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INSTALLATION RESTORATION PROGRAM

FINAL

SITE INVESTIGATION REPORT

185 th TACTICAL FIGHTER GROUP
IOWA AIR NATIONAL GUARD
SIOUX GATEWAY AIRPORT
SERGEANT BLUFF, IOWA

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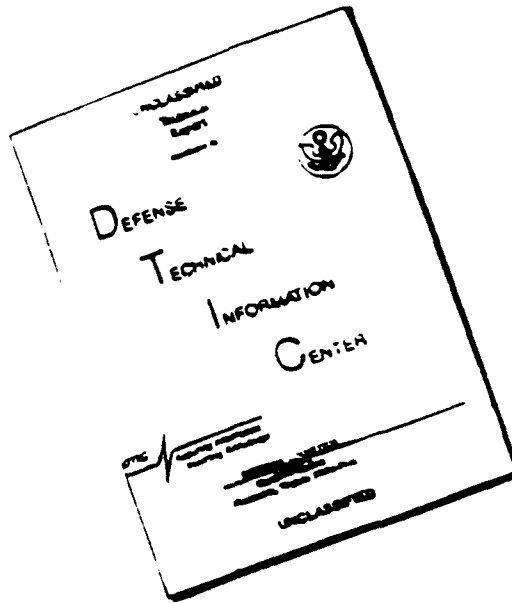
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AIR NATIONAL GUARD
INSTALLATION RESTORATION PROGRAM
SITE INVESTIGATION REPORT

FINAL

**185th Tactical Fighter Group
Iowa Air National Guard
Sioux Gateway Airport
Sergeant Bluff, Iowa**

Prepared by:

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MARTIN MARIETTA ENERGY SYSTEMS, INC.
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Prepared for:

**NGB/DEVR
ANDREWS AIR FORCE BASE, MARYLAND**

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185TH TACTICAL FIGHTER GROUP
SERGEANT BLUFF, IOWA

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ACRONYMS

AAS - Atomic Absorption Spectrophotometer
ANG - Air National Guard
ARAR - Applicable or Relevant and Appropriate Requirements
ASTM - American Society for Testing Materials

BAT - Best Available Technology
BCT - Best Conventional Technology
BTEX- Benzene, Toluene, Ethylbenzene, Xylenes

•C - degrees centigrade
CCC - Calibration Check Compounds
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CLP - Contract Laboratory Program

DD - Decision Document
DNR - Department of Natural Resources
DOD - Department of Defense
DOE - Department of Energy
DQO - Data Quality Objectives

EC - electrical conductivity
ES - Engineering-Science, Inc.
eV - electron volt

FS - Feasibility Study
FFS - Focused Feasibility Study

GC - gas chromatograph
GC/MS - Gas Chromatography/Mass Spectrometry

HAL - Health Advisory Limit
HSP - Health and Safety Plan
HARM - Hazard Assessment Rating Methodology
HAS - Hazard Assessment Scores
HAZWRAP - Hazardous Waste Remedial Actions Program
HMTC - Hazardous Materials Technical Center

LANG- Iowa Air National Guard
ICP - Inductively Coupled Plasma Emission Spectrometer
IRP - Installation Restoration Program

LQAC - Laboratory Quality Assurance Coordinator

MCL - Maximum Contaminant Level
MCLG - Maximum Contaminant Level Goal
MSL - Mean Sea Level

ACRONYMS (continued)

NAAQS - National Ambient Air Quality Standard
NPDES - National Pollutant Discharge and Elimination System
NBS - National Bureau of Standards
NGB - National Guard Bureau
NPL - National Priority List
NRL - Negligible Risk Level

OSHA - Office of Safety and Health Administration

PA - Preliminary Assessment
PID - Photoionization Detector
PMP - Project Management Plan
PQL - Practical Quantification Limits
PR - Percent Recovery
PRE - Preliminary Risk Evaluation
PSA - Phase-Separated Hydrocarbons

QA - Quality Assurance
QAM - Quality Assurance Manager
QAPP - Quality Assurance Project Plan
QC - Quality Control

RCRA - Resource Conservation and Recovery Act
RD - Remedial Design
RI - Remedial Investigation
RM - Remedial Measure
RPD - Relative Percent Difference
RRF - Relative Response Factors

SAP - Sampling and Analysis Plan
SARA - Superfund Amendments Reauthorization Act
SCO - Support Contractor Office
SI - Site Investigation
SOW - Statement of Work
SPCC - System Performance Calibration Compounds

TIP - photoionization detector - manufactured by Photovac
TPH - total petroleum hydrocarbons
TWWV - Total Well Water Volume

USAF - U.S. Air Force
USCS - Unified Soil Classification System
USEPA - United States Environmental Protection Agency
UST - underground storage tank

EXECUTIVE SUMMARY

This report documents the findings and activities of the Site Investigation (SI) conducted at the Iowa Air National Guard (LANG) the Sioux Gateway Airport in Sergeant Bluff, Iowa. Field activities at the Installation took place between July 17, 1990 and August 24, 1990. This SI was conducted under the Department of Defense Installation Restoration Program. The purpose of the investigation was to confirm or deny the presence of chemical contamination in sediment and groundwater at the Base and assess potential risks to the environment and human health.

The LANG Installation is located in the west central region of Iowa, approximately seven miles south of downtown Sioux City, in Woodbury County. It is located along Interstate Route 29, just east of the Missouri River. The 185th Tactical Fighter Group operates from 92 acres of land and occupies 40 buildings at the Sioux Gateway Airport.

The Preliminary Assessment (PA) Report (Hazardous Materials Technical Center, 1988) for the LANG identified two sites that may contain hazardous materials or hazardous waste. These sites were rated according to the Hazard Assessment Rating Methodology (HARM) and recommended for further investigation.

During the SI, a total of 17 soil borings were advanced by a drilling rig. Three were completed as one-inch diameter piezometers, five as temporary wells and eight as permanent monitoring wells. One boring was abandoned after sampling. The majority of the borings were drilled to approximately 30 feet.

The unconsolidated deposits across the two sites are generally similar. The uppermost 15 feet is composed of silts and silty clays. These deposits are underlain by slightly silty fine sands. Groundwater levels range between 22 and 25 feet below grade. Groundwater flow is generally toward the southwest.

Site 1 is a former defueling pit where excess JP-4 fuel was dumped from aircraft during the period between 1961 and 1974. An estimated 180,000 gallons of

JP-4 may have been released at this site. The following are activities conducted during the SI at Site 1:

- Soil-gas survey
- Installation of three piezometers
- Installation of eight monitoring wells, including soil samples
- Sampling of soil and water at the surface of the defueling pit
- Groundwater sampling from wells without phase-separated hydrocarbons

Results of these activities showed phase-separated hydrocarbons in three monitoring wells within 200 feet of the defueling pit. The five remaining wells surrounding the pit did not have phase-separated hydrocarbons present though some dissolved concentrations of fuel components were found in two of these wells.

At Site 1, the following parameters were detected:

Volatiles

Benzene
Toluene
Ethylbenzene
Xylenes

Semi-Volatiles

Napthalene
2-Methylnapthalene
Dibenzofuran
Pyrene
Benzo(a)anthracene
Chrysene
Benzo(b)fluoranthene
2,4-Dimethylphenol

Total Petroleum Hydrocarbons

Gross Alpha
Radium 226
Radium 228

All of these parameters except for the radiological parameters were detected within about 170 feet of the defueling pit. Analysis for radiological parameters were performed from only one location about 375 feet north of the defueling pit.

The volatiles (BTEX) were detected in soil and water and their concentrations ranged from non-detect to 100,000 (estimated) ppb. Semi-volatiles were detected in soil and water and their concentrations ranged from non-detect to 2,900 ppb. Total petroleum hydrocarbons concentrations in soil and water ranged

from non-detect to 3,100 ppm and concentrations of radiological parameters ranged from non-detect to 35.6 pCi/l. A potential migration path for the contaminants could be with the groundwater.

Iowa Action Levels for BTEX in groundwater range from 1 ppb for benzene to 10,000 for total xylenes. No enforceable MCLs for BTEX in soil are in effect. Also, there are no enforceable MCLs in effect for semi-volatiles or Total Petroleum Hydrocarbons. MCLs of 15 pCi/l for Gross Alpha and 5 pCi/l for combined Radium 226 and 228 are in effect.

Based on these results, a focused feasibility study with remedial measures is recommended. According to the preliminary risk evaluation (PRE), there is no immediate threat to persons in the area. However, remedial measures should be implemented so that the migration of the free and dissolved hydrocarbons can be checked.

Site 2 is the possible low-level radioactive waste disposal area. This site is a small area ten feet by ten feet enclosed by a dilapidated barbed-wire fence. Inside the fence are three metal casings. It is our understanding that this area was used by the Air Force for the disposal of low-level radioactive wastes, such as radio tubes. The following activities were conducted at the site during the SI:

- Surface radioactivity survey
- Magnetometer survey
- Installation of five temporary monitoring wells
- Collection of soil and groundwater samples for radioactivity analyses
- Removal of temporary wells.

At Site 2, the following parameters were detected:

Gross Alpha
Gross Beta
Radium 226
Radium 228

These concentrations ranged from non-detect to 45 pCi/l in the soil and groundwater. These parameters were detected as far as 160 feet away.

Results of analyses for gross radioactivity and radium showed the following concentrations in the soil at Site 2 to range from 0.9 pCi/g to 3.3 pCi/g for gross

alpha; from 1.3 pCi/g to 5.3 pCi/g for gross beta; from 0.36 pCi/g to 1.5 pCi/g for radium 222 and from less than 0.2 pCi/g to 2.4 pCi/g for radium 228. None of these concentrations exceeded the MCL. In addition, these concentration levels do fall within expected ranges according to the Controls for Environmental Pollution Laboratory (Pers. Comm. J. Mueller, CEP, 1990). The analysis of Missouri River silt samples detected gross alpha concentrations at 2 pCi/g and non-detect while gross beta levels were 4 pCi/g and 0.02 pCi/g (Pers. Comm. T. Kastamzo, Fort Calhoun Nuclear Power Plant, 1990). Values in Nazaroff (1988) for radium 226 and thorium 232, the parent of radium 228, range from 0.11 pCi/g to 4.19 pCi/g for soils in the United States.

Groundwater samples from three of the five wells from Site 2 exceeded the gross alpha MCL. However, radium concentrations in water can range from 19 pCi/l to 180,000 pCi/l depending upon the local geologic conditions (Nazaroff, 1988).

Samples from MW-6 and an UST assessment location were taken for background purposes with the following results:

soil samples collected from monitoring well 6 at Site 1 (located cross-gradient and approximately 3,500 feet east of Site 2) showed gross alpha concentration to be 35 pCi/g for a sample collected at 23 feet and 1.4 pCi/g for a sample collected at 27 feet (The high value of 35 pCi/g is considered an anomaly, since it was not confirmed by the sample below. The value could have been caused by minerals such as biotite or feldspar). Soil samples from a monitoring well installed for an underground storage tank assessment, located approximately one mile east of Site 2, had gross alpha concentrations of 1.2 pCi/g and 1.6 pCi/g. A water sample from monitoring well 6 had a gross alpha concentration of 21 pCi/l and the value from the well at the underground storage tank was 25 pCi/l.

FINAL

The results of the analyses performed on soil and water samples collected from Site 2 (when compared to the background data collected and data available from literature) suggest that the values are within the range of naturally occurring conditions and not a result of Air Force or Air National Guard activities.

It is recommended that a decision document elimination Site 2 from further investigation be prepared along with the available data.

SECTION 1

INTRODUCTION

1.1 BACKGROUND AND AUTHORITY

The Department of Defense (DOD) has developed the Installation Restoration Program (IRP) to identify and fully evaluate suspected problems associated with past contamination, and to control potential health, welfare and environmental hazards resulting from these past operations. The IRP is the basis for response action on ANG installations under the provisions of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 and amended by the Superfund Amendment and Reauthorization Act (SARA) of 1987. This is the primary legislation governing remedial action at past hazardous waste disposal sites.

The National Guard Bureau (NGB), through the Air National Guard (ANG) Support Center, has initiated the IRP in response to policies of the Department of Defense (DOD). The IRP has been developed as a phased program for identifying and addressing environmental contamination resulting from past management practices at ANGB installation. As a part of the IRP, the ANG through a U.S. Air Force (USAF) interagency technical support agreement with the U.S. Department of Energy (DOE), uses Martin Marietta Energy Systems, Inc. (MMES) to provide technical assistance for implementation of the ANG IRP. MMES has been contracted by DOE to carry out the Hazardous Waste Remedial Actions Program (HAZWRAP) at Air National Guard. Engineering-Science (ES) as a subcontractor to HAZWRAP conducted a Site Investigation (SI) at the LANG at the Sioux Gateway Airport in Sergeant Bluff, Iowa. Authorization for the investigation is by General Order No. 96B-99788C, Task Order No. Y-03.

1.2 PURPOSE AND SCOPE

The objective of the SI is to evaluate two identified sites at the Installation and determine whether (1) a Remedial Investigation (RI) is required, (2) a decision of no further action can be supported, (3) a Focused Feasibility Study/Remedial Measure (FFS/RM) is required, or (4) immediate removal is appropriate.

This report documents activities and findings of the SI. The purpose of the SI is to confirm the presence or absence of contamination in soils and groundwater and assess the potential risks to health, welfare and the environment.

Section 6 of this report contains recommendations based on the results of the SI. The recommendations can be divided into two categories: Those indicating further action in the remedial investigation (RI) and those indicating no further action. The purpose of the RI is to define the extent and magnitude of contamination detected in the SI and to further assess potential risks to health, welfare and the environment.

1.3 INSTALLATION DESCRIPTION AND HISTORY

The 185th Tactical Fighter Group was first organized in December, 1946. First known as the 174th Fighter Squadron, the unit was reorganized and designated the 185th Tactical Fighter Group in 1962. The 185th operates from 92 acres of land at the Sioux Gateway Airport and occupies 40 buildings. The Installation had steady growth of personnel from time of its organization until the present time. The majority of building construction took place in the mid to late 1950's and in the mid-1970's.

The present property agreement is between the City of Sioux City, Iowa and the Department of the Air Force (License for National Guard Purposes, Form 1 May 63). The agreement commenced 1 July 1969 and expires 20 June 2019. The agreement automatically renews annually until the expiration date, unless the Government exercises its right to give notice to termination. The agreement provides for the exclusive use of buildings and parcels of land located on the Sioux Gateway Airport, together with all roads, sidewalks, railroads, utilities, drainage ditches, sewer lines, aprons, buildings and structures and tools, equipment and fixtures, on 11 parcels which are lettered and listed within the agreement.

Use and occupancy of the Installation is without cost to the Government, provided the Government maintains and keeps the premises in good repair and condition, and pays all cost of operations, maintenance and restoration caused by the occupancy of the premises. The Government reserves the right to use the property included in the license, including all buildings and improvements situated thereon, for such purposes as the Department of the Air Force deems necessary in the interest of national defense.

During the period from 1968 to 1988, at least 16 shops generating various hazardous wastes were in operation at the LANG Installation (HMTc, 1988). These shops included Aircraft Maintenance, Aerospace Ground Equipment Maintenance, Fuels Maintenance, Entomology, Vehicle Maintenance, Nondestructive Inspection, Weapons Maintenance, Corrosion Control, Paint Shops, Machine Shop, Hangar Spaces, Plumbing Shop, Electric Shop, Battery Shop, PhotoLab and Propulsion Shop.

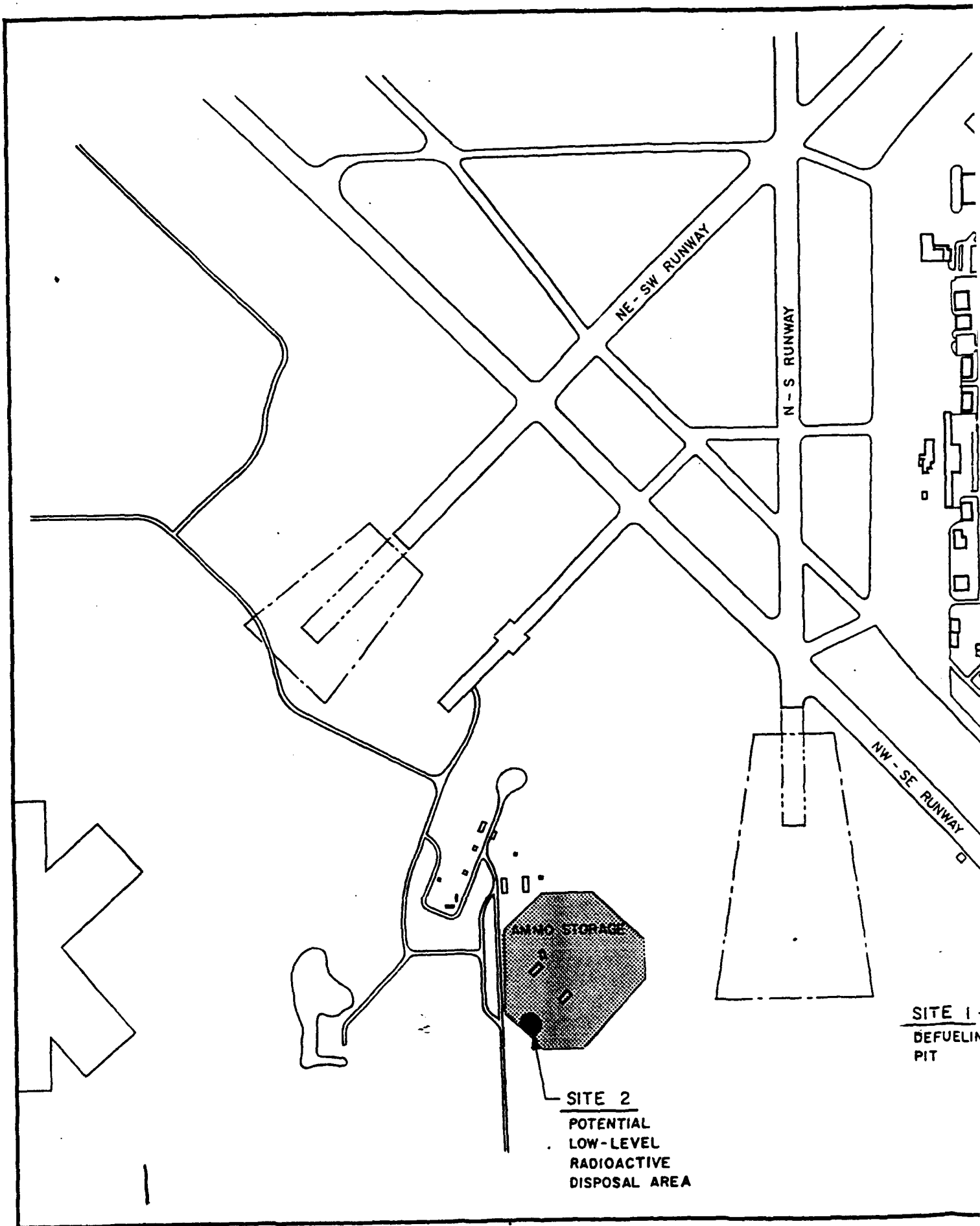
A Preliminary Assessment (PA) conducted in 1988 by the Hazardous Materials Technical Center (HMTc) identified two sites which warranted further investigation.

1.4 SUMMARY OF PREVIOUS ACTIVITIES AND FACILITY DESCRIPTION

One prior investigation was conducted on the Installation. A PA, dated December 1988 was conducted to identify and evaluate suspected problems associated with past hazardous waste handling procedures, disposal sites, and spill sites on the Installation. Personnel from HMTc visited the site, reviewed existing environmental information, analyzed Installation records and conducted interviews with past and present Installation personnel. Based on information developed during the PA, two sites were identified that may contain hazardous materials or hazardous wastes (HMTc, 1988). Specific information identified in the PA is summarized below.

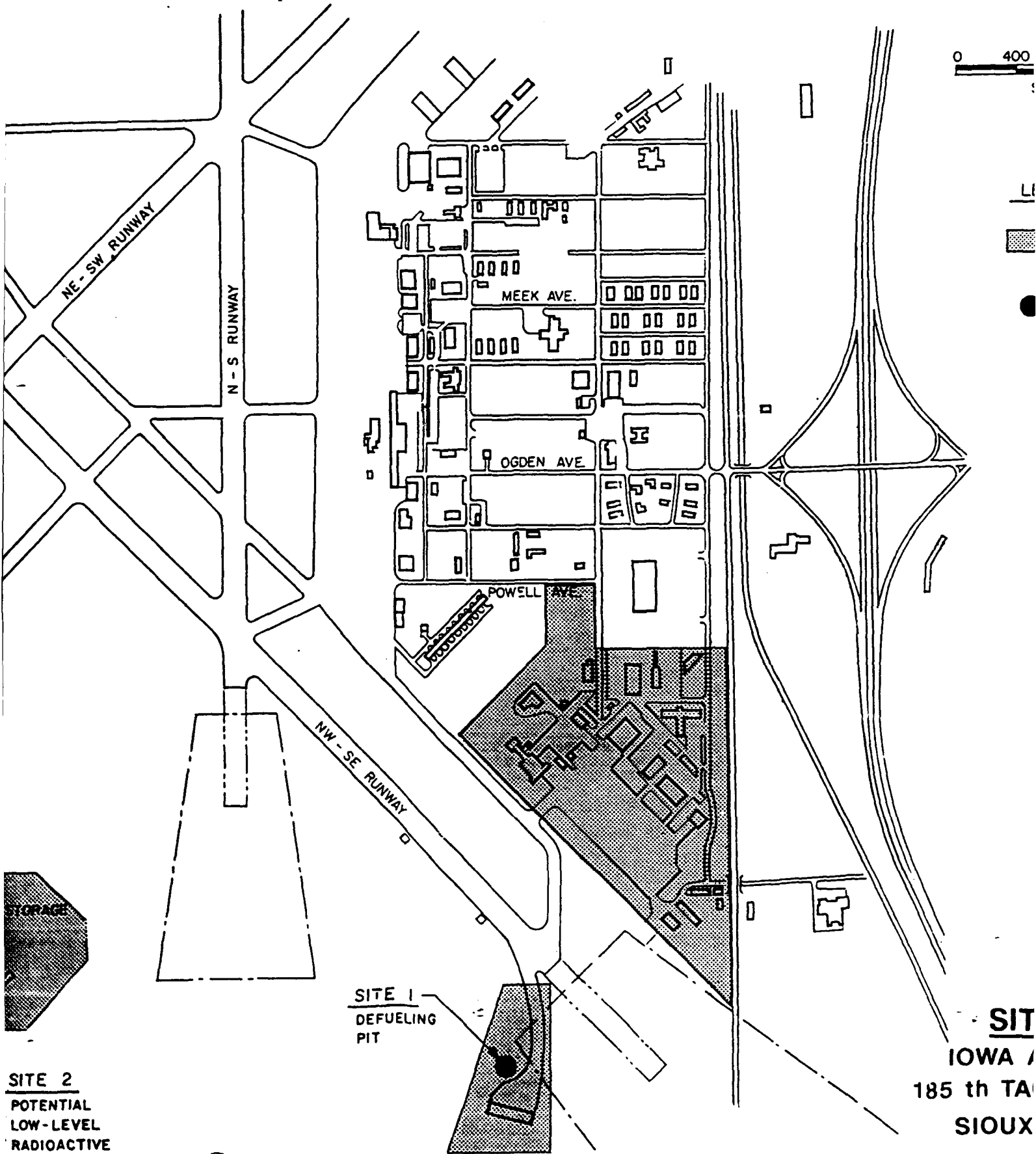
A defueling pit was identified in the PA as Site 1 (Figures 1.1 and 1.2). This defueling pit exists in a slight depression two to three feet deep and is located off the edge of the runway near the Alert Hangar (Building No. 241). The pit was used to dump excess JP-4 fuel approximately twice per month during the period 1961 to 1976. An estimated 180,000 gallons of JP-4 may have been released at this site. In June of 1989, the dimensions of the pit were approximately 30 feet by 20 feet and contained ponded water. Vegetation around the pit did not appear stressed at the time of this inspection. An uncapped metal pipe located at the pit center measures about four inches in diameter and protrudes about three feet from the surface.

Site 2 is the possible low-level radioactive waste disposal area (Figures 1.1 and 1.3). It is located inside the ammunition storage area on the west side of the Installation. Site 2 is a small area of high grasses approximately ten feet by ten feet enclosed by a low, dilapidated barbed wire fence. Within the enclosed area are three neatly installed steel casings, two of which are installed with concrete pads at their bases.



SITE 2
POTENTIAL
LOW-LEVEL
RADIOACTIVE
DISPOSAL AREA

SITE 1
DEFUELING
PIT



SITE 2
POTENTIAL
LOW-LEVEL
RADIOACTIVE
DISPOSAL AREA

SITE 1
DEFUELING
PIT

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FIGURE 1.1

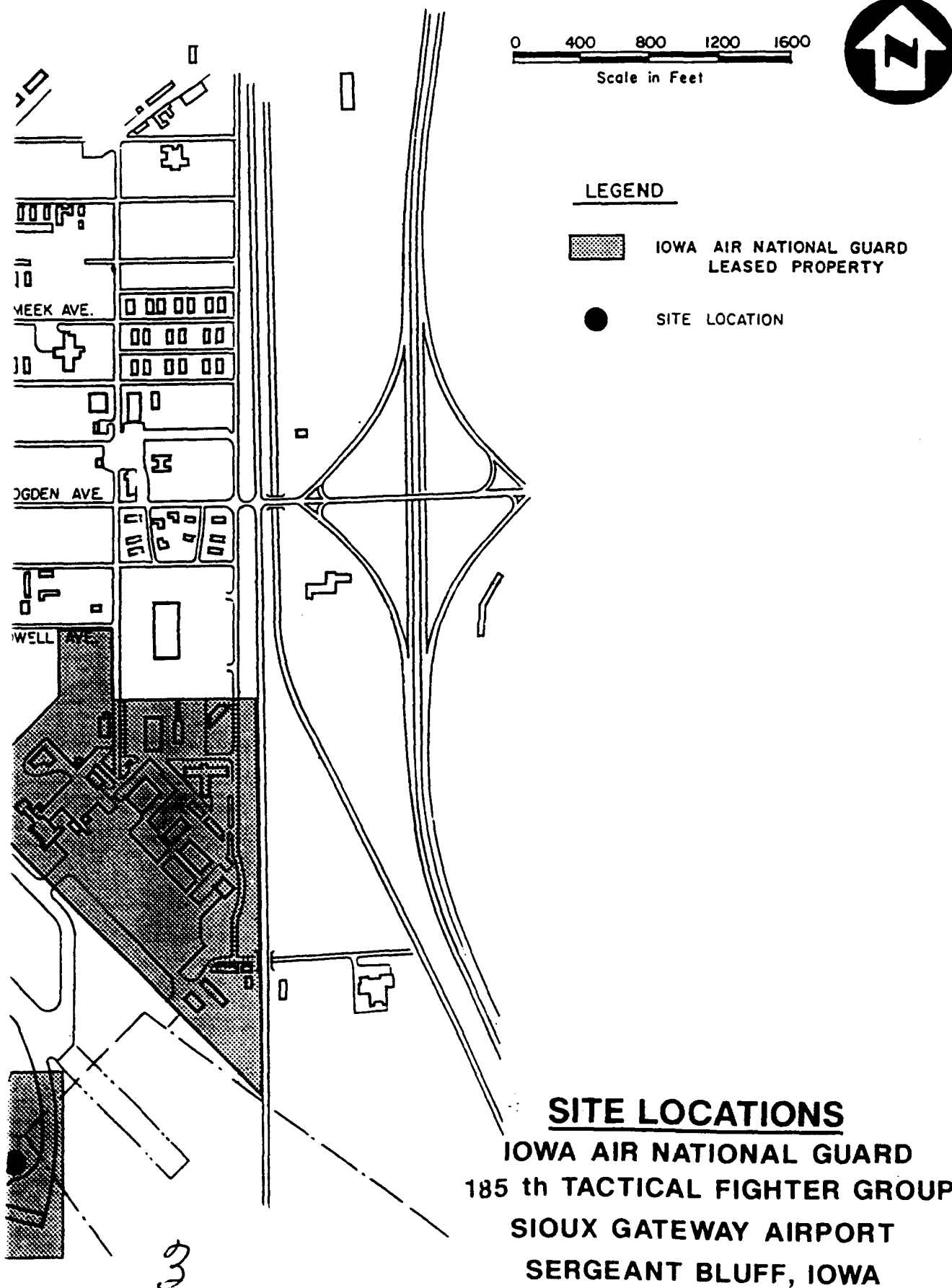


FIGURE 1.2

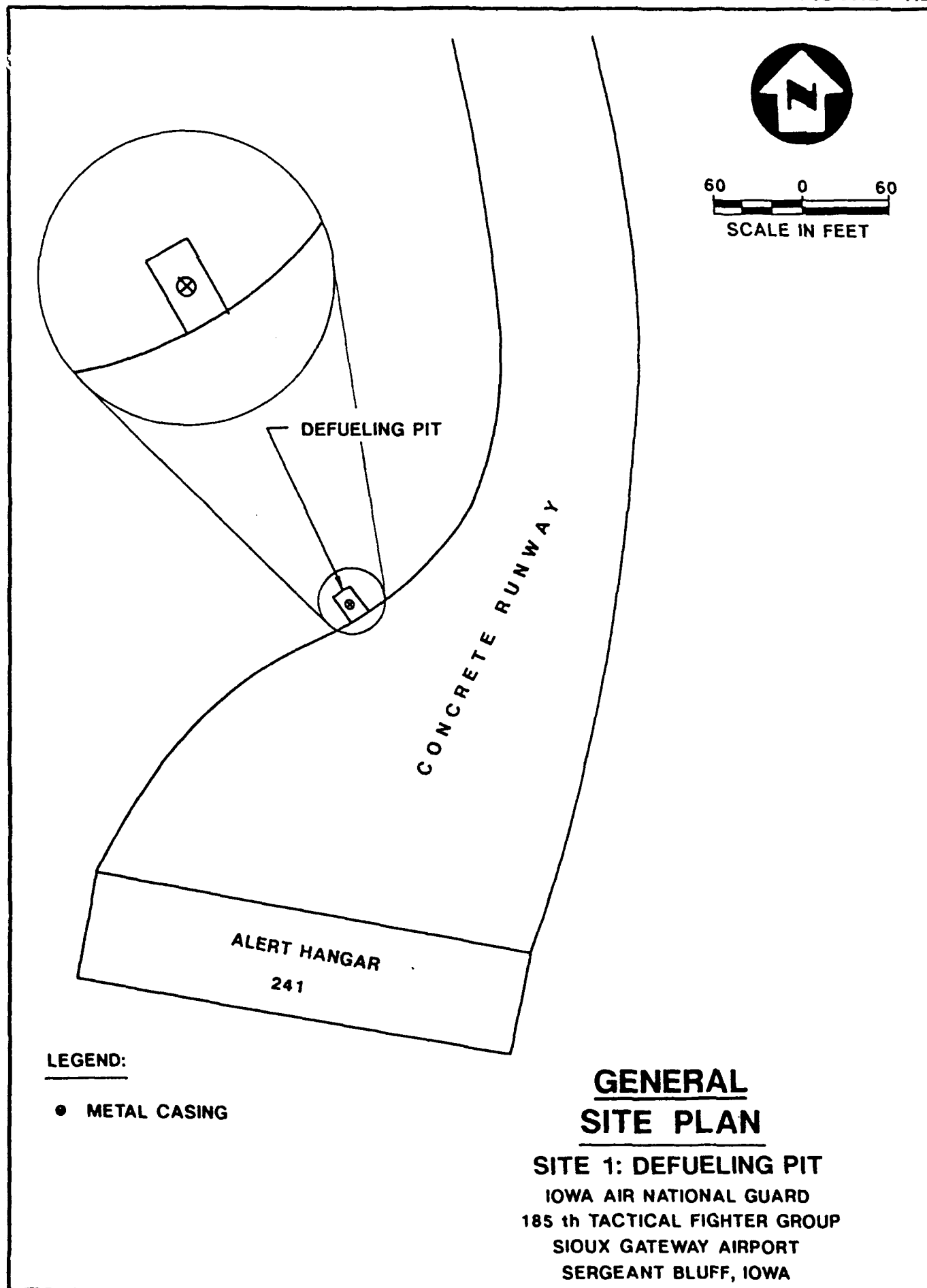
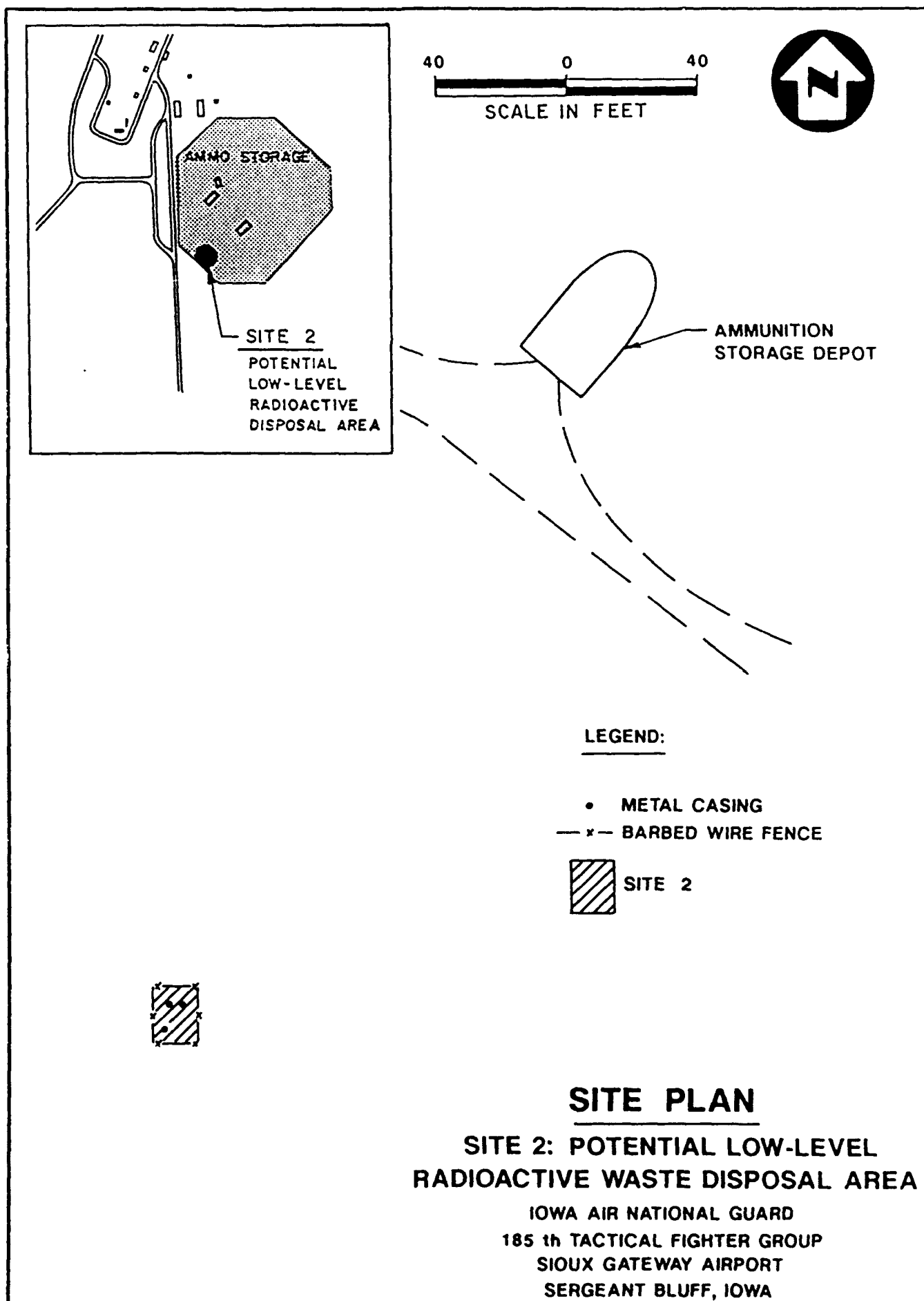


FIGURE 1.3



FINAL

All three have locked lids. It was reported that this area was used by the Air Force for disposal of low-level radioactive wastes, such as radio tubes. Additional information on the amounts and types of wastes disposed of at this site is not available. During inspections for the PA, no radioactivity was detected by a Geiger counter in the vicinity of the fenced area, though readings were not taken on the inside of the casings. There was no evidence of environmental stress at this location.

SECTION 2

ENVIRONMENTAL SETTING

2.1 GEOGRAPHIC SETTING

The 185th Tactical Fighter Group (TFG) of the LANG is located at the Sioux Gateway Airport, Sergeant Bluff, Iowa. The Sioux Gateway Airport is located in the west central region of Iowa, approximately seven miles south of downtown Sioux City, in Woodbury County. The Installation is located in Township 88 North, Range 47 West in Sections 25 and 36. The Installation presently leases a total of 92 acres in eleven separate parcels on the eastern part of the airport from the City of Sioux City, Iowa. Figure 2.1 shows the location of the Installation relative to the State of Iowa.

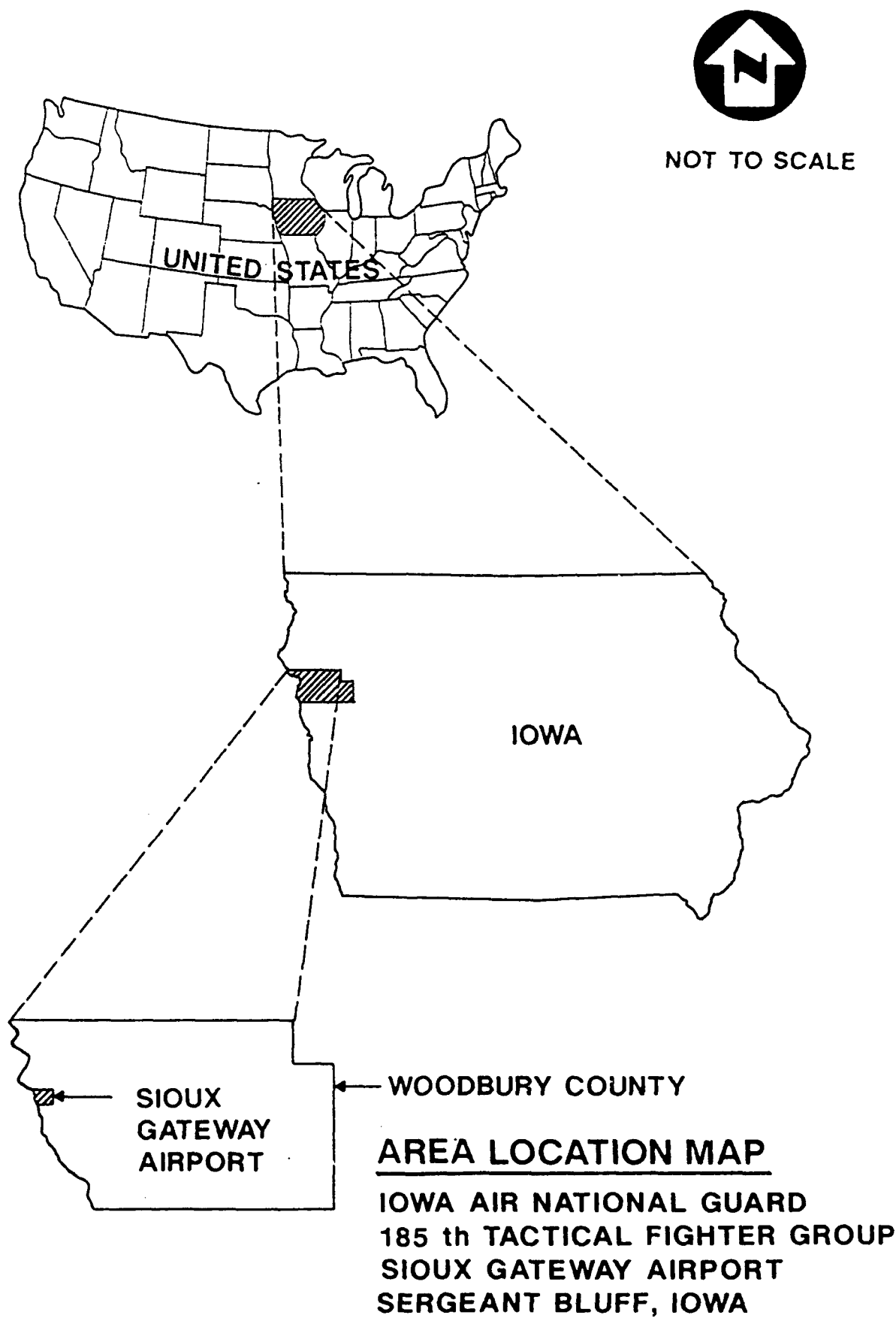
Land located north of the Installation includes the former Sioux City Air Force Base, which is now a mixture of commercial and residential property. West of the Installation are the airport runways and the Missouri River. The Missouri River is approximately 2 miles from the Installation. Properties located south and east of the Installation are primarily agricultural and residential. Approximately 0.75 miles northeast of the Installation is the residential community of Sergeant Bluff, Iowa. The residential population within a 1-mile radius of the Installation, including Installation personnel is estimated at 1,810 (HMTTC, 1988).

2.2 CLIMATE

The climate of the Sioux City, Iowa area is described as typical of interior continental locations. It is characterized by relatively light rainfall, lower humidity, hot summers, cold winters and wide variations in temperature and precipitation from year to year. The average annual temperature for the northern counties of Iowa is 46°F. The coldest month is January and the warmest month is July with average temperatures of 19°F and 73°F, respectively (National Oceanic and Atmospheric Administration, 1974).

The mean annual precipitation in the Sioux City area is 25 inches per year. Approximately 75 percent of annual precipitation falls as rain during the warmer months of April to September. Floods are most frequent in June, but also occur at the end of

FIGURE 2.1



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March usually as a consequence of rain on frozen ground or rain and rapid snowmelt (HMTC, 1988).

2.3 GEOLOGY

The Installation is located approximately two miles east of the Missouri river within the Missouri Alluvial Plain Physiographic Province. The alluvial sediment consists of unconsolidated clay, silt, sand and gravel and was deposited by Pleistocene glacial meltwater (Munter, et al., 1983). According to well logs from the vicinity of Sergeant Bluff, Iowa, the thickness of the unconsolidated deposits range between 110 and 210 feet.

At Site 1 (Defueling Pit) (Figure 2.2), the sediments encountered are generally composed of silty clays and silty fine sand. The stratigraphy showed silty clays occurring between zero and 15 feet and silty sand between 15 and 30 feet below grade. At Site 2 (Figure 2.3) (potential radioactive waste disposal area) which lies approximately 3200 feet northwest of Site 1, sediments encountered were interbedded silts fine sands and clays between zero and 16 feet. Between 16 and 32 feet below grade, silty fine sand was typical. Figures 2.4 and 2.5 show general geologic cross-sections across Sites 1 and 2.

The bedrock beneath the Missouri Alluvial Plain consists of Cretaceous age rocks that dip toward the northwest at approximately four feet per mile. The first bedrock encountered beneath the unconsolidated deposits is the Nishnabotna member of the Dakota Formation. The Nishnabotna member is a medium to coarse grained, micaceous sandstone. It often contains conglomerate, shale, claystone, and fine-grained sandstone interbeds. The thickness of the Nishnabotna member varies from 63 to 365 feet with an undulating surface (Munter, et al., 1983).

The Cretaceous rocks are unconformably underlain by Paleozoic rock in the area of the Installation. These Paleozoic rocks consist of dolostones, limestones, and sandstones which dip to the south-southeast at 18 feet per mile. The first Paleozoic rocks found beneath the Installation is an undifferentiated limestone and dolostone formation of Mississippian-age. This rock unit is underlain by Devonian, Ordovician, and Cambrian-age rock (see Table 2.1).

FIGURE 2.2

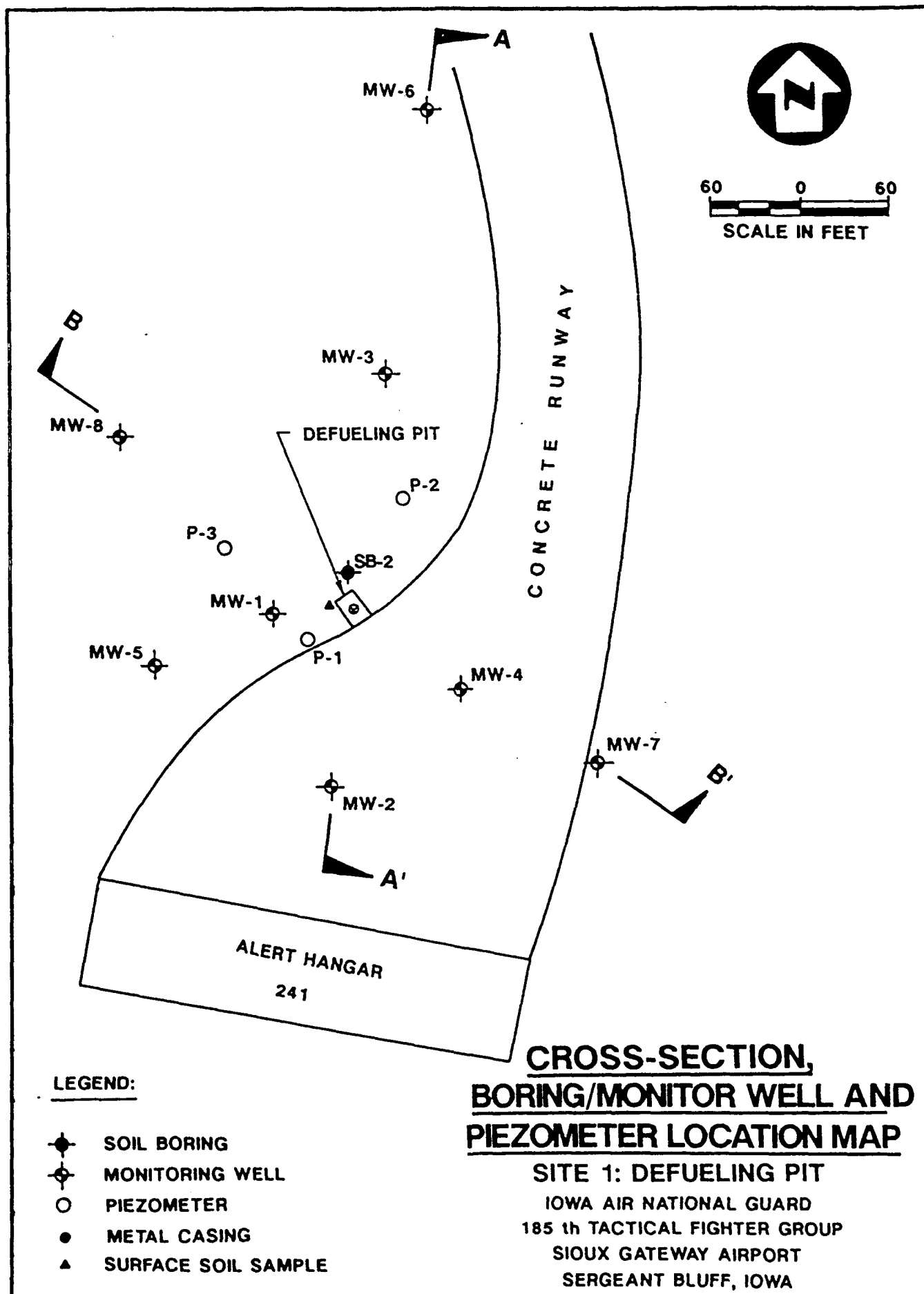
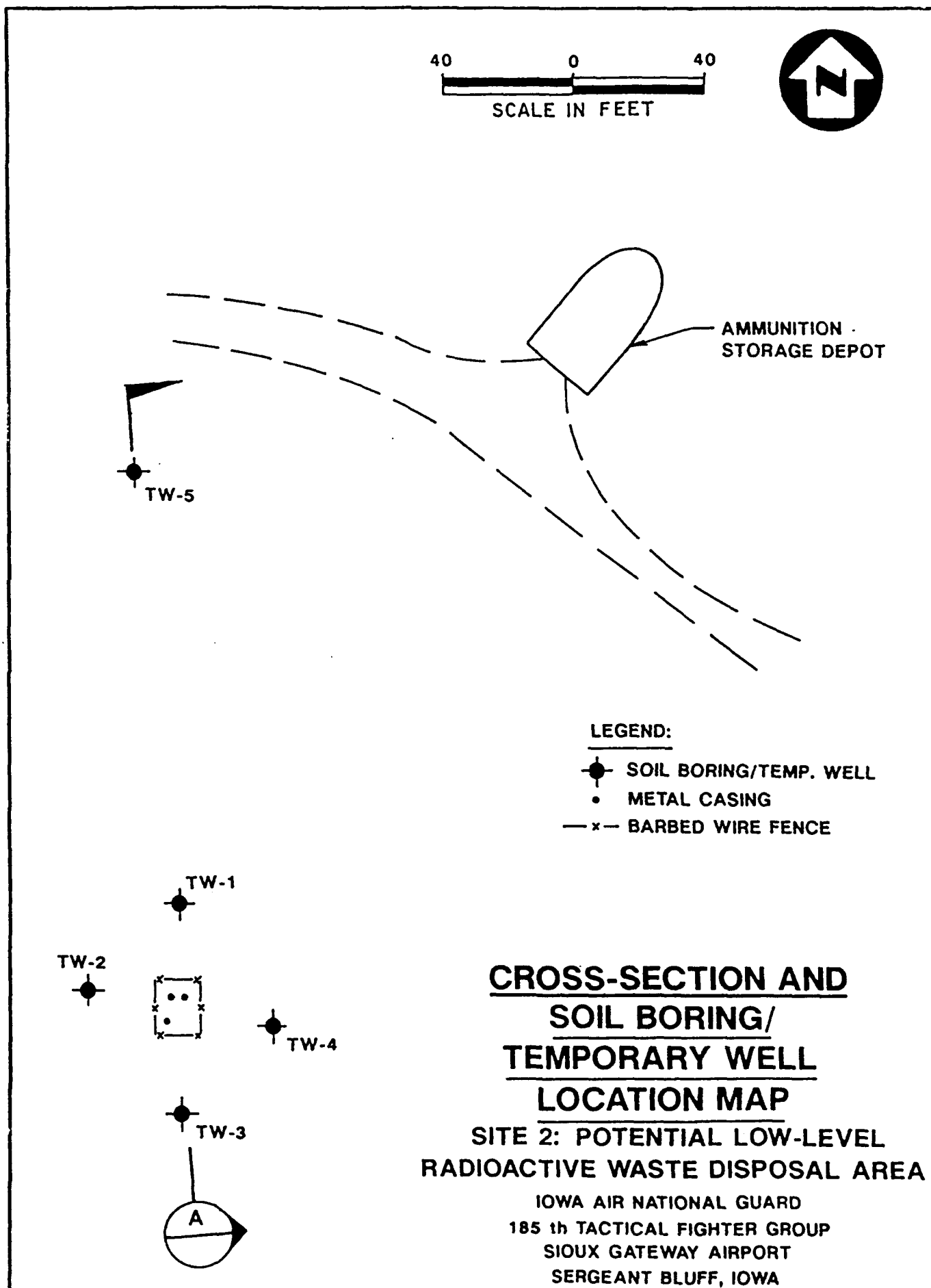
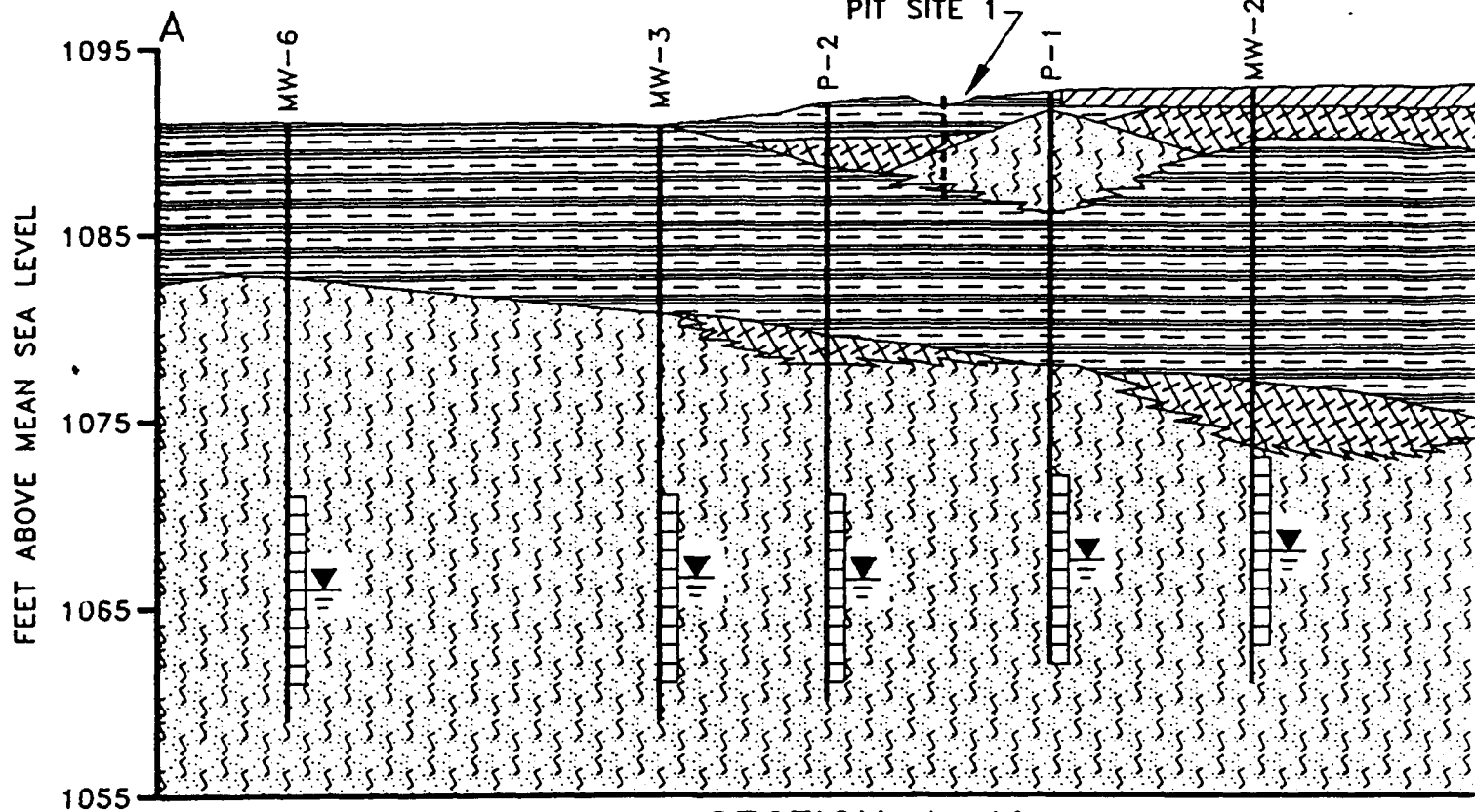


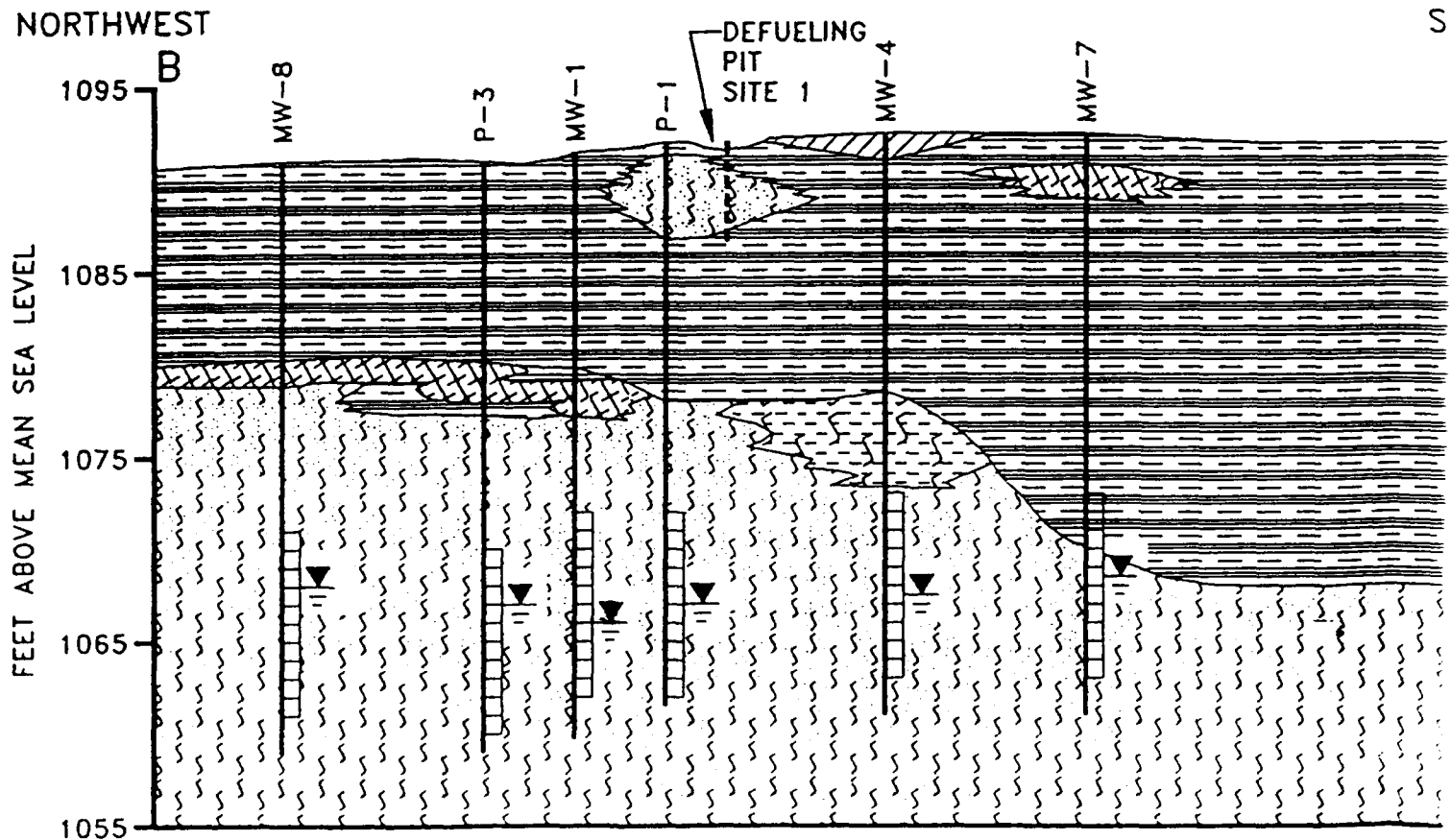
FIGURE 2.3



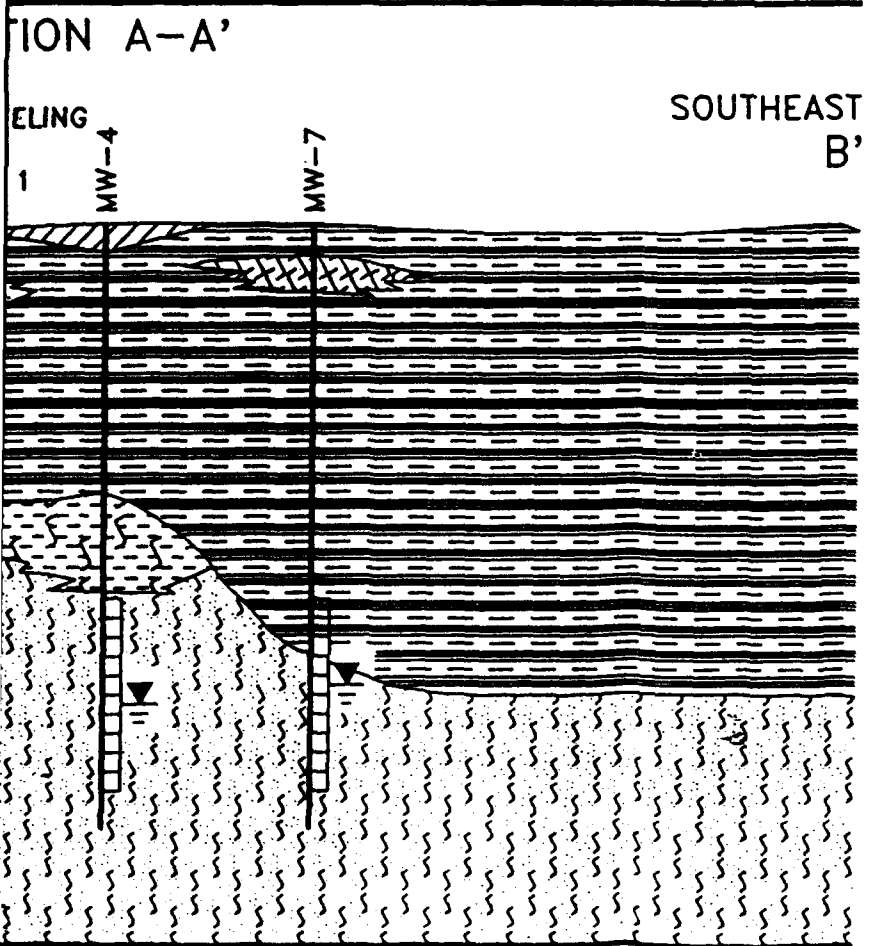
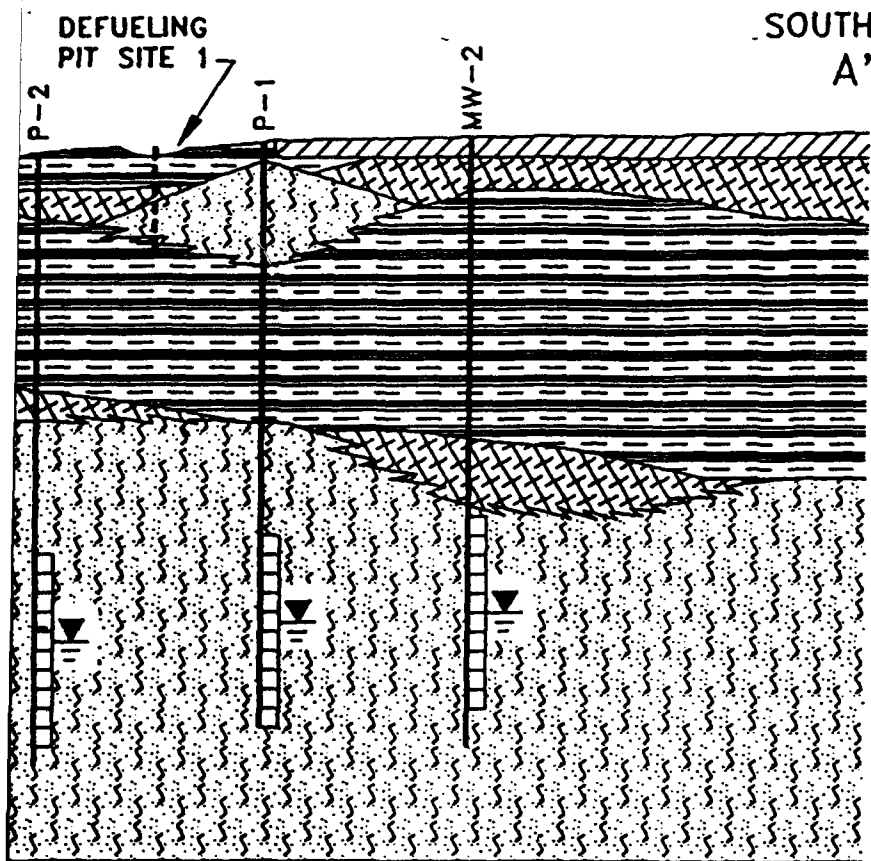
NORTH



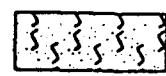
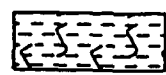
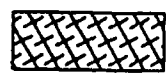
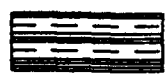
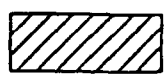
NORTHWEST

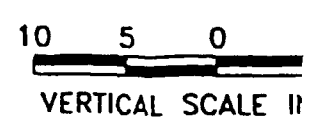
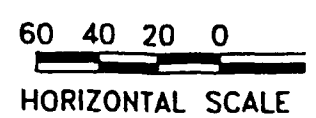


2



LEGEND:

-  SCREENED SHOWING WATER LEVEL ON INSTALLATION SEE FIGURE FOR CONSTRUCTION
-  SILTY FINE SAND
-  SILTY SAND
-  SILT
-  CLAY
-  FILL
-  STEEL CASING



GENERALIZED GEOLOGIC
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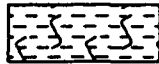
LEGEND:



SCREENED INTERVAL
SHOWING WATER LEVEL
ON INSTALLATION.
SEE FIGURE 3.1 FOR WELL
CONSTRUCTION DETAILS.



SILTY FINE SAND



SILTY SAND WITH CLAY



SILT



CLAY



FILL



STEEL CASING

60 40 20 0 60

HORIZONTAL SCALE IN FEET

10 5 0 10

VERTICAL SCALE IN FEET

GENERALIZED GEOLOGIC CROSS SECTIONS

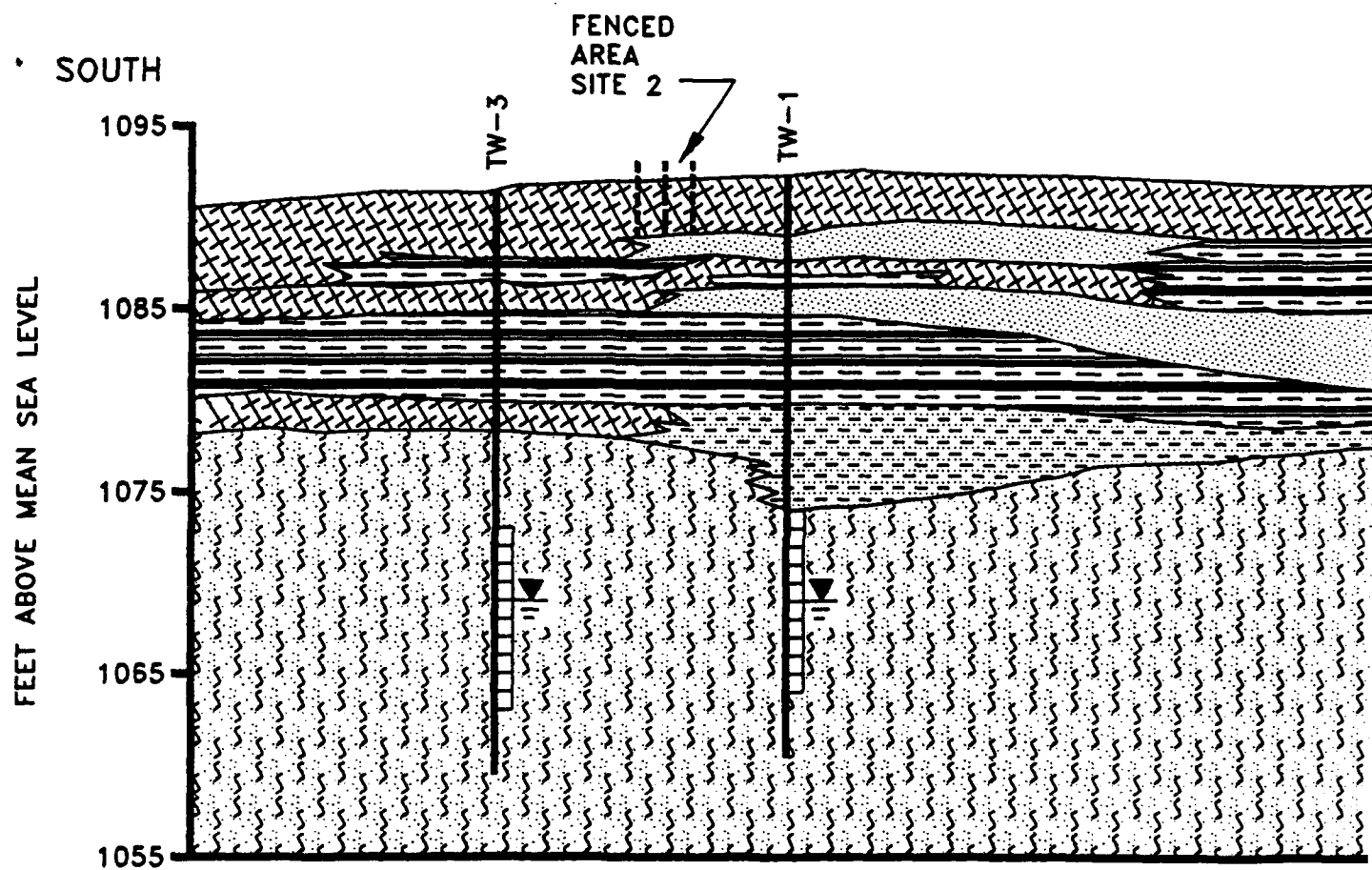
DEFUELING PIT AREA

IOWA AIR NATIONAL GUARD

185TH TACTICAL FIGHTER GROUP

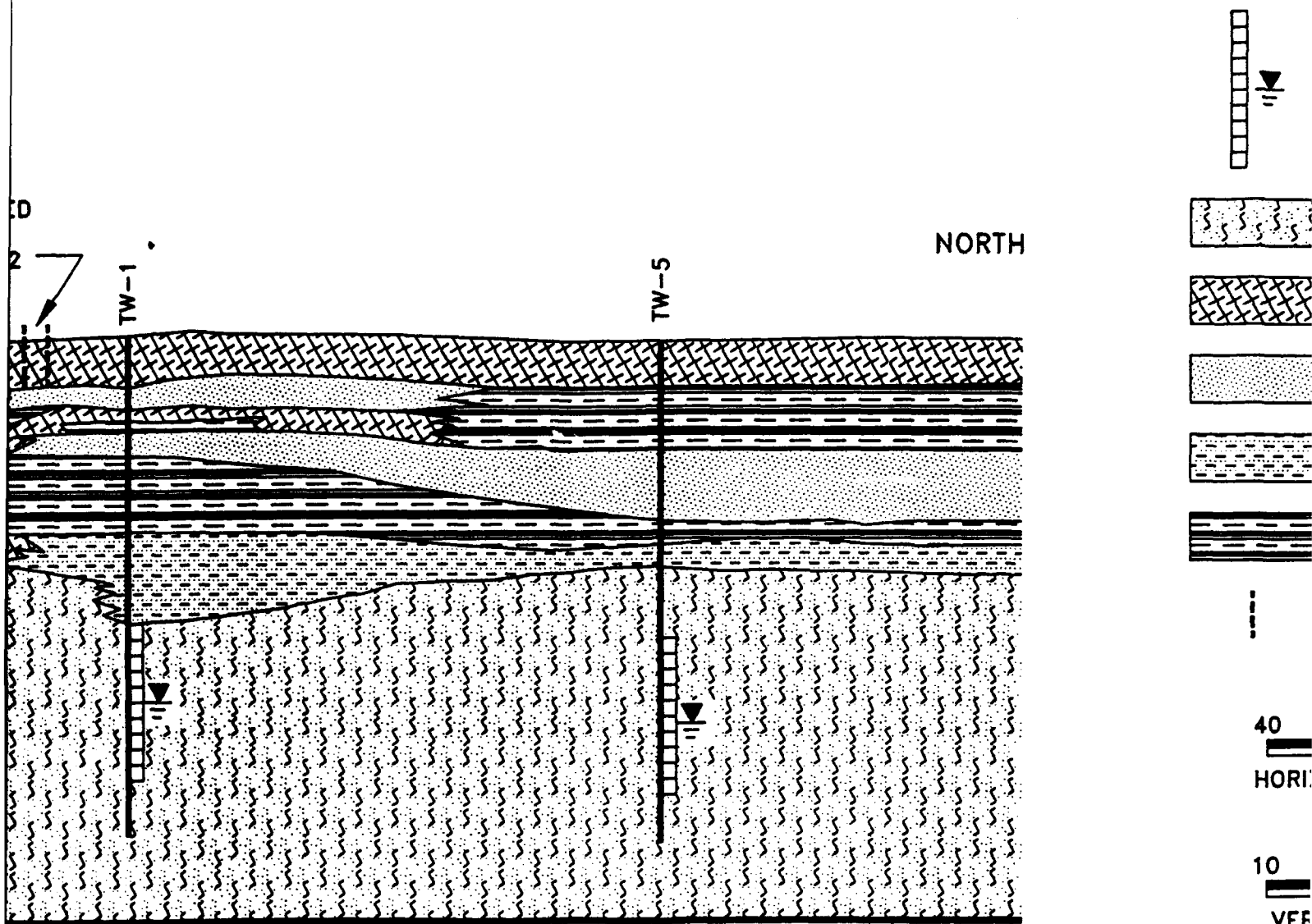
SIOUX GATEWAY AIRPORT

SERGEANT BLUFF, IOWA



SECTION A-A'

2



GENERALIZED GEOLO

SITE 2 - P

RADIOACTIVE W.

IOWA

185TH

2

LEGEND:

SCREENED INTERVAL
SHOWING WATER LEVEL
ON INSTALLATION

NORTH



SILTY FINE SAND



SILT



FINE SAND



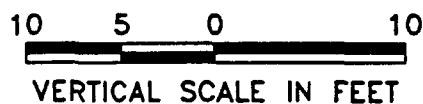
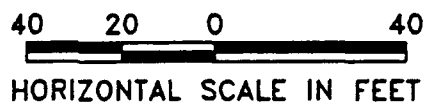
FINE SAND WITH CLAY



CLAY



STEEL CASING

GENERALIZED GEOLOGIC CROSS SECTIONS

SITE 2 POTENTIAL LOW LEVEL
RADIOACTIVE WASTE DISPOSAL AREA

IOWA AIR NATIONAL GUARD

185TH TACTICAL FIGHTER GROUP

SIOUX GATEWAY AIRPORT

SERGEANT BLUFF, IOWA

HYDROGEOLOGIC UNITS
IN NORTHWEST IOWA,
(MUNTER, 1983)

TABLE 2.1

Era	System	Formation	Description	Hydrostratigraphic unit
Cenozoic	Quaternary	undifferentiated	sand and gravel near streams	alluvial aquifers
			loess, wind blown silt mantling uplands and terraces	minor aquifers grading to leaky confining unit
			till, poorly sorted fine-textured glacial sediment	regional confining unit commonly 200-400 feet thick
			sand or sand and gravel within or between tills or beneath tills in bedrock valleys.	intertill or buried channel aquifers, locally highly productive.
Mesozoic	Cretaceous	Carlile	calcareous black marine shale	regional confining beds, where present. Weathered Greenhorn may yield small amounts of water.
		Greenhorn	chalky limestone, shaly	
		Graneros	calcareous marine shale	
		Dakota	Woodbury Member interbedded shale, sandstone and lignite. Thickness and extent variable	minor aquifer grading to confining unit. Low to moderate yields to wells
			Nishnabotna Member Massive sandstone, medium to coarse grained, with shale interbeds. Commonly over 200 feet thick.	major aquifer in much of northwest Iowa.
Paleozoic	Pennsylvanian	undifferentiated	mostly shale, with some sandstone, limestone and coal	confining unit not extensive in northwest Iowa.
	Mississippian	undifferentiated	limestone and dolostone	low to moderate yields to wells, significant aquifer only where near land surface.
	Devonian	undifferentiated	dolostone, shaly near top	
	Ordovician	Maquoketa	dolostone	
		Galena	dolostone	regional confining unit
		Decorah	shale	
		Platteville	shale and shaly dolostone	
		Glenwood	shale and oolitic ironstone	Major regionally extensive aquifer
		St. Peter	sandstone, fine-grained and shaly.	
		Prairie du Chien Group	dolostone and shale	
	Cambrian	Jordan	sandstone, medium-grained, dolomitic	No major aquifers
		St. Lawrence	dolostone	
		Davis	shale, some sandstone and dolostone	
		Bonnetterre	dolostone, silty	
		Mt. Simon	sandstone	
Precambrian		Sioux	quartzite and argillite, commonly weathered at top, low yields to wells	effective base of groundwater systems
		undifferentiated	igneous and metamorphic rocks, very low water-bearing capacity.	

2.4 HYDROGEOLOGY

Groundwater occurs in the glacial and alluvial sediments and in bedrock units below the Installation. A shallow alluvial aquifer exists within the Pleistocene glacial drift deposited in the Missouri River Valley. These glacial deposits consist of unconsolidated gravels, sands, silts and clays. These deposits are reported to be between 110 and 210 feet in thickness. The water table occurs within 20 to 30 feet of the ground surface in the vicinity of the Installation. Groundwater flow direction for this shallow aquifer is generally to the southwest and discharges to the Missouri River or nearby tributaries. The average hydraulic conductivity of the shallow aquifer at Site 1 ranged between 1.4×10^{-2} and 7.80×10^{-3} cm/sec. Locally, this shallow aquifer is very permeable and has reportedly yielded several thousand gallons per minute to wells. The Installation potable water is supplied by Sioux City municipal water which receives 90 percent of its water from wells located along the Missouri River. The alluvial aquifer is tapped by five of Sioux City's municipal wells north of the Installation as well as several private wells south of the Installation. These private wells are reported to be as shallow as 30 feet (HMTC, 1988). The City of Salix, Iowa, located eight miles southeast of the Base, also obtains its water supply from the alluvial aquifer. The City wells are located about six miles north of the Base.

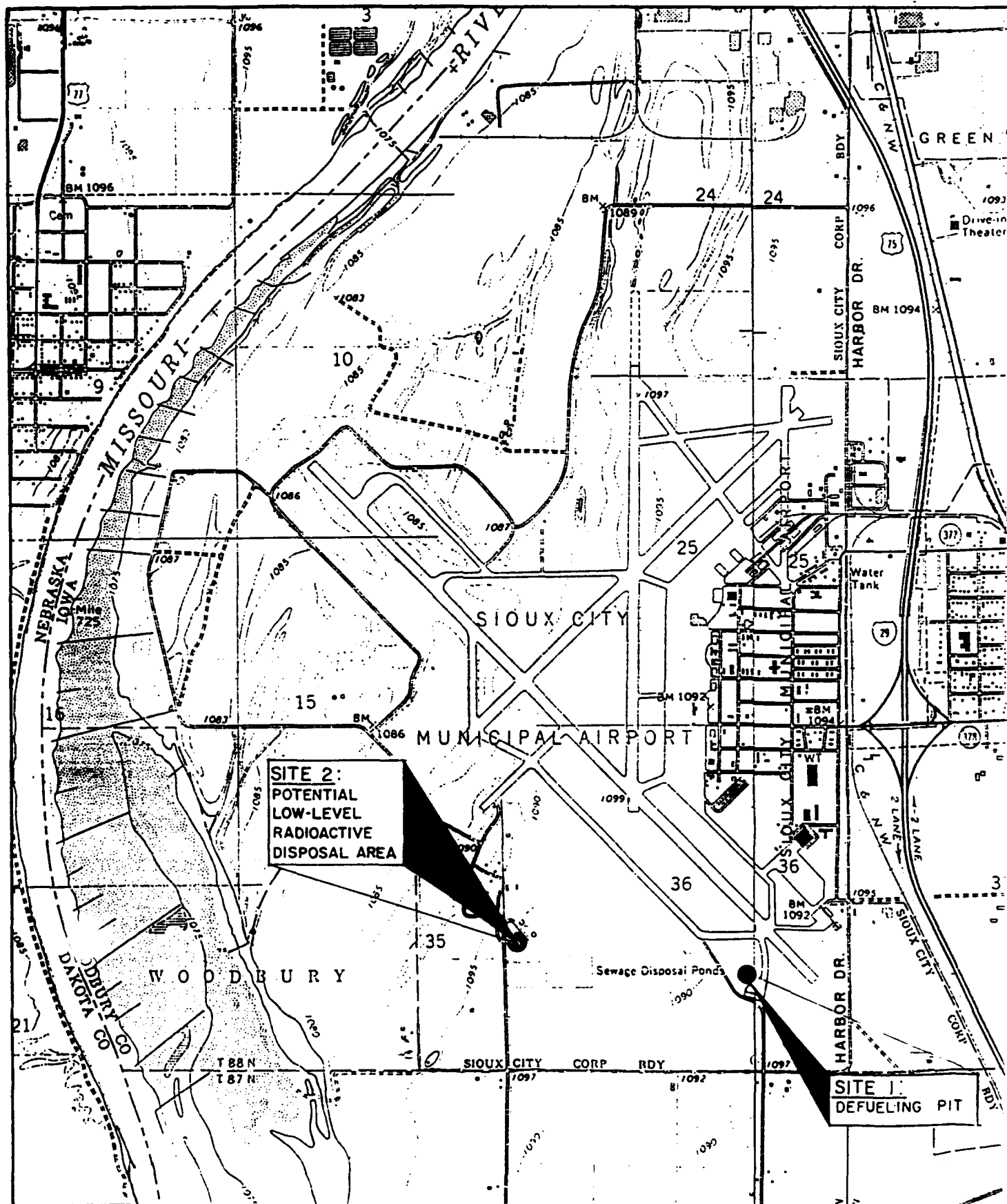
The Dakota aquifer is another important source of water in the region of the Installation. It occurs within the Nishnabotna Member of the Dakota Formation, a massive sandstone unit of Cretaceous-age rock. The Dakota aquifer is approximately 200 feet thick beneath the Installation and has a lateral extent which covers most of the northwestern portion of Iowa (Munter, et al., 1983). The aquifer is confined by overlying glacial tills and fine-textured Pleistocene sediment beneath the Installation. The groundwater within this aquifer flows toward the southwest and has a hydraulic gradient of five feet per mile. The average hydraulic conductivity of the Dakota aquifer is 40 to 45 feet per day (.014 to .016 cm/sec). Five municipal wells of Sioux City penetrate the Dakota aquifer to obtain the municipal water supply.

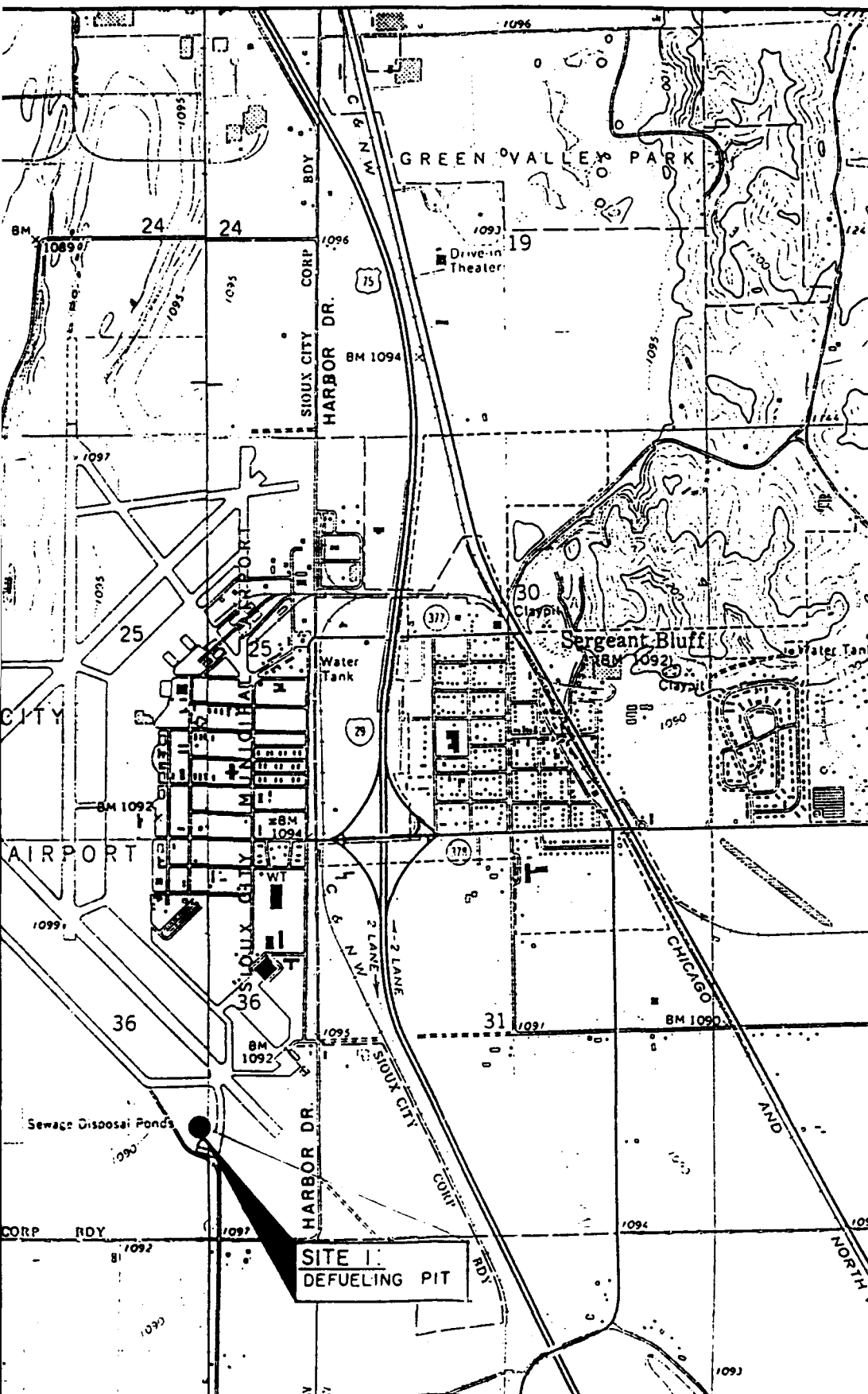
Another aquifer exists in Ordovician and Cambrian rock units. It consists of the St. Peter Formation, Prairie du Chien Group, and Jordan Formations and is confined by the overlying Ordovician shales. The Ordovician-Cambrian aquifer is regionally extensive over the western portion of Iowa.

2.5 TOPOGRAPHY AND DRAINAGE

The topography of the Installation is relatively flat with elevations varying from 1,085 to 1,095 feet above mean seal level (MSL) (Figure 2.6). This has resulted from the even distribution of sedimentary cover deposited by the Missouri River. The surrounding Missouri Alluvial Plain has a gently undulating topography with elevations ranging from 1,075 to 1,100 feet above MSL. The Alluvial Plain of the Missouri River is bordered in this area by 100 to 150 foot high bluffs which are composed of unconsolidated loess and glacial till.

The drainage of the Installation and surrounding area is dominantly controlled by the nearby Missouri River. The Missouri River and many of its natural tributaries have been channelized or straightened to accommodate roadways and control flooding in the area. According to the Iowa Department of Natural Resources, the Installation is not within the 100-year flood plain of the Missouri River. The surface runoff within the Installation is contained in channels and storm sewers which is directed into a drainage ditch that parallels Harbor Drive east of the Installation. This ditch had no outlet prior to 1984; therefore, the water either evaporated or percolated into the soil. However, in 1984 the ditch was reworked to allow the water to discharge directly into the Missouri River.





1000

LEGEND :

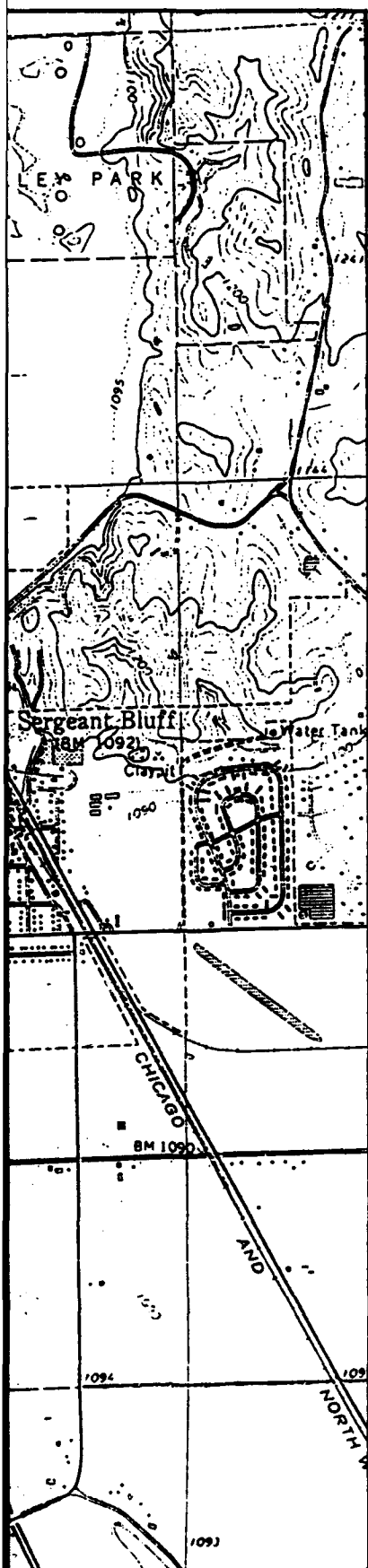
● SITE LOCATION

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IOWA AIR I
 185 th TACTIC
 SIOUX GA
 SERGEAN

2

FIGURE 2.6



1000 0 1000 2000 Feet



SCALE

LEGEND :

● SITE LOCATION

TOPOGRAPHIC MAP

**IOWA AIR NATIONAL GUARD
185th TACTICAL FIGHTER GROUP
SIOUX GATEWAY AIRPORT
SERGEANT BLUFF, IOWA**

SECTION 3

FIELD INVESTIGATION PROGRAM

3.1 PROGRAM DEVELOPMENT

The field investigation program described in this section was developed to determine whether or not the groundwater, surface water or soils of 2 sites at IANG contained specific chemical contamination. A Site Investigation (SI) Work Plan (ES, June 1990) was developed to define the objective of the SI. Included in the Work Plan is a detailed Sampling and Analysis Plan (SAP) to conduct a SI. The SAP includes descriptions of sampling methods and well construction specifications. Some of the techniques described in the following subsections deviate from the Work Plan. Where such a deviation occurs, it is based on the HAZWRAP Quality Control Requirements for Field Methods Document (HAZWRAP, 1989) or is a deviation prompted by field conditions. Appendices A through L contain supplemental field and analytical data.

3.2 FIELD INVESTIGATION PROCEDURES

This subsection describes the sampling methods and construction specifications used during the SI.

3.2.1 Decontamination

All split-spoon samplers, sampling trowels, bailers, pumps and other sampling equipment were decontaminated between samples by washing with soap and tap water, rinsing with tap water, rinsing with de-ionized, ultra-filtered water, and finally rinsing with methyl alcohol.

Augers and drill pipes were cleaned between borings by steam cleaning with tap water, washing with soap and tap water, and rinsing with tap water. The drill rig was steam cleaned between borings.

Decontamination wastes (water and soil) generated in the drill rig decontamination area were contained in a decontamination pad and placed in drums for later sampling

and disposal. The wastes from decontamination during drilling at the sites were placed into drums.

3.2.2 Surface Soil Sampling

The purpose of surface soil sampling was to determine the presence of contamination in the upper soil horizons. Surface soil sampling was utilized at Site 1 where JP-4 fuel was reportedly discharged.

One surface soil sample collected for volatile analysis was placed in a jar as quickly as possible to minimize loss of volatiles. The surface soil sample was collected using a stainless steel trowel.

3.2.3 Surface Water Sampling

One surface water sample was collected from the metal casing located in the center of Site 1. By immersing the sample bottles in the water and allowing it to fill, care was taken to stir up as little bottom sediment as possible while collecting the water sample. This casing measures about six feet in length.

3.2.4 Soil Borings

During the SI work, soil borings for the two inch ID monitoring wells were made using six-inch ID/9-3/4 inch OD continuous flight hollow-stem augers. Split-spoon soil samples were collected according to ASTM Method D-1586. Samples were collected continuously in all the soil borings. All borings were sampled to 30 feet deep.

Soil borings for piezometers (Site 1 only) were made using 3.25-inch ID/7.25-inch OD hollow-stem augers. Split-spoon samples were collected continuously. The three piezometers were sampled to 30 feet deep.

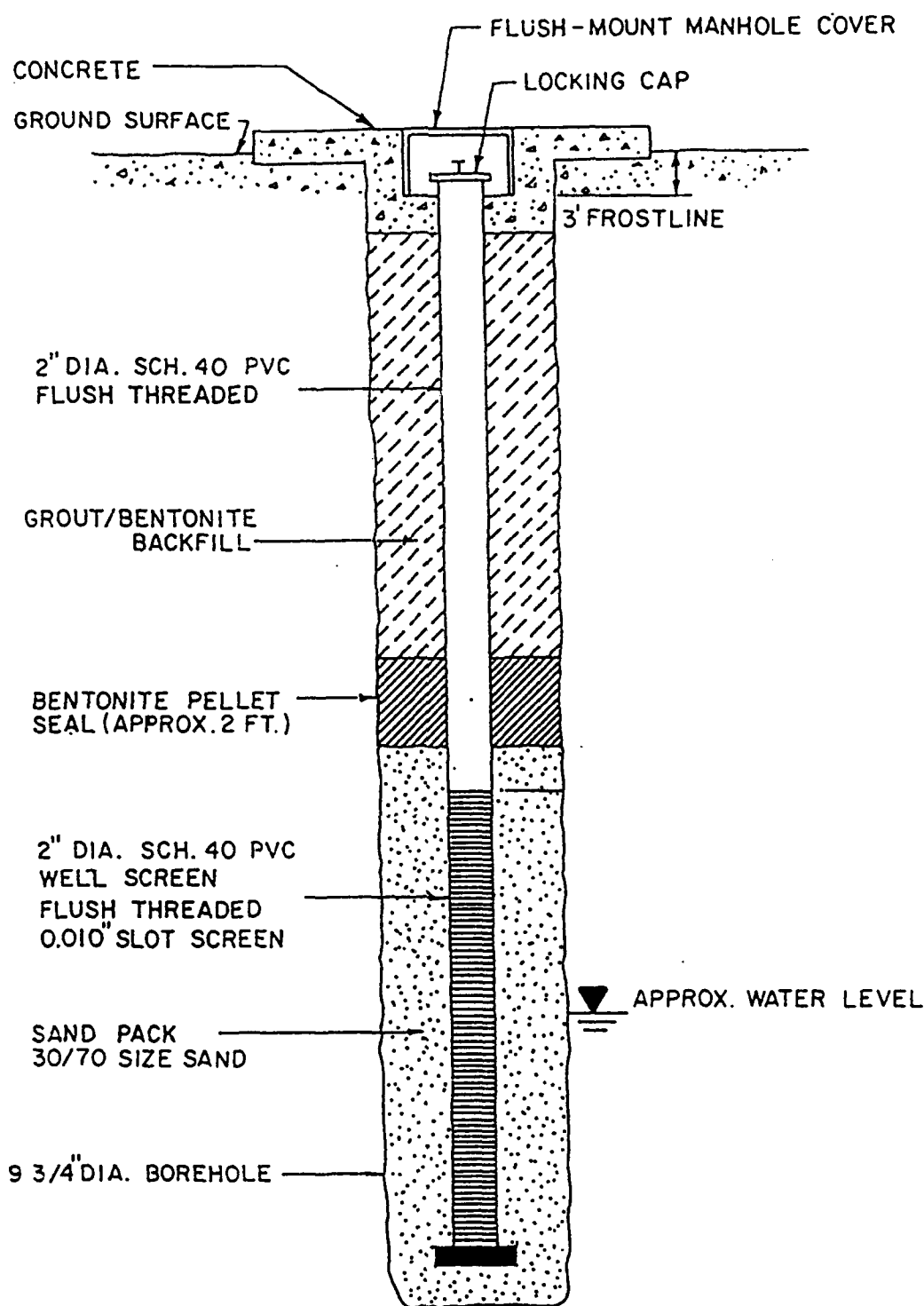
Upon collection, soils were classified with respect to type, by the visual-manual procedure (ASTM D-2488) noting mineralogy, color, odor, staining, etc. The samples were also field screened for the presence of volatile organic compounds (VOC). The test for VOC involved placing a portion of the sample, not intended for volatile analysis at the laboratory, in a glass jar, sealing the jar with foil, allowing the sample to equilibrate for at least five minutes, then inserting a photoionization detector (PID) probe through the foil to detect the presence of VOC in the headspace of the jar.

Generally, the two soil samples displaying the highest PID readings from each boring were submitted for chemical analysis. These samples selected for chemical analysis for semi-volatile and petroleum hydrocarbon constituents (CLP and U.S. EPA 418.1) were removed from the sampler and placed in 16 oz. glass jars with Teflon-lined lids for shipment to the laboratory. Samples for volatile analysis were placed in four oz. jars with Teflon-lined lids as quickly as possible to minimize volatilization. The sample bottle types that were used for soil samples are presented in Table 3.1.

3.2.5 Monitoring Well Construction, Completion and Development

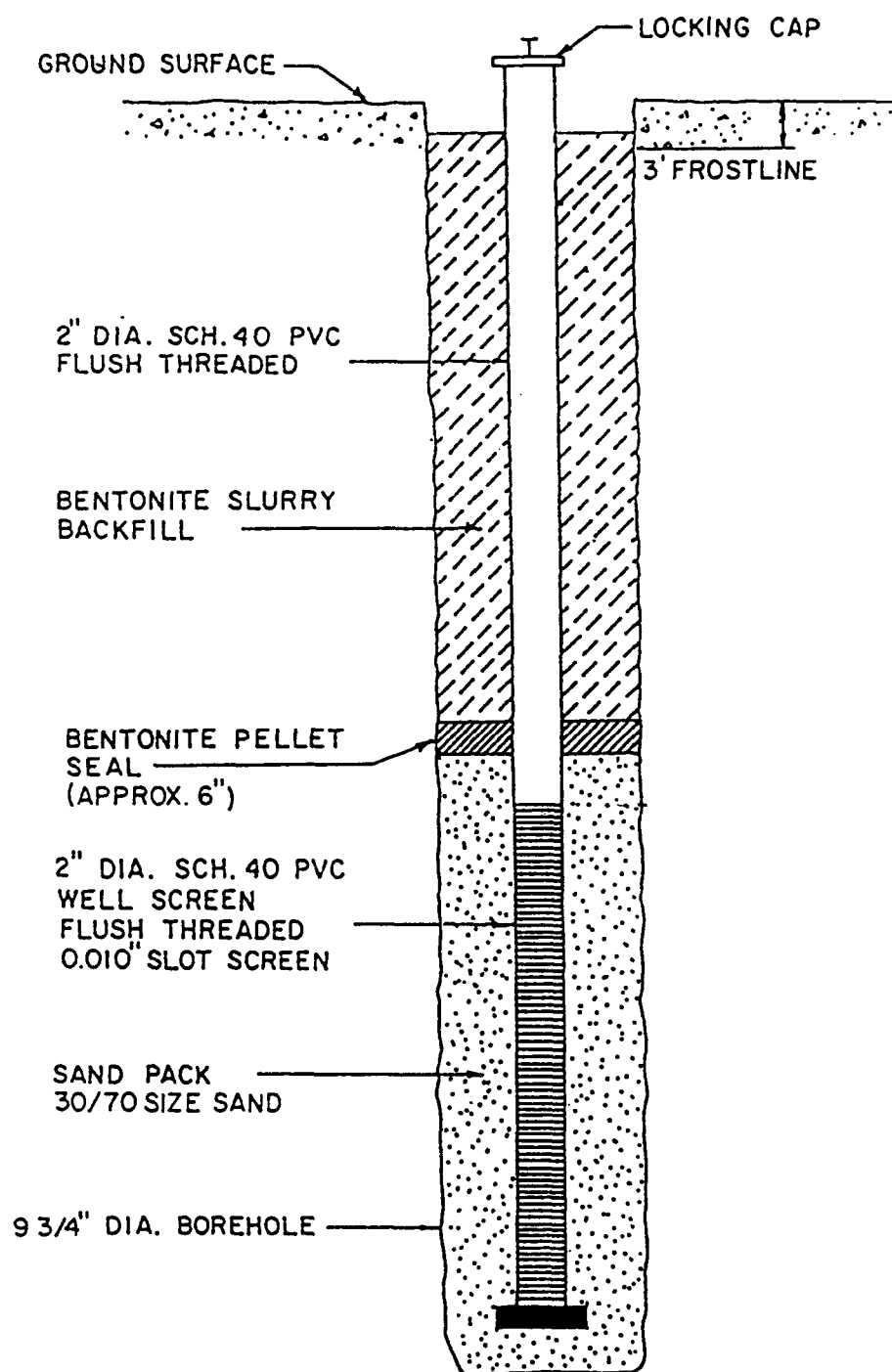
The wells installed to monitor the shallow unconsolidated materials at the two sites consist of two-inch ID Schedule 40 PVC casing and screen. The casing and screen have threaded, flush joints and a threaded bottom cap. In all the wells, a ten-foot screen, machine slotted with 0.010 inch openings was set spanning the water table to detect floating contaminants and to allow for seasonal water table fluctuations. The screen and casing were installed through the augers. A quartz sand pack was placed around the screen while the augers were slowly withdrawn to prevent bridging of the sand. The sand pack extended two feet above the screen. The sand used was a 30/70 sand. The grain size distribution of this sand falls within the range 0.03 and 0.07 inches. A minimum two-foot thick bentonite pellet seal at Site 1 and 0.5 foot thick bentonite pellet seal at Site 2 was placed above the sand pack. The remaining annular space was filled with a cement/bentonite grout mixture at Site 1 and a bentonite slurry at Site 2. The piezometer installed at Site 1 were constructed in the same manner as monitor wells except that PVC used was one-inch ID. Typical monitoring well, piezometer and temporary well construction diagrams for the wells installed in the shallow aquifer are presented in Figures 3.1 and 3.2. Well locations at Sites 1 and 2 are found on Figures 3.3 and 3.4, respectively.

At Site 1, the wells were cut off three inches below grade and a locking protective lid consisting of a cast iron valve box assembly was installed in a concrete mixture above the cement grout. The top of the valve box was finished with a slight crest to facilitate runoff away from the well. The well number was imprinted on the top of the valve box lid. Each below-grade well was fitted with a water-tight cap.



**TYPICAL PERMANENT MONITORING WELL AND
PIEZOMETER FOR FLUSH-MOUNT TYPE WELLS**

SITE 1: DEFUELING PIT
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185 th TACTICAL FIGHTER GROUP
SIOUX GATEWAY AIRPORT
SERGEANT BLUFF, IOWA



TYPICAL TEMPORARY WELL CONSTRUCTION

SITE 2: POTENTIAL LOW LEVEL
RADIOACTIVE WASTE DISPOSAL AREA
IOWA AIR NATIONAL GUARD
185 th TACTICAL FIGHTER GROUP
SIOUX GATEWAY AIRPORT
SERGEANT BLUFF, IOWA

FIGURE 3.3

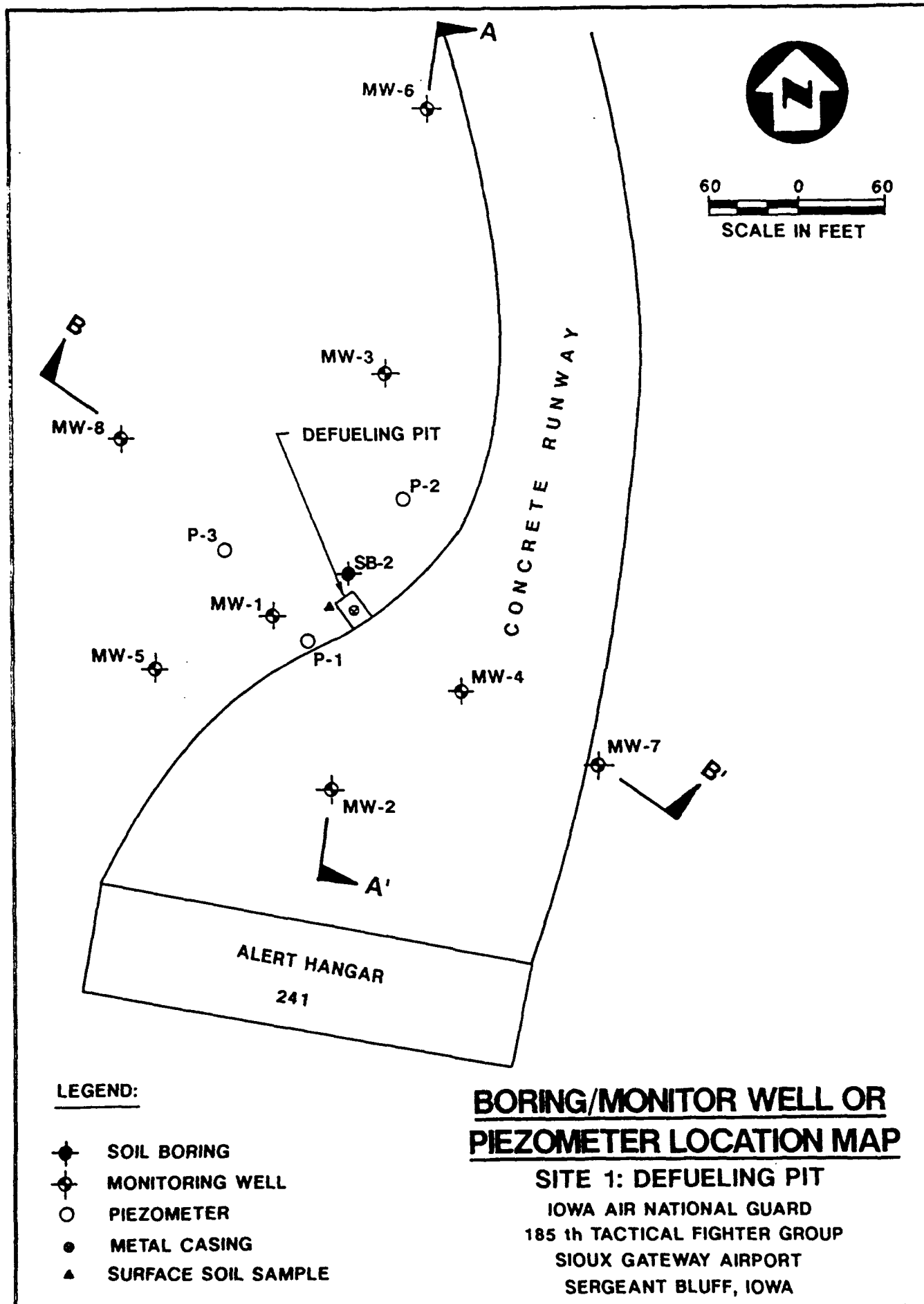


FIGURE 3.4

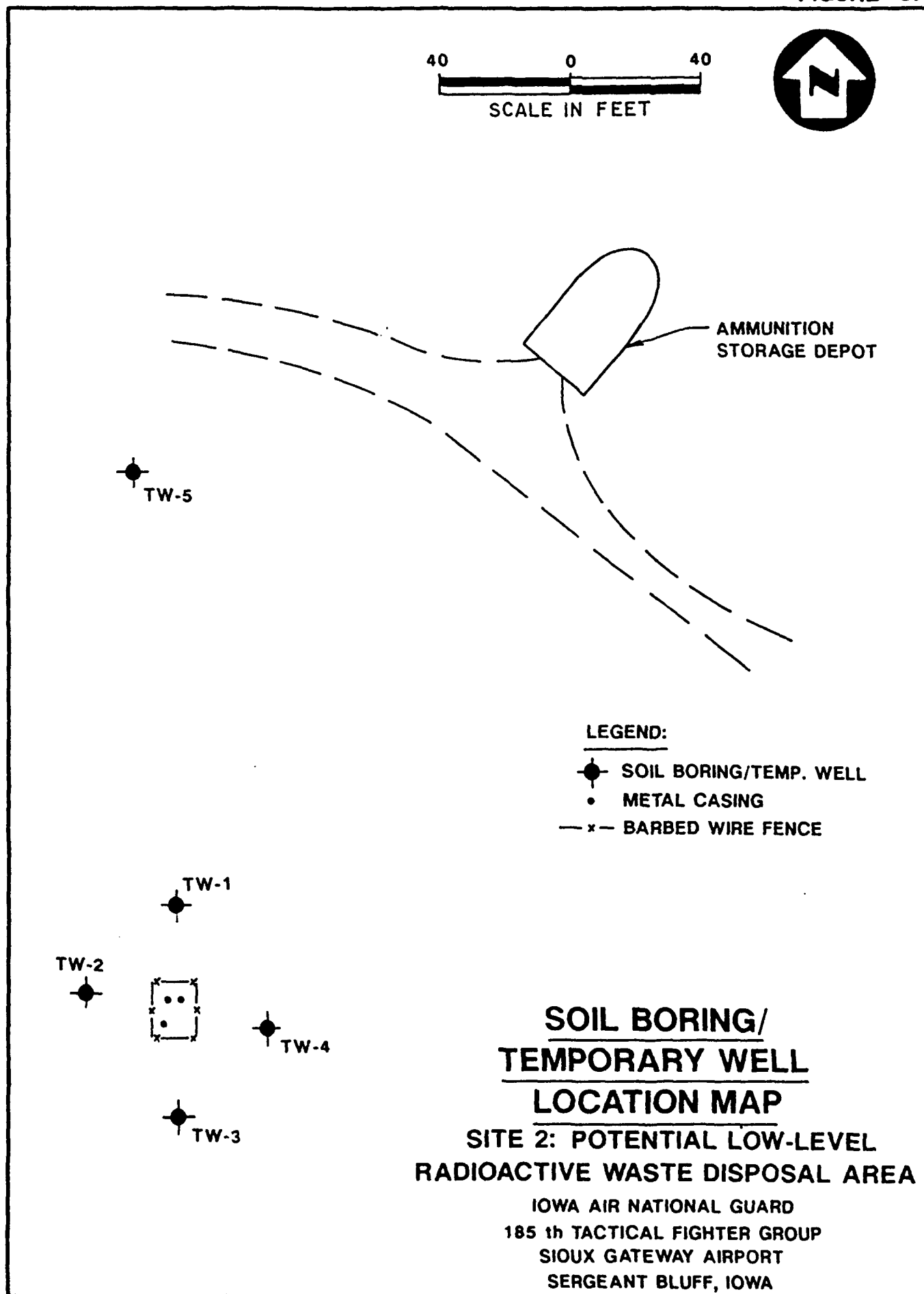


TABLE 3.1
ANALYTICAL METHODS AND COLLECTION SPECIFICATIONS
FOR SOIL SAMPLES
IANG - SERGEANT BLUFF, IOWA

Analytical Parameter	Sample Prep Method	Sample Method	Preservation Container	Method	Holding Time
Aromatic Volatile Organics	5030 ⁽¹⁾	8020 ⁽¹⁾	4 oz, widemouth glass w/Teflon liner	Cool, 4°C	14 days
Semi-Volatile Organics		CLP ⁽²⁾	16 oz, widemouth glass w/Teflon liner	Cool, 4°C	Samples must be extracted within 7 days and extracts analyzed within 40 days
Petroleum Hydrocarbons	9071 ⁽¹⁾	EPA 418.1 ⁽³⁾	16 oz, widemouth glass w/Teflon liner	Cool, 4°C	28 days
Gross Alpha & Gross Beta		EPA 900.0 ⁽⁴⁾	16 oz, widemouth glass w/Teflon liner	Cool, 4°C	6 months
Radium 226		EPA 903.1	16 oz, widemouth glass w/Teflon liner	Cool, 4°C	6 months
Radium 228		EPA 904.0	16 oz, widemouth glass w/Teflon liner	Cool, 4°C	6 months

1. Test Methods for Evaluating Solid Wastes, SW846, U.S. EPA, November 1986.
2. Contract Laboratory Program, Statement of Work for Organics (Number 2/88).
3. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, March 1983.
4. Prescribed Radiochemical Procedures for Drinking Water, EPA 600/4-80-032, 1980. (Soils initially prepared using D.O.E. Health and Safety Laboratory procedure.)

At Site 2, the wells were installed with approximately one foot of riser stick-up above grade. These wells were intended to be sampled one time, then be removed and the borehole grouted. The sampling and abandonment program at Site 2 has been completed.

Wells were developed by bailing. Wells were bailed until pH and conductivity had stabilized to $\pm$ ten percent. Approximately 45 gallons of water were removed from each well and contained in a 55 gallon drum.

3.2.6 Groundwater Sampling

Prior to sampling each monitoring well, the static water level was measured. The well was purged by bailing until the total well water volume (TWWV) had been removed and pH, conductivity and temperature had stabilized ($\pm$ ten percent) or the well was dry (EPA, 1986). The pH, conductivity and temperature of the water were determined two times while purging the well. The TWWV includes water in the screen, riser and sand pack. The TWWV was calculated for a one foot two inch ID screen section in a ten-inch auger boring with 30 percent porosity sand pack. The resulting value of approximately two gallons of water per foot of saturated well was used to calculate the purge volume of each well. The volume of water removed from each well exceeded three casing volumes.

Water was purged and samples collected from the two-inch ID wells using a Teflon bailer with dedicated polypropylene line. The first sample withdrawn was put in a container for volatile analysis (Site 1). Other sample bottles were filled with the remaining water. Appropriate preservatives were added to the sample bottles at the laboratory before shipment to the site. Vials containing samples to be analyzed for volatile organics were checked to assure that no air bubbles were present before the samples were packaged for shipment. A summary of the types of sample bottles and preservatives used for water samples is presented in Table 3.2.

At Site 1, wells MW-1, -3, and -4 showed phase-separated free-floating hydrocarbons. Groundwater was not collected from these wells for analysis. A sample of the hydrocarbons was collected from MW-4 and submitted to the laboratory for a JP-4 fuel fingerprint analysis (Method modified 8015) along with a fresh sample of JP-4 fuel collected from a JP-4 fuel storage truck. This analysis is found in Appendix K.

TABLE 3.2
ANALYTICAL METHODS AND COLLECTION SPECIFICATIONS FOR WATER SAMPLES
IANG - SERGEANT BLUFF, IOWA

Analytical Parameter	Sample Method	Preservation Container	Method	Holding Time
Aromatic Volatile Organics	8020 ⁽¹⁾	40 ml, glass Teflon - lined septum cap	HCl(4 drops), Cool, 4°C	14 days
Semi-Volatile Organics	CLP ⁽²⁾	1 liter, amber glass w/Teflon liner	Cool, 4°C	Samples must be extracted within 7 days and extracts analyzed within 40 days
Petroleum	EPA	1 Liter, amber glass	HCl to pH <2	28 days
Hydrocarbons	418.1 ⁽³⁾	w/Teflon liner	Cool, 4°C	
Gross Alpha & Gross Beta	EPA 900.0 ⁽⁴⁾	1 Liter plastic	HNO ₃ to pH <2	6 months
Radium 226	EPA 903.1	1 Liter plastic	HNO ₃ to pH <2	6 months
Radium 228	EPA 904.0	1 Liter plastic	HNO ₃ to pH <2	6 months

1. Test Methods for Evaluating Solid Wastes, SW846, U.S. EPA, November 1986.
2. Contract Laboratory Program, Statement of Work for Organics (Number 2/88).
3. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised March 1983.
4. Prescribed Radiochemical Procedures for Drinking Water, EPA 600/4-80-032, 1980.

3.2.7 Sample Numbering System

Each sample submitted for laboratory analysis was assigned a unique sample identification number that describes where the sample was collected and what type of sample it is. Each sample number consists of a group of letters and numbers separated by hyphens. A summary of the system is presented in Table 3.3. For example, the first soil sample collected from soil boring 2 at Site 2 was labeled LANG-2-SB/MW-2-S1 and the water sample collected from monitoring well 2 at Site 1 was labeled LANG-1-MW-2. Numbering of duplicate, rinseate, field blank and trip blank samples incorporated some aspects of the basic numbering system. Duplicate soil samples were assigned numbers identifying the actual site number and sample location, but utilized fictitious sample numbers. For example, the duplicate for LANG-2-SB/MW-5-S3 was LANG-2-SB/MW-5-S4. Duplicate groundwater samples were assigned numbers which identified the actual site number but used a sample location number unique to that site. For example, the duplicate groundwater sample collected from LANG-1-MW-8 was LANG-1-MW-9, and a monitor well 9 does not exist at Site 1.

The true identity of the duplicate samples was not disclosed on sample labels or chain-of-custody forms, but was recorded in the field notebooks.

Rinseate samples were identified by the project identification site number and the sample number. For example, sample LANG-1-RB-4 was a rinseate sample collected after decontaminating the split-spoon sampler used to collect soil samples from LANG-1-SB-5/MW-4. Field blanks were identified by the same method as the rinseate samples, e.g., LANG-1-FB-1 (DIUF). The water source for the field blanks was identified as either (DIUF), de-ionized ultrafiltered water from a supplier, or tap water (TAP) from the city water supply. Trip blanks were identified by consecutive number and A or B for each of two 40 ml vials, e.g., 2A, 2B TRIP BLANK.

3.2.8 Sample Handling, Packaging and Shipping

All water and soil samples collected during the SI for chemical analysis were obtained with equipment that was decontaminated prior to each use. Appendix L contains documentation of the sampling jar decontamination. The samples were placed in pre-cleaned glass and plastic jars and bottles supplied by Environmental Sampling Supplies via Engineering-Science, Berkeley, CA., and Controls for Environmental

TABLE 3.3
SAMPLE NUMBERING SYSTEM
IOWA ANGB - SERGEANT BLUFF, IOWA

Project Identification:

LANG - Iowa Air National Guard

Site Identification:

The Site Number

Sample

SB - Soil Boring

MW - Monitoring Well

SV - Soil-Vapor Sampling Station

Sample Type:

S - Soil Sample

G - Groundwater Sample

Sample Number

Sample Number (consecutive for each sampling event)

Example Sample Number

LANG-2-SB-1-S1

Iowa Air National Guard

Site 2 - Soil Boring Number 1, Soil Sample Number 1

Pollution, Santa Fe, NM. Prior to sampling, each of the sample containers was labeled. Information on the labels included:

- Sample identification number;
- Preservatives added;
- Date and time of sample collection; and
- Required analytical method.

Sample containers were wrapped in packing material to minimize the chance of breakage during shipment and packed in plastic coolers. The coolers were then packed with sealed, ice-filled plastic bags. A chain-of-custody form was prepared for the contents of each cooler prior to packing. Information on each chain-of-custody form included sampling information recorded on the label of each sample bottle, and the total number of sample bottles for each sample. The form was then signed by the sampler(s), signed and dated by one of the samplers in the "relinquished by" box and the Federal Express airbill number was written in the "received by" box. The form was then placed in a sealed plastic bag and taped to the inside of the cooler lid. Each cooler was sealed with tape and a security seal and shipped by Federal Express to the ES Laboratories in Berkeley, California (Site 1) and Controls for Environmental Pollution Laboratories in Santa Fe, New Mexico (Site 2).

Upon receipt of a sample set, the laboratory inspected the shipping container for security seals before opening. The container was inspected for the chain-of-custody documents and other information or instructions. The sample custodian verified that the information on the sample bottles matched that on the chain-of-custody forms and signed for receipt. Any discrepancy between the samples received and the chain-of-custody information, broken or leaking sample bottles, or other abnormalities were reported to the laboratory supervisor. Notation of the problem and resolution was made on the chain-of-custody form, initialed and dated by the sample custodian.

Each sample was assigned a unique chronological laboratory number. A sample number label was attached to each bottle. All identifying information was recorded in a bound sample log book. The information documented included:

- Laboratory sample number;
- Date of receipt;
- Client name;
- Client identifying number or description;

- Project number;
- Analyses required, and
- Storage location.

Upon completion of the log-in procedure, the samples were stored in a secure area under the environmental conditions required to maintain sample integrity. A work order form was prepared and provided to the laboratory to assist in scheduling and completion of the tests within required holding times.

3.2.9 Field Measurements

Field measurements (pH, specific conductivity, and temperature) were collected for all water samples during the IANGB sampling activities. A brief discussion of the field measurement procedures is presented below.

Temperature Measurement: The temperature of each water sample was measured with a mercury thermometer.

pH Measurement: The pH of each water sample was measured with a portable pH meter. The meter was calibrated with buffer solutions of the appropriate range for the expected values of pH at the beginning of each day of sampling and the calibration data were entered into the field notebooks. The meter was also recalibrated periodically during periods of continued use.

Conductivity Measurement: The specific conductance of each water sample was measured with a portable field conductivity meter. A standard potassium chloride solution was used to calibrate the instrument prior to use each day. The meter was also recalibrated periodically during periods of continued use.

3.2.10 Analytical Methods and Procedures

The samples of soil, groundwater and surface water were analyzed for the parameters listed in Tables 3.1 and 3.2. The target compounds for methods using gas chromatography (GC) (8020), and gas chromatography/mass spectrometry (GC/MS), for semi-volatile organics under the Contract Laboratory Program (CLP) are listed in Table 3.4. Second column confirmation was performed for GC analyses when target compounds were present above detection limits. The detection limits for organic

TABLE 3.4

LIST OF COMPOUNDS FOR GC AND CLP METHODS
IOWA ANGB - SERGEANT BLUFF, IOWA

<u>SW 8020 - Aromatic Volatile Organics</u>	
Benzene	1,4-Dichlorobenzene
Chlorobenzene	Ethyl Benzene
1,2-Dichlorobenzene	Toluene
1,3-Dichlorobenzene	Xylenes (Dimethyl benzenes)
 <u>Semi-Volatile Organics</u>	
Phenol	bis(2-Chloroethyl) ether
1,3-Dichlorobenzene	2-Chlorophenol
1,4-Dichlorobenzene	Hexachloroethane
1,2-Dichlorobenzene	Nitrobenzene
2-Methylphenol	Isophorone
bis(2-Chloroisopropyl) ether	2-Nitrophenol
4-Methylphenol	2,4-Dimethylphenol
N-Nitroso-di-n-dipropylamine	4-Chloroaniline
4-Chloro-3-methylphenol	Hexachlorobutadiene
bis(2-Chloroethoxy) methane	2-Methylnaphthalene
2,4-Dichlorophenol	
1,2,4-Trichlorobenzene	Dimethylphthalate
Naphthalene	Acenaphthylene
Hexachlorocyclopentadiene	2,6-Dinitrotoluene
2,4,6-Trichlorophenol	3-Nitroaniline
2,4,5-Trichlorophenol	Acenaphthene
	4-Chlorophenyl-phenyl ether
2-Chloronaphthalene	
2-Nitroaniline	Fluorene
2,4-Dinitrophenol	4-Nitroaniline
4-Nitrophenol	4,6-Dinitro-2-methylphenol
Dibenzofuran	N-nitrosodiphenylamine
2,4-Dinitrotoluene	Di-n-butylphthalate
Diethylphthalate	
4-Bromophenyl-phenylether	Fluoranthene
Hexachlorobenzene	Pyrene
Pentachlorophenol	Butylbenzylphthalate
Phenanthrene	3,3'-Dichlorobenzidine
Anthracene	Benzo(k)fluoranthene
Benzo(a)anthracene	Benzo(a)pyrene
Chrysene	Indeno(1,2,3-cd)pyrene
bis(2-Ethylhexyl)phthalate	Dibenz(a,h)anthracene
Di-n-octylphthalate	Benzo(g,h,i)perylene
Benzo(b)fluoranthene	

compound analyses using GC or GC/MS methods are published in the respective methods (SW 846).

Laboratory internal quality control (QC) sampling included at least one blank, one matrix spike and one duplicate sample for each ten field samples received. One matrix/spike duplicate sample was analyzed for each set of samples received or every 20 samples, if sample sets had greater than 20 samples. Blind field duplicates were analyzed as quality assurance (QA) samples at a frequency of approximately one in ten. A summary of QC and QA results is presented in Appendix I.

3.2.11 Aquifer Testing

In-situ hydraulic conductivity tests utilizing the rising head slug test technique were conducted on ten monitoring wells showing no free hydrocarbons at LANG. Water level recovery data was collected with a HERMIT data logger (Model SE 1000B).

Prior to testing, static water levels were measured in each monitoring well with an electronic water level indicator. The transducer for the HERMIT data logger was inserted into each well to a depth of at least 5 feet below the static water level. In addition, a Teflon bailer (3 ft. in length and 1.6 in. outside diameter) was inserted and completely submerged in the well above the transducer. The water level in the well was allowed to return to the original static level.

Prior to initiation of the test, the static water level was remeasured with a water level indicator. The water level was entered into the data logger as a reference value from which changes in head over time during the test were measured. The data logger was then activated and the bailer rapidly removed from the well.

During the test, water level changes in each well were checked periodically with an electronic water level indicator as a means of validating the transducer data. When water levels in each well approached the initial static level (within 0.1 ft.) recovery was determined to be complete and the test terminated.

The raw data from each test was reduced and converted into hydraulic conductivity values according to the technique developed by Hvorslev (1951). Appendix F contains calculations and hydraulic conductivity values for each of the ten wells.

3.2.12 Soil-Vapor Survey

The soil-gas survey was used to obtain field measurements of BTEX parameters present in the soil. This screening method is useful for delineating areas of varying BTEX concentrations. Samples of vadose zone vapor were collected from 31 locations, based on a grid with 20 foot centers, from the area surrounding Site 1. These samples were obtained by driving to depth a hollow stainless steel probe into the ground. A vacuum pump was then attached by hose, to this probe and used to purge the location of extraneous vapors for 60 seconds prior to the collection of a representative soil-vapor sample.

To collect a soil-gas sample, a sample collection train was utilized. This train consisted of a vacuum desiccator with two valves, a TEDLAR sample collection bag, Teflon tubing and miscellaneous stainless steel hardware. To assemble this unit, the TEDLAR bag was attached to one of the valves entering directly into the interior of the desiccator. On the outside, this valve was attached directly to the soil-gas probe. A second valve was installed to allow for the creation of vacuum within the desiccator using the vacuum pump. To draw this gas into the TEDLAR sample bag, a vacuum was created in the desiccator, thereby drawing the vapors out of the ground and into the collection bag.

A gas-tight syringe was then used to extract an aliquot of the sample from the collection bag and inject it into a Photovac 10S70 portable gas chromatograph (GC) present onsite. This GC was equipped with a photoionization detector which utilizes a 10.6eV light source and an isothermal capillary column.

This GC was calibrated with daily prepared one ppm standards of benzene, toluene and xylenes. These standards were prepared by qualified ES personnel by injecting known volumes of pure benzene, toluene and xylene vapors into a one liter TEDLAR bag filled with ultra zero air. The amount of each vapor injected into this TEDLAR bag was such that a one ppm solution was created.

After gas samples were injected into the GC and analyzed, results were printed out as a chromatogram and a printout listing concentrations of standardized compounds present in the sample.

All sample collection and analysis equipment was decontaminated between each use. Decontamination was performed by forcing air through all equipment causing all contaminants to be volatilized.

A number of QA/QC procedures were followed during the course of the soil gas survey. Standard calibration checks were obtained during the initial and final runs of each day by injecting the standard gas mixture into the GC. Decontamination procedures were checked by injecting samples of ambient air that were passed through the sampling train and needles. If contamination was detected, decontamination was repeated until no contamination appeared. These types of blanks were done prior to each day's testing or when significant amounts of compounds were noted in a sample. A sample profile at two, four and six foot depths were taken at several sites in order to obtain an optimum sampling depth. Some samples were repeated in order to confirm recorder response and validity.

At Site 1, a sample spacing of 20 feet was used for 31 sampling points (Figure 3.5).

3.2.13 Radiological Survey

A radiological survey was conducted at the potential low-level radioactive waste disposal area (Site 2). The purpose of this survey was to determine surface radioactivity levels.

The survey was conducted using an Eberline Geiger Mueller survey meter, Model E-120. The instrument was calibrated at the factory and checked in the field with a vendor provided radioactive source prior to use.

The radiological survey consisted of recording the background radiation level approximately 200 feet from site and then obtaining general area readings three feet above the ground at 22 locations over the site (Figure 3.6). Six locations over and around the exposed portions of the storage containers were also checked with contact readings. Survey locations were recorded in the field log book.

3.2.14 Magnetometer Survey

At Site 2, a surface magnetometer survey was conducted. In this area, three metal containers are partially exposed. This survey was designed to identify the presence of

FIGURE 3.5

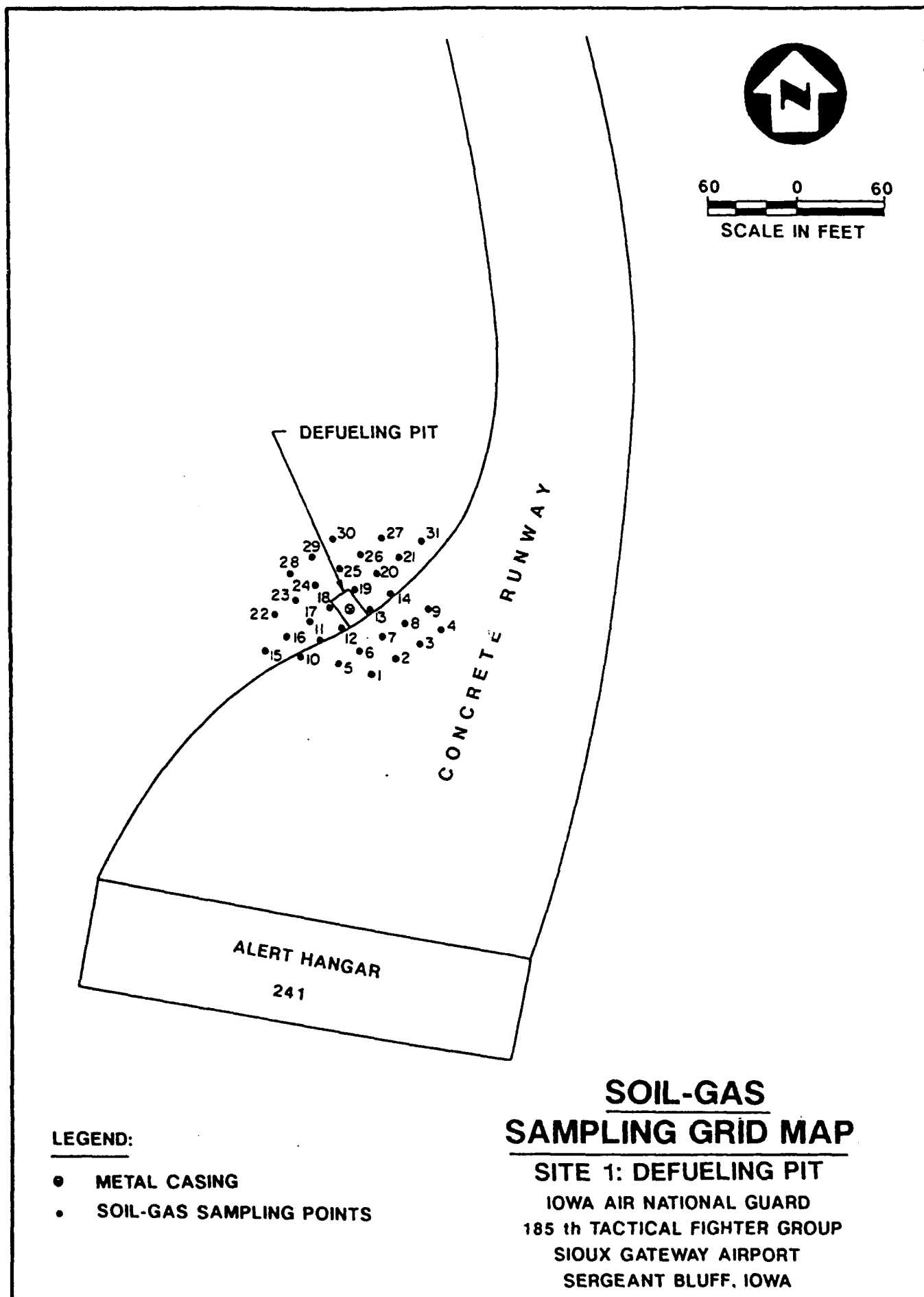
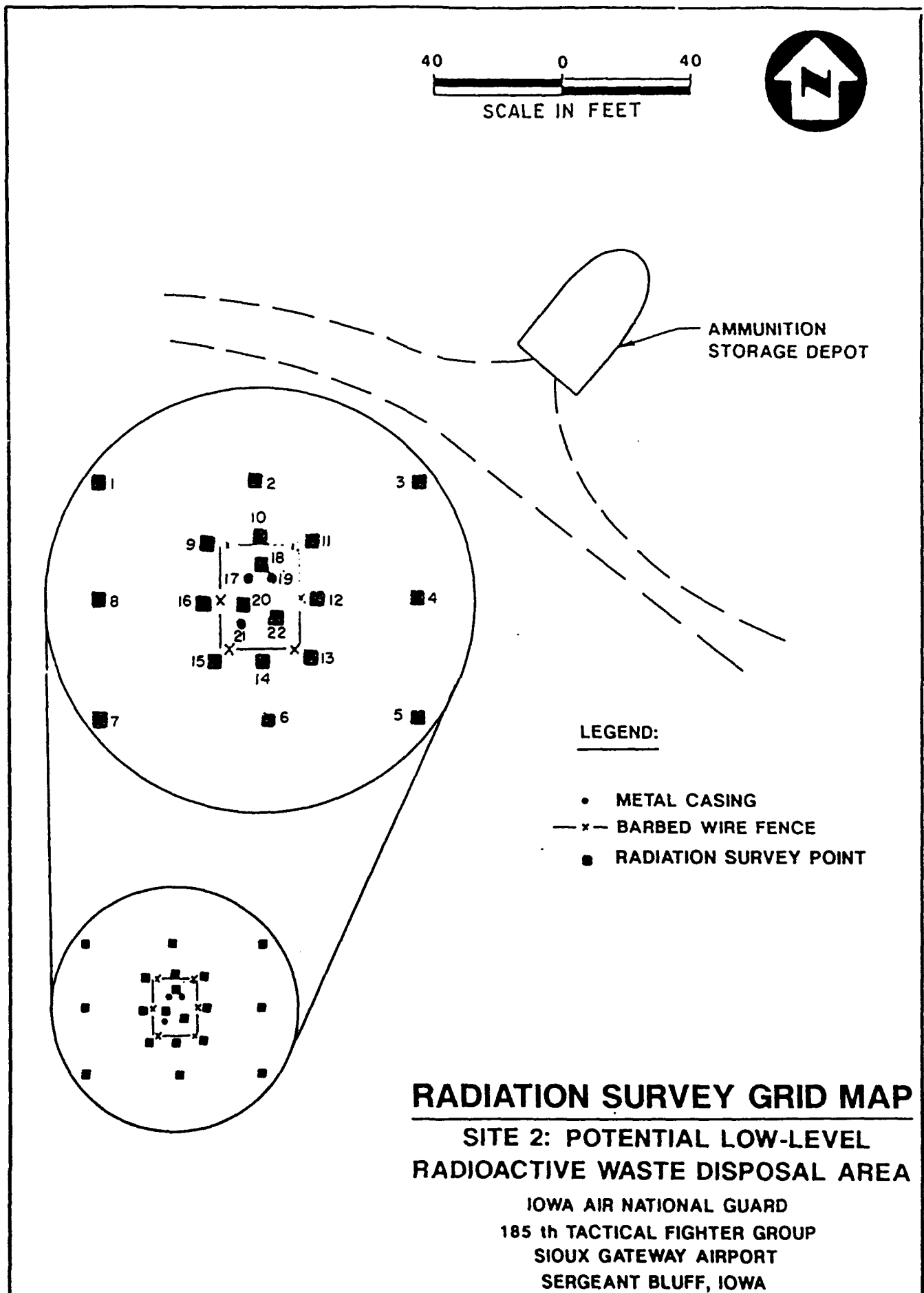


FIGURE 3.6



RADIATION SURVEY GRID MAP

**SITE 2: POTENTIAL LOW-LEVEL
RADIOACTIVE WASTE DISPOSAL AREA**

IOWA AIR NATIONAL GUARD
185th TACTICAL FIGHTER GROUP
SIOUX GATEWAY AIRPORT
SERGEANT BLUFF, IOWA

other objects which may have been buried or to otherwise identify the approximate limits of the disposal area.

The magnetometer survey consisted of station-to-station measurements using a grid system. The stations were set five feet apart using a measuring wheel and a Brunton compass. The measurements were obtained using a Geometrics G826 Magnetometer which indicates the total magnetic field intensity at the site in gammas. The field measurements and grid locations were recorded in the field notebook.

3.2.15 Site Elevation Survey

The monitor wells at Site 1 and the temporary well grade elevations at Site 2 were surveyed by a licensed surveyor from Siouxland Engineering Associates, South Sioux City, Nebraska. The horizontal locations were determined to an accuracy of one foot. Elevations were determined with reference to U.S. Geological Survey benchmarks with an accuracy of ± 0.01 foot.

At Site 2, the temporary wells were removed before the surveyor obtained top of casing elevations. Grade elevations were then taken at each temporary well location at Site 2.

3.3 DEVIATIONS FROM WORK PLAN

The following are descriptions of activities that deviated from the Work Plans.

At Site 1, the defueling pit, three of the eight wells installed had PSH. These three wells were not sampled, which is a plan deviation. The presence of PSH in the wells precluded the necessity of sampling to determine if contamination exists.

At Site 2, the potential low level radioactive waste disposal area, five temporary wells were installed as described in the Work Plans. The wells were sampled and results obtained prior to removal. It was the intent to have the wells surveyed by a local surveyor prior to the wells being removed. However, the surveyor did not complete the work and did not notify ES. The wells were removed and grouted back without having been surveyed. Once the problem was discovered, a survey of the grade elevations was discovered and a survey of the grade elevations of each temporary well was provided.

This information allowed preparation of generalized cross-sections, but no groundwater flow map could be prepared with confidence.

In general, soil sampling was conducted as outlined in the Work Plans. The use of a stainless steel split-spoon samplers was changed during installation of the first wells as the softness of the metal caused the sampler to become bent. At the point that this problem was discovered, a standard carbon steel split-spoon was employed.

In addition, two soil samples and a water sample were collected in the vicinity of a UST and analyzed for radiological parameters as background.

Handling of Well Cuttings and Waters

All soils from borings having odors or elevated PID readings (>100 ppm) were drummed, labeled and stored on pallets at Site 1. Cuttings from wells or borings having no noticeable odors and less than 100 ppm on the PID were spread out on the site. Development waters of all wells sampled were drummed, labeled and placed on pallets at Site 1. The cuttings from Site 2 were drummed, labeled and brought to the storage area at Site 1, at the request of Installation personnel. Development waters from the temporary wells at Site 2 were also taken to Site 1.

Based on laboratory analyses of soil and water samples taken during the SI, soils from Site 1 should be disposed of in a landfill accepting soils containing petroleum hydrocarbons. From available information, soils collected at Site 2 do not contain levels of rad-components uncommon to the area and could be disposed of on site. Waters from Site 2 do not appear to exceed any ARARs. Water from wells 2 and 5 at Site 1 exceeded ARARs for benzene and should be disposed of as a hazardous waste, or with permission of the Iowa DNR, treated on site.

SECTION 4

RESULTS, CONCLUSIONS AND RECOMMENDED ACTIONS

This Section contains Subsection 4.1, a summary of contaminants found during the SI; Subsection 4.2, a description of the applicable or relevant and appropriate requirements (ARARs) which are used to evaluate the significance of the results at the individual sites; and Subsections 4.3 and 4.4, which each contain a site description, a description of field activities, and the results and conclusions for each site investigated. The site-specific subsections are organized into the following subheadings:

- Site Description
- Field Activities
- Results of Field Program
- Preliminary Risk Evaluation
- Significance of Results
- Conclusions and Recommendations

4.1 DATA EVALUATION

Data evaluation is the first step in assessing the results of the site investigation with respect to identifying contaminants and performing a preliminary risk assessment. Data evaluation includes the review of available analytical and physical data for the site, evaluation of analytical methods and data quality and development of the data base for use in subsequent risk characterization. Data validation was performed on all the analytical data collected during the Site Investigation. This was done in accordance with the Contract Laboratory Procedures (CLP) protocol and the HAZWRAP document Requirements for Quality Control of Analytical Data, DOE/HWP-65/RI. Results of the data validation are summarized in Section 5.

The valid data results are summarized in the following Section 4.1.1 and discussed in detail in the site-specific sections. A preliminary risk evaluation was performed for each site. The site-specific exposure assessment, Step 2 in the risk assessment process, is presented in each site-specific section.

The SI conducted at the LANG identified the presence of the following:

Site 1

- 4 Volatile organic contaminants in groundwater and surface water
- 4 Volatile organic contaminants in soils
- 1 semi-volatile organic contaminant in surface water
- 8 semi-volatile organic contaminants in soils
- TPH in surface water
- TPH in soils
- 3 radiological parameters in the groundwater and soil

Site 2

- 4 radiological parameters in the groundwater
- 4 radiological parameters in the soil

Table 4.1 summarizes the concentrations of compounds detected in groundwater and soil samples collected during the SI. The regulatory criteria which was used to evaluate the significance of the presence of these compounds are described in Subsection 4.2.

4.2 CRITERIA FOR EVALUATING RESULTS

The mere presence of contaminants in the environment due to past materials handling or waste disposal practices does not mean that the contaminants pose an unacceptable threat to human health or the environment. To ensure that resources for further investigations and remedial actions are efficiently committed, priorities must be established based on estimates of risk to human health and the environment. The objectives of this subsection are to present criteria for determining the significance of the results presented in later subsections in order that more accurate estimates of risk can be made. Applicable regulatory standards and guidelines were used as the criteria for determining the significance of the results.

Section 121 of the Superfund Amendments Reauthorization Act (SARA) addresses clean-up standards for superfund sites. This act sets forth the need for appropriate remedial actions, consistent with the National Contingency Plan (NCP), that provide a cost-effective response. The degree of cleanup specified in Subsection (d) of 121 of SARA is "to achieve applicable or relevant and appropriate requirements (ARARs) under other Federal or State laws." "Applicable" standards must be legally applicable to the hazardous substance or pollutant of concern. "Relevant and

TABLE 4.1
MAXIMUM CONCENTRATION OF CHEMICALS FOUND IN SOIL AND WATER
SITES 1 & 2
LANG, SERGEANT BLUFF, IOWA

PARAMETER	SITE 1 SOIL	SITE 1 WATER	SITE 2 SOIL	SITE 2 WATER	SITE 1 SOIL SB-7 MW-6-BR1	SITE 1 SOIL SB-7 MW-6-BR2	SITE 1 WATER MW-6
Volatile Organics (ug/kg or ug/l)							
Benzene	5600	180	NA	NA			
Ethylbenzene	44000 J	150	NA	NA			
Toluene	61000 J	5	NA	NA			
Xylenes	100000 J	360	NA	NA			
Semivolatile Organics (ug/kg or ug/l)							
Naphthalene	2700	--	NA	NA			
2-Methylnaphthalene	2900	--	NA	NA			
Dibenzofuran	140 J	--	NA	NA			
Fluoranthene	440 J	--	NA	NA			
Pyrene	580	--	NA	NA			
Benzo(a)anthracene	290 J	--	NA	NA			
Chrysene	340 J	--	NA	NA			
Benzo(b)fluoranthene	710	--	NA	NA			
2,4-Dimethylphenol	--	10 J	NA	NA			
TPH (mg/kg or mg/l)	3100	1	NA	NA			
Radiological Parameters (pCi/g or pCi/l)							
Gross Alpha	35.6+/-2.4	21+/-7	3.3+/-0.8	22+/-10	35.6+/-2	0.5U	21+/-7
Gross Beta	7.8+/-1.3	32+/-7	5.3+/-1.0	45+/-12	7.8+/-1.3	0.8U	32+/-7
Radium-226	0.51+/-0.34	17.0+/-7.8	1.6+/-0.2	4.1+/-1	0.3U	0.51+/-0.34	
Radium-228	--	--	2.4+/-1.1	--	0.5U	0.5U	

Footnotes:

-- Not detected
NA Not analyzed

appropriate" standards must be based on the circumstances presented by the release or threatened release. The U.S. EPA has identified three categories of ARARs:

- Chemical Specific;
- Location Specific, i.e., wetlands limitations or historic sites; and
- Action Specific, i.e., performance and design standards.

The evaluation of the significance of results for the SI considered only chemical specific ARARs.

4.3 SITE 1 - DEFUELING PIT

4.3.1 Site Description

The defueling pit is located north of the old alert hanger (Building No. 241). Excess JP-4 fuel in the F-100 aircraft was dumped into the pit approximately twice per month from 1961-1976. An estimated total of 180,000 gallons of JP-4 may have been released here. At the time of the SI, the dimensions of the pit were 42 by 18.5 feet and the pit was full of water. The surrounding area is flat with minimal relief.

Since there was no evidence to the contrary, it was assumed that only JP-4 was released to the pit and that the pit was unlined, allowing non-volatilized fuel to infiltrate the underlying soils. The capacity of the soil to accept the fuel was exceeded, causing some phase-separated fuel to reach the top of the zone of saturation and either remain there or laterally migrate. The soil vapor screening was intended to identify the approximate lateral migration of fuel components. The borings and wells were intended to provide data on the concentration left in the soils, whether phase-separated hydrocarbons were present atop the water table, and the degree of dissolved fuel components present in the underlying shallow groundwater. PSH are the relatively immiscible fraction present in fuels and oils. PSH tend to "float" on water in monitoring wells because the specific gravity of "floaters" is less than water.

The borings were used to identify the geologic conditions and the vertical extent of JP-4. Two-inch PVC wells were installed and screened across the water table to identify the presence of phase-separated hydrocarbons. Based upon the soil gas survey, borings/wells were drilled radially away from the pit to identify the horizontal extent of migration. Indicators of JP-4 were run on all laboratory soil and water samples analyzed. One background well was installed several hundred feet north of the defueling pit.

4.3.2 Field Activities

A 31 point soil-gas survey was conducted at Site 1 on 17, 18, and 19 July 1990. The results of the survey were used to assist in the location of soil borings and monitor wells surrounding the defueling pit.

Sampling began on 24 July 1990 with the collection of continuous soil samples to 30 feet for piezometer installations. These samples were screened in the field for VOCs with the photoionization detector (PID). The elevated PID readings were noted to determine the intervals with possible hydrocarbon contamination. The piezometers were installed to determine the groundwater flow direction on the site. Monitor wells were then located upgradient and downgradient of the defueling pit. Soil samples from piezometer borings were not submitted for chemical analysis.

Soil boring samples were collected from 31 July 1990 to 12 August 1990. These samples were collected in accordance with previously stated procedure (sub-section 3.2.4). All samples were tested for VOCs by headspace analysis with a PID. Two samples from each boring were selected for laboratory analysis based on elevated PID readings and/or stratigraphic interval. Table 4.2 shows the sample intervals selected for laboratory analyses. The samples were analyzed for volatile organics (Method 8020), semi-volatile organics (CLP) and total petroleum hydrocarbons (Method 418.1).

Monitoring wells were installed in the soil borings at Site 1. Immediately after the last soil sample was taken, the well was installed through the hollow-stem augers then the augers were removed as the sand pack and bentonite/cement grout were installed. One soil boring was not converted to a monitoring well. It was abandoned during the delineation of the PSH plume.

Monitor wells LANG-1-MW-1, LANG-1-MW-3 and LANG-1-MW-4 were installed nearest the defueling pit and showed PSH in the wells after installation. The soil-gas survey indicated these locations to be generally high in total BTEX concentrations.

Monitor wells LANG-1-MW-2, -5, -6, -7 and -8 were installed radially from the defueling pit in order to delineate the edge of the PSH plume. These wells showed no PSH after installation. These wells were developed on 14 August 1990. Development was conducted using a 1.5-inch I.D. by 3 foot long Teflon bailer. 45 gallons were bailed from each well and contained in a 55 gallon drum.

TABLE 4.2
SOIL HEADSPACE ORGANIC VAPOR ANALYSIS⁽¹⁾
SITE 1 - DEFUELING PIT
IANG - SERGEANT BLUFF, IOWA

Sample ⁽²⁾ Location	Sample No.	Sample ⁽³⁾ Depth (feet)	PID ⁽⁴⁾ (ppm)
MW-1	S1	20 - 22	4920
	S2	22 - 24	4790
MW-2	S1	22 - 24	3637
	S2	24 - 26	2811
MW-3	S1	18 - 20	6209
	S2	20 - 22	6748
MW-4	S1	20 - 22	4500
	S2	24 - 26	5000
MW-5	S1	4 - 6	119
	S2	26 - 28	2.9
MW-6	S1	8 - 10	139
	S2	20 - 22	77
MW-7	S1	8 - 10	65
	S2	22 - 24	2.8
MW-8	S1	16 - 18	19
	S2	20 - 22	23

- (1) Measured with a photoionization detector (PID) in parts per million.
(2) Boring/well locations are shown on Figure 2.2. Boring logs are included in Appendix B.
(3) Approximate sample depth.
(4) Samples submitted for laboratory analysis based on highest PID readings.

Groundwater samples were collected on 15 August 1990 and submitted for laboratory analyses. A duplicate from well LANG-1-MW-8 was also submitted for laboratory analyses. The wells were purged using a 1.5-inch by 3-foot Teflon bailer. Purging was conducted as described in sub-section 3.2.6. The purge water was added to the development water contained in a 55 gallon drum. These samples were analyzed for volatiles (Method 8020), semi-volatiles (CLP), and TPH (Method 418.1). In-situ hydraulic conductivity tests were run on the wells on 22 August 1990.

4.3.3 Results of Field Program

4.3.3.1 Soil-Gas Survey Results

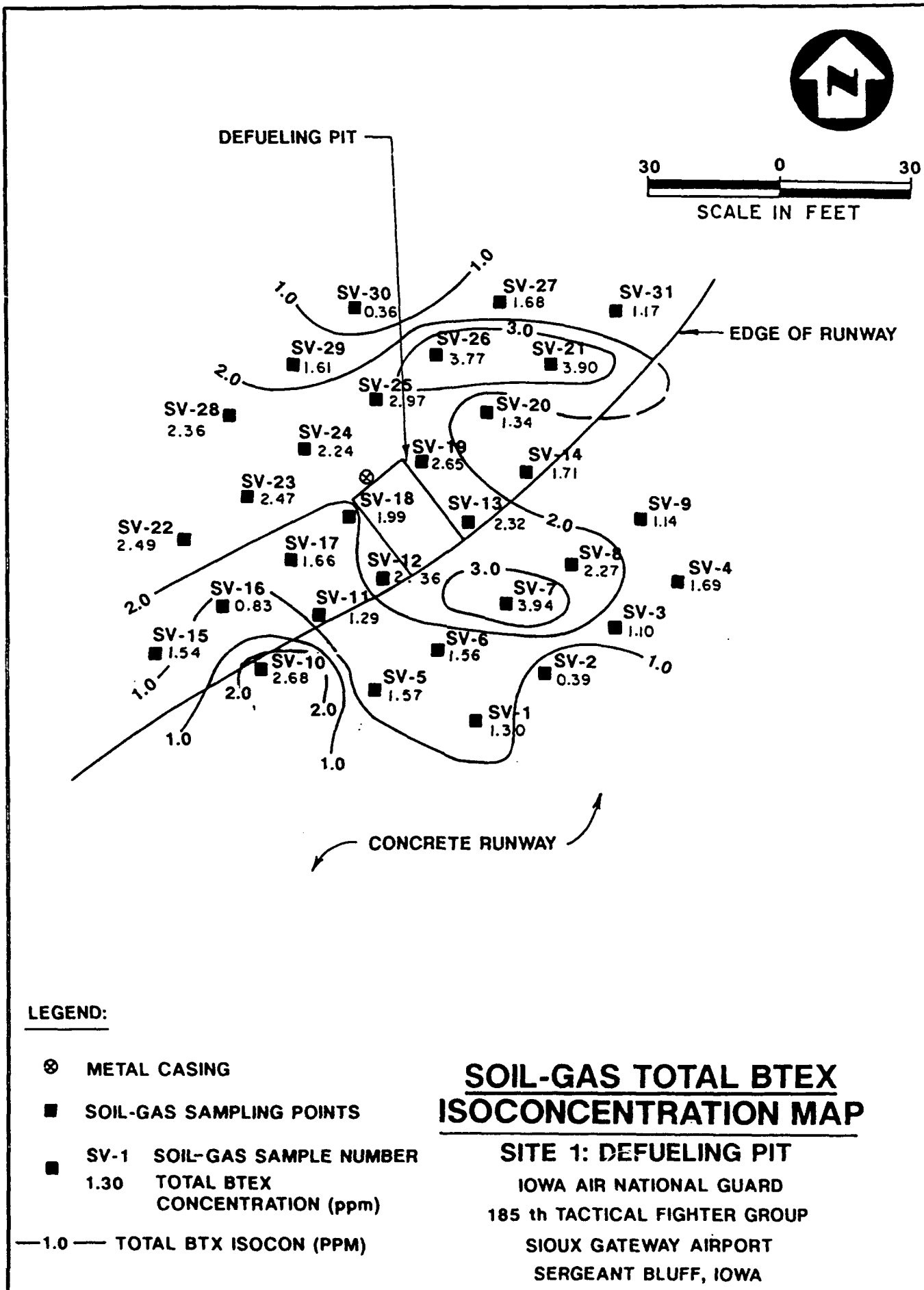
The soil gas survey identified two areas of elevated total BTEX concentration. The sample from LANG-1-SV-7 (Figure 4.1) contained the highest concentration (3.943 ppm). Samples LANG-1-SV-21 and -26 contained the next highest BTEX concentrations of 3.900 ppm and 3.767 ppm, respectively. This data is summarized in Appendix D. The other points indicate a limited extent of volatile organic contamination at the perimeter of the survey zone.

4.3.3.2 Hydrogeologic Results

The borings for monitor wells LANG-1-MW-1, -MW-2, -MW-3 and -MW-4 penetrated brown and gray silt and silty clay overlying brown and gray silty sand. Elevated headspace PID responses of up to 6,700 ppm were obtained from soil samples below 14 feet and hydrocarbon odors were detected over the same interval. The wells were installed to 30 feet (see Logs, Appendix E). The ten foot well screen spanned the unsaturated and saturated zone interface in a fine-grained silty sand. Water was detected during drilling at 24 to 25 feet. The usefulness of a PID for on-site screening is that relative differences between concentrations of volatile organic contaminants present in samples can be established in the field. Based on this screening information, samples can be selected for laboratory analysis.

The borings for LANG-1-MW-5, -MW-6, -MW-7 and -MW-8 penetrated the same soil section sequence as the other wells but did not have elevated headspace PID responses or odors. The wells were installed to 30 feet. The 10 foot well screen spanned the unsaturated and saturated zone interface in a fine-grained silty sand. Water was detected at 23 to 25 feet.

FIGURE 4.1



Water levels were measured in all the wells on 13 August 1990. The water levels ranged from 22.70 to 25.08 feet below grade. The groundwater gradient is somewhat flat and variable in the Site 1 vicinity with dominant flow direction to the south-southwest toward the Missouri River (Figure 4.2).

In-situ hydraulic conductivity testing in LANG-1-MW-2,-5,-6,-7 and -8 revealed values ranging from 7.80×10^{-3} to 1.41×10^{-2} cm/sec (see Appendix F). Estimated groundwater flow velocities range from 4.20×10^{-2} ft/day to 7.59×10^{-2} ft/day assuming an effective porosity of 0.2 with the local flow gradient measured across the site as 3.8×10^{-4} . Phase-separated hydrocarbons (PSH) were measured in LANG-1-MW-1,-3 and -4 at thicknesses over two feet on 13 August 1990 (Figure 4.3). Table 4.3 provides water elevations and phase-separated hydrocarbon thickness for the Site 1 monitor wells. The nominal diameter of the piezometers were too small to permit insertion of a probe and consequently water levels and PSH were not measured. Regulatory personnel from the State of Iowa DNR were notified of the PSH by a representative from LANG.

4.3.3.3 Chemical Analysis Results

Soil samples were collected at Site 1 during the drilling of monitor wells and the collection of one surface soil sample (Table 4.4). All the soil samples submitted to the laboratory were analyzed for volatile organic compounds (8020), semi-volatile compounds (CLP) and total petroleum hydrocarbons (418.1). The analytical results are summarized in Table 4.5. Soil samples from MW-6 were also analyzed for Gross Alpha, Gross Beta, Radium 226 and Radium 228 and these results are summarized in Table 4-17.

The soil samples collected during the drilling of LANG-1-SB-1, MW-3, and MW-4 contained detectable concentrations of benzene, toluene, ethylbenzene and xylenes and total petroleum hydrocarbons (TPH). The semi-volatiles naphthalene and 2-methylnaphthalene were also detected in these soil samples.

Soil samples collected during the drilling of LANG-1-MW-2, MW-5, MW-6, MW-7 and MW-8 contained detectable concentrations of volatile organics and TPH. The semi-volatiles were not detected.

The surface soil sample collected from the defueling pit area revealed detectable concentrations of volatile organics (xylenes), semi-volatiles (pyrene, benzo(b)-fluoranthene) and a TPH concentration of 160 mg/kg (Figure 4.5).

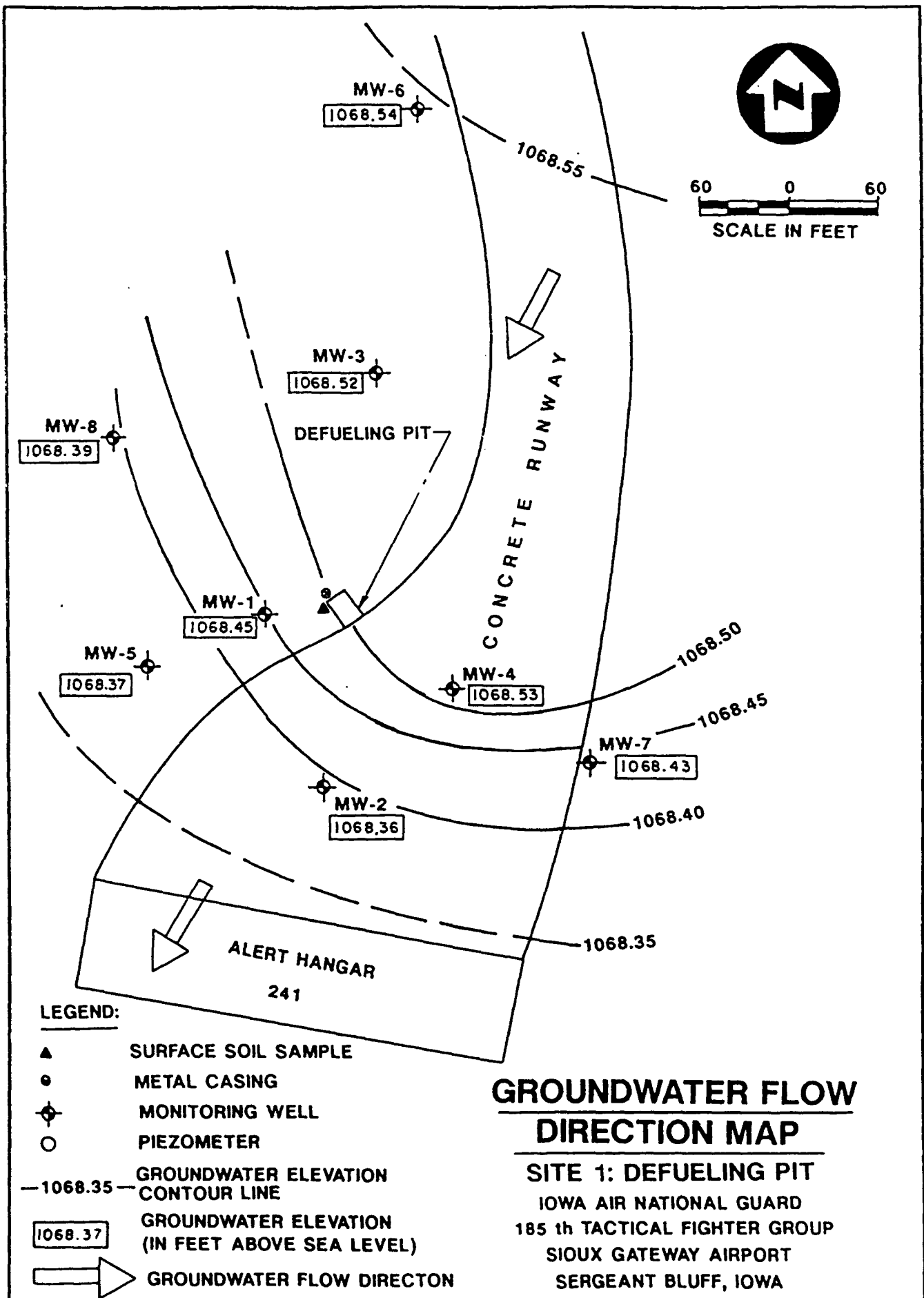
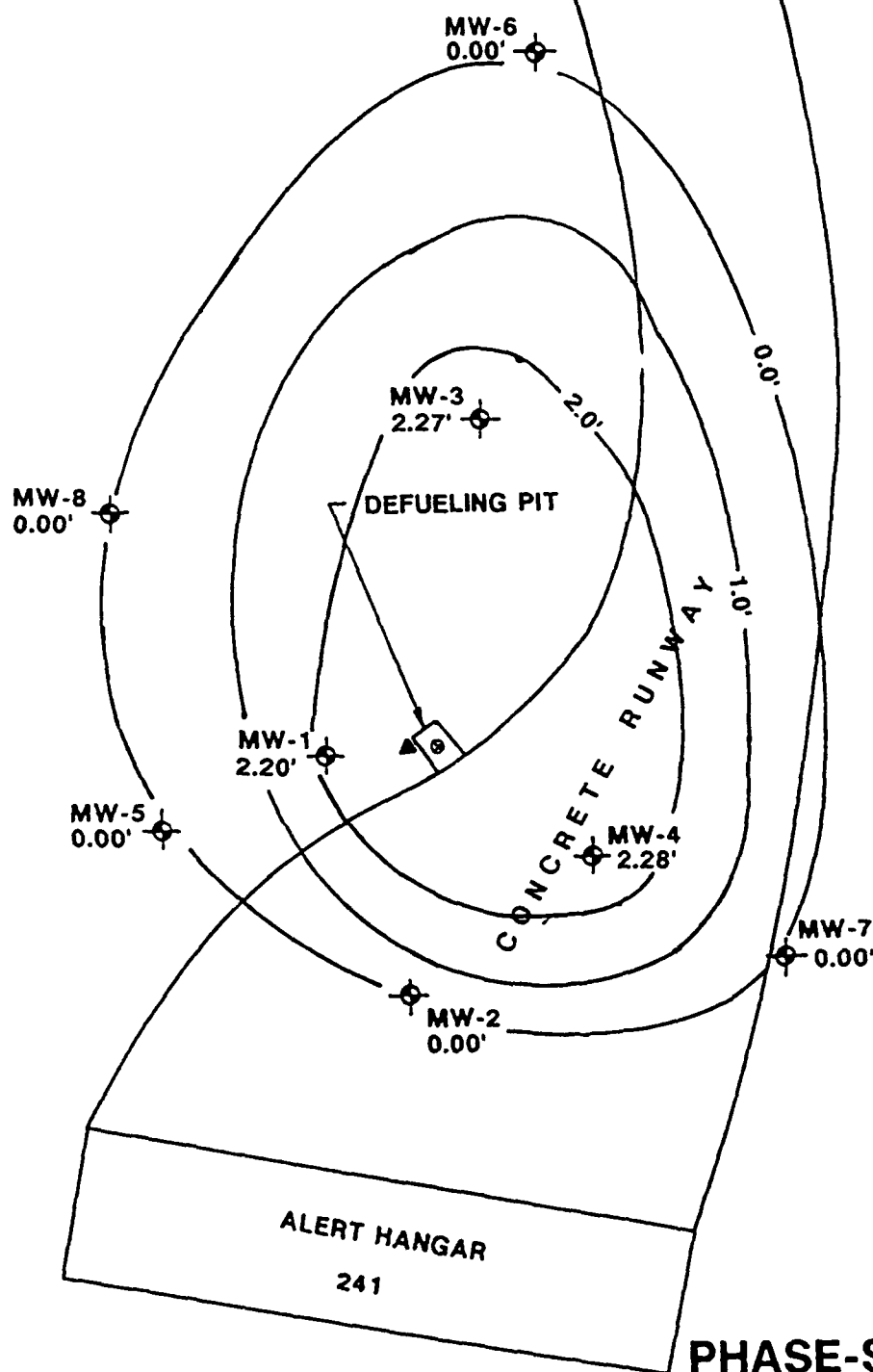


FIGURE 4.3



LEGEND:

- ▲ SURFACE SOIL SAMPLE
- METAL CASING
- ⊕ MONITORING WELL
- PIEZOMETER

—1.0'— PHASE-SEPARATED FREE-FLOATING
HYDROCARBON THICKNESS
CONTOUR LINE (IN FEET)

**PHASE-SEPARATED
FREE-FLOATING
HYDROCARBON THICKNESS MAP**

SITE 1: DEFUELING PIT
IOWA AIR NATIONAL GUARD
185 TH TACTICAL FIGHTER GROUP
SIOUX GATEWAY AIRPORT
SERGEANT BLUFF, IOWA

FIGURE 4.4

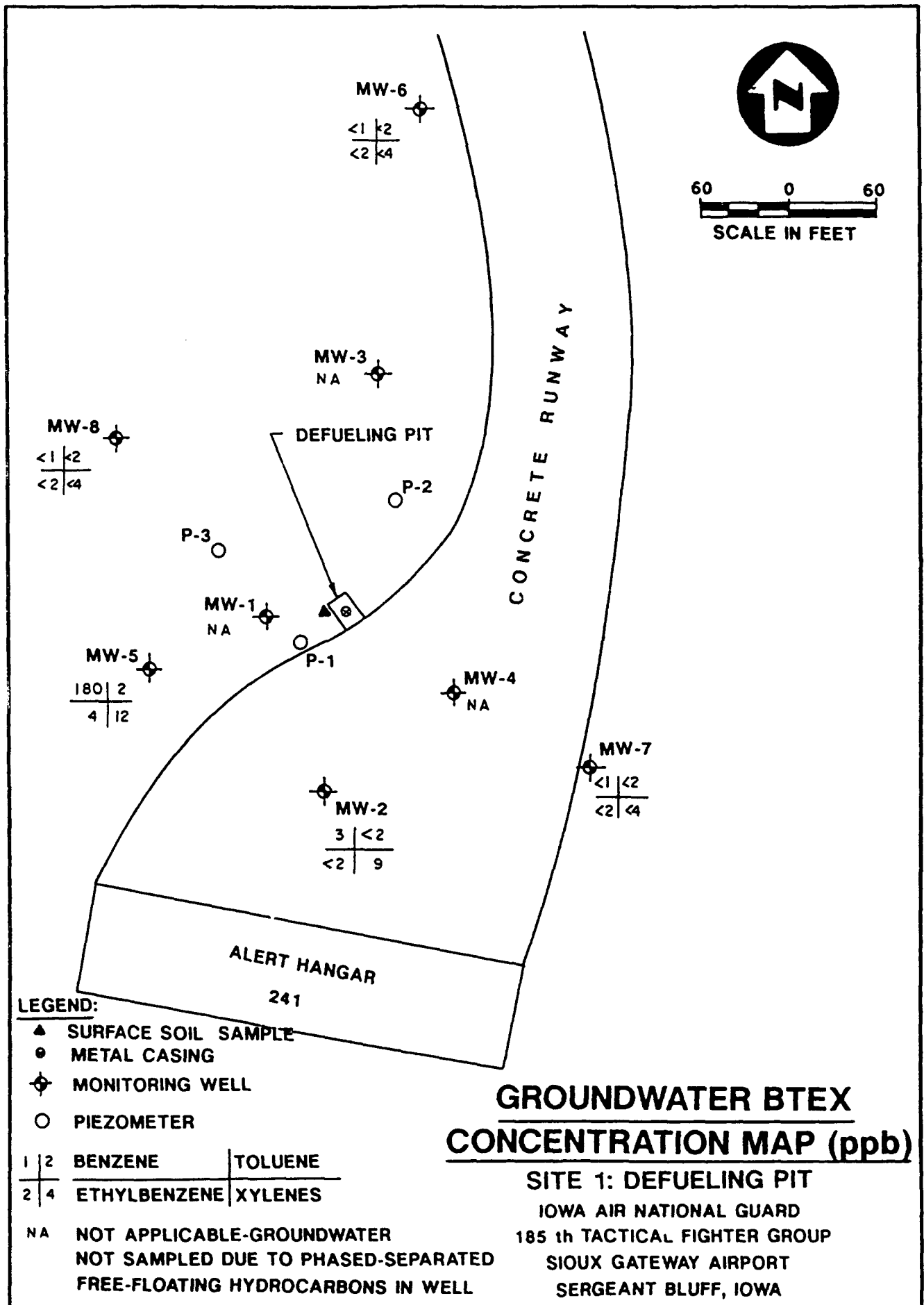


FIGURE 4.5

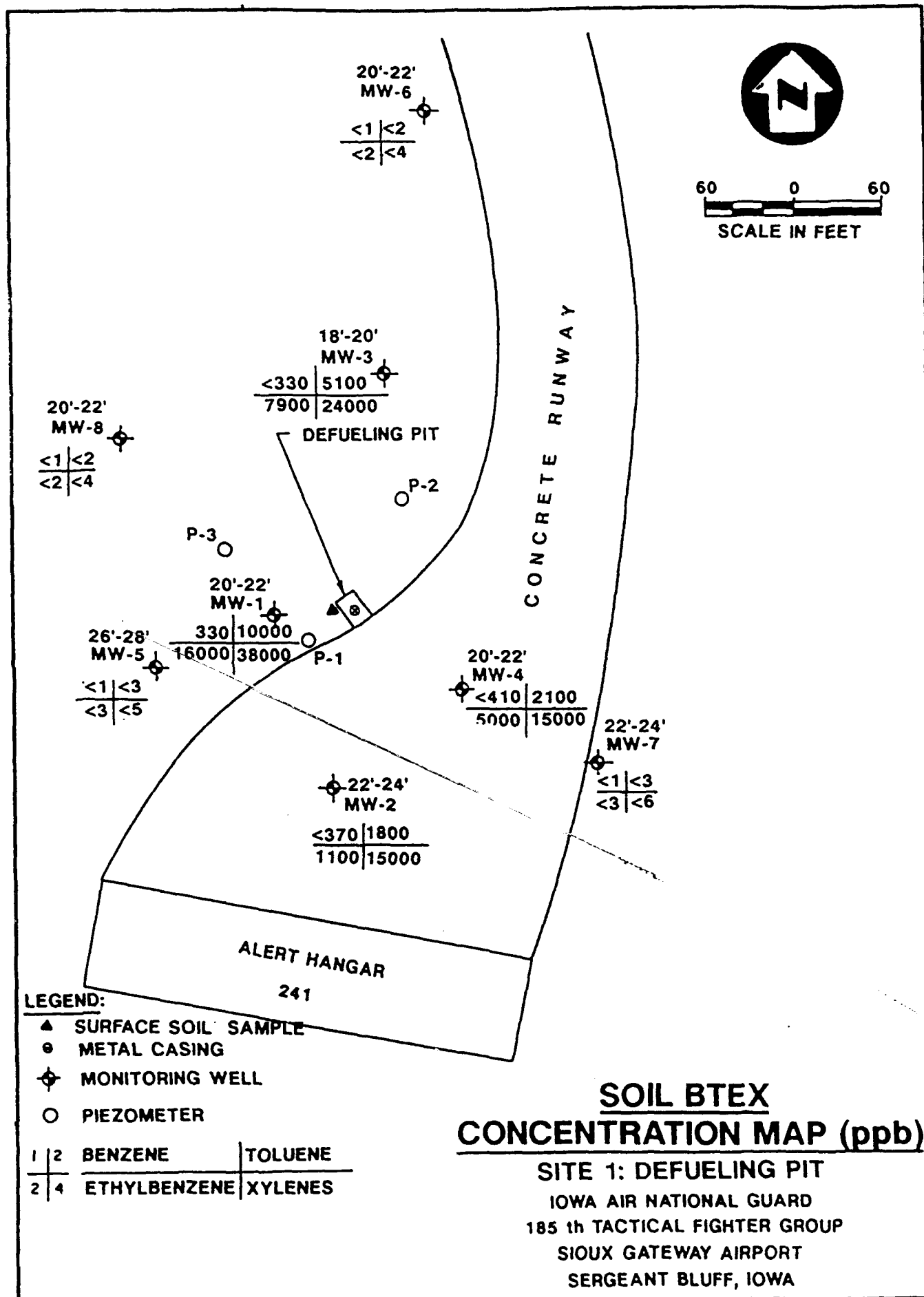


TABLE 4.3
GROUNDWATER ELEVATIONS AND HYDROCARBONS THICKNESS
SITE 1 - DEFUELING PIT

IANG - SERGEANT BLUFF, IOWA

Well ⁽¹⁾ No.	Date	Well Cover ⁽²⁾ Elevation	Depth to Fluid (feet)	Depth to Water (feet)	Hydrocarbon Thickness (feet)	Corrected ⁽³⁾ Water Surface Elevation
MW-1	8/13/90	1092.29	23.40	25.60	2.20	1068.45
MW-2	8/13/90	1093.38	25.02	25.02	0.00	1068.36
MW-3	8/13/90	1091.25	22.28	24.55	2.27	1068.52
MW-4	8/13/90	1092.81	23.82	26.10	2.28	1068.53
MW-5	8/13/90	1092.95	24.58	24.58	0.00	1068.37
MW-6	8/13/90	1091.41	22.87	22.87	0.00	1068.54
MW-7	8/13/90	1092.87	24.44	24.44	0.00	1068.43
MW-8	8/13/90	1091.09	22.70	22.70	0.00	1068.39

(1) Monitor well locations are shown on Figure 3.2.

(2) Elevations are in feet above mean sea level. Depths measured from rim of flush-mounted well cover.

(3) Water surface elevation correction: (hydrocarbon thickness x 0.8) + measured water surface elevation = corrected water surface elevation (after AFL Industries, General Engineering Data, No. 17-05.G.1)

TABLE 4.4
SOIL AND WATER SAMPLES SUBMITTED FOR
LABORATORY ANALYSIS - SITE 1
LANG - SERGEANT BLUFF, IOWA

Location	Soil (Sample Depth)	Water	Analysis
MW-1	(20 - 22) (22 - 24)	✓	8020, 8240, 418.1 8020, 8240, 418.1
MW-2	(22 - 24) (24 - 26)	✓	8020, 8240, 418.1 8020, 8240, 418.1
MW-3	(18 - 20) (20 - 22)	✓	8020, 8240, 418.1 8020, 8240, 418.1
MW-4	(20 - 22) (24 - 25)	✓	8020, 8240, 418.1 8020, 8240, 418.1
MW-5	(4 - 6) (26 - 28)	✓	8020, 8240, 418.1 8020, 8240, 418.1
MW-6	(8 - 10) (20 - 22)	✓	8020, 8240, 418.1 8020, 8240, 418.1
MW-7	(8 - 10) (22 - 24)	✓	8020, 8240, 418.1 8020, 8240, 418.1
MW-8	(16 - 18) (20 - 22)	✓	8020, 8240, 418.1 8020, 8240, 418.1

TABLE 4.5
DETECTED COMPOUNDS IN SOIL SAMPLES
SITE 1 DEFUELING PIT
IANG, SERGEANT BLUFF, IOWA

SAMPLE ID:	IANG-1 SB-1-S1	IANG-1 SB-1-S2	IANG-1 SB-3/ MW-2-S1 *	IANG-1 SB-3/ MW-2-S2 *	IANG-1 SB-4/ MW-3-S1 *	IANG-1 SB-4/ MW-3-S2 *
Date Sampled:	31-JUL-90	31-JUL-90	6-AUG-90	6-AUG-90	7-AUG-90	7-AUG-90
.....						
Volatile Organics (ug/kg)						
.....						
Benzene	330	5000 J	370 U	110 U	330 U	380 U
Ethyl Benzene	16000	46000 J	1100	220	7900	17000
Toluene	10000	61000 J	1800	220 U	5100	12000
Xylenes	36000	100000 J	15000	2200	24000	58000
.....						
Semi-Volatile Organics (ug/kg)						
.....						
Naphthalene	820	1800	340 U	400 U	1100	2300
2-Methylnaphthalen	1400	2500	340 U	400 U	1600	2500
Dibenzofuran	340 U	350 U	340 U	400 U	340 U	340 U
Fluoranthene	340 U	350 U	340 U	400 U	340 U	340 U
Pyrene	340 U	350 U	340 U	400 U	340 U	340 U
Benzo(a)Anthracene	340 U	350 U	340 U	400 U	340 U	340 U
Chrysene	340 U	350 U	340 U	400 U	340 U	340 U
Benzo(b)fluoranthene	340 U	350 U	340 U	400 U	340 U	340 U
.....						
TPH (mg/kg)	730	1700	10 U	29	920	1600
.....						

Footnotes:

- J--the value reported is an estimated concentration.
- U--the compound was analyzed for, but not detected.
- * SB-2 was not converted to a monitor well, thus the boring/well numbering sequence is offset, eg. SB-3 was converted to MW-2.
- See Appendix H for complete analytical results

TABLE 4.5 continued
DETECTED COMPOUNDS IN SOIL SAMPLES
SITE 1 DEFUELING PIT
LANG, SERGEANT BLUFF, IOWA

SAMPLE ID:	LANG-1 SB-5/ MU-4-S1 *	LANG-1 SB-5/ MU-4-S2 *	LANG-1 SB-6/ MU-5-S1 *	LANG-1 SB-8/ MU-7-S2 *	LANG-1 DEFUELING PIT
Date Sampled:	8-AUG-90	8-AUG-90	9-AUG-90	11-AUG-90	15-AUG-90
Volatile Organics (ug/kg)					
Benzene	410 U	5600	1 U	1 U	2 U
Ethyl Benzene	5000	20000	3 U	3 U	3 U
Toluene	2100	29000	3 U	3 U	3 U
Xylenes	15000	53000	5 U	6 U	21
Semi-Volatile Organics (ug/kg)					
Naphthalene	190 J	2700	410 U	460 U	520 U
2-Methylnaphthalen	560	2900	410 U	460 U	520 U
Dibenzofuran	340 U	140 J	410 U	460 U	520 U
Fluoranthene	340 U	410 U	410 U	460 U	440 J
Pyrene	340 U	410 U	410 U	460 U	580
Benzo(a)Anthracene	340 U	410 U	410 U	460 U	290 J
Chrysene	340 U	410 U	410 U	460 U	340 J
Benzo(b)fluoranthene	340 U	410 U	410 U	460 U	710
TPH (ug/kg)	780	3100	20	17	160

Footnotes:

- J--the value reported is an estimated concentration.
- U--the compound was analyzed for, but not detected.
- * SB-2 was not converted to a monitor well, thus the boring/well numbering sequence is offset, eg. SB-3 was converted to MU-2.

See Appendix N for complete analytical results

One surface water sample was collected from the metal casing believed to be used to discharge JP-4 to the subsurface. The water sample was analyzed for volatiles, semi-volatiles and TPH. The results revealed detectable levels of benzene, toluene, ethylbenzene and xylenes (Figure 4.4). The analytical results are summarized in Table 4.6.

The groundwater samples were collected from monitor wells containing no phase-separated hydrocarbons. Wells LANG-1-MW-2, -5, -6, -7 and -8 were sampled and submitted for laboratory analyses. The results revealed concentrations of benzene, toluene, ethylbenzene and xylenes above detection limits in LANG-1-MW-2 and -5 (Table 4.6).

The JP-4 fuel fingerprint analysis results indicate both the hydrocarbon sample collected from MW-4 and the fresh JP-4 fuel collected from the JP-4 fuel storage truck are likely to be from similar producer distillation cuts. However, small differences are notable on the chromatograms regarding ratios of the major peaks, indicating that the two samples are from different manufacturing lots, and/or refineries. Both samples can be considered essentially unweathered JP-4 (Appendix K).

4.3.3.4 Radiological Results

Soil samples collected from monitoring well 6 showed gross alpha concentration to be 35 pCi/g for a sample collected at 23 feet and 1.4 pCi/g for a sample collected at 27 feet. No obvious source material was observed in the boring and subsequent background samples taken at the UST site had gross alpha concentrations of 1.2 pCi/g and 1.6 pCi/g, respectively. The high value detected in MW-6 can most likely be considered an anomaly attributable to naturally occurring variations in the geology.

4.3.4 Preliminary Risk Evaluation

4.3.4.1 Introduction

The preliminary risk evaluation provides an evaluation of the potential risks to human health and the environment posed by the contaminants detected at the two sites investigated during the SI at the Base. The data used in this evaluation was collected during the SI. The objectives of the preliminary risk evaluation are to provide qualitative information on the potential risks to human and environmental receptors due to the release or threat of release of hazardous substances from the two sites; to aid in

TABLE 4.6
DETECTED COMPOUNDS IN WATER SAMPLES
SITE 1 DEFUELING PIT
IANG, SERGEANT BLUFF, IOWA

Sample ID:	IANG-1 MW-2	IANG-1 MW-5	IANG-1 DEFUELING PIT	IOWA ACTION LEVEL (1)
Date Sampled:	15-Aug-90	15-Aug-90	15-Aug-90	
Volatile Organics (ug/l)				
Benzene	3	180	3	1.0
Ethyl Benzene	2 U	4	150	----
Toluene	2 U	2	5	2,420
Xylenes	9	12	360	10,000
Semi-Volatile Organics (ug/l)				
2,4-Dimethylphenol	20 U	20 U	10	----
TPH (mg/l)	1 U	1 U	1	----

Footnotes:

J--the value reported is an estimated concentration.
U--the compound was analyzed for, but not detected.

(1) IOWA CRITERIA FOR ACTION LEVELS:

- A- The HAL (lifetime Health Advisory Level) if one exists; if not
- B- the NRL (Negligible Risk Level, risk of $10E-06$ over lifetime) if one exists, if not
- C- The MCL (Maximum Contaminant Level) if one exists, if not
- D- A concentration level established by the Iowa Department of Natural Resources, based on literature recommended guidelines of EPA and experts on a case-by-case basis.

identifying additional data needed to complete a quantitative risk assessment during the RI; or to provide information for the determination that no further action is required if risks to human and environmental receptors are not identified.

The initial steps of the preliminary evaluation were to:

- Summarize the available chemical sampling data.
- Establish criteria for selecting chemicals that are or may be related to the site, and that may have an adverse affect on human health or the environment in the concentrations present.
- Review the factors that affect migration of contaminants, and identify and evaluate the potential migration pathways.
- Evaluate the potential toxicities associated with exposure to the selected chemicals by human or environmental receptors.
- Identify potential hazards to human or environmental receptors that may be affected by the migration of contaminants along identified pathways.

The SI is the initial investigation of a site and its purpose is to confirm or deny the presence of contamination. Therefore, detailed calculations to quantify risk to human health and the environment from the site were not performed. Instead, a qualitative approach was taken in which all potential receptors and exposure pathways were evaluated, and the potential importance of each exposure pathway was ascertained based on a comparison with standards or criteria and an evaluation of the likelihood of pathway completion. This evaluation was based on existing site information concerning migration pathways, the location and types of contaminants present, and the location of current and possible future receptors. Conservative assumptions were employed to insure that potential exposure pathways were not excluded from consideration.

4.3.4.2 Preliminary Human Health Evaluation

4.3.4.2.1 Selection of Contaminants of Concern

During the selection of indicator chemicals, available information regarding the hazards of substances present at the site was evaluated. Data used in selecting chemicals of concern for this preliminary human health evaluation were compiled from the SI field work performed at the Installation. Compounds which were not detected in any samples were eliminated from further evaluation. Laboratory contaminants such as methylene chloride and acetone were eliminated from further consideration if they were

present in samples at concentrations less than ten times the highest concentration detected in the appropriate QA samples.

Contaminants detected in soil and groundwater samples from the two sites included volatile fuel components, petroleum hydrocarbons and polynuclear aromatic hydrocarbons.

Analytical data were reviewed by medium to characterize contamination at each of the two sites at the Installation. Not all compounds were detected at both sites or in all media. The maximum concentrations for each chemical provide an indication of the magnitude of chemical contamination in the analyzed samples. The maximum values are used in subsequent sections to estimate the potential for adverse health affects.

Toxicity information on the chemicals of concern for both human and environmental receptors is included in the following paragraphs. Also, included, when available, is information on environmental fate of each compound. The following polynuclear aromatic hydrocarbon (PNA) compounds are discussed as a group rather than as individual compounds: Benzo(a)anthracene, Benzo(b)fluoranthene, Chrysene, Dibenzofuran, Fluoranthene, Naphthalene, 2-methylnaphthalene, 2,4-Dimethylphenol and Pyrene.

Benzene: Benzene is a colorless aromatic hydrocarbon with a characteristic odor. Benzene was widely used in the past as a solvent and as an octane-raising additive in gasoline. Presently, benzene is used primarily in the chemical industry as a starting or intermediate material for the synthesis of many other organic compounds.

Benzene has been shown to be mobile in the soil/groundwater system. It is relatively soluble in groundwater and may be transported through sandy soils and soils of low organic content. The amount of benzene sorbed to the soil increases with increasing organic content. Benzene is highly volatile, and volatilization in surficial soils is probably an important transport mechanism. However, sorption of benzene vapors onto soil particles may slow vapor-phase transport. Data on the biodegradation of benzene are inconclusive. There is some evidence of gradual biodegradation at low concentrations by aquatic organisms, but the compound is considered fairly resistant to biodegradation. The rate of biodegradation may be enhanced in the presence of other hydrocarbons.

Benzene is readily absorbed following oral and inhalation exposure. The toxic effects of benzene in humans following exposure by inhalation is the same as that for laboratory animals, and includes central nervous system effects, hematological effects, and immune system depression. In humans, acute exposures to high concentrations of benzene vapors has been associated with dizziness, nausea, vomiting, headache, drowsiness, narcosis, coma, and death. Chronic exposure to benzene vapors can produce reduced leukocyte, platelet, and red blood cell levels.

Chronic exposure to benzene is associated with leukemia and bone marrow damage. In addition, the compound is a central nervous system depressant at high concentrations, and may cause acute narcotic reactions. Benzene has been classified a Group A human carcinogen by U.S. EPA.

Data are not considered sufficient to develop ambient water quality criteria for benzene. No information is available on the toxicity of benzene to terrestrial wildlife, domestic animals, or birds. Toxic effects in laboratory animals include central nervous system effects, hematological effects, and immune system depression.

Toluene: Toluene is a monocyclic aromatic, colorless liquid. It is used in manufacturing benzoic acid, benzaldehyde, explosives, dyes, and many other organic compounds. Toluene functions as a solvent in products such as wood furniture cleaners.

From the available data, it appears that volatilization is the major route of removal from aquatic environments. Once volatilized, atmospheric photodestruction of toluene probably subordinates all other fates. Toluene will be adsorbed by sediments and suspended solids, but the degree to which this adsorption will interfere with volatilization is unknown. Toluene does not bioaccumulate in the environment.

Toluene in low-levels may irritate both the skin and eye and may cause impairment of coordination and reaction time when inhaled at low-levels. Higher levels of exposure may result in additional symptoms such as headaches, nausea, and loss of appetite. Acute poisoning is rare, but chronic poisoning occasionally results in anemia and leucopenia.

Ethylbenzene: Ethylbenzene is a colorless aromatic liquid. It is used in industry as a resin solvent and in the conversion to styrene monomer. No empirical studies on

the bioaccumulation of ethylbenzene were found. No information on the toxicity of ethylbenzene to terrestrial wildlife or birds was available.

Ethylbenzene is moderately adsorbed to soils but it will leach to groundwater, particularly in soils containing low levels of organic matter. Ethylbenzene will volatilize from surface soils and it is thought that it will biodegrade once microbial populations become acclimated (Howard, 1980).

Polynuclear Aromatic Hydrocarbons: PNAs, also termed polycyclic aromatic hydrocarbons (PAHs) are a class of chemical compounds characterized by a basic structure of two or more fused aromatic (benzene) rings. The compounds are fused by pairs of carbon atoms, resulting in a molecule with a carbon atom lying in a single plane with hydrogen atoms. The lowest molecular weight member of this group is naphthalene, with two fused rings. The highest molecular weight member is graphite. PNA compounds can be divided into two groups based on their chemical, physical and biological properties. These two groups are the lower molecular weight (two- to three-ring) compounds and the higher molecular weight (four- to seven-ring) compounds.

The physical properties of PNAs typically vary with increasing molecular weight. Vapor pressure and solubility decrease almost logarithmically with increasing molecular weight. Resistance to reduction and oxidation typically decreases with increasing molecular weight. These trends help to explain why the lower-ring-numbered and higher-ring numbered compounds differ substantially in their behavior and distribution in the environment.

PNAs have been noted to be ubiquitous in the environment. In the past, PNA compounds were typically thought to result only from high-temperature pyrolysis of organic materials. Although this is the principal means of PNA generation, it has more recently been shown that low-temperature transformation of sedimentary organic material to form fossil fuels, as well as direct biosynthesis by microbes and plants, are additional sources of PNAs. Anthropogenic sources also increase the loading of PNAs into the environment. This includes industrial activities such as coke and coal gas production, gas production from petroleum, oil refining, and preparation of acetylene from natural gas. Other sources include incineration of domestic and industrial wastes, power generation from fossil fuels, and automobile exhaust.

PNA compounds vary substantially in their acute toxicity to aquatic animals. In general, toxicity to species will increase with increasing molecular weight. However, the higher-ring-numbered PNAs have low acute toxicity, apparently due to their low solubilities. In most cases, crustaceans are the most sensitive species, polychaete worms are intermediate in sensitivity, and fish are the most resistant. Acute toxicity levels in water are several orders of magnitude higher than levels found in even the most polluted marine and freshwaters. Sediment levels typically approach concentrations similar to the acutely toxic level, however, being bound to the sediment renders PNAs considerably less toxic.

Biodegradation is thought to be the primary fate of PNAs in the environment. Some PNA compounds have been noted to be highly toxic, carcinogenic, mutagenic, and/or teratogenic to many species. PNAs have demonstrated toxicity via the oral and dermal routes, indicating that they are capable of passage across epithelial membranes. Additionally, research indicates that they are easily absorbed through the lungs. They tend to concentrate initially in the liver and kidneys until they are excreted. They eventually move to organs containing or surrounded by fat (e.g., mammary glands, adrenals).

Xylenes: Xylenes are mixtures of the ortho-, meta-, and para-dimethyl benzenes, with the meta-form usually the principal component. Xylenes may also contain 6 to 10 percent impurities such as benzene, ethyl benzene, trimethylbenzene, toluene, phenol, thiophene, pyridene, and nonaromatic hydrocarbons. Xylenes are widely used as fuel components and as solvents for inks, rubbers, gums, resins, adhesives, lacquers, paints, and insecticides. Xylenes are commonly used in the chemical industry as intermediates. Specifically, ortho-xylene is used in the manufacture of phthalic anhydride, which is a basic building block for plasticizers. Meta-xylene is an intermediate in the preparation of isophthalic acid, which is the base of unsaturated polyester resins. Commercially, para-xylene is the most important isomer, most of which is converted to terephthalic acid or dimethylterephthalate and used to make fibers, films, and resins.

The primary exposure pathway of concern from soil/water systems is the migration of xylenes into groundwater used for drinking water supplies. Inhalation resulting from volatilization from surface soils may also be important. Xylenes are relatively mobile in soil/water systems, especially in the aqueous phase. Volatilization is

also possible. The chemical is resistant to hydrolysis but is probably biodegradable. Xylenes could persist for months to years.

Petroleum Hydrocarbons

Petroleum hydrocarbons are a group of compounds that are thick, dark yellow to brown, or green-black liquids which consist of a mixture of hydrocarbons from C_2H_2 and up. They are used as a source of gasoline, petro ether, petrolatum, fuel and lubricating oils, butane, and isopropyl alcohol. Gasoline, jet fuel, and mineral spirits are the petroleum hydrocarbons of primary concern in this risk evaluation.

Hydrocarbon-containing petroleum residues are decomposed in soil systems. Hydrocarbons degrade to carbon dioxide and water via several intermediates (organic acids, ketones, aldehydes, alcohols, and other hydrocarbon derivatives). Nonvolatile components of oils tend to stay tightly bound in soil, while volatile fractions may escape into the atmosphere. No significant loss or movement of oil through surface runoff from rainfall or downward leaching occurs.

Gasoline is an aspiration hazard, defats the skin, and has been shown to cause kidney tumors in laboratory animals. It contains benzene and toluene which may be absorbed through the skin. Benzene is a cancer hazard that affects the blood. Primary routes of exposure are inhalation and skin contact. Eye contact with liquid gasoline may cause burning, tearing, redness, and transient corneal damage. Prolonged or repeated dermal contact may cause burning, redness, drying and cracking of the skin, and dermatitis. Exposure to mist or excessive vapor concentration may cause irritation of the nose, throat, and upper respiratory tract. Severe exposures may result in unconsciousness, coma, and death. Ingestion of gasoline may cause signs of central nervous system depression, headache, nausea, drowsiness, and dizziness.

Fuel oil is a combustible liquid and a skin irritant. Breathing oil mists may irritate the nose and throat. Chronic exposure to oil mists may lead to the development of lipoid pneumonia. Similarly refined and processed petroleum residual materials have been shown to cause skin cancer and liver damage in laboratory animals through prolonged skin contact. There is no direct evidence that fuel oil causes skin cancer or liver damage in humans.

4.3.4.2.2 Environmental Fate and Transport

An evaluation of the environmental fate and transport of the selected chemicals of concern for Iowa ANGB can help determine the potential for migration in the environment and the potential for exposure to the contaminants. The environmental fate and transport of contaminants is dependent upon the physical and chemical properties of the compounds, the environmental transformation processes affecting them, and the media through which they migrate. In this section, the chemical and physical properties of the chemicals of concern are presented, and the relevance of these properties to environmental fate and transport is discussed. In addition, mechanisms of chemical migration into air, groundwater, and surface water and processes of biotransformation and bioaccumulation are discussed in relation to the environmental fate and transport of the chemicals of concern.

Environmental Setting

The environmental setting is discussed in detail in Section 2.

Chemical and Physical Properties of the Chemicals of Concern

Physical and chemical properties of the chemicals of concern will affect fate and transport of those chemicals in the environment. Table 4.7 summarizes several important physical and chemical properties for many of the selected chemicals of concern.

The water solubility of a substance is a critical property affecting environmental fate. Highly-soluble chemicals can be rapidly leached from wastes and soils and are generally mobile in groundwater. Solubilities can range from less than 1 mg/L to totally miscible, with most common organic chemicals falling between 1 mg/L and 1,000,000 mg/L [Lyman et al., 1982]. The solubility of chemicals which are not readily soluble in water may become enhanced in the presence of organic solvents (e.g., toluene), which themselves are more soluble in water. As shown in Table 4.7, benzene has the highest solubility of any of the contaminants found on the Base. Because of its relatively high solubility (greater than 1000 mg/L) these compounds are expected to be mobile in the soil.

Volatilization of a compound will depend on its vapor pressure, water solubility, and air diffusion coefficient. Highly water-soluble compounds generally have lower

TABLE 4.7

RELEVANT PHYSICAL AND CHEMICAL PROPERTIES OF INDICATOR CHEMICALS^(a)

Indicator	CAS Number	Water Solubility ^(h) (mg/l)	Vapor Pressure ^(h) (mm Hg)	Henry's Law Constant (atm-m ³ /mol)	K _{oc} (ml/g)
Benzene	71-43-2	1.75E+03	9.52E+01	5.59E-03	83
Benzo[a]anthracene	56-55-3	5.70E+03	2.20E-08	1.16E-06	1,380,000
Benzo[b]fluoranthene	205-99-2	1.40E+02	5.00E-07	1.19E-05	550,000
Chrysene	218-01-9	1.80E-03	6.30E-09	1.05E-06	200,000
Dibenzofuran	132-64-9 ^(e)	10 ppm ⁽ⁱ⁾	4.4E-03	--	--
Ethylbenzene	100-41-4	1.52E+02	7.00E-00	6.43E-03	1,100
Fluoranthene	206-44-0	2.06E-01	5.00E-06	6.46E-06	38,000
2-Methylnaphthalene	91-57-6 ⁽ⁱ⁾	NS ^m	6.81-02 ⁽ⁱ⁾	--	--
Naphthalene	91-20-3	3.3E+01 ^c	2.3E-1 ^c	1.15E-3 ^c	--
Pyrene	129-00-0	1.32E-01	2.50E-06	5.04E-06	38,000
Toluene	108-88-3	5.35E-02	2.81E-01	6.37E-03	300
Xylene	1330-20-7	1.98E+02	1.00E+01	7.04E-03	240

(a) Source: U.S. EPA, 1986, unless otherwise stated

(b) A = Human Carcinogen; B1, B2 = Probable Carcinogen;

C = Possible Carcinogen; d = Not classified

(c) Source: Lyman, 1985

(d) ATSDR Draft Toxicological Profile

(e) Source: NIOSH, 1985

(f) Source: SAX, 1987

(g) Source: IRIS, 1991

(h) Measured in temperature range 20-30 °C unless otherwise noted.

(i) HSDB = National Library of Medicine

CAS = Chemical Abstract System

mg/L
mmHg
atm-m³/mol
ml/g
K_{oc}
NR
l/kg

Milligrams per liter
Millimeters of mercury
Atmosphere-cubic meter per mole
Milliliters per gram
Organic carbon partition coefficient
Not relevant
Liters per kilogram

volatilization rates from water unless they also have high vapor pressures. Vapor pressure, a relative measure of the volatility of chemicals in their pure state, ranges from roughly 0.001 to 760 millimeters of mercury (mm Hg) for liquids. The Henry's Law Constant, which combines vapor pressure with solubility, is more appropriate than vapor pressure alone for estimating releases from water to air for compounds having Henry's Law Constants. Compounds with Henry's Law Constants greater than 10^{-3} atmospheres-cubic meter per mole ($\text{atm}\cdot\text{m}^3/\text{mole}$) can be expected to readily volatilize from water; those with values ranging from 10^{-3} to 10^{-5} are associated with moderate volatilization, while compounds with values less than 10^{-5} will only volatilize from water to a limited extent [Lyman et al., 1982].

The organic carbon partition coefficient (Koc) reflects the propensity of a compound to sorb to organic matter found in soil. The normal range of Koc values is 1 to 107 milliliters per gram (mL/g). Chemicals which have a strong tendency to sorb to organic matter (i.e., chemicals with high Koc values) will move more slowly in the environment than chemicals with low Koc values. The polynuclear aromatic hydrocarbons and dichlorobenzenes have the highest Koc values of any compounds identified at the Base. These compounds would therefore be expected to be strongly adsorbed by organic matter present in the soil and have relatively low mobilities.

Chemicals of concern were classified into several categories according to their similarity in chemical structure and/or physiochemical properties (factors which would influence mobility in the environment) as follows:

- volatile organics: benzene, ethyl benzene, toluene, xylenes.
- semivolatile organics: benzo(a)anthracene, benzo(b)fluoranthene, chrysene, dibenzofuran, fluoranthene, pyrene, 2-methylnaphthalene, naphthalene, 2,4-dimethylphenol.
- other: TPH.

Each of these categories are discussed below with respect to how their properties affect the persistence and transport of these compounds in the environment.

Volatile Organics

Volatile organic compounds are low molecular weight compounds whose presence in soil and water samples collected at the Installation is due to their widespread use as fuel. These compounds generally have high Henry's Law Constants,

moderate to high solubilities and low Koc values. This indicates that these compounds can be expected to be mobile in the environment.

The soils at the Installation consist primarily of silts and silty clays. Groundwater at the Installation is between 22 and 25 feet deep and the migration of these compounds to the groundwater is possible. As described in Section 4, several of these compounds have been detected in the groundwater at the site.

The properties that enhance the mobilities of these compounds also make them more available for degradation. Because of their high vapor pressures these compounds would be expected to volatilize from surface soils.

Semi-Volatile Organics

Semi-volatile organic compounds detected in soil collected at Site 1 consisted of polynuclear aromatics (PNAs). One phenolic compound was detected in the groundwater. The semi-volatile organics have higher molecular weights than the volatile compounds. They also have lower vapor pressures, lower solubilities, and higher Koc values. These compounds are expected to be strongly adsorbed by site soils and therefore less mobile in the environment. While the semi-volatile compounds are not soluble in water, they are soluble in non-water solvents such as fuels. The application of fuels to the ground could enhance the mobility of these compounds.

Petroleum Hydrocarbons

Petroleum hydrocarbon concentrations are measured using fluorocarbon-113 extraction of organic compounds with medium to high molecular weights. Low molecular weight compounds and light fuels, such as gasoline, volatilize during the analysis and, therefore, have low recoveries. The aliphatic organics which constitute most of the recoverable petroleum hydrocarbons are generally less toxic than the volatile organic compounds. The primary health concern associated with chronic exposure is through ingestion of contaminated food and water.

The fate of petroleum hydrocarbons in soils is affected primarily by their distribution, volatility, and leaching potential. Low molecular weight aromatic hydrocarbons such as benzene, toluene, and xylenes partially evaporate. The remaining hydrocarbons will migrate to different depths in the soil column and possibly to groundwater.

The aliphatic organics which represent the residual compounds have negligible water solubilities, low vapor pressures and high adsorption coefficients. The proportion of petroleum hydrocarbons that will adsorb to soil particles rather than continue migration depends on the type of soil, the particular petroleum product involved, the volume of the release, and the amount of rainfall. In general, leaching to groundwater is favored by high rainfall and permeable soils, and increases for petroleum compounds with high solubility and low adsorption coefficients.

Most compounds measured as petroleum hydrocarbons are relatively persistent in the environment. Biodegradation is the main elimination mechanism, but rates are fairly slow, especially for cyclic or aromatic hydrocarbons. Complete biodegradation of petroleum hydrocarbons may require many years or decades [API, 1986].

4.3.4.2.3 Exposure Assessment

The presence of a contaminant in a particular environmental medium does not necessarily indicate that human exposure will occur. In order for human exposure to occur, a complete exposure pathway must exist. A complete exposure pathway consists of the following:

- a contaminant source and mechanism for release;
- an environmental transport medium;
- an exposure point; and
- a human receptor and a feasible route of exposure at the exposure point.

If any of the items listed above are missing then an exposure pathway is incomplete. The following paragraphs describe the transport mechanism and exposure pathways for the two sites at the Installation.

Mechanisms of Migration

The media into which a contaminant migrates affects the types of human and environmental exposures which may occur. The previous subsections have described the physical and chemical properties of concern. This subsection discusses the mechanisms of contaminant migration and potential exposure routes for the Installation.

Contaminants have been detected in groundwater and soil at Site 1. Several mechanisms exist through which contaminants from these areas may migrate.

Migration into Air. Contaminants may migrate into the air through three primary mechanisms: volatilization; soil gas migration; and suspension of soil particles (wind erosion or mechanical disturbances).

Volatilization is the mass transfer of a compound from a specific medium (soil or water) to the air. Environmental factors that affect volatilization include temperature, soil porosity, soil water content, soil organic carbon content, and depth of contamination. Volatilization may be an important migration pathway for contaminants having high vapor pressures (greater than 100 mm Hg) or high Henry's Law Constants (greater than 10^{-3} atm-m³/mole). Contaminants detected at Site 1 which are in this category include the aromatics (benzene, xylenes, toluene, etc.). Some other chemicals of concern while having lower vapor pressures may still have a tendency to volatilize. The polynuclear aromatic hydrocarbons (PAHs) fall in this category. Volatilization is not a potential migration pathway for Site 1 since volatile organic compounds and PAHs are present in subsurface soils.

The migration of chemicals into soil gas is controlled by factors similar to those that control volatilization. Soil gas samples collected at Site 1 identified the presence of contaminants indicating that this soil gas migration is a potential migration pathway for these sites.

Fugitive dust emissions from wind or vehicle disturbances is not possible because affected soils are below the surface.

Leaching into Groundwater. The percolation of rainwater through the soils at the four sites could leach soil contaminants into the groundwater. Since groundwater contamination has been detected at Site 1, it appears that this has already occurred.

Once contaminants have reached the groundwater the different contaminants will have different migration rates. Compounds with low water solubilities and high organic carbon partition coefficients, such as the semi-volatile compounds will be transported in the direction of groundwater flow but at a slower rate than the groundwater. The volatile organic compounds which have much higher solubilities and lower Koc values will have higher mobilities in the groundwater.

Migration in Ponded Water. Contaminant migration into ponded water is unlikely since affected soils are below the surface.

Identification of Exposure Pathways.

Potential exposure pathways for Site 1 are summarized in Table 4.8.

The property around Site 1 has restricted access to Installation personnel only by means of locked fences. Adjacent property is used primarily for agriculture, in particular corn crops. There are several farms within a mile radius of each site. The water supply source of these dwellings is undocumented, although it is most likely that they have private wells. The closest dwelling is approximately ¼-mile to the south of Site 1. Groundwater flow direction is believed to flow generally to the southwest.

Future land use will remain the same according to the Master Plan for Sioux Gateway Airport. No residential development is planned.

The present property agreement is between the City of Sioux City, Iowa and the Department of the Air Force (License for National Guard Purposes, Form 1 May 63). The agreement commenced 1 July 1969 and expires 20 June 2019. The agreement automatically renews annually until the expiration date, unless the Government exercises its right to give notice to termination. The agreement provides for the exclusive use of buildings and parcels of land located on the Sioux Gateway Airport, together with all roads, sidewalks, railroads, utilities, drainage ditches, sewer lines, aprons, buildings and structures and tools, equipment and fixtures, on 11 parcels which are lettered and listed within the agreement.

Current pathways include exposure to air, groundwater, surface water and soils by Installation personnel, visitors, trespassers and nearby residents. The possibility of air and soil pathways is very low since affected soils are below the surface.

Groundwater is not used by the Installation, but is not known exactly for what purpose the local farmers use their wells. However, there is low possibility of exposure due to limited contamination.

Future pathways are limited since land use is expected to remain the same. Contaminant migration to downgradient wells may occur but may be offset by other mechanisms such as degradation. Construction workers may be exposed to affected soil. However, construction in the area of Site 1 is unplanned and unlikely.

TABLE 4.8

MATRIX OF POTENTIAL EXPOSURE PATHWAYS
SITE 1 - IOWA AIR NATIONAL GUARD

Transport Medium	Release Source or Mechanism	Primary Exposure Point	Potential Receptors	Primary Exposure Route	Probability of Pathway Completion
<u>Current Use</u> Air	Affected soils/ fugitive dust generation, volatilization	Areas downwind of Site 1.	Base personnel, trespassers, local farmers	Inhalation, dermal	None: affected soils are below the subsurface.
	Affected soils, groundwater	Wells used for drinking water or irrigation	Local farmers	Ingestion, Inhalation, Dermal	Low: affected groundwater is limited to the immediate vicinity of Site 1.
			Base personnel	Ingestion, Inhalation, dermal	None: Water is supplied to the Base from the City of Sioux City which is supplied by distant wells.
Soils	Affected soils, groundwater/site leaching, runoff, tracking	Surface soils	Base personnel, local farmers, trespassers	Ingestion, dermal	None: Surface soils are not affected, site access is limited and Site 1 is in- frequently visited.

TABLE 4.8 (continued)

MATRIX OF POTENTIAL EXPOSURE PATHWAYS
SITE 1 - IOWA AIR NATIONAL GUARD

Transport Medium	Release Source or Mechanism	Primary Exposure Point	Potential Receptors	Primary Exposure Route	Probability of Pathway Completion
<u>Future Use</u> Groundwater	Affected soils, groundwater	Downgradient wells used for drinking or irrigation	Local farmers	Ingestion, inhalation, dermal	Low: Affected groundwater may migrate to down-gradient wells, but concentrations may decrease due to degradation, volatilization, etc.
Soils	Affected soils irrigation	Soils at the site	Construction workers	Ingestion, inhalation, dermal	Low: Future construction in contaminated areas is not planned, but is possible.

4.3.4.2.4 Toxicity Assessment

The objective of the toxicity assessment is to weigh available evidence regarding the potential for particular contaminants to cause adverse effects in exposed individuals and to provide, where possible, an estimate of the relationship between the extent of exposure to a contaminant and the increased likelihood and/or severity of adverse effects. The types of toxicity information considered in this assessment include the slope factor to evaluate carcinogenic potential and the reference dose (RfD) used to evaluate noncarcinogenic effects.

Health Criteria for Carcinogenic Effects

For chemicals that exhibit carcinogenic effects, most authorities recognize that one or more molecular events can evoke changes in a single cell or a small number of cells that can lead to tumor formation. This is the nonthreshold theory of carcinogenesis which purports that any level of exposure to a carcinogen can result in some finite possibility of generating the disease. Generally, regulatory agencies assume the non-threshold hypothesis for carcinogens in the absence of information concerning the mechanisms of action for the chemical.

EPA's Carcinogen Assessment Group (CAG) has developed slope factors (i.e., dose-response values) for estimating excess lifetime cancer risks associated with various levels of lifetime exposure to potential human carcinogens. The carcinogenic slope factors can be used to estimate the lifetime excess cancer risk associated with exposure to a potential carcinogen. Risks estimated using slope factors are considered unlikely to underestimate actual risks, but they may overestimate actual risks. Excess lifetime cancer risks are generally expressed in scientific notation and are probabilities. An excess lifetime cancer risk of 1×10^{-6} represents the probability that one individual out of one million will develop cancer as a result of exposure to a carcinogenic chemical over a 70-year lifetime under specified exposure conditions. EPA has suggested developing remedial alternatives for cleanup of Superfund sites using total excess lifetime cancer risks ranging from 10^{-4} to 10^{-6} .

In practice, slope factors are derived from the results of human epidemiology studies or chronic animal bioassays. The data from animal studies are generally fitted to the linearized multistage model and dose-response curve is obtained. The 95th percentile upper confidence limit slope of the dose-response curve is subjected to

various adjustments and an interspecies scaling factor is applied to conservatively derive the slope factor for humans. Thus, the actual risks associated with exposure to a potential carcinogen quantitatively evaluated based on animal data are not likely to exceed the risks estimated using these slope factors, but they may be much lower. Dose-response data derived from human epidemiological studies are fitted to dose-time-response curves on an ad hoc basis. These models provide rough but plausible estimates of the upper limits on lifetime risk. Slope factors based on human epidemiological data are also derived using very conservative assumptions and, as such, they too are considered unlikely to underestimate risks. In summary, while the actual risks associated with exposures to potential carcinogens are unlikely to be higher than the risks calculated using a slope factor, they could be considerably lower.

In addition, there are varying degrees of confidence in the weight of evidence for carcinogenicity of a given chemical. EPA has proposed a system for characterizing the overall weight of evidence for a chemical's carcinogenicity based on the availability of animal, human, and other supportive data [EPA, 1986a]. The weight-of-evidence classification is an attempt to determine the likelihood that an agent is a human carcinogen and thus qualitatively affects the estimation of potential health risks. Three major factors are considered in characterizing the overall weight of evidence for carcinogenicity: (1) the quality of evidence from human studies and (2) the quality of evidence from animal studies, which are combined into a characterization of the overall weight of evidence for human carcinogenicity; and (3) other supportive information which is assessed to determine whether the overall weight of evidence should be modified. EPA's final classification of the overall weight of evidence includes the following five categories:

- Group A - - Human Carcinogen

This category indicates that there is sufficient evidence from epidemiological studies to support a casual association between an agent and cancer.

- Group B - - Probable Human Carcinogen

This category generally indicates that there is at least limited evidence from epidemiological studies of carcinogenicity to humans (Group B1) or that, in the absence of adequate data on humans, there is sufficient evidence of carcinogenicity in animals (Group B2).

- Group C - - Possible Human Carcinogen

This category indicates that there is limited evidence of carcinogenicity in animals in the absence of data on humans.

- Group D - - Not Classified

This category indicates that the evidence for carcinogenicity in animals is inadequate.

- Group E - - No Evidence of Carcinogenicity to Humans

This category indicates that there is no evidence for carcinogenicity in at least two adequate animal tests in different species, or in both epidemiological and animal studies.

Slope factors are developed based on epidemiological or animal bioassay data for a specific route of exposure, either oral or inhalation. For some chemicals, sufficient data are available to develop route-specific slope factors for inhalation and ingestion. For chemicals with only one route-specific slope factor but for which carcinogenic effects may also occur via another route, EPA has used the available value to evaluate risks associated with both potential routes of exposure.

Several of the selected chemicals of concern have been classified as potential carcinogens by EPA. Some of these chemicals are:

- Group A - - Human Carcinogens

Benzene

- Group B - - Probable Human Carcinogens

Benzo(a)Anthracene

Benzo(b)Fluoranthene

Chrysene

- Group C - - Possible Human Carcinogens

2-Methylnaphthalene

Potential carcinogenic effects and slope factors for chemicals of concern identified at the Base are shown in Table 4.9.

Health Criteria for Noncarcinogenic Effects

For chemicals that exhibit noncarcinogenic effects, many authorities consider organisms to have repair and detoxification capabilities that must be exceeded by some critical concentration (threshold) before the health effect is manifested. For example, an organ can have a large number of cells performing the same or similar functions that must be significantly depleted before the effect on the organ is seen. This threshold view holds that a range of exposures from just above zero to some finite value can be tolerated by the organism without an appreciable risk of adverse effects.

TABLE 4.9

TOXICITY CONSTANTS FOR CHEMICALS OF CONCERN
POTENTIAL CARCINOGENIC EFFECTS
SITE 1 - IOWA AIR NATIONAL GUARD

Chemical	Slope Factor 1/(mg/kg/day)		Weight of Evidence Classification		Tumor Site	
	Inhalation	Oral	Inhalation	Oral	Inhalation	Oral
Benzene	2.9E-02	2.9E-02	A	A	Blood Cells	Blood Cells
Benzo[a]anthracene	NA	NA	B2	B2	NA	Total Tumors
Benzo[b]fluoranthene	NA	NA	B2	B2	NA	NA
Chrysene	NA	NA	B2	B2	Lung	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA

NA - Not Available

A - Human Carcinogen

B2 - Probable human carcinogen. Sufficient evidence in animals and inadequate or no evidence in humans.

Health Criteria for chemicals exhibiting noncarcinogenic effects for use in risk assessment are generally developed using EPA RfDs. In general, the RfD is an estimate of route-specific average daily intake (dose) for individuals (including sensitive individuals) below which there will not be an appreciable risk of adverse health effects. The RfD is derived using conservative safety factors (e.g., to adjust from animals to humans and to protect sensitive subpopulations) to ensure that it is unlikely to underestimate the potential for adverse noncarcinogenic effects to occur. The purpose of the RfD is to provide a benchmark against which the sum of other doses (e.g., those projected from human exposure to various environmental conditions) might be compared. Doses that are significantly higher than the RfD may indicate an inadequate margin of safety could exist for exposure to that substance and that an adverse health effect could occur.

EPA has developed oral and inhalation RfDs for many of the chemicals of concern selected for the Installation. In addition, the chemicals of concern may affect different target organs in the body. Some of the chemicals of concern that may have noncarcinogenic effects following long-term exposure, and the target organs that are most sensitive to these chemicals, are as follows:

- Chemicals That May Adversely Affect The Liver

Fluoranthene	Naphthalene
Ethylbenzene	Toluene
Xylenes	
- Chemicals That May Adversely Affect the Kidney

Ethylbenzene	Toluene
Pyrene	Fluoranthene
- Chemicals That May Adversely Affect the Nervous System

Toluene	Xylene	Naphthalene
- Chemicals That May Adversely Affect the Blood

Benzene	Fluoranthene
- Chemicals That May Adversely Affect Other Systems

Naphthalene may cause ocular lesions.
Total xylenes may cause reproductive effects.

Potential noncarcinogenic effects with RfDs of chemicals of concern identified at the Installation are shown on Table 4.10.

TABLE 4.10
TOXICITY CONSTANTS FOR CHEMICALS OF CONCERN
POTENTIAL NONCARCINOGENIC EFFECTS
SITE 1 - IOWA AIR NATIONAL GUARD

Chemical	Chronic RfD (mg/kg/day)		Critical Effect	
	Inhalation	Oral	Inhalation	Oral
Dibenzofuran	NA	NA	NA	NA
Ethylbenzene	NA	1.0E-01	NA	Kidney, liver toxicity
Fluoranthene	NA	4.0E-02	NA	Nephropathy, increased liver weight, hematological altering
Naphthalene	NA	4.0E-03H	NA	Decreased body weight gain
Pyrene	NA	3.0E-02	NA	Renal tubular pathology, decreased kidney weight
Toluene	2.0E+00H	2.0E-01	Eye irritation nose irritation CNS effects	Change in liver and kidney weight
Xylenes	3.0E-1	2.0E+00	Hepatomegaly	Hyperactivity, decreased body weight, increased mortality
TPH	--	--	--	--

RfD - Reference Dose
NA - Not Available

No RfDs or slope factors are available for the dermal route of exposure. In some cases, however, noncarcinogenic or carcinogenic risks associated with dermal exposure can be evaluated using an oral RfD or an oral slope factor. Exposures via the dermal route generally are calculated and expressed as absorbed doses. These absorbed doses are compared to an oral toxicity value that is also expressed as an absorbed dose. This requires quantitative estimates of both oral and dermal exposure and is only appropriate for chemicals causing systemic toxicity.

4.3.4.2.5 Risk Screening

In evaluating the degree of contamination at a site, consideration must be given to applicable or relevant and appropriate requirements (ARARs) of Federal and State environmental laws. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations that specifically address a hazardous substance, contaminant, remedial action, or other circumstance at a site. Relevant and appropriate requirements are those standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations that, while not "applicable", address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site.

Potential ARARs for water quality at the Installation include the Safe Drinking Water Act, the Clean Water Act and State policies. Standards and criteria promulgated under these programs are provided in Table 4.11 for potential contaminants of concern at the Installation.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) mandates EPA to establish regulations to protect human health from contaminants in drinking water. EPA has promulgated drinking water standards which generally apply to community water systems. Primary drinking water standards include maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs). MCLs are set at levels that are protective of human health, while taking into account available treatment technologies and the costs to large public water systems. MCLGs are strictly health-based and do not take cost or feasibility into account. Secondary drinking water regulations consist primarily of secondary maximum contaminant levels (SMCLs) for specific contaminants or water

TABLE 4.11

APPLICABLE OR RELEVANT APPROPRIATE REQUIREMENTS
STANDARDS AND CRITERIA FOR COMPOUNDS DETECTED AT SITES 1 AND 2
SITE 1 - IOWA AIR NATIONAL GUARD

Criteria ⁽²⁾	Current MCL (µg/l)	Proposed MCL	Safe Drinking Water Act ⁽¹⁾ Current MCLG	Proposed MCLG	Water Quality Criteria ⁽²⁾ Drinking Water Only (µg/L) ⁽⁴⁾	Iowa Action Level ⁽⁵⁾ Groundwater (µg/L)
Benzene	5	--	0	--	0(0.67)	1.0
Benzo[a]anthracene	0.1	--	--	--	0(0.0031)	--
Benzo[b]fluoranthene	0.2	--	--	--	0(0.0031)	--
Chrysene	0.2	--	--	--	0(0.0031)	--
Dibenzofuran	--	--	--	--	--	--
Ethylbenzene	700	--	--	700	2,400	700
Fluoranthene	--	--	--	--	188	--
Naphthalene	--	--	--	--	--	20
Pyrene	--	--	--	--	0(0.0031)	--
Toluene	1,000	--	--	--	15,000	1,000
Xylenes	10,000	--	--	--	--	10,000
2-Methylnaphthalene	--	--	--	--	--	--
Gross Alpha	15 pCi/L	--	--	--	--	15 pCi/L
Gross Beta	--	--	--	--	--	--
Radium 226,228	5 pCi/L	--	--	--	--	5 pCi/L

(1) Source: 40 CFR 141, updated with respect to 1990 EPA ARARs, where applicable.

(2) Source: Federal Register, Vol. 50, No. 145, July 29, 1985; Vol. 45, No. 231, November 28, 1980.

(3) Proposed MCLs, MCLGs, Federal Register, Vol. 54, No. 47, May 22, 1989, updated with respect to 1990 EPA ARARs, where applicable.

(4) For compounds identified as potential carcinogen by U.S. EPA, the criteria is 0. The value in parentheses is concentration which is associated with a 10⁻⁶ cancer risk.

(5) Iowa Criteria for action levels:

A-The HAL (lifetime Health Advisory Level) if one exists; if not

B-The NRL (Negligible Risk Level, risk of 10E-06 over lifetime) if one exists; if not

C-The MCL (Maximum Contaminant Level) if one exists; if not

D-A concentration level established by the Iowa Department of Natural Resources, based on literature recommended guidelines of EPA and experts on a case-by-case basis.

characteristics that may affect the aesthetic qualities of drinking water (i.e., color, odor, and taste).

MCLs and MCLGs for contaminants of concern at the Installation are provided in Table 4.11. Proposed MCLs and proposed MCLGs are also identified. The concentrations provided are potential ARARs.

Clean Water Act

The Clean Water Act (CWA) requires the establishment of guidelines and standards to control the direct or indirect discharge of pollutants to waters of the United States. The standards required by the CWA include water quality criteria for specific pollutants. EPA has developed two kinds of water quality criteria: one for the protection of human health and another for the protection of aquatic life. These criteria are non-enforceable guidelines used by the States to set water quality standards for surface water. These non-enforceable standards are potential ARARs when the state has not promulgated water quality standards for the specific pollutants and water bodies of concern.

Iowa Action Levels

The Iowa Department of Natural Resources has established water quality standards based on U.S. EPA health advisory levels, negligible risk levels for carcinogens, and maximum contaminant levels. These values are presented in Table 4.11.

Comparing ARARs to Maximum Levels at Site 1

In this section, concentrations of chemicals of concern are compared with appropriate criteria to provide a rough estimation as to whether the contaminant pose a risk. The method is intended as a preliminary screening tool rather than a detailed evaluation of risks posed by contaminants at the site.

In this section concentrations of chemicals of concern are compared with appropriate criteria to provide a rough estimation as to whether the contaminants pose a risk. The method is intended as a preliminary screening tool rather than a detailed evaluation of risks posed by contaminants at the site. For clarity, each of the two sites is evaluated separately. Where ARARs are not developed, other information may be needed to determine what is protective of human health and the environment. Other

criteria to be used for comparison purposes include health-based levels derived from toxicity data.

Current information on the health and environmental effects of various toxicants, including slope factors and RfDs were obtained from the Integrated Risk Information System (IRIS) [EPA, 1991] and the HEAST (Health Effects Assessment Summary Tables) from FY-1990. IRIS is a computerized library of current information that is updated on a continuous basis. It contains health risk assessment information on chemicals that have undergone a detailed review of toxicity data by work groups composed of EPA scientists from several agency program offices, and represents an EPA consensus. Information includes slope factors and RfDs for systemic toxicants. These values are used to calculate human health-based criteria according to EPA guidelines.

As previously described, human health-based criteria for carcinogens represent an upper bound estimate of the average daily dose of a carcinogenic substance that corresponds to a specified excess cancer risk for lifetime exposure. The criteria were calculated from slope factors (Table 4.12) in the following manner:

$$C_i = (R/q1^*) \times (W/I)$$

where:

- C_i = the criterion concentration for the constituent of interest;
- R = the specified risk level (e.g., 10^{-6});
- $q1^*$ = the carcinogenic slope factor in (mg/kg/day) $^{-1}$ developed by EPA;
- W = the assumed weight of the exposed individual; and
- I = the intake amount for a given time period.

Human health-based criteria for (i.e., noncarcinogenic) toxicants are an estimate of the daily exposure an individual (including sensitive individuals) can experience without appreciable risk of health effects during a lifetime, and are based on EPA-derived RfDs (Table 4.12).

TABLE 4.12

COMPARISON OF THE MAXIMUM CONCENTRATIONS OF CHEMICALS DETECTED IN SOIL SAMPLES
WITH HEALTH CRITERIA FOR SOIL INGESTION
SITE 1 - IOWA AIR NATIONAL GUARD

Chemical of Concern	Maximum Release Concentration (mg/kg)	Type	Criterion Value (mg/kg)	Criteria Exceeded 7
Benzene	5.6	SF	12	No
Ethylbenzene	44J	RfD	35,000	No
Toluene	61J	RfD	70,000	No
Xylenes	100J	RfD	700,000	No
Naphthalene	2.7	RfD	1,400	No
2-Methylnaphthalene	2.9	NA	--	--
Dibenzofuran	0.14 J	NA	--	--
Fluoranthene	0.44 J	RfD	14,000	No
Pyrene	0.58	RfD	10,500	No
Benzo[a]anthracene	0.29 J	NA	--	--
Chrysene	0.34 J	NA	--	--
Benzo[b]fluoranthene	0.71	NA	--	--

NA Not Available

SF Slope Factor (carcinogens)

RfD Reference dose (noncarcinogens)

For soil ingestion, the assumed intake rate is 0.2 g/day for a 70 Kg construction worker. Human health-based criteria were calculated for the selected exposure routes, as shown in the following equation:

$$C_i = (RfD) \times (W/I)$$

where

- C_i = Criterion concentration for constituent of interest;
- RfD = Reference Dose developed by EPA;
- W = the assumed weight of the exposed individual; and
- I = the intake amount for a given time period.

Where toxicants caused both carcinogenic and noncarcinogenic effects, the value based on carcinogenic effects was used for human health assessment.

The potential for current exposure at Site 1 is very low. Because affected soils are below the surface and groundwater contamination has not migrated offsite, there are currently no completed pathways. If, however, contamination migrates to downgradient wells, pathway completion is possible. Table 4.13 compares the maximum concentrations found in groundwater at Site 1 with the appropriate criteria. The concentration of benzene exceeded the Iowa Action Level by almost 200 times.

The only other possible completed pathways would be if future construction workers excavate at Site 1. Table 4.12 compares the chemicals of concern in the soil with applicable criterion. None of the criterion were exceeded.

The probability of pathway completion is low at Site 1 for both current and future pathways.

There is a gap in the data regarding the number, distance and use of downgradient wells. This would affect potential pathways and exposure levels.

Uncertainties in Risk Screening

In quantifying risks for a given receptor who is exposed to multiple chemicals by a number of different pathways, EPA generally assumes that the total risk incurred by the receptor is essentially a sum of the individual risks incurred by each chemical and pathway of exposure. This is reflected in the EPA methodology used to quantify both carcinogenic and noncarcinogenic risks. Thus, the potential for adverse effects in a

TABLE 4.13

COMPARISON OF MAXIMUM CHEMICAL CONCENTRATIONS WITH HEALTH CRITERIA FOR GROUNDWATER INGESTION
SITE 1 - IOWA AIR NATIONAL GUARD

Chemical of Concern	Maximum Release Concentration ($\mu\text{g/L}$)	Type	Criterion Value ($\mu\text{g/L}$)	Criteria Exceeded ?
Benzene	180	Iowa	1	Yes
Ethylbenzene	150	Proposed MCL	700	No
Toluene	5	Proposed MCL	2,000	No
Xylenes	360	Iowa	10,000	No
2,4-dimethylphenol	10J	--	--	--

given receptor will increase with the number of chemicals detected at the site and the number of pathways by which the receptor could be exposed.

The preliminary risk assessment methodology employed here uses Health Criteria which were developed as though each chemical in question were present at the site by itself and as though exposure would occur through only one pathway (oral exposure to the medium of concern). Thus the risk screening process employed in this assessment considers only oral exposure pathways and does not apportion risks among the total number of chemicals detected at the site. Although in most cases, oral exposure will account for most contaminants, dermal and inhalation exposures are sometimes also of concern. If risks were apportioned among the total number of chemicals present and all possible pathways of exposure, Health Criteria values would be lower and site-specific.

Since the purpose of this evaluation procedure is to determine which sites may have potential problems, the procedure is adequate when the risk screening yields positive (yes) results as in the case of Site 1.

4.3.4.3 Preliminary Ecological Evaluation

The purpose of this Preliminary Ecological Evaluation is to determine the potential effects of site contaminants on plant and animal species, and to determine if any data gaps exist which may need to be addressed in future investigations.

The Preliminary Human Health Evaluation is used as a basis for this Ecological Evaluation, including the sections discussing data evaluation, environmental fate and transport, and chemicals of concern.

4.3.4.3.1 Selection of Chemicals of Concern

Selection of chemicals of concern were described in Subsection 4.3.4.2.1.

4.3.4.3.2 Environmental Receptors

Vegetation

The Installation is located within the Missouri Alluvial Plain Physiographic Province. Vegetation in the area is characterized by treeless prairies, woodlands, and

row crops. Each of these types of vegetation are represented within the areal extent of this study.

Woodlands vegetation in this area include silver maple, aspen, cottonwood and elm. Treeless areas are generally vegetated with prairie grass. Row crops are grown in the area surrounding the Installation. Corn, oats, flax, soybeans and hay are crops commonly grown in this area of Iowa. Soil moisture levels in this region are sufficient to grow crops of this type without irrigation.

Terrestrial and Aquatic Wildlife

In general, both the terrestrial and aquatic wildlife of grassland areas are limited in species diversity. This is due to the often homogeneous nature of food sources at the lower end of the food chain. For example, prairie grasses are often the dominant terrestrial plants and as such will limit the variety of species adapted for survival under those conditions.

Animals with specialized adaptations to grassland habitats will often occur in large numbers, occupy limited ecological niches and remain somewhat homogeneous taxonomically. For example, ground nesting birds such as the western meadowlark and red-winged blackbirds may be found to reside in the grasslands where arboreal growth is generally restricted due to overly moist soil conditions. Some grassland birds nest in the surface of the ground while others nest in weeds or shrubs. Such birds as the red-tailed hawk may occur in limited numbers which feed on small mammals such as mice and rabbits. Other common birds might include scavengers, such as crows and blackbirds.

Among small mammals, rodents are typical inhabitants of grassland areas. Such rodents in this area might include woodchuck, deer mice, squirrels and the cottontail rabbit. Other small mammals might include herbivores such as the prairie vole and red squirrel as well as second level carnivores such as the red fox and racoon, among others.

Terrestrial reptiles expected to reside in these grasslands might include the king snake, black snake and garter snake. Semi-aquatic reptiles residing in small ponds or streams with muddy bottoms might also include the common snapping turtle.

Amphibians common to this area of grassy swales, intermittent tree cover and heavily vegetated ponds might include the Great Plains toad, tree frogs and tiger salamander, among others.

Insects expected to occur in great numbers here might include various grasshoppers (Orthopteran Order). Aquatic insects and/or insect larvae found in ephemeral streams or temporary ponds of this area might include mosquitoes, true flies such as chironomid midges, caddisflies, water strider, cicadas, mayflies, beetles, crane flies, and honeybees.

Fish species expected to occur in the area's ephemeral streams might include catfish and carp.

4.3.4.3 Ecological Exposure Pathways

As stated previously, the Installation is located within the Missouri Alluvial Plain of Iowa. Vegetation on the site is characterized by maple, ash, cottonwood and aspen and woodland, prairie grasslands. The area is currently influenced predominantly by agricultural and rural uses. Wildlife includes a variety of species including ground nesting birds, hawks, small mammals, snakes, turtles, frogs and insects. It is not known whether endangered species occur on the Installation.

Receptor organisms were identified by biological resource group based on those organisms likely to be present at the base. Receptor organisms were categorized as follows: wildlife, aquatic life, and vegetation. Ecological receptors may be exposed to chemical contaminants through direct or indirect pathways. Direct pathways would include direct contact with or ingestion of contaminated media such as soil, sediment, or water. Indirect pathways include those in which an animal consumes other previously-contaminated organisms. If exposure pathways between contaminated media and receptor organisms are not complete, contaminants do not constitute an environmental risk.

Exposure media and routes may differ between various organisms due to their physiological and behavioral differences. For example, fish-eating birds may be exposed to contaminants by consuming fish that have bioaccumulated contaminants from surface water and sediments, whereas seed-eating birds may be exposed to contaminants from direct contact with soils, through incidental ingestion of soil while foraging, or from

seeds that have assimilated contaminants through plant uptake from the soil. Environmental Pathways are summarized in Table 4.14. The following sections discuss in more detail the exposure pathways for each type of receptor.

Soils

Terrestrial animals at the site may be directly and indirectly exposed to contaminants in the soil. Direct dermal contact with subsurface contaminated soil and incidental ingestion of soil could occur among burrowing animals. In general, information for quantifying and evaluating the toxicity of dermal exposures to wildlife species is limited.

Indirect exposure to soil contaminants may occur through ingestion of soil-dwelling invertebrates, (e.g., earthworms) or grasses and other plants which may bioaccumulate contaminants. As with other exposure pathways, the importance of this pathway varies from species to species because of behavioral differences. For example, populations of animals such as field mice, which are ground-dwelling animals and fastidious groomers, may be more greatly affected by contaminated soils than other species which contact soil less often.

Plants may be directly exposed to contaminants in soil via uptake through their roots. Chemicals may accumulate in plant tissues depending on the species. Because chemical uptake is known to vary between plant species and tissues, evaluating the potential impacts to plants is often difficult. However, plant phytotoxic criteria for agriculturally important species are relatively well documented.

Groundwater

Groundwater contaminants may constitute a risk to environmental receptors when utilized by plants, discharged by springs or wells to where animals may drink, and when surface waters are contaminated by groundwater discharges. Pathways may be direct or indirect, and are most common where groundwater depths are shallow.

Plants with roots extending to the water table may be affected or may concentrate contaminants found in groundwater. This may cause direct phytotoxic effects to result. Similarly, the ingestion of contaminated drinking water may affect small and large mammals, birds, and all other organisms ingesting water derived from wells or springs.

TABLE 4.14

MATRIX OF POTENTIAL ECOLOGICAL EXPOSURE PATHWAYS
SITE 1 - IOWA AIR NATIONAL GUARD

Transport Medium	Release Source or Mechanism	Primary Exposure Point	Potential Receptors	Primary Exposure Route	Probability of Pathway Completion
Groundwater	Affected soils, groundwater	Downgradient wells used for drinking/irrigation	Surrounding plants and animals.	Ingestion, Inhalation, Dermal	Low: affected groundwater is limited to the immediate vicinity of Site 1 and penetration of roots and burrowing animals to that depth is unlikely.
Soils	Affected soils, groundwater/site leaching.	Site 1	Surrounding plants and animals	Ingestion, Inhalation, dermal	Moderate: Subsurface soil at Site 1 may be encountered by burrowing animals and plant roots.

As shown in Table 4.14, the potentially complete pathways considered for these sites are as follows:

- Contact of animals and plants with contaminated soils.
- Contact of plants, animals and aquatic life with contaminated groundwater.

4.3.4.3.4 Risk Screening

Important pathways for ecological exposure at Site 1 have been presented in this evaluation. However, no criteria are available for comparison. The results of the human health evaluation revealed chemical levels in groundwater exceeding human health based criteria. This indicates a potential for adverse health effects to wildlife and vegetation exposed to contaminated soil or groundwater.

4.3.4.3.5 Uncertainty

Uncertainties arise from the lack of criteria and also the lack of information on sensitive biotic communities and species that may be present in the area of the Installation.

4.3.5 Conclusions and Recommendations

- The soil and groundwater at SITE 1 are contaminated with volatile petroleum hydrocarbons, the components of JP-4 fuel.
- The preliminary risk assessments shows that presently there are no completed exposure pathways. Future pathway may be completed depending on the land use.
- The extent of contamination has been generally defined, however, further investigation is recommended along with simultaneous and immediate remedial activities.

4.4 SITE 2 - POTENTIAL LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AREA

4.4.1 Site Description

This area, located within the ammunition storage area west of the Installation, was reportedly used by the Air Force for the disposal of low-level radioactive wastes, such as radio tubes. The area is approximately ten feet square and enclosed by a dilapidated wire fence. Three padlocked metal cylinders protrude from the ground

within this area. At the time of the SI, there were no signs of contamination and a Geiger counter detected no radioactivity in the vicinity of the fenced area.

It is assumed that only small volumes of low-level radioactive waste were disposed of in this ten by ten foot area. The waste reportedly consisted of radio tubes which were placed in metallic containers. Because it is not precisely known if only radio tubes were disposed of, the radiation survey and the environmental samples included monitoring for all types of radiation. One other assumption in the planning of the subsurface program was that potential radiation which may be picked up by cursory surface monitoring may not necessarily be representative of that occurring at depth either in intensity or in type. Therefore for health and safety purposes especially during the drilling/sampling program, the monitoring equipment was responsive to all types of radiation at low levels.

4.4.2 Field Activities

A radiological survey was conducted at the potential low-level radioactive waste disposal area (Site 2). The purpose of this survey was to determine surface radioactivity levels. The survey was conducted using an Eberline Geiger Mueller survey meter, Model E-120. The instrument was calibrated at the factory and checked in the field with a vendor provided radioactive source prior to use.

The radiological survey consisted of recording the background radiation level approximately 200 feet from site and then obtaining general area readings three feet above the ground at 22 locations over the site. Six locations over and around the exposed portions of the storage containers were also checked with contact readings (Table 4.15). Survey locations were recorded in the field log book.

A surface magnetometer survey was also conducted. In this area, three metal containers are partially exposed. A smaller grid was set up at the Site 2 background well location. This survey was designed to identify the presence of other objects which may have been buried or to otherwise identify the approximate limits of the disposal area.

The magnetometer survey consisted of station-to-station measurements using a grid system. The stations were set five feet apart using a measuring wheel and a Brunton compass. The measurements were obtained using a Geometrics G826 Magnetometer which indicates the total magnetic field intensity at the site in gammas. The field measurements and grid locations were recorded in the field notebook.

TABLE 4.15
RADIOLOGICAL SURVEY DATA
IANG - SERGEANT BLUFF, IOWA

Location	Height of Instrument	
	3 feet above grade (MR/HR)	Contact at grade (MR/HR)
1	0.02	--
2	0.02	--
3	0.02	--
4	0.02	--
5	0.02	--
6	0.02	--
7	0.02	--
8	0.02	--
9	0.02	--
10	0.02	--
11	0.02	--
12	0.02	--
13	0.02	--
14	0.02	--
15	0.02	--
16	0.02	--
17	0.02	0.02
18	0.02	0.02
19	0.02	0.02
20	0.02	0.02
21	0.02	0.02
22	0.02	0.02

Soil boring samples were collected from 28 to 30 July 1990. These samples were collected in accordance with previously stated procedure (sub-section 3.2.4). All samples were screened in the field for radiation using the Geiger Mueller. Three samples from each boring were selected for laboratory analysis based on stratigraphic interval. The samples were analyzed for gross alpha, gross beta, radium 226 and radium 228.

Temporary monitoring wells at Site 2 were installed in the five soil borings. Immediately after the last sample was taken, the well was installed through the hollow-stem augers then the augers were removed as the sand pack, bentonite pellets and bentonite slurry were installed. The wells were installed by this method for ease of removal after one groundwater sampling event.

Temporary wells LANG-2-TW-1,-2,-3 and -4 were installed radially around the site within thirty feet of the wire fence. LANG-2-TW-5 was installed approximately 155 feet north of the fenced-off casings as a Site 2 background well.

These wells were developed on 13 August 1990. Development was conducted using a 1.5 inch I.D. by 3 foot long Teflon bailer. 45 gallons of water were bailed from each well and contained in a 55 gallon drum.

Groundwater samples were collected on 14 August 1990 and submitted for laboratory analyses. A duplicate from well LANG-2-TW-5 was also submitted for laboratory analyses. The wells were purged using a 1.5-inch by 3-foot Teflon bailer. Purging was conducted as described in sub-section 3.2.6. The purge water was added to the development water contained in a 55 gallon drum. These samples were analyzed for gross alpha, gross beta, radium 226 and radium 228. In-situ hydraulic conductivity tests were run on the wells on 21 August 1990.

Two soil samples were also collected approximately one mile east of Site 2, at the site of an underground storage tank (UST) assessment. The range of concentrations detected were 1.2 pCi/g to 1.6 pCi/g for gross alpha and 1.0 pCi/g to 1.3 pCi/g for gross beta.

4.4.3 Results of Field Program

4.4.3.1 Radiological Survey Results

The area radiological survey results indicated readings of background radiation levels of 0.02 MR/HR (millirems per hour). The contact readings indicated background radiation levels of 50 CPM (counts per minute).

4.4.3.2 Magnetometer Survey Results

The magnetic data obtained during the magnetometer survey was reviewed and used to generate a contour map (Figure 4.6). The magnetic contour map shows a high and low anomaly directly adjacent to the three metal casings. The data indicates a detection of the ferromagnetic material (metal) used in the casings. No buried metallic objects were detected outside the barbed wire fence. The magnetic data is found in the Field Notes in Appendix B.

4.4.3.3 Hydrogeologic Results

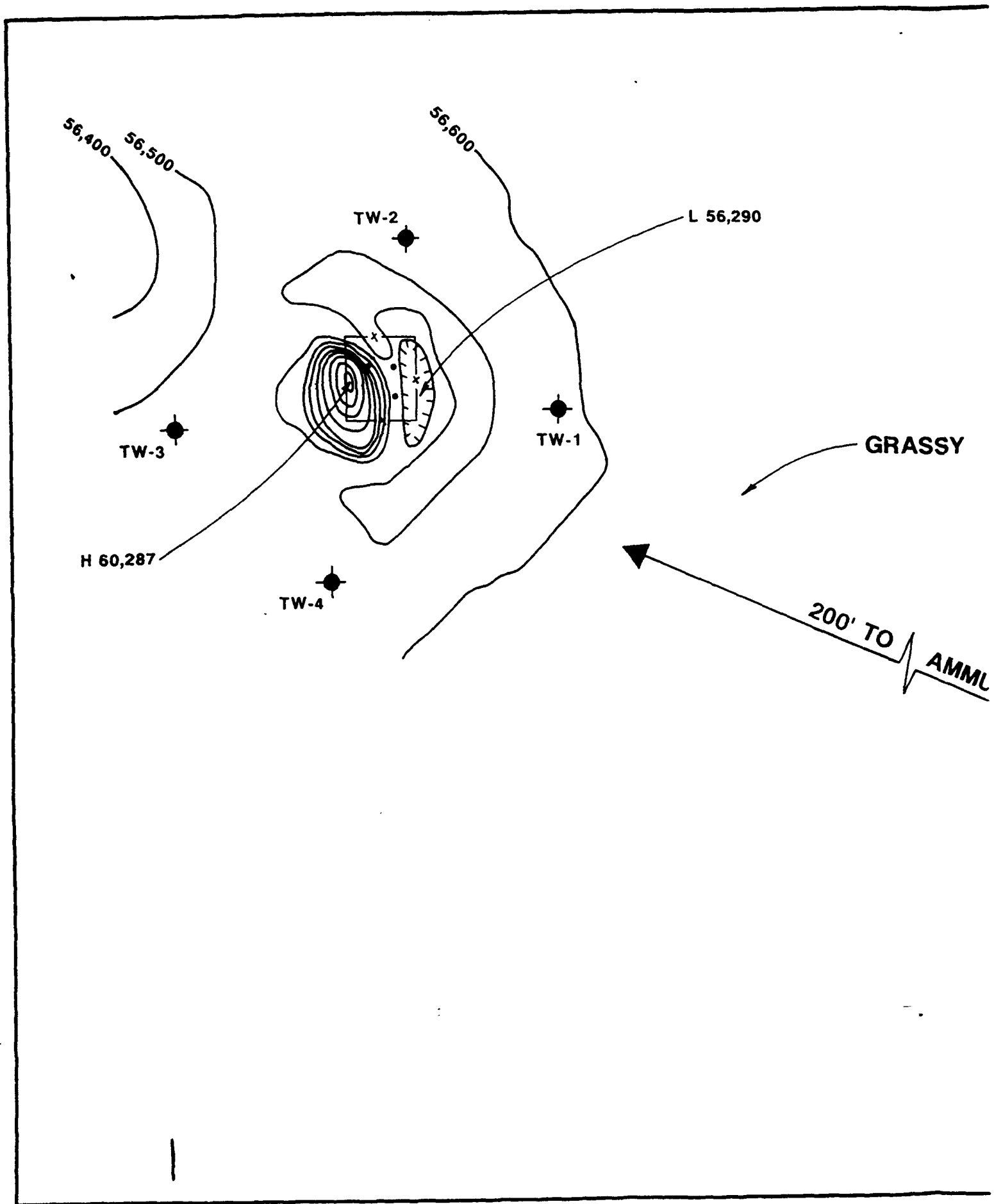
The borings for monitor wells LANG-2-TW-1,-2,-3,-4, and TW-5 penetrated brown and gray silt and silty clay overlying brown and gray silty sand (Appendix E). The wells were installed to approximately 30 feet. The 10 foot well screen spanned the unsaturated and saturated zone interface in a fine-grained silty sand. Water was detected during drilling at 22.5' to 24.5'.

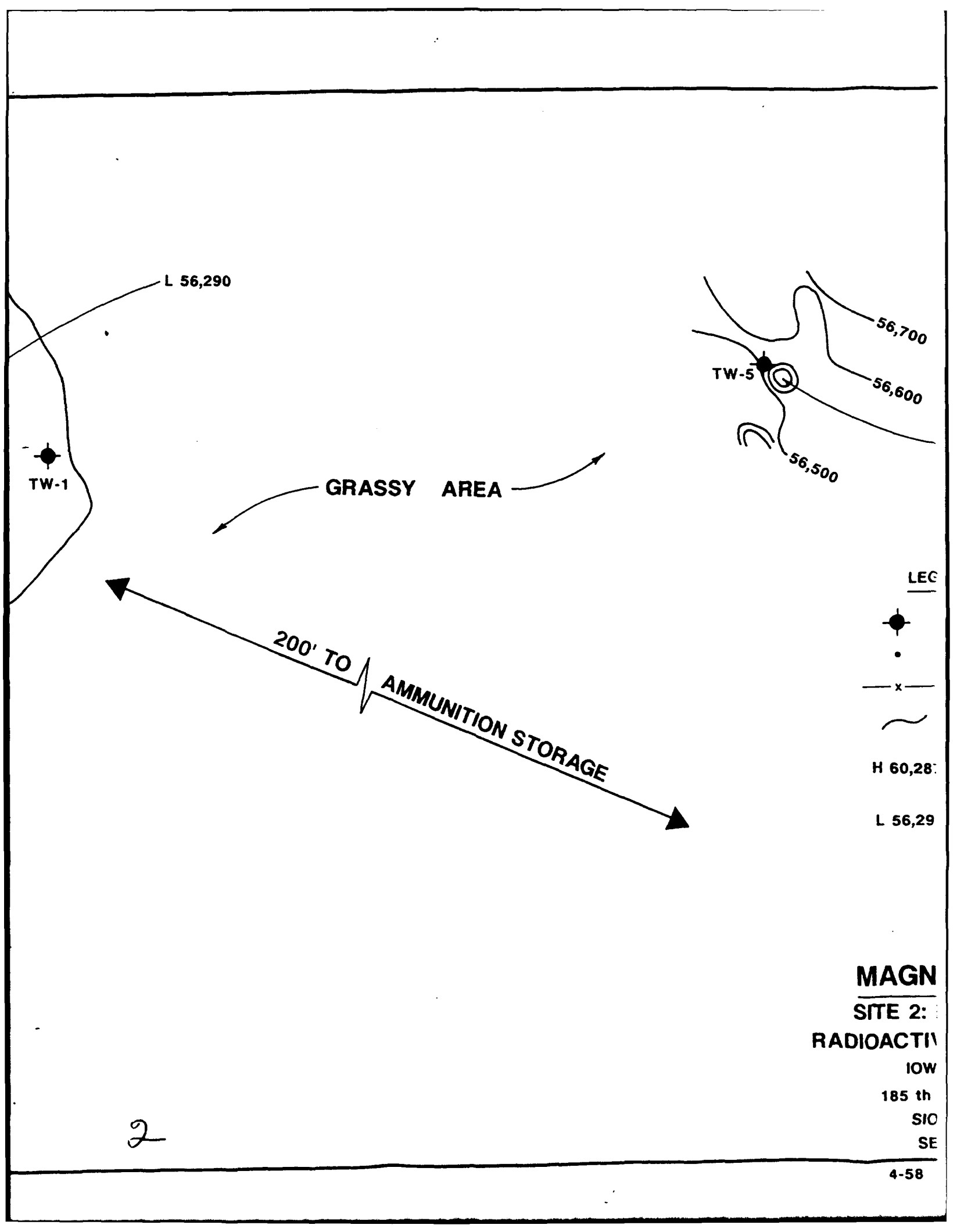
Water levels were measured in all the wells on 21 August 1990. The water levels ranged from 24 to 2.6 feet below grade. The general groundwater flow direction is believed to be to the west, toward the Missouri River. The placement of the temporary wells permitted sample collection from both upgradient and downgradient.

In-situ hydraulic conductivity testing in the temporary wells at Site 2 revealed values ranging from 4.1×10^{-3} cm/sec (11.66 ft/day) to 1.02×10^{-2} cm/sec (28.99 ft/day). Test work sheets are presented in Appendix F.

4.4.3.4 Chemical Analysis Results

Soil samples were collected at Site 2 during the drilling of the temporary wells (Table 4.16). All the soil samples submitted to the laboratory were analyzed for gross alpha, gross beta, radium 226 and radium 228. The analytical results are summarized in Table 4.17.





L 56,290

TW-1

GRASSY AREA

TW-5

56,700

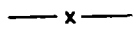
56,600

56,500

200' TO

AMMUNITION STORAGE

LEG



H 60,28'

L 56,29

MAGN
SITE 2:
RADIOACTIVE

IOW

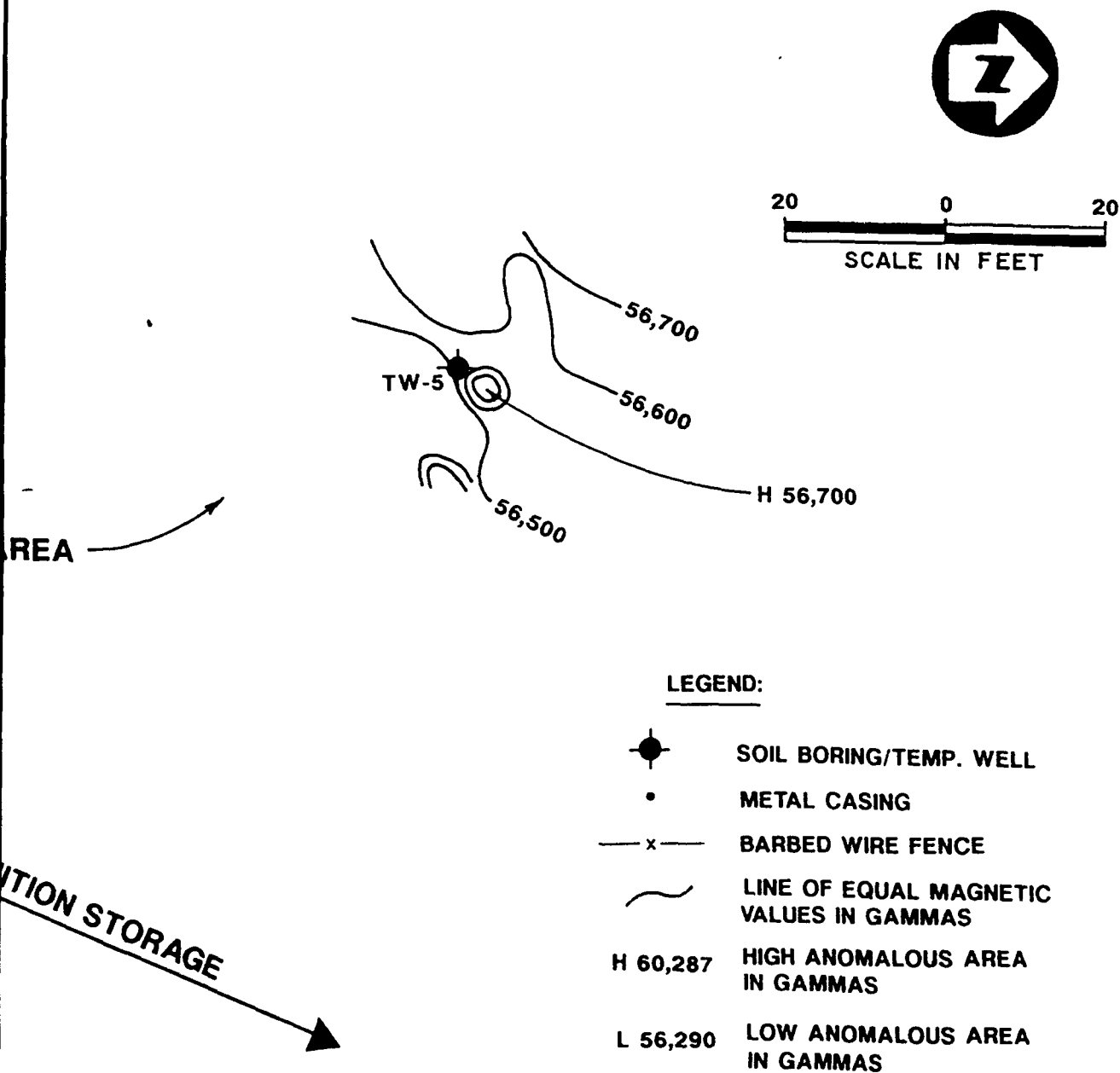
185 th

SIO

SE

2

FIGURE 4.6



MAGNETIC SURVEY MAP **SITE 2: POTENTIAL LOW-LEVEL** **RADIOACTIVE WASTE DISPOSAL AREA** IOWA AIR NATIONAL GUARD 185 th TACTICAL FIGHTER GROUP SIOUX GATEWAY AIRPORT SERGEANT BLUFF, IOWA

3

The soil samples collected during the drilling of LANG-2-TW-1,-2,-3,-4 and -5 contained the following ranges of concentrations in pico curies per gram (pCi/g): gross alpha (0.7 to 3.3), gross beta (1.3 to 5.3), radium 226 (0.47 to 1.6) and radium 228 (<0.2 to 2.4) (Figure 4.8). Two background, upgradient soil samples were collected from Site 1 at LANG-1-SB-7/MW-6. The range of concentrations was: gross alpha (<0.5 to 35.6 pCi/g), gross beta (<0.8 to 7.8 pCi/g), radium 226 (<0.3 to 0.51 pCi/g), and radium 228 (<0.5 pCi/g).

Two soil samples were also collected approximately one mile east of Site 2, at the site of an underground storage tank (UST) assessment (UST MW-1). The range of concentrations was: gross alpha (1.2 to 1.6 pCi/g) and gross beta (1.0 to 1.3 pCi/g).

The groundwater samples collected from the wells at Site 2 were submitted for laboratory analysis of gross alpha, gross beta, radium 226 and radium 228. The results revealed a range of the following concentrations in pico curies per liter (pCi/l): gross alpha (4 to 22), gross beta (19 to 45), radium 226 (0.6 to 4.1), radium 228 (<1) (Figure 4.7). Monitor well MW-6 at Site 1 was sampled as a background upgradient well. The results revealed concentrations of 21 pCi/l gross alpha, 32 pCi/l gross beta, 17.0 pCi/l radium 226 and <1 pCi/l radium 228. A groundwater sample was also collected from UST MW-1. Results from this well showed a gross alpha concentrations of 25 pCi/l and a gross alpha beta concentration of 41 pCi/l. Table 4.18 summarizes the analytical results.

The United States Environmental Protection Agency (U.S. EPA) has established MCLs for gross alpha (15 pCi/l including radium 226, but excluding radon and uranium) and combined radium 226 and radium 228 (5 pCi/l). Samples from TW-1 and TW-4 at Site 2 revealed gross alpha concentrations of 22 pCi/l and 19 pCi/l, respectively, both of which are above the MCL for gross alpha (15 pCi/l). However, the laboratory analysis for gross alpha includes gross alpha, radium 226 and uranium, whereas, the MCL for gross alpha includes gross alpha and radium 226, excluding uranium.

The groundwater samples from Site 1 (MW-6) revealed concentrations of gross alpha and radium 226 and radium 228 above the MCL. However, these concentrations fall within typical levels and there is no evidence known of radioactive materials being disposed of in the area of Site 1 (Kastanzo, 1990; Mueller, 1990; Nazaroff, 1988). Gross alpha was detected at 21 pCi/l and radium 226 was detected at 17 pCi/l, radium 228 was

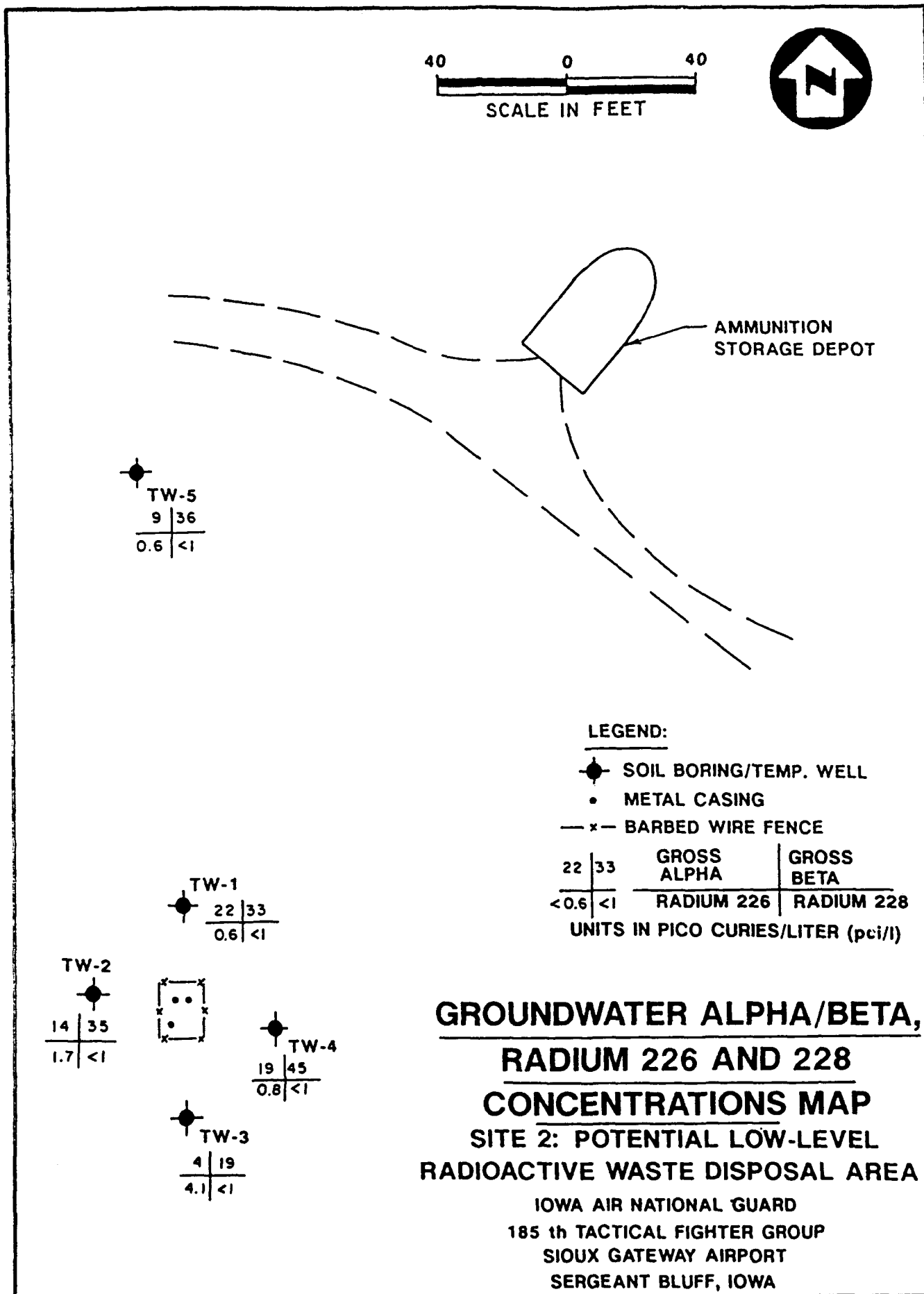


FIGURE 4.8

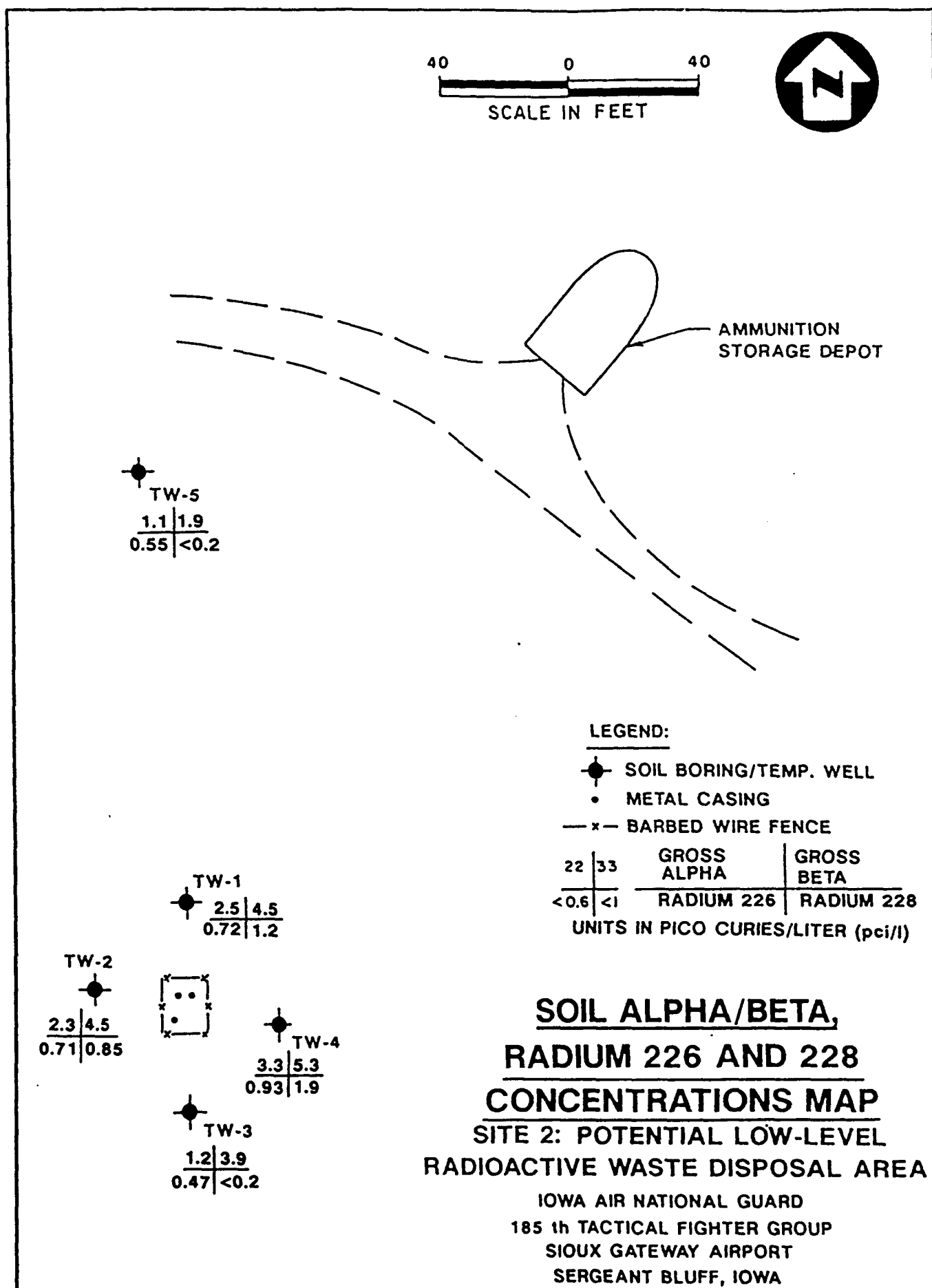


TABLE 4.16

SITE 2 - SOIL AND WATER SAMPLES SUBMITTED FOR
LABORATORY ANALYSIS

IANG - SERGEANT BLUFF, IOWA

Location	Soil (Sample Depth)	Analysis
TW-1	(2'-4',8'-9',20'-22')	Gross Alpha, Gross Beta, Radium 226, Radium 228
TW-2	(2'-4',8'-9',24'-22')	Gross Alpha, Gross Beta, Radium 226, Radium 228
TW-3	(2'-4',8'-9',20'-22')	Gross Alpha, Gross Beta, Radium 226, Radium 228
TW-4	(2'-4',8'-10',20'-22')	Gross Alpha, Gross Beta, Radium 226, Radium 228
TW-5	(2'-4',8'-10',20'-22')	Gross Alpha, Gross Beta, Radium 226, Radium 228
UST (MW-1)	(15'-17',25'-27')	Gross Alpha, Gross Beta, Radium 226, Radium 228

TABLE 4.17
DETECTED COMPOUNDS IN SOIL SAMPLES
SITE 2 POTENTIAL LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AREA
IANG, SERGEANT BLUFF, IOWA

Sample ID:	IANG-2 SB-1-S1	IANG-2 SB-1-S2	IANG-2 SB-1-S3	IANG-2 SB-2-S1	IANG-2 SB-2-S2	IANG-2 SB-2-S3	IANG-2 SB-3-S1	MCL (1)
Date Sampled:	27-Jul-90	28-Jul-90	28-Jul-90	28-Jul-90	28-Jul-90	28-Jul-90	29-Jul-90	
Radiological Parameters (pCi/g)								
Gross Alpha	0.9+/-0.6	2.5+/-0.7	1.5+/-0.7	1.8+/-0.8	2.3+/-0.7	1.2+/-0.6	2.0+/-0.8	15 (2)
Gross Beta	3.3+/-0.9	4.5+/-0.8	3.4+/-0.9	2.6+/-0.8	4.5+/-0.9	2.5+/-0.8	2.3+/-0.8	-----
Radium-226	0.74+/-0.23	0.72+/-0.26	1.5+/-0.2	0.82+/-0.20	0.71+/-0.22	1.3+/-0.1	1.6+/-0.2	5 (3)
Radium-228	0.2 U	1.2+/-0.2	0.2 U	1.1+/-0.2	0.85+/-0.30	0.2 U	0.2 U	

Footnotes:

- U--the compound was analyzed for, but not detected.
(1) Source: 40 CFR 161, updated with respect to 1990 EPA ARARS,
where applicable
(2) Includes radium 226 and excludes radon and uranium
(3) Includes radium 226 and radium 228

Sample ID:	IANG-2 SB-3-S2	IANG-2 SB-3-S3	IANG-2 SB-3-S4	IANG-2 SB-4-S1	IANG-2 SB-4-S2	IANG-2 SB-4-S3	IANG-2 SB-5-S1	IANG-2 SB-5-S2
Date Sampled:	29-JUL-90	29-JUL-90	29-JUL-90	30-JUL-90	30-JUL-90	30-JUL-90	30-JUL-90	30-JUL-90
Radiological Parameters (pCi/g)								
Gross Alpha	1.2+/-0.6	1.0+/-0.6	1.3+/-0.6	1.7+/-0.7	3.3+/-0.8	1.5+/-0.6	0.7+/-0.5	1.1+/-0.6
Gross Beta	3.9+/-0.8	2.0+/-0.8	1.9+/-0.8	3.8+/-1.0	5.3+/-1.0	1.3+/-0.8	1.8+/-0.8	1.9+/-1.0
Radium-226	0.47+/-0.18	1.0+/-0.3	1.4+/-0.2	1.4+/-0.2	0.93+/-0.16	0.78+/-0.15	1.6+/-0.2	0.55+/-0.28
Radium-228	0.2 U	0.2 U	0.2 U	1.6+/-0.3	1.9+/-0.8	1.8+/-0.9	2.4+/-1.1	0.2

TABLE 4.17 CONTINUED
DETECTED COMPOUNDS IN SOIL SAMPLES
SITE 2 POTENTIAL LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AREA
IANG, SERGEANT BLUFF, IOWA

Sample ID:	IANG-2 SB-5-53	IANG-2 SB-5-54	IANG-2 BENTONITE	IANG-2 SB-7 MU-6-RR1 10-AUG-90	IANG-2 SB-7 MU-6-BR2 10-AUG-90	UST SITE MU-1 BACKGROUND 12-DEC-90	UST SITE MU-1 BACKGROUND 12-DEC-90	MCL (1)
Date Sampled:	30-JUL-90	30-JUL-90	30-JUL-90	10-AUG-90	10-AUG-90	12-DEC-90	12-DEC-90	
Radiological Parameters (pCi/g)								
Gross Alpha	1.0 +/- 0.6	0.9 +/- 0.6	11.4 +/- 1.4	35.6 +/- 2.4	0.50	1.2 +/- 0.6	1.6 +/- 0.7	15 (2)
Gross Beta	2.3 +/- 1.0	0.9 U	8.8 +/- 1.3	7.8 +/- 1.3	0.80	1.3 +/- 1.0	1.0 +/- 0.5	
Radium-226	0.85 +/- 0.25	0.36 +/- 0.10	4.9 +/- 0.3	0.30	0.51 +/- 0.34			5 (3)
Radium-228	0.2 U	2.4 +/- 0.5	8.9 +/- 1.4	0.50	0.50			

Footnotes:

- U--the compound was analyzed for, but not detected.
(1) Source: 40 CFR 161, updated with respect to 1990 EPA ARARs,
where applicable
(2) Includes radium 226 and excludes radon and uranium
(3) Includes radium 226 and radium 228

TABLE 4.18
DETECTED COMPOUNDS IN WATER SAMPLES
SITE 2 POTENTIAL LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AREA
IANG, SERGEANT BLUFF, IOWA

Sample ID:	IANG-2 TU-1	IANG-2 TU-2	IANG-2 TU-3	IANG-2 TU-4	IANG-2 TU-5	IANG-1 MU-6 BACKGROUND	UST SITE MU-1 BACKGROUND 12-Dec-90	MCL (1)
Date Sampled:	14-Aug-90	14-Aug-90	14-Aug-90	14-Aug-90	14-Aug-90			
Radiological Parameters (pCi/l)								
Gross Alpha	22 +/- 10	14 +/- 9	4 +/- 3	19 +/- 9	9 +/- 8	21 +/- 7	25 +/- 4	15 (2)
Gross Beta	33 +/- 12	35 +/- 12	19 +/- 6	45 +/- 12	36 +/- 12	32 +/- 7	41 +/- 5	-----
Radium-226	0.6 U	1.7 +/- 0.6	4.1 +/- 1	0.8 +/- 0.5	0.6 U	17.0 +/- 7.8	-----	5 (3)
Radium-228	1 U	1 U	1 U	1 U	1 U	1 U	-----	-----
Footnotes:								

U--the compound was analyzed for, but not detected.

(1) SOURCE: 40 CFR 141, UPDATED WITH RESPECT TO 1990 EPA ARAR'S,

WHERE APPLICABLE

(2) INCLUDES RADIUM 226 AND EXCLUDES RADON AND URANIUM

(3) INCLUDES RADIUM 226 AND RADIUM 228

not detected above the detection limit of 1 pCi/l. Groundwater from UST MW-1 also exceeded the MCL for gross alpha. Laboratory analyses showed the sample to have 25 pCi/l.

The data indicate the background concentrations of gross alpha, radium 226 and radium 228 at Site 1 and Site 2 exceed the MCL. This could be due to uranium concentrations included in the laboratory analysis for gross alpha and/or the percentage of naturally occurring radionuclides in the sediments in this particular geographic area.

4.4.4 Exposure Assessment

The data results are presented in Tables 4.17 and 4.18 in Section 4 of this report. Site 2 does not show evidence of radioactivity above background levels. Because it is likely that these levels are naturally occurring, no further risk evaluation will be done for this site.

4.4.5 Conclusions and Recommendations

The results of analyses for gross radioactivity and radium performed on soil and water samples collected from Site 2 suggest that the levels are within the range of naturally occurring concentrations. None of the soil samples displayed concentrations exceeding the MCL; water samples did, however, contain concentrations which exceeded the MCL, but which were lower than background levels.

A soil sample collected at Site 2 as a background value did exceed the MCL. This value may be considered as an anomaly because another sample collected from directly beneath yielded a value below the MCL as did all other soil samples analyzed from the site.

There is no indication that the concentrations of gross alpha detected in the groundwater at Site 2 are the result of activities from the Iowa Air National Guard Installation. A preliminary risk evaluation was not performed at Site 2 because concentrations of radionuclides did not exceed levels found to be typical for the Installation. The entire Installation seems to have a naturally occurring concentration of radionuclides which probably extend off Base.

No further site activities are recommended for Site 2.

SECTION 5

LABORATORY QUALITY CONTROL REPORT

This Section presents a summary and review of quality assurance and quality control results for the laboratory analysis of water and soil collected from Site 1 and Site 2 at LANGB in Sergeant Bluff, Iowa. This investigation was part of the Site Investigation during the period of July to August, 1990.

Analysis of soil and water samples for volatile organics (Method 8020), semi-volatile organics (CLP) and TPH (418.1) was performed by Engineering-Science Berkeley Laboratory (ESBL). Radioactivity parameters on soil and water samples were determined by Controls for Environmental Pollution, Inc. (CEP).

The results from ESBL are divided into five data packages. Each data package is assigned a work order number and includes all the required quality control documentation. Each package was validated by reviewing holding times, GC/MS tuning, initial and continuing calibration, blank/spike control samples, surrogate results, method blanks, matrix spike/spike duplicates and field quality control sample results. If the criteria were not met in any of these categories, action was taken as specified by the HAZWRAP document DOE/HWP-65/RI. Specific problems will be discussed in this section along with the action that was taken. Validation notes are included in Appendix I. Laboratory deliverables will be submitted under separate cover.

The analytical results of the environmental and quality control (QC) samples were evaluated to assess the representativeness, precision and accuracy, comparability and completeness of the data.

Representativeness was evaluated from the analytical results of the trip blanks, field blanks, rinseate blanks, method blanks and field duplicate samples. Analytical results of the blanks, except for the method blanks, are summarized in Appendix H. Comparison of the analytical results from duplicate samples are also summarized in Appendix H. The method blank summaries are included with the other data deliverables.

Precision and accuracy were evaluated by reviewing the laboratory matrix spike sample (MS), matrix spike duplicate sample (MSD) and the surrogate spike sample.

This information along with the Case Narratives which discuss specific QC problems, is included with the data deliverables.

Comparability qualitatively expresses the confidence with which one data set can be compared with another. Analytical methods were used for this investigation which are documented standard methods. Any investigation in the future can use these same methods to compare the results with this site investigation.

The completeness of the results was determined by the number of valid analyses compared to invalid analyses. This is determined from the results of the data validation procedure.

5.1 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data represents the characteristics of a population. Therefore, the level of representativeness of the data is often determined by the methodology of the field sampling program. The methods used for the sampling of the soil and groundwater at LANG are described in Section 3 of the text. The sampling protocol was followed to insure a high level of sample representativeness.

5.1.1 Field Blanks

A field blank is a sample of the deionized organic-free water used for decontamination. It is placed directly from the source bottle into an appropriate sample container. Two field blanks were associated with the sampling at Site 1 and four blanks at Site 2. The field blanks were analyzed for aromatic hydrocarbons, semi-volatile organics and TPH at Site 1 and radioactivity parameters at Site 2. No compounds were detected in the field blanks from Site 1. Two of the field blanks at Site 2 were the tap water used for decontamination. Gross Beta was detected in one of the tap waters at 7 ± 3 pCi/L. All four radioactivity parameters were non-detected in the deionized water blank, except for radium-228 in LANG-2-FB-2 (DIUF) at very close to the detection limit. Since this water is always used as a final rinse, the gross beta found in the tap water should not present a problem and the radium-228 is very low. The field blank data is presented in Appendix H.

5.1.2 Trip Blanks

A trip blank consisted of deionized organic-free water in 40 ml vials filled by the laboratory for purposes of traveling with a cooler of samples back to the lab. The trip blanks were only analyzed for aromatic hydrocarbons. None of the six trip blanks showed any aromatics above detection limits. The trip blank data is presented in Appendix H.

5.1.3 Rinseate Blanks

Rinseate blanks consisted of deionized organic-free water poured through the decontaminated bailer or split-spoon into sample bottles. The rinseate blank data is presented in Appendix H. The rinseate blanks were analyzed for aromatic hydrocarbons, semi-volatile organics and TPH at Site 1 and radioactivity parameters at Site 2. No compounds were detected.

5.1.4 Method Blanks

Method blanks are aliquots of analyte-free water analyzed with a sample batch to identify contaminants introduced by the preparation or analysis procedure. Method Blank Summary sheets are included with the data deliverables under separate cover. The Method Blank Summary Sheets were reviewed for each batch of analyses. No analytes were detected in any of the method blanks, except for one. In Work Order 2136, di-ni-butyl-phthalate was found in method blank MSBNA900822 at 160 J g/kg. In an associated sample, LANG-1-SB6/MW5-S1 the same phthalate was found at 180 J g/kg. Since this is a common lab contaminant and it was found within ten times the blank concentration, the sample concentration was flagged as non-detected (U).

5.1.5 Duplicate Samples

The analytical results of the soil and water duplicate samples are summarized in Appendix H. Two soil duplicate sets from Site 1 were analyzed for aromatic volatile organics, semivolatile organics and TPH. For each set, the concentration of the sample and its duplicate are non-detected and are in agreement. A background set of soil samples from Site 1 was analyzed for the radioactivity parameters. All results are non-detected.

One set of duplicate water samples (LANG-1-MW8 and MW9) was analyzed from Site 1. Both samples were all non-detected for all parameters and are in agreement. A

background water sample (LANG-1-MW6) was duplicated for radioactivity parameters and Well MW5 at Site 2 was duplicated (MW6) for these parameters. The results showed similar concentrations.

5.2 PRECISION AND ACCURACY

Precision and accuracy are assessed from the results obtained from the analysis of matrix spike and matrix spike duplicate samples and surrogate spiked samples.

5.2.1 Precision

Precision refers to the relative percent difference (RPD) in values obtained from two duplicate samples, in this case a matrix spike sample and its duplicate sample. RPD is calculated as follows:

$$\text{Relative Percentage Difference (RPD)} = \frac{2 (C1 - C2)}{C1 + C2} \times 100$$

where:

C1, C2 = The two values obtained by analyzing duplicate samples.

Acceptable levels of precision vary according to the sample matrix, the specific analytical method, and the analytical concentration relative to the method detection limit. The data is not qualified on the matrix spike/matrix spike duplicate (MS/MSD) results alone. This information is used in conjunction with other criteria to determine the need for action.

The precision of the analyses of volatile aromatic compounds was evaluated on the basis of the RPD calculated for quantitation on a single chromatograph column. The EPA methods for these analyses provide statistical precision data as a function of concentration for individual compounds. These values are used as a guideline to assess the precision of duplicate analyses.

For Work Order 2091, four RPDs were high for the MS/MSD for water. Because they were not far out of range, the percent recoveries were all in range, no other criteria were unacceptable and no semi-volatiles were found in the only associated sample (LANGB-1-RB1), no further action was taken.

5.2.2 Accuracy

Accuracy refers to the correctness of the value obtained from the preparation and analysis of a sample. It is determined by comparing the analytical results of a given sample and its corresponding matrix spike sample. Surrogate compounds added to each sample also make it possible to evaluate the analytical accuracy. Accuracy is expressed as percentage recovery (PR) and is calculated using the following formula.

$$\text{Percentage Recovery (PR)} = \frac{S_s - S_o}{S} \times 100$$

value:

- S_o = Background value, the value obtained by analyzing the sample before spiking;
- S = Concentration corresponding to the spike addition to the sample; and
- S_s = Value obtained by analyzing the matrix spike sample with the spike added.

The degree of accuracy, or PR, to be expected is dependent upon the sample matrix, specific analytical method, and the concentration of the analyte relative to its detection limit. The closer the measured value is to the detection limit, the lower the accuracy of analysis.

The procedures for spike samples to be analyzed by gas chromatography are described in the method. The expected range for recoveries of each compound are also provided in the method description.

If quality control results demonstrated an out of control situation for the spiked sample or spiked duplicate sample, a corrective action was taken. This may have included checking the calculations, flagging data in accordance with the procedures prescribed for the method, recalibration of the instrument, and/or re-analyses of the samples.

In Work Order 2091, the surrogate for the volatile organics for sample LANG-1-SB1-S2 was out of range. As required, the laboratory reextracted and reanalyzed. Again, the surrogate was out of range. The data from the first analysis was used and flagged as estimated (J).

The semivolatile organic analysis for Work Order 2169 had several poor surrogate recoveries for most of the groundwater samples. The samples were reextracted and in general the surrogate analysis of the reextracts was not better. The final actions are presented below. Details are discussed fully in the validation notes in Appendix I. Sample defueling pit water (2169-01) was reextracted and the surrogates were in range. Since the reextract was out of holding time, the results were flagged as estimated. The results of the original extract of MW5 (2169-02) were used with the base neutral (BN) fraction flagged as estimated. For samples MW6 (2169-03) and MW8 (2169-05), no reextracts were performed due to lack of sample. Since three BN were high for both samples, all BN were flagged as estimated. The results of sample MW7 (2169-10) are all flagged as unusable (R) since both extracts have at least two recoveries less than ten percent.

In summary, the semivolatile organics for Work Order 2169, are flagged due to poor surrogate recoveries. Since the blank surrogate recoveries were good and the soil surrogate recoveries were good for this Work Order, it seems likely that this is a matrix effect.

5.3 COMPARABILITY

Comparability qualitatively expresses the confidence with which one data set can be compared with another. The analytical methods used for this investigation are documented standard methods. Although CLP methods were not used for every analysis, CLP-type data packages were received for each analytical method. Future investigations using the same standard methods can be compared to this investigation.

5.4 COMPLETENESS

The completeness of the data is the percentage of analyses which are judged to be valid and is determined by calculating the number of invalid analyses. Invalid analyses can include those analyses which were not performed by the lab or those analyses which are disqualified due to quality control problems. One semivolatile organic analysis (sample LANG-1-MW7) was flagged as invalid due to very low surrogate recoveries. Since the rest of the analyses are considered valid, the goal of 90 percent completeness was achieved.

SECTION 6

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

This Section presents the Conclusions and Recommendations for Site 1 and Site 2 of the Iowa ANG. The findings and results of the SI are summarized below. Based on the results, recommendations are made to address existing conditions.

Site 1 is a former defueling pit where excess JP-4 was dumped from aircraft during the period between 1961 and 1974. An estimated 180,000 gallons of JP-4 may have been released at this site. The following are activities conducted during the SI:

- Soil-gas survey
- Installation of three piezometers
- Installation of eight monitoring wells, including soil samples
- Sampling of soil and water at the surface of the defueling pit
- Groundwater sampling from wells without phase-separated hydrocarbons
- The soil and groundwater at Site 1 are contaminated with volatile petroleum hydrocarbons, the components of JP-4 fuel.
- The preliminary risk assessments show that presently there are no completed exposure pathways. Future pathways may be completed depending on the land use.
- The extent of contamination has been generally defined, however, further investigation is recommended along with simultaneous and immediate remedial activities.

Site 2 is the possible low-level radioactive waste disposal area. This site is a small area ten feet by ten feet enclosed by a dilapidated fence. Inside the fence are three metal casings. It is our understanding that this area was used by the Air Force for the disposal of low-level radioactive wastes, such as radio tubes. The following activities were conducted at the site during the SI:

- Surface radioactivity survey
- Magnetometer survey
- Installation of five temporary monitoring wells
- Collection of soil and groundwater samples for radioactivity analyses
- Removal of temporary wells.

Results of analyses for gross radioactivity and radium showed the soil samples from this site to be at or within average soil concentrations. Soil samples collected cross-gradient and approximately 3500 feet away showed higher concentrations of gross alpha which exceeded expected averages. Groundwater results from the temporary

wells on site showed three wells exceeding the MCL for combined gross alpha/radium 226. The cross-gradient, background well exceeded the MCL for combined radium 226/228 and the MCL for gross alpha/radium 226.

The results of the investigation at this site show background concentrations of gross radioactivity is present and naturally occurring within the local sediments and not a result of Air Force or National Guard activities.

It is recommended that a decision document eliminating this site from further investigation be prepared with the available data.

SECTION 7

REFERENCES

- Engineering-Science, 1989, Installation Restoration Program, Project Health and Safety Plan, 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa.
- Hazardous Materials Technical Center, 1988, Installation Restoration Program, Preliminary Assessment, 185 TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa, and 133rd TCF, Iowa Air National Guard, Fort Dodge Municipal Airport, Fort Dodge, Iowa.
- Hvorslev, M.J., 1951, Time Lag and Soil Permeability in Groundwater Observations. U.S. Army Corps of Engineers, Waterways Exp. Sta. Bull. 36, Vicksburg, Miss.
- Kastanzo, T., 1990, Personal Communication, Fort Calhoun Nuclear Power Plant, Fort Calhoun, Nebraska.
- Munter, J.A, Ludvigson, G.A, and Bunker, B. J. Hydrogeology and Stratigraphy of the Dakota Formation in Northwest Iowa. Iowa Geological Survey, 1983.
- Mueller, J., 1990, Personal Communication. Lab Manager, CEP Laboratory, Santa Fe, New Mexico.
- National Oceanic and Atmospheric Administration, U.S. Department of Commerce, "Climates of the States," Volume II - Western States, 1974.
- Hazardous Waste Remedial Actions Program, Martin Marietta Energy Systems, Inc., Requirements for Quality Control of Analytical Data, DOE/HWP-651R1, July 1990.
- EPA, 1989, Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part A) Interim Final, EPA/540/1-89/002, December 1989.
- EPA, 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, U.S. GPO, 1987.
- Nazaroff, W.W. and Nero, A.V., Radon and Its Decay Products in Indoor Air. John Wiley & Sons, 1988.

APPENDIX A
MONITOR WELL DEVELOPMENT LOGS

REV. DATE: JAN 1989

WELL DEVELOPMENT LOG		WELL NO.: <u>2A15-1-MW-2</u>	Page <u>1</u> of <u>1</u>
Installation: <u>Iowa Air National Guard</u>		Site: <u>1</u>	
Project No.: <u>2370</u>	Client/Project: <u>Iowa Air National Guard</u>		
HAZWRAP Contractor: <u>ES</u>	Dev. Contractor:		
Dev. Start: (: — m)	Dev. End: (: — m)	Csg Dia.: <u>2"</u>	
Developed by: <u>Fox Drilling</u>		Dev. Rig (Y/N) <u>(N)</u>	

Dev. Method Bailed water from wellEquipment Totton bailer

Pre-Dev. SWL 25.02 Maximum drawdown during pumping NA ft of NA gpm
 Range and Average discharge rate NA gpm
 Total quantity of material bailed NA
 Total quantity of water discharged by pumping 42 gal.
 Disposition of discharge water 55 gallon drum

Time	Volume Removed (gal)	Water Level ft. BTOC	Turbidity	Clarity/Color	Temp. °C	pH	Conductivity	Remarks
NA	40	25.02	medium	silty/brown	16.7	6.9	800	8/17/90

WELL DEVELOPMENT LOG		WELL NO.: <u>2116-1-MW-5</u>	Page <u>1</u> of <u>1</u>
Installation: <u>Town Air National Guard</u>		Site: <u>1</u>	
Project No.: <u>62390</u>	Client/Project: <u>Town Air National Guard</u>		
H2S WRAP Contractor: <u>ES</u>	Dev. Contractor:		
Dev. Start: <u>(: — m)</u>	Dev. End: <u>(: — m)</u>	Csg Dia.: <u>2"</u>	
Developed by: <u>Fox Drilling</u>		Dev. Rig <u>(Y/N)</u>	

Dev. Method Bailed water from well

Time	Volume Removed (gal)	Water Level H.D.TOC	Turbidity	Clarity/ Color	Temp. °C	pH	Conductivity	Remarks
NA	40	24.58	medium	silty/ brown	14.4	7	200	8/14/70

REV. DATE: JAN 1989

WELL DEVELOPMENT LOG		WELL NO.: <u>IAN6-1-MW-6</u>	Page <u>1</u> of <u>1</u>
Installation: <u>Iowa Air National Guard</u>		Site: <u>1</u>	
Project No.: <u>66390</u>	Client/Project: <u>Iowa Air National Guard</u>		
HAZWOP Contractor: <u>ES</u>	Dev. Contractor:		
Dev. Start: <u>1</u> : <u>—</u> m)	Dev. End: <u>(</u> : <u>—</u> m)	Csg Dia.: <u>2"</u>	
Developed by: <u>Fox Drilling</u>		Dev. Rig (Y/N):	

Dev. Method Bailed water from well

Equipment T-1100 bailer

Pre-Dev. SWL 20.87 Maximum drawdown during pumping NA ft of NA gpm
 Range and Average discharge rate NA gpm
 Total quantity of material bailed NA
 Total quantity of water discharged by pumping 400 gal
 Disposition of discharge water 55 gallons drum

Time	Volume Removed (gal)	Water Level ft.BTOC	Turbidity	Clarity/Color	Temp. °C	pH	Conductivity	Remarks
NA	40	20.87	medium	silty/brown	14.4	7.1	700	7/14/90

WELL DEVELOPMENT LOG		WELL NO.: <u>IAN6-1-MW-8</u>	Page <u>1</u> of <u>1</u>
Installation: <u>Iowa Air National Guard</u>		Site: <u>1</u>	
Project No.: <u>2390</u>	Client/Project: <u>Iowa Air National Guard</u>		
HAZWRAP Contractor: <u>ES</u>	Dev. Contractor:		
Dev. Start: <u>1</u> : <u>—</u> m)	Dev. End: <u>(</u> : <u>—</u> m)	Csg Dia.: <u>2"</u>	
Developed by: <u>Fox Drilling</u>		Dev. Rig (Y/N) <u>(Y)</u>	

Dev. Method Bailed water from well

Equipment Teflon bailer

Pre-Dev. SWL 22.70 Maximum drawdown during pumping NA ft of NA gpm
 Range and Average discharge rate NA gpm
 Total quantity of material bailed NA
 Total quantity of water discharged by pumping 40 gal.
 Disposition of discharge water 55 gallon drum

Time	Volume Removed (gal)	Water Level ft.OTOC	Turbidity	Clarity/Color	Temp. °C	pH	Conductivity	Remarks
NA	40	22.70	medium	2.4/1 brown	14.4	6.9	800	8/14/90

REV. DATE: JAN 1989

WELL DEVELOPMENT LOG		WELL NO.: TW-1	Page 1 of 1
Installation: Iowa Air National Guard		Site: 2	
Project No.: 11370	Client/Project: Iowa Air National Guard		
HAZWRAP Contractor: ES	Dev. Contractor:		
Dev. Start: (: — m)	Dev. End: (: — m)	Csg Dia.: 2"	
Developed by: Fox Drilling		Dev. Rig (Y/N)	

Dev. Method Boiled water from wellEquipment Teflon boiler

Pre-Dev. SWL 26.02 Maximum drawdown during pumping NA ft of NA gpm
 Range and Average discharge rate NA gpm
 Total quantity of material boiled NA
 Total quantity of water discharged by pumping 40 gal.
 Disposition of discharge water 55 gallon drum

Time	Volume Removed (gal)	Water Level 11.DTOC	Turbidity	Clarity/ Color	Temp. °C	pH	Conductivity	Remarks
NA	40	26.02	medium	silty/ brown	13.3	6.9	1750	8/13/10

REF. DATE: JAN 1962

Equipment Tractor wailer

Pre-Dev. SWL 25.88 Maximum drawdown during pumping NA ft of NA gpm
Range and Average discharge rate NA gpm
Total quantity of material boiled NA
Total quantity of water discharged by pumping 40 gal.
Disposition of discharge water 55 gallon drum

A-8

WELL DEVELOPMENT LOG		WELL NO.: TW-3	Page 1 of 1	REV. DATE: JAN 1987
Installation: Iowa Air National Guard		Site: 2		
Project No.: 61390	Client/Project: Iowa Air National Guard			
HAZWRAP Contractor: ES		Dev. Contractor:		
Dev. Start: (: — m)	Dev. End: (: — m)		Csg Dio.:	
Developed by: Fox Drilling			Dev. Rig (Y/N)	

Dev. Method Boiled water from well

Equipment Teflon beaker

Pre-Dev. SWL 25.36 Maximum drawdown during pumping NA ft at NA gpm

Range and Average discharge rate NA gpm

Total quantity of material boiled NA

Total quantity of water discharged by pumping 40 gal.

Disposition of discharge water 5.5 gallon drum

Time	Volume Removed (μ l)	Water Level H.D.TOC	Turbidity	Clarity/ Color	Temp. $^{\circ}$ C	pH	Conductivity	Remarks
NA	40	25.36	medium	silty/ brown	13.8	7.0	1800	8/13/90

REV. DATE: JAN 1987

WELL DEVELOPMENT LOG		WELL NO.: <u>TW-4</u>	Page <u>1</u> of <u>1</u>
Installation: <u>Jawa Air National Guard</u>		Site: <u>2</u>	
Project No.: <u>CL370</u>	Client/Project: <u>Jawa Air National Guard</u>		
HAZWAP Contractor: <u>ES</u>	Dev. Contractor:		
Dev. Start: <u>1</u> : <u>—</u> m)	Dev. End: <u>1</u> : <u>—</u> m)	Csg Dia.: <u>2"</u>	
Developed by: <u>Fox Drilling</u>		Dev. Rig (Y/N)	

Dev. Method Drilled water - form well

Equipment Tellon boiler

Pre-Dev. SWL 25.52 Maximum drawdown during pumping NA ft of NA gpm

Range and Average discharge rate NA gpm

Total quantity of material boiled NA

Total quantity of water discharged by pumping 40 gal.

Disposition of discharge water 55 gallon drum

Time	Volume Removed (gal)	Water Level (I.D.TOC)	Turbidity	Clarity/Color	Temp. °C	pH	Conductivity	Remarks
NA	40	25.52	medium	silty/brown	14.4	6.9	1200	8/13/70

REV. DATE: JAN 1982

WELL DEVELOPMENT LOG		WELL NO.: TW-5	Page 1 of 1
Installation: Iowa Air National Guard		Site: 2	
Project No.: CL390	Client/Project: Iowa Air National Guard		
HAZWAP Contractor: ES	Dev. Contractor:		
Dev. Start: (: -m)	Dev. End: (: -m)	Csg Dia.: 2"	
Developed by: Fox Drilling		Dev. Rig (Y/N)	

Dev. Method Bailed water from wellEquipment Teflon boiler

Pre-Dev. SWL 25.84 Maximum drawdown during pumping NA ft of NA gpm
 Range and Average discharge rate NA gpm
 Total quantity of material bailed NA
 Total quantity of water discharged by pumping 40 gal.
 Disposition of discharge water 55 gallon drum

Time	Volume Removed (gal)	Water Level ILDTOC	Turbidity	Clarity/Color	Temp. °C	pH	Conductivity	Remarks
NA	40	25.84	medium	silty/blown	12.8	7.1	1200	8/12/90

APPENDIX B
FIELD NOTES

IAN G

Site Log Book Notes

4/11/93

7/14/93

Weather: 80° F, sunny

story

0815

Field Team

K. Palermo

T. Benson

J. Hanson

S. F. 1012

ES

Arrived @ site 0800, waited

Capt. G. Prescott to meet us.

(TAB) 11/14/90

0900 Capt. Gary Prescott

Reviewed PMP & SAP, looked

over site maps.

0900 Capt. Gary Prescott met

us at the gate. Escorted us

to Alcatraz where we will

set up an office and store

field gear & equipment. There

we discussed field activities

(3)	and Base procedures.	Defueling Pit for soil gas probe	
0930	we transported all ES field gear & equipment from storage locker to Alut Hanger 241.	1400	I began taking inventory of sample jars & bottles shipped to the Base from ES lab in Berkeley, CA.
1045	Began setting up grid for soil gas survey @ Site 1	1630	Finished drilling 9 holes through concrete apron for soil gas survey.
1120	Finished grading for soil gas survey, left site for lunch.		Finished jar/bottle inventory. Pace & compass survey of concrete apron.
1245	After lunch picked up gear for @ 500 Reiter for soil gas hammer drill.	1700	Finished pace & compass survey, made list of additional field supplies.
1315	Arrived back @ THWGB Began drilling holes through concrete apron near Site 1	1715	and went to purchase them. Left site for supplies

(4)

1800	Finished purchasing additional field supplies.	TANGIS	7/17/90	(2)
			Weather: 80°F, overcast, rain.	
			0800 Arrived @ site and met with Capt. Prescott about access to Site 2. Potential low level radioactive waste Site. Prescott's busy with phone calls, will meet us later around 1000.	
			0900 Field team same as recorded on page 1. Set up for soil gas survey @ Site 1 - Defueling Pit.	
			I made phone calls to Iowa Public Service to cancel meeting with utilities for line inspections. Re-scheduled meeting for 7/19/90 @ 0800.	

⑥

1030 IANGB personnel escorted us to Site 2 - Rad. Waste Site for recon. Reconced Site 2, questioned Base escort (Munitions maintenance personnel) about the site. He will check on getting us a key for access through gates when we do radiation survey, and magnetometer survey, and borings/well installation. Returned to Alert Hanger 241.

1100 Marked piezometer and monitor well locations with stakes @ Site 1

⑦

1130 Went to lunch and returned generator to Soo Rental. Stopped @ store for paper spool for Gas Chromatograph (GSC). 1300 met with Capt. Prescott for applications for Airport Security Access. K. Palumbo and myself filled out applications for security access and faxed them to ES-Cleveland for signatures. They will fax to Sioux Gateway Airport Authority.

1430 Returned to Alert Hanger 241. K. Palumbo & J. Hansen took equip + went

(8)

to Site 2 - Rad. Waste Site
 to perform radiation
 survey. S. Fiore & myself
 are preparing to conduct
 soil gas survey after
 calibration corrections were
 made by S. Fiore on
 GC.
 1500 Began soil gas survey
 sampling.
 1620 Palombo & Hansen returned
 from Site 2, finished Rad.
 survey.
 1645 Fiore & I finished
 soil gas for today. wrote
 up field notes while GC

(9)

finished running analyses.
 1715 GC analyses finished
 left site for the day.

T. Benson

(10)

TANGB

7/18/90

Weather: 80° F, overcast

0800 K. Palumbo + I

met w/ D. McWilliams of

Sioux Gateway Airport

Authority to be tested

for security authorization

permits.

0900 Returned to Alert

Hangar 241 and prepared

for magnetometer survey

at Site 2 while S. Fiore

+ J. Hansen continued soil

gas survey @ Site 1.

1030 Escorted by Munitions

personnel to Site 2 for PK-Mag.

survey. Set up grid for

mag. survey

(11)

1230 Returned to Alert

Hangar 241 to go to lunch

1330 Returned from lunch

and continued mag. survey

@ Site 2 and soil gas

survey @ Site 1.

1740 Returned from

mag. survey @ Site 2

to Alert Hangar 241. Soil

gas survey still in progress.

Get Cell Battery pack for

sampling pump needs to be

recharged.

1800 Left site for the

day.

J. F. Benson

(2)

TANGS

7/19/90

Wet. 70°F, rain

0800 Field team same as on page 1. Arrived @

Alfred Hanger, S. Fiore

& J. Hansen continued

soil gas survey, K. Palombo

& I went to gate to meet

utilities personnel. Took

to Site 1 & 2 to locate

electric, phone, & gas.

1000 K. Palombo & J. Hansen

went to Site 2 to finish

mag survey.

1230 Collected Fiore & Hansen

(13)

1000 K. Palombo & J. Hansen

went to pick up security

access passes, not ready,

we will try later.

1200 Met drillers @ gate

as we were leaving for lunch,

took them to Site 1 &

set up access pad.

1300 Went to lunch

1400 Returned from lunch,

K. Palombo & J. Hansen

continued mag. survey @

Site 2. S. Fiore & J. Hansen

continued soil gas survey @

Site 1.

1630 Finished mag. survey

and returned to Alfred Hanger.

(14)

1700 Finished field notes
and left site ^{7:00} for
the day

T. Benson

(15)

7/20/80
Weather: 80°F, sunny
0800 Arrived @ Site 1 Q
Alex A. Hansen at 244. Talked
to drillers about decon
pad. The drillers need
lumber for sides of decon
pad, went to buy it.
0830 Equipment to be
shipped back to office
is being packed up.
1045 J. Hansen went to
shipped ^{7:00} 7-20-80 equip. back
to ES-Cleveland office.
1100 Drillers return with
lumber and start building

(16)

decon pad. sides of
decon pad are ~2' high
and will be covered with
plastic (visqueen).
K. Palombo took pictures
of site. Metal detector
showed possible metallic
object under location for
one of three piezometers.
K. Palombo moved piezometer
location to cleared location
~15' southwest.
12/15 J. Hansen returned
from Federal Express office.
Drillers finished setting up
decon pad and left site
for home. They will pick up
more drilling supplies @ shop.

(17)

1300 We moved field
equipment to Capt. Prescott's
office location (Civil Eng.
ineering). Did not want to
leave expensive equip in
Alert Hangar 244. Went
to lunch.
1400 Returned from
lunch and called E.S. office
in Cleveland about auditors
next week.
1500 Cleaned up around
the Alert Hangar, granted
in soil gas holes in concrete
apron @ Site 1. Left site
for the day. Flights @
4:00 PM into 1600.
T. Benson

113

TANG B

7/23/80

Weather: 80°F sunny

0800 Arrived @ Alert Hanger

241. Fox Drilling called me

@ Holiday Inn @ 0730 and

informed me they were having

problems with the support

truck. Ben Fox said they

were working on the repair.

1030 K. Palombo arrived

@ Sioux Gateway Airport.

We returned to Alert Hanger

241 to make phone calls.

Took K. Palombo to Holiday

Inn to check in. Went

back to Alert Hanger 241

to wait there for J. Duncan

Duncan

114

to airport from Atlanta

ES office.

1330 K. Palombo & I

went to lunch. We left

message with guard for

J. Duncan to meet us

at Oehler Restaurant.

1430 J. Duncan from

ES Atlanta arrived @

restaurant. We drove back

to Alert Hanger 241 and

showed J. Duncan S. K.

1st 2. Talked about

audits.

1700 left Alert Hanger

241 for the day.

J. Duncan

20

TANG

7/24/90

Weather: 70°F, overcast

0800 Field Team: K. Polombo

ES

J. Duncan

T. Benson

Fox

W. Holloman

D.G.

D. Ivanovich

Arrived @ site, met drillers

and had H&M & Safety

meeting. K. Polombo informed

drillers of site locations,

level & protection unless air

monitoring indicates higher level

of protection, need for hard-hat,

steel toe shoes, no smoking,

on site, down procedures for

decumming rig & tools & well

casing/screen before entering
ground, emergency first aid
procedures in case of
accident, hospital location,
schedule and sequence of
drilling/sampling events to
be performed

0830 Drillers moving down
area to concrete pit not
presently being used by TANG.
Capt. Prescott gave permission
to use concrete pit for
decon area. Drillers construct-
ing decon facility inside

(22)

concrete pit. Drillers also
 unloading semi-trailer which
 was delivered to the Alert
 Hangar before we arrived @
 site Monday 7-23-90.
 Trailer contains well installation
 equipment: sand (20 bags @ 100 lbs
 ea. if 20-10), Quickrete (42 bags
 @ 80 lbs. ea.), Portland Cement
 (70 bags @ 94 lbs. ea.), Enviro plug,
 Wyoming Bentonite pellets, 1/4" dia.
 50 - 5 gallon buckets, 6 metal
 manhole covers for 2" diameter
 wells, protective metal casings
 for projecting wells.

(23)

1100 Drillers begin steam
 cleaning & decontaminating
 rig and tools.
 1200 K. Polombo, T. Benson
 and J. Duncan went to lunch.
 drillers stayed @ site 1.
 1330 Returned from lunch.
 Drillers still decontaminating
 and tools.
 1430 Moved rig onto
 first piezometer location.
 1530
 1500 Began sampling
 Piezometer - 1 (P-1)

TAB

1/24/90

(24)

1530 Breathing space air monitoring

with PID = 0.00 ppm

before drilling (background)

Lower Explosive Limit (LEL)

with Bacharach Sniffer

Combustible Gas Indicator

less than 10% explosibility

1645 Charlie Lutz with

~~Martin Macintosh~~ arrived @ site 1

TAP 7-24-90

He will be back tomorrow

7-25-90 for HAZWASTE audit.

Drillers took break while we talked

7745 to Charlie Lutz

TAP 7-25-90

1715 Drillers began sampling

@ 78' 16'

TAP 7-25-90

1730 Took last soil sample

of the day. Willie needs to

get fan belt for rig. Stopped

drilling @ 20' deep, moist

fine-grained sand, have not

reached water table yet.

Cleaned up site and left

for the day @ 1800.

TAP 7-24-90

(26)	DATE	7/25/90	calibrated PID w/ 100 ppm isobutylene	(27)
	Weather	70's F, partly sunny, breezy	0915 K. Palombo, J. Duncan, C. Cutz, T. Cady went to site 2 to familiarize Cutz & Cady with the site and the work previously performed and work to be performed there.	
	0815	Arrived @ site (Field Team: K. Palombo, T. Benson, J. Duncan, C. Cutz, T. Cady)	0940 Field Team @ Site 2 returned to Site 1.	
		Showered T. Cady around site 1.	0930 Hit water table @ 25'	
		Willie fixing fan belt on rig.	0950 Took 28'-30' sample wet, some hydrocarbon odor	
	0840	Ready to begin drilling from depth where we stopped yesterday 724' 90 @ 28'.	K. Palombo, J. Duncan + T. Benson decided to set P-1 @ 31' with 6' of screen below water table and 4' above.	
		No water in borehole.		
	0900	CEL < 10% (hydr < 10%)		
		Breathing Spas (PID) = 0.00 (hydr. 0.00)		

(28)

1000	J. Duncan left for Atlanta.				(29)
1040	K. Polombo took photos of IANF Fire Training Area near the Munitions Depot at T. Cady's request.	7/5/80	1130	1115	Rain has stopped drilling operations temporarily.
1050	Returned to Sital.		1145	1145	K. Polombo, T. Danson, C. Lutz went for lunch.
	Drillers washing piezometer screen and casing up liquidex when stern cleaning screen & casing.				Drillers Willie & Doug drag stayed on Sital.
1100	T. Cady left for Oak Ridge.		1300		Returned from lunch. Drillers getting ready to install piezometer. Tripped down hole with roller bit to unplug augers.
1110	Augered to 30' and attempted to install piezometer but sand heaved up inside auger is preventing installation. Willie trying to push sand out of augers.		1300		Unplugged augers and installed piezometer P-1

(30)

T-05 11/25/90

Bottom of screen @ 37' -
 top of screen @ 21' 12" waste
 grade. 2.5' below

1400 P-1 sand from 31'
 to 19', bentonite pellets
 from 19' to 17'

2 1/2 bags of sand (polb.
 bags) and 50 lb. bent. pellets
 (1 bucket)

Hydrated bentonite pellets
 14/20 Began to pull augers
 out of borehole.

14/30 C. Lutz auditing field books

14/45 Drillers began deconning
 augers and rig.

(31)

1515 T. Benson took
 K. Palombo to airport

1545 Returned from
 airport. Drillers still
 deconning augers & rig

1615 C. Lutz went to
 airport to check schedules
 for departing flights
 tomorrow 7-20-90.

1715 Water level in P-1
 26' from grade
 strong product odor
 possible free product.
 Rain started again

(30)	1745 Rain has postponed drilling for the day. Left site.	INDG.	Weather: 65-70°F, overcast; predicted rain	7-26-80 (33)
	DPS 7-25-80	0800	Arrived @ Site 1. Drillers (Willie + Drag) already on site.	
		0830	Moved rig to 2nd piezometer (P-2) location, set up for boring/sampling.	
		0900	Began sampling. (continuous) P-2 boring.	
		1000	Willie + Drag trying to fix spoons. Stuck. Steel spoons have become difficult to assemble due to	

(34)

the softness of the steel
and the wear from use.
Filing threads and edge
grooves seems to temporarily
alleviate the problem.

1010 Sampling again.
C. Butz arrived @ Site 1.
Talked about audit, I
signed the Findings & Observa-
tions checklist, in agreement
with and aware of his comments.

1030 C. Butz left site
for airport

1040 I have to calibrate
PID. Having trouble Vdow to
humidity.
(with calibration)

(35)

1100 Calibrated PID to
zero @ ambient air and
100 ppm isobutylene span gas.
Drillers spreading cuttings
around on ground surface.

PID indicates VOC < 100 ppm
in these cuttings. All
cuttings from P-2 will be
drummed from row on.
At 9' hydrocarbon odor
and high VOC levels were
detected in the samples.
Hence cuttings shallower
than 9' were not drummed,
cuttings deeper than 9'
will be drummed.

Breathing air spec monitoring
PID = 0.00 ppm
LEL < 10% (Zeroed to ambient air)

(36)

1230 Finished sampling
P-2. Encountered water
table @ 24.5', sampled
to 30'. Hydrocarbon odors
from 9' to 30'. Slight H-C
shown on water inside spoon @
24.5', sample S-13.

1240 TANG personnel informed;
Willie of airplane engine testing
being performed in the hush box
near the deep pit. We will
not be allowed back in the decon
area until testing is completed.
I gave go ahead to wash and
rinse pressure washer casing & screen
with liquid & clean rinse water.

(37)

before P-2 installation.
1245 Re-charging one of
the Nicotip batteries in bomb
storage hangar next to our
office.

Willie & Doug deconned
P-2 casing & screen and
began installation.

1340 Finished P-2 installation
Cannot deconn augers yet
due to engine testing
procedures.

1430 J. called ES - Cleveland
office and talked to K. Palumbo
about audit.

J. Duncan, ES - Atlanta called about
audit.

(38)

1500 I left site
to try to find product detecting
probe. Need to check P-1
for product, interface probe
will not fit inside piezometer.
Siouxland Engineering
called about product finding
probe I had called about
earlier. They are also working
on the IANGB. I went to
look for them where Capt.
Prescott thought they were
working. I did not find
them. Went to buy string
to lower empty VOA vial
down P-1 for product.

(39)

detection.
1620 Returned to site
1645 IANGB personnel
performing jet engine testing
moved jet. Willie & Drag
set up for steam cleaning.
I found product in P-1
with 1/2" diameter PVC casing
rigged into small boiler and
lowered into P-1. Product is
clear, smells like diesel and
kerosene mix - jet fuel.
Tried to call Capt. Prescott
but he is gone for the day.
Tried to call C. Lutz @
Morton Marine to leave

TIME	ACTIVITY	REMARKS	DATE
0700	Message, but Base for switchboard gone for the day. Will try C. Kutz from hotel room.	Weather 70 s.f., partly sunny	7/27/90
1800	Dry steam cleaning for pressure washer installation (P-3) throw and site 2 bring sampling	0800 Arrived @ Site 1, Willie + Dreg on site. I called F. Polanco to inform him of free product in P-1. He will inform Hazzard or Martin Maritz or Enard	
1845	Left site for the day	0830 I went to make boring log copies @ Capt. Prescott's office	
1340 - 1645	(3 hrs) Standby for Willie + Dreg due to jet engine testing	0845 Returned to Site 1 and set up for sampling	
	T. Benson	0900 Began boring/sampling P-3.	

(43)

10/5 Breathing Air Space
Monitoring
PID = 0.00
LEL < 10%
1100 Hit Hydrocarbon
odors in 5-9 sample @ 17'
Cleared uncontaminated soil
away from augers, will drum
all soil cuttings from 17' to
total depth.
1215 Finished sampling
began P-3 installation
1300 Finished P-3
installation
1315 Began steam cleaning.
K. Polunco called, wants

(42)

Calibrated PID: zeroed to
ambient air; span gas to 100
ppm isobutylene.
Calibrated LEL: zeroed to
ambient air
Filled out field variance
form for switching changing
from air line to vent split zone
to metal spoons due to time
and work involved in filing
spoon edges and threads to
allow assembly of spoons after
cleaning. Pieometer samples
will not be analyzed by lab,
only field screened for VOCs.

(44)

9

(45)

Well Wizard or Interface	He told me someone would be working the weekend to open gates @ Site 2.
Probe sent back to Cleveland.	
Till send interface probe.	
1345 I went to make copies @ Prescott's office and get some lunch.	1515 Munitions personnel escorted us to Site 2.
1410 Returned to site 1, Willie & Doug done steaming	1530 Willie looked over site, began to set up for boring.
1415 Called Munitions to get to Site 2. Ebner said they'd be out in 1/2 hour	1550 Started sampling - Geiger-Müller (Eberline E-100) [CPM] 0-100 background, factory calibrated
1500 I called Munitions and asked about the weekend	1630 stopped boring due to thunder/lightening storm.
	1710 Called Security for escort out of Munitions area.
	1730 Left site for the day. T. Benson 1/24/40

(46)

IANG

7/28/80

Weather: 80 F, overcast

0700 Arrived @ Site 1

and waited for drillers to arrive.

0710 Drillers arrived. Weather was threatening to storm, so we waited to determine if it was safe to drill.

0730 Called Security Police for escort to Site 2.

0740 Security arrived and escorted us to Site 2.

0750 Began sampling @

Site 2 SD-1 for 4 hr. day-
(Eberline E-100) bldg.

Geyer-Mueller: factory core; SD-100 CRL

0930 Hit water table @ 22.5'.

(47)

1015 Finished boring
SB-1, began well installation1045 Need more sand and
formic equipment to set
benzene backfill in temporary
wells at Site 2.
1100 Called Security to
unlock gates.1115 I left drillers @ Alert
Hanger, while they loaded up
supplies. I went to get ice
for samples & drinks.1140 Returned to Alert
Hanger, called Security,
we drove out to gates, and
site.

(18)

1200 Continued installation
of TANG-2-MW-1.

1245 Finished installation
of TANG-2-MW-1

1245-1249
moved to next location

1300 Sycam cleaned equip
at down area.

1400 Returned to Site 2.
Moved to SB-2 location and
began sampling.

1530 Hit water table @
24.5'

1600 Thunder/lightening storm
stopped drilling for Tuesday

(49)

Drillers left for the day
I stayed @ Albert Hugar
and packaged samples for
lab.

1930 I left site for
the day.

T: Benson
7-28-90

(50)

TANG

7/29/80

Weather: 80°F, sunny

0700 Arrived @ Alfort

Hanger 241, drivers on
site. Loaded up supplies
and went to site 2 up

Security escort

0730 Arrived @ Site 2

Ground is wet. Willie

concerned about getting

support truck stuck in

wet mud. Above rental

car around site, ground

appears solid enough. Willie

drove on to site.

0800 began installation

(51)

- two trucks

of TANG-2 - MW-2

Casing and screen was down -

laminated with lignite &

water wash, top water rinse,

DUFF water rinse. Installed

temporary well TANG-2 - MW-2
to 31'.

0930 Came back to Alfort

Hanger to down rigging &

equipment.

1000 Started deconning,

I went to get drinks and

try to find water finding

paste. Could not find paste.

1045 Returned to Base.

Still deconning. I got

water levels in picometers.

(52)	Used Well Wizard for water levels. Could see where product level was on plastic tape above water sensor. Strong product odor in P-1 + P-2. P-1 and P-2 showed product thickness of ~2'. No product in P-3.	Location, TANG-2-SB-3 Began sampling, Geiger-Mueller (Eberline E-120) factory Cal. 50-100 CPM 14400 Hit water table @ 22.5', slight decaying organics odor	(53)
	1200 Finished steam cleaning. I took rinse blank sampler after decoupling steamed spoon DVP with liquorix + water wash. Tap water rinse, DUF water rinse, methanol rinse.	1540 Finished sampling / boring. Began installation of temporary well TANG-2-MW-3	
	1230 Back @ Site 2 Set up on next boring	Took duplicate sample of S-11 20'-22' TANG-2-SB-3 Log # S-11 = Lab sample # S3 Lab sample # S3 = S4 (Duplicate)	

(55)

TANG

7/30/80

weather: 80°S, sunny

0700 Arrived @ Site 1

drillers loading up sand,

water & bentonite for

Site 2.

Sent them out to Site 2.

I had to survey piezometers

@ Site 1, then ^{7/31/80} Site 2.

survey notes, water / product

elevations to Dave's office.

1130 Arrived @ Site 2,

drillers installing temp. well.

TANG-2 - SB/MW-4

(54)

1700 Finished temp.

well TANG-2-MW-3

installation. 1700-1800 Dean

1800 Moved to next location

SB-4 @ Site 2

1805 Began boring / sampling

TANG-2 - SB/MW-4.

1830 Stopped boring for the

day. Called Security for

escort out of Site 2.

1800 Labeled samples

for shipment to Lab tomorrow.

packed up cooler.

1930 Left Site for the

day

TMB
7/31/80

T. Benson 7/31/80

(25)

(25)

1300	Finished installation of temp. well & cleaned up. moved to next location. back ground well.	DOR	Took duplicate sample of S-11 20-20'
1300-1400	Decon equip.		TANG-2-SB-5- Log # S-11 = Lab sample # 53
Geiger-Mueller (Eberline E-100)			Lab sample # 53 = 54 (Duplicate)
factory calibrated; 50-100 counts per minute (CPM) =		1700 1700	Finished installation of temp. well TANG-2-nw-5
background		7/30/90	Cleaned up and left site
1400	Moved on to background well @ Site 2, TANG-2-SB/nw-5		2.
Began sampling.			Wilkie & Doug start cleaning equip @ decon area.
1530	Hit water table @ 24.5'		1800 - left site for Federal Express office
1550	Finished boring, began well installation		to ship water level indicator back to office
			T-Benson 7/30/90

(58)

JANG

7/31/80

Weather: 80°F, Sunny

0700

Arrived @ site 1,

Willie & Doug loading up

equipment & water.

I took rinse blank sample from 7/30/80 before starting drilling for today.

Called Capt. Prescott,

informed him of the spec -

flocking hydrocarbons (P-4

fuel) in P-1 & P-2. He

said he had already been

informed by Guard personnel.

Capt. Prescott was out of the

office on Friday 7/27/80

(59)

and Monday 7/30/80. I

could not reach him on

Base during those days.

0800 Moved drilling rig

on to first boring location

and began sampling.

Decon procedure: liquorinox

and water wash, tap water

rinse, DIUF water (De-ionized

Ultra Filtered) rinse, methanol

rinse, air dry.

PID calibration: zero to

ambient air, span gas: 100 ppm

isobutylene

(60)

Breathing Air Monitoring:

PID = 0.0 ppm

LEL 7.2-10% explosibility

LEL Calibration: zero

ambient air factory calibrated

to hexane.

0930 Hit hydrocarbon odor
in samples @ 14'0945 All cuttings shallower
than 14' were removed from
around augers and spread out
around site. All cuttings
from 14' and deeper will be
dumped.

7/11/90

(61)

1010 Resumed boring/
sampling.1030 Hit water table @
24'1100 Finished boring @
30', set up for IAWG-1-
MW-1 installation1245 Finished installation
of IAWG-1-SB/MW-1,
still grouting to surface1330
1300 Decanning augers &
equipment @ down pad

(62)

1500 Finished steaming
equip. & took rinse blank
after steaming steamed
spoon: liquidex ^{top} water
wash top water rinse, DIUF
water rinse

1530 Began boring

JAN 6-1-5B-2.

1700 Finished boring
for the day @ 10'

1900 I sorted out labels
all samples, packed cassettes
did chain of custody, called

(63)

ES lab in Berkeley, CA
about billing to CEP in
Santa Fe, NM.
left site for 46 day.

T. Benson 7/8/90

(64)

TANG

3/1/90

Weather: 80°F, sunny

0700 Arrived @ Site,

drillers already here.

Continued sampling IADG-1-

SB-2.

PID calibration: zero to

ambient air, span gas = 100ppm

iso butylene

LEL calibration: zeroed to

ambient air, factory calibrated.

to hexane

Breathing Air Spca

Monitoring:

PID 0.0 ppm

LEL < 10% explosibility

0830 K. Polombo called to

inform me that HAZWAST?

wants to abandon the boring

currently being sampled and

move to a location south of

the defueling pit on the

concrete. I acknowledged

and informed the drillers of

that decision. Defining the

edge of the product plume

is the objective in re-locating-

0930 Drivers are abandoning

JAN 6-1-58-2 by installing

o ben bui kam, t gaut

from the bottom of the boring

to ground surface. Bentonite is

Super Crel-X, Extra High

Yield Drilling Fluid, made

by American Colloid Company.

A-1 5% Benzoin / Portland Cement

grout was mixed in grout

46 and ~~turned~~ into the base -

hole.			

1030	Finished grading

bonehole. Took rig to dean

area to steam clean.

[illegible]

(67)

1030 Steam cleaning
qualors + equipment

[illegible]

1200	Finished 5 leami.

equipment	Drillers m

and added max cement

to abandoned barrels.

I made copies of papers

1300 set-up on new

for perimeter well ~ 1000

Source of - / ON CON
TAG-1-5B-3/MW-

11.5	5. Feb 26	5. Feb 26

approximately half way bet

the defueling pit and

Albert Haugan.

1400 Still boring the

concrete with lead pigment

100

(68)

center bit. I'm labeling
samples and pecking orders
for Fed-X.

1500 Through concrete and
into soil sub-base.

1530 Drillers cleared up
site and left for four days
off. Did not want to start
sampling and have to leave
rig set up over hole or
the concrete for four days.

1700 I finished paperwork,
and pepping samples for
lab. Took to Fed-X and

(67)

shipped out. Also Fed-X'd
time sheet and expenses to
Carol Bowers and shipped
hard lens to Jim Duncan,
ES, Atlanta. Finished
for the day.

T. Panson 8/1/90

(10)

JANG -

Weather: 80°F, partly sunny

1050 Came out to site to
move equip to Capt. Prescott's
office & get water product levels.

JANG-1 MW-1 23.25 25.00
Prod water

Interface Probe detected top
of product @ 23.25' &
top of water @ 25.00'

Product thickness = 1.75'
Clear trailer shows 1.50'

P-1 shows no product
1230 left site

7/10/90
5/6/90

(11)

JANG -

Weather: 80°F, sunny

0700 Drillers on site,
I arrived got equip from
Capt. Prescott's office.
Base has lock on office
door, can't get in.

0800 Security came out
with bolt cutters and cut
off lock.

0830 Started boring/sampling
JANG-1 SB-2 where we left
off, below concrete. A gravel/
sand sub-base under concrete
was cleared out by driller to

2'	started sampling	thru	DOB 8/16/90	1200 1100	Finished boring to 32' Drillers getting set up for well installation.
Calibrated: PID:	zeroed to ambient air; span gas = 100 ppm isobutylene			1400	Finished well installation up to top of bentonite pellets, setting up for grouting to surface.
Calibrated LEL:	zeroed to ambient air; factory calibrated to hexane			1530	Finished trenching canary bentonite/grout to ~1' from surface. Cleaned up around top of well, drummed soil from augers.
0.0 ppm w/ PID <10%			DOB 8/16/90	1545	Decoupling augers and equipment with steam cleaner.
1030 Hit water @ 25', sour hydrocarbon odor				1700	Finished steam cleaning

(10)

equipment. I took nine blank

TANG-Y-RB-3.

1730 Finished field notes

and left for the day.

T. Benson 8/6/90

(95)

TANG

8/7/90

weather: 80°F, sunny

0700 Arrived @ Site 1,

drillers arrived same line.

0730 Moved to next boring

location TANG-1-SB-14W-3

north of P-2 ~ 75'.

0800 Began boring/sampling-

1045 Hit water @ 24',

odors @ 16', strong odors

directly above water @ ~ 23'.

1315 Finished well installation

up to top of bentonite pellets.

1400	Finished Penobscot / cement grout tremie to ~2' from ground surface. Began steam cleaning & down pad. I ran errands.	concrete, cleared out hole to 2' and began sampling.
1500	I returned to Site. Drillers finished denoising. I talked to K. Palumbo (ES) about next well location. Moved drillers on to next boring location.	1715 Sampled to 12' and finished for the day. Drillers left. I stayed to label & prep samples for lab.
1530	Began boring through concrete @ IAWG-1-SB-5/mw.4.	1900 Finished prepping samples, will ship out tomorrow.
1630	Finished boring through	T. Danson 8/7/90

(18)

(79)

TAN 6

Weather: 70°F

8/8/90

Sunny

0700 Drillers and I arrived

on site. Set up to continue

boring/sampling on TAN 6 - 1-325/

MW-4 where we left off yesterday.

0915 Hit water @ 25'

0930 Finished boring/

sampling @ 30'. Began

well installation. Augured

to 30', installed well to

30'.

1200 Finished grouting

to ~2' from surface.

Cleaned up concrete area
around well.

1230 Set engine testing

near decom pad preventing

steam cleaning augers &

too/s. Will be doing setting

up to install concrete pads

and flush manhole covers on

wells 1-4

Concrete pads for wells

1-4 are being installed

1630 Set engine tests

are finished for the day.

Drillers moved rig to clean

(30)

pad and skinned augers &
tools

1730 J. left for Fed-X
office to ship samples to
ES lab - Berkeley.

T. Benson 5/5/90

TANG

Weather: 80°F, sunny

0700 Drillers on site,
loading up for tank on support
truck. I arrived and loaded
next baring.

0745 Set up on 18N6-1-
SB-6/MW-5 ~ 100' SW of
P-1.

0800 began sampling.

Calibrated PID: zeroed to
ambient air; spargers to 100
ppm isobutylene.

Calibrated LEL: zeroed to
ambient air; factory calibrated
to hexane.

(31)

8/7/90

(82)

Breathing Air Spec Monitoring:

PID = 0.0 ppm

LEL < 10% explosibility

1100 finished boring/cramping

Hit water @ 24', no definite

H-C odor, but a definite

odor of some kind - from 26'

to 30' (sweet smelling, possibly

hydrocarbon). No product in

samples was visible. PID

readings were low.

well installation

1130 Set up for grouting

of IAN 6-1-58-#mw5.

TAS
8/1/00

(83)

Set well to 30', top

of screen @ 20'.

1300 Sand pack and bentonite

pellets in place, setting up

for bentonite/cement grout

mix backfill.

1330 Finished backfilling

with grout. Cleaned up

around borehole. Cuttings

were uncontaminated based

on screening with PID.

Drillers spread cuttings

around area.

1400 Received call from

Water/Product Levels		Product THK.		map. I started getting levels. Dr. Hoss sitcom cleaning.
DTF	DTW			
JAN 6-1-MV-1	23.42	25.60	2.18'	
"	25.30	25.30	0.00	
"	24.29	24.50	2.21"	1700 Measured product/
AD 94	23.85	26.10	2.16'	water levels in all site
"	24.30	24.30	0.00	wells presently installed
Connection for water tank with floating product				(1-5). Called D. Edwards to inform him it would fit new site sketch and water table / flow direction map
$X = 0.8 \times \text{product thickness (feet)}$				timed morning 8/10/80.
Water elevation + X = corrected water elevation				
D. Edwards - ES. Need				Tried to set up on next boring location but utilities were in the way. Will contact
to know product thickness in wells and current water table				Adapt the theory in the morning. - Thompson 8/19/80

9/26

23/01/80

Westerly 70° S, overcast.

primary

0720

Arrived @ Airpax

office to check on utilities

near next boring location.

Tagged to report personnel	

looked @ maps, went to site

and cleared	boiling location

with Aircraft personnel.

0900

set up for boring/sampling

TANG-1-SB-7/mw-d.

1000

Hit water @ 25'

no orders.

12.00	Finished boring/sampling

45-locked moving, lightning

0020

1330 Regan well installation
of DWS-1-58-7/4WC

Top/ke

1530 Finished well inspection
and set benfont cement grout
to a 2" from surface.

Moved rig to down feed

Ernst Moritz Arndt

5/20/15

Contributors	for the day:

1

PID calibration! zeroed to

ambient air, sparged to 100 ppm
isobutylene.

LED calibration: zeroed to

ambient air, factory calibrated

to hexane gas.

Split Spoon decon procedure:

- tap water + Aquinox wash

- tap water rinse

- DIUF water (De-ionized Ultra-filtered)

rinse

- MeOHanol rinse

- Air dry

1600 I went to purchase

cooler for sample shipping.

Ron Chew informed me the

coolers he sent went to

Cheyenne Wyoming site by

misled. I told him he requested

I send samples Monday, approx.

8/13/90 instead of Sat. 8/11/90.

1700 Drills finished

deconting. I took rinse blank

and called today.

T. Benson 8/10/90.

(90)

IANG
 8/4/90
 Weather: 80°F, sunny
 0700 Drills on site. I
 tried to locate water line.
 near next boring location,
 IANG-1-S38/NW-7, from
 fax I received from D. Edwards,
 ES-Clive. @ hotel last night
 8/10/90. Could not locate
 water line. Set up and started
 boring/sampling very carefully in
 first 10'.

TAP
8/11/90

1030
 0830 Hit water @ 24', no
 odor. S. Dean procedure for
 split Spoon same as page 88.

(91)

1130 Finished sampling to
 30' in IANG-1-S38/NW-7
 Calibration of PID and
 LEL same as on page 87-88.
 Breathing Air Spec Monitoring:
 PID 0.00 ppm
 LEL <10% explosibility
 1200 Began well installation
 1315 Finished installing
 screen, riser, sand & bentonite
 pellets
 1330 Setting up for great
 tremie.

(92)

1400 Bentonite/cement grout
in place from top of bentonite
pellets to ~2' from ground
surface. Cleaned up around
well and moved rig to decom-
pad to steam augers & tools

1550 Finished decoming
augers & tools w/ steam cleaner

1600 Located next boring/
well location from map, fixed to
me by P. Edwards. Map
showed 80' NW of P-3. Took
cap off P-3 and smelled
product odor. P-3 boring log
showed elevated PID readings

(93)

and strong hydrocarbon odor.
Initially, after P-3 installation,
no product was detected
nor product odor.

Began boring/sampling
FANG-1-SB-9/MW-8

1800 Sampled 4.20',
no odor.

Decided to quit for the
day and finish well tomorrow.

T. Benson 8/1/80

(94)

TANG

Weather: 80° F, partly sunny

8/13/90

0700 Arrived @ site,

drillers here, too - Connected
up water tank with water
from hydrant on site.Moved on to TANG-1-SB9/HWS
where we left off yesterday.

0800

Began boring/sampling
@ 20'Hit water @ 23', no odors.
Finished boring @ 30', no odors.

0900

Began well installation.

(95)

Calibrations: PID + LEL

PID - zeroed to ambient air,
span to 100 ppm isobutyleneLEL - zeroed to ambient air,
factory cal. to hexane.

Breathing Air Space Monitor

PID 0.00 ppm

LEL < 10% explosibility

Decon spray procedure -

same as on page 88.

1100 TANG-1-SB-9/HWS installation

(146)

complete up to top of bent/aerent.
great backfill (2' from ground
surface).

1200 Moved rig to clean
pod and steam cleaned
augers & tools.

1400 Took rinse blank
INAG-1RB-5, and field
blank INAG-1-FB-1 of
b41 tap water from hydrant
and DIVE water.

1500 Drillers constructed
concrete pads to MW-5
thru P.

(147)

I labeled and packed
samples.

1800 Drillers left site
for the day.

2000 I left for the day.

T. Benson 8/12/80

DATE	WELL NO.	DTH	DTW	Prod. Yld.
8/13/80				
Near Well: 70's f overcast				
0700 Arrived on site 1, drillers started developing NW-2. I went to get batteries for Interface Probe.				
1000 - 1100 Took water/prod. levels				
Water / Product Levels				
Well #	DTH	DTW	Prod. Yld.	
TAN-1-NW-1	23.40	25.60	2.20	
2	25.02	25.02	0.00	
3	22.28	24.55	2.27	
4	23.82	26.10	2.28	
5	24.58	24.58	0.00	
6	22.87	22.87	0.00	
7	24.41	24.41	0.00	
8	22.70	22.70	0.00	

(100)

of paper work and talk to
Capt. Prescott about project.
Stopped to buy small cooler
for samples.

1800 Arrived Fed. Ex
office and began shipping
out coolers and Rad.
field book to K. Palumbo
ES.

1900 Returned to site.
drillers gone. I cleaned
up & left for the day.

T-Danson 8/13/90

(101)

8/14/90

TANQ

Weather: 80° F, sunny

0700 Arrived on site.
drillers here.

I made phone calls to
decide about soil pipes @
Site 2 and getting surveyor
to survey site 2 wells ASAP.

0800 we went to dump
trash (paper)

0900 Drillers started
developing Site 1 wells.

Pat McDonnell (ES) here.
is arriving this morning to
assist with water sampling.

TAB
8/14/90

(101)

1230 Returned w/ P. McDermott

and got sampling equip.

together for Site 2

Purged and sampled wells

1-5 @ Site 2, took

duplicate @ MW-5, labeled

it MW-6.

MW-5 36 baits

Temp = 57°F

pH = 7.1 pH

Cond = 1800
(µMhos)

1600 Finished sampling

wells @ Site 2.

Decanted bailers between

(103)

each well.

Dean procedure

- Tap water & liquor was 54

- Tap water rinse

- DIUF water rinse

- Methanol rinse

- Air dry

MW-1 36 baits

Temp = 56°F

pH = 6.9

Cond = 1750 (µMhos)

MW-2 36 baits

Temp = 57°F

pH = 7.0

Cond = 1700

(104)

S/15/80

TANG

MW-3

36 bail/s

Temp = 57°F

pH = 7.0

Cond: 1800

MW-4

36 bail/s

Temp = 58°F

pH = 6.9

Cond: 1800

16:00 left Site 2 and

labeled & packed samples
in coolers

1800 Took waters to

Fed-Ex office and shipped
out.

1830 left Fed-Ex office.

T. Jensen 8/14/80

Weather: 70°F, sunny

0700 Met drillers on

Site. Drillers loading up
for trip home. Met ^{much} they

can do today because we are

waiting on Site 2 soil lab

results. It contaminated,

we will need more barrels.

All barrels being used now.

Put ~~at~~ ^{is} labeling sample
bottles for sampling Site 1
wells today.Duplicate sample for volatiles
is labeled MW-9, taken from
TANG-1-MW-8

(106)

Duplicate sample for

gross alpha/beta + radium

226, 228 's labeled MW-10,

taken from TANG-1-MW-6

Put decontaminated barrels and

made out chains-of-custody

for all coolers while I am

errands and bought supplies.

1130 Decon procedure:

- tap water & liquor wash

- tap water rinse

- DUF water rinse

- methanol rinse

- air dry

(107)

TANG-1-MW-2

DTU = 25.01'

Temp 62°F, 61°F

pH = 6.9, 7.0

Cond 800 (uathos), 800

TAB
8/15/90

Depth to well screen bottom = 30.65'

Depth to top of screen = 20.00'

30 Boils = ~ 10 gal

108

1ANG-1-MW-5

DTW = 24.57'

Depth to well bottom = 30.65'

Depth to top of screen = 20.00'

Temp. = 58°F, 59°F

pH = 7.0, 6.9

Cond. = 800, 800

36 br/s = ~12.5 gal

1ANG-1-MW-6

DTW = 22.85

Depth to well bottom = 30.50

Depth to top of screen = 20.00

Temp = 58°F, 59°F

pH = 7.1, 7.0

Cond = 900, 800

30 br/s = ~10 gal

(110)

IAG-1-MW-7

DTW = 24.45'

Depth to well bottom = 30 - 30

Depth to top screen = 19.80

Temp = 57°F, 58°F

pH = 6.9, 7.0

Cond = 800, 800

30 bails = ~10 gal

(111)

IAG-1-MW-8

DTW = 22.69'

Depth to well bottom = 30.45

Depth to top screen = 29.00

Temp = 58°F, 59°F

pH = 6.9, 6.9

Cond = 800, 900

30 bails = ~10 gal

1445 Long Street New York

Siouxland Engineering

gained on Base to learn

sites	1	2	for survey

We walked side 1 and

Site 2	Talked to Capt.

Prescott about 1845 of

the eyes and bench marks

on the Base.

1730	Jerry Stephan left

side.	I	helped	Pat	McDonnell

pack samples in coolers

and take	water	4.5011

samples of the dotting

Pit.

1830 We will ship wings

tomorrow, cleaned up

Alex Hanger office and

look equip to ship food-

Ex	back	to	Cl	valent

left side.

T. Benson 8/5/90

74N6

Water: 80°F, sunny

0880

Pat McDonnell &

I delivered samples to

Fed. Ex. office and also shipped

equip	to	Chr. office.

1100' flew out of Sioux

city.

T. Hansen	8-16-90

(114)

TANG

8/21/80

Waco Kher: 70 ft, cloudy

0800 K. Palombo, T. Benson

arrived @ site 1. Picked

up Hermit Pressure Transducer

Data Logger, and other

equipment that was Fed-Ex'd

to Capt. Prescott's office.

Went to Aft Hanger

and set up Hermit computer

for site 2

1000 Took water/product

levels in wells @ Site 1.

(113)

DTF DTW Pco That

MW-2 25.00 25.00 0

MW-7 24.41 24.41 0

MW-5 24.56 24.56 0

MW-8 22.68 22.68 0

MW-6 22.87 22.87 0

MW-3 22.25

1100 Moved to Site 2

to get water levels and

perform aquifer testing with

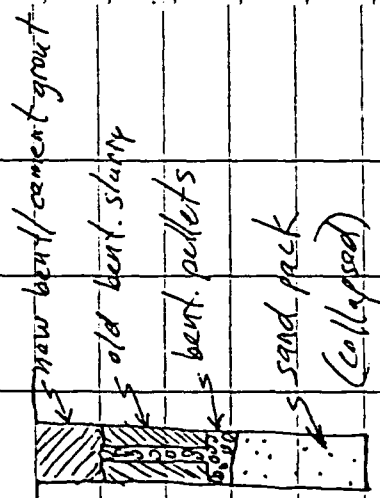
Hermit.

116	Site 2			TANG	8/22/80	(117)
Well	DTW (from top of casing)				Weather: 70's F, cloudy, drizzle	
MW-1	26.02					
MW-2	25.88			0800	K. Palombo, T. Benson arrived @ site 1. Drillers on site cleaning up down pad and getting ready to remove temporary wells at site 2.	
MW-3	25.36					
MW-4	25.52					
MW-5	25.84					
1115	Set up Hermit for aquifer testing and began performing slug tests on monitor wells.			0900	KMP + STD setting up for Hermit aquifer testing at site 1. Drillers waiting on rain.	
1630	Finished aquifer testing at site 2, called for gates to be unlocked.					
1700	Left site 1. Alot Hanger for the day. T. Benson 8/23/80			1000	Drillers move out to site 2 to begin removing	

Temporary wells

Removal procedure:

- pull 2" pvc temporary well with drilling rig cable winch
- measure depth to top of sand pack (collapsed)
- add bentonite pellets up to top of old bentonite slurry
- add new bentonite/cement grout to surface



- 1100 KMP & TAB running aquifer test on site / MW-2, 5, 6, 7, 8
- 1330 Finished aquifer testing. Packed up Hermit & equipment for Fed. Ex.
- 1400 Went to Fed. Ex. to ship Hermit & equip to Sinking Springs, PA. for different project.
- 1530 Took KMP to airport. KMP flew out @ 1600.
- 1700 Labeled barrels of development/purge water. Left for day 19/20/21/22

(170)	IANG	8/23/90	this time.	(121)
	Weather: 70°F, cloudy			
	0700 Drillers on site,		0930 I faxed development	
	I arrived, talked to drillers		and purge data to L. Polombo,	
	about drumming soil @		ES - cleve.	
	Site 2.		1000 Took field blank	
	0800 Drillers moved out		samples of DIUF water	
	to Site 2 to start		used in decontaminating	
	drumming soil. I decided		bailers, IANG-1 FB-2 (DIUF).	
	to drum soil @ Site 2 based		Also got sample of fresh	
	on verbal results from CEP		product (JP-4 fuel) and	
	lab doing alpha/beta and		old product from IANG 1-MW-4.	
	radium analyses. Verbal		Sent to ES lab, Berkeley, CA.	
	results indicated some		Cleaned up office area.	
	alpha/beta in soils. Radium			
	results are not ready at		1400 Took samples to	

(103)

Fed. Ex. out shipped
out. Also shipped Duv
water + methanol back
to ES - clone.
JP-4 samples needed to
be re-packed in 2 - 16 oz.
jars instead of 2 - 1 liter
ambers half-full. I took
them back to Base and
re-packed. Also packed
all extra sample bottles &
jars not used and prepped
them for shipment to ES
lab.
2030. Got everything ready
for tomorrow morn. to ship
out then fly out.
T. Peterson 5/22/90

9/3/80

TANK

Weather: 70°F, p. cloudy
0700 Met drillers at
Site 1. They are
almost ready to leave
site. They finished
drumming Site 2 soil
cuttings and brought
drums to Site 1 where
Capt. Prescott indicated
he wanted the drums stored.
I labeled all drums.

Drillers took wooden frames
off frame well & piezometer
pads while I went to Site
2 to check things over

(123)

5/24/90

(134)

and take pictures.

0830 Dillars left site. I stamped well and piezometer #s on IANB-1-MW-1 through MW-8 and P-1, 2, 3. Loaded up equipment and product samples to Fed. EX. out

0845 Left for Fed. EX. office

0900 Arrived Fed. EX. and shipped everything out.

0945 Arrived back at Airt Hanger to load up the rest of equip. & extra bottles. Called Capt. Phasutti, but not in. Called ES-clay. talked to KAH.

(135)

1010 Left for Fed. EX. and shipped everything out.

1030 Left Fed. EX. for airport.

1045 Arrived at airport and returned rental (Budget) car.

1100 Boarded flight for CLEVELAND, OHIO

~~1100 Boarded flight for CLEVELAND, OHIO~~

~~1100 Boarded flight for CLEVELAND, OHIO~~

T. Benson 8/24/90

11A14

Rad. Area Survey Book

No. 105

LANG B 7/17/90

WEATHER 85° 14:30

FIELD TEAM GS K. M. Colombo

J. L. Hansen

Prepare to conduct Radiation

Survey across Site 2

Babe Munitions Office has

provided personnel to open

and close gates for us.

We are not permitted

to come and go on our

own

Discussed Health & Safety Issues

Potential Hazards

as discussed on page 6-6

of Health and safety plan

2

CALIBRATE INSTRUMENT

Eberline "E 120" INSTRUMENT

SERIAL NO. 13450

MODEL NO.

CALIBRATED WITH A SOURCE

CHECK - Cesium 137 "CS-74"

Gen. Amp. Readings at 3' above ground.

* Instrument calibrated at

factory on 6-19-90

Calibration is good with

9-1990

BACKGROUND - HP270 probe - 0.02 MR/Hr.

Began survey with 80 foot ^{HP} probe

findings, 8 points - 20 ft from fence

all readings background

Continued survey: 8 pts. equidistant

around the fence. All readings

background.

Survey numbering system

IANGS-2-RAD-SL THAW 528

1. 2. 3.

9. 10. 11.

8. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.

7. 6. 5.

522-28 same points as 517-22 respectively
just a probe change

O - indicate casing lids

All survey readings - Background

Note:

HP270 probe and HP210 probe

Readings taken at the same

positions inside the fence.

3

(N)

Continued surveying inside the fence - 3 pts on contact with the lids of the cas. N.G.s. All Background. 3 ground cover pts. - All Background.

Changed Probe to HP-210 (Higher sensitivity) and performed source check - satisfactory.

Background: 50 cpm
monitored 6 points inside fence.

All contact points, 3 on rising
Lids & 3 on the soil.

All Readings Background.

Marked Tentative well locations
using stakes (wooden) & flagging tape.
Left site at 16:00

Ken M. Palmer

IANG

Field Equipment Book

Notes

| | |
|---|---------|
| IANG | 7/25/90 |
| Weather 70°F, partly
sunny, breezy | |
| Photovac | |
| Gas Chromatograph (GC) | |
| calibrate GC by the
following method: | |
| fill internal gas reservoir
with zero ^{air} gas carrier gas
as 7/25/90 | |
| and set up standard of
o,p xylene, benzene,
toluene (BTX), calibrate | |
| GC to a ppm BTX | |
| standard (taken from
soil gas survey field book
7-17-90) | |
| | |
| | |
| | |

| Radiation Detector | Magnetometer |
|---|---|
| Eberline E-120/H6-270 | GeoMetrics G 820 |
| Servo No. 13450 | Magnetometer |
| Source Eberline MP-1 SW 123 | Factory calibrated, batteries good |
| CS-137/SW EI-123 | Field calibrated to 5000 |
| CS-137 SW EI-153 | Fillogramms based on illustration and instructions in manual. |
| - calibrated with a source | (taken from Mag. survey field notes 7-18-70) |
| checks in field | |
| - calibrated @ factory on 6-19-70 and is good | |
| through 9-1970 | |
| (taken from Rad. survey field notes 7-17-70) | |

Photores Microtip PID

Hand held Air Monitor

Photoionization Detector

MP-100

Serial No. NA890188

Specificity Gas Mixture:

100 ppm Isobutylene

Lot 31030

- Calibrated with

ambient air for zero

gas and 100 ppm

isobutylene for span

gas. Taken from 1/15/90

Combustible Gas Indicator

Bacharach

Sniffer Model L

Part No. 23-7271

Serial No. UBDS17

- factory calibrated

with hexane

- field calibrated zero

to ambient air

Water Level Indicator

Well Wizard

Model 6000

Serial No. 10599

Calibration field checked

- ~~Field was 10599~~
~~Field was 10599~~ on

25' survey rod

IANG

Surveys Survey Book

Notes

7-17-90 1
IANGB 7-10-90
WEATHER 80° F sunny
0815 AIRM @ site w/field team
F. Palombi, T. Benson
J. Wenzel S. Fiore
0900 Start to set up
GC equipment - fill
internal gas reservoir with
BP 7.0.10¹⁰ gas
zero carrier gas and
setup standard of
propylene, benzene, butane
(BTX)
0930 - GC equipment set
up and standard
made. Will start
to calibrate equipment
now. Calibration using
1 ppm BTX std prepared
earlier.

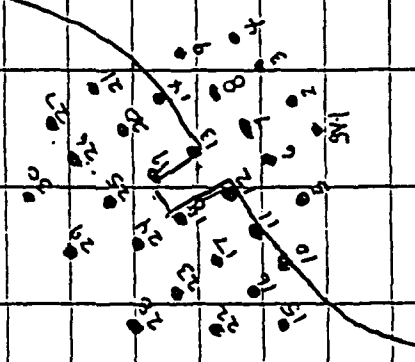
30

17 July 1990

↑N

Soil Gas Survey
Sampling Grid

SAMPLING NUMBERS IANDB - SY-1 → SY-30



2

0940 INTER STOP. INTO GC
INSTRUMENT will not
calibrate correctly.
INTERNAL FLOW'S are probably
out of spec. Need to
fix. Start to change flows

1020 Call numbers for
above or above
mentioned problem.
It gave correct flow
rates for each channel
of GC.

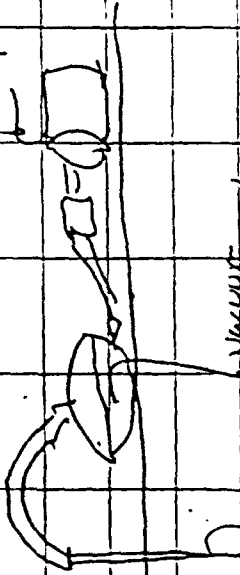
1050 Cal GC again w/ BTX ST
still not able to
calibrate GC correctly

5

| | | | |
|------|---|------|---|
| 1130 | WENT TO LUNCH
TO BUY CHROMATOGRAPHY
PAPER FOR GC
RTN. GUNNATHUR ET AL. | 1500 | GC UP AND RUNNING
AFTER CALIBRATING AIR-FLOW
IN SERIES AND IN PARALLEL. |
| 1300 | RTN TO BASE MEET
W. CAPT G. P. SCOTT
ABOUT FLIGHTLINE PROBLEMS
+ SECURITY ACCESS | 1530 | CALIBRATE GC TO
A 1 PPM STD BTX
AND DECON ALL SAMPLES
PROBES USING FOLLOWING
PROCEDURE:
- WIPE ALL DIRT OFF
- CLEAN SAMPLE PARTS
- CLEAN FOR MIN 2 MIN WITH
AIR COMPRESSION
- RUN PERIODIC BLEND |
| 1430 | RTN TO 241 AND CALL
PASCAL LA FANTANA OF
PHOTOCHE INC TO OBTAIN
FURTHER TECHNICAL
INSTRUCTION. INSTRUCTIONS
RECEIVED. SEPTEMBER WAS
LOOSE AND NEEDED REPLACEMENT
DISK DRIVE. | 1540 | START TO COLLECT
SV SAMPLES USING
TRAIN SHOWN ON
PAGE 8 |

[illegible]

vac pump

vacuum
breaker w/ water
vapor bag in soilsoil
vapor
sample
probe

sampling protocol

- Drill hole through concrete / asphalt if needed
- Drive slambor to depth - 6 inches
- insert deaerated probe into hole
- Drive probe ~~probe~~ ^{5 ft} to depth using hammer
- connect vacuum pump to probe and evacuate

hole for mini minide

- attach sampling train to

to probe

- collect sample / INTERBAG
7-12-77

- run soil vapor sample

on GC

1550 sample SV 1-2' collected
from a depth of 2 feet

1555 sample SV 1-4' collected

from a depth of 4 feet

water may be at depth in

hole RUN SV 1-2'

sample

BIX present

draw needle by way

zero Air - deaerated
equipment by

1510

| | | | | | | |
|------|----------------------|----------------|------------|----------------------|-----------------------|----|
| 1610 | run | SUS | 4' sample | 1643 | decon needle and run | 11 |
| | B TX | present | 250' 10gms | | SUS 3 @ 2' on GC | |
| 1618 | 6' sample | not possible | probed | | net 250' @ 10gms | |
| 1620 | will take | 2' SUS survey | | SSP | B7 x detected | |
| | as it exhibits | highest | | ~~1643~~ 1710 | needle blank inserted | |
| | BTX ready | | | | rework 250' / 10gms | |
| 1630 | Collect | SUS 2 @ 2' | | 1710 | | |
| 1635 | Run | SUS 2-2' on GC | | 1715 | clean up GC equip | |
| | using decontaminated | needle. 10gms | | | leave out for day | |
| | 250' @ 10gms. | | | | | |
| 1640 | Collect | SUS 3 @ 3' | | | | |
| 1645 | decon | SUS equipment | | | | |
| | train by | methods | | | | |
| | described on | pages | | | | |

SSK

| 14 | TABLE OF CONCENTRATIONS | | | | N SOIL GATS | |
|------------|-------------------------|-------|----------------|------|---------------|----------|
| SAMPLE | DEPTH
(Feet) | TIME | VOLUME
(UL) | DATE | CONCENTRATION | COMMENTS |
| | | | | | ppm | |
| Column Blk | - | 8:50 | - | 2 | ND | ND |
| STD 1 | - | 9:00 | 250 | 2 | A-B 5/RT | |
| STD 2 | - | 9:02 | 250 | 10 | 1.00 | 1.00 |
| SV-4 | 2ft | 9:30 | 250 | 10 | ND | 1.239 |
| SV-5 | - | 10:00 | 250 | 12 | ND | ND |
| SV-6 | - | 10:10 | 250 | 2 | ND | ND |
| SV-5 | 2ft | 10:24 | 250 | 2 | A-B 5/RT | |
| SV-5 | 2ft | 10:26 | 250 | 10 | .046 | .3216 |
| SV-6 | 2ft | 10:43 | 250 | 10 | .197 | .290 |
| SV-7 | 2ft | 11:00 | 250 | 10 | ND | .790 |
| SV-8 | 2ft | 11:17 | 250 | 10 | .182 | .565 |
| Column Blk | - | 11:30 | 250 | 10 | ND | ND |
| SV-9 | 2ft | 11:40 | 250 | 10 | ND | .220 |
| SV-10 | 2ft | 11:50 | 250 | 10 | .050 | .554 |
| SV-11 | 2ft | 12:10 | 250 | 10 | .099 | .512 |
| | | | | | .110 | .181 |

M-xylene peak

M-xylene peak

M-xylene peak

16

17

| | | | | |
|------|-----------------------------|---------|------|---|
| 0500 | INJECT 2500 | BTR | 0935 | Collect SV-S |
| | SID @ 2 gain | | | Using train and equip |
| | | | | procedure on page 8 @ 2' |
| 0502 | Abort above run end | | | |
| | re inject 2500 | BTR SID | 0945 | GC turns off needs |
| | @ gain of 10 | | | AC to finish operation |
| | | | | connect to ^{safe} plot extension |
| | | | | cord in outlet. |
| 0915 | Calibrate GC to 5+10 and | | | allow GC to warm up |
| | begin to collect samples | | 0958 | after reestablishing power |
| 0925 | collect sample SVS-4 | | | |
| | using equipment train and | | 1000 | inject 250 u/l reader |
| | sampling protocol listed on | | | blank to document decay |
| | page 8 from @ 4' | | | procedure |
| 0930 | inject SVS-4 | | 1005 | Collect SV-6 for |
| | zero needle by | | | 2 feet |
| | using zero air | | | |

| | | | | | | |
|------|-------------------------------------|-------|--|--|--|-----|
| 1018 | decontaminated | | | | | 19. |
| 1010 | re injected needle blank | 10410 | inject 250ul @ 10g | | | |
| | after accounting | | of SV-6 into GC | | | |
| | of p-xylene still exist. | | decon needle w/can | | | |
| | needle is clean | | collect SV-8, 9, 10, ¹⁻¹⁰⁻⁹ ~~SV-8~~ | | | |
| 1015 | collect SV-7 using | 1045 | using train and protect | | | |
| | equipment train and protect | | on page 8. | | | |
| | shown on page 8 | | GC battery pack ^{SS-8/9} | | | |
| 1024 | inject SV-5 into | | loses power - Plug into | | | |
| | GC / Abort ^{SV-10-9} reset | | charger | | | |
| | gain factor: 10. | 1100 | inject SV-7 250ul | | | |
| 1025 | re inject SV-5 250ul | | at gain of 10 into GC. | | | |
| | @ gain of 10 | | decon needle using zero air | | | |
| 1030 | Decon SS Sampling Probe | 1110 | decon SS probes and | | | |
| | by methods given on | | train using protect | | | |
| | page 5. | | listed on page 5 | | | |

20

| | | | | | |
|------|----------------------|------------|------|--------------------------------|------------------|
| 1117 | INJECT SV-8 | 250ul | 1120 | lost on | page 8 - then |
| | original 10 into GC | | | deconned | same by protocol |
| | Decon Needle | | | lost on | page 5. Decon on |
| 1130 | inject sample + air | | 1210 | small ^{0.10} detected | on SV-12 Probe |
| | decon blank 250ul | | | INJECT | 250ul at 10 |
| | original 10 into GC | | | gain of | SV-11 into |
| | | | | GE Decon needle using | |
| 1140 | inject SV-9 | 10 gain | | zero air | |
| | 250ul into GC | | 1220 | INJECT | 250ul at 10 |
| | Decon needle | | | gain of | SV-12 into |
| | | | | GC Decon needle using | |
| 1150 | inject SV-10 | at 10 gain | | zero air | |
| | 250ul into GC | | | | |
| | decon needle | | | | |
| | | | 1230 | Break for lunch | |
| 1200 | collected SV-11 | and | | | |
| | SV-12 using protocol | | 1330 | return to site for lunch | |

21

22

1335

restart GC and
recalibrate unit.

inject 250 ul of 1 PPR

BTX 5 TO @ gain of 10

to calibrate

1345 Abort re inject w

gain of 10. Collect SV 14

and SV-15 w/ sample in on log

1415 inject SV-15 250 ul

@ gain of 10

Per equipment

1426 ^{SV-14} inject SV-14 250

ul @ gain of 10

Decon needle

1446 inject needle blank

250 ul @ gain of 10

23

1455 inject SV-15 250 ul

@ gain of 10

Decon needle zero Air

1510 inject SV-16

250 ul @ gain 10

Decon needle using

zero Air

1515 Collect SV-17

from 2' vialy decon

to probe and equipment

train listed on page 0

1527 inject SV-17

250 ul @ gain 10

Decon needle using

zero air

| 24 | SAMPLE | DEPTH
(ft) | TIME | NO. OF
(ul) | GAIN | CONCENTRATION
PPM | WATER
PPM | OXYGEN
PPM | P. VALUE | # | 25 |
|----|--------------|---------------|------|----------------|------|----------------------|--------------|---------------|----------|----|---------------|
| | BTXSD | — | 1335 | 250 | 2 | A | B | 0.82 | | 17 | 6.111112 |
| | BTXSD | — | 1345 | 250 | 10 | 988 | 980 | 9.87 | .322 | 18 | |
| | SV-B | 2 | 1415 | 250 | 10 | 425 | 1.710 | .122 | ND | 19 | |
| | SV-14 | 2 | 1420 | 250 | 10 | .028 | .386 | .698 | .595 | 20 | m xylene also |
| | needle blank | — | 1440 | 250 | 10 | ND | ND | ND | ND | 21 | |
| | SV-15 | 2 | 1455 | 250 | 10 | .052 | .412 | .586 | .485 | 22 | |
| | SV-16 | 2 | 1520 | 250 | 10 | ND | .039 | .336 | .451 | 23 | m xylene also |
| | SV-17 | 2 | 1535 | 250 | 10 | .139 | .444 | .627 | .446 | 24 | |
| | SV-18 | 2 | 1600 | 250 | 10 | .034 | .476 | .718 | .762 | 25 | |
| | SV-19 | 2 | 1640 | 250 | 10 | .093 | .693 | .874 | .994 | 26 | |
| | SV-20 | 2 | 1643 | 250 | 10 | ND | ND | .229 | ND | 27 | |
| | " | 2 | 1700 | 250 | 10 | ND | ND | ND | ND | 28 | |
| | SV-20 | 2 | 1715 | 250 | 10 | .047 | .642 | .647 | ND | 29 | |
| | Cal BTX | — | 1740 | 250 | 10 | 1.053 | .946 | .377 | .750 | 30 | |

260 1530 collect SV-18 from 1700 re-inject decon blank
 2' using deconmed after observing that concentration
 sample train as per of xylene were present in
 pop 5, 8 the first decon blank.
 1545 1 HJECT SV-18 250ul @ gain of 10
 250ul gain 10
 Decon needle with 1712 collect sample SV-20
 zero air using techniques listed on
 1600 Collect SV-19 using pages 8 and 5
 deconmed sampling train 1715 inject SV-20 250ul
 as per pop 5, 8 10' gain Decon needle.
 1645 inject 250ul @ gain of with zero air.
 10 of SV-19
 Decon needle w/ zero air 1730 pack up decon
 decon equipment train done for day.
 inject decon blank.
 250ul @ gain 2551

27

283

29

1A NGRB

7/4/90

Decom Procedures

cubon - 75° range

0810 arrive on site proceed to

bldg 241

1

SAMPLE TRAIN

AFTER EACH SAMPLE,

COMPRESSED AIR WILL BE

PUSH THROUGH ENTIRE

SYSTEM TO VOCALIZE

ANY RESIDUAL VOCs

DECON BLANKS WILL VOC.

INJECTION NEEDLE

AFTER EACH INJECTION

NEEDLES WILL BE

DECONTAMINATED USING ZERO AIR

TO VOC. ANY VOCs

Probes

as per page 5.

0820 set up GC and turn

on to calibrate after

filling reservoir w/ zero

air. Decon probes and 2

sample train as per page

0830 prepare 1 ppm BTX

standard run column

Blank - Decon needle

with zero air

3

858 INJECT 25001 BTX STD

AT GAP of 10 down

needle w/ zero air

283

1/1/90

7/1/90
cubon - 75° rainy

0810 arrive on site proceed to

blk 241

0820 set up ck and turn on to calibrate after filling neuron w/ zero air. Decon probes and

sample train as per pg

0830 prepare 1 ppm BTX standard run column

blank - Decon needle

with zero air

858 inject 250 ul BTX STD

AT end of 10 decon

needle w/ zero air

29

Decon Procedures

1 SAMPLE TRAIN

AFTER EACH SAMPLE,

COMPRESSED AIR WILL BE

PURGE THROUGH ENTIRE

SYSTEM TO VOCALIZE

ANY RESIDUAL VOCs

DECON BLANKS WILL VOC.

INJECTION NEEDLE

AFTER EACH INJECTION

NEEDLES WILL BE

DECONED USING ZERO AIR

TO VOC. ANY VOCs

Probes

as per pages.

| 30 | SAMPLE | DEPTH | TME | Vol | bar | Benzene | Toluene | o-xylene | p-xylene | # | Comments |
|----|---------------------|-------|------|-----|-----|-----------|---------|----------|----------|----|----------|
| | | ft | | ul | | PPM | PPM | PPM | PPM | | |
| | Column Blank | - | 858 | - | 2 | ND | ND | ND | ND | 1 | - |
| | BTEX STD | - | 911 | 250 | 10 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | |
| | DECON/
NUCLE DUK | - | 920 | 250 | 10 | A PIPOR-T | | | | | 3 |
| | Run 2 | - | 932 | 250 | 10 | ND | ND | ND | ND | 4 | |
| | SV-21 | 2ft | 944 | 250 | 10 | 1.257 | 1.445 | 1.024 | 1.72 | 5 | |
| | SV-22 | 2ft | 1001 | 250 | 10 | 1.037 | 1.520 | 1.470 | 1.91 | 6 | |
| | SV-23 | 2ft | 1015 | 250 | 10 | 1.465 | 1.881 | 1.890 | 2.21 | 7 | - |
| | SV-24 | 2ft | 1028 | 250 | 10 | ND | 1.572 | 1.245 | 1.23 | 8 | - |
| | Decontam | - | 1044 | 250 | 10 | ND | ND | ND | ND | 9 | |
| | SV-25 | 2ft | 1158 | 250 | 10 | 1.302 | 1.796 | 1.370 | 1.504 | 10 | |
| | SV-26 | 2ft | 1111 | 250 | 10 | 1.770 | 1.278 | 1.357 | 1.354 | 11 | |
| | SV-27 | 2ft | 1126 | 250 | 10 | 1.232 | 1.460 | 1.220 | 1.58 | 12 | |
| | NUCLE DUK | - | 1145 | 250 | 0 | ND | ND | ND | ND | 13 | |
| | SV-28 | 2ft | 1157 | 250 | 10 | 1.251 | 1.707 | 1.714 | 1.648 | 14 | |
| | SV-29 | 2ft | 1201 | 250 | 10 | 1.109 | 1.426 | 1.991 | 1.7 | 15 | |
| | SV-30 | 2ft | 1102 | 250 | 10 | 1.057 | ND | 1.1 | 1.307 | 16 | |

31

32

0920

INJECT 250 ul

1005

INJECT 250 ul of

DEION BLANK TO

SV-23 @ gain of 10

ENTER DEION PROCEEDURE

DEION NEEDLES W

ABORT -- RE DEION ~~SV-23~~

ZERO AIR

925

REINJECT 250 ul Deion

1020

INJECT 250 ul of

blanks - collect SV-21 using

SV-24 @ gain of 10

sampling protocol on page 8

deion needle w/ person

935

INJECT 250 ul of SV-21

collect sample SV-25

at gain of 10 Deion

SV-26, SV-27 and SV-28

needle with Deion.

using deion sample probe

Deion sample train

and then tested on page 8

940

collect sample SV-22

using protocol on page 8

INJECT 250 ul of

945

INJECT SV-22 250 ul gain 10

Deion blank at gain of

950

collect SV-23 and SV-24

10.

using sample train of

page 8

33

| | | | | | | |
|------|----------------------------|------|--------|---------------------------------|-----------------|-------|
| 34 | | | | | | 35 |
| 1048 | INSECT 250ul @ gain 10 | 1145 | INSECT | SV-28 | 250ul | |
| | of SV-25, Decon | | | a gram of | 10 | Decon |
| | sampling train and | | | needle and | seawater | SV |
| | needle | | | equipment | | |
| 1111 | INSECT 250ul @ gain 10 | | | | | |
| | of SV-26 Decon | 1157 | INSECT | SV-29 | 250 | |
| | sampling train and needle | | | ul | at a gram of 10 | |
| 1120 | INSECT 250ul @ gain 10 | | | Decon needle and seawater | | |
| | of SV-27 decon all | | | SV equipment | | |
| 1130 | Collect SV-28, SV-29 and | 1210 | | clean back | | |
| | SV 30 using decontaminated | 1:45 | | return from back of | | |
| | sampling train and needles | | | taking to duffel, Cap's Presci- | | |
| 1135 | INSECT 250ul @ gain 10 | 1:50 | | INSECT 250ul @ gain 10 | | |
| | 250ul @ gain 10 | | | of SV-30 | about | |
| | | | | run Changy gain 10 | | |

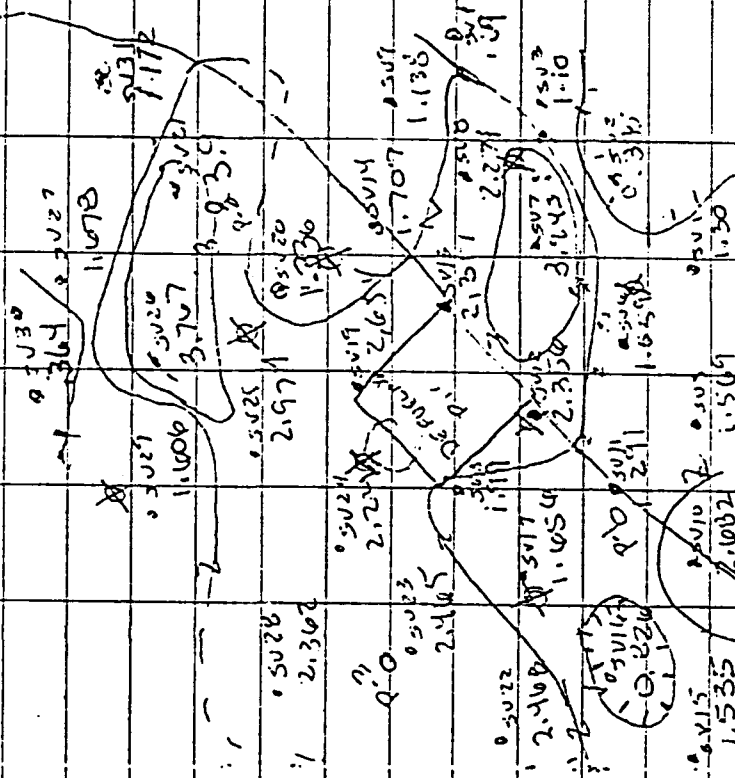
26

151 reinspect at gain of 10
250 u / 30 decem need
and sample time.

201 collect are additional
soil vapor sample from
an additional point
added to cross a
plume of contaminants
this point is below
1 ANKOSTSV31 and
is located 20 away
from SV21

210 INJECT SV31 250 u @
gain of 10. decem need
puck equipment

TOTAL BJA 150 and MIP 37



23

| SAMPLE | DEPTH |
|--------|-------|
| 1 | 0.5 |
| 2 | 1.0 |
| 3 | 1.5 |
| 4 | 2.0 |
| 5 | 2.5 |
| 6 | 3.0 |
| 7 | 3.5 |
| 8 | 4.0 |
| 9 | 4.5 |
| 10 | 5.0 |
| 11 | 5.5 |
| 12 | 6.0 |
| 13 | 6.5 |
| 14 | 7.0 |
| 15 | 7.5 |
| 16 | 8.0 |
| 17 | 8.5 |
| 18 | 9.0 |
| 19 | 9.5 |
| 20 | 10.0 |
| 21 | 10.5 |
| 22 | 11.0 |
| 23 | 11.5 |
| 24 | 12.0 |
| 25 | 12.5 |
| 26 | 13.0 |
| 27 | 13.5 |
| 28 | 14.0 |
| 29 | 14.5 |
| 30 | 15.0 |
| 31 | 15.5 |
| 32 | 16.0 |
| 33 | 16.5 |
| 34 | 17.0 |
| 35 | 17.5 |
| 36 | 18.0 |
| 37 | 18.5 |
| 38 | 19.0 |
| 39 | 19.5 |
| 40 | 20.0 |
| 41 | 20.5 |
| 42 | 21.0 |
| 43 | 21.5 |
| 44 | 22.0 |
| 45 | 22.5 |
| 46 | 23.0 |
| 47 | 23.5 |
| 48 | 24.0 |
| 49 | 24.5 |
| 50 | 25.0 |
| 51 | 25.5 |
| 52 | 26.0 |
| 53 | 26.5 |
| 54 | 27.0 |
| 55 | 27.5 |
| 56 | 28.0 |
| 57 | 28.5 |
| 58 | 29.0 |
| 59 | 29.5 |
| 60 | 30.0 |
| 61 | 30.5 |
| 62 | 31.0 |
| 63 | 31.5 |
| 64 | 32.0 |
| 65 | 32.5 |
| 66 | 33.0 |
| 67 | 33.5 |
| 68 | 34.0 |
| 69 | 34.5 |
| 70 | 35.0 |
| 71 | 35.5 |
| 72 | 36.0 |
| 73 | 36.5 |
| 74 | 37.0 |
| 75 | 37.5 |
| 76 | 38.0 |
| 77 | 38.5 |
| 78 | 39.0 |
| 79 | 39.5 |
| 80 | 40.0 |
| 81 | 40.5 |
| 82 | 41.0 |
| 83 | 41.5 |
| 84 | 42.0 |
| 85 | 42.5 |
| 86 | 43.0 |
| 87 | 43.5 |
| 88 | 44.0 |
| 89 | 44.5 |
| 90 | 45.0 |
| 91 | 45.5 |
| 92 | 46.0 |
| 93 | 46.5 |
| 94 | 47.0 |
| 95 | 47.5 |
| 96 | 48.0 |
| 97 | 48.5 |
| 98 | 49.0 |
| 99 | 49.5 |
| 100 | 50.0 |

Time

| | |
|----|----|
| 21 | 22 |
|----|----|

6A12

Page
PPM

Example 1

| | |
|--------|--------|
| Oxylen | Papier |
|--------|--------|

Wdd
Dyler

#

5

39

5431

$$2f +$$

1414

252

10

2

20

| | |
|-------|------|
| 1.099 | ,073 |
|-------|------|

17

01570

)

052

Q1

1.92

653

21/12 20

18

[illegible]
$$\begin{array}{r} 1.095 \\ 1.075 \\ \hline 1.17 \end{array}$$

410

300 picking GC and

Fed Ex out to

Cleveland.

Are is GC

310 Finish clearing up CC support

equipment.

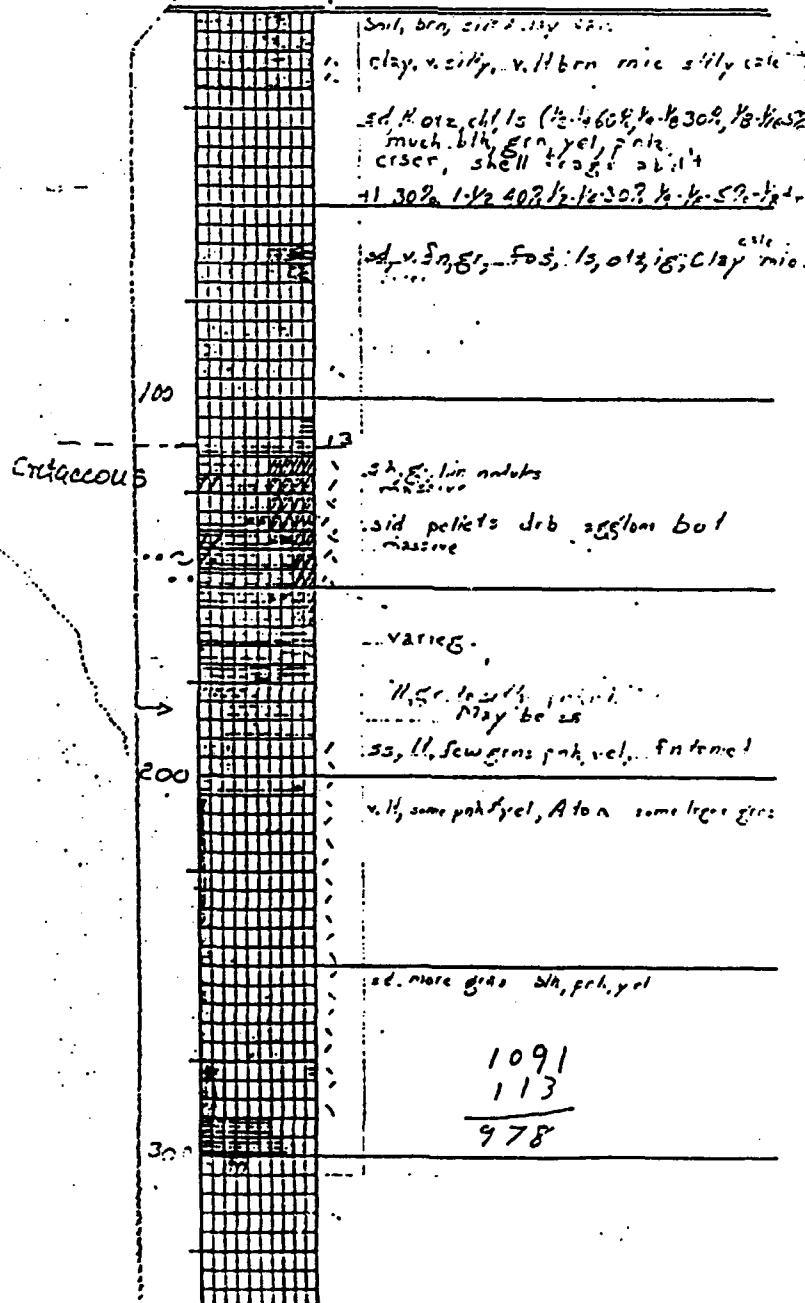
Shawn J. Price 7-19-90

51)

APPENDIX C
RECORDS OF PUBLIC WATER WELLS

FORM NO. 78 - In stock and for sale by Mid-West Pkg. Co., Tulsa V-176-

| | | | | | | | | | | | | | | | | | | | |
|---|---------|---------------------------|-----------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|---------------|--|
| STATE | | SERGEANT BLUFF (WOODBURY) | | | | | | | | | | | | | | | | | |
| SENNONE-SF. | | SIOUX CITY AC. 250 #9 | | | | | | | | | | | | | | | | | |
| SEC. 25 | | | | | | | | | | | | | | | | | | | |
| TWP. EBN | RGE. 8W | COMMENCED | COMPLETED | | | | | | | | | | | | | | | | |
| <table border="1"> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> </table> | | | | | | | | | | | | | | | | | | CASING RECORD | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| LOGGED | | BY | | | | | | | | | | | | | | | | | |
| October 1943 | | SE7/air is Jr. | | | | | | | | | | | | | | | | | |
| REMARKS | | | | | | | | | | | | | | | | | | | |
| Elev 1091 | | | | | | | | | | | | | | | | | | | |
| T.D. 307 | | | | | | | | | | | | | | | | | | | |

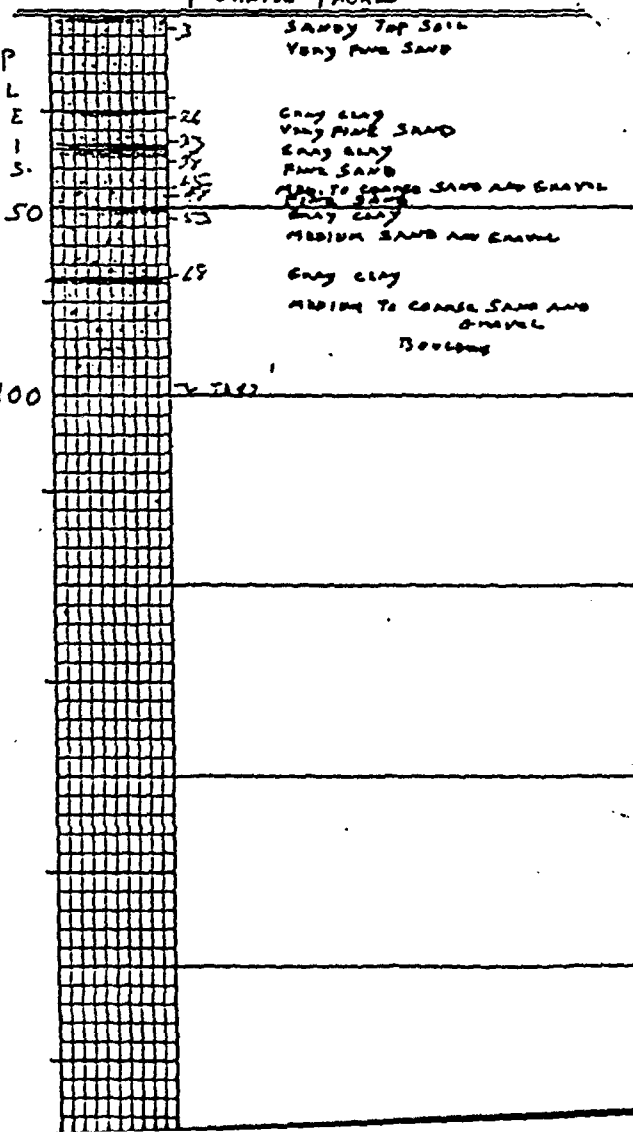


These 2 additional logs are in the opposite direction, but they do further characterize the alluvium in the area and the depth to bedrock - at least at these 2 points.

[illegible]

| | | | |
|----------------------|--------------------|--------------------------------|----------------|
| STATE
IOWA | | SIoux CITY (WOODBURY) | |
| SW/ENE SE | | IOWA HIGHWAY COMMISSION | |
| SEC.
6 | | Well #2 - WEST SIDE OF HIGHWAY | |
| TWP.
87N | RGE.
47W | COMMENCED | COMPLETED |
| | | DEC. 8, 1965 | |
| | | THORPE WELL CO. | |
| | | CASING RECORD | |
| | | 87' OF 6" C.S.G. | |
| | | 10' OF 6" SCREEN | |
| | | LOGGED | BY |
| | | NOV. 1, 1966 | MORTHUP |
| REMARKS | | | |
| EL 1090 FWD. | | WELL IS GRAVEL PACKED | |
| TD 97' TOP | | SWL 14' | |

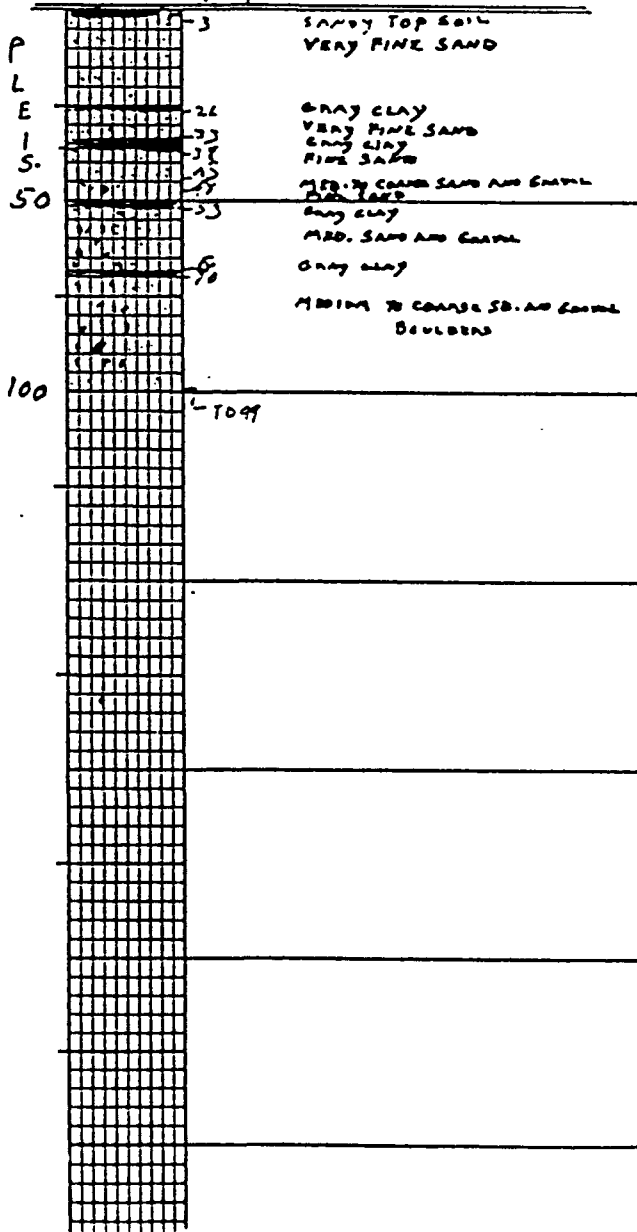
PL 23' @ 235 GPM
 DRILLING LOG ONLY -
 NO SAMPLES - WELL IS
 GRAVEL PACKED

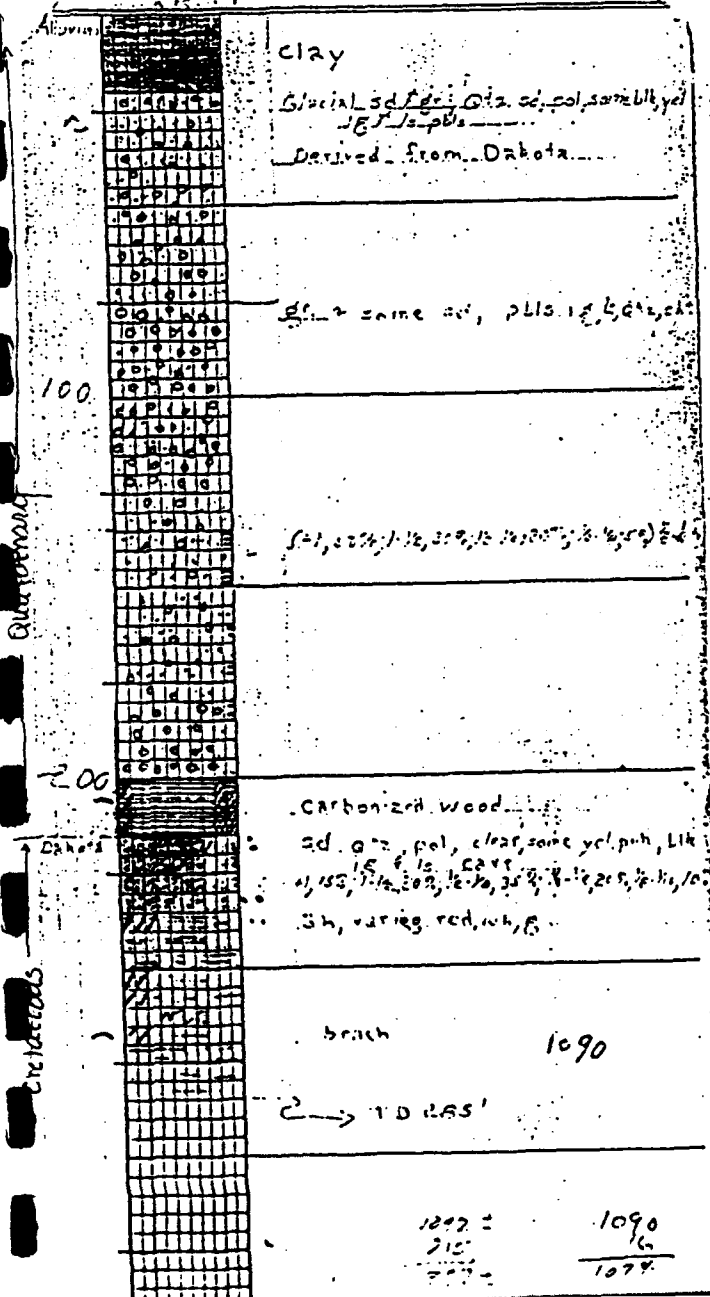


| | | | | | | | | | | | | | | | | | | | | |
|---|------|-----------------------------------|-----------|-----------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|-----------------|--|--|
| STATE | | IOWA | | SIOUX CITY (WOODBURY) | | | | | | | | | | | | | | | | |
| SW SE SE SE | | IOWA HIGHWAY COMMISSION | | | | | | | | | | | | | | | | | | |
| SEC. 6 | | WELL M - EAST SIDE OF HIGHWAY | | | | | | | | | | | | | | | | | | |
| TWP. | RGE. | COMMENCED | COMPLETED | | | | | | | | | | | | | | | | | |
| 87N | 47W | NOV. 22-23, 1945 | | | | | | | | | | | | | | | | | | |
| <table border="1"> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> </table> | | | | | | | | | | | | | | | | | | THORPE WELL CO. | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| CASING RECORD | | | | | | | | | | | | | | | | | | | | |
| 89' OF 6" CSG. | | | | | | | | | | | | | | | | | | | | |
| 10' OF 6" SCREEN | | | | | | | | | | | | | | | | | | | | |
| LOGGED | | NOV. 1, 1966 | | BY NORTHUP | | | | | | | | | | | | | | | | |
| REMARKS | | EL 1090 FND WELL IS GRAVEL PACKED | | | | | | | | | | | | | | | | | | |
| TD 99' TO 0 | | SWL 8' | | | | | | | | | | | | | | | | | | |
| | | PL 26' @ 2906 FT. | | | | | | | | | | | | | | | | | | |

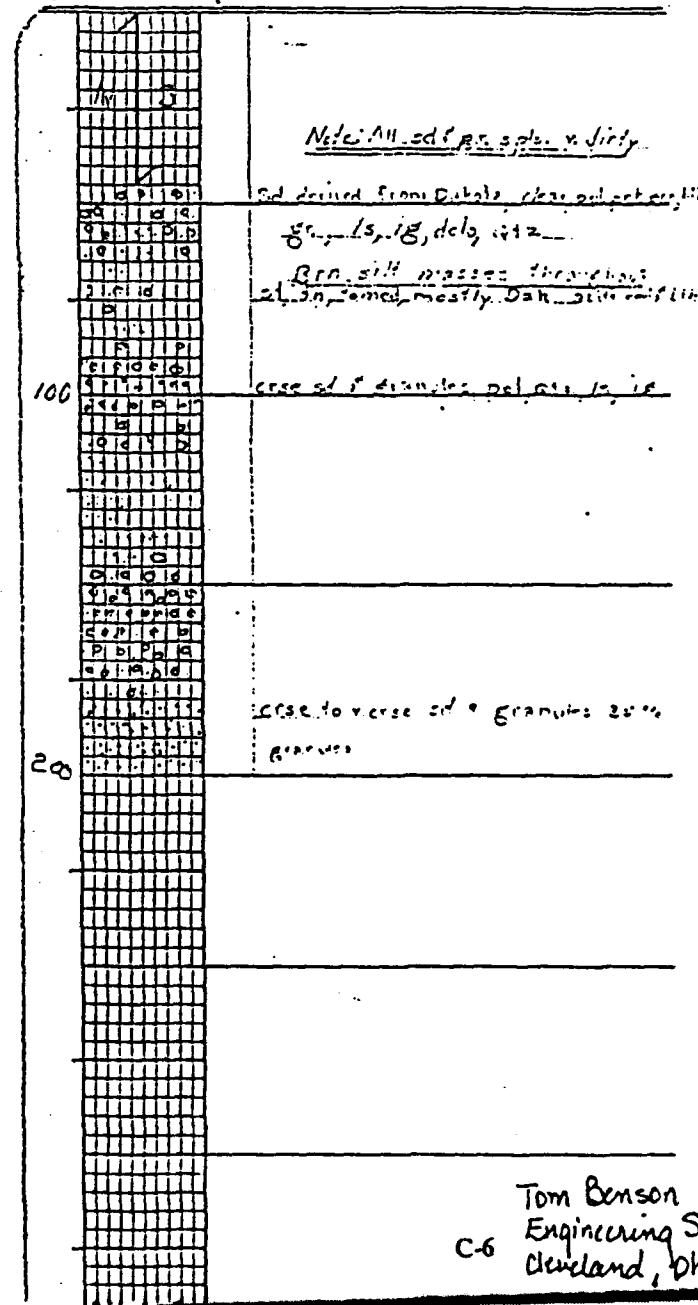
NO SAMPLES - DRILLER'S LOG

COPIED





| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---------------------------|---|--|--|--|--|--|--|--|---|----|---|--|--|--|--|--|--|--|--|-------------------|--|
| FORM NO. 78 - In stock and for sale by Mid-West Prtg. Co., Tulsa | | W-1712 | | | | | | | | | | | | | | | | | | | | | |
| STATE | | SARGENT BLUFF (WOODBERRY) | | | | | | | | | | | | | | | | | | | | | |
| 14WA | | SINK CITY AIRBASE | | | | | | | | | | | | | | | | | | | | | |
| SW-SE-NE | | SEC. | | | | | | | | | | | | | | | | | | | | | |
| 36 | | | | | | | | | | | | | | | | | | | | | | | |
| TWP. RGE. | | COMMENCED | | | | | | | | | | | | | | | | | | | | | |
| 28 48 | | COMPLETED | | | | | | | | | | | | | | | | | | | | | |
| | | July 1943 | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td>3</td><td>10</td><td>0</td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> </table> | | | | | | | | | | | 3 | 10 | 0 | | | | | | | | | LAYING - RECORDED | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | 3 | 10 | 0 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | CASING RECORD | | | | | | | | | | | | | | | | | | | | | |
| | | 12" GAS LINE | | | | | | | | | | | | | | | | | | | | | |
| | | 20' of RECORDED | | | | | | | | | | | | | | | | | | | | | |
| | | LOGGED | | | | | | | | | | | | | | | | | | | | | |
| | | BY | | | | | | | | | | | | | | | | | | | | | |
| | | July 20, 1943 | | | | | | | | | | | | | | | | | | | | | |
| | | SE. Harris | | | | | | | | | | | | | | | | | | | | | |
| REMARKS | | | | | | | | | | | | | | | | | | | | | | | |
| Elev 1090 | | SW 1/4 - 18' | | | | | | | | | | | | | | | | | | | | | |
| T.D. 235 | | | | | | | | | | | | | | | | | | | | | | | |



C-6 Tom Benson
Engineering Scie
Cleveland, Ohio

APPENDIX D
SOIL-GAS TABLE OF RESULTS

TABLE 1
SOIL-GAS TABLE OF RESULTS

| Sample Location | Depth (feet) | Benzene (ppm) | Toluene (ppm) | O-Xylene (ppm) | P-Xylene (ppm) |
|-----------------|--------------|---------------|---------------|----------------|----------------|
| SV1 | 2 | .138 | .431 | .519 | .211 |
| SV1 | 4 | ND | .114 | .49 | ND |
| SV2 | 2 | ND | .152 | .186 | .048 |
| SV3 | 2 | .032 | .352 | .528 | .187 |
| SV4 | 2 | ND | .239 | .381 | 1.074 |
| SV5 | 2 | .046 | .322 | .604 | .597 |
| SV6 | 2 | .197 | .290 | .509 | .563 |
| SV7 | 2 | ND | .798 | 1.275 | 1.870 |
| SV8 | 2 | .182 | .565 | .706 | .821 |
| SV9 | 2 | ND | .228 | .479 | .431 |
| SV10 | 2 | .050 | .554 | .857 | 1.221 |
| SV11 | 2 | .099 | .512 | .455 | .522 |
| SV12 | 2 | .118 | .581 | .710 | .947 |
| SV13 | 2 | .485 | 1.710 | .122 | ND |
| SV14 | 2 | .028 | .386 | .698 | .595 |
| SV15 | 2 | .052 | .412 | .586 | .485 |
| SV16 | 2 | ND | .039 | .336 | .451 |
| SV17 | 2 | .139 | .444 | .627 | .446 |
| SV18 | 2 | .034 | .476 | .718 | .762 |
| SV19 | 2 | .013 | .693 | .874 | .994 |
| SV20 | 2 | .047 | .642 | .647 | ND |
| SV21 | 2 | 1.257 | 1.445 | 1.026 | .172 |
| SV22 | 2 | .037 | .520 | 1.420 | .491 |
| SV23 | 2 | .465 | .881 | .898 | .221 |
| SV24 | 2 | ND | .572 | 1.245 | .423 |
| SV25 | 2 | .302 | .796 | 1.372 | .504 |
| SV26 | 2 | .766 | 1.278 | 1.357 | .356 |
| SV27 | 2 | .232 | .468 | .820 | .158 |
| SV28 | 2 | .251 | .767 | 1.714 | .648 |
| SV29 | 2 | .189 | .426 | .991 | ND |
| SV30 | 2 | .057 | ND | ND | .307 |
| SV31 | 2 | ND | ND | 1.099 | .073 |

(1) None detected

APPENDIX E
MONITORING WELLS AND SOIL BORING LOGS

| LOCATION MAP | | | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | |
|------------------------------------|----------------------|-------|-----------------|-----------------------------------|---|--------------------------------|---|
| SEE FIGURE 3.3 | | | | WELL NUMBER P-1 | | LOCATION SITE 1 -DEFUELING PIT | |
| | | | | DATE 24 JULY 1990 | | WEATHER 70°F , OVERCAST BREEZY | |
| | | | | LOCATED BY KMP/TAB | | DRILLED BY FOX DRG. | |
| | | | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | |
| ELEVATION | | | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | |
| CASING TYPE SCH 40 PVC | | | | DIAMETER 1' | | LENGTH 21' | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | | | DIAMETER 1' | | LENGTH 10' | |
| | | | | HOLE DIA 7 1/4" | | TOTAL DEPTH 31' | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 0.0 | 0 | X | 2 | DARK BROWN, DAMP, SLIGHT PLASTIC SILT CLAY, NO HYDROCARBON ODOR, (H-C)(ML) | | |
| | | 1 | | 5 | | | |
| | | 7 | | 7 | | | |
| S-2 | 0.0 | 2 | X | 9 | BROWN, DAMP, NON-PLASTIC, POORLY SORTED, SILTY SAND AND GRAVEL, NO H-C ODOR (SW). | | |
| | | 3 | | 5 | | | |
| | | 4 | | 4 | | | |
| S-3 | 0.0 | 4 | X | 3 | SAME AS ABOVE, MOIST, NO H-C ODOR. | | |
| | | 5 | | 3 | | | |
| | | 6 | | 2 | | | |
| S-4 | 0.0 | 6 | X | 1 | GRAY-BROWN, MOIST, PLASTIC, CLAY, LITTLE SILT, NO H-C ODOR. | | |
| | | 7 | | 2 | | | |
| | | 8 | | 5 | | | |
| S-5 | 0.0 | 9 | X | 1 | | | |
| | | 10 | | 2 | | | |
| | | 11 | | 3 | | | |
| S-6 | 272 | 11 | X | 1 | GRAY WITH DARK GRAY DISCOLORATION, MOIST, MED-HI PLASTICITY, SILTY CLAY, ODOR (CL). | | |
| | | 12 | | 2 | | | |
| | | 13 | | 3 | | | |
| S-7 | 890 | 13 | X | 1 | | | |
| | | 14 | | 2 | | | |
| | | 15 | | 3 | | | |
| S-8 | 6100 | 15 | X | 1 | GRAY, MOIST, NON-PLASTIC, WELL SORTED, FINE-GRAINED SILTY SAND, H-C ODOR. SAME AS ABOVE, MOIST, H-C ODOR, (SM). | | |
| | | 16 | | 2 | | | |
| | | 17 | | 5 | | | |
| S-9 | 6600 | 17 | X | 12 | | | |
| | | 18 | | 11 | | | |
| | | 19 | | 14 | | | |
| S-10 | 3600 | 19 | X | 5 | SAME AS ABOVE, MOIST H-C ODOR. | | |
| | | 20 | | 15 | | | |
| | | 21 | | 22 | | | |
| | | 21 | | 25 | FINISHED FOR THE DAY @ 20'. | | |

0290014

| LOCATION MAP | | | | ENGINEERING-SCIENCE WELL LOG | | | | PAGE 2 OF 2 | |
|------------------------------------|----------------------|-------|-----------------|-----------------------------------|--|--------------------------------|-----------------|------------------|--|
| SEE FIGURE 3.3 | | | | WELL NUMBER P-1 (CONT.) | | LOCATION SITE 1 -DEFUELING PIT | | | |
| | | | | DATE 25 JULY 1990 | | WEATHER 70°F , OVERCAST BREEZY | | | |
| | | | | LOCATED BY KMP/TAB | | DRILLED BY FOX DRLG. | | | |
| | | | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH 40 PVC | | | | DIAMETER 1' | | LENGTH 21' | | HOLE DIA. 7 1/4" | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | | | DIAMETER 1' | | LENGTH 10' | | TOTAL DEPTH 31' | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION | | |
| S-11 | 6500 | 20 | | 7 | GRAY, MOIST, NON-PLASTIC, WELL SORTED, FINE-GRAINED, SILTY SAND, H-C ODDR [SM]. | | | | |
| | | 21 | | 16 | | | | | |
| | | 22 | | 22 | | | | | |
| | | 22 | | 26 | | | | | |
| S-12 | 8715 | 22 | | 6 | 22'-22.5' BROWN SILTY SAND, SAME AS ABOVE. | | | | |
| | | 23 | | 8 | | | | | |
| | | 24 | | 9 | | | | | |
| | | 24 | | 8 | | | | | |
| S-13 | 6720 | 25 | | 3 | SAME AS ABOVE, WET @ 25', H-C ODDR, SHEEN ON WATER INSIDE SPOON SHOE. | | | | |
| | | 25 | | 10 | | | | | |
| | | 26 | | 11 | | | | | |
| | | 26 | | 11 | | | | | |
| S-14 | 450 | 27 | | 3 | SAME AS ABOVE, WET, LESS H-C ODDR. | | | | |
| | | 27 | | 6 | | | | | |
| | | 28 | | 7 | | | | | |
| | | 28 | | 8 | | | | | |
| S-15 | 2450 | 29 | | 5 | SAME AS ABOVE, WET, H-C ODDR. | | | | |
| | | 29 | | 7 | | | | | |
| | | 30 | | 8 | | | | | |
| | | 30 | | 9 | | | | | |
| | | 31 | | | GRAY, WET, NON-PLASTIC, MEDIUM TO POORLY SORTED, FINE TO COARSE-GRAINED, SILTY SAND WITH SUBROUNDED GRAVEL, H-C ODDR [SW]. | | | | |
| | | 32 | | | AUGERED TO 31' AND INSTALLED PIEZOMETER (P-1). | | | | |
| | | 33 | | | | | | | |
| | | 34 | | | | | | | |
| | | 35 | | | | | | | |
| | | 36 | | | | | | | |
| | | 37 | | | | | | | |
| | | 38 | | | | | | | |
| | | 39 | | | | | | | |
| | | 40 | | | | | | | |
| | | 41 | | | | | | | |

0390P13

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | | | |
|------------------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|---|----------------|---|
| SEE FIGURE 3.3 | | WELL NUMBER P-2 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 26 JULY 1990 | | WEATHER 65°F, OVERCAST, RAIN | | | |
| | | LOCATED BY KMP/TAB | | DRILLED BY FOX DRLG. | | | |
| | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| ELEVATION | | | | | | | |
| CASING TYPE SCH 40 PVC | | DIAMETER 1' | | LENGTH 21' | | | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | DIAMETER 1' | | LENGTH 10' | | | |
| | | | | HOLE DIA. 7 1/4" | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 54.3 | 0 | X | 1 | BROWN GRAY, MOIST, MED. PLASTIC, SILTY CLAY WITH ORGANICS, NO HYDROCARBON (H-C) ODDR, [CL]. | | |
| | | 1 | X | 4 | | | |
| | | 2 | X | 7 | | | |
| | | 3 | X | 13 | | | |
| S-2 | 85.9 | 4 | X | 6 | GRAY, DAMP, NON-PLASTIC, SILT, [ML], NO H-C ODDR. | | |
| | | 5 | X | 7 | | | |
| | | 6 | X | 7 | GRAY, DAMP, LOW PLAST. SILTY CLAY, [CL] NO H-C ODDR. | | |
| | | 7 | X | 13 | | | |
| S-3 | 16.6 | 8 | X | 6 | | | |
| | | 9 | X | 8 | | | |
| | | 10 | X | 11 | | | |
| | | 11 | X | 13 | | | |
| S-4 | 14.2 | 12 | X | 3 | SAME AS ABOVE, NO H-C ODDR. | | |
| | | 13 | X | 6 | | | |
| | | 14 | X | 7 | | | |
| | | 15 | X | 7 | | | |
| S-5 | 4427 | 16 | X | 4 | | | |
| | | 17 | X | 6 | | | |
| | | 18 | X | 7 | GRAY WITH GRAY DISCOLORATION, MOIST, LOW-MED. PLAST, SILTY CLAY [CL], H-C ODDR. | | |
| | | 19 | X | 5 | | | |
| S-6 | 7610 | 20 | X | 3 | | | |
| | | 21 | X | 5 | | | |
| | | 22 | X | 7 | SAME AS ABOVE, MOIST, H-C ODDR. | | |
| | | 23 | X | 7 | | | |
| S-7 | 6100 | 24 | X | 3 | GRAY, DAMP TO MOIST, NON-PLASTIC, CLAYEY SILT, [ML], H-C ODDR. | | |
| | | 25 | X | 5 | | | |
| | | 26 | X | 7 | | | |
| | | 27 | X | 10 | GRAY, DAMP, NON-PLASTIC, WELL SORTED, (POORLY GRADED), FINE GRAINED SILTY SAND, [SM], H-C ODDR. | | |
| S-8 | 6333 | 28 | X | 6 | | | |
| | | 29 | X | 13 | | | |
| | | 30 | X | 17 | | | |
| | | 31 | X | 21 | SAME AS ABOVE, H-C ODDR. | | |
| | | 32 | X | 6 | | | |
| S-9 | 6317 | 33 | X | 16 | SAME AS ABOVE, H-C ODDR. | | |
| | | 34 | X | 27 | | | |
| | | 35 | X | 34 | | | |
| | | 36 | X | 10 | SAME AS ABOVE, DAMP, H-C ODDR. | | |
| S-10 | 7140 | 37 | X | 14 | | | |
| | | 38 | X | 20 | | | |
| | | 39 | X | 26 | | | |
| CONTINUED ON NEXT PAGE. | | | | | | | |

0390P2A

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | | | |
|------------------------------------|----------------------|-----------------------------------|-----------------|--------------------------------|---|----------------|---|
| SEE FIGURE 3.3 | | WELL NUMBER P-3 | | LOCATION SITE 1 -DEFUELING PIT | | | |
| | | DATE 27 JULY 1990 | | WEATHER 70-80°F, PARTLY SUNNY | | | |
| | | LOCATED BY KMP/TAB | | DRILLED BY FOX DRLG. | | | |
| | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| ELEVATION | | | | | | | |
| CASING TYPE SCH 40 PVC | | DIAMETER 1' | | LENGTH 21' | | | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | DIAMETER 1' | | LENGTH 10' | | | |
| | | | | HOLE DIA. 7 1/4' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 20.2 | 0 | X | 2 | GRAY BROWN, DAMP-MOIST, SLIGHT PLAST, SILTY CLAY, [CL], NO HYDROCARBON (H-C) ODOR. | | |
| | | 1 | X | 4 | | | |
| | | 2 | X | 6 | | | |
| S-2 | 40.0 | 3 | X | 5 | SAME AS ABOVE, NO H-C ODOR. | | |
| | | 4 | X | 7 | | | |
| | | 5 | X | 9 | | | |
| S-3 | 50.2 | 6 | X | 4 | SAME AS ABOVE, NO H-C ODOR. | | |
| | | 7 | X | 6 | | | |
| | | 8 | X | 9 | | | |
| S-4 | 89.9 | 9 | X | 3 | SAME AS ABOVE, NO H-C ODOR. | | |
| | | 10 | X | 5 | | | |
| | | 11 | X | 8 | | | |
| S-5 | 42.4 | 12 | X | 3 | SAME AS ABOVE, NO H-C ODOR. | | |
| | | 13 | X | 4 | | | |
| | | 14 | X | 6 | | | |
| S-6 | 50.5 | 15 | X | 8 | GRAY, MOIST, SLIGHT PLAST, SILTY CLAY, [CL], NO H-C ODOR, GRADING INTO GRAY, MOIST, NON-PLASTIC, WELL SORTED, (POORLY GRADED), SILTY SAND, [SM], NO H-C ODOR. | | |
| | | 16 | X | 3 | | | |
| | | 17 | X | 4 | | | |
| S-7 | 137 | 18 | X | 7 | GRAY SILTY SAND [SM], AS ABOVE WITH LENS (13'-13.5') OF GRAY SILTY CLAY AS ABOVE, NO H-C ODOR IN SAND OR CLAY. | | |
| | | 19 | X | 8 | | | |
| | | 20 | X | 10 | | | |
| S-8 | 107 | 21 | X | 13 | @ 17', DARK GRAY SILTY SAND [SM] SAME AS ABOVE, FINE-GRAINED, H-C ODOR. | | |
| | | 22 | X | 14 | | | |
| | | 23 | X | 14 | | | |
| S-9 | 3337 | 24 | X | 14 | @ 17.25' GRAY SILTY SAND [SM] SAME AS ABOVE, FINE-GRAINED, H-C ODOR. | | |
| | | 25 | X | 15 | | | |
| | | 26 | X | 19 | | | |
| S-10 | 4214 | 27 | X | 15 | | | |
| | | 28 | X | 16 | | | |
| | | 29 | X | 19 | | | |
| | | 30 | | 29 | | | |
| | | 31 | | | | | |

CONTINUED ON NEXT PAGE.

6390P2A

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | | | |
|------------------------------------|----------------------|-----------------------------------|-----------------|--------------------------------|--|----------------|-----------------|
| SEE FIGURE 3.3 | | WELL NUMBER P-3 (CONT.) | | LOCATION SITE 1 -DEFUELING PIT | | | |
| | | DATE 27 JULY 1990 | | WEATHER 70-80°F | | | |
| | | LOCATED BY KMP/TAB | | DRILLED BY FOX DRLG. | | | |
| | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH 40 PVC | | DIAMETER 1' | | LENGTH 21' | | | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | DIAMETER 1' | | LENGTH 10' | | | |
| | | | | HOLE DIA. 7 1/4" | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION |
| S-11 | 3736 | 20 | | 13 | GRAY, MOIST, NON PLASTIC, WELL SORTED (POORLY GRADED), SILTY SAND, (SM), H-C ODDR. | | |
| | | 21 | | 14 | | | |
| | | 22 | | 19 | | | |
| | | | | 13 | | | |
| S-12 | 733 | 23 | | 6 | SAME AS ABOVE, MOIST TO WET, H-C ODDR. | | |
| | | 24 | | 10 | | | |
| | | | | 19 | | | |
| | | | | 22 | | | |
| S-13 | 880 | 25 | | 8 | SAME AS ABOVE, WATER @24', H-C ODDR. | | |
| | | 26 | | 9 | | | |
| | | | | 14 | | | |
| | | | | 15 | | | |
| S-14 | 187 | 27 | | 3 | SAME AS ABOVE, WET, H-C ODDR. | | |
| | | 28 | | 3 | | | |
| | | | | 6 | | | |
| | | | | 5 | | | |
| S-15 | 161 | 29 | | 3 | BROWN-GRAY, WET, NON-PLASTIC, POORLY SORTED (WELL GRADED), SILTY SAND, (SW), SLIGHT H-C ODDR, SHELL REMAINS 28'-29', PLANT (WOOD) REMAINS @-29.7' IN DARK GRAY TO BLACK ORGANIC SANDY ZONE FROM 29.7'-30'. | | |
| | | 30 | | 3 | | | |
| | | | | 6 | | | |
| | | | | 9 | | | |
| | | 32 | | | AUGERED FROM 30' TO 32' INSTALLED P-3. | | |
| | | 33 | | | | | |
| | | 34 | | | | | |
| | | 35 | | | | | |
| | | 36 | | | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | | | |
|------------------------------------|---------------------|-----------------------------------|-----------------|-----------------------------|--|----------------|---|
| SEE FIGURE 3.4 | | WELL NUMBER IANG-2-SB/MW-1/TV-1 | | LOCATION SITE 2 - RAD. SITE | | | |
| | | DATE 27,28 JULY 1990 | | WEATHER 80°F, SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRLG. | | | |
| | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH 40 PVC | | DIAMETER 2" | | LENGTH 19' | | | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | DIAMETER 2" | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9 3/4' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | COUNTS/MINUTE (CPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 50-100 | 0 | | 2 | BROWN, MOIST, LOW PLAST, SILT, [ML], NO ODDR. | | |
| | | 1 | | 3 | | | |
| | | 2 | | 3 | | | |
| * S-2 (S1) | 50-100 | 3 | | 4 | BROWN, DAMP, NON-PLAST, WELL SORTED (POORLY GRADED) SILTY SAND, [SM], NO ODDR. | | |
| | | 4 | | 5 | | | |
| | | 5 | | 5 | BROWN, SILT AS EARLIER [ML], NO ODDR. | | |
| S-3 | 50-100 | 5 | | 5 | BROWN-GRAY, MOIST, PLAST, SILTY CLAY [CL], NO ODDR. | | |
| | | 6 | | 6 | | | |
| S-4 | 50-100 | 7 | | 7 | BROWN, DAMP, NON-PLAST, WELL SORTED (POORLY GRADED), SILTY SAND, [SM], NO ODDR. | | |
| | | 8 | | 1 | | | |
| | | 9 | | 2 | BROWN, MOIST, LOW PLAST, SILTY CLAY, [CL], NO ODDR. | | |
| * S-5 (S2) | 50-100 | 10 | | 3 | SAME AS ABOVE, MOIST, NO ODDR. | | |
| | | 11 | | 6 | | | |
| S-6 | 50-100 | 12 | | 8 | BROWN, DAMP, NON-PLASTIC, WELL SORTED (POORLY GRADED), SILTY SAND, [SM], NO ODDR, WITH INTERBEDS OF | | |
| | | 13 | | 9 | BROWN, MOIST, PLASTIC, SILTY CLAY, [CL], NO ODDR. | | |
| S-7 | 50-100 | 14 | | 3 | | | |
| | | 15 | | 3 | | | |
| S-8 | 50-100 | 16 | | 4 | SAME AS ABOVE, NO ODDR. | | |
| | | 17 | | 4 | | | |
| S-9 | 50-100 | 18 | | 2 | | | |
| | | 19 | | 5 | BROWN & GRAY, DAMP, NON-PLASTIC WELL SORTED (POORLY GRADED), SILTY FINE-GRAINED SAND, [SM] SOME CLAY, NO ODDR. | | |
| S-10 | 50-100 | 20 | | 3 | | | |
| | | 21 | | 5 | SAME AS ABOVE, NO ODDR. | | |
| | | | | 6 | CONTINUED ON NEXT PAGE. | | |

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | | | |
|------------------------------------|---------------------|-----------------------------------|-----------------|-----------------------------|--|----------------|-----------------|
| SEE FIGURE 3.4 | | WELL NUMBER IANG-2-SB/MW-1/TW-1 | | LOCATION SITE 2 - RAD. SITE | | | |
| | | DATE 28 JULY 1990 | | WEATHER 80°F, SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRLG. | | | |
| | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH 40 PVC | | DIAMETER 2' | | LENGTH 19' | | | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | DIAMETER 2' | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9 3/4" | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | COUNTS/MINUTE (CPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION |
| * S-11 (S3) | 50-100 | 20 | | 2 | BROWN AND GRAY, DAMP TO MOIST, NON-PLASTIC, WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND, [SM], NO ODOR. | | |
| | | 21 | | 4 | | | |
| | | 22 | | 5 | | | |
| S-12 | 50-100 | 23 | | 6 | GRAY, WET, NON-PLASTIC, WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND, [SM], LITTLE CLAY, DECAYING ORGANICS ODOR. WATER TABLE @ 22.5'. | | |
| | | 24 | | 2 | | | |
| | | 25 | | 1 | | | |
| S-13 | 50-100 | 26 | | 1 | SAME AS ABOVE, DECAYING WOOD @ 27', DECAYING ORGANICS ODOR. | | |
| | | 27 | | 3 | | | |
| | | 28 | | 5 | | | |
| S-14 | 50-100 | 29 | | 7 | BROWN, WET, NON-PLASTIC, WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND, [SM], NO ODOR. | | |
| | | 30 | | 4 | | | |
| | | 31 | | 6 | | | |
| S-15 | 50-100 | 32 | | 9 | AUGERED TO 32' AND INSTALLED TEMPORARY WELL. | | |
| | | 33 | | 12 | | | |
| | | 34 | | | | | |
| | | 35 | | | * SOIL SAMPLE CHOSEN FOR LAB ANALYSES. | | |
| | | 36 | | | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |
| | | | | | | | |

03902V13

| LOCATION MAP | | | ENGINEERING-SCIENCE WELL LOG | | | PAGE 1 OF 2 | | |
|----------------|---------------------|-------|------------------------------------|------------------------|---|----------------|---|--------------------|
| SEE FIGURE 3.4 | | | WELL NUMBER JANG-2-SB/MW-2/IV-2 | | LOCATION SITE 2 - RAD. SITE | | | |
| | | | DATE 28 JULY 1990 | | WEATHER 80°F, SUNNY | | | |
| | | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRLG. | | | |
| | | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| | | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| ELEVATION | | | CASING TYPE SCH 40 PVC | | DIAMETER 2" | | LENGTH 21' | HOLE D.I.A. 9 3/4" |
| | | | SCREEN TYPE SCH 40 PVC SLOT 0.010" | | DIAMETER 2" | | LENGTH 10' | TOTAL DEPTH 32' |
| SAMPLE NO. | COUNTS/MINUTE (CPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER | |
| S-1 | 50-100 | 0 | | 2 | BROWN, DAMP, NON-PLASTIC, SILT, [ML], NO ODOR. | | | |
| * S-2 (S1) | 50-100 | 3 | | 3 | BROWN, DRY, NON-PLASTIC, SILT, [ML], (LOESS), NO ODOR. | | | |
| S-3 | 50-100 | 5 | | 2 | SAME AS ABOVE. | | | |
| S-4 | 50-100 | 7 | | 3 | SAME AS ABOVE WITH INTERBEDS OF GRAY, DAMP, PLASTIC, SILTY CLAY [CL], NO ODOR. | | | |
| * S-5 (S2) | 50-100 | 9 | | 4 | GRAY, DAMP, PLASTIC, SILTY CLAY, [CL], NO ODOR. | | | |
| S-6 | 50-100 | 11 | | 4 | SAME AS ABOVE, NO ODOR. | | | |
| S-7 | 50-100 | 13 | | 3 | SAME AS ABOVE, NO ODOR. | | | |
| S-8 | 50-100 | 15 | | 4 | BROWN, DAMP, NON-PLASTIC, WELL SORTED (POORLY GRADED), SILTY FINE-GRAINED, SAND, [SM], NO ODOR. | | | |
| S-9 | 50-100 | 17 | | 4 | SAME AS ABOVE, NO ODOR. | | | |
| S-10 | 50-100 | 19 | | 5 | SAME AS ABOVE, NO ODOR. | | | |
| | | 20 | | 7 | | | | |
| | | 21 | | | CONTINUED ON NEXT PAGE. | | | |

D3902V2A

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | | | |
|------------------------------------|---------------------|-----------------------------------|-----------------|-----------------------------|---|----------------|-----------------|
| SEE FIGURE 3.4 | | WELL NUMBER JANG-2-SB/MV-2/TW-2 | | LOCATION SITE 2 - RAD. SITE | | | |
| | | DATE 28 JULY 1990 | | WEATHER 80°F, SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRLG. | | | |
| | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH 40 PVC | | DIAMETER 2" | | LENGTH 21' | | | |
| SCREEN TYPE SCH 40 PVC SLDY 0.010" | | DIAMETER 2" | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9 3/4" | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | COUNTS/MINUTE (CPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION |
| S-11 | 50-100 | 20 | | 5 | BROWN, DAMP, NON-PLASTIC, WELL SORTED (POORLY GRADED), SILTY, FINE-GRAINED, SAND, [SM], NO ODDR. | | |
| | | 21 | | 6 | | | |
| | | 22 | | 6 | | | |
| | | 23 | | 5 | | | |
| S-12 | 50-100 | 23 | | 4 | SAME AS ABOVE, NO ODDR. | | |
| | | 24 | | 5 | | | |
| | | 25 | | 4 | | | |
| | | 26 | | 3 | | | |
| * S-13 (S3) | 50-100 | 25 | | 4 | GRAY, WET, NON-PLASTIC, WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND [SM], DECAYING ORGANICS ODDR. | | |
| | | 26 | | 6 | | | |
| | | 27 | | 3 | | | |
| | | 28 | | 4 | | | |
| S-14 | 50-100 | 27 | | 4 | SAME AS ABOVE, DECAYING ORGANICS ODDR. | | |
| | | 28 | | 4 | | | |
| | | 29 | | 1 | | | |
| | | 30 | | 2 | | | |
| S-15 | 50-100 | 29 | | 4 | AUGERED TO 32' AND INSTALLED TEMPORARY WELL. | | |
| | | 30 | | 4 | | | |
| | | 31 | | 4 | | | |
| | | 32 | | | | | |
| | | 33 | | | * SOIL SAMPLE CHOSEN FOR LAB ANALYSES. | | |
| | | 34 | | | | | |
| | | 35 | | | | | |
| | | 36 | | | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

03902V28

| LOCATION MAP | | | ENGINEERING-SCIENCE WELL LOG | | | PAGE 1 OF 2 | | |
|-------------------------|---------------------|-------|------------------------------------|------------------------|---|-----------------------------|------------------------------|--|
| SEE FIGURE 3.4 | | | WELL NUMBER JANG-2-SB/MW-3/TW-3 | | | LOCATION SITE 2 - RAD. SITE | | |
| | | | DATE 29 JULY 1990 | | | WEATHER 80°F, SUNNY | | |
| | | | LOCATED BY TAB/KMP | | | DRILLED BY FOX DRLG. | | |
| | | | DRILLING METHOD HOLLOW-STEM AUGER | | | SAMPLING METHOD SPLIT-SPOON | | |
| | | | GRAVEL PACK SAND (30/70) | | | SEAL BENTONITE | | |
| ELEVATION | | | CASING TYPE SCH 40 PVC | | | DIAMETER 2" LENGTH 19' | | |
| | | | SCREEN TYPE SCH 40 PVC SLOT 0.010" | | | HOLE DIA. 9 3/4" | | |
| | | | | | | TOTAL DEPTH | | |
| SAMPLE NO. | COUNTS/MINUTE (CPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION | |
| | | | | | | | FLUSH MOUNT PROTECTIVE COVER | |
| S-1 | 50-100 | 0 | | 1 | BROWN, DAMP, NON-PLASTIC SILT, [ML], NO ODOR. | | | |
| | | 1 | | 5 | | | | |
| | | | | 4 | | | | |
| | | 2 | | 4 | | | | |
| * S-2 | 50-100 | 3 | | 2 | SAME AS ABOVE. | | | |
| (S1) | | | | 4 | | | | |
| | | 4 | | 2 | | | | |
| S-3 | 50-100 | 5 | | 4 | BROWN & GRAY, DAMP, PLASTIC, SILTY CLAY, [CL], NO ODOR. | | | |
| | | | | 3 | | | | |
| | | 6 | | 4 | BROWN, DAMP, NON-PLAST, SILT, [ML], NO ODOR. | | | |
| S-4 | 50-100 | 7 | | 2 | | | | |
| | | | | 3 | | | | |
| | | 8 | | 4 | BROWN & GRAY, DAMP, PLASTIC, SILTY CLAY, [CL], NO ODOR. | | | |
| * S-5 | 50-100 | 9 | | 2 | | | | |
| (S2) | | | | 3 | | | | |
| | | 10 | | 4 | SAME AS ABOVE, NO ODOR. | | | |
| | | | | 7 | | | | |
| S-6 | 50-100 | 11 | | 1 | | | | |
| | | | | 4 | | | | |
| | | 12 | | 7 | BROWN, DAMP, NON-PLASTIC, SILT, [ML], NO ODOR. | | | |
| | | | | 5 | | | | |
| | | 13 | | 3 | | | | |
| S-7 | 50-100 | 14 | | 6 | BROWN, DAMP, NON-PLASTIC, WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND, [SM], NO ODOR. | | | |
| | | | | 5 | | | | |
| | | 15 | | 5 | | | | |
| S-8 | 50-100 | 16 | | 4 | SAME AS ABOVE, NO ODOR. | | | |
| | | | | 3 | | | | |
| | | 17 | | 3 | | | | |
| S-9 | 50-100 | 18 | | 4 | SAME AS ABOVE, NO ODOR. | | | |
| | | | | 4 | | | | |
| | | 19 | | 4 | | | | |
| S-10 | 50-100 | 20 | | 3 | SAME AS ABOVE, NO ODOR. | | | |
| | | | | 4 | | | | |
| | | 21 | | 5 | | | | |
| | | | | 4 | | | | |
| CONTINUED ON NEXT PAGE. | | | | | | | | |

03902V3A

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | | | |
|------------------------------------|---------------------|-----------------------------------|-----------------|-----------------------------|---|----------------|-----------------|
| SEE FIGURE 3.4 | | WELL NUMBER 1ANG-2-SB/MW-3/TW-3 | | LOCATION SITE 2 - RAD. SITE | | | |
| | | DATE 29 JULY 1990 | | WEATHER 80°F, SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FDX DRLG. | | | |
| | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| ELEVATION | | | | | | | |
| CASING TYPE SCH 40 PVC | | DIAMETER 2" | | LENGTH 19' | | | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | DIAMETER 2" | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9 3/4" | | | |
| | | | | TOTAL DEPTH | | | |
| SAMPLE NO. | COUNTS/MINUTE (CPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION |
| * S-11 | 50- | 20 | | 3 | BROWN, DAMP TO MOIST, NON-PLASTIC WELL SORTED (POORLY GRADED), SILTY, FINE-GRAINED, SAND, [SM], NO ODDR. | | |
| (S3) | 100 | 21 | | 4 | | | |
| ** (S4) | | 22 | | 5 | | | |
| | | 22 | | 4 | | | |
| | | 23 | | 2 | GRAY, WET, NON-PLASTIC, WELL SORTED (POORLY GRADED), SILTY, FINE-GRAINED, SAND, [SM], SLIGHT DECAYING ORGANICS ODDR, WATER TABLE @ 22.5'. | | |
| S-12 | 50- | 23 | | 2 | | | |
| | 100 | 24 | | 2 | | | |
| | | 24 | | 2 | | | |
| S-13 | 50- | 25 | | 2 | SAME AS ABOVE, DECAYING ORGANICS ODDR. | | |
| | 100 | 26 | | 3 | | | |
| | | 27 | | 2 | | | |
| | | 27 | | 3 | | | |
| S-14 | 50- | 28 | | 5 | SAME AS ABOVE, LITTLE CLAY, DECAYING ORGANICS ODDR. | | |
| | 100 | 28 | | 5 | | | |
| | | 29 | | 1 | | | |
| | | 29 | | 2 | | | |
| S-15 | 50- | 30 | | 3 | AUGERED TO 32' AND INSTALLED TEMPDRARY WELL. | | |
| | 100 | 31 | | | | | |
| | | 32 | | | | | |
| | | 33 | | | * SOIL SAMPLE CHOSEN FOR LAB ANALYSES. | | |
| | | 34 | | | ** DUPLICATE SAMPLE OF S3. | | |
| | | 35 | | | | | |
| | | 36 | | | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

| LOCATION MAP | | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | | |
|-------------------------|---------------------|-------|------------------------------|------------------------|---|----------------|---|
| SEE FIGURE 3.4 | | | WELL NUMBER | | LOCATION | | |
| | | | IANG-2-SB/MV-4/TW-4 | | SITE 2 - RAD. SITE | | |
| | | | DATE | | WEATHER | | |
| | | | 29 JULY 1990 | | 80°F, SUNNY | | |
| ELEVATION | | | LOCATED BY | | DRILLED BY | | |
| | | | TAB/KMP | | FOX DRLG. | | |
| DRILLING METHOD | | | HOLLOW-STEM AUGER | | SAMPLING METHOD | | |
| GRAVEL PACK | | | SAND (30/70) | | SEAL BENTONITE | | |
| CASING TYPE | | | SCH 40 PVC | | DIAMETER 2' LENGTH 19' | | |
| SCREEN TYPE | | | SCH 40 PVC SLOT 0.010" | | DIAMETER 2' LENGTH 10' | | |
| | | | | | HOLE DIA. 9 3/4' | | |
| | | | | | TOTAL DEPTH 32' | | |
| SAMPLE NO. | COUNTS/MINUTE (CPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 50-100 | 0 | | 2 | BROWN, DAMP, NON-PLASTIC, SILT, [ML], NO ODOR. | | |
| | | 1 | | 2 | | | |
| | | 2 | | 3 | | | |
| | | 3 | | 2 | | | |
| * S-2 (S1) | 50-100 | 4 | | 3 | SAME AS ABOVE, NO ODOR. | | |
| | | 5 | | 2 | | | |
| | | 6 | | 3 | | | |
| S-3 | 50-100 | 7 | | 4 | SAME AS ABOVE, NO ODOR. | | |
| | | 8 | | 4 | INTERBEDS OF BROWN, DAMP, PLASTIC, SILTY CLAY, [CL], NO ODOR. | | |
| | | 9 | | 6 | | | |
| S-4 | 50-100 | 10 | | 2 | BROWN, DAMP, PLASTIC, SILTY CLAY, [CL] NO ODOR. | | |
| | | 11 | | 2 | | | |
| | | 12 | | 4 | | | |
| | | 13 | | 4 | | | |
| * S-5 (S2) | 50-100 | 14 | | 3 | | | |
| | | 15 | | 4 | | | |
| | | 16 | | 6 | | | |
| S-6 | 50-100 | 17 | | 9 | SAME AS ABOVE, NO ODOR. | | |
| | | 18 | | 3 | | | |
| | | 19 | | 3 | | | |
| S-7 | 50-100 | 20 | | 4 | BROWN, DAMP, NON-PLASTIC, WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND, [SM], NO ODOR. | | |
| | | 21 | | 5 | | | |
| S-8 | 50-100 | 22 | | 2 | | | |
| | | 23 | | 4 | | | |
| | | 24 | | 5 | | | |
| | | 25 | | 4 | SAME AS ABOVE, NO ODOR. | | |
| S-9 | 50-100 | 26 | | 2 | GRAY, DAMP, PLASTIC, WELL SORTED SILTY CLAY, [CL], NO ODOR. | | |
| | | 27 | | 1 | | | |
| | | 28 | | 5 | GRAY & BROWN, DAMP, NON-PLASTIC, WELL SORTED, (POORLY GRADED), SILTY SAND [SM], NO ODOR. | | |
| | | 29 | | 4 | | | |
| S-10 | 50-100 | 30 | | 2 | SAME AS ABOVE, NO ODOR. | | |
| | | 31 | | 5 | | | |
| | | 32 | | 4 | | | |
| CONTINUED ON NEXT PAGE. | | | | | | | |

03902V4A

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | | | |
|------------------------------------|---------------------|-----------------------------------|-----------------|-----------------------------|--|----------------|-----------------|
| SEE FIGURE 3.4 | | WELL NUMBER 1ANG-2-SB/MW-4/TW-4 | | LOCATION SITE 2 - RAD. SITE | | | |
| | | DATE 30 JULY 1990 | | WEATHER 80°F, SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRLG. | | | |
| | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH 40 PVC | | DIAMETER 2' | | LENGTH 19' | | | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | DIAMETER 2' | | LENGTH 10' | | | |
| | | | | HOLE D.I.A. 9 3/4" | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | COUNTS/MINUTE (CPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION |
| * S-11 (S3) | 50-100 | 20 | | 5 | BROWN, DAMP, NON-PLASTIC, WELL SORTED, (POORLY GRADED), SILTY SAND, [SM], NO ODDR. | | |
| | | 21 | | 2 | | | |
| | | 22 | | 6 | | | |
| S-12 | 50-100 | 23 | | 8 | SAME AS ABOVE, NO ODDR. | | |
| | | 24 | | 8 | | | |
| | | 25 | | 20 | | | |
| S-13 | 50-100 | 26 | | 21 | SAME AS ABOVE, WET @ 24', NO ODDR. | | |
| | | 27 | | 7 | | | |
| | | 28 | | 8 | | | |
| S-14 | 50-100 | 29 | | 3 | SAME AS ABOVE, WET, NO ODDR. | | |
| | | 30 | | 7 | | | |
| | | 31 | | 3 | | | |
| S-15 | 50-100 | 32 | | 4 | SAME AS ABOVE, WET, NO ODDR. | | |
| | | 33 | | 5 | | | |
| | | 34 | | 3 | | | |
| | | 35 | | 5 | AUGERED TO 32' AND INSTALLED TEMPORARY WELL. | | |
| | | 36 | | 8 | | | |
| | | 37 | | 8 | | | |
| | | 38 | | | * SAMPLE CHOSEN FOR LAB ANALYSES. | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

03962V43

| LOCATION MAP | | | ENGINEERING-SCIENCE WELL LOG | | | PAGE 1 OF 2 | | |
|------------------------------------|---------------------|-------|------------------------------|------------------------|---|--------------------|---|--|
| SEE FIGURE 3.4 | | | WELL NUMBER | | IANG-2-SB/MW-5/TV-5 | | LOCATION SITE 2 - RAD. SITE | |
| | | | DATE | | 30 JULY 1990 | | WEATHER 80°F, SUNNY | |
| | | | LOCATED BY | | TAB/KMP | | DRILLED BY FOX DRLG. | |
| | | | DRILLING METHOD | | HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | |
| | | | GRAVEL PACK | | SAND (30/70) | | SEAL BENTONITE | |
| ELEVATION | | | | | | | | |
| CASING TYPE SCH 40 PVC | | | DIAMETER 2' | | | LENGTH 19' | | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | | DIAMETER 2' | | | LENGTH 10' | | |
| | | | | | | HOLE D.I.A. 9 3/4" | | |
| | | | | | | TOTAL DEPTH 32' | | |
| SAMPLE NO. | COUNTS/MINUTE (CPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER | |
| S-1 | 50-100 | 0 | | 2 | BROWN, DAMP, NON-PLASTIC SILT, [ML], NO ODDR. | | | |
| | | 1 | | 2 | | | | |
| | | 2 | | 2 | | | | |
| * S-2 (S1) | 50-100 | 3 | | 2 | BROWN & GRAY, DAMP, PLASTIC, SILTY CLAY, [CL], NO ODDR. | | | |
| | | 4 | | 3 | | | | |
| | | 5 | | 2 | | | | |
| S-3 | 50-100 | 6 | | 1 | SAME AS ABOVE, NO ODDR. | | | |
| | | 7 | | 2 | | | | |
| | | 8 | | 4 | | | | |
| S-4 | 50-100 | 9 | | 2 | SAME AS ABOVE, NO ODDR. | | | |
| | | 10 | | 4 | | | | |
| | | 11 | | 6 | | | | |
| * S-5 (S2) | 50-100 | 12 | | 2 | BROWN, DAMP, NON-PLASTIC, WELL SORTED (POORLY GRADED), SILTY, FINE-GRAINED SAND [SM], NO ODDR. | | | |
| | | 13 | | 3 | | | | |
| | | 14 | | 4 | | | | |
| S-6 | 50-100 | 15 | | 2 | SAME AS ABOVE, NO ODDR. | | | |
| | | 16 | | 5 | | | | |
| | | 17 | | 4 | | | | |
| S-7 | 50-100 | 18 | | 1 | BROWN & GRAY, DAMP, PLASTIC, SILTY CLAY, [CL], NO ODDR. | | | |
| | | 19 | | 2 | | | | |
| | | 20 | | 3 | | | | |
| S-8 | 50-100 | 21 | | 2 | BROWN, DAMP, NON-PLASTIC, VERY WELL SORTED (POORLY GRADED), SILTY, CLAYEY, SAND, [SM], NO ODDR. | | | |
| | | 22 | | 5 | | | | |
| | | 23 | | 3 | | | | |
| S-9 | 50-100 | 24 | | 3 | BROWN, DAMP, NON-PLASTIC, WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND, [SM], NO ODDR. | | | |
| | | 25 | | 9 | | | | |
| | | 26 | | 15 | | | | |
| | | 27 | | 24 | SAME AS ABOVE, NO ODDR. | | | |
| | | 28 | | 27 | | | | |
| | | 29 | | 8 | | | | |
| S-10 | 50-100 | 30 | | 16 | SAME AS ABOVE, NO ODDR. | | | |
| | | 31 | | 16 | | | | |
| | | 32 | | 12 | | | | |
| CONTINUED ON NEXT PAGE. | | | | | | | | |

13962VSA

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | | | |
|------------------------------------|---------------------|-----------------------------------|-----------------|-----------------------------|--|----------------|-----------------|
| SEE FIGURE 3.4 | | WELL NUMBER IANG-2-SB/MW-5/IV-5 | | LOCATION SITE 2 - RAD. SITE | | | |
| | | DATE 30 JULY 1990 | | WEATHER 80°F, SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRLG. | | | |
| | | DRILLING METHOD HOLLOW-STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH 40 PVC | | DIAMETER 2' | | LENGTH 19' | | | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | DIAMETER 2' | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9 3/4" | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | COUNTS/MINUTE (CPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION |
| * S-11 (S3) | 50-100 | 20 | | 5 | BROWN, DAMP, NON-PLASTIC, WELL SORTED (POORLY GRADED), FINE-GRAINED SILTY SAND, [SM], NO ODDR. | | |
| ** (S4) | | 21 | | 7 | | | |
| | | 22 | | 20 | | | |
| S-12 | 50-100 | 23 | | 18 | SAME AS ABOVE, NO ODDR. | | |
| | | 24 | | 10 | | | |
| | | 25 | | 13 | | | |
| S-13 | 50-100 | 26 | | 15 | SAME AS ABOVE, WET @ 24', NO ODDR. | | |
| | | 27 | | 17 | | | |
| | | 28 | | 9 | | | |
| S-14 | 50-100 | 29 | | 7 | SAME AS ABOVE, WET, NO ODDR. | | |
| | | 30 | | 6 | | | |
| | | 31 | | 7 | | | |
| S-15 | 50-100 | 32 | | 3 | GRAY, WET, NON-PLASTIC, WELL SORTED (POORLY GRADED), SILTY, FINE-GRAINED, SAND, [SM], NO ODDR. | | |
| | | 33 | | 5 | | | |
| | | 34 | | 7 | | | |
| | | 35 | | 8 | AUGERED TO 32' AND INSTALLED TEMPORARY WELL. | | |
| | | 36 | | 2 | | | |
| | | 37 | | 1 | | | |
| | | 38 | | 3 | * SAMPLE CHOSEN FOR LAB ANALYSES.
** DUPLICATE SAMPLE OF S3. | | |
| | | 39 | | 3 | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

C2902V58

| LOCATION MAP

SEE FIGURE 3.3 | | ENGINEERING-SCIENCE WELL LOG | | PAGE : OF 2 | | | |
|------------------------------------|----------------------|-------------------------------------|-----------------|---------------------------------|--|----------------|---|
| | | WELL NUMBER IANG-1-SB/MW-1 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 31 JULY 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FDX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| ELEVATION | | CASING TYPE SCH. 40 PVC | | DIAMETER 2" LENGTH 20' | | | |
| | | SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | DIAMETER 2" LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 4.4 | 0 | | 1 | BROWN AND GRAY, DAMP, PLASTIC, SILTY CLAY (CL), NO ODOR. | | |
| | | 1 | | 2 | | | |
| | | 2 | | 7 | | | |
| S-2 | 4.8 | 3 | | 5 | SAME AS ABOVE, NO ODOR. | | |
| | | 4 | | 7 | | | |
| | | 5 | | 10 | | | |
| S-3 | 3.2 | 6 | | 10 | SAME AS ABOVE, NO ODOR. | | |
| | | 7 | | 4 | | | |
| | | 8 | | 4 | | | |
| S-4 | 2.5 | 9 | | 7 | SAME AS ABOVE, NO ODOR. | | |
| | | 10 | | 8 | | | |
| | | 11 | | 1 | | | |
| S-5 | 2.5 | 12 | | 3 | SAME AS ABOVE, NO ODOR. | | |
| | | 13 | | 5 | | | |
| | | 14 | | 5 | | | |
| S-6 | 2.4 | 15 | | 1 | SAME AS ABOVE, NO ODOR. | | |
| | | 16 | | 3 | | | |
| | | 17 | | 4 | | | |
| S-7 | 2.5 | 18 | | 4 | SAME AS ABOVE, NO ODOR. | | |
| | | 19 | | 1 | | | |
| | | 20 | | 3 | | | |
| S-8 | 56 | 21 | | 3 | BROWN, DAMP, NON-PLASTIC SILT (ML), LITTLE CLAY, NO ODOR. | | |
| | | 22 | | 3 | | | |
| | | 23 | | 3 | | | |
| S-9 | 2420 | 24 | | 6 | GRAY, DAMP, NON-PLASTIC, WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND (SM), HYDROCARBON (H-C) ODOR. | | |
| | | 25 | | 14 | | | |
| | | 26 | | 16 | | | |
| S-10 | 4511 | 27 | | 7 | SAME AS ABOVE, H-C ODOR. | | |
| | | 28 | | 13 | | | |
| | | 29 | | 17 | | | |
| | | 30 | | 19 | SAME AS ABOVE, H-C ODOR. | | |
| | | 31 | | 8 | | | |
| | | 32 | | 15 | | | |
| | | | | | CONTINUED ON PAGE 2 OF 2 | | |

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | | | |
|-------------------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|--|----------------|-----------------|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB/MW-1 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 31 JULY 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| ELEVATION | | | | | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2' | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | DIAMETER 2' | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION |
| * S-11 (S1) | 4920 | 20 | | 10 | GRAY, DAMP, NON-PLASTIC, WELL-SORTED (POORLY GRADED), SILTY FINE-GRAINED SAND, [SM], H-C ODOR. | | |
| | | 21 | | 18 | | | |
| * S-12 (S2) | 4790 | 22 | | 20 | SAME AS ABOVE, H-C ODOR. | | |
| | | 23 | | 19 | | | |
| S-13 | 3880 | 24 | | 5 | SAME AS ABOVE, WET @ 24', H-C ODOR. | | |
| | | 25 | | 10 | | | |
| S-14 | 3120 | 26 | | 13 | SAME AS ABOVE, WET, H-C ODOR. | | |
| | | 27 | | 3 | | | |
| S-15 | 510 | 28 | | 7 | SAME AS ABOVE, WET, H-C ODOR. | | |
| | | 29 | | 10 | | | |
| | | 30 | | 3 | AUGERED TO 32' AND INSTALLED IANG-1-MW-1 | | |
| | | 31 | | 6 | | | |
| | | 32 | | 9 | * SAMPLES CHOSEN FOR LABORATORY ANALYSES. | | |
| | | 33 | | 6 | | | |
| | | 34 | | | | | |
| | | 35 | | | | | |
| | | 36 | | | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

0390W18

| LOCATION MAP | | | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | |
|-------------------------------------|----------------------|-------|-----------------|------------------------------|---|----------------|---|
| SEE FIGURE 3.3 | | | | WELL NUMBER | LOCATION SITE 1 - DEFUELING PIT | | |
| | | | | DATE | WEATHER | | |
| | | | | LOCATED BY | DRILLED BY | | |
| | | | | DRILLING METHOD | SAMPLING METHOD | | |
| ELEVATION | | | | GRAVEL PACK | SEAL BENTONITE | | |
| CASING TYPE SCH. 40 PVC | | | | DIAMETER | LENGTH | HOLE D.I.A. | |
| SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | | | DIAMETER | LENGTH | TOTAL DEPTH | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| | | 0 | | | CONCRETE | | |
| | | 1 | | | SAND AND GRAVEL SUB-BASE | | |
| S-1 | 250 | 2 | | 2 | BROWN, DAMP, NON-PLASTIC SILT [ML], NO ODOR. | | |
| | | 3 | | 5 | | | |
| | | 4 | | 4 | DARK, GRAY, DAMP, PLASTIC, SILTY CLAY [CL], NO ODOR. | | |
| | | 5 | | 2 | | | |
| S-2 | 150 | 6 | | 3 | | | |
| | | 7 | | 5 | | | |
| | | 8 | | 2 | | | |
| S-3 | 24 | 9 | | 4 | SAME AS ABOVE, NO ODOR. | | |
| | | 10 | | 7 | | | |
| | | 11 | | 7 | | | |
| S-4 | 120 | 12 | | 2 | GRAY AND BROWN, DAMP, PLASTIC, SILTY CLAY [CL], NO ODOR. | | |
| | | 13 | | 4 | | | |
| | | 14 | | 8 | | | |
| S-5 | 50 | 15 | | 7 | SAME AS ABOVE, NO ODOR. | | |
| | | 16 | | 2 | | | |
| | | 17 | | 3 | | | |
| S-6 | 3.5 | 18 | | 4 | SAME AS ABOVE, NO ODOR. | | |
| | | 19 | | 5 | | | |
| | | 20 | | 1 | | | |
| S-7 | 4.4 | 21 | | 3 | SAME AS ABOVE, NO ODOR. | | |
| | | 22 | | 3 | | | |
| | | 23 | | 3 | | | |
| S-8 | 25 | 24 | | 1 | GRAY, DAMP TO MOIST SILT [ML], NO ODOR. | | |
| | | 25 | | 3 | | | |
| | | 26 | | 4 | | | |
| | | 27 | | 3 | | | |
| S-9 | 55 | 28 | | 1 | | | |
| | | 29 | | 2 | | | |
| | | 30 | | 10 | | | |
| | | 31 | | 18 | BROWN, MOIST, WELL SORTED (POORLY GRADED) SILTY SAND [SM], SLIGHT HYDROCARBON (H-C) ODOR. | | |

CONTINUED ON PAGE 2 OF 2

E390MV2A

| LOCATION MAP | | | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | |
|-------------------------------------|----------------------|-------|-----------------|-----------------------------------|--|--|-----------------|
| SEE FIGURE 3.3 | | | | WELL NUMBER IANG-1-SB-3/MW-2 | | LOCATION SITE 1 - DEFUELING PIT | |
| | | | | DATE 6 AUGUST 1990 | | WEATHER 80'S - SUNNY | |
| | | | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | |
| | | | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | |
| | | | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | |
| ELEVATION | | | | CASING TYPE SCH. 40 PVC | | DIAMETER 2' LENGTH 20' HOLE DIA. 9.75' | |
| SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | | | DIAMETER 2' LENGTH 10' | | TOTAL DEPTH 32' | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION |
| S-10 | 88 | 20 | | 8 | BRDN, DAMP TO MOIST, WELL SORTED (POORLY GRADED) SILTY SAND, [SM], SLIGHT H-C ODDR. | | |
| | | 21 | | 15 | | | |
| | | 22 | | 20 | | | |
| | | 23 | | 26 | | | |
| * S-11 (S1) | 3637 | 23 | | 9 | SAME AS ABOVE, H-C ODDR. | | |
| | | 24 | | 18 | | | |
| | | 25 | | 17 | | | |
| * S-12 (S2) | 2811 | 25 | | 13 | SAME AS ABOVE, WET @ 25', H-C ODDR. | | |
| | | 26 | | 6 | | | |
| | | 27 | | 6 | | | |
| S-13 | 38 | 27 | | 7 | SAME AS ABOVE, WET, SLIGHT H-C ODDR. | | |
| | | 28 | | 8 | | | |
| | | 29 | | 1 | | | |
| S-14 | 32 | 29 | | 1 | BROWN, WET, MODERATELY SORTED (POORLY GRADED) SILTY SAND, [SP], SLIGHT TO NO H-C ODDR. | | |
| | | 30 | | 2 | | | |
| | | 31 | | 3 | | | |
| | | 32 | | 2 | AUGERED TO 32' AND INSTALLED WELL. | | |
| | | 33 | | 5 | | | |
| | | 34 | | 7 | | | |
| | | 35 | | 7 | | | |
| | | 36 | | | * SAMPLES CHOSEN FOR LABORATORY ANALYSES. | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |
| | | | | | | | |
| | | | | | | | |

0390ML-29

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | | | |
|-------------------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|---|----------------|---|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB-4/MW-3 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 7 AUGUST 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| ELEVATION | | | | | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2" | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | DIAMETER 2" | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 300 | 0 | | 3 | GRAY, DAMP, PLASTIC, SILTY, CLAY (CL), NO ODOR, SOME ORGANICS (GRASS ROOTS). | | |
| | | 1 | | 5 | | | |
| | | 2 | | 7 | | | |
| S-2 | 38 | 3 | | 3 | SAME AS ABOVE, NO ODOR. | | |
| | | 4 | | 5 | | | |
| | | 5 | | 9 | | | |
| S-3 | 15 | 6 | | 12 | SAME AS ABOVE, NO ODOR. | | |
| | | 7 | | 3 | | | |
| | | 8 | | 6 | | | |
| S-4 | 15.9 | 9 | | 6 | SAME AS ABOVE, NO ODOR. | | |
| | | 10 | | 9 | | | |
| | | 11 | | 2 | | | |
| S-5 | 9.7 | 12 | | 4 | SAME AS ABOVE, NO ODOR. | | |
| | | 13 | | 6 | | | |
| | | 14 | | 8 | | | |
| S-6 | 115 | 15 | | 2 | BROWN, DAMP, VERY WELL SORTED (POORLY GRADED), VERY FINE-GRAINED SILTY SAND, (SM), NO ODOR. | | |
| | | 16 | | 6 | | | |
| | | 17 | | 9 | | | |
| S-7 | 37 | 18 | | 12 | SAME AS ABOVE, NO ODOR. | | |
| | | 19 | | 15 | | | |
| | | 20 | | 16 | | | |
| S-8 | 56 | 21 | | 9 | GRAY, DAMP, VERY WELL SORTED (POORLY GRADED) VERY FINE-GRAINED SILTY SAND, (SM), SLIGHT HYDROCARBON (H-C) ODOR. | | |
| | | 22 | | 13 | | | |
| | | 23 | | 14 | | | |
| S-9 | 6190 | 24 | | 20 | SAME AS ABOVE, STRONG H-C ODOR. | | |
| | | 25 | | 10 | | | |
| | | 26 | | 19 | | | |
| S-10 | 6209 (S1) | 27 | | 24 | SAME AS ABOVE, H-C ODOR. | | |
| | | 28 | | 23 | | | |
| | | 29 | | 8 | | | |
| | | 30 | | 13 | CONTINUED ON PAGE 2 OF 2 | | |
| | | 31 | | 14 | | | |
| | | 32 | | 20 | | | |

0392M, 3A

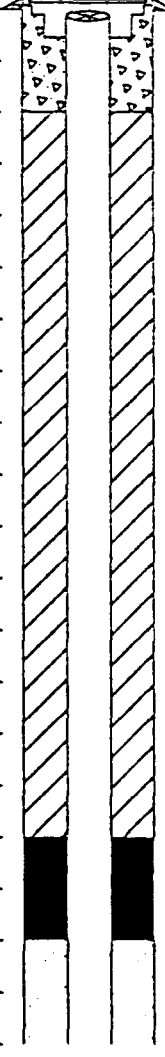
| LOCATION MAP | | ENGINEERING-SCIENCE WFIL LOG | | PAGE 2 OF 2 | | | |
|-------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|---|----------------|-----------------|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB-4/MW-3 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 7 AUGUST 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2" | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC | | SLDT 0.010" | | DIAMETER 2" | | | |
| | | | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION |
| * S-11 6748 (S2) | | 20 | | 7 | GRAY, DAMP, VERY WELL-SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND, [SM], H-C ODDR. | | |
| | | 21 | | 10 | | | |
| | | 22 | | 18 | | | |
| S-12 5980 | | 23 | | 5 | SAME AS ABOVE, MOIST WITH HYDROCARBONS, STRONG H-C ODDR. | | |
| | | 24 | | 5 | | | |
| | | 25 | | 8 | | | |
| S-13 2033 | | 26 | | 9 | SAME AS ABOVE, WATER @ 24', H-C ODDR. | | |
| | | 27 | | 4 | | | |
| | | 28 | | 6 | | | |
| S-14 115 | | 29 | | 8 | SAME AS ABOVE, WET, H-C ODDR. | | |
| | | 30 | | 9 | | | |
| | | 31 | | 4 | | | |
| S-15 619 | | 32 | | 13 | GRAY, WET MODERATELY SORTED (POORLY GRADED), SILTY SAND, [SP], H-C ODDR. | | |
| | | 33 | | 26 | | | |
| | | 34 | | 23 | | | |
| | | 35 | | 4 | AUGERED TO 32' AND INSTALLED WELL. | | |
| | | 36 | | 5 | | | |
| | | 37 | | 5 | | | |
| | | 38 | | | * SOIL SAMPLE CHOSEN FOR LAB ANALYSES. | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

0290-V33

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | | | |
|--------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|---|--|---|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB-5/MW-4 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 7 AUGUST 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2" | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC | | SLOT 0.010" | | DIAMETER 2" LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| | | 0 | | | CONCRETE | | |
| | | 1 | | | SAND AND GRAVEL SUB-BASE. | | |
| S-1 | 65 | 2 | | 2 | GRAY, DAMP, PLASTIC, SILTY CLAY (CL), NO ODDR. | | |
| | | 3 | | 3 | | | |
| | | 4 | | 4 | | | |
| | | 5 | | 3 | | | |
| S-2 | 129 | 6 | | 4 | SAME AS ABOVE, NO ODDR. | | |
| | | 7 | | 6 | | | |
| | | 8 | | 6 | SAME AS ABOVE, NO ODDR. | | |
| S-3 | 250 | 9 | | 1 | | | |
| | | 10 | | 3 | | | |
| | | 11 | | 5 | | | |
| S-4 | 150 | 12 | | 5 | SAME AS ABOVE, NO ODDR. | | |
| | | 13 | | 1 | | | |
| S-5 | 100 | 14 | | 3 | SAME AS ABOVE, NO ODDR. | | |
| | | 15 | | 4 | | | |
| S-6 | 33 | 16 | | 1 | 8/7/90 | | |
| | | 17 | | 2 | 8/8/90 | | |
| | | 18 | | 4 | SAME AS ABOVE, NO ODDR. | | |
| | | 19 | | 5 | | | |
| | | 20 | | 3 | | | |
| S-7 | 21 | 21 | | 4 | | GRAY-BROWN, DAMP, VERY WELL SORTED (POORLY GRADED), SILTY, FINE-GRAINED SAND (SM), NO ODDR W/ INTERBEDS OF SILTY CLAY. | |
| | | 22 | | 5 | | | |
| | | 23 | | 4 | | | |
| | | 24 | | 5 | | | |
| S-8 | 66 | 25 | | 4 | SAME AS ABOVE WITH HYDROCARBON (H-C) ODDR @ APPROX. 17'. | | |
| | | 26 | | 13 | | | |
| | | 27 | | 18 | | | |
| | | 28 | | 8 | | | |
| S-9 | 4256 | 29 | | 20 | SAME AS ABOVE, H-C ODDR. | | |
| | | 30 | | 27 | | | |
| | | 31 | | 32 | | | |
| | | 32 | | | | | |
| CONTINUED ON PAGE 2 OF 2 | | | | | | | |

| LOCATION MAP | | | ENGINEERING-SCIENCE WELL LOG | | | PAGE 2 OF 2 | | |
|-------------------------|----------------------|-------|-----------------------------------|------------------------|--|---------------------------------|-----------------|--|
| SEE FIGURE 3.3 | | | WELL NUMBER IANG-1-SB-5/MW-4 | | | LOCATION SITE 1 - DEFUELING PIT | | |
| | | | DATE 8 AUGUST 1990 | | | WEATHER 80'S - SUNNY | | |
| | | | LOCATED BY TAB/KMP | | | DRILLED BY FOX DRILLING | | |
| | | | DRILLING METHOD HOLLOW STEM AUGER | | | SAMPLING METHOD SPLIT-SPOON | | |
| ELEVATION | | | GRAVEL PACK SAND (30/70) | | | SEAL BENTONITE | | |
| CASING TYPE SCH. 40 PVC | | | DIAMETER 2' | | | LENGTH 20' | | |
| SCREEN TYPE SCH. 40 PVC | | | SLOT 0.010" | | | DIAMETER 2' | | |
| | | | | | | HOLE DIA. 9.75' | | |
| | | | | | | TOTAL DEPTH 32' | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION | |
| * S-10 | 4500 | 20 | | 7 | GRAY, BROWN, DAMP, VERY WELL-SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND, [SM], H-C ODOR. | | | |
| (S1) | | 21 | | 13 | | | | |
| | | 22 | | 20 | | | | |
| S-11 | 3860 | 23 | | 19 | SAME AS ABOVE, H-C ODOR, MOIST WITH HYDROCARBONS. | | | |
| | | 24 | | 6 | | | | |
| | | 25 | | 13 | | | | |
| * S-12 | 5000 | 26 | | 17 | SAME AS ABOVE, H-C ODOR, WATER @ 25'. | | | |
| (S2) | | 27 | | 16 | | | | |
| | | 28 | | 5 | | | | |
| S-13 | 2140 | 29 | | 3 | SAME AS ABOVE, H-C ODOR, WATER @ 25'. | | | |
| | | 30 | | 4 | | | | |
| | | 31 | | 3 | | | | |
| S-14 | 274 | 32 | | 4 | SAME AS ABOVE, WET, H-C ODOR. | | | |
| | | 33 | | 6 | | | | |
| | | 34 | | 3 | | | | |
| | | 35 | | 4 | SAME AS ABOVE, WET, H-C ODOR. | | | |
| | | 36 | | 5 | | | | |
| | | 37 | | 8 | | | | |
| | | 38 | | | AUGERED TO 32' AND INSTALLED WELL. | | | |
| | | 39 | | | | | | |
| | | 40 | | | | | | |
| | | 41 | | | * SAMPLES CHOSEN FOR LABORATORY ANALYSES. | | | |
| | | | | | | | | |
| | | | | | | | | |

03904V48

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | | | |
|-------------------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|--|--|--|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB-6/MW-5 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 9 AUGUST 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2" | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | DIAMETER 2" | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY,
SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 236 | 0 | | 2 | GRAY-BROWN, DAMP, SLIGHT PLASTICITY, SILTY CLAY, [CL], NO ODOR. |  |  |
| | | 1 | | 4 | | | |
| | | 2 | | 6 | | | |
| | | 3 | | 9 | SAME AS ABOVE, NO ODOR. | | |
| S-2 | 58 | 4 | | 4 | | | |
| | | 5 | | 5 | | | |
| | | 6 | | 9 | SAME AS ABOVE, NO ODOR. | | |
| S-3 | 119 | 7 | | 14 | | | |
| (S1) | | 8 | | 4 | | | |
| | | 9 | | 8 | SAME AS ABOVE, NO ODOR. | | |
| S-4 | 47 | 10 | | 14 | | | |
| | | 11 | | 15 | | | |
| | | 12 | | 4 | SAME AS ABOVE, NO ODOR. | | |
| S-5 | 0 | 13 | | 5 | | | |
| | | 14 | | 9 | | | |
| | | 15 | | 15 | SAME AS ABOVE, NO ODOR. | | |
| S-6 | 1.3 | 16 | | 2 | | | |
| | | 17 | | 4 | | | |
| | | 18 | | 8 | SAME AS ABOVE, NO ODOR. | | |
| S-7 | 0.1 | 19 | | 9 | | | |
| | | 20 | | 2 | | | |
| | | 21 | | 5 | SAME AS ABOVE, MOIST, NO ODOR. | | |
| S-8 | 1.5 | 22 | | 5 | | | |
| | | 23 | | 2 | | | |
| | | 24 | | 4 | BROWN, DAMP, WELL SORTED (POORLY GRADED), SILTY FINE-GRAINED SAND (SM), WITH INTERBEDS (3') OF SILTY CLAY AS ABOVE. NO ODOR. | | |
| S-9 | 1.7 | 25 | | 3 | | | |
| | | 26 | | 3 | | | |
| | | 27 | | 2 | SAME AS ABOVE, NO CLAY INTERBEDS, NO ODOR. | | |
| S-10 | 1.7 | 28 | | 5 | | | |
| | | 29 | | 9 | | | |
| | | 30 | | 10 | GRAY, MOIST VERY WELL SORTED (POORLY GRADED), FINE GRAINED, SILTY SAND (SM), SLIGHT H-C, SLIGHT DECAYING ORGANICS ODOR. | | |
| | | 31 | | 6 | | | |
| | | 32 | | 13 | | | |
| | | | | 19 | CONTINUED ON PAGE 2 OF 2 | | |
| | | | | 21 | | | |

8398-154

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | | | |
|-------------------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|--|----------------|-----------------|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB-6/MW-5 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 9 AUGUST 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPDON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2' | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | DIAMETER 2' | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION |
| S-11 | 1.3 | 20 | X | 12 | GRAY, DAMP TO MOIST, VERY WELL SORTED (POORLY GRADED), FINE-GRAINED SILTY SAND (SM), NO H-C ODOR, SLIGHT DECAYING ORGANICS ODOR. | | |
| | | 21 | | 19 | | | |
| | | 22 | | 23 | | | |
| S-12 | 0 | 23 | X | 13 | SAME AS ABOVE, NO H-C ODOR. | | |
| | | 24 | | 12 | | | |
| | | 25 | | 10 | | | |
| S-13 | 0 | 25 | X | 4 | SAME AS ABOVE, WATER @ 24'. NO H-C ODOR. | | |
| | | 26 | | 6 | | | |
| | | 27 | | 6 | | | |
| * S-14 (S2) | 2.9 | 27 | X | 3 | SAME AS ABOVE, WET, SWEET ODOR, (POSSIBLY H-C). | | |
| | | 28 | | 6 | | | |
| | | 29 | | 5 | | | |
| S-15 | 3.4 | 29 | X | 7 | GRAY, WET MODERATELY SORTED (POORLY GRADED), SILTY SAND (SP), LITTLE GRAVEL, SOME ODOR AS ABOVE, POSSIBLY H-C. | | |
| | | 30 | | 3 | | | |
| | | 31 | | 3 | | | |
| | | 32 | | | | | |
| | | 33 | | | AUGERED TO 32' AND INSTALLED WELL. | | |
| | | 34 | | | | | |
| | | 35 | | | * SAMPLES CHOSEN FOR LABORATORY ANALYSES. | | |
| | | 36 | | | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

03904-58

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | | | |
|-------------------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|--|----------------|---|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB-7/MW-6 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 10 AUGUST 1990 | | WEATHER 70'S - OVERCAST | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2' | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | DIAMETER 2' | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 212 | 0 | | 2 | BROWN, DAMP, PLASTIC, SILTY, CLAY [CL], NO ODDR, SOME ORGANICS (GRASS ROOTS). | | |
| | | 1 | | 4 | | | |
| | | 2 | | 4 | | | |
| | | 3 | | 6 | | | |
| S-2 | 160 | 4 | | 4 | SAME AS ABOVE, NO ODDR. | | |
| | | 5 | | 5 | | | |
| | | 6 | | 9 | | | |
| | | 7 | | 10 | | | |
| S-3 | 67 | 8 | | 3 | SAME AS ABOVE, NO ODDR. | | |
| | | 9 | | 4 | | | |
| | | 10 | | 9 | | | |
| | | 11 | | 10 | | | |
| S-4 | 24 | 12 | | 1 | SAME AS ABOVE, NO ODDR. | | |
| | | 13 | | 3 | | | |
| | | 14 | | 4 | | | |
| | | 15 | | 4 | | | |
| S-5 | 139 | 16 | | 1 | BROWN, DAMP, VERY WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND [SM], NO ODDR. | | |
| | | 17 | | 3 | | | |
| | | 18 | | 12 | | | |
| | | 19 | | 11 | | | |
| S-6 | 54 | 20 | | 6 | SAME AS ABOVE, NO ODDR. | | |
| | | 21 | | 8 | | | |
| | | 22 | | 5 | | | |
| | | 23 | | 4 | | | |
| S-7 | 24 | 24 | | 2 | SAME AS ABOVE, NO ODDR. | | |
| | | 25 | | 2 | | | |
| | | 26 | | 2 | | | |
| | | 27 | | 2 | | | |
| S-8 | 8 | 28 | | 2 | SAME AS ABOVE, NO ODDR. | | |
| | | 29 | | 4 | | | |
| | | 30 | | 5 | | | |
| | | 31 | | 5 | | | |
| S-9 | 9 | 32 | | 6 | SAME AS ABOVE, MOIST, NO ODDR. | | |
| | | 33 | | 12 | | | |
| | | 34 | | 15 | | | |
| | | 35 | | 7 | | | |
| S-10 | 14 | 36 | | 11 | SAME AS ABOVE, MOIST, NO ODDR. | | |
| | | 37 | | 17 | | | |
| | | 38 | | 22 | | | |
| | | 39 | | | | | |
| | | | | | CONTINUED ON PAGE 2 OF 2 | | |

| LOCATION MAP | | | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | |
|-------------------------------------|----------------------|-------|-----------------|-----------------------------------|--|--|-----------------|
| SEE FIGURE 3.3 | | | | WELL NUMBER IANG-1-SB-7/MW-6 | | LOCATION SITE 1 - DEFUELING PIT | |
| | | | | DATE 10 AUGUST 1990 | | WEATHER 70'S - OVERCAST | |
| | | | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | |
| | | | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | |
| | | | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | |
| ELEVATION | | | | CASING TYPE SCH. 40 PVC | | DIAMETER 2' LENGTH 20' HOLE DIA. 9.75' | |
| SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | | | DIAMETER 2' LENGTH 10' | | TOTAL DEPTH 32' | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDOR.) | LITHO. PROFILE | WELL COMPLETION |
| S-11
(S2)
** | 77 | 20 | | 11 | BROWN, MOIST, VERY WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND, [SM], NO ODDOR. | | |
| | | 21 | | 13 | | | |
| S-12
(BR1)
*** | 46 | 22 | | 11 | SAME AS ABOVE, NO ODDOR. | | |
| | | 23 | | 8 | | | |
| S-13
51 | | 24 | | 8 | SAME AS ABOVE, WATER @ 25', NO ODDOR. | | |
| | | 25 | | 6 | | | |
| S-14
(BR2)
*** | 43 | 26 | | 7 | SAME AS ABOVE, NO ODDOR. | | |
| | | 27 | | 3 | | | |
| S-15
35 | | 28 | | 4 | SAME AS ABOVE, NO ODDOR. | | |
| | | 29 | | 9 | | | |
| | | 30 | | 11 | AUGERED TO 32' AND INSTALLED WELL | | |
| | | 31 | | 3 | | | |
| | | 32 | | 4 | * SAMPLES CHOSEN FOR LABORATORY ANALYSES.
** SAMPLES CHOSEN FOR DUPLICATE.
*** SAMPLES CHOSEN FOR GROSS ALPHA/BETA, RADIUM 226, RADIUM 228 ANALYSES. | | |
| | | 33 | | 6 | | | |
| | | 34 | | 7 | | | |
| | | 35 | | | | | |
| | | 36 | | | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

0390HL69

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | | | |
|-------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|---|----------------|---|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB-8/MW-7 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 11 AUGUST 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2" | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC | | SLOT 0.010" | | DIAMETER 2" | | | |
| | | | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75" | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 69 | 0 | | 3 | BROWN AND GRAY, DAMP, PLASTIC, SILTY CLAY, [CL], NO ODOR. (SOME ORGANICS, GRASS ROOTS). | | |
| | | 1 | | 3 | | | |
| | | 2 | | 7 | | | |
| | | 3 | | 9 | BROWN, DAMP, NON-PLASTIC SILT, [ML], NO ODOR. | | |
| S-2 | 35 | 4 | | 6 | | | |
| | | 5 | | 9 | | | |
| | | 6 | | 12 | BROWN AND GRAY, DAMP, PLASTIC, SILTY CLAY, [CL], NO ODOR. | | |
| S-3 | 65 | 7 | | 6 | | | |
| | | 8 | | 7 | | | |
| | | 9 | | 9 | SAME AS ABOVE, NO ODOR. | | |
| S-4 | 64 | 10 | | 2 | | | |
| | | 11 | | 3 | | | |
| | | 12 | | 5 | SAME AS ABOVE, NO ODOR. | | |
| S-5 | 65 | 13 | | 6 | | | |
| (S1) | | 14 | | 7 | | | |
| | | 15 | | 2 | SAME AS ABOVE, NO ODOR. | | |
| S-6 | 0 | 16 | | 3 | | | |
| | | 17 | | 4 | | | |
| | | 18 | | 5 | SAME AS ABOVE, NO ODOR. | | |
| S-7 | 0 | 19 | | 2 | | | |
| | | 20 | | 3 | | | |
| | | 21 | | 7 | SAME AS ABOVE, NO ODOR. | | |
| S-8 | 2.7 | 22 | | 2 | | | |
| | | 23 | | 3 | | | |
| | | 24 | | 4 | 15.5'-15.7' BROWN, SILTY SAND, [SM], LENS, MOIST, NO ODOR. | | |
| S-9 | 0 | 25 | | 3 | | | |
| | | 26 | | 1 | | | |
| | | 27 | | 2 | SAME AS ABOVE, NO ODOR. | | |
| S-10 | 0 | 28 | | 1 | | | |
| | | 29 | | 1 | | | |
| | | 30 | | 2 | CONTINUED ON PAGE 2 OF 2 | | |
| | | 31 | | | | | |

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | | | |
|-------------------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|---|----------------|-----------------|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB-8/MW-7 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 11 AUGUST 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2' | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC SLET 0.010" | | DIAMETER 2' | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION |
| S-11 | 0 | 20 | X | 1 | GRAY, MOIST, PLASTIC, SILTY CLAY, [CL] SOME SAND, NO ODOR. | | |
| | | 21 | X | 1 | | | |
| | | 22 | X | 1 | | | |
| * S-12 (S2) | 2.8 | 23 | X | 1 | GRAY, WET VERY WELL SORTED, (POORLY GRADED) FINE-GRAINED, SILTY SAND, [SM], NO ODOR, WATER 3 24'. | | |
| | | 24 | X | 6 | | | |
| S-13 | 0 | 25 | X | 21 | SAME AS ABOVE, WET, NO ODOR. | | |
| | | 26 | X | 34 | | | |
| | | 27 | X | 42 | | | |
| S-14 | 0 | 28 | X | 4 | SAME AS ABOVE, WET NO ODOR. | | |
| | | 29 | X | 8 | | | |
| | | 30 | X | 7 | | | |
| S-15 | 0 | 31 | X | 7 | AUGERED TO 32' AND INSTALLED WELL. | | |
| | | 32 | X | 1 | | | |
| | | 33 | X | 1 | | | |
| | | 34 | | 2 | * SAMPLES CHOSEN FOR LABORATORY ANALYSES. | | |
| | | 35 | | | | | |
| | | 36 | | | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

03904V78

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 1 OF 2 | | | |
|-------------------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|---|----------------|---|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB-9/MW8 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 11 AUGUST 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2" | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | DIAMETER 2" | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY,
SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER |
| S-1 | 1 | 0 | | 3 | GRAY AND BROWN, DAMP, MED. PLAST, SILTY CLAY, (CL), NO ODDR, SOME ORGANICS (GRASS ROOTS). | | |
| | | 1 | | 4 | | | |
| | | | 7 | | | | |
| S-2 | 2.3 | 2 | | 7 | SAME AS ABOVE, NO ODDR. | | |
| | | 3 | | 4 | | | |
| | | | 5 | | | | |
| S-3 | 1.9 | 4 | | 7 | SAME AS ABOVE, NO ODDR. | | |
| | | 5 | | 8 | | | |
| | | | 4 | | | | |
| S-4 | 1.5 | 6 | | 5 | SAME AS ABOVE, NO ODDR. | | |
| | | 7 | | 7 | | | |
| | | | 9 | | | | |
| S-5 | 1.0 | 8 | | 3 | SAME AS ABOVE, NO ODDR. | | |
| | | 9 | | 6 | | | |
| | | | 9 | | | | |
| S-6 | 0.5 | 10 | | 11 | BROWN AND GRAY, DAMP, SILT, (ML), SOME CLAY, NO ODDR. | | |
| | | 11 | | 2 | | | |
| | | | 5 | | | | |
| S-7 | 10 | 12 | | 5 | BROWN, DAMP, VERY WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND, (SM), NO ODDR. | | |
| | | 13 | | 12 | | | |
| | | | 14 | | | | |
| S-8 | 11.4 | 14 | | 13 | SAME AS ABOVE, MOIST, NO ODDR. | | |
| | | 15 | | 7 | | | |
| | | | 8 | | | | |
| S-9
(S1) | 19 | 16 | | 10 | SAME AS ABOVE, DAMP, NO ODDR. | | |
| | | 17 | | 14 | | | |
| | | | 9 | | | | |
| S-10 | 16 | 18 | | 11 | SAME AS ABOVE, NO ODDR. | | |
| | | 19 | | 16 | | | |
| | | | 18 | | | | |
| | | 20 | | 8 | | | |
| | | 21 | | 18 | | | |
| | | | | 28 | | | |
| | | | | 28 | | | |
| CONTINUED ON PAGE 2 OF 2 | | | | | | | |

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | PAGE 2 OF 2 | | | |
|-------------------------------------|----------------------|-----------------------------------|-----------------|---------------------------------|---|----------------|-----------------|
| SEE FIGURE 3.3 | | WELL NUMBER IANG-1-SB-9/MW-8 | | LOCATION SITE 1 - DEFUELING PIT | | | |
| | | DATE 11 AUGUST 1990 | | WEATHER 80'S - SUNNY | | | |
| | | LOCATED BY TAB/KMP | | DRILLED BY FOX DRILLING | | | |
| | | DRILLING METHOD HOLLOW STEM AUGER | | SAMPLING METHOD SPLIT-SPOON | | | |
| ELEVATION | | GRAVEL PACK SAND (30/70) | | SEAL BENTONITE | | | |
| CASING TYPE SCH. 40 PVC | | DIAMETER 2" | | LENGTH 20' | | | |
| SCREEN TYPE SCH. 40 PVC SLOT 0.010" | | DIAMETER 2" | | LENGTH 10' | | | |
| | | | | HOLE DIA. 9.75' | | | |
| | | | | TOTAL DEPTH 32' | | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODOR.) | LITHO. PROFILE | WELL COMPLETION |
| S-11
(S2)
** (S2-D) | 23 | 20 | | 8 | BROWN, DAMP, VERY WELL SORTED (POORLY GRADED), FINE-GRAINED, SILTY SAND (SM), NO ODOR. | | |
| | | 21 | | 15 | | | |
| S-12 | 10.9 | 22 | | 13 | SAME AS ABOVE, WATER @ 23', NO ODOR. | ▼ | |
| | | 23 | | 5 | | | |
| S-13 | 7.0 | 24 | | 3 | SAME AS ABOVE, WET, NO ODOR. | | |
| | | 25 | | 3 | | | |
| S-14 | 16.5 | 26 | | 8 | BROWN, WET, MODERATELY SORTED (POORLY GRADED), FINE TO COARSE GRAINED, SILTY SAND WITH GRAVEL, (SP), NO ODOR. | ○ | |
| | | 27 | | 1 | | | |
| S-15 | 13.5 | 28 | | 3 | SAME AS ABOVE, NO ODOR. | ○ | |
| | | 29 | | 3 | | | |
| | | 30 | | 5 | AUGERED TO 32' AND INSTALLED WELL. | ○ | |
| | | 31 | | 6 | | | |
| | | 32 | | | * SAMPLES CHOSEN FOR LABORATORY ANALYSES. | | |
| | | 33 | | | | | |
| | | 34 | | | ** SAMPLES CHOSEN FOR DUPLICATE. | | |
| | | 35 | | | | | |
| | | 36 | | | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

0390V83

| LOCATION MAP | | ENGINEERING-SCIENCE WELL LOG | | | | PAGE 1 OF 1 | |
|--------------------|----------------------|------------------------------|-----------------|------------------------|---|---------------------|-----------------|
| WELL NUMBER | | 1ANG-1-SB-2 | | LOCATION | | SITE 1 - DEFUEL PIT | |
| DATE | | 7 JULY 1990 | | WEATHER | | 80'S - SUNNY | |
| WELLSITE GEOLOGIST | | TAB/KMP | | DRILLED BY | | FOX DRILLING | |
| DRILLING METHOD | | HOLLOW STEM AUGERS | | SAMPLING METHOD | | SPLIT-SPOON | |
| ELEVATION | | GRAVEL PACK NA | | SEAL | | BENTONITE | |
| CASING TYPE | | NA | | DIAMETER | | NA | |
| SCREEN TYPE | | NA | | SLCT | | NA | |
| | | | | DIAMETER | | NA | |
| | | | | LENGTH | | NA | |
| | | | | | | HOLE DIA. 9.75' | |
| | | | | | | TOTAL DEPTH 20' | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION |
| S-1 | 32.7 | 0 | | 1 | BROWN AND GREY, DAMP, PLASTIC, VERY WELL SORTED (POORLY GRADED), SILTY CLAY.
(CL), NO ODDR | | |
| | | 1 | | 2 | | | |
| | | 2 | | 4 | | | |
| | | 3 | | 6 | | | |
| S-2 | 43.4 | 3 | | 3 | SAME AS ABOVE | | |
| | | 4 | | 6 | | | |
| | | 5 | | 8 | | | |
| | | 6 | | 10 | | | |
| S-3 | 75 | 7 | | 2 | SAME AS ABOVE | | |
| | | 8 | | 4 | | | |
| | | 9 | | 6 | | | |
| | | 10 | | 8 | | | |
| S-4 | 53 | 11 | | 3 | SAME AS ABOVE | | |
| | | 12 | | 4 | | | |
| | | 13 | | 6 | | | |
| | | 14 | | 8 | | | |
| S-5 | 45 | 15 | | 2 | SAME AS ABOVE, HYDROCARBON ODDR (H-C) | | |
| | | 16 | | 4 | | | |
| | | 17 | | 1 | | | |
| | | 18 | | 2 | | | |
| S-6 | 208 | 19 | | 3 | BROWN AND GREY, DAMP, NONPLASTIC, WELL SORTED, SILT (H-C) ODDR, INTERBEDS OF DAMP, FINE GRAINED SILTY SAND. | | |
| | | 20 | | 4 | | | |
| | | 21 | | 2 | | | |
| | | 22 | | 3 | | | |
| S-7 | 844 | 23 | | 2 | BROWN AND GREY, NONPLASTIC, WELL SORTED, FINE GRAINED, SILTY SAND, (H-C) ODDR | | |
| | | 24 | | 9 | | | |
| | | 25 | | 9 | | | |
| | | 26 | | 16 | | | |
| S-8 | 3409 | 27 | | 16 | SAME AS ABOVE | | |
| | | 28 | | 20 | | | |
| | | 29 | | 10 | | | |
| | | 30 | | 20 | | | |
| S-9 | 3410 | 31 | | 31 | SAME AS ABOVE | | |
| | | 32 | | 37 | | | |
| | | 33 | | 8 | | | |
| | | 34 | | 9 | | | |
| S-10 | 3811 | 35 | | 13 | SAME AS ABOVE | | |
| | | 36 | | 15 | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | | | | ABANDONED BORING AS PER HAZWRAP REQUEST. | | |
| | | 0930 | | 1 AUG 1990 | | T. BENSON | |

0390582
LB

| LOCATION MAP | | | ENGINEERING-SCIENCE WELL LOG | | | PAGE 1 OF 2 | | |
|------------------------------------|----------------------|-------|---|------------------------|---|----------------|---|--|
| SEE SITE PLAN | | | WELL NUMBER B1/MW-1 | | LOCATION IDWA ANG UST ASS. | | | |
| | | | DATE 12-12-90 | | WEATHER CLOUDY, 30'S | | | |
| | | | WELLSITE GEOLOGIST K. PALOMBO | | DRILLED BY FOX DRILLING | | | |
| | | | DRILLING METHOD 6.25" ID HOLLOW STEM AUGS | | SAMPLING METHOD 2' SPLIT-SPOON | | | |
| | | | GRAVEL PACK 20-40 SILICA SAND | | SEAL BENTONITE | | | |
| ELEVATION | | | | | | | | |
| CASING TYPE SCH 40 PVC | | | DIAMETER 4" | | LENGTH 10.3' | | HOLE DIA. 10" | |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | | DIAMETER 4" | | LENGTH 15' | | TOTAL DEPTH 26' | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION
FLUSH MOUNT PROTECTIVE COVER | |
| | | 0 | | | ASPHALT | | | |
| | | 1 | | | BROWN FINE SAND | | | |
| | | 2 | | | | | | |
| | | 3 | | | DARK GRAY CLAY | | | |
| | | 4 | | | | | | |
| 1 | 50 | 5 | 4 | | MEDIUM BROWN MOTTLED GRAY CLAY | | | |
| | | 6 | 9 | | WITH TRACE SILT FEW REDDISH BROWN | | | |
| | | 7 | 9 | | ROOT TRAILS. | | | |
| | | 8 | 12 | | | | | |
| | | 9 | | | BROWN FINE SAND WITH A TRACE OF | | | |
| | | 10 | | | SILT. | | | |
| 2 | 10 | 11 | 2 | | | | | |
| | | 12 | 1 | | | | | |
| | | 13 | 1 | | | | | |
| | | 14 | 2 | | BROWN CLAY WITH MINOR SILT. | | | |
| | | 15 | | | | | | |
| | | 16 | | | | | | |
| 3 | 17 | 17 | 1 | | WET, GRAY MOTTLED REDDISH BROWN | | | |
| | | 18 | 2 | | FINE SILTY SAND WITH FEW REDDISH | | | |
| | | 19 | 4 | | BROWN ROOTLETS. | | | |
| | | 20 | 3 | | | | | |
| | | 21 | | | | | | |
| 4 | 14.5 | 21 | 1 | | SOFT, MOIST GRAY CLAY | | | |
| | | | 1 | | | | | |

| LOCATION MAP | | | ENGINEERING-SCIENCE WELL LOG | | | PAGE 2 OF 2 | |
|------------------------------------|----------------------|-------|------------------------------|------------------------|---|----------------|-----------------|
| SEE SITE PLAN | | | WELL NUMBER | | LOCATION | | |
| | | | DATE | | WEATHER | | |
| | | | WELLSITE GEOLOGIST | | DRILLED BY | | |
| | | | DRILLING METHOD | | SAMPLING METHOD | | |
| | | | GRAVEL PACK | | SEAL | | |
| ELEVATION | | | 20-40 SILICA SAND | | BENTONITE | | |
| CASING TYPE SCH 40 PVC | | | DIAMETER 4" | | LENGTH 10.3' | | HOLE DIA. 10" |
| SCREEN TYPE SCH 40 PVC SLOT 0.010" | | | DIAMETER 4" | | LENGTH 15' | | TOTAL DEPTH 26' |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | DESCRIPTION/REMARKS
(COLOR, MOISTURE, PLASTICITY, SORTING, SOIL TYPE, ODDR.) | LITHO. PROFILE | WELL COMPLETION |
| | | 20 | | | SOFT MOIST GRAY CLAY. | | |
| | | 21 | | 1 | | | |
| | | 22 | | 1 | | | |
| | | 23 | | | | | |
| | | 24 | | | WET, DARK GRAY FINE TO MEDIUM SAND (60-70% QUARTZ SAND) | | |
| 5 | 8.5 | 25 | | 1 | | | |
| | | 26 | | 7 | | | |
| | | 27 | | 8 | | | |
| | | 28 | | 6 | | | |
| | | 29 | | | | | |
| | | 30 | | | | | |
| | | 31 | | | | | |
| | | 32 | | | | | |
| | | 33 | | | | | |
| | | 34 | | | | | |
| | | 35 | | | | | |
| | | 36 | | | | | |
| | | 37 | | | | | |
| | | 38 | | | | | |
| | | 39 | | | | | |
| | | 40 | | | | | |
| | | 41 | | | | | |

APPENDIX F
HYDRAULIC CONDUCTIVITY TEST RESULTS

HVORSLEV'S METHOD FOR K

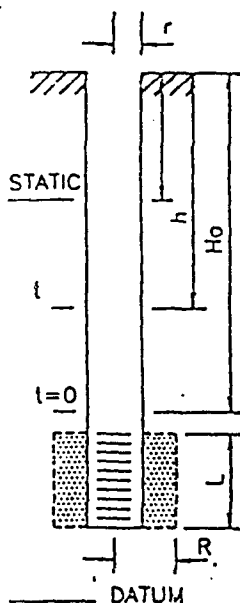
PROJECT IOWA ANG

WELL NUMBER M10-2 (T-1)

DATE 8-22-90

LOCATION SITE 1 - Defueling P.

ELEVATION _____



STATIC HEAD 25.50

PIPE RADIUS (r) .083

BORE HOLE RADIUS (R) 1.117

SATURATED SCREEN LENGTH (L) 5.5

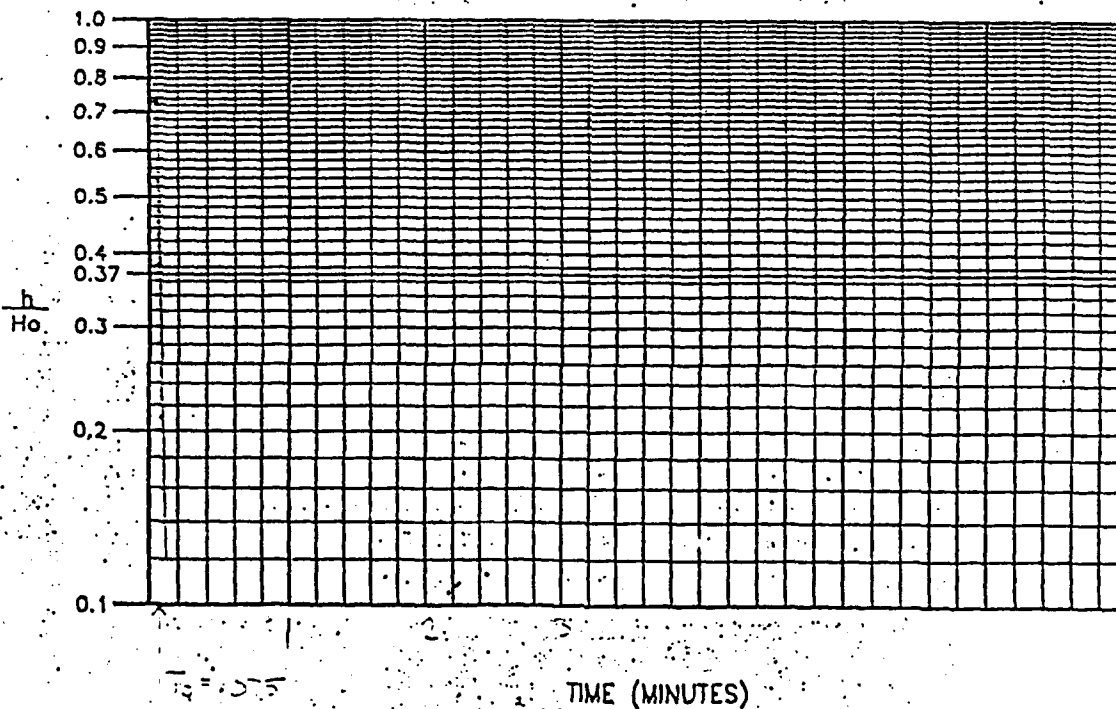
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{(.083)^2 \ln(5.5/1.117)}{2(5.5)(.075)}$$

| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 25.50 | | |
| 00 | 26.67 | 1.67 (Ho) | 1.00 |
| 02 | 26.22 | 1.22 (h) | .73 |
| 03 | 25.80 | .80 (h) | .52 |
| 05 | 25.64 | .64 (h) | .38 |
| 07 | 25.47 | .47 (h) | .28 |
| 09 | 25.35 | .35 (h) | .21 |
| 10 | 25.26 | .26 (h) | .16 |
| 12 | 25.20 | .20 (h) | .12 |
| 13 | 25.15 | .15 (h) | .09 |
| 15 | 25.12 | .12 (h) | .07 |
| 17 | 25.10 | .10 (h) | .06 |
| 25 | 25.04 | .04 (h) | .02 |
| 33 | 25.03 | .03 (h) | .02 |
| 42 | 25.11 | .11 (h) | |

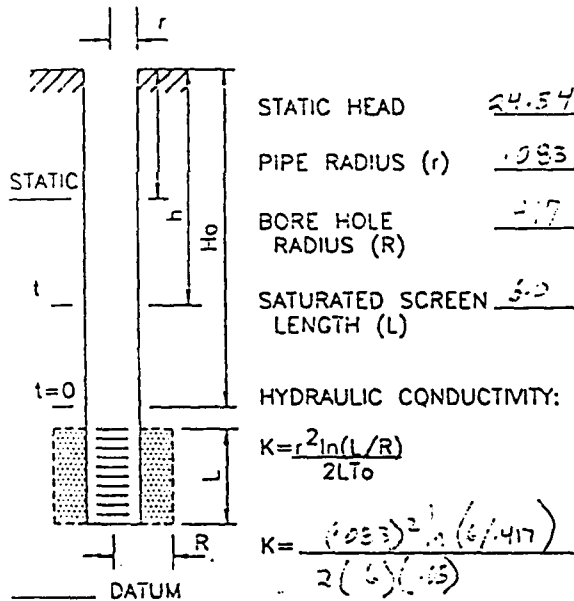
K = .233 FT/MIN K = 31.68 FT/DAY K = 1.1 x 10⁻² CM/SEC



HVORSLEV'S METHOD FOR K

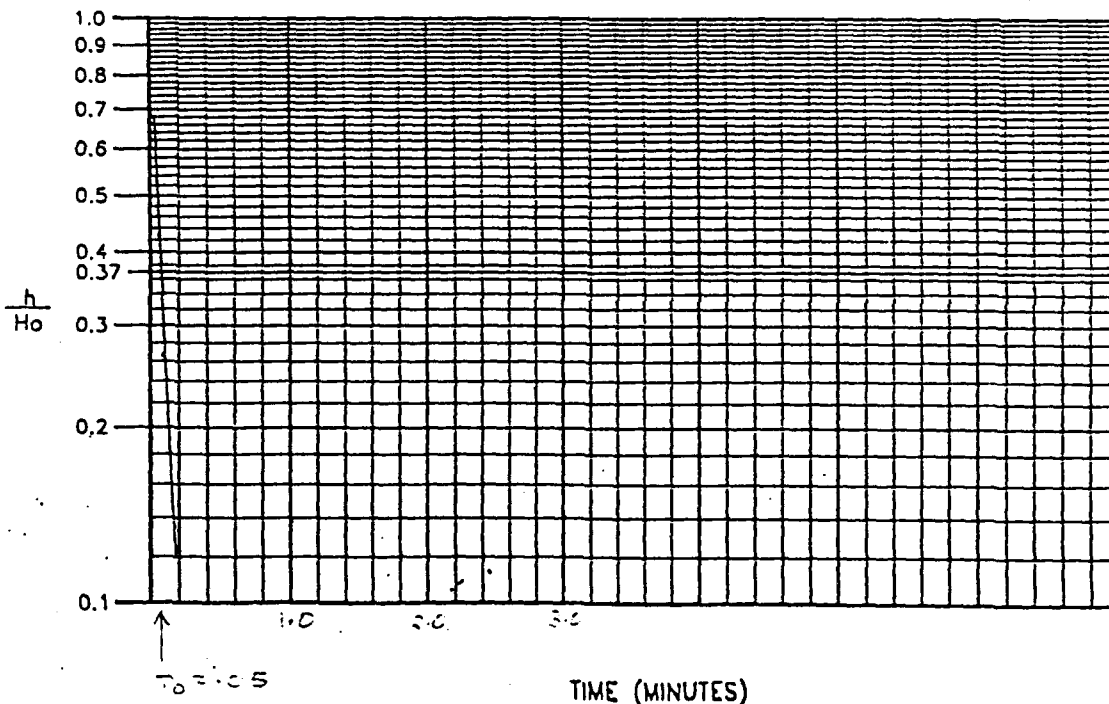
PROJECT IOWA RIVER
WELL NUMBER 192-5 (20-1)
DATE 8/22/90

LOCATION SITE 3 - DEFUELING PIT
ELEVATION _____



| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC $\pm$ (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 24.54 | | |
| 00 | 23.37 | 1.17 (H ₀) | 1.00 |
| 02 | 23.20 | .75 (h) | .84 |
| 05 | 23.04 | .50 (h) | .73 |
| 10 | 22.88 | .66 (h) | .81 |
| 15 | 22.72 | .22 (h) | .74 |
| 20 | 22.56 | .98 (h) | .83 |
| 25 | 22.40 | .14 (h) | .77 |
| 30 | 22.24 | .30 (h) | .87 |
| 35 | 22.08 | .46 (h) | .95 |
| 40 | 21.92 | .62 (h) | .94 |
| 45 | 21.76 | .78 (h) | .92 |
| 50 | 21.60 | .94 (h) | .90 |
| 55 | 21.44 | 1.10 (h) | .81 |
| 60 | 21.28 | 1.26 (h) | .70 |

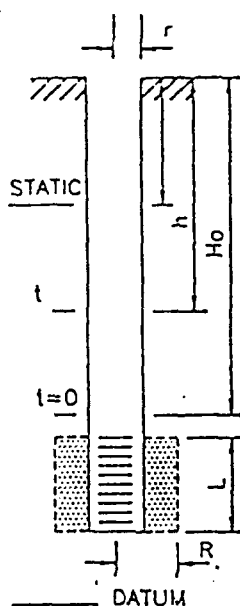
$K = .031$ FT/MIN $K = 44.64$ FT/DAY $K = 1.57 \times 10^{-2}$ CM/SEC



HVORSLEV'S METHOD FOR K

PROJECT LOWA KING
WELL NUMBER 14-5 (7-1)
DATE 8/22/90

LOCATION SITE 1 - D
ELEVATION _____



STATIC HEAD 24.54
PIPE RADIUS (r) .083
BORE HOLE RADIUS (R) .417
SATURATED SCREEN LENGTH (L) 6.0

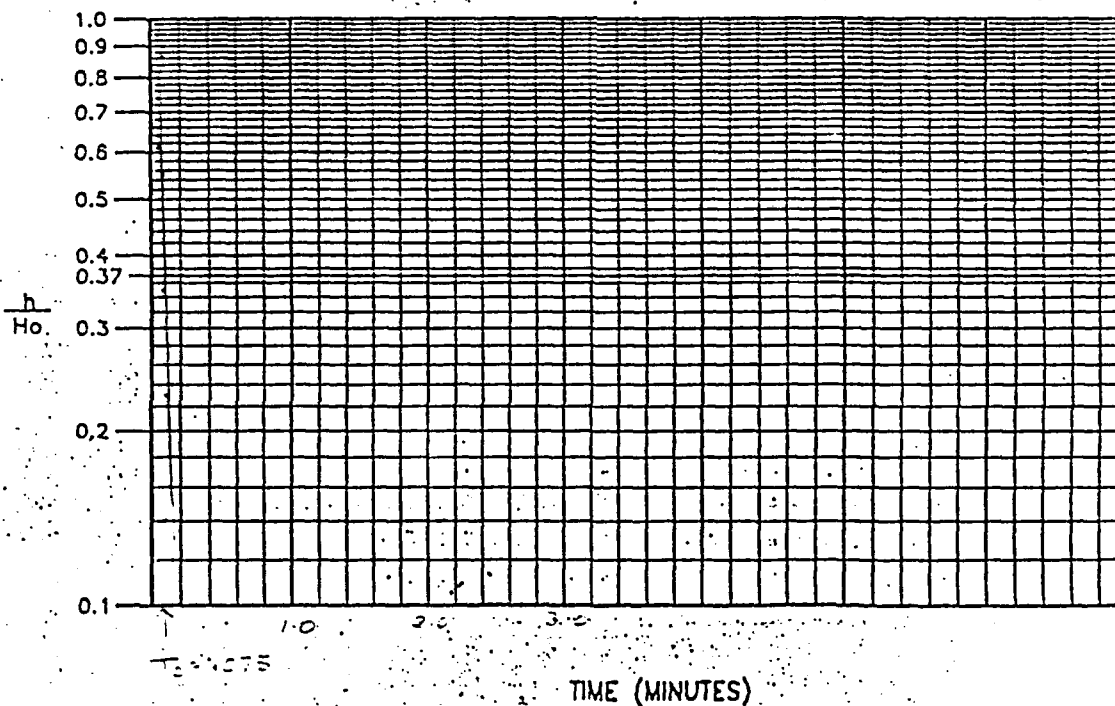
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{(0.083)^2 \ln(0.417/0.075)}{2(6)(0.075)}$$

K = .030 FT/MIN K = 29.4 FT/DAY K = 1.04 x 10⁻² CM/SEC

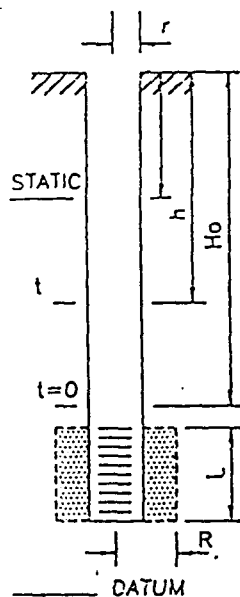
| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 24.54 | _____ | _____ |
| 00 | 25.59 | .05 (H ₀) | 1.00 |
| 01 | 25.16 | .04 (h) | .81 |
| 03 | 24.84 | .02 (h) | .64 |
| 05 | 24.73 | .01 (h) | .49 |
| 07 | 25.12 | .05 (h) | .55 |
| 08 | 24.91 | .07 (h) | .35 |
| 10 | 24.78 | .04 (h) | .23 |
| 12 | 24.72 | .02 (h) | .14 |
| 13 | 24.63 | .09 (h) | .69 |
| 15 | 24.62 | .06 (h) | .56 |
| 22 | 24.54 | 0 (h) | 0 |
| | | (h) | |
| | | (h) | |



HVORSLEV'S METHOD FOR K

PROJECT INDIANA ANG
WELL NUMBER MW-7 (200)
DATE 5/22/40

LOCATION Site 1 - Defueling Pit
ELEVATION _____



STATIC HEAD 24.41

PIPE RADIUS (r) .083

BORE HOLE RADIUS (R) .417

SATURATED SCREEN LENGTH (L) 6.0

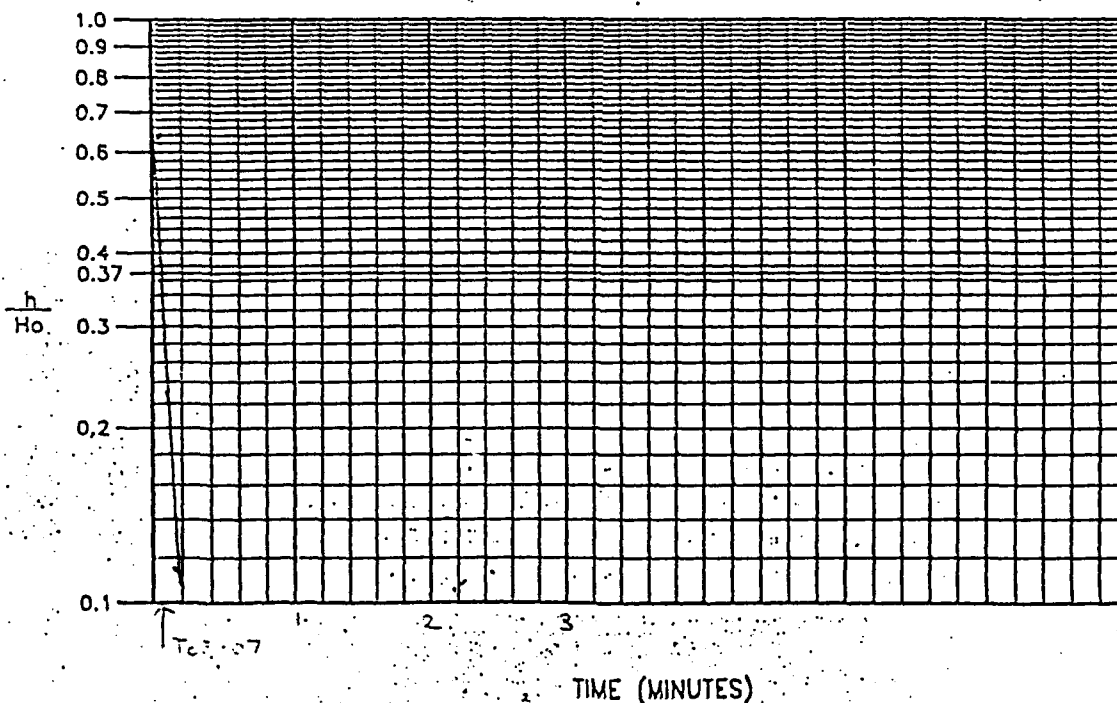
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{(.083)^2 / \ln(6.0 / .417)}{2(6)(.07)}$$

| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 24.41 | — | — |
| 00 | 24.43 | 1.02 (H ₀) | 1.00 |
| .03 | 25.44 | 1.03 (h) | .64 |
| .07 | 25.03 | .62 (h) | .30 |
| .10 | 24.79 | .32 (h) | .13 |
| .13 | 24.65 | .24 (h) | .15 |
| .17 | 24.59 | .15 (h) | .11 |
| .33 | 24.44 | .03 (h) | .02 |
| .50 | 24.42 | .01 (h) | .01 |
| .62 | 24.41 | .00 (h) | — |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |

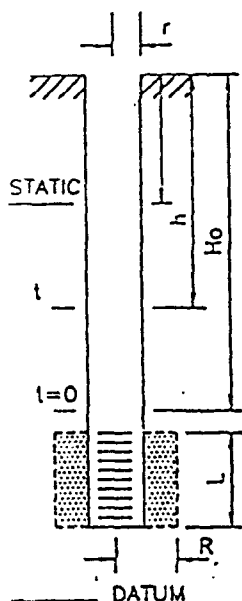
K = .022 FT/MIN K = 31.68 FT/DAY K = 1.11 x 10⁻² CM/SEC



HVORSLEV'S METHOD FOR K

PROJECT Force A116
WELL NUMBER FW-7 (Test 2)
DATE 5/27/90

LOCATION Site 1 Defueling Pit
ELEVATION _____



STATIC HEAD 24.41

PIPE RADIUS (r) .053

BORE HOLE RADIUS (R) .417

SATURATED SCREEN LENGTH (L) 6.0

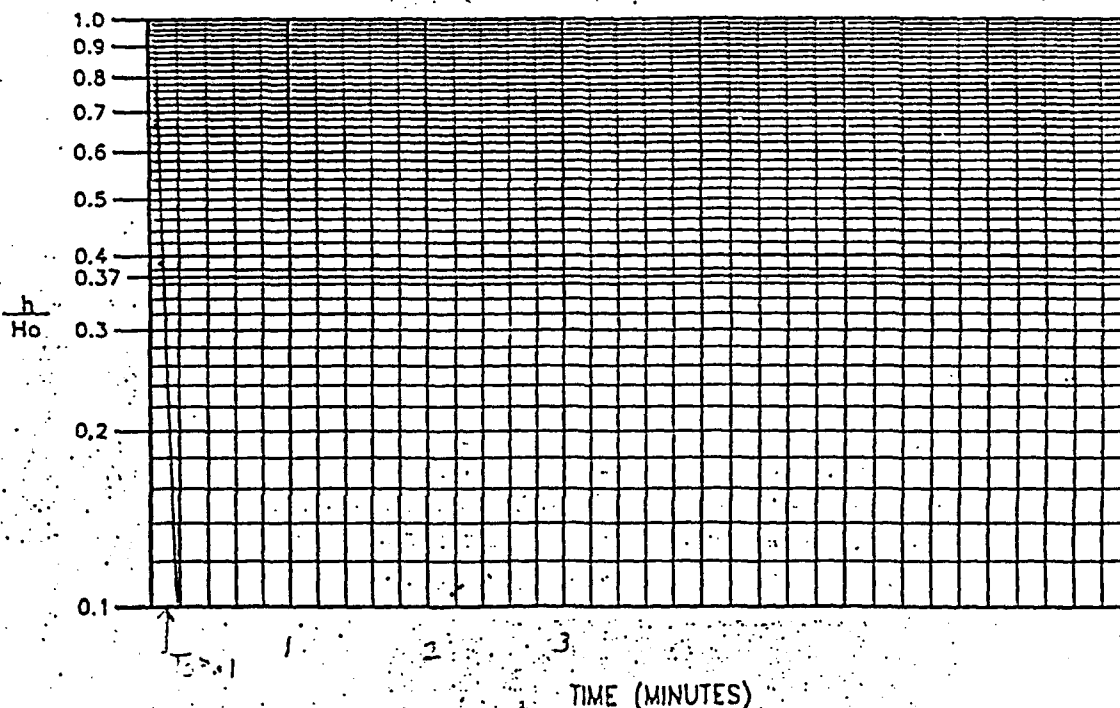
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{(.053)^2 (6/.417)}{2(6)(.1)}$$

K = .015 FT/MIN K = .22 FT/DAY K = 7.9×10^{-3} CM/SEC

| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 24.41 | — | — |
| 00 | 26.28 | 1.87 (H ₀) | 1.00 |
| .03 | 25.12 | 1.25 (h) | .570 |
| .07 | 25.15 | .74 (h) | .39 |
| .12 | 24.82 | .45 (h) | .24 |
| .13 | 24.68 | .27 (h) | .14 |
| .23 | 24.51 | .10 (h) | .05 |
| .40 | 24.12 | .01 (h) | — |
| .5 | 24.11 | 0 (h) | — |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |



HVORSLEV'S METHOD FOR K

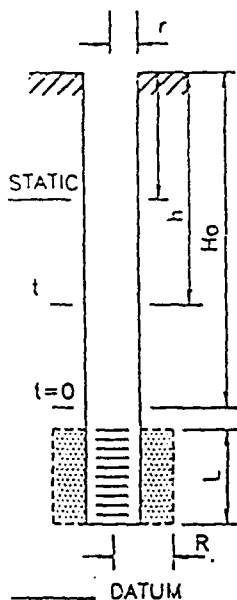
PROJECT Iron A-1

WELL NUMBER 10-8 (10-8)

DATE 2/22/00

LOCATION 1000 1st St. N. S.W.

ELEVATION _____



STATIC HEAD 22.70'

PIPE RADIUS (r) 0.53

BORE HOLE
RADIUS (R) 0.117

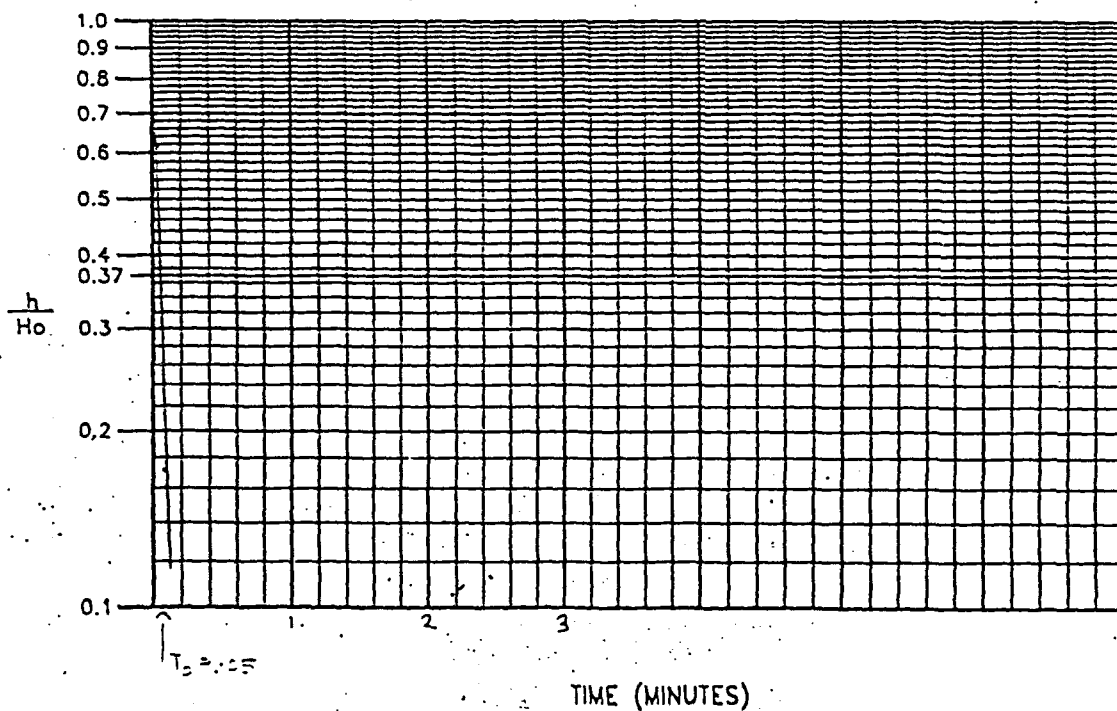
SATURATED SCREEN 7.0
LENGTH (L)

HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2L\tau_0}$$

$$K = \frac{(0.53)^2 / 1 (7.417)}{2(7)(1.55)}$$

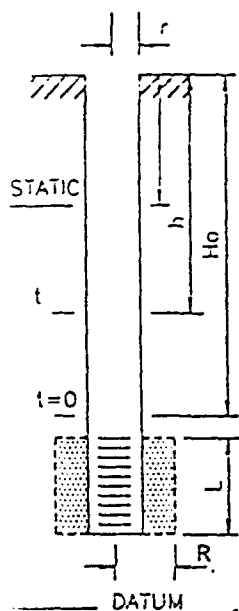
$K = 0.25$ FT/MIN $K = 39.77$ FT/DAY $K = 1.4 \times 10^{-2}$ CM/SEC

[illegible]

HVORSLEV'S METHOD FOR K

PROJECT TRUCK RIVER
WELL NUMBER TW-1 (Test 1)
DATE 9-21-60

LOCATION SITE 2 - P.O. - 1.2
ELEVATION _____



STATIC HEAD 27.74

PIPE RADIUS (r) 0.093

BORE HOLE RADIUS (R) 0.417

SATURATED SCREEN LENGTH (L) 4.0

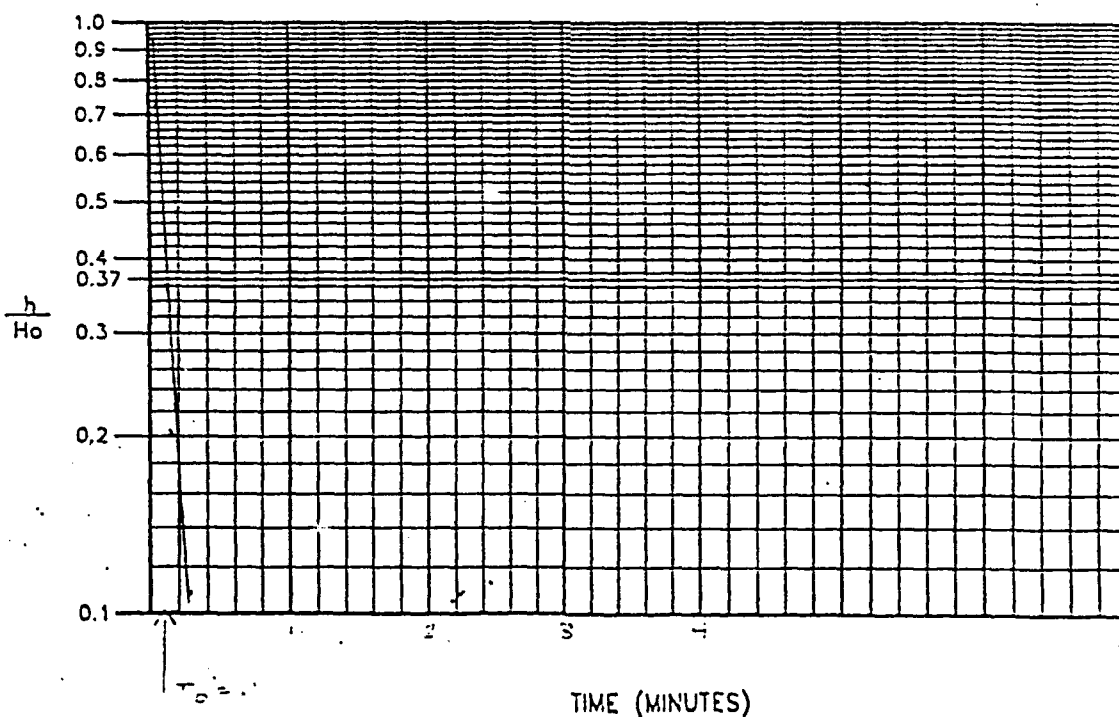
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{(0.093)^2 \ln(4/0.417)}{2(4)(0.1)}$$

$$K = 1.9 \times 10^{-2} \text{ FT/MIN} \quad K = 27 \text{ FT/DAY} \quad K = 9.65 \times 10^{-3} \text{ CM/SEC}$$

| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 27.74 | — | — |
| 00 | 27.74 | 1.74 (H ₀) | 1.00 |
| 03 | 27.30 | 0.44 (h) | 0.73 |
| 10 | 26.65 | 1.09 (h) | 0.36 |
| 20 | 26.32 | 1.42 (h) | 0.19 |
| 28 | 26.22 | 1.52 (h) | 0.12 |
| 45 | 26.10 | 1.64 (h) | 0.06 |
| 70 | 26.05 | 1.69 (h) | 0.03 |
| 95 | 26.03 | 1.71 (h) | 0.02 |
| 170 | 26.02 | 1.72 (h) | 0.01 |
| 32 | 26.01 | 1.73 (h) | 0.005 |
| 52 | 26.00 | 1.74 (h) | 0 |
| | | (h) | |
| | | (h) | |
| | | (h) | |



HVORSLEV'S METHOD FOR K

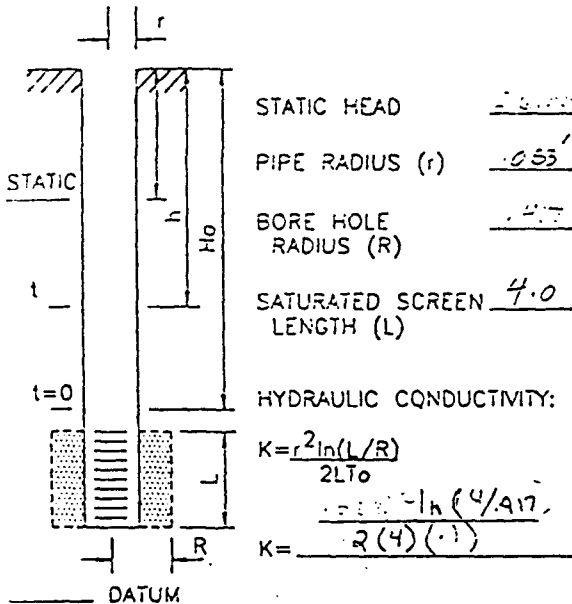
PROJECT WELL 412

LOCATION Site 2, 1/2 mi. S. of

WELL NUMBER 7-1-1 (7-1-3)

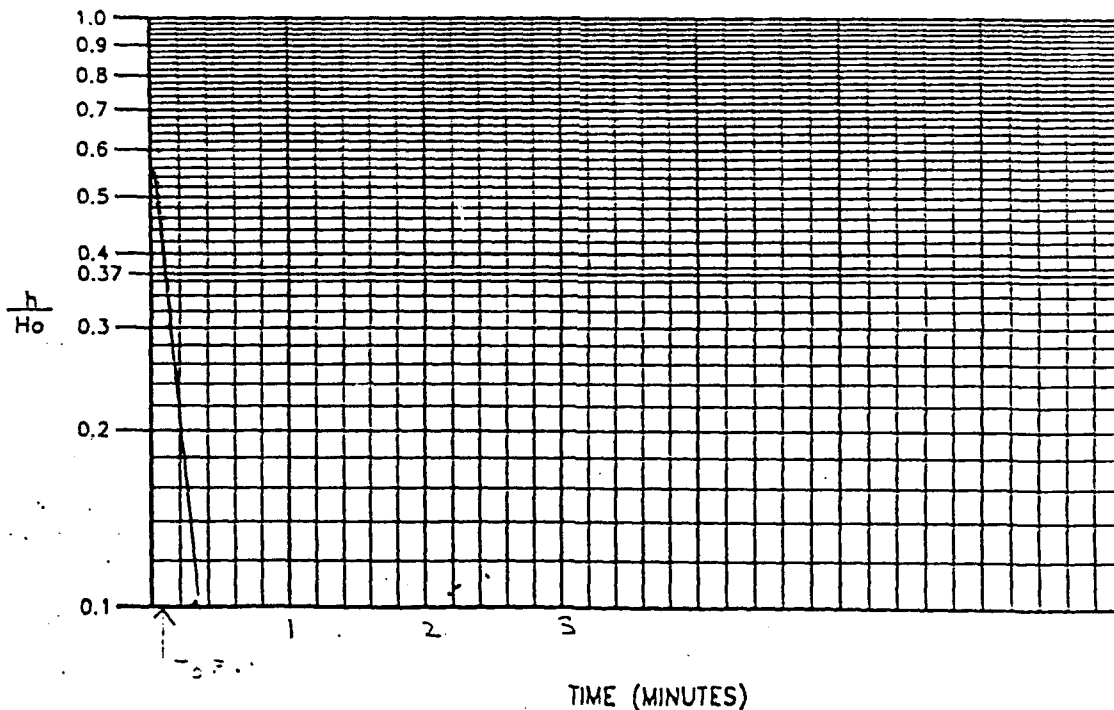
ELEVATION

DATE 2/11/70



| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC $\pm$ (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 26.00 | — | — |
| 00 | 27.64 | 1.64 (H0) | 1.00 |
| .07 | 27.20 | 1.00 (h) | .61 |
| .12 | 26.75 | .75 (h) | .46 |
| .15 | 26.60 | .60 (h) | .35 |
| .32 | 26.17 | .17 (h) | .16 |
| .73 | 25.55 | .25 (h) | .13 |
| 1.01 | 25.23 | .23 (h) | .08 |
| 3.52 | 24.50 | .50 (h) | .0 |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |

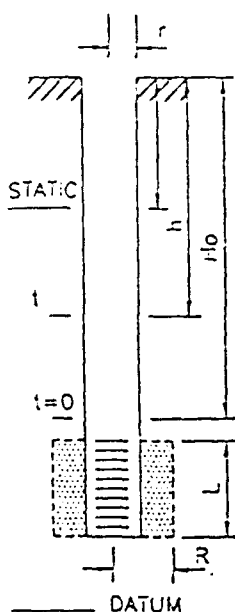
K = .0194 FT/MIN K = 28.03 FT/DAY K = 9.89 x 10⁻³ CM/SEC



HVORSLEV'S METHOD FOR K

PROJECT Lower A114
WELL NUMBER TW-2 (100)
DATE 9/21/90

LOCATION SITE 2 - 127. RD. S-1
ELEVATION _____



STATIC HEAD 25.89

PIPE RADIUS (r) .053

BORE HOLE RADIUS (R) .417

SATURATED SCREEN LENGTH (L) 5.0

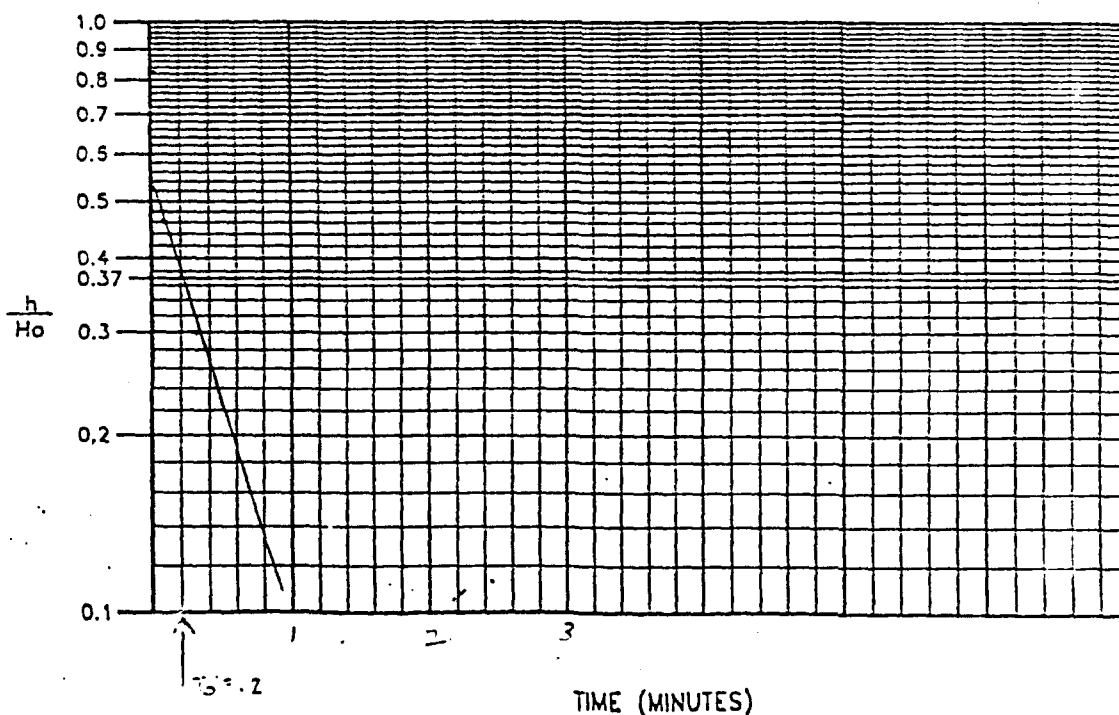
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{(.053)^2 \ln(5/.417)}{2(5)(.20)}$$

| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 25.89 | — | — |
| 00 | 27.89 | 2.0 (H ₀) | 1.00 |
| .03 | 27.55 | 1.34 (h) | .53 |
| .13 | 27.20 | .91 (h) | .42 |
| .30 | 26.93 | .59 (h) | .27 |
| .47 | 26.83 | .44 (h) | .17 |
| .63 | 26.80 | .39 (h) | .15 |
| .75 | 26.86 | .37 (h) | .14 |
| .97 | 26.85 | .36 (h) | .13 |
| 1.13 | 26.84 | .35 (h) | .12 |
| 1.33 | 26.93 | .34 (h) | .12 |
| 2.00 | 26.92 | .33 (h) | .12 |
| | | (h) | |
| | | (h) | |
| | | (h) | |

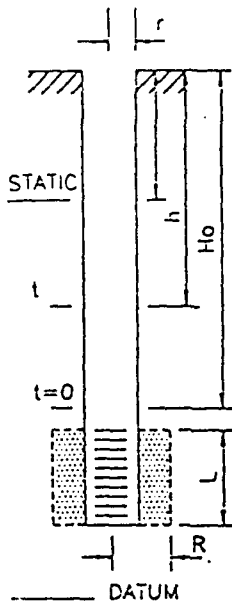
K = .0085 FT/MIN K = 12.32 FT/DAY K = 4.54 × 10⁻³ CM/SEC



HVORSLEV'S METHOD FOR K

PROJECT Feas Study
 WELL NUMBER Tw-2 (Test)
 DATE 8/21/90

LOCATION Site 2 - Pet. Prod. Unit
 ELEVATION _____



STATIC HEAD 65.22
 PIPE RADIUS (r) .05
 BORE HOLE RADIUS (R) ...
 SATURATED SCREEN LENGTH (L) 5.0

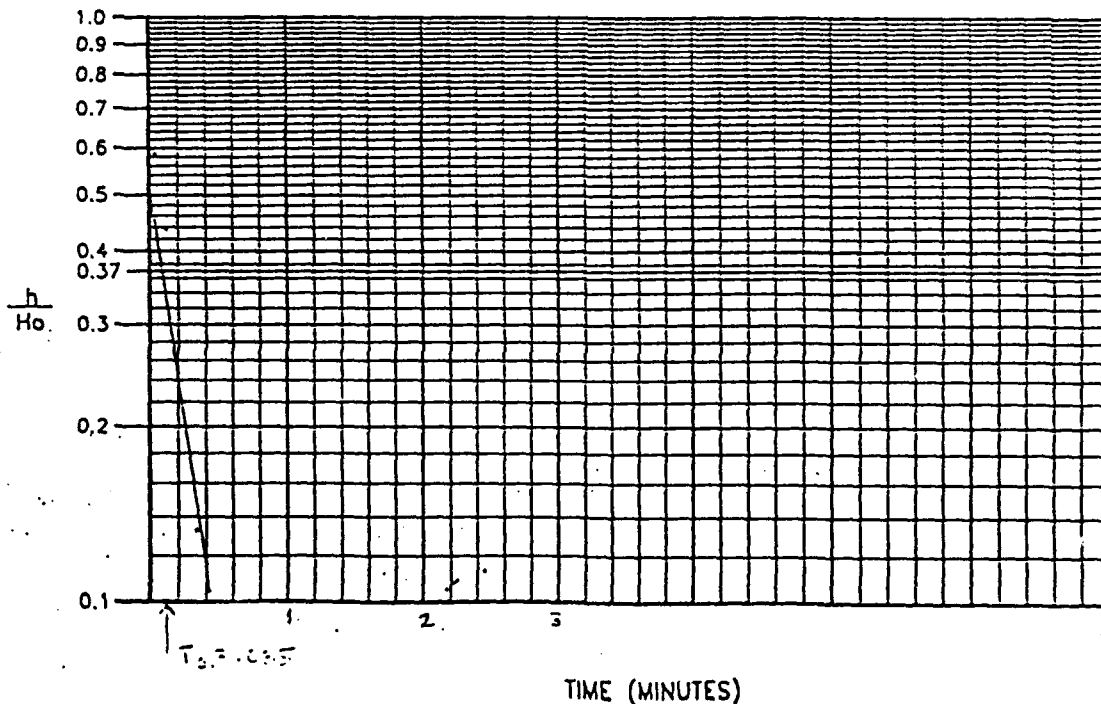
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{.05^2 \ln(5/.05)}{2(5)(.085)}$$

| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 25.02 | — | — |
| 00 | 27.65 | 1.17 (Ho) | 1.00 |
| .5 | 24.57 | .68 (h) | .59 |
| 1 | 23.38 | .51 (h) | .44 |
| 1.5 | 22.78 | .38 (h) | .32 |
| 2.33 | 21.02 | .15 (h) | .13 |
| 3.0 | 20.08 | .05 (h) | .02 |
| 3.45 | 19.02 | .04 (h) | .03 |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |

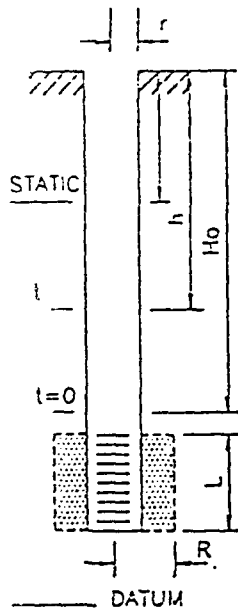
K = .020 FT/MIN K = 28.99 FT/DAY K = 1.02 x 10⁻² CM/SEC



HVORSLEV'S METHOD FOR K

PROJECT WELL 3
WELL NUMBER TW-3
DATE 9/21/60

LOCATION S. 1/4 2 - P. 2 - R. 10 - S. 1
ELEVATION _____



STATIC HEAD 25.29
PIPE RADIUS (r) 1.83
BORE HOLE RADIUS (R) 1.417
SATURATED SCREEN LENGTH (L) 5.0

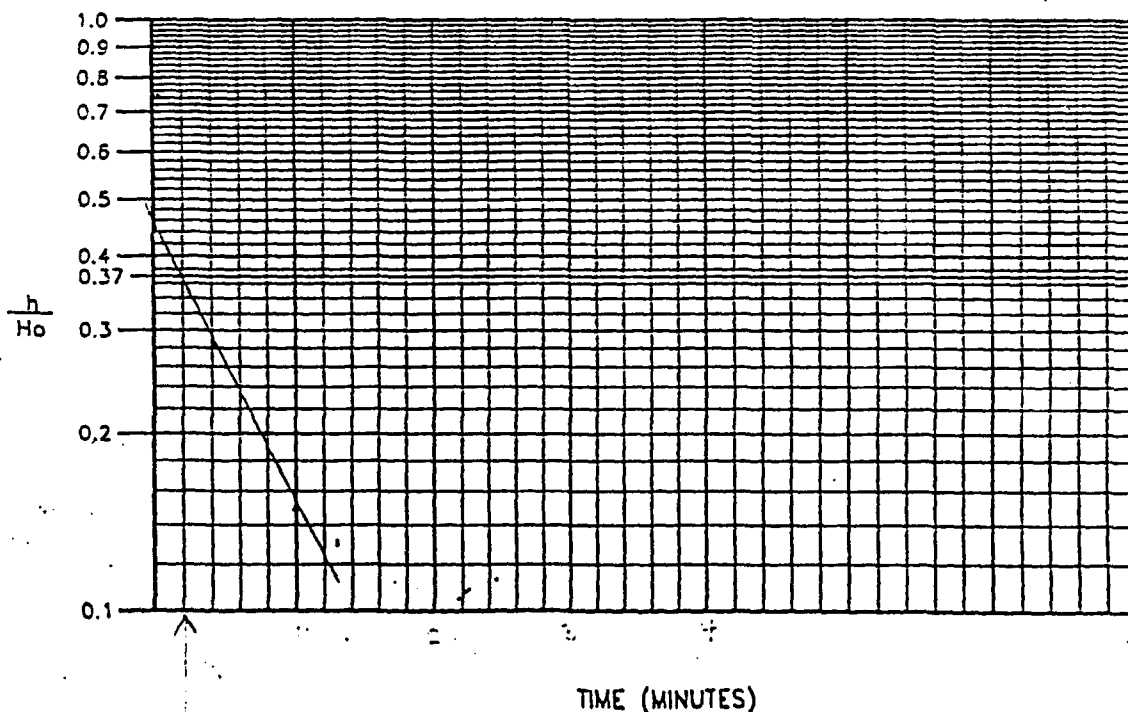
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{(1.83)^2 / \ln(5/1.417)}{2(5)(1.2)}$$

$$K = 3.55 \times 10^{-3} \text{ FT/MIN} \quad K = 12.24 \text{ FT/DAY} \quad K = 4.32 \times 10^{-3} \text{ CM/SEC}$$

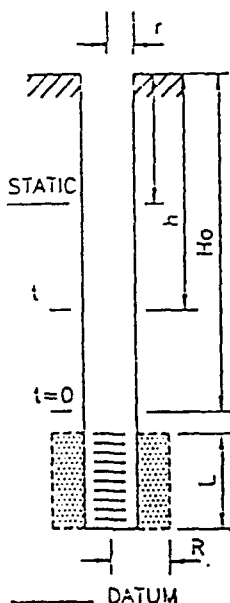
| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 25.29 | — | — |
| 00 | 27.68 | 2.39 (H ₀) | 1.00 |
| .25 | 27.07 | 1.20 (h) | .75 |
| .55 | 26.33 | 1.24 (h) | .44 |
| .71 | 25.97 | .65 (h) | .28 |
| .75 | 25.71 | .50 (h) | .21 |
| 1 | 25.65 | .31 (h) | .15 |
| 1.25 | 25.61 | .32 (h) | .13 |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |
| | | (h) | |



HVORSLEV'S METHOD FOR K

PROJECT SEWER A&P
 WELL NUMBER TW-4
 DATE 2/2/70

LOCATION SITE 2 - POT HOLE SITE
 ELEVATION _____



STATIC HEAD 25.48
 PIPE RADIUS (r) .093
 BORE HOLE RADIUS (R) .417
 SATURATED SCREEN LENGTH (L) 6.5'

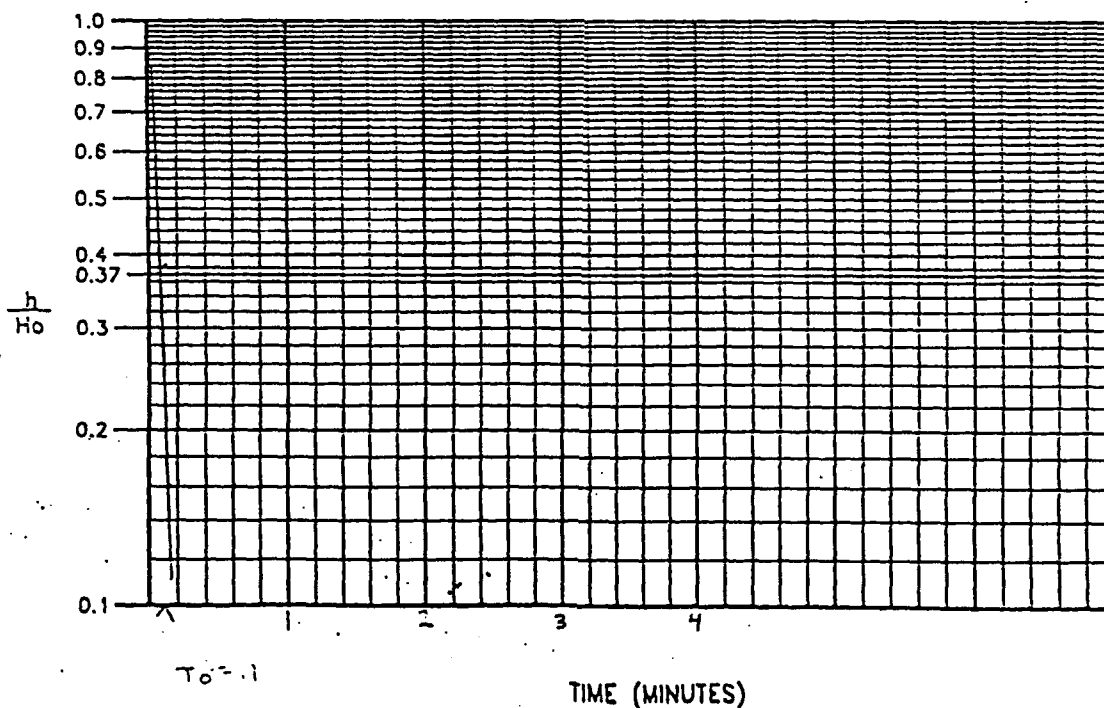
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{(.093)^2 \ln(6.5/.417)}{2(6.5)(.1)}$$

| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 25.48 | — | — |
| 00 | 27.21 | 1.73 (H ₀) | 1.00 |
| .07 | 26.43 | .95 (h) | .55 |
| .10 | 26.14 | .66 (h) | .33 |
| .16 | 25.76 | .28 (h) | .16 |
| .27 | 25.64 | .16 (h) | .09 |
| .52 | 25.56 | .08 (h) | .05 |
| .77 | 25.55 | .07 (h) | .04 |
| 1.27 | 25.53 | .05 (h) | .03 |
| 1.52 | 25.53 | .05 (h) | .03 |
| 2.27 | 25.50 | .02 (h) | .01 |
| 2.77 | 25.48 | 0 (h) | 0 |
| | | (h) | |
| | | (h) | |
| | | (h) | |

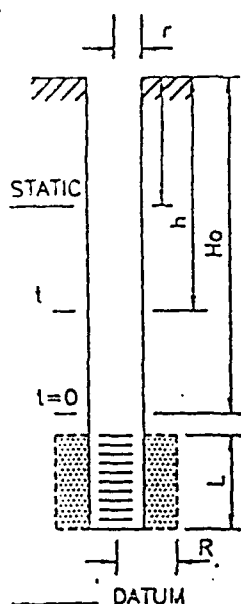
K = .0146 FT/MIN K = 21.02 FT/DAY K = 7.44 × 10⁻³ CM/SEC



HVORSLEV'S METHOD FOR K

PROJECT TOURN 4116
 WELL NUMBER TW-5 (Test 1)
 DATE 2/11/90

LOCATION SITE 2 - POT FAD. SITE
 ELEVATION _____



STATIC HEAD 25.84

PIPE RADIUS (r) .053

BORE HOLE RADIUS (R) .417

SATURATED SCREEN LENGTH (L) 5.5

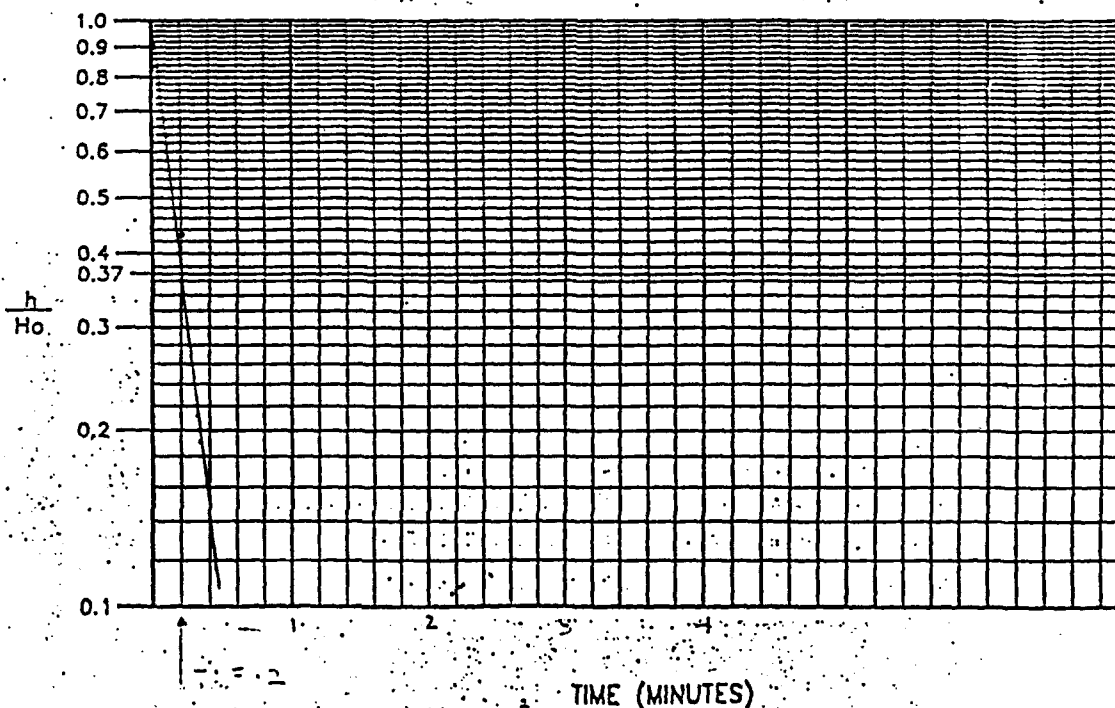
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{(0.053)^2 \ln(5.5/.417)}{2(5.5 \times .2)}$$

| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 25.84 | — | — |
| 00 | 25.75 | 1.91 (H ₀) | 1.00 |
| .02 | 25.62 | 1.58 (h) | .83 |
| .07 | 25.47 | 1.39 (h) | .73 |
| .10 | 25.37 | 1.23 (h) | .64 |
| .13 | 25.28 | 1.25 (h) | .55 |
| .17 | 25.15 | .91 (h) | .48 |
| .20 | 25.02 | .82 (h) | .43 |
| .27 | 24.82 | .36 (h) | .19 |
| .53 | 24.31 | .17 (h) | .09 |
| .70 | 24.14 | .10 (h) | .05 |
| .67 | 24.00 | .04 (h) | .03 |
| 1.03 | 25.55 | .14 (h) | .02 |
| 1.20 | 25.36 | .12 (h) | .01 |
| 1.37 | 25.34 | .00 (h) | 0 |

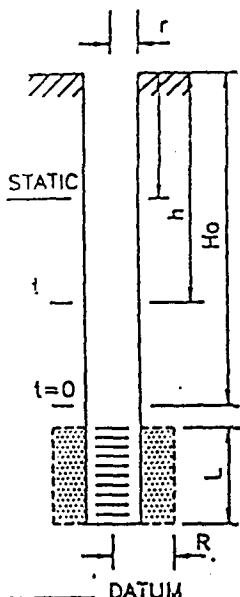
K = .0021 FT/MIN K = 11.66 FT/DAY K = 4.1 x 10⁻³ CM/SEC



HVORSLEV'S METHOD FOR K

PROJECT IOWA ANG
WELL NUMBER TW-5 (TEST 2)
DATE 3/21/90

LOCATION SITE 2 - POT. RAD. SITE
ELEVATION _____



STATIC HEAD 25.34

PIPE RADIUS (r) .093

BORE HOLE RADIUS (R) .417

SATURATED SCREEN LENGTH (L) 5.5

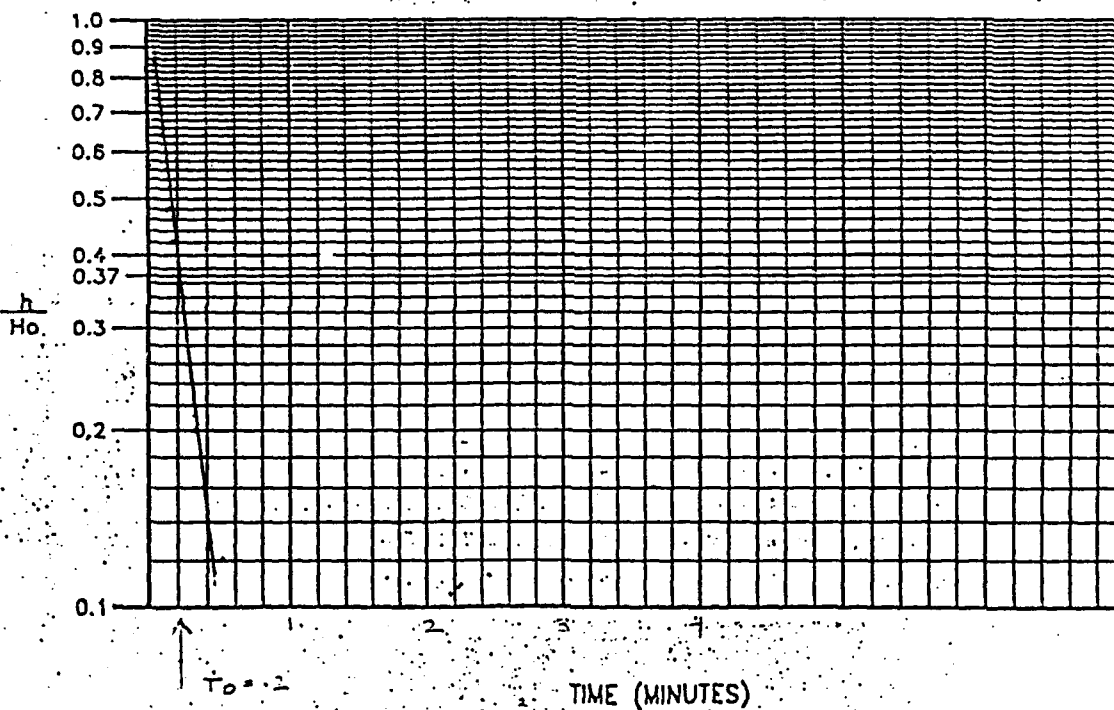
HYDRAULIC CONDUCTIVITY:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

$$K = \frac{(.093)^2 \ln(5.5/.417)}{2(5.5)(.2)}$$

| TIME (MIN) | WATER DEPTH (FT) | RECOVERY TO STATIC ± (WATER DEPTH-STAT) | $\frac{h}{H_0}$ |
|------------|------------------|---|-----------------|
| STATIC | 25.34 | — | — |
| 00 | 27.62 | 1.78 (H ₀) | 1.00 |
| .03 | 27.35 | 1.51 (h) | .95 |
| .07 | 27.13 | 1.22 (h) | .74 |
| .10 | 26.90 | 1.15 (h) | .65 |
| .13 | 26.84 | 1.0 (h) | .56 |
| .17 | 26.70 | .86 (h) | .48 |
| .19 | 26.58 | .74 (h) | .42 |
| .37 | 26.19 | .35 (h) | .20 |
| .53 | 26.03 | .19 (h) | .12 |
| .70 | 25.92 | .12 (h) | .07 |
| .87 | 25.92 | .08 (h) | .04 |
| 1.03 | 25.90 | .06 (h) | .03 |
| 2.37 | 25.56 | .02 (h) | .01 |
| | | (h) | |

K = .0051 FT/MIN K = 11.66 FT/DAY K = 4.1 x 10⁻³ CM/SEC

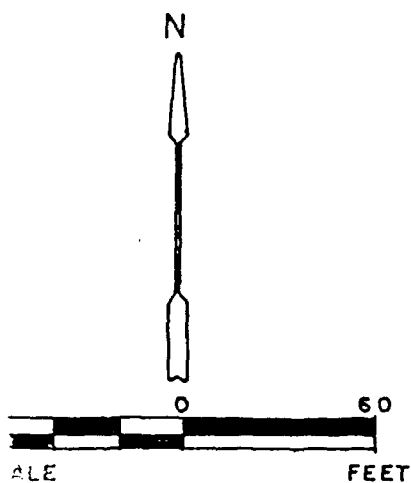


APPENDIX G
SURVEYOR RESULTS

| Boring | Ground Elev. | |
|--------|--------------|----------|
| A(5) | 1092.3 | } Site 2 |
| B(1) | 1092.5 | |
| C(4) | 1092.2 | |
| D(3) | 1091.7 | |
| E(2) | 1093.7 | |

1) Temporary well numbers

| Monitoring Well # | Rim Elev. | Top of Casing Elev. | |
|-------------------|-----------|---------------------|----------|
| MW #1 | 1092.29 | 1091.98 | } Site 1 |
| MW #2 | 1093.38 | 1093.04 | |
| MW #3 | 1091.25 | 1090.90 | |
| MW #4 | 1092.91 | 1092.49 | |
| MW #5 | 1092.75 | Locked | |
| MW #6 | 1091.41 | 1091.07 | |
| MW #7 | 1092.87 | 1092.53 | |
| MW #8 | 1091.09 | 1090.79 | |
| P1 | 1092.74 | 1092.51 | |
| P2 | 1092.09 | 1091.83 | |
| P3 | 1092.10 | 1091.32 | |



+ MW 3

+ MW 8

+ P 2

+ P 3

+ MW 1

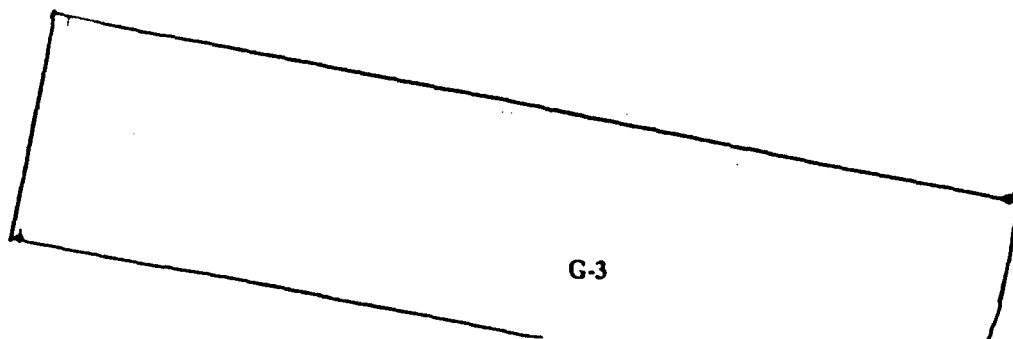
+ P 1

+ MW 5

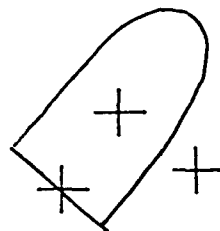
+ MW 4

MW 7 +

+ MW 2



G-3



+^B
MW

+^B
MW

+^E
MW

• • •
• • •

+^C
MW

+^D
MW

APPENDIX H
ANALYTICAL RESULTS SUMMARY TABLES

| LANG SITE 1 WATER SAMPLES | TPH | SEMI-VOLATILES | VOLATILES |
|---------------------------|----------------|----------------|----------------|
| Client's ID: | LANG-1
MW-2 | LANG-1
MW-5 | LANG-1
MW-6 |
| Date Sampled: | 15-Aug-90 | 15-Aug-90 | 15-Aug-90 |
| Lab ID: | 2169-08 | 2169-02 | 2169-03 |
| Matrix: | Water | Water | Water |
| Associated Samples: | FB-2(DIUF) | FB-2(DIUF) | FB-2(DIUF) |

Volatile Organics (ug/l)

| Date Analyzed: | 28-Aug-90 | 28-Aug-90 | 25-Aug-90 |
|---------------------|-----------|-----------|-----------|
| Benzene | | 180 | |
| Ethyl Benzene | | | |
| Toluene | | | |
| Xylenes | | | |
| Chlorobenzene | | | |
| 1,2-Dichlorobenzene | | | |
| 1,4-Dichlorobenzene | | | |
| 1,2-Dichlorobenzene | | | |

Semi-Volatile Organics (ug/l)

| Date Analyzed: | 23-Aug-90 | 23-Aug-90 | 24-Aug-90 |
|-----------------------------|-----------|-----------|-----------|
| N-Nitroso-Dimethylamine | | | |
| Phenol | | | |
| bis(2-Chloroethyl)ether | | | |
| 2-Chlorophenol | | | |
| 1,3-Dichlorobenzene | | | |
| 1,4-Dichlorobenzene | | | |
| Benzyl Alcohol | | | |
| 1,2-Dichlorobenzene | | | |
| 2-Methylphenol | | | |
| bis(2-chloroisopropyl)Ether | | | |
| 4-Methylphenol | | | |
| N-Nitroso-Di-n-Propylamine | | | |
| Hexachloroethane | | | |
| Nitrobenzene | | | |
| Isophorone | | | |
| 2-Nitrophenol | | | |
| 2,4-Dimethylphenol | | | |
| bis(2-Chloroethoxy)methane | | | |
| 2,4-Dichlorophenol | | | |
| Benzoic Acid | | | |
| 1,2,4-Trichlorobenzene | | | |
| Naphthalene | | | |
| 4-Chloroaniline | | | |
| Hexachlorobutadiene | | | |
| 4-Chloro-3-Methylphenol | | | |
| 2-Methylnaphthalene | | | |
| Hexachlorocyclopentadiene | | | |
| 2,6-Trichlorophenol | | | |
| 2,4-Trichlorophenol | | | |
| 2-Chloronaphthalene | | | |
| 2-Nitroaniline | | | |
| Dimethylphthalate | | | |
| Acenaphthylene | | | |
| 2,6-Dinitrotoluene | | | |
| 3-Nitroaniline | | | |
| Acenaphthene | | | |
| 2,4-Dinitrophenol | | | |
| 2-Benzofuran | | | |
| 2-Nitrophenol | | | |
| 2,4-Dinitrotoluene | | | |
| Fluorene | | | |
| Diethylphthalate | | | |
| 2-Chlorophenyl-phenylether | | | |
| 2-Nitroaniline | | | |
| 2,6-Dinitro-2-Methylphenol | | | |
| N-Nitrosodiphenylamine | | | |
| 4-Bromophenyl-phenylether | | | |
| Hexachlorobenzene | | | |
| Pentachlorophenol | | | |
| Phenanthrene | | | |
| Anthracene | | | |
| Di-n-Butylphthalate | | | |
| Fluoranthene | | | |
| Pyrene | | | |
| Butylbenzylphthalate | | | |
| Benzo(a)Anthracene | | | |
| 3,3'-Dichlorobenzidine | | | |
| Chrysene | | | |
| bis(2-Ethylhexyl)Phthalate | | | |
| Di-n-octylphthalate | | | |
| Benzo(b)Fluoranthene | | | |
| Benzo(k)Fluoranthene | | | |
| Benzo(a)Pyrene | | | |
| Indeno(1,2,3-cd)Pyrene | | | |
| Dibenz(a,h)Anthracene | | | |
| Benzo(g,h,i)Perylene | | | |

Miscellaneous Parameters

| Date Analyzed: | 27-Aug-90 | 27-Aug-90 | 27-Aug-90 |
|----------------|-----------|-----------|-----------|
| TPH (mg/l) | 1 U | 1 U | 1 U |

Footnotes:

- J--the value reported is an estimated concentration.
- U--the compound was analyzed for, but not detected.
- R--Data is unusable.

| LANG SITE 1 WATER SAMPLES | SEMI-VOLATILES | VOLATILES | TPH |
|---------------------------|----------------|----------------|---------------------|
| Client's ID: | LANG-1
MW-7 | LANG-1
MW-8 | LANG-1
DEFUELING |
| Date Sampled: | 15 Aug-90 | 15-Aug-90 | 15-Aug-90 |
| Lab ID: | 2169-10 | 2169-05 | 2169-01 |
| Matrix: | Water | Water | Water |
| Associated Samples: | FB-2(DIUF) | FB-2(DIUF) | FB-2(DIUF) |

Volatile Organics (ug/l)

| Date Analyzed: | 26-Aug-90 | 25-Aug-90 | 28-Aug-90 |
|---------------------|-----------|-----------|-----------|
| Benzene | 1 U | 1 U | 3 |
| Ethyl Benzene | U | U | 150 |
| Toluene | U | U | U |
| Xylenes | U | U | 360 |
| Chlorobenzene | U | U | U |
| 1,2-Dichlorobenzene | U | U | U |
| 1,3-Dichlorobenzene | U | U | U |
| 1,4-Dichlorobenzene | U | U | U |

Semi-Volatile Organics (ug/l)

| Date Analyzed: | 23-Aug-90 | 24-Aug-90 | 23-Aug-90 |
|-----------------------------|-----------|-----------|-----------|
| N-Nitroso-Dimethylamine | 20 R | 20 U | 20 U |
| Phenol | U | U | U |
| bis(2-Chloroethyl)ether | U | U | U |
| 2-Chlorophenol | U | U | U |
| 1,3-Dichlorobenzene | U | U | U |
| 1,4-Dichlorobenzene | U | U | U |
| Benzyl Alcohol | U | U | U |
| 1,2-Dichlorobenzene | U | U | U |
| 2-Methylphenol | U | U | U |
| bis(2-chloroisopropyl)Ether | U | U | U |
| 4-Methylphenol | U | U | U |
| N-Nitroso-Di-n-Propylamine | U | U | U |
| Hexachloroethane | U | U | U |
| Nitrobenzene | U | U | U |
| Isophorone | U | U | U |
| 2-Nitrophenol | U | U | U |
| 2,4-Dimethylphenol | U | U | U |
| bis(2-Chloroethoxy)methane | U | U | U |
| 2,4-Dichlorophenol | U | U | U |
| Benzoic Acid | 100 | 100 | 100 |
| 1,2,4-Trichlorobenzene | U | U | U |
| Naphthalene | U | U | U |
| 4-Chloroaniline | U | U | U |
| Hexachlorobutadiene | U | U | U |
| 4-Chloro-3-Methylphenol | U | U | U |
| 2-Methylnaphthalene | U | U | U |
| Hexachlorocyclopentadiene | U | U | U |
| 2,4,6-Trichlorophenol | U | U | U |
| 2,4,5-Trichlorophenol | 100 | 100 | 100 |
| 2-Chloronaphthalene | U | U | U |
| 2-Nitroaniline | 100 | 100 | 100 |
| Dimethylphthalate | U | U | U |
| Acenaphthylene | U | U | U |
| 2,6-Dinitrotoluene | U | U | U |
| 3-Nitroaniline | 100 | 100 | 100 |
| Acenaphthene | U | U | U |
| 2,4-Dinitrophenol | 100 | 100 | 100 |
| Dibenzofuran | U | U | U |
| 4-Nitrophenol | 100 | 100 | 100 |
| 2,4-Dinitrotoluene | U | U | U |
| Fluorene | U | U | U |
| Diethylphthalate | U | U | U |
| 4-Chlorophenyl-phenylether | U | U | U |
| 4-Nitroaniline | 100 | 100 | 100 |
| 2,6-Dinitro-2-Methylphenol | U | U | U |
| N-Nitrosodiphenylamine | U | U | U |
| 4-Bromophenyl-phenylether | U | U | U |
| Hexachlorobenzene | U | U | U |
| Pentachlorophenol | 100 | 100 | 100 |
| Phenanthrene | U | U | U |
| Anthracene | U | U | U |
| Dj-n-Butylphthalate | U | U | U |
| Fluoranthene | U | U | U |
| Pyrene | U | U | U |
| Butylbenzylphthalate | U | U | U |
| Benzo(a)Anthracene | U | U | U |
| 3,7-Dichlorobenzidine | U | U | U |
| Chrysene | U | U | U |
| bis(2-Ethylhexyl)Phthalate | U | U | U |
| Di-n-octylphthalate | U | U | U |
| Benzo(b)Fluoranthene | U | U | U |
| Benzo(k)Fluoranthene | U | U | U |
| Benzo(a)Pyrene | U | U | U |
| Indeno(1,2,3-cd)Pyrene | U | U | U |
| Dibenz(a,h)Anthracene | U | U | U |
| Benzo(g,h,i)Perylene | U | U | U |

Miscellaneous Parameters

| Date Analyzed: | 27-Aug-90 | 27-Aug-90 | 27-Aug-90 |
|----------------|-----------|-----------|-----------|
| TPH (mg/l) | 1 U | 1 U | 1 |

Footnotes:

J--the value reported is an estimated concentration.
U--the compound was analyzed for, but not detected.
R--Data is unusable.

LANG SITES 1 AND 2 SOIL DUPLICATE SAMPLES VOLATILES SEMI-VOLATILES TPH RADIOLOGICAL PARAMETERS

| | | | | | | |
|---------------------------------|---------------------------------|-----------------------------------|-----------------------|-------------------------|---------------------------------|-----------------------------------|
| Client's ID: | LANG-1
SB-1 | LANG-1
SB-1 | LANG-1
SB-1 | LANG-1
SB-1 | LANG-1
SB-1 | LANG-1
SB-1 |
| Date Sampled: | MW-6-52
10-Aug-90
2136-08 | MW-6-52-0
10-Aug-90
2136-09 | MW-6-BR2
10-Aug-90 | MW-6-BR2-0
10-Aug-90 | MW-8-52
12-Aug-90
2136-13 | MW-8-52-0
12-Aug-90
2136-14 |
| Lab ID: | | | | | | |
| Matrix: | Soil | Soil | Soil | Soil | Soil | Soil |
| Volatile Organics (ug/kg) | | | | | | |
| Date Analyzed: | 21-Aug-90 | 20-Aug-90 | -- | -- | 21-Aug-90 | 21-Aug-90 |
| Benzene | J | J | -- | -- | J | J |
| Ethyl Benzene | U | U | -- | -- | U | U |
| Toluene | U | U | -- | -- | U | U |
| Xylenes | U | U | -- | -- | U | U |
| Chlorobenzene | U | U | -- | -- | U | U |
| 1,2-Dichlorobenzene | U | U | -- | -- | U | U |
| 1,3-Dichlorobenzene | U | U | -- | -- | U | U |
| 1,4-Dichlorobenzene | U | U | -- | -- | U | U |
| Semi-Volatile Organics (ug/kg) | | | | | | |
| Date Analyzed: | 24-Aug-90 | 24-Aug-90 | -- | -- | 24-Aug-90 | 24-Aug-90 |
| N-Nitroso-Dimethylamine | 360 | 360 | -- | -- | 360 | 360 |
| Phenol | U | U | -- | -- | U | U |
| Bis(2-Chloroethyl)ether | U | U | -- | -- | U | U |
| 2-Chlorophenol | U | U | -- | -- | U | U |
| 1,3-Dichlorobenzene | U | U | -- | -- | U | U |
| 1,4-Dichlorobenzene | U | U | -- | -- | U | U |
| Benzyl Alcohol | U | U | -- | -- | U | U |
| 1,2-Dichlorobenzene | U | U | -- | -- | U | U |
| 1-Ethylphenol | U | U | -- | -- | U | U |
| Bis(2-Chloroisopropyl)Ether | U | U | -- | -- | U | U |
| 4-Ethylphenol | U | U | -- | -- | U | U |
| N-Nitroso-Di-n-Propylamine | U | U | -- | -- | U | U |
| Hexachloroethane | U | U | -- | -- | U | U |
| Nitrobenzene | U | U | -- | -- | U | U |
| Isophorone | U | U | -- | -- | U | U |
| 2-Nitrophenol | U | U | -- | -- | U | U |
| 4-Methylphenol | U | U | -- | -- | U | U |
| Bis(2-Chloroethoxy)methane | U | U | -- | -- | U | U |
| 1,2-Dichlorophenol | U | U | -- | -- | U | U |
| Benzic Acid | 1 | 1 | -- | -- | 1 | 1 |
| 1,2,4-Trichlorobenzene | U | U | -- | -- | U | U |
| Naphthalene | U | U | -- | -- | U | U |
| 4-Chloroaniline | U | U | -- | -- | U | U |
| Hexachlorobutadiene | U | U | -- | -- | U | U |
| 2-Chloro-3-Methylphenol | U | U | -- | -- | U | U |
| 2-Methylnaphthalene | U | U | -- | -- | U | U |
| Hexachlorocyclopentadiene | U | U | -- | -- | U | U |
| 2,4,6-Trichlorophenol | U | U | -- | -- | U | U |
| 2,4,5-Trichlorophenol | U | U | -- | -- | U | U |
| 2-Chloronaphthalene | U | U | -- | -- | U | U |
| 2-Nitroaniline | U | U | -- | -- | U | U |
| Dimethylphthalate | U | U | -- | -- | U | U |
| Acenaphthylene | U | U | -- | -- | U | U |
| 4,6-Dinitrotoluene | U | U | -- | -- | U | U |
| 4-Nitroaniline | U | U | -- | -- | U | U |
| Acenaphthene | U | U | -- | -- | U | U |
| 2,4-Dinitrophenol | U | U | -- | -- | U | U |
| Benzofuran | U | U | -- | -- | U | U |
| 2-Nitrophenol | U | U | -- | -- | U | U |
| 2,4-Dinitrotoluene | U | U | -- | -- | U | U |
| Fluorene | U | U | -- | -- | U | U |
| Diethylphthalate | U | U | -- | -- | U | U |
| 4-Chlorophenyl-phenylether | U | U | -- | -- | U | U |
| 4-Nitroaniline | U | U | -- | -- | U | U |
| 4,6-Dinitro-2-Methylphenol | U | U | -- | -- | U | U |
| N-Nitrosodiphenylamine | U | U | -- | -- | U | U |
| 4-Bromophenyl-phenylether | U | U | -- | -- | U | U |
| Hexachlorobenzene | U | U | -- | -- | U | U |
| Pentachlorophenol | U | U | -- | -- | U | U |
| Phenanthrene | U | U | -- | -- | U | U |
| Anthracene | U | U | -- | -- | U | U |
| Di-n-Butylphthalate | U | U | -- | -- | U | U |
| Fluoranthene | U | U | -- | -- | U | U |
| Pyrene | U | U | -- | -- | U | U |
| Butylbenzylphthalate | U | U | -- | -- | U | U |
| Benz(a)Anthracene | U | U | -- | -- | U | U |
| 3,3'-Dichlorobenzidine | U | U | -- | -- | U | U |
| Chrysene | U | U | -- | -- | U | U |
| Bis(2-Ethylhexyl)Phthalate | U | U | -- | -- | U | U |
| Di-n-octylphthalate | U | U | -- | -- | U | U |
| Benz(b)Fluoranthene | U | U | -- | -- | U | U |
| Benz(k)Fluoranthene | U | U | -- | -- | U | U |
| Benz(a)Pyrene | U | U | -- | -- | U | U |
| Indeno(1,2,3-cd)Pyrene | U | U | -- | -- | U | U |
| Benz(a,h)Anthracene | U | U | -- | -- | U | U |
| Benz(g,h,i)Perylene | U | U | -- | -- | U | U |
| Miscellaneous Parameters | | | | | | |
| Date Analyzed: | 27-Aug-90 | 27-Aug-90 | -- | -- | 27-Aug-90 | 31-Aug-90 |
| TPH (mg/kg) | 11 U | 11 U | -- | -- | 11 U | 11 U |
| Radiological Parameters (pCi/g) | | | | | | |
| Date Analyzed: | | | | | | |
| Gross Alpha | -- | -- | 0.5 U | 0.5 U | -- | -- |
| Gross Beta | -- | -- | 0.5 U | 0.5 U | -- | -- |
| Radium-226 | -- | -- | 0.51 +/- 0.34 U | 0.58 +/- 0.20 U | -- | -- |
| Radium-228 | -- | -- | 0.5 U | 0.72 +/- 0.14 U | -- | -- |

Footnotes:

J--the value reported is an estimated concentration. This is used when the compound detected at an amount less than the reporting limit.
 U--the compound was analyzed for, but not detected.

[illegible][illegible]

Radiological Parameters, pCi/l

[illegible]

Footnotes:
J--the value reported is an estimated concentration.
Y--the compound was analyzed for, but not detected.

IANG SITE SOIL SAMPLES RADIOLOGICAL PARAMETERS
 Client's ID: IANG-2 SB-1-S1 27-Jul-90 Soil RB-1
 Date Sampled: IANG-2 SB-1-S2 28-Jul-90 Soil RB-2
 Matrix: IANG-2 SB-1-S3 28-Jul-90 Soil RB-2
 Associated Samples: IANG-2 SB-2-S1 29-Jul-90 Soil RB-3
 IANG-2 SB-2-S2 28-Jul-90 Soil RB-2
 IANG-2 SB-2-S3 28-Jul-90 Soil RB-2
 IANG-2 SB-4-S1 30-Jul-90 Soil RB-4

DATE ANALYZED
 Radiological Parameters (pCi/g)
 Gross Alpha 0.9 +/- 0.6 2.5 +/- 0.7 1.5 +/- 0.7 1.8 +/- 0.8 2.3 +/- 0.7 2.0 +/- 0.8 1.7 +/- 0.7
 Gross Beta 0.74 +/- 0.23 0.12 +/- 0.25 1.3 +/- 0.6 0.82 +/- 0.26 0.71 +/- 0.33 1.3 +/- 0.6 1.6 +/- 0.3
 Radium-226 0.74 +/- 0.23 0.12 +/- 0.25 1.3 +/- 0.6 0.82 +/- 0.26 0.71 +/- 0.33 1.3 +/- 0.6 1.6 +/- 0.3

Footnotes:
 J--the value reported is an estimated concentration.
 U--the compound was analyzed for, but not detected.

IANG SITE SOIL SAMPLES
 Client's ID: IANG-2 SB-4-S2 30-Jul-90 Soil RB-4
 Date Sampled: IANG-2 SB-4-S3 30-Jul-90 Soil RB-4
 Matrix: IANG-2 SB-4-S4 30-Jul-90 Soil RB-4
 Associated Samples: IANG-2 SB-5-S1 30-Jul-90 Soil RB-4
 IANG-2 SB-5-S2 30-Jul-90 Soil RB-4
 IANG-2 SB-5-S3 30-Jul-90 Soil RB-4
 IANG-2 SB-5-S4 30-Jul-90 Soil RB-4
 IANG-2 BENTONITE 30-Jul-90 Soil FB-1(TAP)

DATE ANALYZED
 Radiological Parameters (pCi/g)
 Gross Alpha 2.3 +/- 0.8 1.5 +/- 0.6 0.7 +/- 0.6 1.0 +/- 0.6 1.0 +/- 0.6 0.9 +/- 0.6 1.1 +/- 0.6
 Gross Beta 0.83 +/- 0.17 0.78 +/- 0.15 1.8 +/- 0.8 0.85 +/- 0.22 0.85 +/- 0.22 0.34 +/- 0.19 0.8 +/- 0.3
 Radium-226 1.9 +/- 0.8 0.78 +/- 0.15 2.4 +/- 1.1 0.55 +/- 0.28 0.55 +/- 0.28 0.24 +/- 0.1 0.6 +/- 0.2

Footnotes:
 J--the value reported is an estimated concentration.
 U--the compound was analyzed for, but not detected.

IANG SITE SOIL SAMPLES
 Client's ID: IANG-1 SB-7 10-Aug-90 Soil RB-2
 Date Sampled: IANG-1 SB-7 10-Aug-90 Soil RB-2
 Matrix: IANG-1 SB-7 10-Aug-90 Soil RB-2
 Associated Samples: IANG-1 SB-7 10-Aug-90 Soil RB-2
 IANG-1 SB-7 10-Aug-90 Soil RB-2
 IANG-1 SB-7 10-Aug-90 Soil RB-2
 IANG-1 SB-7 10-Aug-90 Soil RB-2

DATE ANALYZED
 Radiological Parameters (pCi/g)
 Gross Alpha 35.8 +/- 2.4 0.5 1.3 +/- 0.6 1.6 +/- 0.7
 Gross Beta 0.5 0.51 +/- 0.35 1.3 +/- 0.6 1.6 +/- 0.7
 Radium-226 0.5 0.51 +/- 0.35 1.3 +/- 0.6 1.6 +/- 0.7

Footnotes:
 J--the value reported is an estimated concentration.
 U--the compound was analyzed for, but not detected.

LANG SITE 1 SOIL SAMPLES SEMI-VOLATILES VOLATILES TPH RADIOLOGICAL PARAMETERS

| SAMPLE ID: | LANG-1
SB-9/
MW-8-51 | LANG-1
SB-9/
MW-8-52 | LANG-1
DEFUELING
PIT |
|---------------------|----------------------------|----------------------------|----------------------------|
| Date Sampled: | 11-AUG-90 | 12-AUG-90 | 15-AUG-90 |
| Lab ID: | 2136-12 | 2136-13 | 2169-07 |
| Matrix: | Soil | Soil | Soil |
| Associated Samples: | FB-1(DIUF) | FB-1(DIUF) | FB-1(DIUF) |

Volatiles Organics (ug/kg)

| Date Analyzed: | 21-AUG-90 | 21-AUG-90 | 23-AUG-90 |
|---------------------|-----------|-----------|-----------|
| Benzene | 1 U | 1 U | 2 U |
| Ethyl Benzene | U | U | U |
| Toluene | U | U | U |
| Xylenes | U | U | 2 U |
| Chlorobenzene | U | U | U |
| 1,2-Dichlorobenzene | U | U | U |
| 1,3-Dichlorobenzene | U | U | U |
| 1,4-Dichlorobenzene | U | U | U |

Semi-Volatile Organics (ug/kg)

| Date Analyzed: | 24-AUG-90 | 24-AUG-90 | 30-AUG-90 |
|---------------------------|-----------|-----------|-----------|
| N-Nitroso-Dimethylamine | 320 U | 360 U | 520 U |
| Phenol | 320 U | 320 U | 320 U |
| Bis(2-Chloroethyl)ether | 320 U | 320 U | 320 U |
| 2-Chlorophenol | 320 U | 320 U | 320 U |
| 2,4-Dichlorophenol | 320 U | 320 U | 320 U |
| 1,2-Dichlorobenzene | 320 U | 320 U | 320 U |
| Benzyl Alcohol | 320 U | 320 U | 320 U |
| 1,2-Dichlorobenzene | 320 U | 320 U | 320 U |
| 2-Methylphenol | 320 U | 320 U | 320 U |
| Bis(2-Chloroisopropyl)Eth | 320 U | 320 U | 320 U |
| 4-Methylphenol | 320 U | 320 U | 320 U |
| N-Nitroso-Di-n-Propylamin | 320 U | 320 U | 320 U |
| Hexachloroethane | 320 U | 320 U | 320 U |
| Nitrobenzene | 320 U | 320 U | 320 U |
| Isophorone | 320 U | 320 U | 320 U |
| 2-Nitrophenol | 320 U | 320 U | 320 U |
| 2,4-Dimethylphenol | 320 U | 320 U | 320 U |
| Bis(2-Chloroethoxy)methan | 320 U | 320 U | 320 U |
| 2,4-Dichlorophenol | 320 U | 320 U | 320 U |
| Benzoic Acid | 1200 U | 1200 U | 2200 U |
| 1,2,4-Trichlorobenzene | 320 U | 320 U | 320 U |
| Naphthalene | 320 U | 320 U | 320 U |
| 4-Chloroaniline | 320 U | 320 U | 320 U |
| Hexachlorobutadiene | 320 U | 320 U | 320 U |
| 4-Chloro-3-Methylphenol | 320 U | 320 U | 320 U |
| 2-Methylnaphthalene | 320 U | 320 U | 320 U |
| Hexachlorocyclopentadiene | 320 U | 320 U | 320 U |
| 4,7,8-Trichlorophenol | 320 U | 320 U | 320 U |
| 4,7,8-Trichlorophenol | 1200 U | 1200 U | 2200 U |
| 5-Chloronaphthalene | 320 U | 320 U | 320 U |
| 5-Nitroaniline | 320 U | 320 U | 320 U |
| Dimethylphthalate | 320 U | 320 U | 320 U |
| Acenaphthylene | 320 U | 320 U | 320 U |
| 2,6-Dinitrotoluene | 320 U | 320 U | 320 U |
| 3-Nitroaniline | 1200 U | 1200 U | 2200 U |
| Acenaphthene | 320 U | 320 U | 320 U |
| 2,4-Dinitrophenol | 1200 U | 1200 U | 2200 U |
| Dibenzofuran | 320 U | 320 U | 320 U |
| 4-Nitrophenol | 1200 U | 1200 U | 2200 U |
| 2,4-Dinitrotoluene | 320 U | 320 U | 320 U |
| Fluorene | 320 U | 320 U | 320 U |
| Diethylphthalate | 320 U | 320 U | 320 U |
| 4-Chlorophenyl-phenylethe | 320 U | 320 U | 320 U |
| 4-Nitroaniline | 1200 U | 1200 U | 2200 U |
| 4,6-Dinitro-2-Methylpheno | 320 U | 320 U | 320 U |
| N-Nitrosodiphenylamine | 320 U | 320 U | 320 U |
| 4-Bromophenyl-phenylether | 320 U | 320 U | 320 U |
| Hexachlorobenzene | 320 U | 320 U | 320 U |
| Pentachlorophenol | 1200 U | 1200 U | 2200 U |
| Phenanthrene | 320 U | 320 U | 320 U |
| Anthracene | 320 U | 320 U | 320 U |
| Di-n-Butylphthalate | 320 U | 320 U | 320 U |
| Fluoranthene | 320 U | 320 U | 320 U |
| Pyrene | 320 U | 320 U | 320 U |
| Butylbenzylphthalate | 320 U | 320 U | 320 U |
| Benzo(a)Anthracene | 320 U | 320 U | 320 U |
| 3,5-Dichlorobenzidine | 320 U | 320 U | 320 U |
| Chrysene | 320 U | 320 U | 320 U |
| Bis(2-Ethylhexyl)Phthalat | 320 U | 320 U | 320 U |
| Di-n-octylphthalate | 320 U | 320 U | 320 U |
| Benzo(b)Fluoranthene | 320 U | 320 U | 320 U |
| Benzo(k)Fluoranthene | 320 U | 320 U | 320 U |
| Benzo(a)Pyrene | 320 U | 320 U | 320 U |
| Indeno(1,2,3-cd)Pyrene | 320 U | 320 U | 320 U |
| Dibenz(a,h)Anthracene | 320 U | 320 U | 320 U |
| Benzo(g,h,i)Perylene | 320 U | 320 U | 320 U |

LANG SITE 1 SOIL SAMPLES

| SAMPLE ID: | LANG-1
SB-9/
MW-8-51 | LANG-1
SB-9/
MW-8-52 | LANG-1
DEFUELING
PIT |
|---------------|----------------------------|----------------------------|----------------------------|
| Date Sampled: | 11-AUG-90 | 12-AUG-90 | 15-AUG-90 |
| Lab ID: | 2136-12 | 2136-13 | 2169-07 |
| Matrix: | Soil | Soil | Soil |

Miscellaneous Parameters

| Date Analyzed: | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 |
|----------------|-----------|-----------|-----------|
| TPH (mg/kg) | 10 U | 11 U | 160 |

Footnotes:
J--the value reported is an estimated concentration.
U--the compound was analyzed for, but not detected.

| IANG SITE 1 SOIL SAMPLES | | SEMI-VOLATILES | VOLATILES | TPH RADIOLOGICAL PARAMETERS |
|--------------------------|----------------------------|----------------------------|----------------------------|-----------------------------|
| SAMPLE ID: | IANG-1
SB-7/
MW-6-S1 | IANG-1
SB-7/
MW-6-S2 | IANG-1
SB-8/
MW-7-S1 | IANG-1
SB-8/
MW-7-S2 |
| Date Sampled: | 10-AUG-90 | 10-AUG-90 | 11-AUG-90 | 11-AUG-90 |
| Lab ID: | 2136-07 | 2136-08 | 2136-10 | 2136-11 |
| Matrix: | Soil | Soil | Soil | Soil |
| Associated Samples: | FB-1(DIUF) | FB-1(DIUF) | FB-1(DIUF) | FB-1(DIUF) |

Volatile Organics (ug/kg)

| | | | | |
|---------------------|-----------|-----------|-----------|-----------|
| Date Analyzed: | 21-AUG-90 | 21-AUG-90 | 21-AUG-90 | 21-AUG-90 |
| Benzene | 1 U | 1 U | 1 U | 1 U |
| Ethyl Benzene | U | U | U | U |
| Toluene | U | U | U | U |
| Xylenes | U | U | U | U |
| Chlorobenzene | U | U | U | U |
| 1,2-Dichlorobenzene | U | U | U | U |
| 1,3-Dichlorobenzene | U | U | U | U |
| 1,4-Dichlorobenzene | U | U | U | U |

Semi-Volatile Organics (ug/kg)

| | | | | |
|---------------------------|-----------|-----------|-----------|-----------|
| Date Analyzed: | 24-AUG-90 | 24-AUG-90 | 24-AUG-90 | 24-AUG-90 |
| N-Nitroso-Dimethylamine | 360 | 360 | 440 | 460 |
| Phenol | U | U | U | U |
| Bis(2-Chloroethyl)ether | U | U | U | U |
| 2-Chlorophenol | U | U | U | U |
| 1,3-Dichlorobenzene | U | U | U | U |
| 1,4-Dichlorobenzene | U | U | U | U |
| Benzyl Alcohol | U | U | U | U |
| 2,4-Dichlorophenol | U | U | U | U |
| 2-Methylphenol | U | U | U | U |
| Bis(2-Chloroisopropyl)Eth | U | U | U | U |
| 4-Methylphenol | U | U | U | U |
| N-Nitroso-Di-n-Propylamin | U | U | U | U |
| Hexachloroethane | U | U | U | U |
| Nitrobenzene | U | U | U | U |
| Isophorone | U | U | U | U |
| 2-Nitrophenol | U | U | U | U |
| 2,4-Dimethylphenol | U | U | U | U |
| Bis(2-Chloroethoxy)methan | U | U | U | U |
| 2,6-Dichlorophenol | U | U | U | U |
| Benzic Acid | 1 | 1 | 2100 | 2300 |
| 1,2,4-Trichlorobenzene | U | U | U | U |
| Naphthalene | U | U | U | U |
| 4-Chloroaniline | U | U | U | U |
| Hexachlorobutadiene | U | U | U | U |
| 3-Chloro-2-Methylphenol | U | U | U | U |
| 2-Methylnaphthalene | U | U | U | U |
| Hexachlorocyclopentadiene | U | U | U | U |
| 1,4,6-Trichlorophenol | U | U | U | U |
| 2,4,5-Trichlorophenol | 1 | 1 | 2100 | 2300 |
| 2-Chloronaphthalene | U | U | U | U |
| 2-Nitroaniline | U | U | U | U |
| Dimethylphthalate | U | U | U | U |
| Acenaphthylene | U | U | U | U |
| 2,6-Dinitrotoluene | U | U | U | U |
| 3-Nitroaniline | U | U | U | U |
| Acenaphthene | U | U | U | U |
| 2,4-Dinitrophenol | 1 | 1 | 2100 | 2300 |
| 2-Benzofuran | U | U | U | U |
| 2-Nitrophenol | U | U | U | U |
| 2,4-Dinitrotoluene | U | U | U | U |
| Fluorene | U | U | U | U |
| Diethylphthalate | U | U | U | U |
| 2-Chlorophenyl-phenylethe | U | U | U | U |
| 2-Nitroaniline | U | U | U | U |
| 2,6-Dinitro-2-Methylpheno | U | U | U | U |
| N-Nitrosodiphenylamine | U | U | U | U |
| 2-Bromophenyl-phenylether | U | U | U | U |
| Hexachlorobenzene | U | U | U | U |
| Pentachlorophenol | 1 | 1 | 2100 | 2300 |
| Phenanthrene | U | U | U | U |
| Anthracene | U | U | U | U |
| Di-n-Butylphthalate | U | U | U | U |
| Fluoranthene | U | U | U | U |
| Pyrene | U | U | U | U |
| Butylbenzylphthalate | U | U | U | U |
| Benzo(a)Anthracene | U | U | U | U |
| 3,3'-Dichlorobenzidine | U | U | U | U |
| Chrysene | U | U | U | U |
| Bis(2-Ethylhexyl)Phthalat | U | U | U | U |
| Di-n-octylphthalate | U | U | U | U |
| Benzo(b)Fluoranthene | U | U | U | U |
| Benzo(k)Fluoranthene | U | U | U | U |
| Benzo(a)Pyrene | U | U | U | U |
| Indeno(1,2,3-cd)Pyrene | U | U | U | U |
| Benzo(a,h)Anthracene | U | U | U | U |
| Benzo(g,h,i)Perylene | U | U | U | U |

IANG SITE 1 SOIL SAMPLES

| SAMPLE ID: | IANG-1
SB-7/
MW-6-S1 | IANG-1
SB-7/
MW-6-S2 | IANG-1
SB-8/
MW-7-S1 | IANG-1
SB-8/
MW-7-S2 |
|--------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Date Sampled: | 10-AUG-90 | 10-AUG-90 | 11-AUG-90 | 11-AUG-90 |
| Lab ID: | 2136-07 | 2136-08 | 2136-10 | 2136-11 |
| Matrix: | Soil | Soil | Soil | Soil |
| Miscellaneous Parameter: | | | | |
| Date Analyzed: | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 |
| TPH (mg/kg) | 11 U | 11 U | 13 U | 17 |

Footnotes:

U--the value reported is an estimated concentration.
 U--the compound was analyzed for, but not detected.

| IANG SITE 1 SOIL SAMPLES | | SEMI-VOLATILES | | VOLATILES | | TPH RADIOLOGICAL PARAMETERS | |
|--------------------------|----------------------------|----------------------------|----------------------------|----------------------------|--|-----------------------------|--|
| SAMPLE ID: | IANG-1
SB-7/
MW-6-S1 | IANG-1
SB-7/
MW-6-S2 | IANG-1
SB-8/
MW-7-S1 | IANG-1
SB-8/
MW-7-S2 | | | |
| Date Sampled: | 10-AUG-90 | 10-AUG-90 | 11-AUG-90 | 11-AUG-90 | | | |
| Lab ID: | 2136-07 | 2136-08 | 2136-10 | 2136-11 | | | |
| Matrix: | Soil | Soil | Soil | Soil | | | |
| Associated Samples: | FB-4
RB-5
FB-1(DIUF) | FB-4
RB-5
FB-1(DIUF) | FB-4
RB-5
FB-1(DIUF) | FB-4
RB-5
FB-1(DIUF) | | | |

Volatile Organics (ug/kg)

| Date Analyzed: | 21-AUG-90 | 21-AUG-90 | 21-AUG-90 | 21-AUG-90 |
|-----------------------|-----------|-----------|-----------|-----------|
| Benzene | 1 U | 1 U | 1 U | 1 U |
| Ethyl Benzene | 1 U | 1 U | 1 U | 1 U |
| Toluene | 1 U | 1 U | 1 U | 1 U |
| Xylenes | 1 U | 1 U | 1 U | 1 U |
| Chlorobenzene | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichlorobenzene | 1 U | 1 U | 1 U | 1 U |
| 1,4-Dichlorobenzene | 1 U | 1 U | 1 U | 1 U |
| 1,2,4-Dichlorobenzene | 1 U | 1 U | 1 U | 1 U |

Semi-Volatile Organics (ug/kg)

| Date Analyzed: | 24-AUG-90 | 24-AUG-90 | 24-AUG-90 | 24-AUG-90 |
|---------------------------|-----------|-----------|-----------|-----------|
| N-Nitroso-Dimethylamine | 380 U | 360 U | 440 U | 460 U |
| Phenol | 220 U | 220 U | 220 U | 220 U |
| Bis(2-Chloroethyl)ether | 220 U | 220 U | 220 U | 220 U |
| 2-Chlorophenol | 220 U | 220 U | 220 U | 220 U |
| 1,4-Dichlorobenzene | 220 U | 220 U | 220 U | 220 U |
| 1,2-Dichlorobenzene | 220 U | 220 U | 220 U | 220 U |
| Benzyl Alcohol | 220 U | 220 U | 220 U | 220 U |
| 1,2-Dichlorobenzene | 220 U | 220 U | 220 U | 220 U |
| 2-Methylphenol | 220 U | 220 U | 220 U | 220 U |
| Bis(2-Chloroisopropyl)Eth | 220 U | 220 U | 220 U | 220 U |
| 4-Methylphenol | 220 U | 220 U | 220 U | 220 U |
| N-Nitroso-Di-n-Propylamin | 220 U | 220 U | 220 U | 220 U |
| Hexachloroethane | 220 U | 220 U | 220 U | 220 U |
| Nitrobenzene | 220 U | 220 U | 220 U | 220 U |
| Isophorone | 220 U | 220 U | 220 U | 220 U |
| 2-Nitrophenol | 220 U | 220 U | 220 U | 220 U |
| 2,4-Dimethylphenol | 220 U | 220 U | 220 U | 220 U |
| Bis(2-Chloroethoxy)methan | 220 U | 220 U | 220 U | 220 U |
| 2,4-Dichlorophenol | 220 U | 220 U | 220 U | 220 U |
| Benzoic Acid | 1 U | 1 U | 2100 U | 2300 U |
| 1,2,4-Trichlorobenzene | 1 U | 1 U | 220 U | 220 U |
| Naphthalene | 220 U | 220 U | 220 U | 220 U |
| 4-Chloroaniline | 220 U | 220 U | 220 U | 220 U |
| Hexachlorobutadiene | 220 U | 220 U | 220 U | 220 U |
| 4-Chloro-3-Methylphenol | 220 U | 220 U | 220 U | 220 U |
| 2-Methylnaphthalene | 220 U | 220 U | 220 U | 220 U |
| Hexachlorocyclopentadiene | 220 U | 220 U | 220 U | 220 U |
| 1,2,4-Trichlorophenol | 1 U | 1 U | 220 U | 220 U |
| 1,2,5-Trichlorophenol | 1 U | 1 U | 2100 U | 2300 U |
| 5-Chloronaphthalene | 1 U | 1 U | 220 U | 220 U |
| 6-Nitroaniline | 1 U | 1 U | 220 U | 220 U |
| Dimethylphthalate | 220 U | 220 U | 220 U | 220 U |
| Acenaphthylene | 220 U | 220 U | 220 U | 220 U |
| 2,6-Dinitrotoluene | 1 U | 1 U | 220 U | 220 U |
| 4-Nitroaniline | 220 U | 220 U | 2100 U | 2300 U |
| Acenaphthene | 180 U | 180 U | 220 U | 220 U |
| 2,4-Dinitrophenol | 180 U | 180 U | 220 U | 220 U |
| Dibenzofuran | 180 U | 180 U | 220 U | 220 U |
| 2-Nitrophenol | 180 U | 180 U | 220 U | 220 U |
| 2,4-Dinitrotoluene | 180 U | 180 U | 220 U | 220 U |
| Fluorene | 220 U | 220 U | 220 U | 220 U |
| Diethylphthalate | 220 U | 220 U | 220 U | 220 U |
| 2-Chlorophenyl-phenylethe | 220 U | 220 U | 220 U | 220 U |
| 4-Nitroaniline | 1 U | 1 U | 2100 U | 2300 U |
| 2,6-Dinitro-2-Methylpheno | 1 U | 1 U | 2100 U | 2300 U |
| N-Nitrosodiphenylamine | 220 U | 220 U | 220 U | 220 U |
| 4-Bromophenyl-phenylether | 220 U | 220 U | 220 U | 220 U |
| Hexachlorobenzene | 220 U | 220 U | 220 U | 220 U |
| Pentachlorophenol | 1 U | 1 U | 2100 U | 2300 U |
| Phenanthrene | 220 U | 220 U | 220 U | 220 U |
| Anthracene | 220 U | 220 U | 220 U | 220 U |
| Di-n-Butylphthalate | 220 U | 220 U | 220 U | 220 U |
| Fluoranthene | 220 U | 220 U | 220 U | 220 U |
| Pyrene | 220 U | 220 U | 220 U | 220 U |
| Butylbenzylphthalate | 220 U | 220 U | 220 U | 220 U |
| Benzo(a)Anthracene | 220 U | 220 U | 220 U | 220 U |
| 3,3'-Dichlorobenzidine | 220 U | 220 U | 220 U | 220 U |
| Chrysene | 220 U | 220 U | 220 U | 220 U |
| Bis(2-Ethylhexyl)Phthalat | 220 U | 220 U | 220 U | 220 U |
| Di-n-octylphthalate | 220 U | 220 U | 220 U | 220 U |
| Benzo(b)Fluoranthene | 220 U | 220 U | 220 U | 220 U |
| Benzo(k)Fluoranthene | 220 U | 220 U | 220 U | 220 U |
| Benzo(a)Pyrene | 220 U | 220 U | 220 U | 220 U |
| Indeno(1,2,3-cd)Pyrene | 220 U | 220 U | 220 U | 220 U |
| Dibenz(a,h)Anthracene | 220 U | 220 U | 220 U | 220 U |
| Benzo(g,h,i)Perylene | 220 U | 220 U | 220 U | 220 U |

IANG SITE 1 SOIL SAMPLES

| SAMPLE ID: | IANG-1
SB-7/
MW-6-S1 | IANG-1
SB-7/
MW-6-S2 | IANG-1
SB-8/
MW-7-S1 | IANG-1
SB-8/
MW-7-S2 |
|---------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Date Sampled: | 10-AUG-90 | 10-AUG-90 | 11-AUG-90 | 11-AUG-90 |
| Lab ID: | 2136-07 | 2136-08 | 2136-10 | 2136-11 |
| Matrix: | Soil | Soil | Soil | Soil |
| Miscellaneous Parameters: | | | | |
| Date Analyzed: | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 |
| TPH (mg/kg) | 11 U | 11 U | 13 U | 17 |

Footnotes:

J--the value reported is an estimated concentration.
U--the compound was analyzed for, but not detected.

| IANG SITE 1 SOIL SAMPLES | | SEMI-VOLATILES | | VOLATILES | | TPH RADIOLOGICAL PARAMETERS | |
|--------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|-----------------------------|--|
| SAMPLE ID: | IANG-1
SB-4/
MW-3-S2 | IANG-1
SB-5/
MW-4-S1 | IANG-1
SB-2/
MW-4-S2 | IANG-1
SB-6/
MW-5-S1 | IANG-1
SB-6/
MW-5-S2 | | |
| Date Sampled: | 7-AUG-90 | 8-AUG-90 | 8-AUG-90 | 9-AUG-90 | 9-AUG-90 | | |
| Lab ID: | 2125-09 | 2125-01 | 2125-02 | 2136-05 | 2136-06 | | |
| Matrix: | Soil | Soil | Soil | Soil | Soil | | |
| Associated Samples: | TB-1
RB-1 | TB-3
RB-2 | TB-3
RB-2 | TB-2
RB-5
FB-1(DIUF) | TB-2
RB-5
FB-1(DIUF) | | |

Volatile Organics (ug/kg)

| Date Analyzed: | 17-AUG-90 | 17-AUG-90 | 20-AUG-90 | 21-AUG-90 | 21-AUG-90 |
|---------------------|-----------|-----------|-----------|-----------|-----------|
| Benzene | 380 U | 410 U | 5600 | J U | J U |
| Ethyl Benzene | 17000 U | 5000 U | 20000 | J U | J U |
| Toluene | 12000 U | 2100 U | 20000 | J U | J U |
| Xylenes | 58000 U | 15000 U | 53000 | J U | J U |
| Chlorobenzene | 760 U | 820 U | 2200 U | J U | J U |
| 1,2-Dichlorobenzene | 1200 U | 1600 U | 4500 U | J U | J U |
| 1,3-Dichlorobenzene | 1500 U | 1600 U | 4500 U | J U | J U |
| 1,4-Dichlorobenzene | 1100 U | 1200 U | 3200 U | J U | J U |

Semi-Volatile Organics (ug/kg)

| Date Analyzed: | 13-AUG-90 | 21-AUG-90 | 13-AUG-90 | 24-AUG-90 | 24-AUG-90 |
|---------------------------|-----------|-----------|-----------|-----------|-----------|
| N-Nitroso-Dimethylamine | 320 U | 320 U | 410 U | 410 U | 410 U |
| Phenol | 320 U | 320 U | 320 U | 320 U | 320 U |
| Bis(2-Chloroethyl)ether | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Chlorophenol | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1,3-Dichlorobenzene | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1,4-Dichlorobenzene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzyl Alcohol | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1,2-Dichlorobenzene | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Methylphenol | 320 U | 320 U | 320 U | 320 U | 320 U |
| Bis(2-Chloroisopropyl)Eth | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Methylphenol | 320 U | 320 U | 320 U | 320 U | 320 U |
| N-Nitroso-Di-n-Propylamin | 320 U | 320 U | 320 U | 320 U | 320 U |
| Hexachloroethane | 320 U | 320 U | 320 U | 320 U | 320 U |
| Nitrobenzene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Sophorone | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Nitrophenol | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,4-Dimethylphenol | 320 U | 320 U | 320 U | 320 U | 320 U |
| Bis(2-Chloroethoxy)methan | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,4-Dichlorophenol | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzoic Acid | 1600 U | 1600 U | 200 U | 200 U | 200 U |
| 1,2,4-Trichlorobenzene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Naphthalene | 2300 U | 320 U | 320 U | 320 U | 320 U |
| 4-Chloroaniline | 320 U | 320 U | 320 U | 320 U | 320 U |
| Hexachlorobutadiene | 320 U | 320 U | 320 U | 320 U | 320 U |
| 4-Chloro-3-Methylphenol | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Methylnaphthalene | 2200 U | 320 U | 320 U | 320 U | 320 U |
| Hexachlorocyclopentadiene | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1,2,3-Trichlorophenol | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1,3,5-Trichlorophenol | 1600 U | 1600 U | 200 U | 200 U | 200 U |
| 2-Chloronaphthalene | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Nitroaniline | 320 U | 320 U | 320 U | 320 U | 320 U |
| Dimethylphthalate | 320 U | 320 U | 320 U | 320 U | 320 U |
| Acenaphthylene | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,6-Dinitrotoluene | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Nitroaniline | 1600 U | 1600 U | 200 U | 200 U | 200 U |
| Acenaphthene | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,4-Dinitrophenol | 1600 U | 1600 U | 200 U | 200 U | 200 U |
| Dibenzofuran | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1-Nitrophenol | 320 U | 320 U | 320 U | 320 U | 320 U |
| 3,4-Dinitrotoluene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Fluorene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Diethylphthalate | 320 U | 320 U | 320 U | 320 U | 320 U |
| 4-Chlorophenyl-phenylethe | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Nitroaniline | 1600 U | 1600 U | 200 U | 200 U | 200 U |
| 1,6-Dinitro-2-Methylpheno | 320 U | 320 U | 320 U | 320 U | 320 U |
| N-Nitrosodiphenylamine | 320 U | 320 U | 320 U | 320 U | 320 U |
| 4-Bromophenyl-phenylether | 320 U | 320 U | 320 U | 320 U | 320 U |
| Hexachlorobenzene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Pentachlorophenol | 1600 U | 1600 U | 200 U | 200 U | 200 U |
| Phenanthrene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Anthracene | 320 U | 320 U | 320 U | 320 U | 320 U |
| D-n-Butylphthalate | 320 U | 320 U | 320 U | 320 U | 320 U |
| Fluoranthene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Pyrene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Butylbenzylphthalate | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzo(a)Anthracene | 320 U | 320 U | 320 U | 320 U | 320 U |
| 3,3'-Dichlorobenzidine | 680 U | 680 U | 80 U | 80 U | 80 U |
| Chrysene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Bis(2-Ethylhexyl)Phthalat | 320 U | 320 U | 320 U | 320 U | 320 U |
| D-n-octylphthalate | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzo(b)Fluoranthene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzo(k)Fluoranthene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzo(a)Pyrene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Indeno(1,2,3-cd)Pyrene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Dibenzo(a,h)Anthracene | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzo(g,h,i)Perylene | 320 U | 320 U | 320 U | 320 U | 320 U |

IANG SITE 1 SOIL SAMPLES

| SAMPLE ID: | IANG-1
SB-4/
MW-3-S2 | IANG-1
SB-5/
MW-4-S1 | IANG-1
SB-5/
MW-4-S2 | IANG-1
SB-6/
MW-5-S1 | IANG-1
SB-6/
MW-5-S2 |
|--------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Date Sampled: | 7-AUG-90 | 8-AUG-90 | 8-AUG-90 | 9-AUG-90 | 9-AUG-90 |
| Lab ID: | 2125-09 | 2125-01 | 2125-02 | 2136-05 | 2136-06 |
| Matrix: | Soil | Soil | Soil | Soil | Soil |
| Miscellaneous Parameters | | | | | |
| Date Analyzed: | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 |
| TPH (mg/kg) | 1600 | 780 | 3100 | 20 | 12 U |

Footnotes:

J--the value reported is an estimated concentration.
U--the compound was analyzed for, but not detected.

| IANG SITE 1 SOIL SAMPLES | | SEMI-VOLATILES | | VOLATILES | | TPH RADIOLOGICAL PARAMETERS | |
|--------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-----------------------------|-------------------|
| SAMPLE ID: | IANG-1
SB-1-S1 | IANG-1
SB-1-S2 | IANG-1
SB-1-S3 | IANG-1
SB-2-S1 | IANG-1
SB-2-S2 | IANG-1
SB-2-S3 | IANG-1
SB-2-S4 |
| Date Sampled: | 31-JUL-90 | 31-JUL-90 | 6-AUG-90 | 6-AUG-90 | 6-AUG-90 | 6-AUG-90 | 7-AUG-90 |
| Lab ID: | 2091-01 | 2091-02 | 2125-05 | 2125-06 | 2125-06 | 2125-06 | 2125-08 |
| Matrix: | Soil | Soil | Soil | Soil | Soil | Soil | Soil |
| Associated Samples: | RB-1 | RB-1 | RB-1 | RB-1 | RB-1 | RB-1 | RB-1 |

| Volatile Organics (ug/kg) | | SEMI-VOLATILES | | VOLATILES | | TPH RADIOLOGICAL PARAMETERS | |
|---------------------------|-----------|----------------|-----------|-----------|-----------|-----------------------------|-----------|
| Date Analyzed: | 13-AUG-90 | 9-AUG-90 | 17-AUG-90 | 17-AUG-90 | 17-AUG-90 | 17-AUG-90 | 17-AUG-90 |
| Benzene | 330 | 5000 U | 370 U | 110 U | 330 U | 330 U | 330 U |
| Ethyl Benzene | 16000 | 42000 U | 18000 | 5500 | 7000 | 7000 | 7000 |
| Toluene | 18000 | 100000 U | 15000 | 22000 | 22000 | 22000 | 22000 |
| Xylenes | 38000 | 100000 U | 15000 | 22000 | 22000 | 22000 | 22000 |
| Chlorobenzene | 1000 | 3200 U | 1500 | 2200 | 2200 | 2200 | 2200 |
| 1,2-Dichlorobenzene | 1000 | 3200 U | 1500 | 2200 | 2200 | 2200 | 2200 |
| 1,3-Dichlorobenzene | 1000 | 3200 U | 1500 | 2200 | 2200 | 2200 | 2200 |
| 1,4-Dichlorobenzene | 750 U | 2700 U | 1100 | 320 | 1000 | 1000 | 1000 |

| Semi-Volatile Organics (ug/kg) | | SEMI-VOLATILES | | VOLATILES | | TPH RADIOLOGICAL PARAMETERS | |
|--------------------------------|----------|----------------|-----------|-----------|-----------|-----------------------------|-----------|
| Date Analyzed: | 3-AUG-90 | 3-AUG-90 | 13-AUG-90 | 13-AUG-90 | 13-AUG-90 | 13-AUG-90 | 13-AUG-90 |
| N-Nitroso-Dimethylamine | 320 U | 350 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Bis(2-Chloroethyl)ether | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1-Chlorophenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1,3-Dichlorobenzene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1,4-Dichlorobenzene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzyl Alcohol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1,2-Dichlorobenzene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Methylphenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Bis(2-Chloroisopropyl)Eth | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 4-Methylphenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| N-Nitroso-Di-n-Propylamin | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Hexachloroethane | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Nitrobenzene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Isophorone | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Nitrophenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,4-Dimethylphenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Bis(2-Chloroethoxy)methan | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,4-Dichlorophenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzoic Acid | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 1,2,4-Trichlorobenzene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Naphthalene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 4-Chloroaniline | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Hexachlorobutadiene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 4-Chloro-3-Methylphenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2-Methylnaphthalene | 1000 | 2000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| Hexachlorocyclopentadiene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,7,8-Trichlorophenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,4,6-Trichlorophenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 5-Chloronaphthalene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 5-Nitroaniline | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Dimethylphthalate | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Acenaphthylene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,6-Dinitrotoluene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 3-Nitroaniline | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Acenaphthene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,4-Dinitrophenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Dibenzofuran | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 1-Nitrophenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 2,4-Dinitrotoluene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Fluorene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Diethylphthalate | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 4-Chlorophenyl-phenylethe | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 4-Nitroaniline | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 4,6-Dinitro-2-Methylpheno | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| N-Nitrosodiphenylamine | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 4-Bromophenyl-phenylether | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Hexachlorobenzene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Pentachlorophenol | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Phenanthrene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Anthracene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| D,n-Butylphthalate | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Fluoranthene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Pyrene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Butylbenzylphthalate | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzo(a)Anthracene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| 3,3'-Dichlorobenzidine | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Chrysene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Bis(2-Ethylhexyl)Phthalat | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Di-n-octylphthalate | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzo(b)Fluoranthene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzo(k)Fluoranthene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzo(a)Pyrene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Indeno(1,2,3-cd)Pyrene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Dibenz(a,h)Anthracene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |
| Benzo(g,h,i)Perylene | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U | 320 U |

| IANG SITE 1 SOIL SAMPLES | | SEMI-VOLATILES | | VOLATILES | | TPH RADIOLOGICAL PARAMETERS | |
|--------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-----------------------------|-------------------|
| SAMPLE ID: | IANG-1
SB-1-S1 | IANG-1
SB-1-S2 | IANG-1
SB-1-S3 | IANG-1
SB-2-S1 | IANG-1
SB-2-S2 | IANG-1
SB-2-S3 | IANG-1
SB-2-S4 |
| Date Sampled: | 31-JUL-90 | 31-JUL-90 | 6-AUG-90 | 6-AUG-90 | 6-AUG-90 | 6-AUG-90 | 7-AUG-90 |
| Lab ID: | 2091-01 | 2091-02 | 2125-05 | 2125-06 | 2125-06 | 2125-06 | 2125-08 |
| Matrix: | Soil | Soil | Soil | Soil | Soil | Soil | Soil |
| Miscellaneous Parameters | | | | | | | |
| Date Analyzed: | 6-AUG-90 | 6-AUG-90 | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 |
| TPH (mg/kg) | 730 | 1700 | 10 U | 29 | 29 | 29 | 920 |

Footnotes:
 J--the value reported is an estimated concentration.
 U--the compound was analyzed for, but not detected.

| IANG SITE 1 SOIL SAMPLES | | SEMI-VOLATILES | | VOLATILES | | TPH RADIOLOGICAL PARAMETERS | |
|--------------------------|-------------------|-------------------|----------------------------|----------------------------|----------------------------|-----------------------------|--|
| SAMPLE ID: | IANG-1
SB-1-S1 | IANG-1
SB-1-S2 | IANG-1
SB-3/
MW-2-S1 | IANG-1
SB-4/
MW-2-S2 | IANG-1
SB-4/
MW-3-S1 | | |
| Date Sampled: | 31-JUL-90 | 31-JUL-90 | 6-AUG-90 | 6-AUG-90 | 7-AUG-90 | | |
| Lab ID: | 2091-01 | 2091-02 | 2125-05 | 2125-06 | 2125-08 | | |
| Matrix: | Soil | Soil | Soil | Soil | Soil | | |
| Associated Samples: | RB-1 | RB-1 | RB-1 | RB-1 | RB-1 | | |

Volatile Organics (ug/kg)

| Date Analyzed: | 13-AUG-90 | 9-AUG-90 | 17-AUG-90 | 17-AUG-90 | 17-AUG-90 |
|---------------------|-----------|----------|-----------|-----------|-----------|
| Benzene | 330 | 5000 J | 370 U | 110 U | 330 U |
| Ethyl Benzene | 16000 | 42000 J | 1700 | 220 U | 7500 |
| Toluene | 10000 | 61000 J | 1800 | 220 U | 2100 |
| Xylenes | 38000 | 100000 J | 15000 | 2200 U | 22000 |
| Chlorobenzene | 500 U | 1800 UJ | 1750 U | 220 U | 670 U |
| 1,2-Dichlorobenzene | 1000 U | 1800 UJ | 1750 U | 220 U | 1300 U |
| 1,3-Dichlorobenzene | 1000 U | 3500 UJ | 1500 U | 320 U | 1300 U |
| 1,4-Dichlorobenzene | 750 U | 2700 UJ | 1100 U | 320 U | 1000 U |

Semi-Volatile Organics (ug/kg)

| Date Analyzed: | 3-AUG-90 | 3-AUG-90 | 13-AUG-90 | 13-AUG-90 | 13-AUG-90 |
|---------------------------|----------|----------|-----------|-----------|-----------|
| N-Nitroso-Dimethylamine | 340 U | 350 U | 340 U | 400 U | 340 U |
| Phenol | 340 U | 340 U | 340 U | 400 U | 340 U |
| bis(2-Chloroethyl)ether | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2-Chlorophenol | 340 U | 340 U | 340 U | 400 U | 340 U |
| 1,3-Dichlorobenzene | 340 U | 340 U | 340 U | 400 U | 340 U |
| 1,4-Dichlorobenzene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Benzyl Alcohol | 340 U | 340 U | 340 U | 400 U | 340 U |
| 1,2-Dichlorobenzene | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2-Methylphenol | 340 U | 340 U | 340 U | 400 U | 340 U |
| bis(2-Chloroisopropyl)Eth | 340 U | 340 U | 340 U | 400 U | 340 U |
| 4-Methylphenol | 340 U | 340 U | 340 U | 400 U | 340 U |
| N-Nitroso-Di-n-Propylamin | 340 U | 340 U | 340 U | 400 U | 340 U |
| Hexachloroethane | 340 U | 340 U | 340 U | 400 U | 340 U |
| Nitrobenzene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Isophorone | 340 U | 340 U | 340 U | 400 U | 340 U |
| 3-Nitrophenol | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2,4-Dimethylphenol | 340 U | 340 U | 340 U | 400 U | 340 U |
| bis(2-Chloroethoxy)methan | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2,6-Dichlorophenol | 340 U | 340 U | 340 U | 400 U | 340 U |
| Benzoic Acid | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| 1,2,4-Trichlorobenzene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Naphthalene | 340 U | 340 U | 340 U | 400 U | 340 U |
| 4-Chloroaniline | 340 U | 340 U | 340 U | 400 U | 340 U |
| Hexachlorobutadiene | 340 U | 340 U | 340 U | 400 U | 340 U |
| 4-Chloro-3-Methylphenol | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2-Methylnaphthalene | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| Hexachlorocyclopentadiene | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2,4,6-Trichlorophenol | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2,4,5-Trichlorophenol | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| 2-Chloronaphthalene | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2-Nitroaniline | 340 U | 340 U | 340 U | 400 U | 340 U |
| Dimethylphthalate | 340 U | 340 U | 340 U | 400 U | 340 U |
| Acenaphthylene | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2,6-Dinitrotoluene | 340 U | 340 U | 340 U | 400 U | 340 U |
| 3-Nitroaniline | 1600 U | 1600 U | 1600 U | 1600 U | 1600 U |
| Acenaphthene | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2,4-Dinitrophenol | 1600 U | 1600 U | 1600 U | 1600 U | 1600 U |
| Dibenzofuran | 340 U | 340 U | 340 U | 400 U | 340 U |
| 4-Nitrophenol | 1600 U | 1600 U | 1600 U | 1600 U | 1600 U |
| 2,4-Dinitrotoluene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Fluorene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Diethylphthalate | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2-Chlorophenyl-phenylethe | 340 U | 340 U | 340 U | 400 U | 340 U |
| 2-Nitroaniline | 1600 U | 1600 U | 1600 U | 1600 U | 1600 U |
| 4,6-Dinitro-2-Methylpheno | 340 U | 340 U | 340 U | 400 U | 340 U |
| N-Nitrosodiphenylamine | 340 U | 340 U | 340 U | 400 U | 340 U |
| 4-Bromophenyl-phenylether | 340 U | 340 U | 340 U | 400 U | 340 U |
| Hexachlorobenzene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Pentachlorophenol | 340 U | 340 U | 340 U | 400 U | 340 U |
| Phenanthrene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Anthracene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Di-n-Butylphthalate | 340 U | 340 U | 340 U | 400 U | 340 U |
| Fluoranthene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Pyrene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Butylbenzylphthalate | 340 U | 340 U | 340 U | 400 U | 340 U |
| Benzo(a)Anthracene | 340 U | 340 U | 340 U | 400 U | 340 U |
| 3,3'-Dichlorobenzidine | 680 U | 680 U | 680 U | 680 U | 680 U |
| Chrysene | 340 U | 340 U | 340 U | 400 U | 340 U |
| bis(2-Ethylhexyl)Phthalat | 340 U | 340 U | 340 U | 400 U | 340 U |
| Di-n-octylphthalate | 340 U | 340 U | 340 U | 400 U | 340 U |
| Benzo(b)fluoranthene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Benzo(k)fluoranthene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Benzo(a)Pyrene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Indeno(1,2,3-cd)Pyrene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Dibenz(a,h)Anthracene | 340 U | 340 U | 340 U | 400 U | 340 U |
| Benzo(g,h,i)Perylene | 340 U | 340 U | 340 U | 400 U | 340 U |

IANG SITE 1 SOIL SAMPLES

| SAMPLE ID: | IANG-1
SB-1-S1 | IANG-1
SB-1-S2 | IANG-1
SB-3/
MW-2-S1 | IANG-1
SB-4/
MW-2-S2 | IANG-1
SB-4/
MW-3-S1 |
|---------------|-------------------|-------------------|----------------------------|----------------------------|----------------------------|
| Date Sampled: | 31-JUL-90 | 31-JUL-90 | 6-AUG-90 | 6-AUG-90 | 7-AUG-90 |
| Lab ID: | 2091-01 | 2091-02 | 2125-05 | 2125-06 | 2125-08 |
| Matrix: | Soil | Soil | Soil | Soil | Soil |

Miscellaneous Parameters

| Date Analyzed: | 6-AUG-90 | 6-AUG-90 | 27-AUG-90 | 27-AUG-90 | 27-AUG-90 |
|----------------|----------|----------|-----------|-----------|-----------|
| TPH (mg/kg) | 730 | 1700 | 10 U | 29 | 920 |

Footnotes:

J--the value reported is an estimated concentration.
U--the compound was analyzed for, but not detected.

LANG SITES 1 AND 2 WATER SAMPLE DUPLICATES

| | | | |
|---------------|----------------|-----------------------------------|----------------|
| Client's ID: | LANG-1
MW-6 | LANG-1
MW-10 | LANG-1
MW-8 |
| Date Sampled: | 15-Aug-90 | 15-Aug-90
DUPLICATE
OF MW-6 | 15-Aug-90 |
| Lab ID: | | | |
| Matrix: | Water | Water | Water |

| | | | |
|---------------|-----------|-----------|-----------|
| DATE ANALYZED | 25-AUG-90 | 25-AUG-90 | 25-AUG-90 |
|---------------|-----------|-----------|-----------|

Volatile Organics (ug/l)

| | | | |
|---------------------|----|----|----|
| Benzene | 1 | -- | 1 |
| Ethyl Benzene | UU | -- | UU |
| Toluene | UU | -- | UU |
| Xylenes | UU | -- | UU |
| Chlorobenzene | UU | -- | UU |
| 1,2-Dichlorobenzene | UU | -- | UU |
| 1,4-Dichlorobenzene | UU | -- | UU |
| 1,3-Dichlorobenzene | UU | -- | UU |

Semi-Volatile Organics (ug/l)

| | | | |
|---------------|-----------|-----|-----------|
| DATE ANALYZED | 24-AUG-90 | --- | 24-AUG-90 |
|---------------|-----------|-----|-----------|

N-Nitroso-Dimethylamine
 Phenol
 Bis(2-Chloroethyl)ether
 2,4-Dichlorophenol
 1,2-Dichlorobenzene
 Benzyl Alcohol
 1,2-Dichlorobenzene
 2-Methylphenol
 Bis(2-Chloroisopropyl)Ether
 4-Methylphenol
 N-Nitroso-Di-n-Propylamine
 Hexachloroethane
 Nitrobenzene
 Isophorone
 2-Nitrophenol
 2,4-Dimethylphenol
 Bis(2-Chloroethoxy)methane
 2,4-Dichlorophenol
 Benzoic Acid
 1,2,4-Trichlorobenzene
 Naphthalene
 4-Chloroaniline
 Hexachlorobutadiene
 2-Chloro-3-Methylphenol
 2-Methylnaphthalene
 Hexachlorocyclopentadiene
 2,2,4-Trichlorophenol
 2,4,6-Trichlorophenol
 2-Chloronaphthalene
 2-Nitroaniline
 Dimethylphthalate
 Acenaphthylene
 2,6-Dinitrotoluene
 3-Nitroaniline
 Acenaphthene
 2,4-Dinitrophenol
 6-Benzofuran
 4-Nitrophenol
 2,4-Dinitrotoluene
 Fluorene
 Diethylphthalate
 4-Chlorophenyl-phenylether
 4-Nitroaniline
 2,6-Dinitro-2-Methylphenol
 N-Nitrosodiphenylamine
 4-Bromophenyl-phenylether
 Hexachlorobenzene
 Pentachlorophenol
 Phenanthrene
 Anthracene
 Di-n-Butylphthalate
 Fluoranthene
 Pyrene
 Butylbenzylphthalate
 Benzo(a)Anthracene
 3,3'-Dichlorobenzidine
 Chrysene
 Bis(2-Ethylhexyl)Phthalate
 Di-n-octylphthalate
 Benzo(b)Fluoranthene
 Benzo(k)Fluoranthene
 Benzo(a)Pyrene
 Indeno(1,2,3-cd)Pyrene
 Dibenz(a,h)Anthracene
 Benzo(g,h,i)Perylene

MISCELLANEOUS PARAMETERS

LANG SITES 1 AND 2 WATER SAMPLE DUPLICATES

| | | | |
|---------------|----------------|-----------------------------------|----------------|
| Client's ID: | LANG-1
MW-6 | LANG-1
MW-10 | LANG-1
MW-8 |
| Date Sampled: | 15-Aug-90 | 15-Aug-90
DUPLICATE
OF MW-6 | 15-Aug-90 |
| Lab ID: | | | |
| Matrix: | Water | Water | Water |

| | | | |
|---------------|-----------|-----|-----------|
| DATE ANALYZED | 27-AUG-90 | --- | 27-AUG-90 |
|---------------|-----------|-----|-----------|

TPH (mg/l)

| | | | |
|--|-----|----|-----|
| | 1 U | -- | 1 U |
|--|-----|----|-----|

Radiological Parameters (pCi/l)

| | | | |
|-------------|----------|----------|----|
| Gross Alpha | 21/-7 | 20/-7 | -- |
| Gross Beta | 32/-7 | 29/-7 | -- |
| Radium-226 | 177/-7.8 | 7.9/-4.1 | -- |
| Radium-228 | | | -- |

IANG SITES 1 AND 2 WATER SAMPL

Client's ID:

IANG-1
MW-9IANG-2
MW-5IANG-2
MW-6

Date Sampled:

15-Aug-90
DUPLICATE
OF MW-8

14-Aug-90

14-Aug-90
DUPLICATE
OF MW-5

Lab ID:

Matrix:

Water

Water

Water

DATE ANALYZED

25-AUG-90

28-AUG-90

28-AUG-90

Volatile Organics (ug/l)

| | | | |
|---------------------|-----|----|----|
| Benzene | 1 U | -- | -- |
| Ethyl Benzene | U | -- | -- |
| Toluene | U | -- | -- |
| Xylenes | U | -- | -- |
| Chlorobenzene | U | -- | -- |
| 1,2-Dichlorobenzene | U | -- | -- |
| 1,4-Dichlorobenzene | U | -- | -- |
| 1,2-Dichlorobenzene | U | -- | -- |

Semi-Volatile Organics (ug/l)

DATE ANALYZED

24-AUG-90

| | | | |
|-----------------------------|-------|----|----|
| N-Nitroso-Dimethylamine | 20 U | -- | -- |
| Phenol | U | -- | -- |
| bis(2-Chloroethyl)ether | U | -- | -- |
| 2-Chlorophenol | U | -- | -- |
| 1,2-Dichlorobenzene | U | -- | -- |
| 1,4-Dichlorobenzene | U | -- | -- |
| Benzyl Alcohol | U | -- | -- |
| 1,2-Dichlorobenzene | U | -- | -- |
| 2-Methylphenol | U | -- | -- |
| bis(2-Chloroisopropyl)Ether | U | -- | -- |
| 4-Methylphenol | U | -- | -- |
| N-Nitroso-Di-n-Propylamine | U | -- | -- |
| Hexachloroethane | U | -- | -- |
| Nitrobenzene | U | -- | -- |
| Isophorone | U | -- | -- |
| 2-Nitrophenol | U | -- | -- |
| 2,4-Dimethylphenol | U | -- | -- |
| bis(2-Chloroethoxy)methane | U | -- | -- |
| 2,4-Dichlorophenol | U | -- | -- |
| Benzoic Acid | 100 U | -- | -- |
| 1,2,4-Trichlorobenzene | U | -- | -- |
| Naphthalene | U | -- | -- |
| 4-Chloroaniline | U | -- | -- |
| Hexachlorobutadiene | U | -- | -- |
| 4-Chloro-3-Methylphenol | U | -- | -- |
| 2-Methylnaphthalene | U | -- | -- |
| Hexachlorocyclopentadiene | U | -- | -- |
| 2,4,6-Trichlorophenol | 100 U | -- | -- |
| 2-Chloronaphthalene | U | -- | -- |
| 2-Nitroaniline | 100 U | -- | -- |
| Dimethylphthalate | U | -- | -- |
| Acenaphthylene | U | -- | -- |
| 5,6-Dinitrotoluene | U | -- | -- |
| 3-Nitroaniline | 100 U | -- | -- |
| Acenaphthene | U | -- | -- |
| 2,4-Dinitrophenol | 100 U | -- | -- |
| 6-Benzofuran | U | -- | -- |
| 4-Nitrophenol | 100 U | -- | -- |
| 2,4-Dinitrotoluene | 100 U | -- | -- |
| Fluorene | U | -- | -- |
| Diethylphthalate | U | -- | -- |
| 4-Chlorophenyl-phenylether | U | -- | -- |
| 2-Nitroaniline | U | -- | -- |
| 4,6-Dinitro-2-Methylphenol | 100 U | -- | -- |
| N-Nitrosodiphenylamine | U | -- | -- |
| 4-Bromophenyl-phenylether | U | -- | -- |
| Hexachlorobenzene | U | -- | -- |
| Pentachlorophenol | 100 U | -- | -- |
| Phenanthrene | U | -- | -- |
| Anthracene | U | -- | -- |
| 01-n-Butylphthalate | U | -- | -- |
| Fluoranthene | U | -- | -- |
| Pyrene | U | -- | -- |
| Butylbenzylphthalate | U | -- | -- |
| Benzo(a)Anthracene | U | -- | -- |
| 2,3-Dichlorobenzidine | U | -- | -- |
| 2-Furylene | U | -- | -- |
| bis(2-Ethylhexyl)Phthalate | U | -- | -- |
| 01-n-octylphthalate | U | -- | -- |
| Benzo(b)fluoranthene | U | -- | -- |
| Benzo(k)fluoranthene | U | -- | -- |
| Benzo(a)Pyrene | U | -- | -- |
| Indeno(1,2,3-cd)Pyrene | U | -- | -- |
| Dibenz(a,h)Anthracene | U | -- | -- |
| Benzo(g,h,i)Perylene | U | -- | -- |

MISCELLANEOUS PARAMETERS

IANG SITES 1 AND 2 WATER SAMPL

Client's ID:

IANG-1
MW-9IANG-2
MW-5IANG-2
MW-6

Date Sampled:

15-Aug-90
DUPLICATE
OF MW-8

14-Aug-90

14-Aug-90
DUPLICATE
OF MW-5

Lab ID:

Matrix:

Water

Water

Water

DATE ANALYZED

27-AUG-90

TPM (mg/l)

1 U

--

--

Radiological Parameters (pCi/l)

Gross Alpha
Gross Beta
Radium-226
Radium-228--
--
--
--9%/-8%
36%/-12%
0.9 U11%/-8%
22%/-11%
1.0%/-0.4%
U

LANG SITES 1 AND 2 WATER SAMPL

| | | | |
|---------------|-----------------------------------|----------------|-----------------------------------|
| Client's ID: | LANG-1
MW-9 | LANG-2
MW-5 | LANG-2
MW-8 |
| Date Sampled: | 15-Aug-90
DUPLICATE
OF MW-8 | 14-Aug-90 | 14-Aug-90
DUPLICATE
OF MW-5 |
| Lab ID: | | | |
| Matrix: | Water | Water | Water |

=====

| | | | |
|---------------|-----------|-----------|-----------|
| DATE ANALYZED | 25-AUG-90 | 28-AUG-90 | 28-AUG-90 |
|---------------|-----------|-----------|-----------|

Volatile Organics (ug/l)

| | | | |
|---------------------|-----|----|----|
| Benzene | 1 U | -- | -- |
| Ethyl Benzene | U | -- | -- |
| Toluene | U | -- | -- |
| Xylenes | U | -- | -- |
| Chlorobenzene | U | -- | -- |
| 1,2-Dichlorobenzene | U | -- | -- |
| 1,3-Dichlorobenzene | U | -- | -- |
| 1,4-Dichlorobenzene | U | -- | -- |

=====

Semi-Volatile Organics (ug/l)

| | | | |
|---------------|-----------|-----|-----|
| DATE ANALYZED | 24-AUG-90 | --- | --- |
|---------------|-----------|-----|-----|

N-Nitroso-Dimethylamine

| | | | |
|-----------------------------|---|----|----|
| Phenol | U | -- | -- |
| Bis(2-Chloroethyl)ether | U | -- | -- |
| 2-Chlorophenol | U | -- | -- |
| 1,3-Dichlorobenzene | U | -- | -- |
| 1,4-Dichlorobenzene | U | -- | -- |
| Benzyl Alcohol | U | -- | -- |
| 1,2-Dichlorobenzene | U | -- | -- |
| 2-Methylphenol | U | -- | -- |
| Bis(2-Chloroisopropyl)Ether | U | -- | -- |
| 4-Methylphenol | U | -- | -- |
| N-Nitroso-Di-n-Propylamine | U | -- | -- |
| Hexachloroethane | U | -- | -- |
| Nitrobenzene | U | -- | -- |
| Isophorone | U | -- | -- |
| 2-Nitrophenol | U | -- | -- |
| 2,4-Dimethylphenol | U | -- | -- |
| Bis(2-Chloroethoxy)methane | U | -- | -- |
| 2,4-Dichlorophenol | U | -- | -- |
| Benzic Acid | U | -- | -- |
| 1,2,4-Trichlorobenzene | U | -- | -- |
| Naphthalene | U | -- | -- |
| 4-Chloroaniline | U | -- | -- |
| Hexachlorobutadiene | U | -- | -- |
| 2-Chloro-3-Methylphenol | U | -- | -- |
| 2-Methylnaphthalene | U | -- | -- |
| Hexachlorocyclopentadiene | U | -- | -- |
| 1,2,4-Trichlorophenol | U | -- | -- |
| 1,2,5-Trichlorophenol | U | -- | -- |
| 2-Chloronaphthalene | U | -- | -- |
| 2-Nitroaniline | U | -- | -- |
| Dimethylphthalate | U | -- | -- |
| Acenaphthylene | U | -- | -- |
| 2,6-Dinitrotoluene | U | -- | -- |
| 2-Nitroaniline | U | -- | -- |
| Acenaphthene | U | -- | -- |
| 2,4-Dinitrophenol | U | -- | -- |
| 0-Benzofuran | U | -- | -- |
| 2-Nitrophenol | U | -- | -- |
| 2,4-Dinitrotoluene | U | -- | -- |
| Fluorene | U | -- | -- |
| Diethylphthalate | U | -- | -- |
| 2-Chlorophenyl-Phenylether | U | -- | -- |
| 4-Nitroaniline | U | -- | -- |
| 2,6-Dinitro-2-Methylphenol | U | -- | -- |
| N-Nitrosodiphenylamine | U | -- | -- |
| 4-Bromophenyl-phenylether | U | -- | -- |
| Hexachlorobenzene | U | -- | -- |
| Pentachlorophenol | U | -- | -- |
| Phenanthrene | U | -- | -- |
| Anthracene | U | -- | -- |
| Di-n-Butylphthalate | U | -- | -- |
| Fluoranthene | U | -- | -- |
| Pyrene | U | -- | -- |
| Butylbenzylphthalate | U | -- | -- |
| Benzo(a)Anthracene | U | -- | -- |
| 2,3-Dichlorobenzidine | U | -- | -- |
| Corryene | U | -- | -- |
| Bis(2-Ethylhexyl)Phthalate | U | -- | -- |
| Di-n-octylphthalate | U | -- | -- |
| Benzo(b)Fluoranthene | U | -- | -- |
| Benzo(k)Fluoranthene | U | -- | -- |
| Benzo(a)Pyrene | U | -- | -- |
| Indeno(1,2,3-cd)Pyrene | U | -- | -- |
| Benz(a,h)Anthracene | U | -- | -- |
| Benzo(g,h,i)Perylene | U | -- | -- |

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MISCELLANEOUS PARAMETERS

| | | | |
|--------------------------------|-----------------------------------|----------------|-----------------------------------|
| LANG SITES 1 AND 2 WATER SAMPL | | | |
| Client's ID: | LANG-1
MW-9 | LANG-2
MW-5 | LANG-2
MW-8 |
| Date Sampled: | 15-Aug-90
DUPLICATE
OF MW-8 | 14-Aug-90 | 14-Aug-90
DUPLICATE
OF MW-5 |
| Lab ID: | | | |
| Matrix: | Water | Water | Water |

=====

| | | | |
|---------------|-----------|-----|-----|
| DATE ANALYZED | 27-AUG-90 | --- | --- |
|---------------|-----------|-----|-----|

TPH (mg/l)

| | | | |
|--|-----|----|----|
| | 1 U | -- | -- |
|--|-----|----|----|

Radiological Parameters (pCi/l)

| | | | |
|-------------|----|----------|----------|
| Gross Alpha | -- | 36.7-8.2 | 11.7-8.7 |
| Gross Beta | -- | 0.9 U | 2.2-1.1 |
| Radium-226 | -- | | 1.0-0.5 |
| Radium-228 | -- | | |

LANG SITES 1 AND 2 TRIP/FIELD/RINSE BLANKS

| | | | |
|---------------|---------------|---------------|---------------|
| Client's ID: | LANG-1
181 | LANG-1
182 | LANG-1
183 |
| Date Sampled: | 10-Jul-90 | 07-Aug-90 | 08-Aug-90 |
| Lab ID: | 2091-04 | 2125-10 | 2125-04 |
| Matrix: | Water | Water | Water |

=====

Volatile Organics (ug/l)

| | | | |
|---------------------|-----------|-----------|-----------|
| DATE ANALYZED | 13-AUG-90 | 17-AUG-90 | 17-AUG-90 |
| Benzene | J | J | J |
| Ethyl Benzene | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| Toluene | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| Xylenes | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| Chlorobenzene | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| 1,2-Dichlorobenzene | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| 1,4-Dichlorobenzene | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| 1,2-Dichlorobenzene | UUUUUUUU | UUUUUUUU | UUUUUUUU |

=====

Semi-Volatile Organics (ug/l)

| | | | |
|-----------------------------|----|----|----|
| DATE ANALYZED | -- | -- | -- |
| N-Nitroso-Dimethylamine | -- | -- | -- |
| Phenol | -- | -- | -- |
| Bis(2-Chloroethyl)ether | -- | -- | -- |
| 4-Chlorophenol | -- | -- | -- |
| 1,3-Dichlorobenzene | -- | -- | -- |
| 1,4-Dichlorobenzene | -- | -- | -- |
| Benzyl Alcohol | -- | -- | -- |
| 2-Dichlorobenzene | -- | -- | -- |
| 2-Methylphenol | -- | -- | -- |
| Bis(2-Chloroisopropyl)Ether | -- | -- | -- |
| 4-Methylphenol | -- | -- | -- |
| N-Nitroso-Di-n-Propylamine | -- | -- | -- |
| Hexachloroethane | -- | -- | -- |
| Nitrobenzene | -- | -- | -- |
| Isophorone | -- | -- | -- |
| 2-Nitrophenol | -- | -- | -- |
| 4-Dimethylphenol | -- | -- | -- |
| Bis(2-Chloroethoxy)methane | -- | -- | -- |
| 2,4-Dichlorophenol | -- | -- | -- |
| Benzoic Acid | -- | -- | -- |
| 1,2,4-Trichlorobenzene | -- | -- | -- |
| Naphthalene | -- | -- | -- |
| 4-Chloroaniline | -- | -- | -- |
| Hexachlorobutadiene | -- | -- | -- |
| 5-Chloro-3-Methylphenol | -- | -- | -- |
| 2-Methylnaphthalene | -- | -- | -- |
| Hexachlorocyclopentadiene | -- | -- | -- |
| 2,4,6-Trichlorophenol | -- | -- | -- |
| 2,4,5-Trichlorophenol | -- | -- | -- |
| 2-Chloronaphthalene | -- | -- | -- |
| 2-Nitroaniline | -- | -- | -- |
| Dimethylphthalate | -- | -- | -- |
| Acenaphthylene | -- | -- | -- |
| 2,6-Dinitrotoluene | -- | -- | -- |
| 3-Nitroaniline | -- | -- | -- |
| Acenaphthene | -- | -- | -- |
| 4-Dinitrophenol | -- | -- | -- |
| Dibenzofuran | -- | -- | -- |
| 4-Nitrophenol | -- | -- | -- |
| 2,4-Dinitrotoluene | -- | -- | -- |
| Fluorene | -- | -- | -- |
| Diethylphthalate | -- | -- | -- |
| 4-Chlorophenyl-phenylether | -- | -- | -- |
| 4-Nitroaniline | -- | -- | -- |
| 2,6-Dinitro-2-Methylphenol | -- | -- | -- |
| N-Nitrosodiphenylamine | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | -- | -- |
| Hexachlorobenzene | -- | -- | -- |
| Pentachlorophenol | -- | -- | -- |
| Phenanthrene | -- | -- | -- |
| Anthracene | -- | -- | -- |
| Di-n-Butylphthalate | -- | -- | -- |
| Fluoranthene | -- | -- | -- |
| Pyrene | -- | -- | -- |
| Butylbenzylphthalate | -- | -- | -- |
| Benzo(a)Anthracene | -- | -- | -- |
| 2,3'-Dichlorobenzidine | -- | -- | -- |
| Chrysene | -- | -- | -- |
| Bis(2-Ethylhexyl)Phthalate | -- | -- | -- |
| Di-n-octylphthalate | -- | -- | -- |
| Benzo(b)fluoranthene | -- | -- | -- |
| Benzo(k)fluoranthene | -- | -- | -- |
| Benzo(a)Pyrene | -- | -- | -- |
| Indeno(1,2,3-cd)Pyrene | -- | -- | -- |
| Dibenz(a,h)Anthracene | -- | -- | -- |
| Benzo(g,h,i)Perylene | -- | -- | -- |

MISCELLANEOUS PARAMETERS

| | | | |
|-------------------------|---------------|---------------|---------------|
| Client's ID: | LANG-1
181 | LANG-1
182 | LANG-1
183 |
| DATE ANALYZED | ---- | ---- | ---- |
| Date Sampled: | | | |
| Lab ID: | 2091-04 | 2125-10 | 2125-04 |
| Matrix: | Water | Water | Water |
| TPH (mg/kg) | ---- | ---- | ---- |
| Matrix: | Water | Water | Water |
| Radiological Parameters | | | |
| DATE ANALYZED | ---- | --- | --- |
| Gross Alpha | -- | -- | -- |
| Gross Beta | -- | -- | -- |
| Radium-226 | -- | -- | -- |
| Radium-228 | -- | -- | -- |

Footnotes:
 J--the value reported is an estimated concentration. This is used when the
 U--the compound was analyzed for, but not detected.

IANG SITES 1 AND 2 TRIP/FIELD/

| Client's ID: | IANG-1
164 | IANG-1
165 | IANG-1
166 | IANG-1
167
(DUE) |
|---------------|---------------|---------------|---------------|------------------------|
| Date Sampled: | 12-Aug-90 | 15-Aug-90 | 23-Aug-90 | 12-Aug-90 |
| Lab ID: | 2136-15 | 2169-04 | 2195-02 | 2136-01 |
| Matrix: | Water | Water | Water | Water |

Volatile Organics (ug/l)

| DATE ANALYZED | 90 | 17-AUG-90 | 25-AUG-90 | 31-AUG-90 | 17-AUG-90 |
|---------------------|----|-----------|-----------|-----------|-----------|
| Benzene | U | U | U | U | U |
| Ethyl Benzene | U | U | U | U | U |
| Toluene | U | U | U | U | U |
| Xylenes | U | U | U | U | U |
| Chlorobenzene | U | U | U | U | U |
| 1,2-Dichlorobenzene | U | U | U | U | U |
| 1,4-Dichlorobenzene | U | U | U | U | U |
| 1,3-Dichlorobenzene | U | U | U | U | U |

Semi-Volatile Organics (ug/l)

| DATE ANALYZED | 90 | 17-AUG-90 | 25-AUG-90 | 31-AUG-90 | 17-AUG-90 |
|-----------------------------|----|-----------|-----------|-----------|-----------|
| N-Nitroso-Dimethylamine | U | U | U | U | U |
| Phenol | U | U | U | U | U |
| Bis(2-Chloroethyl)ether | U | U | U | U | U |
| 2-Chlorophenol | U | U | U | U | U |
| 1,3-Dichlorobenzene | U | U | U | U | U |
| 1,4-Dichlorobenzene | U | U | U | U | U |
| Benzyl Alcohol | U | U | U | U | U |
| 1,2-Dichlorobenzene | U | U | U | U | U |
| 2-Methylphenol | U | U | U | U | U |
| Bis(2-Chloroisopropyl)Ether | U | U | U | U | U |
| 4-Methylphenol | U | U | U | U | U |
| N-Nitroso-Di-n-Propylamine | U | U | U | U | U |
| Hexachlorocyclopentadiene | U | U | U | U | U |
| Nitrobenzene | U | U | U | U | U |
| Isophorone | U | U | U | U | U |
| 2-Nitrophenol | U | U | U | U | U |
| 2,4-Dimethylphenol | U | U | U | U | U |
| Bis(2-Chloroethoxy)methane | U | U | U | U | U |
| 2,4-Dichlorophenol | U | U | U | U | U |
| Benzoic Acid | U | U | U | U | U |
| 1,2,4-Trichlorobenzene | U | U | U | U | U |
| Naphthalene | U | U | U | U | U |
| 4-Chloroaniline | U | U | U | U | U |
| Hexachlorobutadiene | U | U | U | U | U |
| 4-Chloro-3-Methylphenol | U | U | U | U | U |
| 2-Methylnaphthalene | U | U | U | U | U |
| Hexachlorocyclopentadiene | U | U | U | U | U |
| 2,2,6-Trichlorophenol | U | U | U | U | U |
| 2,4,6-Trichlorophenol | U | U | U | U | U |
| 5-Chloronaphthalene | U | U | U | U | U |
| 5-Nitroaniline | U | U | U | U | U |
| Dimethylphthalate | U | U | U | U | U |
| Acenaphthylene | U | U | U | U | U |
| 4,6-Dinitrotoluene | U | U | U | U | U |
| 3-Nitroaniline | U | U | U | U | U |
| Acenaphthene | U | U | U | U | U |
| 2,4-Dinitrophenol | U | U | U | U | U |
| 1-Benzotriazole | U | U | U | U | U |
| 2-Nitrophenol | U | U | U | U | U |
| 2,4-Dinitrotoluene | U | U | U | U | U |
| Fluorene | U | U | U | U | U |
| Diethylphthalate | U | U | U | U | U |
| 4-Chlorophenyl-phenylether | U | U | U | U | U |
| 4-Nitroaniline | U | U | U | U | U |
| 4,6-Dinitro-2-Methylphenol | U | U | U | U | U |
| N-Nitrosodiphenylamine | U | U | U | U | U |
| 4-Bromophenyl-phenylether | U | U | U | U | U |
| Hexachlorobenzene | U | U | U | U | U |
| Pentachlorophenol | U | U | U | U | U |
| Phenanthrene | U | U | U | U | U |
| Anthracene | U | U | U | U | U |
| D,n-Butylphthalate | U | U | U | U | U |
| Fluoranthene | U | U | U | U | U |
| Pyrene | U | U | U | U | U |
| Butylbenzylphthalate | U | U | U | U | U |
| Benzo(a)Anthracene | U | U | U | U | U |
| 3,9-Dichlorobenzidine | U | U | U | U | U |
| Chrysene | U | U | U | U | U |
| Bis(2-Ethylhexyl)Phthalate | U | U | U | U | U |
| Di-n-octylphthalate | U | U | U | U | U |
| Benzo(b)Fluoranthene | U | U | U | U | U |
| Benzo(k)Fluoranthene | U | U | U | U | U |
| Benzo(a)Pyrene | U | U | U | U | U |
| Indeno(1,2,3-cd)Pyrene | U | U | U | U | U |
| Dibenz(a,h)Anthracene | U | U | U | U | U |
| Benzo(g,h,i)Perylene | U | U | U | U | U |

MISCELLANEOUS PARAMETERS

| Client's ID: | IANG-1
164 | IANG-1
165 | IANG-1
166 | IANG-1
167 |
|-------------------------|---------------|---------------|---------------|---------------|
| DATE ANALYZED | ---- | ---- | ---- | 23-AUG-90 |
| Date Sampled: | | | | 12-Aug-90 |
| Lab ID: | 2136-15 | 2169-04 | 2195-02 | 2136-01 |
| Matrix: | Water | Water | Water | Water |
| TPH (mg/kg) | ---- | ---- | ---- | 1 U |
| Matrix: | Water | Water | Water | Water |
| Radiological Parameters | | | | |
| DATE ANALYZED | --- | --- | --- | --- |
| Gross Alpha | --- | --- | --- | 2 U |
| Gross Beta | --- | --- | --- | U |
| Radium-226 | --- | --- | --- | 1.0 +/- 0.6 U |
| Radium-228 | --- | --- | --- | 1 U |

Footnotes:
 U - the value reported is an he compound is detected at an amount less than the reporting limit.
 --- the compound was analyzed

LANG SITES 1 AND 2 TRIP/FIELD/

| | | | | |
|---------------|---------------|---------------|---------------|-------------------------|
| Client's ID: | LANG-1
184 | LANG-1
185 | LANG-1
186 | LANG-1
187
(DIUF) |
| Date Sampled: | 12-Aug-90 | 15-Aug-90 | 23-Aug-90 | 12-Aug-90 |
| Lab ID: | 2136-15 | 2169-04 | 2195-02 | 2136-01 |
| Matrix: | Water | Water | Water | Water |

Volatile Organics (ug/l)

| | | | | | |
|---------------------|----|-----------|-----------|-----------|-----------|
| DATE ANALYZED | 90 | 17-AUG-90 | 25-AUG-90 | 31-AUG-90 | 17-AUG-90 |
| Benzene | U | 1 U | 1 U | 1 U | 1 U |
| Ethyl Benzene | U | U | U | U | U |
| Toluene | U | U | U | U | U |
| Xylenes | U | U | U | U | U |
| Chlorobenzene | U | U | U | U | U |
| 1,2-Dichlorobenzene | U | U | U | U | U |
| 1,3-Dichlorobenzene | U | U | U | U | U |
| 1,4-Dichlorobenzene | U | U | U | U | U |

Semi-Volatile Organics (ug/l)

| | | | | |
|-----------------------------|----|----|----|----|
| DATE ANALYZED | | | | |
| N-Nitroso-Dimethylamine | .. | .. | .. | .. |
| Phenol | .. | .. | .. | .. |
| Bis(2-Chloroethyl)ether | .. | .. | .. | .. |
| 1-Chlorophenol | .. | .. | .. | .. |
| 1,3-Dichlorobenzene | .. | .. | .. | .. |
| 1,4-Dichlorobenzene | .. | .. | .. | .. |
| Benzyl Alcohol | .. | .. | .. | .. |
| 1,2-Dichlorobenzene | .. | .. | .. | .. |
| 2-Methylphenol | .. | .. | .. | .. |
| Bis(2-Chloroisopropyl)Ether | .. | .. | .. | .. |
| 4-Methylphenol | .. | .. | .. | .. |
| N-Nitroso-Di-n-Propylamine | .. | .. | .. | .. |
| Hexachloroethane | .. | .. | .. | .. |
| Nitrobenzene | .. | .. | .. | .. |
| Isophorone | .. | .. | .. | .. |
| 2-Nitrophenol | .. | .. | .. | .. |
| 2,4-Dimethylphenol | .. | .. | .. | .. |
| Bis(2-Chloroethoxy)methane | .. | .. | .. | .. |
| 1,4-Dichlorophenol | .. | .. | .. | .. |
| Benzoic Acid | .. | .. | .. | .. |
| 1,2,4-Trichlorobenzene | .. | .. | .. | .. |
| Naphthalene | .. | .. | .. | .. |
| 4-Chloroaniline | .. | .. | .. | .. |
| Hexachlorobutadiene | .. | .. | .. | .. |
| 2-Chloro-3-Methylphenol | .. | .. | .. | .. |
| 2-Methylnaphthalene | .. | .. | .. | .. |
| Hexachlorocyclopentadiene | .. | .. | .. | .. |
| 1,2,8-Trichlorophenol | .. | .. | .. | .. |
| 1,2,8-Trichlorophenol | .. | .. | .. | .. |
| 2-Chloronaphthalene | .. | .. | .. | .. |
| 2-Nitroaniline | .. | .. | .. | .. |
| Dimethylphthalate | .. | .. | .. | .. |
| Acenaphthylene | .. | .. | .. | .. |
| 2,6-Dinitrotoluene | .. | .. | .. | .. |
| 3-Nitroaniline | .. | .. | .. | .. |
| Acenaphthene | .. | .. | .. | .. |
| 1,4-Dinitrophenol | .. | .. | .. | .. |
| 1-Benzotriazole | .. | .. | .. | .. |
| 4-Nitrophenol | .. | .. | .. | .. |
| 2,4-Dinitrotoluene | .. | .. | .. | .. |
| Fluorene | .. | .. | .. | .. |
| Diethylphthalate | .. | .. | .. | .. |
| 4-Chlorophenyl-phenylether | .. | .. | .. | .. |
| 2-Nitroaniline | .. | .. | .. | .. |
| 2,6-Dinitro-2-Methylphenol | .. | .. | .. | .. |
| N-Nitrosodiphenylamine | .. | .. | .. | .. |
| 4-Bromophenyl-phenylether | .. | .. | .. | .. |
| Hexachlorobenzene | .. | .. | .. | .. |
| Pentachlorophenol | .. | .. | .. | .. |
| Phenanthrene | .. | .. | .. | .. |
| Anthracene | .. | .. | .. | .. |
| 01-n-Butylphthalate | .. | .. | .. | .. |
| Fluoranthene | .. | .. | .. | .. |
| Pyrene | .. | .. | .. | .. |
| Butylbenzylphthalate | .. | .. | .. | .. |
| Benzo(a)Anthracene | .. | .. | .. | .. |
| 3,3'-Dichlorobenzidine | .. | .. | .. | .. |
| Chrysene | .. | .. | .. | .. |
| Bis(2-Ethylhexyl)Phthalate | .. | .. | .. | .. |
| 01-n-octylphthalate | .. | .. | .. | .. |
| Benzo(b)Fluoranthene | .. | .. | .. | .. |
| Benzo(k)Fluoranthene | .. | .. | .. | .. |
| Benzo(a)Pyrene | .. | .. | .. | .. |
| Indeno(1,2,3-cd)Pyrene | .. | .. | .. | .. |
| Dibenz(a,h)Anthracene | .. | .. | .. | .. |
| Benzo(g,h,i)Perylene | .. | .. | .. | .. |

MISCELLANEOUS PARAMETERS

| | | | | |
|-------------------------|---------------|---------------|---------------|---------------|
| Client's ID: | LANG-1
184 | LANG-1
185 | LANG-1
186 | LANG-1
187 |
| DATE ANALYZED | ---- | ---- | ---- | 23-AUG-90 |
| Date Sampled: | | | | 12-Aug-90 |
| Lab ID: | 2136-15 | 2169-04 | 2195-02 | 2136-01 |
| Matrix: | Water | Water | Water | Water |
| TPH (mg/kg) | ---- | ---- | ---- | 1 U |
| Matrix: | Water | Water | Water | Water |
| Radiological Parameters | | | | |
| DATE ANALYZED | --- | --- | ---- | |
| Gross Alpha | .. | .. | .. | 2 U |
| Gross Beta | .. | .. | .. | 2 U |
| Radium-226 | .. | .. | .. | 1.0 +/- 0.1 U |
| Radium-228 | .. | .. | .. | 1 U |

Footnotes:

U - the value reported is an he compound is detected at an amount less than the reporting limit.

IANG SITES 1 AND 2 TRIP/FIELD/

| | | | | |
|---------------|----------------|----------------|----------------|----------------|
| Client's ID: | IANG-2
RB-2 | IANG-2
RB-3 | IANG-2
RB-4 | IANG-2
RB-5 |
| Date Sampled: | 28-Jul-90 | 29-Jul-90 | 30-Jul-90 | 14-Aug-90 |
| Lab ID: | -- | -- | -- | -- |
| Matrix: | Water | Water | Water | Water |

Volatile Organics (ug/l)

DATE ANALYZED

| | | | | |
|---------------------|----|----|----|----|
| Benzene | -- | -- | -- | -- |
| Ethyl Benzene | -- | -- | -- | -- |
| Toluene | -- | -- | -- | -- |
| Xylenes | -- | -- | -- | -- |
| Chlorobenzene | -- | -- | -- | -- |
| 1,2-Dichlorobenzene | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | -- | -- | -- | -- |

Semi-Volatile Organics (ug/l)

DATE ANALYZED

| | | | | |
|-----------------------------|----|----|----|----|
| N-Nitroso-Dimethylamine | -- | -- | -- | -- |
| Phenol | -- | -- | -- | -- |
| bis(2-Chloroethyl)ether | -- | -- | -- | -- |
| 2-Chlorophenol | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | -- | -- | -- | -- |
| Benzyl Alcohol | -- | -- | -- | -- |
| 1,2-Dichlorobenzene | -- | -- | -- | -- |
| 2-Methylphenol | -- | -- | -- | -- |
| bis(2-Chloroisopropyl)Ether | -- | -- | -- | -- |
| 4-Methylphenol | -- | -- | -- | -- |
| N-Nitroso-Di-n-Propylamine | -- | -- | -- | -- |
| Hexachloroethane | -- | -- | -- | -- |
| Nitrobenzene | -- | -- | -- | -- |
| Isophorone | -- | -- | -- | -- |
| 2-Nitrophenol | -- | -- | -- | -- |
| 4,4-Dimethylphenol | -- | -- | -- | -- |
| bis(2-Chloroethoxy)methane | -- | -- | -- | -- |
| 2,4-Dichlorophenol | -- | -- | -- | -- |
| Benzoic Acid | -- | -- | -- | -- |
| 1,2,4-Trichlorobenzene | -- | -- | -- | -- |
| Naphthalene | -- | -- | -- | -- |
| 4-Chloroaniline | -- | -- | -- | -- |
| Hexachlorobutadiene | -- | -- | -- | -- |
| 2-Chloro-3-Methylphenol | -- | -- | -- | -- |
| 2-Methylnaphthalene | -- | -- | -- | -- |
| Hexachlorocyclopentadiene | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | -- | -- | -- | -- |
| 2,4,5-Trichlorophenol | -- | -- | -- | -- |
| 2-Chloronaphthalene | -- | -- | -- | -- |
| 2-Nitroaniline | -- | -- | -- | -- |
| Dimethylphthalate | -- | -- | -- | -- |
| Acenaphthylene | -- | -- | -- | -- |
| 2,6-Dinitrotoluene | -- | -- | -- | -- |
| 3-Nitroaniline | -- | -- | -- | -- |
| Acenaphthene | -- | -- | -- | -- |
| 2,4-Dinitrophenol | -- | -- | -- | -- |
| 5-Benzofuran | -- | -- | -- | -- |
| 4-Nitrophenol | -- | -- | -- | -- |
| 2,4-Dinitrotoluene | -- | -- | -- | -- |
| Fluorene | -- | -- | -- | -- |
| Diethylphthalate | -- | -- | -- | -- |
| 4-Chlorophenyl-phenylether | -- | -- | -- | -- |
| 4-Nitroaniline | -- | -- | -- | -- |
| 4,6-Dinitro-2-Methylphenol | -- | -- | -- | -- |
| N-Nitrosodiphenylamine | -- | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | -- | -- | -- |
| Hexachlorobenzene | -- | -- | -- | -- |
| Pentachlorophenol | -- | -- | -- | -- |
| Phenanthrene | -- | -- | -- | -- |
| Anthracene | -- | -- | -- | -- |
| Di-n-Butylphthalate | -- | -- | -- | -- |
| Fluoranthene | -- | -- | -- | -- |
| Pyrene | -- | -- | -- | -- |
| Butylbenzylphthalate | -- | -- | -- | -- |
| Benzo(a)Anthracene | -- | -- | -- | -- |
| 3,3'-Dichlorobenzidine | -- | -- | -- | -- |
| Chrysene | -- | -- | -- | -- |
| bis(2-Ethylhexyl)Phthalate | -- | -- | -- | -- |
| Di-n-octylphthalate | -- | -- | -- | -- |
| Benzo(b)Fluoranthene | -- | -- | -- | -- |
| Benzo(k)Fluoranthene | -- | -- | -- | -- |
| Benzo(a)Pyrene | -- | -- | -- | -- |
| Indeno(1,2,3-cd)Pyrene | -- | -- | -- | -- |
| Benzo(a,h)Anthracene | -- | -- | -- | -- |
| Benzo(g,h,i)Perylene | -- | -- | -- | -- |

IANG SITES 1 AND 2 TRIP/FIELD/

| | | | |
|---------------|----------------|----------------|----------------|
| Client's ID: | IANG-1
FB-1 | IANG-1
FB-2 | IANG-1
FB-3 |
| Date Sampled: | 12-AUG-90 | 23-AUG-90 | 31-JUL-90 |
| Lab ID: | 2136-04 | 2195-01 | 2091-03 |
| Matrix: | Water | Water | Water |

Volatile Organics (ug/l)

| | | | |
|---------------------|-----------|-----------|-----------|
| DATE ANALYZED | 17-AUG-90 | 31-AUG-90 | 13-AUG-90 |
| Benzene | J | J | J |
| Ethyl Benzene | U | U | U |
| Toluene | U | U | U |
| Xylenes | U | U | U |
| Chlorobenzene | U | U | U |
| 1,2-Dichlorobenzene | U | U | U |
| 1,3-Dichlorobenzene | U | U | U |
| 1,4-Dichlorobenzene | U | U | U |

Semi-Volatile Organics (ug/l)

| | | | |
|-----------------------------|----|-----------|----------|
| DATE ANALYZED | -- | 29-AUG-90 | 6-AUG-90 |
| N-Nitroso-Dimethylamine | -- | 20 | 20 |
| Phenol | -- | U | U |
| Bis(2-Chloroethyl)ether | -- | U | U |
| 4-Chlorophenol | -- | U | U |
| 1,2-Dichlorobenzene | -- | U | U |
| 1,3-Dichlorobenzene | -- | U | U |
| Benzyl Alcohol | -- | U | U |
| 1,2-Dichlorobenzene | -- | U | U |
| 2-Methylphenol | -- | U | U |
| Bis(2-Chloroisopropyl)Ether | -- | U | U |
| 4-Methylphenol | -- | U | U |
| N-Nitroso-Di-n-Propylamine | -- | U | U |
| Hexachloroethane | -- | U | U |
| Nitrobenzene | -- | U | U |
| Isophorone | -- | U | U |
| 4-Nitrophenol | -- | U | U |
| 2,4-Dimethylphenol | -- | U | U |
| Bis(2-Chloroethoxy)methane | -- | U | U |
| 2,4-Dichlorophenol | -- | U | U |
| Benzic Acid | -- | 1 | 1 |
| 1,2,4-Trichlorobenzene | -- | U | U |
| Naphthalene | -- | U | U |
| 4-Chloroaniline | -- | U | U |
| Hexachlorobutadiene | -- | U | U |
| 4-Chloro-3-Methylphenol | -- | U | U |
| 2-Methylnaphthalene | -- | U | U |
| Hexachlorocyclopentadiene | -- | U | U |
| 4,2,6-Trichlorophenol | -- | U | U |
| 2-Chloronaphthalene | -- | U | U |
| 2-Nitroaniline | -- | U | U |
| Dimethylphthalate | -- | U | U |
| Acenaphthylene | -- | U | U |
| 2,6-Dinitrotoluene | -- | U | U |
| 3-Nitroaniline | -- | U | U |
| Acenaphthene | -- | U | U |
| 2,4-Dinitrophenol | -- | U | U |
| Dibenzofuran | -- | U | U |
| 5-Nitrophenol | -- | U | U |
| 2,4-Dinitrotoluene | -- | U | U |
| Fluorene | -- | U | U |
| Diethylphthalate | -- | U | U |
| 4-Chlorophenyl-phenylether | -- | U | U |
| 4-Nitroaniline | -- | U | U |
| 2,6-Dinitro-2-Methylphenol | -- | U | U |
| N-Nitrosodiphenylamine | -- | U | U |
| 4-Bromophenyl-phenylether | -- | U | U |
| Hexachlorobenzene | -- | U | U |
| Pentachlorophenol | -- | U | U |
| Phenanthrene | -- | U | U |
| Anthracene | -- | U | U |
| Di-n-Butylphthalate | -- | U | U |
| Fluoranthene | -- | U | U |
| Pyrene | -- | U | U |
| Butylbenzylphthalate | -- | U | U |
| Benzo(a)Anthracene | -- | U | U |
| 3,5-Dichlorobenzidine | -- | U | U |
| Chrysene | -- | U | U |
| Bis(2-Ethylhexyl)Phthalate | -- | U | U |
| Di-n-octylphthalate | -- | U | U |
| Benzo(b)Fluoranthene | -- | U | U |
| Benzo(k)Fluoranthene | -- | U | U |
| Benzo(a)Pyrene | -- | U | U |
| Indeno(1,2,3-cd)Pyrene | -- | U | U |
| Dibenz(a,h)Anthracene | -- | U | U |
| Benzo(g,h,i)Perylene | -- | U | U |

MISCELLANEOUS PARAMETERS

| | | |
|-------------------------|----------------|----------------|
| Client's ID: | IANG-1
FB-1 | IANG-1
FB-2 |
| DATE ANALYZED | | 31-AUG-90 |
| Date Sampled: | | 23-AUG-90 |
| Lab ID: | 2136-04 | 2195-01 |
| Matrix: | Water | Water |
| TPH (mg/kg) | ---- | 1 U |
| Matrix: | Water | Water |
| Radiological Parameters | | |
| DATE ANALYZED | | |
| Gross Alpha | 10-2 U | 4-2 U |
| Gross Beta | 0-3 U | 0-3 U |
| Radium-226 | 0-1 U | 0-1 U |
| Radium-228 | | |

Footnotes:
J: the value reported is an
U: the compound was analyzed

IANG SITES 1 AND 2 TRIP/FIELD/

| | | | |
|---------------|-------------------------|--------------------------|----------------|
| Client's ID: | IANG-1
FB-1
(TAP) | IANG-1
FB-2
(DIUF) | IANG-1
RB-1 |
| Date Sampled: | 12-AUG-90 | 23-AUG-90 | 31-Jul-90 |
| Lab ID: | 2136-04 | 2195-01 | 2091-03 |
| Matrix: | Water | Water | Water |

Volatile Organics (ug/l)

| | | | |
|---------------------|-----------|-----------|-----------|
| DATE ANALYZED | 17-AUG-90 | 31-AUG-90 | 13-AUG-90 |
| Benzene | 1 U | 1 U | 1 U |
| Ethyl Benzene | U | U | U |
| Toluene | U | U | U |
| Xylenes | U | U | U |
| Chlorobenzene | U | U | U |
| 1,2-Dichlorobenzene | U | U | U |
| 1,3-Dichlorobenzene | U | U | U |
| 1,4-Dichlorobenzene | U | U | U |

Semi-Volatile Organics (ug/l)

| | | | |
|-----------------------------|----|-----------|----------|
| DATE ANALYZED | -- | 29-AUG-90 | 6-AUG-90 |
| N-Nitroso-Dimethylamine | .. | 20 | 20 |
| Phenol | .. | U | U |
| Bis(2-Chloroethyl)ether | .. | U | U |
| 4-Chlorophenol | .. | U | U |
| 1,3-Dichlorobenzene | .. | U | U |
| 1,4-Dichlorobenzene | .. | U | U |
| Benzyl Alcohol | .. | U | U |
| 2-Dichlorobenzene | .. | U | U |
| 2-Methylphenol | .. | U | U |
| Bis(2-chloroisopropyl)Ether | .. | U | U |
| 4-Methylphenol | .. | U | U |
| N-Nitroso-Di-n-Propylamine | .. | U | U |
| Hexachloroethane | .. | U | U |
| Nitrobenzene | .. | U | U |
| Isophorene | .. | U | U |
| 4-Nitrophenol | .. | U | U |
| 2,4-Dimethylphenol | .. | U | U |
| Bis(2-Chloroethoxy)methane | .. | U | U |
| 2,4-Dichlorophenol | .. | 10 | 10 |
| Benzic Acid | .. | U | U |
| 1,2,4-Trichlorobenzene | .. | U | U |
| Naphthalene | .. | U | U |
| 4-Chloroaniline | .. | U | U |
| Hexachlorobutadiene | .. | U | U |
| 4-Chloro-3-Methylphenol | .. | U | U |
| 2-Methylnaphthalene | .. | U | U |
| Hexachlorocyclopentadiene | .. | U | U |
| 2,4,6-Trichlorophenol | .. | 10 | 10 |
| 5,4-Trichlorophenol | .. | U | U |
| 5-Chloronaphthalene | .. | 10 | 10 |
| 5-Nitroaniline | .. | U | U |
| Dimethylphthalate | .. | U | U |
| Acenaphthylene | .. | U | U |
| 2,6-Dinitrotoluene | .. | 10 | 10 |
| 3-Nitroaniline | .. | U | U |
| Acenaphthene | .. | U | U |
| 2,4-Dinitrophenol | .. | 10 | 10 |
| Dibenzoturan | .. | U | U |
| 5-Nitrophenol | .. | U | U |
| 2,4-Dinitrotoluene | .. | U | U |
| Toluene | .. | U | U |
| Diethylphthalate | .. | U | U |
| 4-Chlorophenyl-phenylether | .. | U | U |
| 4-Nitroaniline | .. | U | U |
| 2,6-Dinitro-2-Methylphenol | .. | U | U |
| N-Nitrosodiphenylamine | .. | U | U |
| 4-Bromophenyl-phenylether | .. | U | U |
| Hexachlorobenzene | .. | U | U |
| Pentachlorophenol | .. | U | U |
| Phenanthrene | .. | U | U |
| Anthracene | .. | U | U |
| Di-n-Butylphthalate | .. | U | U |
| Fluoranthene | .. | U | U |
| Pyrene | .. | U | U |
| Butylbenzylphthalate | .. | U | U |
| Benzofluoranthene | .. | U | U |
| 1,3-Dichlorobenzidine | .. | U | U |
| Chrysene | .. | U | U |
| Bis(2-Ethylhexyl)phthalate | .. | U | U |
| Di-n-octylphthalate | .. | U | U |
| Benzo(b)fluoranthene | .. | U | U |
| Benzo(k)fluoranthene | .. | U | U |
| Benzo(a)pyrene | .. | U | U |
| Indeno(1,2,3-cd)Pyrene | .. | U | U |
| Dibenz(a,h)Anthracene | .. | U | U |
| Benzo(g,h,i)Perylene | .. | U | U |

MISCELLANEOUS PARAMETERS

| | | |
|-------------------------|----------------|----------------|
| Client's ID: | IANG-1
FB-1 | IANG-1
FB-2 |
| DATE ANALYZED | | 31-AUG-90 |
| Date Sampled: | | 23-AUG-90 |
| Lab ID: | 2136-04 | 2195-01 |
| Matrix: | Water | Water |
| TPH (mg/kg) | ---- | 1 U |
| Matrix: | Water | Water |
| Radiological Parameters | | |
| DATE ANALYZED | | |
| Gross Alpha | 10-2 U | 4-2 U |
| Gross Beta | 6-3 U | 6-3 U |
| Radium-226 | | |
| Radium-228 | | |

Footnotes:
J--the value reported is an
U--the compound was analyzed

IANG SITES 1 AND 2 TRIP/FIELD/

| | | | |
|---------------|-------------------------|--------------------------|----------------|
| Client's ID: | IANG-2
FB-2
(TAP) | IANG-2
FB-2
(DIUF) | IANG-2
RB-1 |
| Date Sampled: | 14-Aug-90 | 14-Aug-90 | 27-Jul-90 |
| Lab ID: | -- | -- | -- |
| Matrix: | Water | Water | Water |

=====

Volatile Organics (ug/l)

DATE ANALYZED

| | | | |
|---------------------|------|------|------|
| | ---- | ---- | ---- |
| Benzene | -- | -- | -- |
| Ethyl Benzene | -- | -- | -- |
| Toluene | -- | -- | -- |
| Xylenes | -- | -- | -- |
| Chlorobenzene | -- | -- | -- |
| 1,2-Dichlorobenzene | -- | -- | -- |
| 1,3-Dichlorobenzene | -- | -- | -- |
| 1,4-Dichlorobenzene | -- | -- | -- |

=====

Semi-Volatile Organics (ug/l)

DATE ANALYZED

| | | | |
|-----------------------------|------|------|------|
| | ---- | ---- | ---- |
| N-Nitroso-Dimethylamine | -- | -- | -- |
| Phenol | -- | -- | -- |
| Bis(2-Chloroethyl)ether | -- | -- | -- |
| 2-Chlorophenol | -- | -- | -- |
| 1,2-Dichlorobenzene | -- | -- | -- |
| 1,4-Dichlorobenzene | -- | -- | -- |
| Benzyl Alcohol | -- | -- | -- |
| 1,2-Dichlorobenzene | -- | -- | -- |
| 2-Methylphenol | -- | -- | -- |
| Bis(2-Chloroisopropyl)Ether | -- | -- | -- |
| 4-Methylphenol | -- | -- | -- |
| N-Nitroso-Di-n-Propylamine | -- | -- | -- |
| Hexachloroethane | -- | -- | -- |
| Nitrobenzene | -- | -- | -- |
| Sophorone | -- | -- | -- |
| 2-Nitrophenol | -- | -- | -- |
| 2,4-Dimethylphenol | -- | -- | -- |
| Bis(2-Chloroethoxy)methane | -- | -- | -- |
| 2,4-Dichlorophenol | -- | -- | -- |
| Benzoic Acid | -- | -- | -- |
| 1,2,4-Trichlorobenzene | -- | -- | -- |
| Naphthalene | -- | -- | -- |
| 4-Chloroaniline | -- | -- | -- |
| Hexachlorobutadiene | -- | -- | -- |
| 4-Chloro-3-Methylphenol | -- | -- | -- |
| 2-Methylnaphthalene | -- | -- | -- |
| Hexachlorocyclopentadiene | -- | -- | -- |
| 2,4,6-Trichlorophenol | -- | -- | -- |
| 2,4,5-Trichlorophenol | -- | -- | -- |
| 2-Chloronaphthalene | -- | -- | -- |
| 2-Nitroaniline | -- | -- | -- |
| Dimethylphthalate | -- | -- | -- |
| Acenaphthylene | -- | -- | -- |
| 2,6-Dinitrotoluene | -- | -- | -- |
| 3-Nitroaniline | -- | -- | -- |
| Acenaphthene | -- | -- | -- |
| 2,4-Dinitrophenol | -- | -- | -- |
| Dibenzofuran | -- | -- | -- |
| 4-Nitrophenol | -- | -- | -- |
| 2,4-Dinitrotoluene | -- | -- | -- |
| Fluorene | -- | -- | -- |
| Diethylphthalate | -- | -- | -- |
| 4-Chlorophenyl-phenylether | -- | -- | -- |
| 4-Nitroaniline | -- | -- | -- |
| 4,6-Dinitro-2-Methylphenol | -- | -- | -- |
| N-Nitrosodiphenylamine | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | -- | -- |
| Hexachlorobenzene | -- | -- | -- |
| Pentachlorophenol | -- | -- | -- |
| Phenanthrene | -- | -- | -- |
| Anthracene | -- | -- | -- |
| Di-n-Butylphthalate | -- | -- | -- |
| Fluoranthene | -- | -- | -- |
| Pyrene | -- | -- | -- |
| Butylbenzylphthalate | -- | -- | -- |
| Benzo(a)Anthracene | -- | -- | -- |
| 3,3'-Dichlorobenzidine | -- | -- | -- |
| Chrysene | -- | -- | -- |
| Bis(2-Ethylhexyl)Phthalate | -- | -- | -- |
| Di-n-octylphthalate | -- | -- | -- |
| Benzo(k)Fluoranthene | -- | -- | -- |
| Benzo(a)Fluoranthene | -- | -- | -- |
| Benzo(a)Pyrene | -- | -- | -- |
| Indeno(1,2,3-cd)Pyrene | -- | -- | -- |
| Dibenz(a,h)Anthracene | -- | -- | -- |
| Benzo(g,h,i)Perylene | -- | -- | -- |

IANG SITES 1 AND 2 TRIP/FIELD/

| | | | |
|---------------|----------------|----------------|----------------|
| Client's ID: | IANG-1
RB-2 | IANG-1
RB-2 | IANG-1
RB-3 |
| Date Sampled: | 10-Aug-90 | 08-Aug-90 | 12-Aug-90 |
| Lab ID: | 2136-02 | 2125-03 | 2136-03 |
| Matrix: | Water | Water | Water |

Volatile Organics (ug/l)

| DATE ANALYZED | 17-AUG-90 | 16-AUG-90 | 17-AUG-90 |
|---------------------|-----------|-----------|-----------|
| Benzene | 1 | 1 | 1 |
| Ethyl Benzene | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| Toluene | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| Xylenes | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| Chlorobenzene | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| 1,2-Dichlorobenzene | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| 1,3-Dichlorobenzene | UUUUUUUU | UUUUUUUU | UUUUUUUU |
| 1,4-Dichlorobenzene | UUUUUUUU | UUUUUUUU | UUUUUUUU |

Semi-Volatile Organics (ug/l)

| DATE ANALYZED | 10-AUG-90 | 17-AUG-90 |
|-----------------------------|-----------|-----------|
| N-Nitroso-Dimethylamine | UUUUUUUU | UUUUUUUU |
| Phenol | UUUUUUUU | UUUUUUUU |
| Bis(2-Chloroethyl)ether | UUUUUUUU | UUUUUUUU |
| 2-Chlorophenol | UUUUUUUU | UUUUUUUU |
| 1,3-Dichlorobenzene | UUUUUUUU | UUUUUUUU |
| 1,2-Dichlorobenzene | UUUUUUUU | UUUUUUUU |
| Benzyl Alcohol | UUUUUUUU | UUUUUUUU |
| 1,2-Dichlorobenzene | UUUUUUUU | UUUUUUUU |
| 2-Methylphenol | UUUUUUUU | UUUUUUUU |
| Bis(2-Chloroisopropyl)Ether | UUUUUUUU | UUUUUUUU |
| 4-Methylphenol | UUUUUUUU | UUUUUUUU |
| N-Nitroso-Di-n-Propylamine | UUUUUUUU | UUUUUUUU |
| Hexachloroethane | UUUUUUUU | UUUUUUUU |
| Nitrobenzene | UUUUUUUU | UUUUUUUU |
| Isophorone | UUUUUUUU | UUUUUUUU |
| 2-Nitrophenol | UUUUUUUU | UUUUUUUU |
| 2,4-Dimethylphenol | UUUUUUUU | UUUUUUUU |
| Bis(2-Chloroethoxy)methane | UUUUUUUU | UUUUUUUU |
| 2,4-Dichlorophenol | UUUUUUUU | UUUUUUUU |
| Benzoic Acid | UUUUUUUU | UUUUUUUU |
| 1,2,4-Trichlorobenzene | UUUUUUUU | UUUUUUUU |
| Naphthalene | UUUUUUUU | UUUUUUUU |
| 4-Chloroaniline | UUUUUUUU | UUUUUUUU |
| Hexachlorobutadiene | UUUUUUUU | UUUUUUUU |
| 4-Chloro-3-Methylphenol | UUUUUUUU | UUUUUUUU |
| 2-Methylnaphthalene | UUUUUUUU | UUUUUUUU |
| Hexachlorocyclopentadiene | UUUUUUUU | UUUUUUUU |
| 2,2,6-Trichlorophenol | UUUUUUUU | UUUUUUUU |
| 2,4,6-Trichlorophenol | UUUUUUUU | UUUUUUUU |
| 2-Chloronaphthalene | UUUUUUUU | UUUUUUUU |
| 2-Nitroaniline | UUUUUUUU | UUUUUUUU |
| Dimethylphthalate | UUUUUUUU | UUUUUUUU |
| Acenaphthylene | UUUUUUUU | UUUUUUUU |
| 2,6-Dinitrotoluene | UUUUUUUU | UUUUUUUU |
| 3-Nitroaniline | UUUUUUUU | UUUUUUUU |
| Acenaphthene | UUUUUUUU | UUUUUUUU |
| 2,4-Dinitrophenol | UUUUUUUU | UUUUUUUU |
| 0-Benzotriazole | UUUUUUUU | UUUUUUUU |
| 5-Nitrophenol | UUUUUUUU | UUUUUUUU |
| 2,4-Dinitrotoluene | UUUUUUUU | UUUUUUUU |
| Fluorene | UUUUUUUU | UUUUUUUU |
| Diethylphthalate | UUUUUUUU | UUUUUUUU |
| 4-Chlorophenyl-phenylether | UUUUUUUU | UUUUUUUU |
| 4-Nitroaniline | UUUUUUUU | UUUUUUUU |
| 2,6-Dinitro-2-Methylphenol | UUUUUUUU | UUUUUUUU |
| N-Nitrosodiphenylamine | UUUUUUUU | UUUUUUUU |
| 4-Bromophenyl-phenylether | UUUUUUUU | UUUUUUUU |
| Hexachlorobenzene | UUUUUUUU | UUUUUUUU |
| Pentachlorophenol | UUUUUUUU | UUUUUUUU |
| Phenanthrene | UUUUUUUU | UUUUUUUU |
| Anthracene | UUUUUUUU | UUUUUUUU |
| Di-n-Butylphthalate | UUUUUUUU | UUUUUUUU |
| Fluoranthene | UUUUUUUU | UUUUUUUU |
| Pyrene | UUUUUUUU | UUUUUUUU |
| Butylbenzylphthalate | UUUUUUUU | UUUUUUUU |
| Benzo(a)Anthracene | UUUUUUUU | UUUUUUUU |
| 3,3'-Dichlorobenzidine | UUUUUUUU | UUUUUUUU |
| Chrysene | UUUUUUUU | UUUUUUUU |
| Bis(2-Ethylhexyl)Phthalate | UUUUUUUU | UUUUUUUU |
| Di-n-octylphthalate | UUUUUUUU | UUUUUUUU |
| Benzo(b)Fluoranthene | UUUUUUUU | UUUUUUUU |
| Benzo(k)Fluoranthene | UUUUUUUU | UUUUUUUU |
| Benzo(a)Pyrene | UUUUUUUU | UUUUUUUU |
| Indeno(1,2,3-cd)Pyrene | UUUUUUUU | UUUUUUUU |
| 0-Benz(a,h)Anthracene | UUUUUUUU | UUUUUUUU |
| Benzo(g,h,i)Perylene | UUUUUUUU | UUUUUUUU |

Client's ID:

Date Sampled:

Lab ID:

Matrix:

1 ANG-1
RB-5

15-Aug-90

2169-09

Water

LANG-2
FB-1

30-JUL-90

• •

Water

1 ANG-2
FB-1

30-56108

..

Water

Volatile Organics (ug/l)

DATE ANALYZED

90

Benzene
Ethyl Benzene
Toluene
Xylenes
Chlorobenzene
1,2 Dichlorobenzene
1,3 Dichlorobenzene
1,4 Dichlorobenzene

ברכה

Semi-Volatile Organics (ug/l)

DATE ANALYZED

90

N-Nitroso-Dimethylamine
Phenol
bis(2-Chloroethyl)ether
2-Chlorophenol
1,2-Dichlorobenzene
1,4-Dichlorobenzene
Benzyl Alcohol
1,2-Dichlorobenzene
2-Methylphenol
bis(2-chloroisopropyl)Ether
4-Methylphenol
N-Nitroso-Di-n-Propylamine
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
1,4-Dimethylphenol
bis(2-Chloroethoxy)methane
1,4-Dichlorophenol
Benzoic Acid
1,2-Trichlorobenzene
Naphthalene
4-Chloroaniline
Hexachlorobutadiene
2-Chloro-3-Methylphenol
2-Methylnaphthalene
Hexachlorocyclopentadiene
2,2,6-Trichlorophenol
2,2,6-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Dimethylphthalate
Acenaphthylene
6-Dinitrotoluene
5-Nitroaniline
Acenaphthene
4-Dinitrophenol
Benzofuran
4-Nitrophenol
2,4-Dinitrotoluene
Fluorene
Diethylphthalate
4-Chlorophenyl-phenylether
4-Nitroaniline
4,6-Dinitro-2-Methylphenol
N-Nitrosodiphenylamine
4-Bromophenyl-phenylether
Hexachlorobenzene
Pentachlorophenol
Phenanthrene
Anthracene
Di-n-Butylphthalate
Fluoranthene
Pyrene
Butylbenzylphthalate
Benzo(a)Anthracene
3,3'-Dichlorobenzidine
Chrysene
bis(2-Ethylhexyl)Phthalate
Di-n-octylphthalate
Benzo(b)Fluoranthene
Benzo(k)Fluoranthene
Benzo(a)Pyrene
Indeno(1,2,3-cd)Pyrene
Benzo(g,h,i)Anthracene
Benzo(g,h,i)Perylene

APPENDIX I
VALIDATION NOTES

DATA VALIDATION NOTES

SITE: IANG, SERGEANT BLUFF, Iowa

LAB: ESBL

DATE OF REPORT: 22 Aug 90 , 31 Aug 90

WORK ORDER #: 2091

SAMPLE ID: IANG-1-SB1-S2 (2091-02)

ANALYSIS: V-CLP (8020 list)

PROBLEM AND ACTION: Surrogates out of limit
158 (range 30-140)
lab reextracted + analyzed
ID: 2091-02 RE
again, out: 172

ACTION: go with original
data and flag everything as J

WORK ORDER #: 2125

SAMPLE ID: IANG-1-RB4 (2125-03)

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Blank Spike: PR of 2,4-DNT high
100 (limits 24-96)

Matrix Spike (2119-12)

3 PR's low, 6 RPD's high

Case Narr. states sample
interference. This sample was
not from our site.

Surrogate recoveries are all good.
No SV found in sample.

ACTION: None

1090DPC/D76a-16#

1-2

REVIEWER: JEB

DATE: 9.13.90 / 9.14.90

DATA VALIDATION NOTES

SITE: IANG, SERGEANT BLUFF, IOWA

LAB: ESBL

DATE OF REPORT: 22 Aug 90

WORK ORDER #: 2091

SAMPLE ID: IANG-1-SB1-S1 and S2 (2091-01 and 02)

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Spiked blank: PR of PCP high
110 (limit 17-109) $\therefore$ barely
out of range. no phenols
were found in the samples
ACTION: None

WORK ORDER #: 2091

SAMPLE ID: IANG-1-RB1

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Spiked blank: PR of PCP high,
106 (limit 9-103)
Matrix spike on 2079-04:
4 RPD high.
limits were not exceeded by much,
no SV in sample
ACTION: None

DATA VALIDATION NOTES

SITE: IANG, SERGEANT BLUFF, IOWA

LAB: ESBL

DATE OF REPORT: 31 Aug 90

WORK ORDER #: 2136

SAMPLE ID: IANG-1-SB6/MW5-S1 and S2 (2136-05 and 06)

ANALYSIS: SV-CLP

PROBLEM AND ACTION: phthalates found in samples
Method blank 160 J Di,n-b-p
2136-05 has 180 J Di,n-b-p
2136-06 has 130 J Di,e-p
both common lab contaminants
within 10X amount found in
method blank / or detection limit.

ACTION: flag both as LL ~~#~~ and
raise to CREL

WORK ORDER #: 2136

SAMPLE ID: IANG-1-RB5 and FBI (DIUF) (2136-0 and 01)

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Blank Spike: PR of 2-4-DNT high
100 (limits 24-96)

Matrix Spike: (2119-12)

3 PR low, 6 RPD out

Case Narr. states sample
interference - this sample was
not from our site.

Since blank spike not far out +
surrogates OK. $\Rightarrow$ No Action.

1090DPC/D76a-16#

14 + no SV in
samples

REVIEWER: JEB
DATE: 9.17.90

DATA VALIDATION NOTES

SITE: IANG, SERGEANT BLUFF, IOWA

LAB: ESBL

DATE OF REPORT: 12 Sep 90

WORK ORDER #: 2169

SAMPLE ID: Defueling Pit Soil (2169-07)

ANALYSIS: V-8020

PROBLEM AND ACTION: Matrix Spike

PR of CB high on MS and MSD
Blank Spike OK. MS/MSD was
done on our sample. no CBs
were found in the sample
+ since PR was high, quant.
limits are conservative.

WORK ORDER #: 2169 ACTION: None

SAMPLE ID: all water samples

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Surrogates outside of
acceptable limits.

Lab reextracted when there
was sufficient sample.

No blanks were outside
criteria. soil surr. good

Each sample will be discussed
separately.

DATA VALIDATION NOTES

SITE: IANG, SERGEANT BLUFF, IOWA

LAB: ESBL

DATE OF REPORT: 12 Sep 90

WORK ORDER #: 2169

SAMPLE ID: Defueling Pit Water (2169-01)

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Surrogates out !

2169-01 E 2 BN high

2169-01 RE all OK but out of HT
by 4 day.

01 E : 13 J 2,4 DMP

01 RE : 10 J 2,4 DMP

ACTION: HT not grossly missed, go
with reextract data and flag
results as estimated (J).

WORK ORDER #: 2169

SAMPLE ID: IANG-1-MW5 (2169-02)

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Surrogates out !

2169-02 E 2 BN high

2169-02 RE : 1 BN high 3 A low
($< 10\%$)
and out of HT

neither have hits.

ACTION: Go with original data and
flag BN fraction as UJ

1090DPC/D76a-16#

1-6

REVIEWER: JEB
DATE: 9-24-90

DATA VALIDATION NOTES

SITE: IANG, SERGEANT BLUFF, IOWA

LAB: ESBL

DATE OF REPORT: 12 SEP 90

WORK ORDER #: 2169

SAMPLE ID: IANG-1-MW6 (2169-03)

ANALYSIS: IANG-1-MW8 (2169-05)
SV-CLP

PROBLEM AND ACTION: Surrogates out!

For both samples: 3 BNs high.
no extracts due to lack of sample

Action: flag all BN with J

WORK ORDER #: 2169

SAMPLE ID: IANG-1-MW9 (2169-06 K)

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Surrogates out!

one BN high

Action: None

DATA VALIDATION NOTES

SITE: IAN6, SERGEANT BLUFF, IOWA

LAB: ESTBL

DATE OF REPORT: 12 SEP 90

WORK ORDER #: 2169

SAMPLE ID: 2169 -06 LMS, 2169 LMS RE

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Surrogates out!

-06 LMS 2 acids low (0)

-06 MSRE 1 acid low

ACTION: go with reextract

WORK ORDER #: 2169

SAMPLE ID: 2169 -06 N MSD

ANALYSIS: SV-CLP -06 MSD RE

PROBLEM AND ACTION: Surrogates out!

-06 N MSD 2 BN high

-06 MSD RE 3 acids low (0)

ACTION: go with original MSD

DATA VALIDATION NOTES

SITE: IANG, SERGEANT BLUFF, IOWA

LAB: ESBL

DATE OF REPORT: 12 SEP 90

WORK ORDER #: 2169

SAMPLE ID: IANG-1-MWT (2169-10)

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Surrogates out!

2169-10E 2 BN low ($1 < 10\%$)

2 A low (both $< 10\%$)

2169-10RE 3 A low (all $< 10\%$)

also out of HT.

all results are nondetect

ACTION: use 1st extract, flag as
unusable (R)

WORK ORDER #: 2169

SAMPLE ID: FUELING PIT SOIL (2169-07)

ANALYSIS: SV-CLP

PROBLEM AND ACTION: phthalate found in sample.

BEHP at 200 J ug/kg.

DBP found in method
blank. Since BEHP is
low + no reason to believe
it actually is present - prob.

ACTION: is lab contamination
flag as ~~use~~

1090DPC/D76a-16#

REVIEWER: JEB
DATE: 9.24.90

DATA VALIDATION NOTES

SITE: IANG, SERGEANT BLUFF, IOWA

LAB: ESBL

DATE OF REPORT: 12 SEP 90

WORK ORDER #: 2169

SAMPLE ID: 2169-06

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Matrix Spike on this sample was done on orig. extract 2169-06 k and reextract 2169-06 due to poor surrogate recovery. Both 2169-06 k and 06 have problems which reflect the surrogate recovery problems. Since blank spike was acceptable (see below) seems like a matrix problem + not a lab control problem. ACTION: None

WORK ORDER #: 2169

SAMPLE ID: MWBNA 900828

ANALYSIS: SV-CLP

PROBLEM AND ACTION: Blank Spike

1 PR high 101% limit (23-97%)
since this is barely out of range,
no cresols found in samples,
ACTION: None

DATA VALIDATION NOTES

SITE: IANG, SERGEANT BLUFF, IOWA

LAB: ESBL

DATE OF REPORT: 12 Sep 90

WORK ORDER #: 2195

SAMPLE ID: IANG-1-FB2 (D F) (2195-01)

ANALYSIS: SV

PROBLEM AND ACTION: Blank Spike

PR of 4-C-m-c was 101
(limit 23-97)

MSD was OK

All surrogates good

No SV in samples

Action: None

WORK ORDER #:

SAMPLE ID:

ANALYSIS:

PROBLEM AND ACTION:

APPENDIX J
CHAIN-OF-CUSTODY

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

| PROJ. NO. | PROJECT NAME/LOCATION | | | PARAMETER | | NO. OF CONTAINERS | REMARKS |
|--|-----------------------|------|--------------|------------|------------------------------|-------------------|---------|
| CL 390.05 | ST LOUX CITY | IANG | TDH (H.R.O.) | CLP (SEMI) | | | |
| SAMPLERS: (Signature) <i>Patrick J. McDonnell</i> / <i>John Benson</i> | | | | | | | |
| STA NO. | DATE | TIME | COMP | GR | STATION LOCATION | | |
| | 8/13 | 1200 | | X | IANG-1-MW-7 | 2 | |
| | | | | X | IANG-1-FB-2 (TAR) | 2 | |
| | | | | X | IANG-1-RB-5 | 2 | |
| | | | | | ~~IANG-1-FB-2 (TAR)~~ | | |
| | | | | X | IANG-1-MW-7 | 2 | |
| | | | | X | IANG-1-FB-2 (TAR) | 2 | |
| | | | | X | IANG-1-RB-5 | 2 | |
| | | | | X | IANG-1-MW-2 | 2 | |
| | | | | X | IANG-1-MW-2 | 2 | |
| Relinquished by: (Signature) _____ Date / Time _____ Received by: (Signature) _____ | | | | | | | |
| <i>Patrick J. McDonnell</i> 8/15/90 1700 | | | | | | | |
| Relinquished by: (Signature) _____ Date / Time _____ Received by: (Signature) _____ | | | | | | | |
| Relinquished by: (Signature) _____ Date / Time _____ Received for Laboratory by: (Signature) _____ | | | | | | | |
| Distribution Original Accompanies Shipment. Copy returned with Report. | | | | | | | |

Distribution Original Accompanies Shipment Copy returned with Report.

Chain-of Custody Record

[illegible]

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

Chain-of Custody Record

2091

[illegible]

ENGINEERING-SCIENCE

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

Chain-of Custody Record

| PROJ. NO. | | PROJECT NAME/LOCATION | | NO. OF CON-TAINERS | | PARAMETER | | REMARKS |
|-----------|--------|-----------------------|---------------------|--------------------|----|-------------|-------------------------------|---------|
| STA. NO. | DATE | TIME | STATION LOCATION | NO. | OF | CON-TAINERS | PARAMETER | |
| CL390.05 | 8/6/90 | 1200 | DANG-1-SB-3/MW-2-51 | 1 | 1 | 1 | 2125-05A | |
| | | | " | 1 | 1 | 1 | -05B | |
| | | | DANG-1-SB-3/MW-2-52 | 1 | 1 | 1 | -06B | |
| | | | " | 1 | 1 | 1 | -06B | |
| | | | DANG-1-RB-3 | 2 | 2 | 2 | -07A, B | |
| | | | " | 2 | 2 | 2 | WATER (Hold for conservation) | |
| | | | " | 2 | 2 | 2 | TOU Bencor/Winkler | |
| 8/7/90 | 1200 | | DANG-1-SB-4/MW-3-51 | 1 | 1 | 1 | 2125-08A | |
| | | | " | 1 | 1 | 1 | -08B | |
| | | | DANG-1-SB-4/MW-3-52 | 1 | 1 | 1 | -09A | |
| | | | " | 1 | 1 | 1 | -09B | |
| | | | 2-A TRIP BLANK | 1 | 1 | 1 | -10A | |
| | | | 2-B " " | 1 | 1 | 1 | -10B | |
| | | | | | | | Sample for SC + Intact | |

| Relinquished by: (Signature) | Date / Time | Received by: (Signature) | Date / Time | Relinquished by: (Signature) | Date / Time | Received by: (Signature) | Date / Time |
|------------------------------|-------------|--------------------------|-------------|------------------------------|-------------|--------------------------|-------------|
| Jon Benson | 8/8/90 | 1700 | | | | | |
| | | | | | | | |
| | | | | | | | |

| Relinquished by: (Signature) | Date / Time | Received for Laboratory by: (Signature) | Date / Time | Remarks |
|------------------------------|-------------|---|-------------|---------------------------|
| | | | | shp. receipt # 5440243471 |

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

Chain-of Custody Record

| PROJ. NO. | PROJECT NAME/LOCATION |
|-----------|-----------------------|
|-----------|-----------------------|

62390.05 SIOUX CITY - IANG

SAMPLES: (Signature)

Tom Benson

| STA NO. | DATE | TIME | M.P. | A.B. | STATION LOCATION |
|---------|------|------|------|------|------------------|
|---------|------|------|------|------|------------------|

| STA. NO. | DATE | TIME | COMP. | GRAB. |
|----------|------|------|-------|-------|
| | 90 | | | |

STATION LOCATION

NO.
OF
CON-
TAINERS

PARAMETER

REMARKS

Relinquished by: (Signature)

Dato / Time

Received by: (Signature)

Relinquished by: (Signature)

Date / Time

Received by: (Signature)

Relinquished by: (Signature)

Date / Time

Resolved by: (Signature)

Relinquished by: (Signature)

Date / Time

Received by: (Signature)

Relinquished by: (Signature)

Date / Time

Received for Laboratory by:
(Signature)

Date / Time

Remarks

560. receipt # 54110643483

Distribution Original Accompanies Shipment. Copy returned with Report.

RB2 + FB1 tap
on hold. 8020
num viaduct
not charged jeb 10.12.90

ENGINEERING SCIENCE

18103 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

Chain-of Custody Record 2136

| PROJ. NO. | | PROJECT NAME/LOCATION | | NO. OF CON-TAINERS | | PARAMETER | | REMARKS |
|--|------|-----------------------|------|--|-----------------------|--------------|----------|----------------------------|
| STA. NO. | DATE | TIME | COMP | GRAB | STATION LOCATION | | | |
| CL390.05 | | SIOUX CITY - IANG | | | | | | |
| SAMPLERS: (Signature) <i>John Benson</i> | | | | | | | | |
| | 8/10 | 1200 | | | IANG-1-RB-2 | ✓ | | 2136-02A, B |
| | 8/12 | 1200 | | | IANG-1-RB-5 | ✓ | | 2136-03A, B |
| | 8/12 | 1200 | | | IANG-1-FB-1 (DIUF) | ✓ | | -01A, B |
| | 8/12 | 1200 | | | IANG-1-FB-1 (TAP) | ✓ | | 2136-04A, B |
| | 8/9 | 1100 | | ✓ | IANG-1-SB-6/MW-5-S1 | ✓ | | -05A |
| | 8/9 | 1100 | | ✓ | IANG-1-SB-6/MW-5-S2 | ✓ | | -06A |
| | 8/10 | 1200 | | ✓ | IANG-1-SB-7/MW-6-S1 | ✓ | | -07A |
| | 8/10 | 1200 | | ✓ | IANG-1-SB-7/MW-6-S2 | ✓ | | -08A |
| | 8/10 | 1200 | | ✓ | IANG-1-SB-7/MW-6-S2-D | ✓ | 2136-09A | Used for MS + MSD |
| | 8/11 | 1200 | | ✓ | IANG-1-SB-8/MW-7-S1 | ✓ | | -10A |
| | 8/11 | 1200 | | ✓ | IANG-1-SB-8/MW-7-S2 | ✓ | | -11A |
| | 8/11 | 1800 | | ✓ | IANG-1-SB-7/MW-8-S1 | ✓ | | -12A |
| | 8/12 | 0900 | | ✓ | IANG-1-SB-7/MW-8-S2 | ✓ | | -13A |
| | 8/12 | 0900 | | ✓ | IANG-1-SB-7/MW-8-S2-D | ✓ | | -14A |
| | 8/12 | 1830 | | | 4-A / 4-B TRIP BLANKS | ✓ | | -15A, B |
| Relinquished by: (Signature) | | Date / Time | | Received by: (Signature) | | Date / Time | | Received by: (Signature) |
| <i>John Benson</i> | | 8/12/90 | | | | | | |
| Relinquished by: (Signature) | | Date / Time | | Received by: (Signature) | | Date / Time | | Received by: (Signature) |
| | | | | | | | | |
| Relinquished by: (Signature) | | Date / Time | | Received for Laboratory by (Signature) | | Date / Time | | Remarks |
| | | | | <i>John Benson</i> | | 8/14/90 1030 | | slip. receipt # 5440643025 |
| samples 5C + Intact | | | | | | | | |

ENGINEERING-SCIENCE

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

Chain-of Custody Record

213C

| PROJ. NO. | | PROJECT NAME/LOCATION | | NO. OF CON-TAINERS | | PARAMETER | | REMARKS |
|---|-------------------|-----------------------|------|--------------------|-----------------------|-----------|-------------------|---------|
| CL380.05 | SIoux CITY - IANG | | | | | | | |
| SAMPLERS: (Signature) <i>Tom Benson</i> | | | | | | | | |
| STA. NO. | DATE | TIME | COMP | GRAB | STATION LOCATION | | | |
| | 8/9 | 1100 | | ✓ | IANG-1-SB-6/MW-5-51 | ✓ | 2136-05B | |
| | 8/9 | 1100 | | ✓ | IANG-1-SB-6/MW-5-52 | ✓ | 2136-06B | |
| | 8/10 | 1200 | | ✓ | IANG-1-SB-7/MW-6-51 | ✓ | -07B | |
| | 8/10 | 1200 | | ✓ | IANG-1-SB-7/MW-6-52 | ✓ | -08B | |
| | 8/10 | 1200 | | ✓ | IANG-1-SB-7/MW-6-52-D | ✓ | Used For MS + MSD | |
| | 8/11 | 1200 | | ✓ | IANG-1-SB-8/MW-7-51 | ✓ | 2136-10B | |
| | 8/11 | 1200 | | ✓ | IANG-1-SB-8/MW-7-52 | ✓ | 2136-11B | |
| | 8/11 | 1800 | | ✓ | IANG-1-SB-9/MW-8-51 | ✓ | 2136-12B | |
| | 8/12 | 0900 | | ✓ | IANG-1-SB-9/MW-8-52 | ✓ | 2136-13B | |
| | 8/12 | 0900 | | ✓ | IANG-1-SB-9/MW-8-52-D | ✓ | 2136-14B | |
| <div style="display: flex; justify-content: space-between;"> <div> Relinquished by: (Signature) <i>Tom Benson</i> </div> <div> Date / Time 8/1 </div> <div> Received by: (Signature) </div> <div> Date / Time </div> <div> Relinquished by: (Signature) </div> <div> Date / Time </div> <div> Received by: (Signature) </div> <div> Date / Time </div> </div> | | | | | | | | |
| <div style="display: flex; justify-content: space-between;"> <div> Relinquished by: (Signature) </div> <div> Date / Time </div> <div> Received by: (Signature) </div> <div> Date / Time </div> <div> Relinquished by: (Signature) </div> <div> Date / Time </div> <div> Received by: (Signature) </div> <div> Date / Time </div> </div> | | | | | | | | |
| <div style="display: flex; justify-content: space-between;"> <div> Relinquished by: (Signature) </div> <div> Date / Time </div> <div> Received by: (Signature) </div> <div> Date / Time </div> <div> Relinquished by: (Signature) </div> <div> Date / Time </div> <div> Received by: (Signature) </div> <div> Date / Time </div> </div> | | | | | | | | |

SLP. RECEIVED AT 040643025

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

Chain-of Custody Record

Water

2134

| PROJ. NO. | PROJECT NAME/LOCATION | | PARAMETER | | NO. OF CONTAINERS | STATION LOCATION | REMARKS |
|--|-----------------------|------|-----------|------|-------------------|-------------------|------------|
| CL390,05 | SIOUX CITY - IANG | | | | | | |
| SAMPLERS: (Signature) <i>Tom Benson</i> | | | | | | | |
| STA. NO. | DATE | TIME | COMP | GRAB | | | |
| | 8/10 | 1200 | | | 2 | IANG-1-RB-2 | 2136-02G,D |
| | 8/10 | 1300 | | | 2 | IANG-1-RB-2 | -02E,F |
| | 8/12 | 1300 | | | 2 | IANG-1-RB-5 | -03C,D |
| | 8/12 | 1300 | | | 2 | IANG-1-RB-5 | -03E,F |
| | 8/12 | 1200 | | | 2 | IANG-1-FB-1 (TAP) | -04E,D |
| | 8/12 | 1200 | | | 2 | IANG-1-FB-1 (TAP) | -04E,F |
| <div> <div> <div>Relinquished by: (Signature)</div> <div>8/13/90</div> </div> <div> <div>Received by: (Signature)</div> <div>8/13/90</div> </div> </div> | | | | | | | |
| <div> <div>Relinquished by: (Signature)</div> <div>8/13/90</div> </div> <div> <div>Received by: (Signature)</div> <div>8/13/90</div> </div> | | | | | | | |
| <div> <div>Relinquished by: (Signature)</div> <div>8/13/90</div> </div> <div> <div>Received by: (Signature)</div> <div>8/13/90</div> </div> | | | | | | | |

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

Chain-of Custody Record

| PROJ. NO. | PROJECT NAME/LOCATION |
|-----------|-----------------------|
|-----------|-----------------------|

CL390.05

SAMPLES: (Signature)

Tom Benson

| STA NO | DATE | TIME | STATION LOCATION |
|--------|------------|-------|------------------|
| 1 | 10/10/1964 | 10:00 | 1000 |
| 2 | 10/10/1964 | 10:05 | 1000 |
| 3 | 10/10/1964 | 10:10 | 1000 |
| 4 | 10/10/1964 | 10:15 | 1000 |
| 5 | 10/10/1964 | 10:20 | 1000 |
| 6 | 10/10/1964 | 10:25 | 1000 |
| 7 | 10/10/1964 | 10:30 | 1000 |
| 8 | 10/10/1964 | 10:35 | 1000 |
| 9 | 10/10/1964 | 10:40 | 1000 |
| 10 | 10/10/1964 | 10:45 | 1000 |
| 11 | 10/10/1964 | 10:50 | 1000 |
| 12 | 10/10/1964 | 10:55 | 1000 |
| 13 | 10/10/1964 | 11:00 | 1000 |
| 14 | 10/10/1964 | 11:05 | 1000 |
| 15 | 10/10/1964 | 11:10 | 1000 |
| 16 | 10/10/1964 | 11:15 | 1000 |
| 17 | 10/10/1964 | 11:20 | 1000 |
| 18 | 10/10/1964 | 11:25 | 1000 |
| 19 | 10/10/1964 | 11:30 | 1000 |
| 20 | 10/10/1964 | 11:35 | 1000 |
| 21 | 10/10/1964 | 11:40 | 1000 |
| 22 | 10/10/1964 | 11:45 | 1000 |
| 23 | 10/10/1964 | 11:50 | 1000 |
| 24 | 10/10/1964 | 11:55 | 1000 |
| 25 | 10/10/1964 | 12:00 | 1000 |
| 26 | 10/10/1964 | 12:05 | 1000 |
| 27 | 10/10/1964 | 12:10 | 1000 |
| 28 | 10/10/1964 | 12:15 | 1000 |
| 29 | 10/10/1964 | 12:20 | 1000 |
| 30 | 10/10/1964 | 12:25 | 1000 |
| 31 | 10/10/1964 | 12:30 | 1000 |
| 32 | 10/10/1964 | 12:35 | 1000 |
| 33 | 10/10/1964 | 12:40 | 1000 |
| 34 | 10/10/1964 | 12:45 | 1000 |
| 35 | 10/10/1964 | 12:50 | 1000 |
| 36 | 10/10/1964 | 12:55 | 1000 |
| 37 | 10/10/1964 | 1:00 | 1000 |
| 38 | 10/10/1964 | 1:05 | 1000 |
| 39 | 10/10/1964 | 1:10 | 1000 |
| 40 | 10/10/1964 | 1:15 | 1000 |
| 41 | 10/10/1964 | 1:20 | 1000 |
| 42 | 10/10/1964 | 1:25 | 1000 |
| 43 | 10/10/1964 | 1:30 | 1000 |
| 44 | 10/10/1964 | 1:35 | 1000 |
| 45 | 10/10/1964 | 1:40 | 1000 |
| 46 | 10/10/1964 | 1:45 | 1000 |
| 47 | 10/10/1964 | 1:50 | 1000 |
| 48 | 10/10/1964 | 1:55 | 1000 |
| 49 | 10/10/1964 | 2:00 | 1000 |
| 50 | 10/10/1964 | 2:05 | 1000 |
| 51 | 10/10/1964 | 2:10 | 1000 |
| 52 | 10/10/1964 | 2:15 | 1000 |
| 53 | 10/10/1964 | 2:20 | 1000 |
| 54 | 10/10/1964 | 2:25 | 1000 |
| 55 | 10/10/1964 | 2:30 | 1000 |
| 56 | 10/10/1964 | 2:35 | 1000 |
| 57 | 10/10/1964 | 2:40 | 1000 |
| 58 | 10/10/1964 | 2:45 | 1000 |
| 59 | 10/10/1964 | 2:50 | 1000 |
| 60 | 10/10/1964 | 2:55 | 1000 |
| 61 | 10/10/1964 | 3:00 | 1000 |
| 62 | 10/10/1964 | 3:05 | 1000 |
| 63 | 10/10/1964 | 3:10 | 1000 |
| 64 | 10/10/1964 | 3:15 | 1000 |
| 65 | 10/10/1964 | 3:20 | 1000 |
| 66 | 10/10/1964 | 3:25 | 1000 |
| 67 | 10/10/1964 | 3:30 | 1000 |
| 68 | 10/10/1964 | 3:35 | 1000 |
| 69 | 10/10/1964 | 3:40 | 1000 |
| 70 | 10/10/1964 | 3:45 | 1000 |
| 71 | 10/10/1964 | 3:50 | 1000 |
| 72 | 10/10/1964 | 3:55 | 1000 |
| 73 | 10/10/1964 | 4:00 | 1000 |
| 74 | 10/10/1964 | 4:05 | 1000 |
| 75 | 10/10/1964 | 4:10 | 1000 |
| 76 | 10/10/1964 | 4:15 | 1000 |
| 77 | 10/10/1964 | 4:20 | 1000 |
| 78 | 10/10/1964 | 4:25 | 1000 |
| 79 | 10/10/1964 | 4:30 | |

18.

...

24

●

STATION LOCATION

TAAG-1 = EB-1 (DUE)

DANG-1-FB-1 (DUF)

PARAMETER

NO.
OF
CON-
TAINERS

REMARKS

Relinquished by: (Signature)

Received by: (Signature)

Date / Time

Relinquished by: (Signature)

Received by: (Signature)

Relinquished by: (Signature)

Received by: (Signature)

Date / Time

Relinquished by: (Signature)

Received by: (Signature)

Relinquished by: (Signature)

Received for Laboratory by

Date / Time

Date / Time

Remarks

175-471

Distribution Original Accompanies Shipment. Copy returned with Report.

ENGINEERING-SCIENCE

19-110 WL-4000-90000 301 CLEVELAND OHIO 44119 • 216-486 90005

Unit of Custody Record

2169

| PROJECT NAME/LOCATION | | STATION LOCATION | | NO. OF CON-TAINERS | PARAMETER | | | REMARKS |
|------------------------------|-------------------|------------------|---|------------------------------|------------|--------------|-------------------------------|---------|
| PROJ. NO. | ST. CTRY / IANG | DATE | TIME | | TPH (4/12) | CLP (5/12) | TPH (4/12) | |
| 310.05 | ST. CTRY / IANG | 8/15 | 1200 | 2 | X | X | 2169-020, D | |
| | | | | 2 | X | X | -035, D | |
| | | | | 2 | X | X | CORRECT (IGNORE LINE) | |
| | | | | 2 | X | X | 2169-020, B | |
| | | | | 2 | X | X | -034, B | |
| | | | | 2 | X | X | -044, B | |
| | | | | 2 | X | X | -050, B | |
| | | | | 6 | X | X | USED FOR MS 4 MSD 881, 884, D | |
| | | | | 2 | X | X | | |
| | | | | 2 | X | X | | |
| | | | | 2 | X | X | | |
| | | | | 2 | X | X | 2169-020, F | |
| | | | | 2 | X | X | -035, F | |
| | | | | 2 | X | X | | |
| | 5A / 5B TRIP BANK | | | 2 | X | X | | |
| Relinquished by: (Signature) | | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | | Date / Time | Received by: (Signature) | |
| Patrick J. McDonnell | | 8/15/90 1700 | | | | | | |
| Relinquished by: (Signature) | | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | | Date / Time | Received by: (Signature) | |
| | | | | | | | | |
| Relinquished by: (Signature) | | Date / Time | Received for Laboratory by: (Signature) | Relinquished by: (Signature) | | Date / Time | Remarks | |
| | | | | | | 8/17/90 1740 | SHIPPING RECEIPT # 7566977751 | |

Distribution Original Accompanying Shipment. Copy returned with Report.

WELBURN ROAD SUITE 101, CLEVELAND OHIO 44119 • 216/486-9005

2169

| PROJ. NO. | PROJECT NAME/LOCATION | NO. OF CON-TAINERS | | | PARAMETER | | REMARKS | | |
|------------------------------|-----------------------|--------------------|------|---|-------------------|-------------------|-----------------------------|-------------------------------|--|
| DATE | TIME | COMP | GRAB | STATION LOCATION | TPH (418.1) 80.30 | CLP (SEMI) 100.00 | | | |
| 8/15 | 1200 | | X | SIANG-1-MW-2 | X | | 2169-0-1 | | |
| | | | X | SIANG-1-MW-5 | X | | 2169-02C,D | | |
| | | | X | SIANG-1-MW-6 | X | | -038,D | | |
| | | | X | SIANG-1-MW-2 | X | | CORRECT (IGNORE LINE) | | |
| | | | X | SIANG-1-MW-5 | X | | 2169-02A,B | | |
| | | | X | SIANG-1-MW-6 | X | | -034,B | | |
| | | | X | SIANG-1-MW-7 | X | | -044,B | | |
| | | | X | SIANG-1-MW-8 | X | | -084,B | | |
| | | | X | SIANG-1-MW-9 | X | | USED FOR MS + MSD 88A,B,C,D | | |
| | | | X | SIANG-1-RB-5 | X | | | | |
| | | | X | SIANG-1-FB-2(FAP) | X | | | | |
| | | | X | SIANG-1-MW-2 | X | | | | |
| | | | X | SIANG-1-MW-5 | X | | 2169-028,F | | |
| | | | X | SIANG-1-MW-6 | X | | -038,F | | |
| | | | | SA / 5B TRIP BUNK | X | | | | |
| Relinquished by: (Signature) | | Date / Time | | Received by: (Signature) | | Date / Time | | Received by: (Signature) | |
| Patrick J. McDonnell | | 8/15/90 1700 | | | | | | | |
| Relinquished by: (Signature) | | Date / Time | | Received by: (Signature) | | Date / Time | | Received by: (Signature) | |
| | | | | | | | | | |
| Relinquished by: (Signature) | | Date / Time | | Received for Laboratory by: (Signature) | | Date / Time | | Remarks | |
| | | | | [Signature] | | 9/17/90 1740 | | SHIPPING RECEIPT # 7566977751 | |

Distribution Original Accompanios Shipments. Copy returned with Report.

| Proj. No. | Project Name | NO. OF CONTAINERS | STATION LOCATION | DATE | TIME | REMARKS |
|-----------|-------------------|-------------------|-----------------------------|------|------|-------------------|
| C230.05 | SIOUX CITY - IANB | 2 | ENG-1-Defueling Pit | 8/15 | 1200 | 2169-01A, B |
| | | 2 | " | | | WATER 2169-01C, D |
| | | 2 | " | | | -01G, F |
| | | 1 | IANB-1-Defueling Pit (soil) | | | SOIL |

J-13

Original Accompanies Shipment Copy To Coordinators Field Files

ENGINEERING-SCIENCE

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

Chain-of Custody Record

| PROJ. NO. | | PROJECT NAME/LOCATION | | NO. OF CON-TAINERS | PARAMETER | REMARKS |
|--|--------------|-----------------------|---|--------------------|---------------------------------|---------------------|
| CL37005 | | Sioux City - IAN6 | | | | |
| SAMPLERS: (Signature) | | | | | | |
| <div style="text-align: center;">  </div> | | | | | | |
| STA. NO. | DATE | TIME | COMP | GRAB | STATION LOCATION | |
| | 7/27 | | | | IAN6-2-RB-1 | 61033
61034/3304 |
| | " | | | | IAN6-2-RB-1 | Relinquish 3304 |
| | " | | | | IAN6-2-SB-1-S1 | 61033 |
| | 7/28 | | | | IAN6-2-RB-2 | 61033
61034/3304 |
| | " | | | | IAN6-2-RB-2 | Relinquish 3304 |
| | " | | | | IAN6-2-SB-1-S2 | 61033 |
| | " | | | | IAN6-2-SB-1-S3 | 61033 |
| | " | | | | IAN6-2-SB-2-S1 | 61033 |
| | " | | | | IAN6-2-SB-2-S2 | 61033 |
| | " | | | | IAN6-2-SB-2-S3 | 61033 |
| | 7/29 | | | | IAN6-2-RB-3 | 61033
61034/3304 |
| | " | | | | IAN6-2-RB-3 | Relinquish 3304 |
| | " | | | | IAN6-2-SB-3-S1 | 61033 |
| | " | | | | IAN6-2-SB-3-S2 | 61033 |
| | " | | | | IAN6-2-SB-3-S3 | 61033 |
| | " | | | | IAN6-2-SB-3-S4 | 61033 |
| Relinquished by: (Signature) | Date / Time | | Received by: (Signature) | | Date / Time | |
| Jerry Bergeron | 7/31/40 6:00 | | | | | |
| Relinquished by: (Signature) | Date / Time | | Received by: (Signature) | | Date / Time | |
| | | | | | | |
| Relinquished by: (Signature) | Date / Time | | Received for Laboratory by: (Signature) | | Date / Time | |
| | | |  | | 8-2-90 10:10 | |
| Remarks | | | | | Ship. Bill receipt # 7566875204 | |

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

[illegible]

Distribution Original Accompanies Shipment. Copy returned with Report.

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

[illegible]

Distribution Original Accompanies Shipment. Copy returned with Report.

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

[illegible]

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

[illegible]

Distribution Original Accompanies Shipment. Copy returned with Report.

19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

[illegible]

Distribution Original Accompanies Shipment. Copy returned with Report.

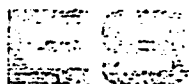
19101 VILLAVIEW ROAD, SUITE 301, CLEVELAND, OHIO 44119 • 216/486-9005

[illegible]

CHAIN OF CUSTODY RECORD

[illegible]

APPENDIX K
JP-FUEL FINGERPRINT ANALYSIS RESULTS



ENGINEERING-SCIENCE, INC.

BERKELEY LABORATORY
600 BANCROFT WAY
BERKELEY, CA 94710
Tel: (415) 841-7353

Report Date: 09/14/90

Work Order No.: 2201

Client: Kevin Palombo
ES Cleveland/Sioux City IANG
19101 Villaview Road
Cleveland, OH. 44119

Date of Sample Receipt: 08/27/90

Your samples identified as:

JP-4 (FRESH)

JP-4 (FROM IANG1-MW-4)

were analyzed for hydrocarbon fingerprint.

The analytical reports for the samples listed above are attached.

RECEIVED

SEP 17 1990

CLEVELAND ES

CASE NARRATIVE
WORK ORDER NO. 2201
JP-4 FUEL FINGERPRINT
METHOD MODIFIED 8015

Both samples have substantially similar characteristics with regard to boiling range and carbon number, indicating that both sample and standard are likely to be from similar producer distillation cuts.

However, small differences are notable on the chromatograms regarding ratios of the major peaks, indicating that the two samples are from different manufacturing lots, and/or refineries.

Further, it is our opinion that both sample and standard can be considered essentially unweathered JP4. The standard has a slightly higher predominance of heavier constituents, giving the appearance that the "Fresh" standard material is slightly more weathered than the sample which is of course, not possible.

[illegible]

[REDACTED]

Sample ID: 12111-1 14100 000
Analysis Date: Thu Sep 17 14:30 8:57:22 pm
Station: 12111-1 1000
Site: 12111-1 1000 000 12111-1 1000 000
Contact: 12111-1 1000 000 12111-1 1000 000

1. "Re: 12111-1"

2207

2207

APPENDIX L
SAMPLE JAR DECONTAMINATION DOCUMENTATION

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
PESTICIDE EPA 608

Work Order NO.: 1617

Matrix: NA

Client ID: 125 ml clear wm short 0100501B

Unit: ug/Bottle

Laboratory ID: 1617-01A

Date Analyzed: 01/18/90

Date Confirmed: NA

Date Extracted: 01/12/90

Dilution Factor: 1

| Compound | Result | Reporting Limit |
|--------------------|--------|-----------------|
| Aldrin | ND | 0.004 |
| Alpha-BHC | ND | 0.003 |
| Beta-BHC | ND | 0.006 |
| Delta-BHC | ND | 0.009 |
| Gamma-BHC | ND | 0.004 |
| Chlordane | ND | 0.014 |
| 4,4'-DDD | ND | 0.011 |
| 4,4-DDE | ND | 0.004 |
| 4,4-DDT | ND | 0.012 |
| Dieldrin | ND | 0.002 |
| Endosulfan I | ND | 0.014 |
| Endosulfan II | ND | 0.004 |
| Endosulfan Sulfate | ND | 0.066 |
| Endrin | ND | 0.006 |
| Heptachlor | ND | 0.003 |
| Heptachlor Epoxide | ND | 0.083 |
| Endrin aldehyde | ND | 0.18 |
| Toxaphene | ND | 0.24 |
| PCB-1016 | ND | 0.1 |
| PCB-1221 | ND | 0.4 |
| PCB-1232 | ND | 0.3 |
| PCB-1242 | ND | 0.2 |
| PCB-1248 | ND | 0.2 |
| PCB-1254 | ND | 0.2 |
| PCB-1260 | ND | 0.2 |

ND-Not Detected

NA-Not Applicable

ANALYST:

P. Wain 1/23/90

GROUP LEADER:

8F
1/23/90

ALL RESULTS ARE REPORTED AS RECEIVED

BTEX

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method 608

Work Order NO.: 1500

% Moisture: NA

Client ID: 0127201A 500 ML WIDE MOUTH
CLEAR SHORT

MATRIX: WATER

Laboratory ID: 89100208

Unit: UG/BOTTLE

Date Extracted: 10/13/89

Date Analyzed: 10/20/89

Dilution Factor: 1

Date Confirmed: NA

| Compound | Result | Reporting Limit |
|--------------------|--------|-----------------|
| Aldrin | ND | 0.004 |
| Alpha-BHC | ND | 0.003 |
| Beta-BHC | ND | 0.006 |
| Delta-BHC | ND | 0.009 |
| Gamma-BHC | ND | 0.004 |
| Chlordane | ND | 0.014 |
| 4,4'-DDD | ND | 0.011 |
| 4,4-DDE | ND | 0.004 |
| 4,4-DDT | ND | 0.012 |
| Dieldrin | ND | 0.002 |
| Endosulfan I | ND | 0.014 |
| Endosulfan II | ND | 0.004 |
| Endosulfan Sulfate | ND | 0.066 |
| Endrin | ND | 0.006 |
| Heptachlor | ND | 0.003 |
| Heptachlor Epoxide | ND | 0.083 |
| Endrin aldehyde | ND | 0.18 |
| Toxaphene | ND | 0.24 |
| PCB-1016 | ND | 0.1 |
| PCB-1221 | ND | 0.4 |
| PCB-1232 | ND | 0.3 |
| PCB-1242 | ND | 0.2 |
| PCB-1248 | ND | 0.2 |
| PCB-1254 | ND | 0.2 |
| PCB-1260 | ND | 0.2 |

ND-Not Detected

NA-Not Applicable

ANALYST:

D. Steward

GROUP LEADER:

8F

10/25/89

NOTE:

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
PESTICIDE EPA 608

Work Order NO.: 1738

Matrix: NA

Client ID: 1-LITER AMBER BOTTLE 0108101B

Unit: ug/Bottle

Laboratory ID: 1738-01

Date Analyzed: 04/04/90

Date Confirmed: NA

Date Extracted: 03/28/90

Dilution Factor: 1

| Compound | Result | Reporting Limit |
|--------------------|--------|-----------------|
| Aldrin | ND | 0.004 |
| Alpha-BHC | ND | 0.003 |
| Beta-BHC | ND | 0.006 |
| Delta-BHC | ND | 0.009 |
| Gamma-BHC | ND | 0.004 |
| Chlordane | ND | 0.014 |
| 4,4'-DDD | ND | 0.011 |
| 4,4'-DDE | ND | 0.004 |
| 4,4'-DDT | ND | 0.012 |
| Dieldrin | ND | 0.002 |
| Endosulfan I | ND | 0.014 |
| Endosulfan II | ND | 0.004 |
| Endosulfan Sulfate | ND | 0.066 |
| Endrin | ND | 0.006 |
| Heptachlor | ND | 0.003 |
| Heptachlor Epoxide | ND | 0.083 |
| Endrin aldehyde | ND | 0.18 |
| Toxaphene | ND | 0.24 |
| PCB-1016 | ND | 0.1 |
| PCB-1221 | ND | 0.4 |
| PCB-1232 | ND | 0.3 |
| PCB-1242 | ND | 0.2 |
| PCB-1248 | ND | 0.2 |
| PCB-1254 | ND | 0.2 |
| PCB-1260 | ND | 0.2 |

ND-Not Detected

NA-Not Applicable

ANALYST:

DS

GROUP LEADER:

87

10 APR 90

ES-ENGINEERING-SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

INORGANICS ANALYTICAL REPORT

Client: ESS
Project: Bottle Analysis

Work Order: 1851
Matrix: Bottle

Client's ID: 0111301B 0211301B
1 LITER 250 ML
HDPE MR HDPE MR

Sample Date: 04/26/90 04/26/90
% Moisture: NA NA
Lab ID: 1851.01 1851.02
A A

| Parameter | Results | Method | Normal
Report
Limit | Units | Date
Analyzed |
|-----------|---------|--------|---------------------------|-----------|------------------|
| Arsenic | ND | GF-AA | 1 | ug/bottle | 05/10/90 |
| Cadmium | ND | ICP | 1 | " | 05/09/90 |
| Chromium | ND | ICP | 5 | " | 05/09/90 |
| Iron | ND | ICP | 5 | " | 05/09/90 |
| Lead | ND | ICP | 10 | " | 05/09/90 |
| Mercury | ND | CV-AA | .04 | " | 05/10/90 |
| Zinc | ND | ICP | 2 | " | 05/09/90 |

ND- Not Detected

ANALYST:

J. Michael

GROUP LEADER:

W. J. [Signature]

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
601 Volatile Compounds

Work Order NO.:1583

% Moisture:NA

Client ID:0134601A

Matrix:Water

Laboratory ID:1583-01

Unit:ug/bottle

Date Collected:12/13/89

Date Analyzed:12/21/89

Date Confirmed:12/21/89

Dilution Factor: 1

Compound

Result

Reporting
Limit

| | | |
|-------------------------|------|-------|
| BROMODICHLOROMETHANE | ND | 0.003 |
| BROMOFORM | ND | 0.005 |
| BROMOMETHANE | ND | 0.030 |
| CARBON TETRACHLORIDE | ND | 0.003 |
| CHLOROBENZENE | ND | 0.006 |
| CHLOROETHANE | ND | 0.013 |
| 2CHLOROETHYL VINYLETHER | ND | 0.003 |
| CHLOROFORM | ND | 0.001 |
| CHLOROMETHANE | ND | 0.002 |
| DIBROMOCHLOROMETHANE | ND | 0.002 |
| 12 DICHLOROBENZENE | ND | 0.004 |
| 13 DICHLOROBENZENE | ND | 0.008 |
| 14 DICHLOROBENZENE | ND | 0.006 |
| DICHLORODIFLUOROMETHANE | ND | 0.045 |
| 11 DICHLOROETHANE | ND | 0.002 |
| 12 DICHLOROETHANE | ND | 0.001 |
| 11 DICHLOROETHENE | ND | 0.003 |
| t-12 DICHLOROETHENE | ND | 0.003 |
| 12 DICHLOROPROPANE | ND | 0.001 |
| c-13 DICHLOROPROPENE | ND | 0.009 |
| t-13 DICHLOROPROPENE | ND | 0.005 |
| METHYLENE CHLORIDE | 0.15 | 0.006 |
| 1122 TETRACHLOROETHANE | ND | 0.001 |
| TETRACHLOROETHENE | ND | 0.001 |
| 111 TRICHLOROETHANE | ND | 0.001 |
| 112 TRICHLOROETHANE | ND | 0.001 |
| TRICHLOROETHENE | ND | 0.003 |
| TRICHLOROFLUOROMETHANE | ND | 0.013 |
| VINYL CHLORIDE | ND | 0.005 |

ND-Not Detected

NA-Not Applicable

ANALYST: MW

12/27/89

GROUP LEADER:

SF
12/27/89

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
602 plus Xylenes

Work Order NO.:1583

% Moisture:NA

Client ID:0134601A

Matrix:Water

Laboratory ID:1583-01

Unit:ug/bottle

Date Collected:12/13/89

Date Analyzed:12/21/89

Date Confirmed:NA

Dilution Factor: 1

Compound

Result

Reporting
Limit

Benzene

ND

0.005

Chlorobenzene

ND

0.005

1,2 Dichlorobenzene

ND

0.010

1,3 Dichlorobenzene

ND

0.010

1,4 Dichlorobenzene

ND

0.008

Ethyl Benzene

ND

0.005

Toluene

ND

0.005

Xylenes (total)

ND

0.010

ND-Not Detected

NA-Not Applicable

ANALYST:

MW

12/27/89

GROUP LEADER:

8F

12/27/89

GC ANALYTICAL REPORT
Analytical Method
PESTICIDE EPA 608

Work Order NO.: 2060

Client ID: 125 ML CLEAR WMS
0120101B

Laboratory ID: 2060-1

Unit: ug/Bottle

Date Extracted: 7/23/90

Date Analyzed: 7/30/90

Inst. Ser. #: EGC5-900730

Date Confirmed: NA

Inst. Ser. #: NA

Dilution Factor: 1

| Compound | Result | Reporting Limit |
|--------------------|--------|-----------------|
| Aldrin | ND | 0.004 |
| Alpha-BHC | ND | 0.003 |
| Beta-BHC | ND | 0.006 |
| Delta-BHC | ND | 0.009 |
| Gamma-BHC | ND | 0.004 |
| Chlordane | ND | 0.014 |
| 4,4'-DDD | ND | 0.011 |
| 4,4'-DDE | ND | 0.004 |
| 4,4'-DDT | ND | 0.012 |
| Dieldrin | ND | 0.002 |
| Endosulfan I | ND | 0.014 |
| Endosulfan II | ND | 0.004 |
| Endosulfan Sulfate | ND | 0.066 |
| Endrin | ND | 0.006 |
| Heptachlor | ND | 0.003 |
| Heptachlor Epoxide | ND | 0.083 |
| Endrin aldehyde | ND | 0.18 |
| Toxaphene | ND | 0.24 |
| PCB-1016 | ND | 0.1 |
| PCB-1221 | ND | 0.4 |
| PCB-1232 | ND | 0.3 |
| PCB-1242 | ND | 0.2 |
| PCB-1248 | ND | 0.2 |
| PCB-1254 | ND | 0.2 |
| PCB-1260 | ND | 0.2 |

ND-Not Detected

NA-Not Applicable

ANALYST:



GROUP LEADER:





SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

REC'D JUN 15 1990

ESS, Inc.
9061 San Leandro St.
Oakland, CA 94693
Attention: Matthew Macy

Client Project ID:
Sample Descript: 500 ml Clear WM Short
Analysis Method: EPA 8080
Lab Number: 005-3691
01142018

Sampled: May 23, 19
Received: May 23, 19
Extracted: Jun 8, 19
Analyzed: Jun 8, 19
Reported: Jun 13, 19

ORGANOCHLORINE PESTICIDES AND PCB'S (EPA 8080)

| Analyte | Detection Limit
µg/L | Sample Results
µg/L |
|--------------------------|-------------------------|------------------------|
| Aldrin..... | 0.10 | N.D. |
| alpha-BHC..... | 0.050 | N.D. |
| beta-BHC..... | 0.050 | N.D. |
| delta-BHC..... | 0.050 | N.D. |
| gamma-BHC (Lindane)..... | 0.40 | N.D. |
| Chlordane..... | 0.15 | N.D. |
| 4,4'-DDD..... | 0.10 | N.D. |
| 4,4'-DDE..... | 0.050 | N.D. |
| 4,4'-DDT..... | 0.10 | N.D. |
| Dieldrin..... | 0.10 | N.D. |
| Endosulfan I..... | 0.15 | N.D. |
| Endosulfan II..... | 0.10 | N.D. |
| Endosulfan sulfate..... | 0.75 | N.D. |
| Endrin..... | 0.010 | N.D. |
| Endrin aldehyde..... | 0.25 | N.D. |
| Heptachlor..... | 0.10 | N.D. |
| Heptachlor epoxide..... | 0.10 | N.D. |
| Methoxychlor..... | 10 | N.D. |
| Toxaphene..... | 0.50 | N.D. |
| PCB-1016..... | 1.0 | N.D. |
| PCB-1221..... | 1.0 | N.D. |
| PCB-1232..... | 1.0 | N.D. |
| PCB-1242..... | 1.0 | N.D. |
| PCB-1248..... | 1.0 | N.D. |
| PCB-1254..... | 1.0 | N.D. |
| PCB-1260..... | 1.0 | N.D. |

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Victor P. Menon
Project Manager