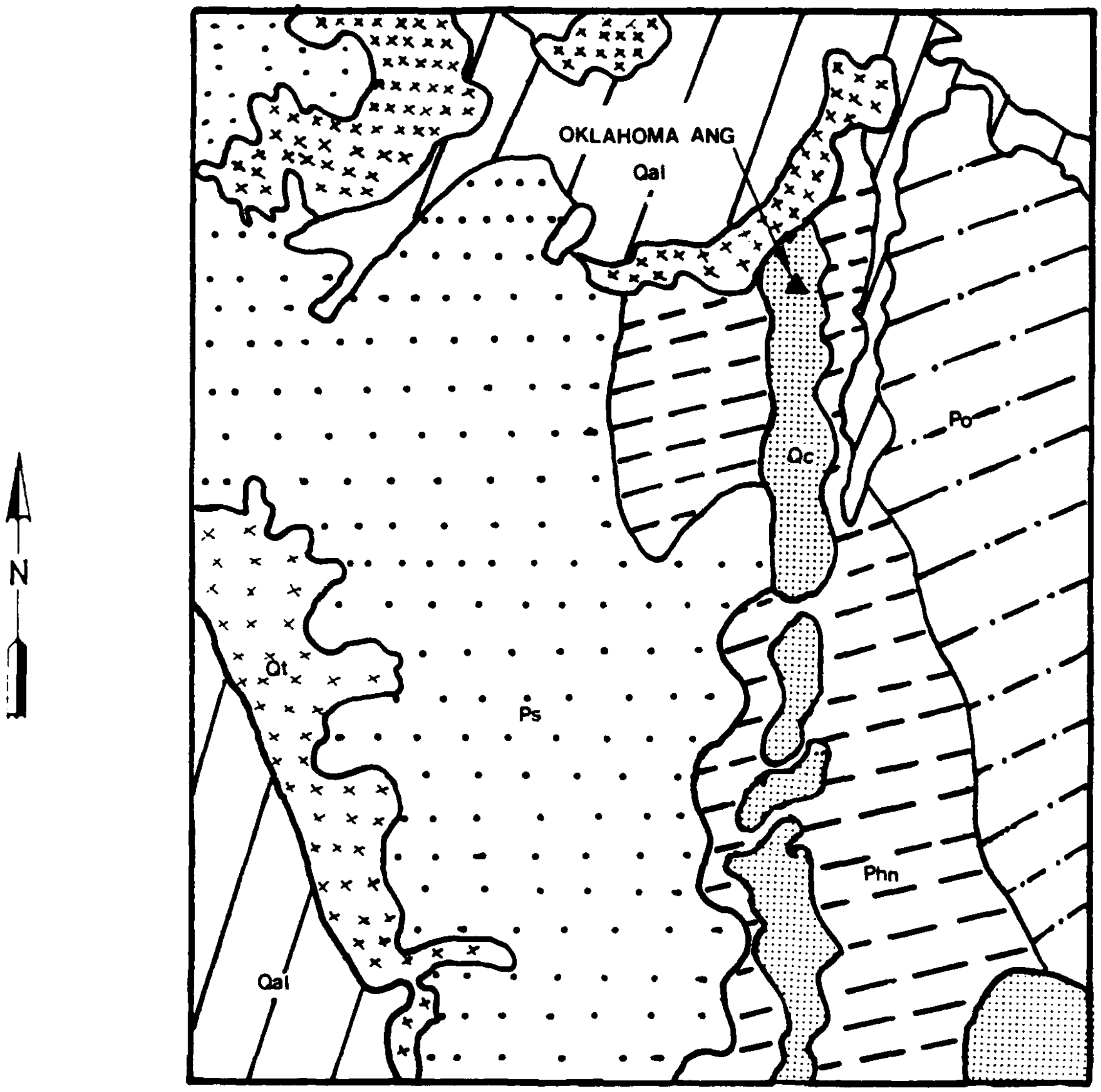
Overlying the Pennsylvanian bedrock units is a combination of unconsolidated sediments. Unconsolidated deposits in the area may be as thick as 200 feet, but on the upland area where the Base is located, they may be thinner.

Terrace alluvium, flood plain alluvium, and colluvium deposits underlie the river flood plains, tributary drainageways, and terrace levels above the present flood plains. Mingo Creek is underlain by flood plain alluvium. The flood plain alluvium is predominantly very fine to coarse sand with some fine gravel. Wood is found at the base of the alluvium. This deposit varies from a few inches to as many as thirty

Source: Tulsa's Physical
Environment, 1972

Figure 5

Generalized Bedrock and Surficial Geologic Map of Tulsa County, Tulsa, Oklahoma.



Legend

Qal	Floodplain Aluvium
Ps	Seminole Formation – Alternating Sandstones and Shales
Qc	Colluvium
Phn	Holdenville and Nowata Formations – Largely Soft Shales with Minor Amounts of Sandstone and Limestone
Po	Oologah Formation
Qt	Terrace Alluvium

0 5
Scale in Miles

feet thick. Although minor flood plain alluvium deposits occur along Bird Creek, this area is mainly underlain by terrace alluvium. Terrace surfaces have been highly dissected by streams or completely eroded, even though much of the underlying alluvium remains. The lithology of all terrace deposits is quite variable. It ranges from clayey silt to gravelly, coarse sand, but fine to medium sand predominates. The Base is underlain by colluvium deposits. Most of this material is mottled light gray and tan silt with some clay. The colluvium has a low bulk density and a high void ratio so that it is quite compressible when it is wet. When it is dry, it is hard, although shrinkage cracks checker the surface.

Topographically, the Base is situated on a slight plateau with approximately a 20-foot rise in elevation to the south towards the airport. To the west, north, and east, the elevation drops very slowly.

C. Soils

According to the U.S. Department of Agriculture, Soil Conservation Service (Cole, 1977), the soils at the Base consist of the Okemah-Parsons-Carytown complex, the Dennis-Radley complex, and the Dennis-Urban land complex (Figure 6A). The permeability of these soils is very low, less than 0.06 inches per hour or 4.24×10^{-5} cm/sec.

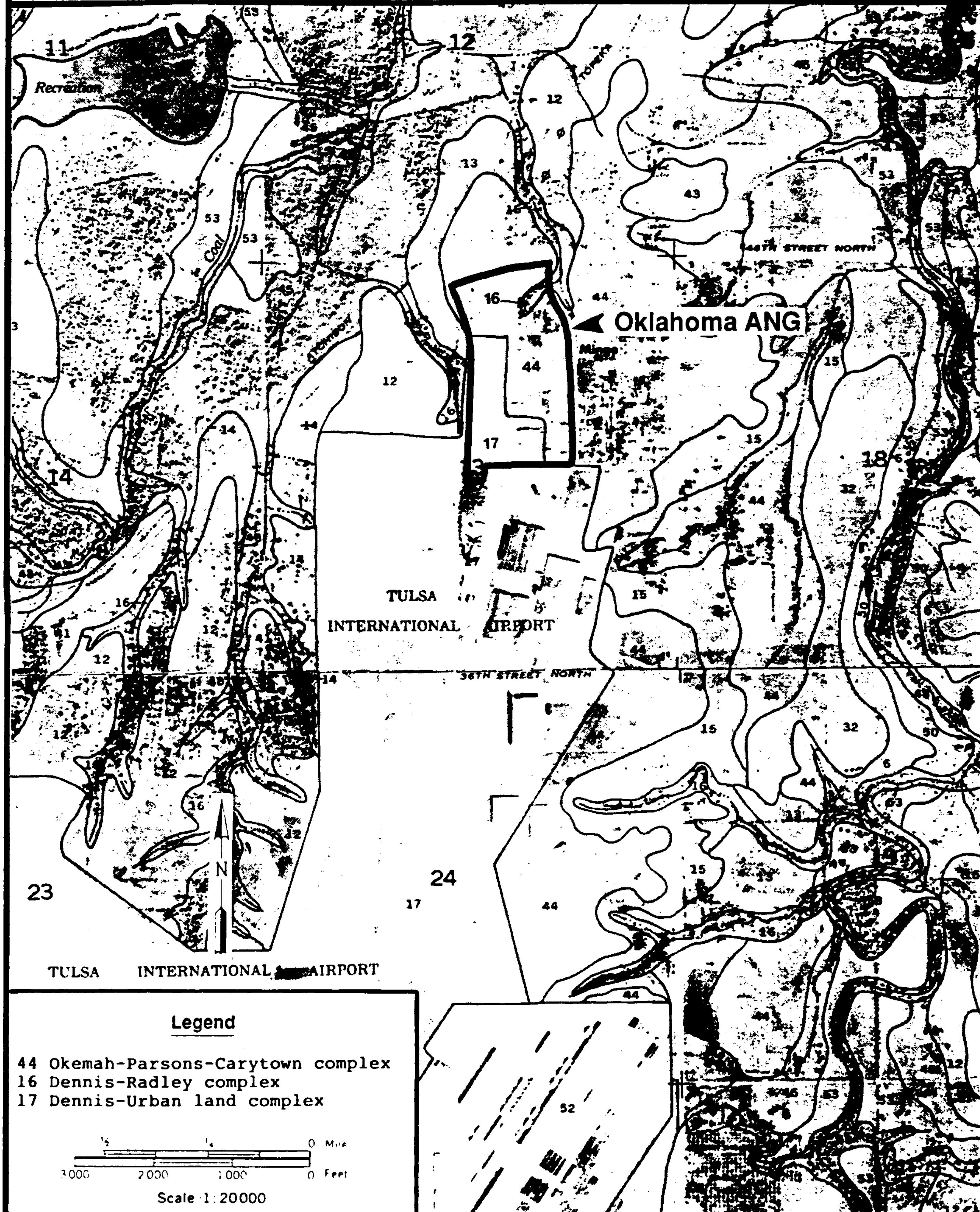
The Okemah-Parsons-Carytown is composed of the moderately well drained Okemah soil; the somewhat poorly drained Parsons soil; and the poorly drained Carytown soil. These nearly level soils are on smooth uplands. This complex is 50 percent Okemah soil, 30 percent Parsons soil, and 20 percent Carytown soil.

The Okemah soil has a surface layer of very dark grayish brown, slightly acid silt loam 17 inches thick. The upper 37 inches of the subsoil is very dark grayish brown, slightly acid or neutral, silty clay loam. The lower part of the subsoil to a depth of 66 inches is mottled, very dark grayish brown and yellowish red, mildly alkaline silty clay. The thickness of the soil and depth to bedrock are more than 60 inches. Available water capacity in the upper 40 inches of the soil ranges from 6.5 inches to 7.5 inches. The Okemah soil has a low permeability.

HMTC

Source: U.S.D.A. Soil Survey of Tulsa County, Oklahoma (1977)

Figure 6A.
Soil Map of the Oklahoma Air National Guard and Vicinity



The Parsons soil has a surface layer of very dark grayish brown, slightly acid silt loam that is 8 inches thick. The subsurface layer is 6 inches of dark grayish brown, slightly acid silt loam. The upper 9 inches of the subsoil is very dark gray, slightly acid clay. The middle part of the subsoil is 29 inches of dark gray and gray, slightly acid clay. The lower part of the subsoil to a depth of 74 inches is gray, mildly alkaline clay. The thickness of the soil and the depth to bedrock are more than 60 inches. Available water capacity in the upper 40 inches ranges from 6.0 to 8.5 inches with an erosion tolerance factor of 5 tons of soil lost per acre per year. The Parsons soil has a very low permeability.

The Carytown soil has a surface layer of dark grayish brown, medium acid silt loam that is 7 inches thick. The upper 7 inches of the subsoil is very dark grayish brown, neutral silty clay. The middle part of the subsoil is 9 inches of dark yellowish brown, slightly acid silty clay and 28 inches of olive brown, slightly acid silty clay. The lower part of the subsoil to a depth of 64 inches is mottled yellowish brown, dark grayish brown, and olive brown, moderately alkaline silty clay. The thickness of the soil and depth to bedrock are more than 60 inches. Available water capacity in the upper 40 inches ranges from 4.5 to 6.0 inches. The Carytown soil has a very low permeability. The sodium content is high.

The Dennis-Radley complex consists of the well drained Dennis soil and the moderately well drained Radley soil. These soils are in drainageways that are 180 feet to 600 feet wide and 10 to 40 feet below the surrounding prairie uplands. The Dennis soil makes up 60 percent of this complex and is on the very gently sloping through sloping parts of the drainageways. The frequently flooded Radley soil makes up 30 percent at this complex and is on the nearly level, flood plain part of the drainageway.

The Dennis soil has an 8 inch thick surface layer of brown, slightly acid silt loam. The upper 6 inches of the subsoil is dark brown, slightly acid silty clay loam. The middle part of the subsoil is 10 inches of olive brown, medium acid silty clay and 14 inches of coarsely mottled, light gray and yellowish brown, mildly alkaline clay. The thickness of the soil and depth to bedrock are more than 60 inches. Available water capacity in the upper 40 inches ranges from 5.5 to 9.5 inches. The Dennis soil has a low permeability.

The Radley soil has a surface layer of very dark grayish brown, slightly acid silt loam to a depth of 10 inches. The next layer, to a depth of 20 inches, is dark brown, medium acid silt loam. The underlying material to a depth of 60 inches is brown, medium acid silty clay loam. Depth to bedrock is more than 60 inches. Available water capacity in the upper 40 inches ranges from 7.0 to 8.5 inches. The Radley soil is moderately permeable.

The Dennis-Urban land complex consists of nearly level to gently sloping soils on prairie uplands. The soils are in such an intricate pattern with buildings, streets, and roads that it is impractical to separate them from the Urban land. This complex is 30 percent Dennis soils and 40 percent Urban land. Minor soils in this complex are in the Okemah and Carytown series.

In about 30 percent of the area of this mapping unit, the soils have been modified by excavating, filling, and grading. In excavated areas, the surface layer is clayey. The fill material is usually loamy material that has been hauled in from other areas. The soils in this complex are used mostly for urban development, including industry.

Information composited from a soil boring (Figure 6B) in the area located north of Building 301 indicates that the surface soil is silty clay with rock fragments. Silty clay soils were found at depths of about 6 inches to 11 feet beneath the asphalt and ranged in thickness from 6 inches to 9 feet. The subsoil consists of sandy silt. It's thickness ranged from 4 feet to 10 feet. At a depth of 27 feet, shale was encountered.

Source: Hemphill Corporation, 1983.

HMTC

Figure 6B.

Typical Boring Log Showing Subsurface Materials at the 138th TFG, Oklahoma Air National Guard, Tulsa, Oklahoma.

BORING LOG

HOLE NO. 2

PROJECT: ANG - Munitions Maintenance Facility — SHEET 1 OF 1

HOLE LOCATION: See Boring Location Plan — DATE 12-20-83

GR. ELEV. ______ WATER TABLE 16.0' (3.0' After 24 hours) BORED BY Cooper LOGGED BY Same

ELEV.	DEPTH AND SCALE	LGND	DESCRIPTION OF MATERIAL (TYPE, COLOR, TEXTURE, CONSISTENCY)
	0.5		ASPHALT
	5.0		CLAY, Silty, Gray, Brown, w/Rock Fragments
	11.0		CLAY, Silty, Tan-Gray, Brown, Moist
	16.0		SILT, Sandy, Tan, Very Moist
	27.0		SILT, Sandy, Tan, Wet
	30.0		SHALE, Gray
			Bottom of Hole

CASING INFORMATION

SIZE	FT-RUN	FT-PULLED	FT-LEFT

DRILLING MUD

TYPE	NO. SACKS

PENETRATION TEST

FROM	TO	BLOWS/6"

SHELBY TUBE SAMPLES

NO.	FROM	TO
1	2.0	3.0
2	7.0	8.0

CORING

FROM	TO	RECOVERY

WATER LOSS

CEMENT (NO. SACKS)

REMARKS

CONSULTING ENGINEERING • GEOLOGICAL INVESTIGATION • ENGINEERING INSPECTION

HEMPHILL CORPORATION

4834 SOUTH 83RD EAST AVENUE

TULSA, OKLAHOMA 74145

OFFICE (918) 622 9133 — AFTER HOURS 597 9822

D. Hydrology

Surface Water

According to the Federal Emergency Management Agency (FEMA), the Base is not considered to be located within the boundaries of the 100-year flood plain of the main surface water drainage feature, Bird Creek. Bird Creek, with a drainage area of 905 square miles, is a major tributary of the Verdigris River. The gauging station on Bird Creek has recorded a maximum discharge of 81.1 cubic feet per second over a 16-year period.

The largest bodies of standing surface water are Lake Yahola and Recreation Lake. Lake Yahola is located approximately 2.8 miles west of the Base and has a designed storage capacity of two billion gallons. This reservoir is used for flood control, drinking water, and recreational purposes. Recreation Lake is located 0.75 miles northwest of the Base. This lake is used for recreational purposes only. More than 1000 people within a three mile radius of the Base receive their water from surface water supplies.

Surface water at the Base is collected in a series of surface water routes (open ditches, drainage swales) and storm drain routes. Storm drains at the Base discharge surface water at three storm drain outfalls. The majority of surface water collected in the Base storm sewer system is discharged at the storm drain outfall west of the aircraft parking apron. Smaller volumes of storm drainage discharge at outfalls west of Building Nos. 020 and 603. Surface water, which is discharged from each of the three Base storm drain outfalls, flows into an open drainage ditch located approximately 200 feet west of the Base's western boundary.

This open ditch trends north-northwest and joins a small, unnamed tributary of Bird Creek. This unnamed stream is used for agricultural and industrial purposes. Recreational Lake flows into it at a point downstream from the Base. Approximately 1 mile north of the Base's northern boundary, the unnamed tributary flows into Bird Creek.

A portion of the Base's surface water flows into an open ditch located approximately 600 feet northeast of

Building No. 222 (Figure 7A). This surface water exits the Base at its eastern boundary, flows to the north, and discharges to an unnamed tributary of Bird Creek. Mingo Creek flows into Bird Creek approximately 2 miles northeast of the Base's eastern boundary. The Base does not discharge surface water to Mingo Creek.

Groundwater

The occurrence and movement of groundwater at the Base is poorly documented. The Base and Airport are supplied by city water. No wells have been drilled on-Base. The two closest groundwater wells are located 3.5 miles from the Base. This would indicate that groundwater supplies are not used by the population within a three mile radius of the Base.

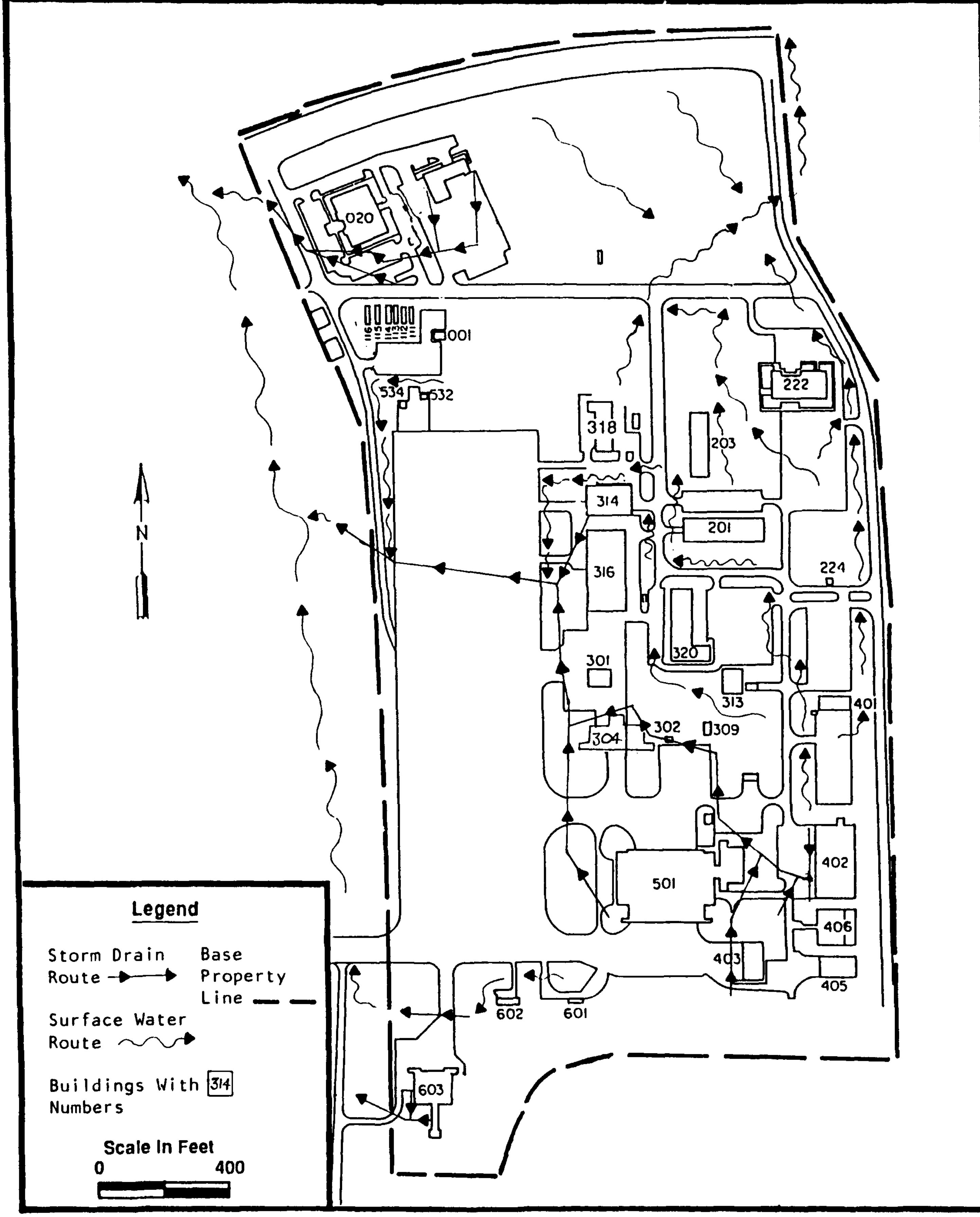
The first well is located north of the Airport at a depth of 28 feet. The water table depth at this location is 20 feet. The second well is located west of the Airport at a depth of 63 feet. The depth of the water table is 49 feet.

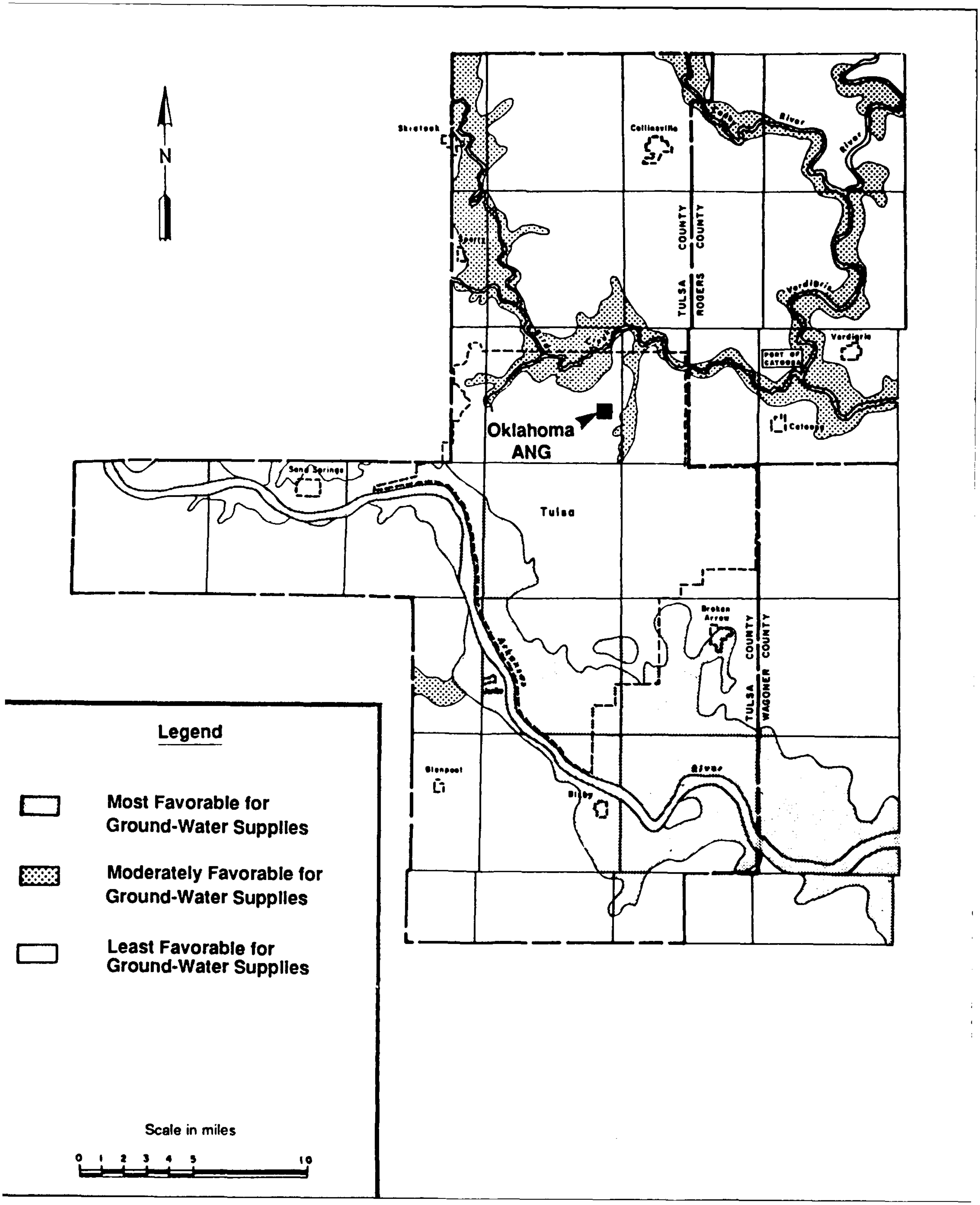
Borings drilled at the Base during the construction of facilities indicate that the water level in the uppermost unconsolidated aquifer ranges from 16 to 18 feet below the land surface. Most of the surficial Pennsylvanian age formations at the Base and in Tulsa County are fine grained, dense, and essentially impermeable. The Base and Tulsa County receive sufficient yearly rainfall to recharge and maintain groundwater aquifers. However, with the exception of groundwater that occurs in the terrace and alluvial aquifers, few aquifers contain water that is acceptable for direct consumption without first being treated. Water with the best quality, which occurs in terrace and alluvial aquifers, is located approximately eight miles southwest of the Base at points away from and above the level of the Arkansas River (Figure 7B). Aquifers in the immediate vicinity of the Base and adjacent to Bird Creek, like the remaining area in Tulsa County, have groundwater quality that is unacceptable for direct consumption. Poor groundwater quality in Tulsa County is exemplified by aquifers that occur along the Verdigris

HMTC Source: Oklahoma ANG

Figure 7A

Surface Water and Storm Drain Routes at the 138th TFG, Oklahoma Air National Guard, Tulsa, Oklahoma




N
Collinsville
TULSA COUNTY
ROGERS COUNTY
Verdigris
Catoosa
Oklahoma ANG
Sand Springs
Tulsa
Broken Arrow
TULSA COUNTY
WAGONER COUNTY
Arkansas
River
Glenpool
Bixby
Legend
Most Favorable for Ground-Water Supplies
Moderately Favorable for Ground-Water Supplies
Least Favorable for Ground-Water Supplies
Scale in miles
0 1 2 3 4 5 10

River approximately nine miles east of the Base. Analytical test results from groundwater samples collected from these aquifers showed high concentrations of gypsum, iron, and sulfur.

The water table aquifer at the Base, which occurs within the terrace and alluvial deposits, flows downgradient to the southwest. The majority of this groundwater discharges (groundwater contribution to the river itself) into the Arkansas River approximately nine miles southwest of the Base.

A smaller groundwater quantity flows downstream within the Arkansas River flood plain alluvium deposits. The average gradient downstream within the flood plain alluvium is 2.8 feet per mile, and the average gradient into the river from the edge of the terrace and flood plain deposits is 35 feet per mile. The alluvial flood plain deposits average 33 feet in thickness with most of the deposits having a thickness between 20 and 40 feet. The thickness of most terrace deposits ranges between 5 and 40 feet with an average of 32 feet.

E. Critical Environments

According to the Oklahoma Division of the United States Fish and Wildlife Service, three endangered species of birds may occur within a one mile radius of the Base. These species are *Haliaeetus leucocephalous* (bald eagle), *Sterna albifrons* (least tern), and *Charadrius melodus* (piping plover).

Two areas of riparian deciduous forest, stands of broadleaf, deciduous trees that concentrate along streams in prairie environments, are found within a one mile radius of the Base. These areas are in the northeast portion of Mohawk Park and along Mingo Creek, north of 46th Street. They are not critical habitats for the three endangered species identified in this section. However, these bottomland forest remnants are rapidly disappearing. Since they are good wildlife habitats, safe movement cover for animals, erosion inhibitors, and limited water quality protectors, the Oklahoma Division of the United States Fish and Wildlife Service is especially concerned with their protection.

IV. SITE EVALUATION

A. Activity Review

A review of Base records and interviews with Base personnel resulted in the identification of specific operations at the Base in which the majority of industrial chemicals are handled and hazardous wastes are generated. A total of 30 past and present Base personnel with an average of 8 years experience at the Base were interviewed. Personnel from Civil Engineering; Aircraft Maintenance; Supply; the Motor Pool; Corrosion Control; Aerospace Ground Equipment (AGE) Maintenance; Bioenvironmental Engineering; Nondestructive Inspection (NDI); and the Fire Department were included in the interviews. Table 1 provides estimates of the quantities of waste currently being generated by the shops and describes the past and present disposal practices for the wastes. Based on information gathered, any shop that is not listed in Table 1 has been determined to produce negligible quantities of wastes requiring disposal.

B. Disposal/Spill Site Identification, Evaluation, and Hazard Assessment

Interviews with Base personnel and a subsequent field inspection resulted in the identification of one site potentially contaminated with HM/HW. Figure 8 illustrates the location of the identified site on the Base.

This potential site was assigned a HAS according to HARM (Appendix C). A copy of the completed Hazard Assessment Rating Form for this site is found in Appendix D. The objective of this assessment is to provide a relative ranking of sites suspected of contamination by hazardous materials. The final rating score reflects specific components of the hazard posed by a specific site: possible receptors of the contamination (e.g., population within a specified distance of the site and/or critical environments within a one-mile radius of the site), the waste and its characteristics, and the potential pathways for contaminant migration (e.g., surface water, groundwater, and flooding). A description of the site follows:

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 138th TFG, Oklahoma Air National Guard, Tulsa International Airport, Tulsa, Oklahoma

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1960 1970 1980 1988
219th Vehicle Maintenance Bldg 025	Engine Oil	200	'-----------------NIE--------------'--CT---'
	Thinner	20	'-----------------NIE--------------'--PRO--'
	PD-680 (type II solvent)	2	'-----------------NIE--------------'--PRO--'
Helicopter Maintenance Bldg 304	PD-680 (type II solvent)	25	'------------NIE-----------'OWS/STO'---CT--'
	Engine Oil	300	'------------NIE-----------'---OS---'--CT--'
	Hydraulic Fluid	15	'------------NIE-----------'---OS-'---NLU--'
Engine Shop Bldg 314	Engine Oil	200	'---------------OS/CT--------------'---CT--'
	PD-680 (type II solvent)	20	'--------OWS/SAN/CT--------'------CT-------'
	Hydraulic Fluid	5	'------------OWS/SAN-------'------CT-------'

KEY:

CT	-	Disposed of by a contractor.
D	-	Defense Reutilization & Marketing Office.
FTA	-	Disposed of at the fire training area.
LO	-	Landfilled off-site.
NIE	-	Shop not in existence.
NIU	-	Material not in use.
NLU	-	Material no longer used.
NSA	-	Disposed of through the sanitary sewer, after neutralization.
OS	-	Hauled off-site for private use.
OWS	-	Disposed of through an oil water separator.
PRO	-	Used up in process.
SAN	-	Disposed of in the sanitary sewer.
SRE	-	Sent to contractor for silver recovery.
STO	-	Disposed of through the storm sewer.
TRA	-	Disposed of in general refuse.
UNK	-	Information not supplied nor available.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 138th TFG, Oklahoma Air National Guard, Tulsa International Airport, Tulsa, Oklahoma (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1960 1970 1980 1988
Aerospace Ground Equipment (AGE) Bldg 318	Thinners	20	'-------------------PRO/TRA------------------'
	MEK	4	'-------------------PRO/TRA------------------'
	Engine Oil	250	'----------OS-------------'---------CT-------'
	Hydraulic Oil	350	'----------OS-------------'---------CT-------'
	Paint Strippers	10	'-------------TRA---------'-----NSA/OWS-----'
	PD-680 (type II solvent)	1	'---------STO/OWS--------'--------TRA-------'
	Parts Cleaner	10	'-----------------TRA--------------'---NLU--'
	Gasoline	25	'-------------------PRO---------------------'
	Battery Acid	20	'----------------NSA---------------------'-D'
	Aircraft Cleaner	50	'--------STO/OWS---------'---SAN/OWS---'NLU'
	7808 Oil	100	'----------------OS----------------'---CT---'
	Transmission Fluids	10	'----------------OS----------------'---CT---'

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NSA - Disposed of through the sanitary sewer, after neutralization.
OS - Hauled off-site for private use.
OWS - Disposed of through an oil water separator.
PRO - Used up in process.
SAN - Disposed of in the sanitary sewer.
SRE - Sent to contractor for silver recovery.
STO - Disposed of through the storm sewer.
TRA - Disposed of in general refuse.
UNK - Information not supplied nor available.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 138th TFG, Oklahoma Air National Guard, Tulsa International Airport, Tulsa, Oklahoma (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1960 1970 1980 1988
Aerospace Ground Equipment (AGE) Bldg 318 (continued)	Brake Fluid	5	'---------------OS---------------'---CT---'
	Diesel Fuel	3	'---------------PRO/TRA-------------------'
Nondestructive Inspection (NDI) Bldg 316	MEK	25	'---------------NIE------'---------PRO------'
	MIBK	7	'--------NIE-------'--OS-'-------NLU--------'
	Penetrant	50	'------NIE-------'---D---'---SAN-------'-CT-'
	Developer	20	'------NIE-------'---D---'-------SAN--------'
	1,1,1 Trichloroethane	25	'---------------NIU-------------'----PRO----'
	Fixer	20	'------NIE---'-----D-----'-------SRE--------'
Vehicle Maintenance (Motor Pool) Bldg 401	Engine Oil	220	'--------UNK--------'------OS-----'---CT----'
	Sulfuric Acid	5	'--------UNK--------'----------NSA----------'
	Ethylene Glycol	10	'--------UNK--------'-----STO-----'---CT----'

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LO - Landfilled off-site.
NIE - Shop not in existence.
NIU - Material not in use.
NLU - Material no longer used.
NSA - Disposed of through the sanitary sewer, after neutralization.
OS - Hauled off-site for private use.
OWS - Disposed of through an oil water separator.
PRO - Used up in process.
SAN - Disposed of in the sanitary sewer.
SRE - Sent to contractor for silver recovery.
STO - Disposed of through the storm sewer.
TRA - Disposed of in general refuse.
UNK - Information not supplied nor available.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 138th TFG, Oklahoma Air National Guard, Tulsa International Airport, Tulsa, Oklahoma (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1960 1970 1980 1988
Vehicle Maintenance (continued)	Transmission Fluid	10	'-------UNK---------'------OS-----'---CT---'
	Brake Fluid	3	'-------------------TRA-------------------'
	Used Batteries	Unknown	'--------LO---------'----------D-----------'
Wheel & Tire Shop Bldg 501	Stripper	200	'--------NIU-------'-----OS-----'----CT----'
	PD-680 (type II solvent)	20	'----------------OS--------------'---CT----'
Fuels Shop Bldg 501	JP-4	150	'------------------FTA-------------------'
Hydraulic Shop Bldg 501	PD-680 (type II solvent)	120	'-----------OWS/STO-------------'----CT---'
	MEK	2	'-------------------PRO-------------------'
	Hydraulic Oil	10	'------------OWS/STO------------'----CT---'

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LO - Landfilled off-site.
NIE - Shop not in existence.
NIU - Material not in use.
NLU - Material no longer used.
NSA - Disposed of through the sanitary sewer, after neutralization.
OS - Hauled off-site for private use.
OWS - Disposed of through an oil water separator.
PRO - Used up in process.
SAN - Disposed of in the sanitary sewer.
SRE - Sent to contractor for silver recovery.
STO - Disposed of through the storm sewer.
TRA - Disposed of in general refuse.
UNK - Information not supplied nor available.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 138th TFG, Oklahoma Air National Guard, Tulsa International Airport, Tulsa, Oklahoma (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1960 1970 1980 1988
Environmental Systems Bldg 501	PD-680 (type II solvent)	5	'------------------PRO/TRA------------------'
Electric Shop Bldg 501	Battery Acid	5	'------------SAN-----------'-----NSA------'
Aircraft Maintenance Bldg 501	PD-680 (type II solvent)	100	'--------------OWS/STO------------'---CT--'
	PS-661	2000	'--------------OWS/STO-----'------NLU-----'
	Engine Oil	50	'----------------OS---------------'---CT--'
Phase Dock Bldg 501	PD-680 (type II solvent)	50	'-------------OWS/STO-------------'--TRA--'
Flightline Maintenance Bldg 501	PD-680 (type II solvent)	100	'-------------OWS/STO-------------'---CT--'
	JP-4	200	'------------------FTA-------------------'
	Hydraulic Oil	80	'----------------OS--------------'---CT--'

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NIE - Shop not in existence.
NIU - Material not in use.
NLU - Material no longer used.
NSA - Disposed of through the sanitary sewer, after neutralization.
OS - Hauled off-site for private use.
OWS - Disposed of through an oil water separator.
PRO - Used up in process.
SAN - Disposed of in the sanitary sewer.
SRE - Sent to contractor for silver recovery.
STO - Disposed of through the storm sewer.
TRA - Disposed of in general refuse.
UNK - Information not supplied nor available.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 138th TFG, Oklahoma Air National Guard, Tulsa International Airport, Tulsa, Oklahoma (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1960 1970 1980 1988
Flightline Maintenance (continued)	Engine Oil	50	'-----------------OS--------------'---CT--'
Hush House Bldg 603	JP-4	100	'-----------------FTA---------------------'
X-RAY Lab TAC Clinic Bldg 201	Developer	30	'--------NIE--------'---D--'---NIE--'-SAN-'
	Fixer	50	'--------NIE--------'---D--'---NIE--'-SRE-'
Weapons Release Shop Bldg 316	PD-680 (type II solvent)	1	'----UNK----'----------CT---------'--PRO--'
	Mirachem	150	'--------------NIU-----------------'--CT-'
Gun Shop Bldg 316	Novite Soap	60	'---------NIE--------'-------OWS/SAN------'

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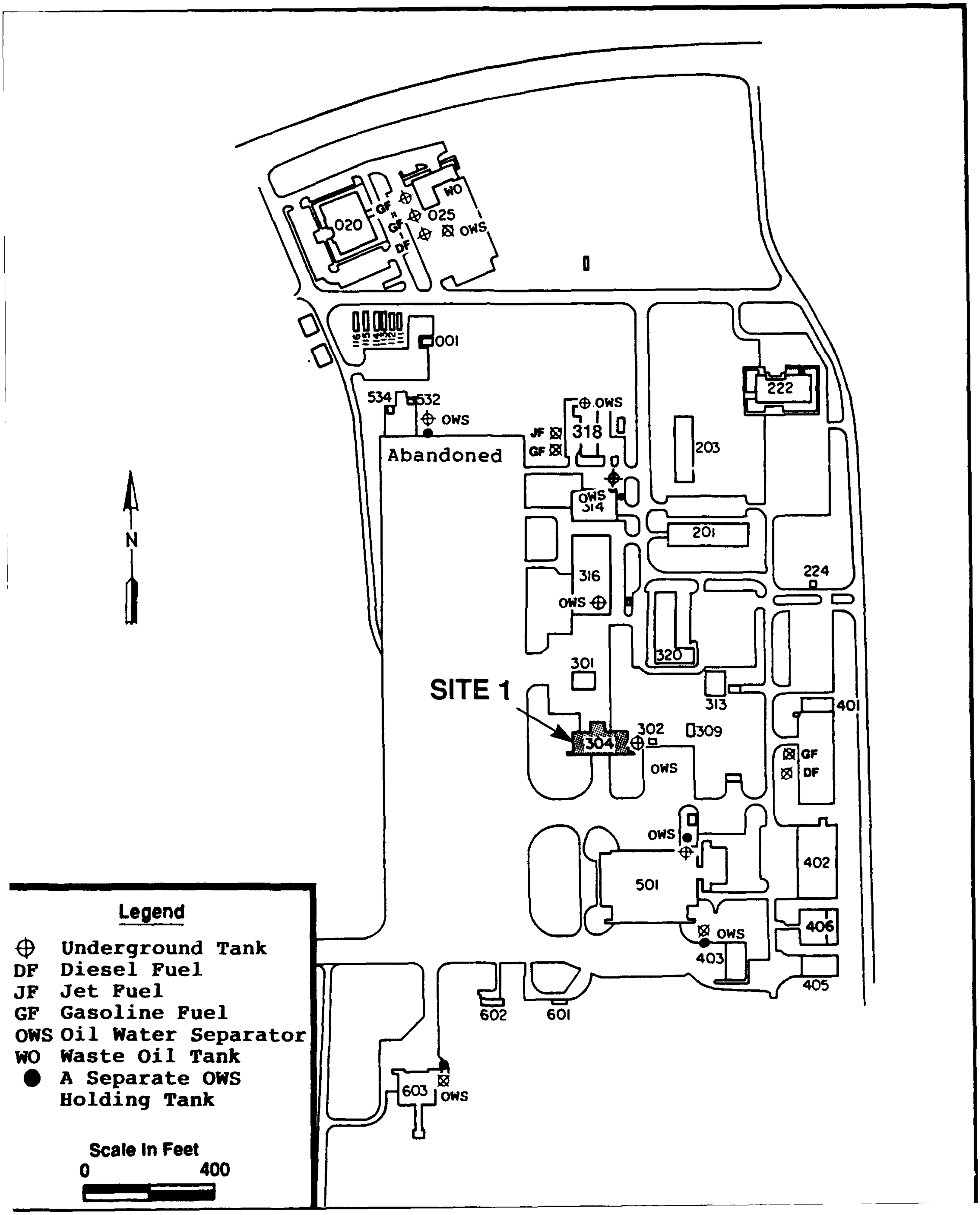
FTA - Disposed of at the fire training area.
LO - Landfilled off-site.
NIE - Shop not in existence.
NIU - Material not in use.
NLU - Material no longer used.
NSA - Disposed of through the sanitary sewer, after neutralization.
CS - Hauled off-site for private use.
OWS - Disposed of through an oil water separator.
PRO - Used up in process.
SAN - Disposed of in the sanitary sewer.
SRE - Sent to contractor for silver recovery.
STO - Disposed of through the storm sewer.
TRA - Disposed of in general refuse.
UNK - Information not supplied nor available.



020
GF
GF
DF
025
WO
OWS
116
115
114
113
112
111
001
534
532
OWS
Abandoned
OWS
JF
GF
318
OWS
314
203
222
201
224
316
OWS
320
301
SITE 1
313
401
304
302
309
OWS
GF
DF
OWS
402
501
406
OWS
403
405
602
601
603
OWS
N
Legend
Underground Tank
DF Diesel Fuel
JF Jet Fuel
GF Gasoline Fuel
OWS Oil Water Separator
WO Waste Oil Tank
A Separate OWS Holding Tank
Scale In Feet
0
400

Site No. 1 - Building 304 (HAS-60)

Building 304 is located near the south central portion of the Base. The Army National Guard has been leasing this building from the Air National Guard since 1981. It has been used for helicopter maintenance and equipment storage.

It has been reported that during periods of heavy rain the oil from the oil water separator (OWS), located approximately 25 feet from the east side of the building, backed up into the trench drain and floor joints as evidenced by oil splattered on the wall. The OWS has a 175-gallon holding capacity.

Army personnel used solvents to clean up the oil, leaving a solvent and waste oil mixture in the floor drain and floor joints. These wastes may have migrated through the floor joints, into the underlying soil, and to the water table.

The water table at the Base occurs at depths ranging from 16 to 18 feet. The groundwater in the vicinity of the Base is not used as a source of potable water.

Discharges of surface water runoff to local waterways may degrade surface water quality. The OWS discharges directly into the storm drainage system to Bird Creek and has been in operation since the construction of Building 304 in 1962.

C. Other Pertinent Information

Effluent from the OWSs at the following locations discharges directly into the storm drainage system: Building 501, the wash rack north of Building 501, and Building 532.

There are a total of 13 USTs on the Base (Figure 8, page IV-8). Five of the 13 tanks are separate waste oil holding tanks for OWSs. Two of these tanks are located at Building 501 (Main Hangar), one is located at Building 603 (Hush House), one is at Building 314 (Jet Engine), and one is at Building 532. The UST inventory is included as Appendix E.

An area northwest of Building 318 (AGE) was used by the airport for a fuel tank farm. The airport leased the property to the ANG on September 1, 1987. Four 3000-gallon fuel storage tanks and one 1500-gallon tank (all above ground) were removed from this area by the airport in 1987. Standing water and evidence of residual fuel were noticed during the site visit. Currently, this area is being remediated by the Airport Authority.

Sewage from the Base goes to the Northside Waste Water Treatment Plant, located north of the Base on 56th Street North between Mingo Road and Garnett Avenue. Solid waste is disposed of by contract at an off-Base sanitary landfill.

Fire training activities are conducted at an off-Base, joint use facility on airport property.

Since the Base uses hazardous materials, generates hazardous wastes, and discharges storm water to nearby tributaries of Bird Creek, the Base has submitted an application for an NPDES Permit. Surface water quality monitoring is conducted on a monthly basis. Water analyses of inflow to the Base and outflow from the Base are shown in Appendix F.

V. CONCLUSIONS

Information obtained through interviews with 30 past and present Base personnel, reviews of Base records, and field observations has resulted in the identification of one potentially contaminated spill site on Base property. The potentially contaminated site is Site No. 1 - Building 304 (HAS-60).

This site is potentially contaminated with HM/HW and exhibits the potential for contaminant migration to groundwater and surface water. Therefore, this site was assigned a HAS according to HARM.

VI. RECOMMENDATIONS

Further IRP investigation is recommended for Site No. 1, Building 304 (HAS 60).

GLOSSARY OF TERMS

ACID [chem] - A compound containing hydrogen in which all or a part of the hydrogen may be exchanged for a metal or a basic radical, forming a salt.

ALKALI [chem] - A hydroxide of any of the alkali metals or ammonium radical, characterized by great solubility in water and capable of neutralizing acids.

ALLUVIUM - A general term for clay, silt, sand, gravel, or similar unconsolidated material deposited during comparatively recent geologic time by a stream or running water.

ANNUAL PRECIPITATION - The total amount of rainfall and snowfall for the year.

AQUIFER - A geologic formation or group of formations that contain(s) sufficient saturated permeable material to conduct groundwater and to yield economically significant quantities of groundwater to wells and springs.

BANK [geomorph] - A steep slope or face, as on a hillside, usually of sand, gravel or other unconsolidated material.

BASAL [adj] - Pertaining to, situated at, or forming the base; bottom.

BASIN - (a) A depressed area with no surface outlet; (b) A drainage basin or river basin; (c) A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated.

BEDROCK - A general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.

CLAY [soil] - A rock or mineral particle in the soil having a diameter less than 0.002 mm (2 microns).

CLAY [geol] - A rock or mineral fragment or a detrital particle of any composition smaller than a fine silt grain, having a diameter less than 1/256 mm (4 microns).

COAL - A readily combustible rock containing more than 50% by weight and more than 70% by volume of carbonaceous material including inherent moisture, formed from compaction and induration of variously altered plant remains similar to those in peat.

COLLUVIUM - (a) A general term applied to any loose, heterogeneous, and incoherent mass of soil material and/or rock fragments deposited by rainwash, sheetwash, or slow continuous downslope creep, usually collecting at the base of gentle slopes or hillsides; (b) Alluvium deposited by unconcentrated surface runoff or sheet erosion, usually at the base of a slope.

CONTAMINANT - As defined by Section 101(f)(33) of the Superfund Amendments and Reauthorization Act of 1986 (SARA) 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; except that the term *"contaminant"* shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under:

(a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,

(b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,

(c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress),

(d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,

(e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and

(f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substances Control Act;

and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

CREEK - A term generally applied to any natural stream of water, normally larger than a brook but smaller than a river.

CREST [geomorph] - The highest point or line of a landform, from which the surface slopes downward in opposite directions.

CRITICAL HABITAT - The specific areas within the geographical area occupied by the species on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management consideration or protection.

DECIDUOUS - Shedding foliage at the end of the growing season.

DOLOMITE - A carbonate sedimentary rock of which more than 50% by weight or by areal percentages under the microscope consists of the mineral dolomite, or a variety of limestone or marble rich in magnesium carbonate.

DOWNGRADIENT - A direction that is hydraulically downslope.

DRAINAGEWAY - A channel or course along which water moves in draining an area.

ENDANGERED SPECIES - Any species which is in danger of extinction throughout all or a significant portion of its range, other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection would present an overwhelming and overriding risk to man.

ETHYLENE GLYCOL - A colcrless, sweetish alcohol $C_2H_4(OH)_2$, formed by decomposing certain ethylene compounds and used as an antifreeze mixture, lubricant, etc.

FLAGGY - Said of bedding 1 cm to 10 cm in thickness.

FLOOD PLAIN - The surface or strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks.

FORMATION - A lithologically distinctive, mappable body of rock.

FOSSIL - A remnant or trace of an organism of a past geologic age, as a skeleton or leaf imprint, embedded in the earth's crust.

GRADIENT [geomorph] - A degree of inclimation, or rate of ascent or descent, of an inclined part of the Earth's surface with respect to the horizontal.

GRADIENT [hydrology] - See hydraulic gradient.

GRAVEL - An unconsolidated, natural accumulation of rounded rock fragments resulting from erosion, consisting predominantly of particles larger than sand, such as boulders, cobbles, pebbles, granules or any combination of these fragments.

GROUNDWATER - Refers to the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

GYPSUM - A mineral consisting of hydrous calcium sulfate ($CaSO_4 \cdot 2H_2O$) which usually occurs with halite and anhydrite in evaporite deposits.

HARM - Hazard Assessment Rating Methodology - A system adopted and used by the United States Air Force to develop and maintain a priority listing of potentially contaminated sites on installations and facilities for remedial action based on potential hazard to public health and welfare and environmental impacts (Reference: DEQPPM 81-5, December 11, 1981).

HAS - Hazard Assessment Score - The score developed by using the Hazard Assessment Rating Methodology (HARM).

HAZARDOUS MATERIAL - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions are also found in OSHA and DOT rules.

HAZARDOUS WASTE - A solid or liquid waste that, 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 or incapacitating reversible illness, or

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

HYDRAULIC CONDUCTIVITY - The rate at which water can move through a permeable medium.

HYDRAULIC GRADIENT - The difference in head (elevation of water surface) at two points divided by the distance between these two points.

INUNDATION - A rising of water and spreading over land not normally submerged.

INTRAFORMATIONAL - (a) Formed within a geologic formation, more or less contemporaneously with the enclosing sediments. The term is especially used in regard to syndepositional folding or slumping; (b) existing within a formation.

IRON [mineral] - A heavy, magnetic, malleable and ductile, and chemically active mineral, the native metallic element Fe.

KETONE - One of a class of organic compounds in which the carbonyl radical unites with two hydrocarbon radicals (i.e., acetone, methyl ethyl ketone).

LENS - A geologic deposit bounded by converging surfaces (at least one of which is curved), thick in the middle and thinning out toward the edges, resembling a convex lens. A lense may be double-convex or plano-convex.

LIMESTONE - A sedimentary rock consisting primarily of calcium carbonate, primarily in the form of the mineral calcite.

LOAM - A rich, permeable soil composed of a friable mixture of relatively equal proportions of sand, silt, and clay particles, and usually containing organic matter.

MARSH - A water-saturated, poorly drained area, intermittently or permanently water-covered, having aquatic and grasslike vegetation, essentially without the formation of peat.

MEAN LAKE EVAPORATION - The total evaporation amount for a particular area; amount based on precipitation and climate (humidity).

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

MOTTLED [soil] - a soil that is irregularly marked with spots or patches of different colors, usually indicating poor aeration or seasonal wetness.

MUD FLAT - A relatively level area of fine silt along a shore or around an island, alternately covered and uncovered by the tide, or covered by shallow water.

NET PRECIPITATION - Precipitation minus evaporation.

NUCULANA - A bivalve mollusk belonging to the order of pelecypods termed Taxodonta. This order is chiefly distinguished by the presence of numerous teeth along the hinge plate.

ONLAP - (a) An overlap characterized by the regular and progressive pinching out, toward the margins or shores of a depositional basin, of the sedimentary units within a conformable sequence of rocks, in which the boundary of each unit is transgressed by the next overlying unit and each unit in turn terminates farther from the point of reference; (b) The progressive submergence of land by the advancing sea.

OUTCROP - That part of a geologic formation or structure that appears at the surface of the Earth; also, bedrock that is covered only by surficial deposits such as alluvium.

PD-680 - A cleaning solvent composed predominately of mineral spirits; Stoddard solvent.

PENNSYLVANIAN - A period of the Paleozoic era (after the Mississippian and before the Permian), thought to have covered the span of time between 320 and 280 million years ago; also, the corresponding worldwide system of rocks.

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.

PERMIAN - The last period of the Paleozoic era (after the Pennsylvanian) from 280 to 225 million years ago.

PESTICIDE - A chemical or other substance used to destroy plant and animal pests.

PHYSIOGRAPHIC PROVINCE - Region of similar structure and climate that has had a unified geomorphic history.

PIEZOMETRIC CONTOUR (Equipotential Line) - A contour line along which the pressure head of groundwater in an aquifer is the same.

PLEISTOCENE - The first epoch of the Quaternary period; the Pleistocene began two to three million years ago and lasted until the start of the Holocene period some 8,000 years ago.

PLIOCENE - An epoch of the Tertiary period, after the Miocene and before the Pleistocene; thought to have covered the span of time between 5 and 1.8 million years ago.

POND - A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger then a pool.

PRECAMBRIAN - All geologic time, and its corresponding rocks, before the beginning of the Paleozoic; it is equivalent to about 90% of geologic time.

RECENT - An epoch of the Quaternary period which covers the span of time from the end of the Pleistocene epoch, approximately 8000 years ago, to the present. Also called the Holocene epoch.

RIDGE [geomorph] - A general term for a long, narrow elevation of the Earth's surface, usually sharp-crested with steep sides, occurring either independently or as part of a larger mountain or hill.

RIPARIAN - Of, adjacent to, or living on, the bank of a river or, sometimes of a lake, pond, etc.

RIVER - A general term for a natural freshwater surface stream of considerable volume and a permanent or seasonal flow, moving in a definite channel toward a sea, lake, or another river.

SAND - A rock or mineral particle in the soil, having a diameter in the range 0.52 - 2 mm.

SANDSTONE - A medium-grained fragmented sedimentary rock composed of abundant round or angular fragments of sand, size set in a fine-grained matrix (silt or clay) and more or less firmly united by a cementing material (commonly silica, iron oxide, or calcium carbonate).

SEDIMENT - Solid fragmental material that originates from weathering of rocks and is transported or deposited by air, water, or ice, or that accumulates by other natural agents, such as chemical precipitation from solution or secretion by organisms, and that forms in layers on the Earth's surface at ordinary temperatures in a loose, unconsolidated form; (b) strictly solid material that has settled down from a state of suspension in a liquid.

SEDIMENTARY ROCK - A rock resulting in the consolidation of loose sediment that has accumulated in layers; e.g., a clastic rock (such as conglomerate or tillite) consisting of mechanically formed fragments of older rock transported from its source and deposited in water or from air or ice; or a chemical rock (such as rock salt or gypsum) formed by precipitation from solution; or an organic rock (such as certain limestones) consisting of the remains or secretions of plants and animals.

SHALE - A fine-grained detrital sedimentary rock, formed by the consolidation (especially by compression) of clay, silt, or mud.

SHELF [geomorph] - (a) Bedrock or other solid rock beneath alluvial soil or deposits; (b) A flat, projecting layer or ledge of rock, as on a slope.

SILL - A tabular igneous that parallels the planar structure of the surrounding rock.

SILT [soil] - (a) A rock or mineral particle in the soil, having a diameter in the range 0.002-0.005 mm; (b) A soil containing more than 80% silt-size particles, less than 12%clay, and less than 20% sand.

SILT LOAM - A soil containing 50 - 88% silt, 0 - 27% clay, and 0 - 50% sand.

SILTY CLAY LOAM - A soil containing 27-40% clay, 60-73% silt, and less than 20% sand.

SLOPE - (a) Gradient; (b) The inclined surface of any part of the Earth's surface.

SOLVENT - A substance, generally a liquid, capable of dissolving other substances.

SULFUR - An orthorhombic mineral, the native nonmetallic element S.

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

SWAMP - An area intermittently or permanently covered with water, having shrubs and trees but essentially without the accumulation of peat.

TERRACE - Benches and terraces are relatively flat, horizontal, or gently inclined surfaces, sometimes long and narrrow, which are bounded by a steeper ascending slope on one side and by a steeper descending slope on the opposite side.

TERRANE - An obsolescent term applied to a rock or group of rocks and to the area in which they crop out.

THREATENED SPECIES - Any species that is likely to become an endangered species within the foreseeable future throughout all or significant portion of its range.

TOPOGRAPHY - The general conformation of a land surface, including its relief and the position of its natural and man-made features.

UPGRADIENT - A direction that is topographically or hydraulically upslope.

UPLIFTS [tect] - A structurally high area in the crust, produced by positive movements that raise or upthrust the rocks, as in a dome or arch.

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

WETLANDS - Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

WILDERNESS AREA - An area unaffected by anthropogenic activities and deemed worthy of special attention to maintain its natural condition.

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United States Department of Defense. Defense Environmental Quality Program Policy Memorandum (DEQPPM 8-5), December 11, 1981.

United States Geological Survey. Mingo Quadrangle (Oklahoma). 7.5 Minute Series (Topographic), Photorevised 1982.

United States Geological Survey. Tulsa Quadrangle (Oklahoma). 7.5 Minute Series (Topographic), Photorevised 1982.

United States Government. National Oil and Hazardous Substances Contigency Plan, Subpart H. Federal Register (40 CFR 31219 and 31233), July 16, 1982.

Appendix A

Resumes of Search Team Members

GRACE E. HILL

EDUCATION

B.S. (enrolled), Environmental Science, University of the District of Columbia
A.S., Marine Science, University of the District of Columbia, 1984

CERTIFICATION

Health & Safety Training Level C

EXPERIENCE

Seven years of experience in various environmental and hazardous waste disciplines including Preliminary Assessments, Remedial Investigations, and Feasibility Studies at Superfund sites, RCRA Facility Assessments, Initial Assessment Studies under the Naval Environmental Energy Study Assessment (NEESA), Region IV Compliance investigation for subsequent legal actions, Information Specialist for the EPA/Superfund Hotline, and assisting in the management of REM/FIT zone contracts.

Performed as task leader for the Blue Plains WWTP Biomonitoring Project consisting of laboratory setup, monitoring test organisms, conducting toxicity tests, and preparation of weekly and monthly reports.

EMPLOYMENT

Dynamac Corporation (1988-present): Environmental Scientist

In working for Dynamac's Hazardous Materials Technical Center (HMTC), performs Preliminary Assessments, Remedial Investigations, and Feasibility Studies (PA/RI/FS) under the Air National Guard Installation Restoration Program. Specifically involved in preparing reports detailing site investigation findings, determining rates and extent of contamination, and recommendations for Phase II monitoring and soil sampling.

Participated in a remedial investigation/feasibility study at a Superfund site in Puerto Rico to ascertain the alleged extent of mercury contamination.

C.C. Johnson & Malhotra, P.C. (1985-1988): Environmental Technician

Task leader for the Blue Plains WWTP Biomonitoring Project consisting of laboratory setup, monitoring test organisms, conducting toxicity tests, and preparation of weekly and monthly reports. Participated in groundwater monitoring, well installation and development at Independent Nail, SC, Superfund site. Conducted RCRA Facility Assessments (RFAs) under EPA's REM III Project for Regions I and IV. Performed literature search, site investigations, sample collection, CLP coordination, health and safety plan preparation, data analysis, and document preparation. Participated on a team involved in the research and organization of compliance documents for subsequent legal actions. Participated in the preparation of an RI/FS consisting of surveying and soil, sediment, surface water and groundwater sampling, groundwater contamination migration determination, and residential well sampling at Geiger C&M Oil, SC, DeRewal, NJ, and Limestone Road, MD, Superfund sites. Assisted in the final preparation of the Initial Assessment Studies under the Navy's hazardous waste control program (NEESA) at three Navy facilities.

Geo/Resource Consultants (1984-1985): Environmental Assistant

Information Specialist for the EPA's RCRA/Superfund Hotline involved in technical assistance regarding federal and state regulations and the requirements necessary for the management of hazardous waste, for industry and the public.

Environmental Protection Agency (1981-1984): Intern

As an environmental intern, assisted Field Investigation Team (FIT) Deputy Project Officers in the management of REM/FIT zone contracts. Specifically involved in the evaluation of completed FIT projects, assistance in the award fee process, evaluation of FIT well drilling procedures, development of analytical documents for RCRA 3012 Cooperative Agreement Program, involving the development of a tracking system of the State agencies use of funds for hazardous waste cleanup.

NATASHA M. BROCK

EDUCATION

Graduate work, civil/environmental engineering, University of Maryland, 1987-present
Graduate work, civil/environmental engineering, University of Delaware, 1985-1986
B.S. (cum laude), environmental science, University of the District of Columbia, 1984
Undergraduate work, biology, The American University, 1978-1980

CERTIFICATION

Health & Safety Training Level C

EXPERIENCE

Three years' experience in the environmental and hazardous waste field. Work performed includes remedial investigations/feasibility studies, RCRA facility assessments, comprehensive monitoring evaluations, and remedial facility investigations. Helped develop and test biological and chemical processes used in minimization of hazardous and sanitary waste generation. Researched multiple substrate degradation using aerobic and anaerobic organisms.

EMPLOYMENT

Dynamac Corporation (1987-present): Environmental Scientist

In working for Dynamac's Hazardous Materials Technical Center (HMTC), performs Preliminary Assessments, Remedial Investigations and Feasibility Studies (PA/RI/FS) under the Air National Guard Installation Restoration Program. Specifically involved in determining rates and extent of contamination, recommending groundwater monitoring procedures, and soil sampling and analysis procedures. In the process of preparing standard operating procedure manuals for quick remedial response to site spills and releases, and PA/RI/FS.

C.C. Johnson & Malhotra, P.C. (1986-1987): Environmental Scientist

Involved as part of a team in performing Remedial Investigations/Feasibility Studies (RI/FS) for EPA Regions I and IV under Resource Conservation and Recovery Act (RCRA) work assignments for REM II projects. Participated on a team involved in RCRA Facility Assessments (RFAs), Comprehensive Monitoring Evaluations (CMEs), and Remedial Facility Investigations (RFIs) for EPA work assignments under RCRA for REM III projects in Regions I and IV. Work included solo oversight observations of field sampling and facility inspections. Additional responsibilities included promotion work, graphic layout, data entry-quality check for various projects. Certified Health & Safety Training Level C.

Work Force Temporary Services (1985-1986): Research Scientist

In working for DuPont's Engineering Test Center, helped in the development and testing of laboratory-scale biological and chemical processes for a division whose main purpose was to reduce the amount of hazardous waste generated. Also worked for Hercules, Inc., with a group involved in polymer use for wastewater treatment for clients in various industrial fields. Specifically involved in product consultation, troubleshooting, and product development.

National Oceanic and Atmospheric Administration (1982-1984): Research Assistant

Involved with an information gathering and distribution center of weather impacts worldwide. Specifically involved in data collection, distribution of data to clients, assessment production and special reports.

DEVALACHERUVU M. MURALI

EDUCATION

M.S., Environmental Engineering, Howard University, 1984
M.Sc. (Tech), Hydrogeology, Osmania University, India, 1975
M.S., Geology, Osmania University, India, 1974
B.S., Geology, Osmania University, India, 1972

SPECIALIZED TRAINING

40-hour Hazardous Waste Training under REM II
Supervisor Health and Safety Training, Levels B, C, and D under REM III
Site Manager Training under REM V

CERTIFICATION

Professional Geologist - State of Delaware, 1988

EXPERIENCE

Ten years of diversified experience serving the governmental and academic communities in various environmental fields. Responsibilities included managing multiple projects, with extensive experience in supervision, planning, scheduling, budgeting, and timely submission of deliverables. Fields of specialization include conducting investigations for remedial action/feasibility studies for uncontrolled hazardous waste sites, performing initial assessment studies, and managing the preparation of over 70 decision documents under the Installation Restoration Program (IRP) for the Air National Guard (ANG).

EMPLOYMENT

Dynamac Corporation (1988-present): Hydrogeologist

Responsibilities include supervising and managing the preparation of over 70 Decision Documents for various Air National Guard Bases throughout the United States, as part of the ANG IRP. Performed Preliminary Assessment (PA) studies at Tulsa, Oklahoma, ANG Base. Also responsible for preparing and reviewing technical proposals and reports.

C.C. Johnson & Malhotra, P.C. (1985-1988): Project Leader

As project leader for the Environmental Studies Group, conducted Remedial Investigation/Feasibility Studies at seven sites as part of REM II, III, IV, and V teams, on a contract with U.S. EPA. Investigation included preparing work plans, field operations plans, health and safety plans, data management plans, QA/QC plans, site inspection reports, remedial investigation reports, and feasibility reports. Responsibilities included managing multiple projects which required extensive experience in supervision, planning, scheduling, budgeting, and reporting to U.S. EPA with timely submission of deliverables. Prepared technical specifications for subcontractor services including site survey, lab analytical services, drilling services, and waste hauling. As assistant site manager, successfully coordinated, directed, and supervised all field operations. Work included site surveying, geophysical investigations, and soil, surface water and sediment sampling, with thorough understanding of CLP lab protocols including shipping and handling of samples. Also instrumental in establishing site-specific groundwater monitoring network, including piezometers and monitoring wells installation, followed by well construction and development. Conducted slug and pump tests, followed by groundwater sampling to gather information on aquifer characteristics, and water quality investigation for plume determination. Acquired extensive experience in data reduction, statistical analysis, and interpretation of data and maps. Prepared RI/FS reports. Studies involved source identification, definition of areal and vertical extent of contamination, and selection of cost-effective technologies to clean up the sites. Prepared Record of Decision (ROD) documents for a site in Region II. As a part of the team, took active part in the preparation of initial assessment studies for three U.S. Naval facilities to identify and evaluate potential hazardous waste sites.

M&M Enterprises, Inc. (1984-1985): Hydrogeologist/Environmental Engineer

Established groundwater monitoring systems for plume determination at hazardous waste sites (G&H Wells and Sullivans Ledge in Massachusetts, and Old Springfield Landfill, Vermont). Work involved setting up monitoring wells and piezometers, litholog preparation, and well construction and development.

Howard University (1981-1984): Research Associate

Performed research on disinfectants in water and trihalomethane removal and formation mechanisms. Disinfectant research included physical and chemical analysis of water, determination of ions, heavy metals, and bacteria. Chlorine and disinfectants were made in terms of disinfectant demand and germicidal killing.

National Geophysical Research Institute, India (1977-1981): Project Scientist

Responsible for completing four major projects in various drainage basins of different hydrogeological units. Work included estimation of recharge, groundwater direction, velocity, and groundwater reserves using radioactive tracers, for understanding the groundwater dynamics of river basins.

Osmania University, India (1975-1977): Hydrogeologist, Geology Department

Conducted groundwater exploration and exploitation for various projects. Studies included reconnaissance surveys using data from surface and subsurface geophysical investigations, drilling, well design, well construction, well logging, and estimating aquifer characteristics.

HARDWARE

IBM-XT, Digital Rainbow 100

SOFTWARE

Lotus 1,2,3, dBASE III Plus

PROFESSIONAL AFFILIATIONS

American Water Works Association (AWWA)
National Water Works Association (NWWA)

PUBLICATIONS

Trihalomethane Removal and Formation Mechanism in Water, May 1983, Office of Water Research and Technology, Washington, D.C., NTIS #PB 83-224410 (co-author).

Influence of Particulate Matter on Disinfectant Demand, February 1984 (co-author).

Estimation of Recharge for Forest Regions of Lower Maner Basin, A.P., India, July 1984 (co-author).

RAYMOND G. CLARK, JR.

EDUCATION

Completed graduate engineering courses, George Washington University, 1957
B.S., Mechanical Engineering, University of Maryland, 1949

SPECIALIZED TRAINING

Grad. European Command Military Assistance School, Stuttgart, 1969
Grad. Army Psychological Warfare School, Fort Bragg, 1963
Grad. Sanz School of Languages, D.C., 1963
Grad. DOD Military Assistance Institute, Arlington, 1963
Grad. Defense Procurement Management Course, Fort Lee, 1960
Grad. Engineer Officer's Advanced Course, Fort Belvoir, 1958

CERTIFICATIONS

Registered Professional Engineer: Kentucky (#4341); Virginia (#8303); Florida (#36228)

EXPERIENCE

Thirty-one years of experience in engineering design, planning and management including construction and construction management, environmental, operations and maintenance, repair and utilities, research and development, electrical, mechanical, master planning and city management. Over six years' logistical experience including planning and programming of military assistance materiel and training for foreign countries, serving as liaison with American private industry, and directing materiel storage activities in an overseas area. Over two years' experience as an engineering instructor. Extensive experience in personnel management, cost reduction programs, and systems improvement.

EMPLOYMENT

Dynamac Corporation (1986-present): Program Manager/Department Manager

Responsible for activities relating to Preliminary Analysis, Site Investigations, Remedial Investigations, Feasibility Studies, and Remedial Action for the Installation Restoration Program for the U.S. Air Force, Air National Guard, Bureau of Prisons, and the U.S. Coast Guard, including records search, review and evaluation of previous studies; preparation of statements of work, feasibility studies; preparation of remedial action plans, designs and specifications; review of said studies/plans to ensure that they are in conformance with requirements; review of environmental studies and reports; preparation of Air Force Installation Restoration Program Management Guidance; and preparation of Part B permits.

Howard Needles Tammen & Bergendoff (HNTB) (1981-1986): Manager

Responsible, as Project Manager, for: design of a new concourse complex at Miami International Airport to include terminal building, roadway system, aircraft apron, drainage channel relocation, satellite building with underground pedestrian tunnel, and associated underground utility corridors, to include subsurface aircraft fueling systems, with an estimated construction cost of $163 million; a cargo vehicle tunnel under the crosswind runway with an estimated construction cost of $15 million; design and construction of two large corporate jet aircraft hangars; and for the hydrocarbon recovery program to include investigation, analysis, design of recovery systems, monitoring of recovery systems, and planning and design of residual recovery systems utilizing biodegradation. Participated, as sub-consultant, in Air Force IRP seminar.

HNTB (1979-1981): Airport Engineer

Responsibilities included development of master plan for Iowa Air National Guard base; project initiation assistance for a new regional airport in Florida; engineering assistance for new facilities design and construction for Maryland Air National Guard; master plan for city maintenance facilities, Orlando, Florida; in-country master plan and preliminary engineering project management for Madrid, Spain, International Airport; and project management of master plan for Whiting Naval Air Station and outlying fields in Florida.

HNTB (1974-1979): Design Engineer

Responsibilities included development of feasibility and site selection studies for reliever airports in Cleveland and Atlanta; site selection and facilities requirements for the Office of Aeronautical Charting and Cartography, NOAA; and onsite mechanical and electrical engineering design for terminal improvements at Baltimore-Washington International Airport, Maryland.

HNTB (1972-1974): Airport Engineer

Responsible for development of portions of the master plan and preliminary engineering for a new international airport for Lisbon, Portugal, estimated to cost $250 million.

Self-employed (1971-1972): Private Consultant

Responsible for engineering planning and installation of a production line for multimillion-dollar contract in Madrid, Spain, to fabricate transmissions and differentials for U.S. Army vehicles.

U.S. Army, Corps of Engineers (1969-1971): Chief, Materiel & Programs

Directed materiel planning and military training programs of military assistance to the Spanish Army. Controlled arrival and acceptance of materiel by host government. Served as liaison/advisor to American industry interested in conducting business with Spanish government. Was Engineer Advisor to Spanish Army Construction, Armament and Combat Engineers, also the Engineer Academy and Engineer School of Application.

Corps of Engineers (1968-1969): Chief, R&D Branch, OCE

Directed office responsible to Chief of Engineers for research and development. Developed research studies in new concepts of bridging, new explosives, family of construction equipment, night vision equipment, expedient airfield surfacing, expedient aircraft fueling systems, water purification equipment and policies, prefabricated buildings, etc. Achieved Department of Army acceptance for development and testing of new floating bridge. Participated in high-level Department Committee charged with development of a Tactical Gap Crossing Capability Model.

Corps of Engineers (1967-1968): Division Engineer

Facilities engineer in Korea. Was fully responsible for management and maintenance of 96 compounds within 245 square miles including 6,000+ buildings, 1 million linear feet of electrical distribution lines, 18 water purification and distribution systems, sanitary sewage disposal systems, roads, bridges, and fire protection facilities with real property value of more than $256 million. Planned and developed the first five-year master plan for this area. Administered $12 million budget and $2 million engineer supply operation. Was in responsible charge of over 500 persons. Developed and obtained approval for additional projects worth $9 million for essential maintenance and repair. Directed cost reduction programs that produced more than $500,000 savings to the United States in the first year.

Corps of Engineers (1963-1967): Engineer Advisor

Engineer and aviation advisor to the Spanish Army. Developed major modernization program for Spanish Army Engineers, including programming of modern engineer and mobile maintenance equipment. Directed U.S. portion of construction, testing and acceptance of six powder plants, one shell loading facility, an Engineer School of Application, and depot rebuild facilities for engineer, artillery, and armor equipment. Planned and developed organization of a helicopter battalion for the Spanish Army. Responsible for sales, delivery, assembly and testing of 12 new helicopters in country. Provided U.S. assistance to unit until self-sufficiency was achieved. Was U.S. advisor to Engineer Academy, School of Application and Polytechnic Institute.

Corps of Engineers (1960-1963): Deputy District Engineer

Responsible for planning and development of extensive construction projects in the Ohio River Basin for flood control and canalization, including dam, lock, bridge, and building construction, highway relocation, watershed studies, real estate acquisitions and dispositions. Was contracting officer for more than $75 million of projects per year. Supervised approximately 1,300 personnel, including 300 engineers. Planned and directed cost reduction programs amounting to more than $200,000 per year. Programmed and controlled development of a modern radio and control net in a four-state area.

Corps of Engineers (1959-1960): Area Engineer

Directed construction of a large airfield in Ohio as Contracting Officer's representative. Assured that all construction (runway, steam power plant, fuel transfer and loading facilities, utilities, buildings, etc.) complied with terms of plans and specifications. Was onsite liaison between Air Force and contractors.

Corps of Engineers (1958-1959): Chief, Supply Branch

Managed engineer supply yard containing over $21 million construction supplies and engineer equipment. Directed in-storage maintenance, processing and deprocessing of equipment. Achieved complete survey of items on hand, a new locator system and complete rewarehousing, resulting in approximately $159,000 savings in the first year.

Corps of Engineers (1957-1958): Student

U.S. Army Engineer School, Engineer Officer's Advanced Course.

Corps of Engineers (1954-1957): Engineer Manager

Managed engineer construction projects and was assigned to staff and faculty of the Engineer School. Was in charge of instruction on engineer equipment utilization, management and maintenance. Directed Electronic Section of the school. Coordinated preparation of five-year master plan for the Department of Mechanical and Technical Equipment.

Corps of Engineers (1949-1954): Engineer Commander

Positions of minor but increasing importance and responsibility in engineering management, communications, demolitions, construction administration and logistics.

PROFESSIONAL AFFILIATIONS

Member, National Society of Professional Engineers
Fellow, Society of American Military Engineers
Member, American Society of Civil Engineers
Member, Virginia Engineering Society
Member, Project Management Institute

HARDWARE

IBM PC

SOFTWARE

Lotus 1-2-3, D Base III Plus, Framework, Project Scheduler 5000, Harvard Project Manager, Volkswriter, Microsoft Project

MARK D. JOHNSON

EDUCATION

B.S., Geology, James Madison University, 1980

EXPERIENCE

Eight years' technical and management experience including geologic mapping, subsurface investigations, foundation inspections, groundwater monitoring, pumping and observation well installation, geotechnical instrumentation, groundwater assessment, preparation of Air Force Installation Restoration Program Guidance, preparation of statements of work for environmental field monitoring and feasibility studies for the Air Force and the Air National Guard, development of environmental field monitoring programs, and preparation of Preliminary Assessments for the Air National Guard.

EMPLOYMENT

<u>Dynamac Corporation (1984-present)</u>: Senior Staff Scientist/Geologist

Primarily responsible for developing and managing technical support programs relevant to CERCLA related activities for the Air Force, Air National Guard, Department of Justice and Coast Guard. These activities include Statements of Work for Site Investigations (SI), Remedial Investigations (RI), and Feasibility Studies (FS); assessing groundwater at hazardous waste disposal/spill sites for the purpose of determining rates and extents of contaminant migration and for developing SI and RI programs and identifying remedial actions; reviewing SI, RI and FS contractor work plans for various government clients, developing technical and contractual requirements for SI, RI and FS projects, managing the development and preparation of Preliminary Assessments, and assisting clients in the development of their environmental management programs, which included preparation of the Air Force's Installation Restoration Program Management Guidance document.

<u>Bechtel Associates Professional Corporation (1981-1984)</u>: Geologist

Performed the following duties in conjunction with major civil engineering projects including subways, nuclear power plants and buildings: prepared geologic maps of surface and subsurface facilities in rock and soil including tunnels, foundations and vaults; assessed groundwater conditions in connection with construction activities and groundwater control systems; monitored the installation of permanent and temporary dewatering systems and observation wells; monitored surface and subsurface settlement of tunnels; and participated in subsurface investigations.

<u>Schnabel Engineering Associates (1981)</u>: Geologist

Inspected foundations and backfill placement.

PROFESSIONAL CREDENTIALS

Registered Professional Geologist, South Carolina, #116, 1987

PROFESSIONAL AFFILIATIONS

Association of Engineering Geologists
National Water Well Association/Association of Ground Water Scientists and Engineers

Appendix B

Outside Agency Contact List

OUTSIDE AGENCY CONTACT LIST

1. U.S. Geological Survey
   12201 Sunrise Valley Drive
   Reston, VA

2. Soil Conservation Service
   4116 East 15th Street
   Tulsa, Oklahoma 74112

3. Oklahoma Water Resource Board
   440 South Huston
   Room 2
   Tulsa, Oklahoma 74127
   Mr. Robert Simms (918) 581-2924

4. Bureau of Land Management
   9522 H East 47th Place
   Tulsa, Oklahoma 74145
   Laurel Upshaw (918) 581-6480

5. City of Tulsa Water & Sewer Department
   2317 South Jackson Avenue
   Tulsa, Oklahoma 74107
   Clayton Edwards (918) 596-9576
   Monte Hannon (918) 588-9571

6. Storm Water Management Department
   200 Civic Center
   Tulsa, Oklahoma 74103

7. USGS Water Resource Division
   P. O. Box 47004
   Tulsa, Oklahoma 74147

8. USGS Minerals Management Service
   6126 East 32nd Place
   Tulsa, Oklahoma 74135

9. USGS Office of Surface Mining
   5100 East Skelly Drive
   Suite 550
   Tulsa, Oklahoma 74135

10. NEOK Exploration, Inc.
6815 South Canton
Suite 105
Tulsa, Oklahoma 74136
John Helton (918) 493-2404

11. W. V. Knight Exploration Company
9815 South Harvard Avenue
Suite 530
Tulsa, Oklahoma 74135
William V. Knight (918) 749-3731

12. Tulsa Geological Society
1307 South Boulder Street
Tulsa, Oklahoma 74119
(918) 582-4762

13. Department of Wildlife Conservation
1801 North Lincoln
P. O. Box 53465
Oklahoma City, Oklahoma 73105

14. United States Fish and Wildlife Service of Tulsa
Office of Ecological Services
222 South Huston Street
Suite A
Tulsa, Oklahoma 74127
Alan Ratzlaff (918) 581-7458

15. Federal Emergency Management Agency
Federal Regional Center
800 North Loop 288
Region 6
Denton, TX 76201
Don Ellison (817) 898-9156

16. Tulsa City - County Health Department
4616 East 15th Street
Tulsa, Oklahoma 74112
Terry Silva (918) 744-1000

17. American Airlines
3800 North Mingo Road
Tulsa, Oklahoma 74151
Ms. Margaret Golliver (918) 832-2962

Appendix C

USAF Hazard Assessment Rating Methodology

USAF HAZARD ASSESSMENT RATING METHODOlOGY

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 Preliminary Assessment phase of its Installation Restoration Program (IRP).

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 National Guard in setting priorities for follow-on site investigations.

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 Preliminary Assessment portion of the IRP. Scoring judgment 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. 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 of this report). The site rating form and the rating factor guideline are provided at the end of this appendix.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: possible receptors of the contamination, the waste and its characteristics, the potential pathways for contaminant migration, and any efforts that were made to contain the wastes resulting from a spill.

The receptors category rating is based on four rating factors: the potential for human exposure to the site, the potential for human ingestion of contaminants should underlying aquifers be polluted, the current and anticipated uses of the surrounding area, and the potential for adverse effects upon important biological resources and fragile natural settings. The potential for human exposure is evaluated on the basis of the total population within 1,000 feet of the site, and the distance between the site and the base boundary. The potential for human ingestion of contaminants is based on the distance between the site and the nearest well, the groundwater use of the uppermost aquifer, and population served by the groundwater supply within 3 miles of the site. The uses of the surrounding area are determined by the zoning within a 1-mile radius. Determination of whether or not critical environments exist within a 1-mile radius of the site predicts the potential for adverse effects from the site upon important biological resources and fragile natural settings. Each rating factor is numerically evaluated (0-3) and increased by a multiplier. The maximum possible score is also computed. The factor score and maximum possible scores are totaled, and the receptors subscore is computed as follows: receptors subscore = (100 x factor score subtotal/maximum score subtotal).

The waste characteristics category is scored in three stages. 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 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: surface-water migration, flooding, and groundwater migration. 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 the three possible routes is used. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The scores for each of the three categories are added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Scores for sites with no 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.

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 ft. of site		4		12
B. Distance to nearest well		10		30
C. Land use-zoning within 1 mile radius		3		9
D. Distance to installation boundary		6		18
E. Critical environments within 1 mile radius of site		10		30
F. Water quality of nearest surface water body		6		18
G. Groundwater use of uppermost aquifer		9		27
H. Population served by surface water supply within 3 miles downstream of site		6		18
I. Population served by groundwater supply within 3 miles of site		6		18
		Subtotals	______	180

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 groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

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

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

2. Flooding

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

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater		8		24
Net precipitation		6		18
Soil permeability		8		24
Subsurface flows		8		24
Direct access to groundwater		8		24
		Subtotals	______	114

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

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

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

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

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

______ x ______ = ______

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.	Groundwater 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	1-50	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

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

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

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

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

S = Suspected confidence level

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

A-3 Hazard Rating

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

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

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

II. **WASTE CHARACTERISTICS**--Continued

Waste Characteristics Matrix

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

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

Confidence Level
- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

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

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

B. **Persistence Multiplier for Point Rating**

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

C. **Physical State Multiplier**

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

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, groundwater, 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	0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to a mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($>10^{-6}$ cm/sec)	6
Rainfall intensity based on 1-year, 24 hour rainfall (thunderstorms)	<1.0 inch 0-5 0	1.0 to 2.0 inches 6-35 30	2.1 to 3.0 inches 36-49 60	>3.0 inches >50 100	8
B-2 Potential for Flooding					
Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1
B-3 Potential for Groundwater Contamination					
Depth to groundwater	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
Subsurface flows	Bottom of site greater than 5 feet above high groundwater level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean groundwater level	8
Direct access to groundwater (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-B-3, then leave blank for calculation of factor score and maximum possible score.

Appendix D

Site Hazardous Assessment Rating Forms and Factor Rating Criteria

HAZARDOUS ASSESSMENT RATING FORM

ME OF SITE Building 304 - Site 1

CATION Oklahoma Air National Guard, Tulsa

TE OF OPERATION OR OCCURENCE 1959 to present

NER/OPERATOR 138th TFG

MMENTS/DESCRIPTION

TE RATED BY HMTC

RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Population within 1,000 ft. of site	3	4	12	12
Distance to nearest well	0	10	0	30
Land use-zoning within 1 mile radius	3	3	9	9
Distance to installation boundary	3	6	18	18
Critical environments within 1 mile radius of site	3	10	30	30
Water quality of nearest surface water body	0	6	0	18
Groundwater use of uppermost aquifer	0	9	0	27
Population served by surface water supply within 3 miles downstream of site	3	6	18	18
Population served by groundwater supply within 3 miles of site	0	C	0	18
		Subtotals	87	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 48

. 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

:. 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 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
		Subtotals	52	108

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

2. Flooding

Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to groundwater	0	8	0	24
		Subtotals	24	114

Subscore (100 x factor score subtotal/maximum score subtotal) 21

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

Pathways Subscore 80

WASTE MANAGEMENT PRACTICES

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

Receptors	48
Waste Characteristics	60
Pathways	80

Total 188 divided by 3 = 63
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

64 x 0.95 = 60

138th Tactical Fighter Group
Oklahoma Air National Guard
Tulsa International Airport
Tulsa, Oklahoma

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

Site No. 1 - Building 304

1.	**RECEPTORS CATEGORY**	**RATING SCALE LEVELS**	**NUMERICAL VALUE**
	Population within 1,000 feet of site	Greater than 100	3
	Distance to nearest well	Greater than 3 miles	0
	Land use/zoning within 1 mile radius	Residential	3
	Distance Base boundary	0 to 1,000 feet	3
	Critical environments	Major habitat of an endangered or threatened species	3
	Water quality of nearest surface water body	Agricultural or Industrial use	0
	Groundwater use of uppermost aquifer	Not used, other sources available	0
	Population served by surface water supply within 3 miles downstream of site	Greater than 1,000	3
	Population served by groundwater supply within 3 miles of site	0	0
2.	**WASTE CHARACTERISTICS**	**RATING SCALE LEVELS**	**NUMERICAL VALUE**
	Quantity	Small quantity	S
	Confidence Level	Confirmed	C
	Hazard Rating:		
	Toxicity	Level 3	3
	Ignitability	Flash point at 80°F to 140°F	2
	Radioactivity	At or below background levels	0
	Persistance Multiplier	Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
	Physical State Multiplier	Liquid	1.0

138th Tactical Fighter Group
Oklahoma Air National Guard
Tulsa International Airport
Tulsa, Oklahoma

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria (continued)

3.	**PATHWAYS CATEGORY**	**RATING SCALE LEVELS**	**NUMERICAL VALUE**
	Surface Water Migration:		
	Distance to nearest surface water	0 to 500 feet	3
	Net precipitation	Less than -10 inches	0
	Surface erosion	None	0
	Surface permeability	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	2
	Rainfall intensity	2.1 to 3.0 inches	2
	Flooding:	Beyond 100-year flood plain	0
	Groundwater Migration:		
	Depth to groundwater	11 feet to 50 feet	2
	Net precipitation	Less than -10 inches	0
	Soil permeability	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	1
	Subsurface flow	Bottom of site greater than 5 feet above high groundwater level	0
	Direct access to groundwater	No evidence of risk	0

4.	**WASTE MANAGEMENT PRACTICES CATEGORY**	**RATING SCALE LEVELS**	**NUMERICAL VALUE**
	Practice:	Limited containment	0.95

Appendix E

Underground Storage

Tank Inventory

Underground Storage Tank Inventory
138th TFG, Oklahoma Air National Guard,
Tulsa International Airport, Tulsa Oklahoma

TANK LOCATION IDENTIFICATION

Location	Bldg 025	Bldg 025	Bldg 025	Bldg 025	Bldg 314	Bldg 603
Capacity (gallons)	6,000	200	6,000	4,000	500	550
Contents	Gasoline Fuel	Waste Engine Oil	Gasoline Fuel	Diesel Fuel	Waste Oil	Waste Oil
Year Installed	1985	1985	1985	1985	1974	1987
Material of Construction	Fiberglass	Steel	Fiberglass	Fiberglass	Steel	Fiberglass
Coatings A. Interior B. Exterior	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. Black Asphaltum	A. uncoated B. uncoated
Cathodic Protection	None	None	None	None	None	None
Status of Tank (Year abandoned)	Active	Active	Active	Active	Active	Active

Underground Storage Tank Inventory
138th TFG, Oklahoma Air National Guard,
Tulsa International Airport, Tulsa Oklahoma

TANK LOCATION IDENTIFICATION

Location	Bldg 318	Bldg 318	Bldg 401	Bldg 401	Bldg 501	Bldg 501
Capacity (gallons)	550	1,000	6,000	5,000	1,150	1,150
Contents	Gasoline Fuel	Jet Fuel	Gasoline Fuel	Diesel Fuel	Waste oil	Waste oil
Year Installed	1980	1980	1985	1977	1968	1970
Material of Construction	Fiberglass	Fiberglass	Fiberglass	Fiberglass	Concrete	Concrete
Coatings A. Interior B. Exterior	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. uncoated
Cathodic Protection	None	None	None	None	None	None
Status of Tank (Year abandoned)	Active	Active	Active	Active	Active	Active

Appendix F

Environmental Monitoring

INFLOW TO BASE 8.5

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE	4. REQUESTOR SAMPLE NO
OEHL	001425 001429	GN 87 0003

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION 12 JAN 1987 15 40

5. DATE RECEIVED BY LAB: 12 Jan, 87
6. DATE ANALYSIS COMPLETED: 3 Feb, 87

ON-SITE ANALYTICAL RESULTS

8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L

11. COLLECTION DATE/PERIOD
12. COLLECTORS NAME
19. RESULTS OF OTHER ON-SITE ANALYSES
13. SAMPLING TECHNIQUE
14. PHONE NUMBER
15. REASON FOR SAMPLE SUBMISSION
NPDES #

ANALYSES REQUESTED AND RESULTS (034)

001425 Preservation Group A (015)	Total	MG/L
Chemical Oxygen Demand	00340	15.
Total Organic CARBON as C	00680	4.

001426 Preservation Group B (29)	Total	MG/L
OIL & GREASE FREON-IR Method	00560	<.3

001427 Preservation Group C (16)	Total	MG/L
AMMONIA as N	00610	<.2
NITRATE as N Cd Reduct. Method	00620	.
NITRITE as N	00615	.
TOTAL KJELDAHL NITROGEN as N	00625	.
PHOSPHORUS Ortho PO4 as P	70507	.
PHOSPHORUS as P	00665	0.17

001428 Preservation Group F (020)		Total	µG/L
ARSENIC	01000	01002	<10 .
BARIUM	01005	01007	<1000 .
CADMIUM	01025	01027	<10 .
CHROMIUM	01030	01034	<50 .
CHROMIUM Hexavalent		01032	<50 .
COPPER	01040	01042	<20 .
IRON	01046	01045	284 .
LEAD	01049	01051	<20 .
MANGANESE	01056	01055	<50 .
MERCURY	71890	71900	<1 .
NICKEL	01065	01067	<50 .
SELENIUM	01145	01147	<10 .
SILVER	01075	01077	<10 .
ZINC	01090	01092	<50 .
CALCIUM as Ca	00915	00916	49.2 mg/l
MAGNESIUM as Mg	00925	00927	5.3 mg/l
POTASSIUM	00935	00937	3.1 mg/l
SODIUM	00930	00929	16.5 mg/l
Antimony		01097	<10
Beryllium		01007	<10
Thallium		01059	<10

001429 Preservation Group G	Total	MG/L
BORON	01022	<500. µg/l
BORON, Dissolved	01020	. µg/l
CHLORIDE	00940	.
COLOR	00080	Units
FLUORIDE	00951	1.1
Residue Filterable (TDS)	00515	203.
Residue Non Filt (SS)	00530	4.
Residue	00500	220.
Residue Volatile	00505	.
Specific Conductance	00095	µmho.
SULFATE as SO_4	00945	44.
SURFACTANTS MBAS as LAS (034)	38260	<.1
TURBIDITY	00076	Units

Preservation Group D: Parameter	Total	MG/L
CYANIDE	00720	.
CYANIDE Free, Amenable to Cl_2	00722	.

Preservation Group E: Parameter	Total	µG/L
PHENOLS	32730	.

PRESERVATION GROUP J
PARAMETER

1. ORGANIZATION REQUESTING ANALYSIS
Hardness as MG/L $CaCO_3$ = 145

TUBAANG

CHEMIST JSC
ENJM [signature]

REVIEWED BY

APPROVED BY
[signature]

AFSC Form 3145, DEC 85 REPLACES AMD FORM 201, MAR 8_ IS OBSOLETE F-1 NON-POTABLE WATER ANALYSIS

2. LABORATORY PERFORMING ANALYSIS: OEHL — OUTFLOW FROM BASE 001420 — 001424

4. REQUESTOR SAMPLE NO: GN 87 0001

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION	5. DATE RECEIVED BY LAB	6. DATE ANALYSIS COMPLETED
	12 Jan. 87	3 Feb. 87

ON-SITE ANALYTICAL RESULTS

8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER	16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O_2 00300 MG/L

11. COLLECTION DATE/PERIOD	12. COLLECTORS NAME	19. RESULTS OF OTHER ON-SITE ANALYSES
13. SAMPLING TECHNIQUE	14. PHONE NUMBER	

15. REASON FOR SAMPLE SUBMISSION

NPDES #

PARAMETERS TESTED AND RESULTS

001420 PRESERVATION GROUP A (019)	TOTAL	MG/L	001423 PRESERVATION GROUP F (020)		TOTAL	µG/L	001424 PRESERVATION GROUP G (034)	TOTAL	MG/L
Chemical Oxygen Demand	00340	15	ARSENIC	01000	01002	<10	BORON	01022	<500 µg/l
Total Organic CARBON as C	00680	4	BARIUM	01005	01007	<1000	BORON, Dissolved	01020	µg/l
001421 PRESERVATION GROUP B (29)	TOTAL	MG/L	CADMIUM	01025	01027	<10	CHLORIDE	00940	
			CHROMIUM	01030	01034	<50	COLOR	00080	Units
OIL & GREASE FREON-IR Method	00560	2.0	CHROMIUM Hexavalent		01032	<50	FLUORIDE	00951	0.9
001422 PRESERVATION GROUP C (16)	TOTAL	MG/L	COPPER	01040	01042	<20	Residue Filterable (TDS)	00515	319
			IRON	01046	01045	344	Residue Non Filt (SS)	00530	2
AMMONIA as N	00610	<.2	LEAD	01049	01051	<20	Residue	00500	321
NITRATE as N Cd Reduct. Method	00620		MANGANESE	01056	01055	182	Residue Volatile	00505	
NITRITE as N	00615		MERCURY	71890	71900	<1	Specific Conductance	00095	µmhos
TOTAL KJELDAHL NITROGEN as N	00625		NICKEL	01065	01067	<50	SULFATE as SO_4	00945	88
PHOSPHORUS Ortho PO4 as P	70507		SELENIUM	01145	01147	<10	SURFACTANTS MBAS as LAS (034)	38260	<.1
PHOSPHORUS as P	00665	0.1	SILVER	01075	01077	<10	TURBIDITY	00076	Units
			ZINC	01090	01092	<50			
PRESERVATION GROUP D			CALCIUM as Ca	00915	00916	66.1 mg/l			
PARAMETER	TOTAL	MG/L	MAGNESIUM as Mg	00925	00927	11.5 mg/l			
CYANIDE	00720		POTASSIUM	00935	00937	2.1 mg/l			
CYANIDE Free, Amenable to Cl_2	00722		SODIUM	00930	00929	33.3 mg/l			
PRESERVATION GROUP E			Antimony		01097	<10	**PRESERVATION GROUP J**		
PARAMETER	TOTAL	µG/L					PARAMETER		
PHENOLS	32730		Beryllium		01012	<10			
			Thallium		01059	<10			

1. ORGANIZATION REQUESTING ANALYSIS

Hardness as mg/l $CaCO_3$ = 212

138th CLINIC/SGPB
TULSA ANG 4200 N 93 E Ave
OK 74115-1699

CHEMIST: JSC EHJM / GFSM

REVIEWED BY

APPROVED BY: [signature]

AFSC Form 3145, DEC 85 REPLACES AMD FORM 201, MAR 83, WHICH IS OBSOLETE — NON-POTABLE WATER ANALYSIS