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INSTALLATION RESTORATION PROGRAM PHASE II - CONFIRMATION/QUANTIFICATION STAGE 1

VOLUME I

U.S. AIR FORCE PLANT NO. 42
Palmdale, California

PREPARED FOR

HEADQUARTERS AERONAUTICAL SYSTEMS DIVISION
FACILITIES MANAGEMENT DIVISION (ASD/PMDA)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-6503

AND

HEADQUARTERS AIR FORCE SYSTEMS COMMAND
COMMAND BIOENVIRONMENTAL ENGINEER (AFSC/SGPB)
ANDREWS AIR FORCE BASE, DIST. OF COLUMBIA 20334-5000

UNITED STATES AIR FORCE
OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY
TECHNICAL SERVICES DIVISION (USAFOEHL/TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

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FEBRUARY 1987

FINAL REPORT

PREPARED BY

ENGINEERING-SCIENCE, INC.
Pasadena, California 91103
Atlanta, Georgia 30329

ES ENGINEERING-SCIENCE

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

VOLUME I

Final Report
For

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February 1987

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USAF CONTRACT NO. F33615-84-D-4403
DELIVERY ORDER NO. 001102

USAFOEHL TECHNICAL PROGRAM MANAGER
John K. Yu, Ph.D.

NOTICE

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An Installation Restoration Program (IRP) Phase II, Stage 1 investigation was conducted at USAF Plant 42 in Palmdale, California, to confirm the presence or absence of contamination at 23 sites. Contamination was suspected at the sites as a result of past spills, leaks, or waste disposal practices. A field investigation program was conducted, consisting of soil boring and sampling, groundwater sampling, and chemical analysis of environmental samples (water and soils) for suspected contaminants. No significant contaminants were found at 17 of the sites. Fuel contamination (petroleum hydrocarbons or oil & grease) was detected at 5 sites, 3 of which also had volatile organics present. At 1 other site, no contamination was found, but other evidence suggested that contaminants might be present. No contamination was found in any groundwater samples; all contaminants detected were in the unsaturated zone. No further action was recommended for 17 sites where contamination was not found. Additional (IRP Phase II, Stage 2) investigations were recommended for 4 sites where the extent of contamination was not fully determined. Remedial action was recommended for 2 sites because of the location and amount of contaminants detected.

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

INTRODUCTION AND PURPOSE

The Department of Defense (DOD) has developed a program to identify and evaluate sites where contamination may be present on DOD property because of past spills or hazardous waste disposal practices, to control the migration of hazardous contaminants, and to control hazards to health, welfare or the environment that may result from contamination at these sites. This program is called the Installation Restoration Program (IRP). The IRP has four phases:

- o Phase I - Installation Assessment/Records Search,
- o Phase II - Confirmation/Quantification,
- o Phase III - Technology Base Development, and
- o Phase IV - Remedial Actions.

Engineering-Science, Inc. (ES) was retained by the United States Air Force (USAF) to conduct the Phase II, Stage 1 investigation at the Production Flight Test Installation, USAF Plant 42 in Palmdale, California, under Contract F33615-84-D-4403, Delivery Order 001102.

The overall objectives of the Phase II effort are to define the magnitude, extent, and direction and rate of movement of identified contaminants, and to determine the need for remedial actions based on an assessment of risks to human health and the environment. To meet these objectives, a series of staged field investigations may be required. Specific objectives of the Stage 1 investigation at USAF Plant 42 were:

- o to determine the presence or absence of contamination at the past spill and waste-disposal sites identified,
- o to determine the magnitude and extent of contamination and, where possible, the potential for migration of contaminants in the various environmental media,

- o to identify potential environmental consequences and health risks of known contaminants, based on State or Federal standards and guidelines, and
- o to identify any specific requirements for additional monitoring to confirm the magnitude, extent, migration, or identity of contaminants present.

BACKGROUND INFORMATION

USAF Plant 42 is located in southern California, approximately 80 miles from the City of Los Angeles, as shown in Figures 1 and 2. Situated on approximately 5,832 acres of land between the communities of Palmdale and Lancaster, USAF Plant 42 is in the southern corner of the Antelope Valley, on the western fringes of the Mojave Desert. The land adjacent to the installation is a mixture of light industrial, commercial, agricultural, and residential.

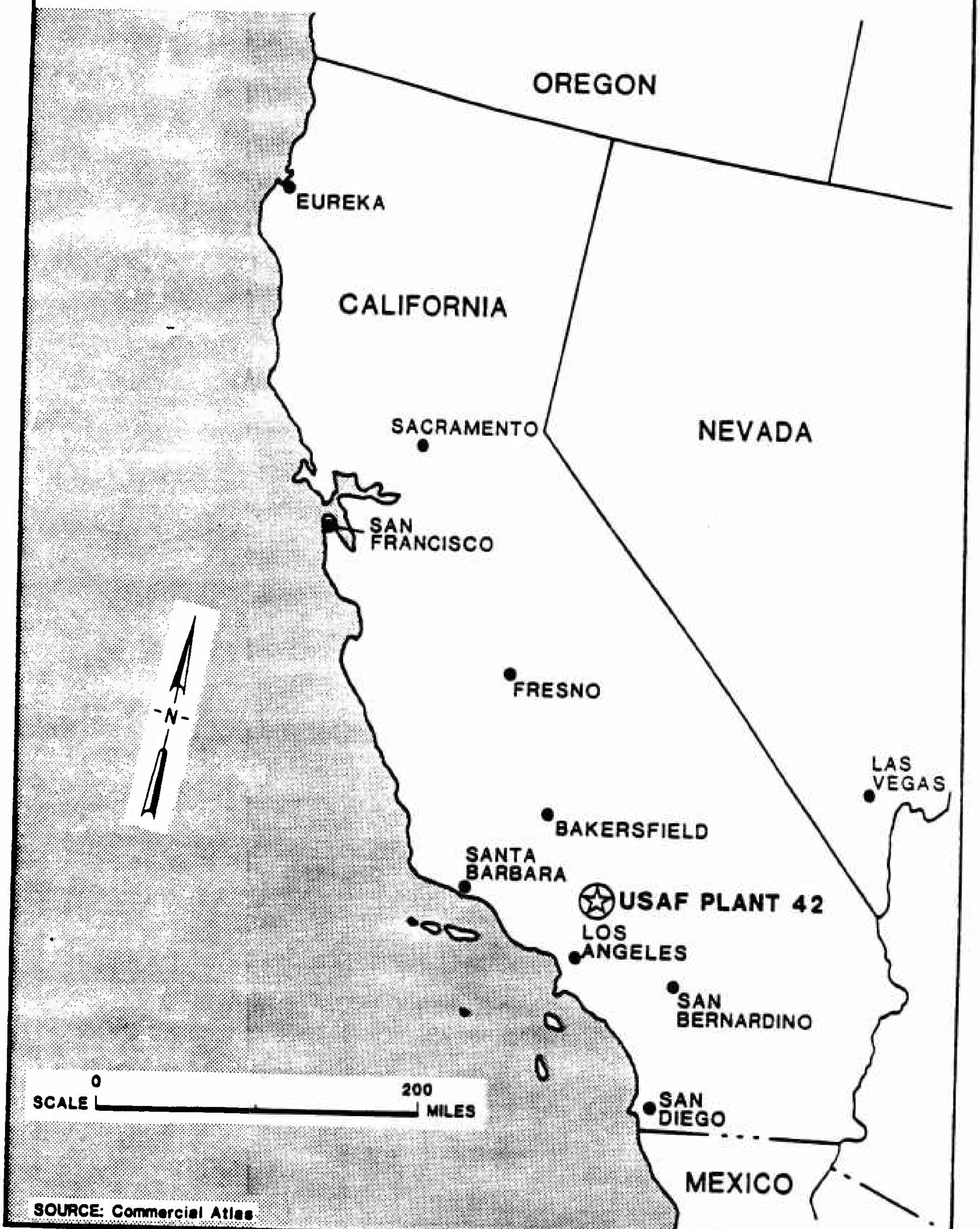
The host unit at USAF Plant 42 is Detachment 2, Air Force Contract Management Division (AFCMD), under the Air Force Systems Command. The primary mission of USAF Plant 42 is to provide and maintain facilities for: (1) final assembly of jet aircraft, (2) production engineering and flight testing programs, and (3) Air Force acceptance flight testing of high performance jet aircraft manufactured by DOD contractors assigned to USAF Plant 42.

IDENTIFICATION OF SITES FOR INVESTIGATION

During the Phase I (Installation Assessment/Records Search) investigation, interviews were conducted with installation personnel to identify current and past disposal and spill sites at USAF Plant 42. A preliminary screening of these sites was performed, based on information obtained from the interviews and available records, to determine which sites might have potentially significant contamination, and whether contaminant migration from these sites might occur. A total of 22 sites from Phase I were identified for further investigation in Phase II, along with one additional site not included in the Phase I Final Report. Table 1 presents a summary listing of all 23 sites investigated in the Phase II, Stage 1 survey at USAF Plant 42. The approximate locations of these sites are shown in Figure 3.

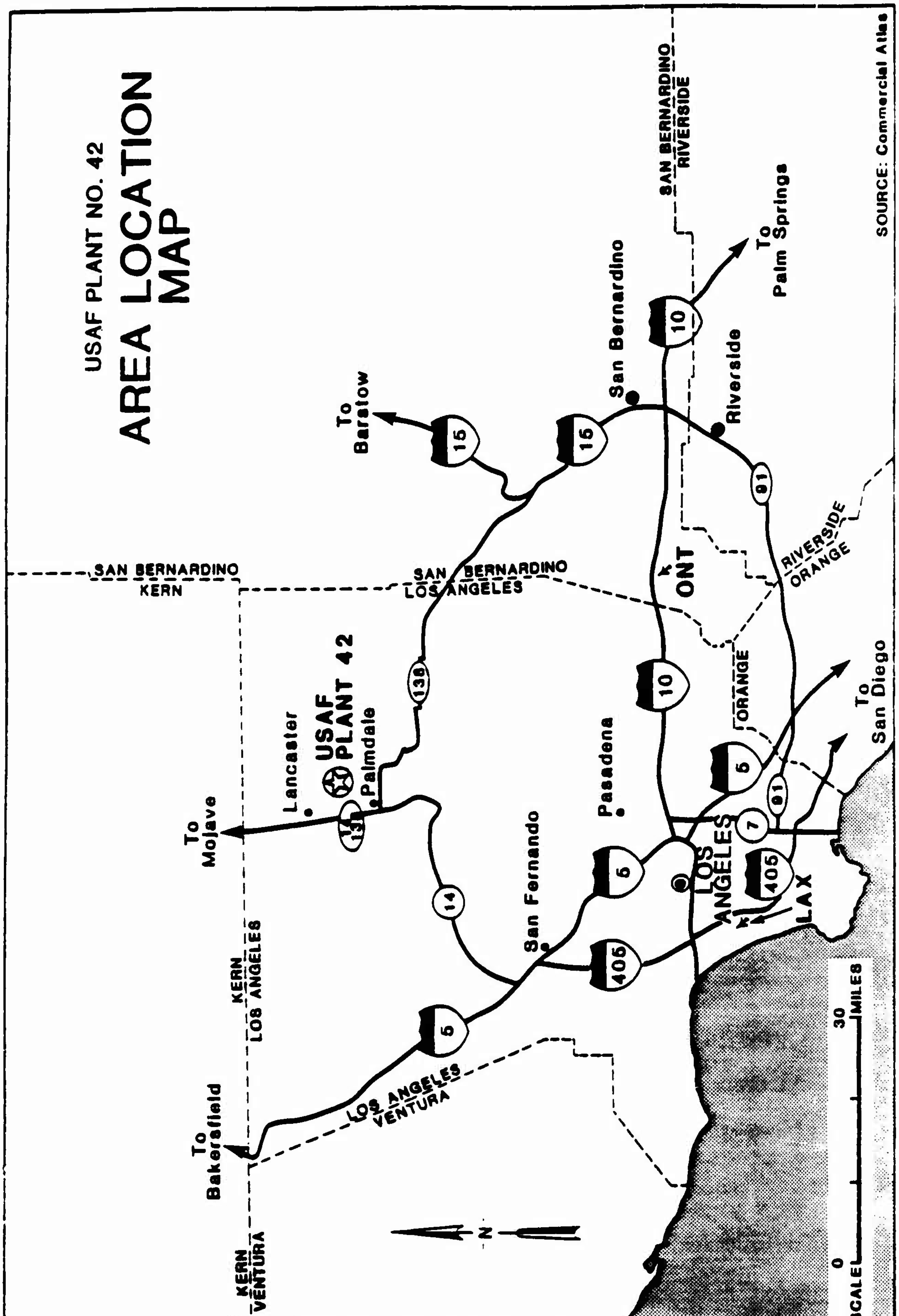
USAF PLANT NO. 42

REGIONAL LOCATION MAP



SOURCE: Commercial Atlas

FIGURE 2



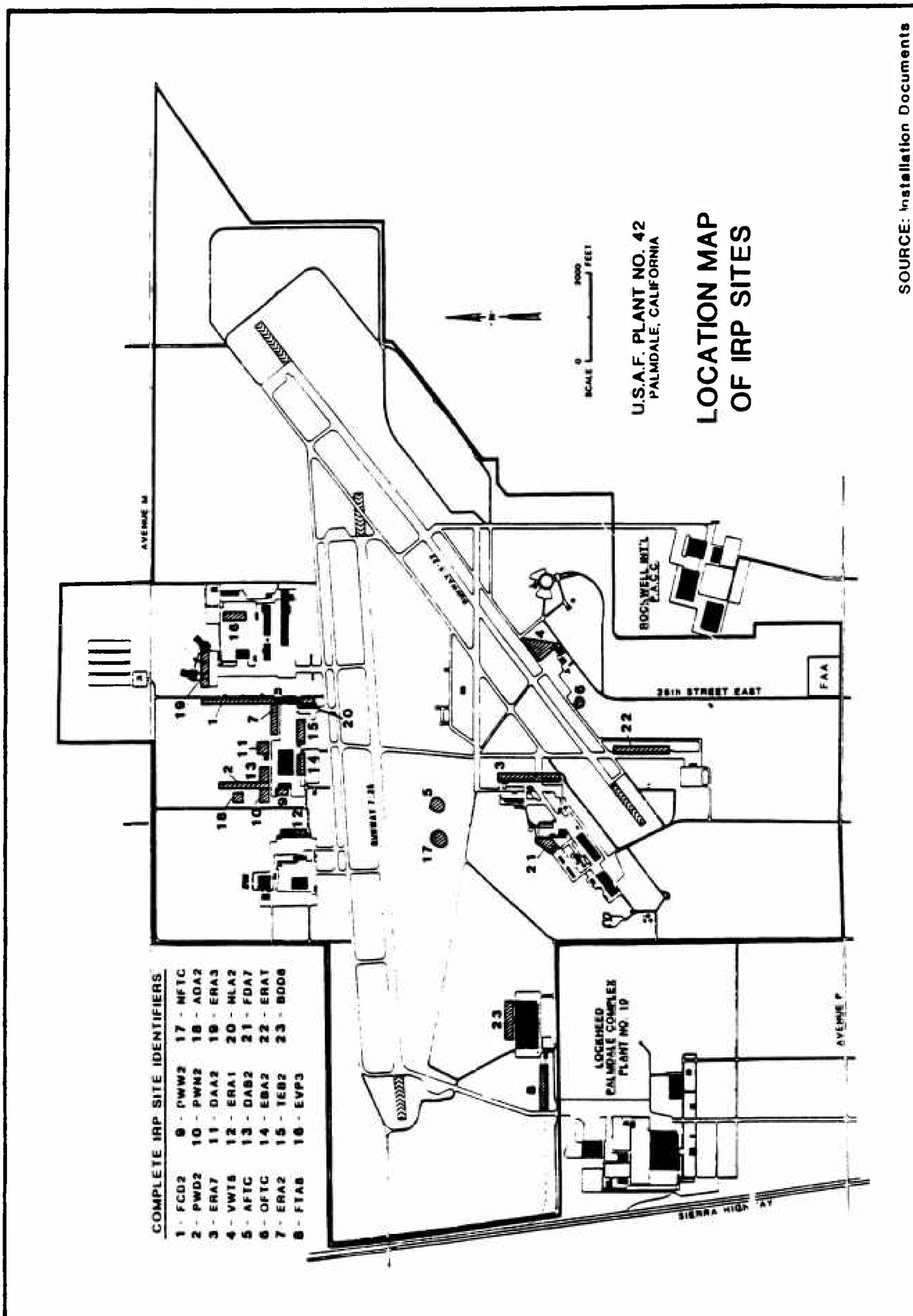
ES ENGINEERING-SCIENCE

TABLE 1

SUMMARY OF SITES INVESTIGATED DURING IRP PHASE II, STAGE 1 AT USAF PLANT 42

Site Identifier	Site Name/Description	Period of Use	Suspected Waste Materials Stored, Spilled, or Disposed at the Site
1-FDC2	Fuel-Contaminated Ditch	1954 to Present	Fuel, waste oils, solvents, hydraulic fluids
2-PWD2	Paint Waste Disposal Ditch	1954 to 1974	Paint residues, solvents, stripping compounds
3-ERA7	Engine Run-up Area in Plant Site 7	1956 to 1971	Fuel, waste oils, solvents, hydraulic fluids
4-VWT5	Vehicle Washrack & Leaking Underground Tank	1954 to Present	Fuel, waste oils, washrack runoff
5-AFTC	Abandoned Fire Training Area	1959 to 1981	Fuel, waste oils, solvents, hydraulic fluids
6-OFTC	Original Fire Training Area	1954 to 1959	Fuel, waste oils, solvents, hydraulic fluids
7-ERA2	Engine Run-up Area in Plant Site 2	1954 to Present	Fuel (JP-4 and JP-7)
8-FTA8	Fuel Transfer Area	1954 to 1984	Fuel (JP-7)
9-PWW2	Paint Waste Disposal Area-West	1954 to 1956	Paint residues, lacquer thinners, solvents
10-PWN2	Paint Waste Disposal Area-North	1954 to 1956	Paint residues, lacquer thinners, solvents
11-DAA2	Disposal Area A	1954 to 1981	Fuel, waste oils, solvents, hydraulic fluids, paint stripper
12-ERA1	Engine Run-up Area in Plant Site 1	Unknown	Fuel, waste oils, hydraulic fluids
13-DAB2	Disposal Area B	1954 to 1959	Waste photochemicals, solvents
14-EBA2	Engine Build-up Area	1954 to 1957	Waste oils, hydraulic fluids
15-TEB2	TEB Disposal Area	1964 to Present	Triethyl borane (TEB) and hydraulic oil
16-EVP3	Evaporation Ponds	1963 to 1967	Nickel-cyanide plating wastes
17-NFTC	New Fire Training Area	1981 to Present	Fuel (JP-4)
18-ADA2	Abandoned Disposal Area	1954 to 1974	Construction debris, miscellaneous trash and rubble
19-EPA3	Engine Run-up Area in Plant Site 3	1957 to 1961	Fuels
20-NLA2	Noise Level Area	1954 to 1958	Fuel, waste oils, hydraulic fluids
21-FDA7	Fuel Disposal Area	Late 1950s	Fuels
22-ERAT	Engine Run-up Area at Palmdale Air Terminal	1955 to 1957	Fuel, waste oils, hydraulic fluids
23-BDD8	Building Ditch Discharge*	1967 to 1971	Rinse water from chemical parts cleaning

* Site 23 was not included in the Phase I investigation.


U.S.A.F. PLANT NO. 42
PALMDALE, CALIFORNIA
LOCATION MAP OF IRP SITES
SOURCE: Installation Documents
SCALE 0 2000 FEET
COMPLETE IRP SITE IDENTIFIERS
1 - FCD2
2 - PWD2
3 - ERA7
4 - VWT8
5 - AFTC
6 - OFTC
7 - ERA2
8 - FTA8
9 - PWW2
10 - PWN2
11 - DAA2
12 - ERA1
13 - DAB2
14 - EBA2
15 - TEB2
16 - EVP3
17 - NFTC
18 - ADA2
19 - ERA3
20 - NLA2
21 - FDA7
22 - ERAT
23 - BOD8
AVENUE M
AVENUE P
SIERRA HIGHWAY
25th STREET EAST
FAA
ROCKWELL INT'L P.A.S.C.
LOCKHEED PALMDALE COMPLEX PLANT NO 10
RUNWAY 7-25
RUNWAY 4-22

ENVIRONMENTAL SETTING

USAF Plant 42 is located in the southern corner of Antelope Valley, a triangular-shaped, closed basin bordered by a series of remnant volcanic peaks (buttes) to the east, by the the Tehachapi Mountains on the northwest, and by the San Gabriel Mountains on the southwest. The mountains slope steeply to the margins of the valley, which are delineated by the 3,000-foot elevation contour. Land slopes decrease within Antelope Valley toward the center of the basin, where the lowest elevations (about 2270 feet msl) occur in the dry beds of Rogers, Rosamond, and Buckhorn Lakes. Elevations within USAF Plant 42 range from about 2,590 feet msl in the southwest to about 2,470 feet msl in the north. Only shallow drainage features and man-made structures break the otherwise gentle slope of the land surface, which ranges from 30 to 40 feet per mile toward the north-northeast.

Antelope Valley lies in a graben, a down-dropped block between two faults. Erosion of the uplifted rocks during the Tertiary and Quaternary periods filled Antelope Valley with unconsolidated sediments. Unconsolidated Quaternary deposits rest directly on basement rocks in most of the valley. The older alluvium consists of poorly-sorted gravel, sand, silt, and clay of granitic origin, and may be as much as 1900 feet thick in some parts of the valley. The younger alluvium consists of water-transported sediments and wind-transported dune sand, mostly of Recent age. These deposits of sand, angular gravel, cobbles and boulders contain small quantities of silt and clay. The younger alluvium is widespread over Antelope Valley but the deposits are generally less than 150 feet thick.

USAF Plant 42 lies approximately three miles from the San Andreas Rift Zone, but no active faults are known to occur at the site. The younger alluvium is approximately 100 feet thick, while the older alluvial deposits range from about 900 feet thick in the southern part of the installation to be more than 1,200 feet thick in the north. The soils developed on the alluvial deposits are relatively immature sandy loams. These soils have a low clay content, contain little natural organic material, and have moderate to high permeabilities.

The average annual precipitation at USAF Plant 42 is less than 5 inches, and the potential evapotranspiration rate from soils is about 35 inches per year (pan and lake evaporation are much higher). Precipitation occurs primarily between November and April, and rainfall can be intense at times, with rains of 4 to 6 inches recorded over a 7-day period recorded in nearby Palmdale. Such intense rainfall could produce surface runoff with potential for transporting contaminants dissolved in water or adsorbed to sediments. However, no major streams flow through USAF Plant 42, and no perennial surface-water bodies are located downslope. Surface runoff is discharged by a buried pipe and ditch system to a percolation pond located within the installation boundaries.

The older alluvial deposits comprise the principal source of groundwater in Antelope Valley. The younger alluvial sediments and dune sands are permeable, but they are thin and occur above the water table in most areas. Recharge to the principal aquifer is from surface water runoff originating in the mountains. Recharge occurs as the flow from the mountain streams is absorbed by the coarse alluvium along the margins of Antelope Valley. Little or no direct recharge occurs from precipitation in the valley itself, because of high evapotranspiration rates. The principal aquifer occurs under water-table conditions at depths of about 350 feet below USAF Plant 42, and groundwater beneath USAF Plant 42 moves toward the north and northeast. The nearest large water-supply wells are located about one mile upgradient (south) of USAF Plant 42, but several wells located within the installation are used for drinking water supply. Groundwater in the vicinity of USAF Plant 42 is potable, generally low in dissolved solids, and ranges from soft to moderately-hard.

The environmental setting of USAF Plant 42 results in a low potential for contaminants to affect water supplies. There are no surface-water supplies downslope of the installation, and spills or short-term discharges of liquids at the land surface are not likely to endanger local groundwater supplies because of:

- high evapotranspiration rates,
- great depth to water table,
- lack of sustained hydraulic gradient (driving force), and
- moderate adsorption potential of the alluvial sediments.

FIELD INVESTIGATION PROGRAM

The field investigation program involved work at the 23 IRP sites as summarized in Table 2. Soil boring and sampling activities were conducted at each of these sites, with selected soils samples collected for chemical analysis. Groundwater samples were also collected for chemical analysis, from existing fire protection and drinking water supply wells throughout the installation, to obtain groundwater quality data characteristics in both upgradient and downgradient regions of USAF Plant 42. The locations of the wells sampled are shown in Figure 4. Field activities began in early December 1985 and were completed in late April 1986.

RESULTS AND SIGNIFICANCE OF FINDINGS

No apparent contamination was found in any groundwater samples collected from seven wells throughout USAF Plant 42. Therefore, no evidence was obtained to suggest that contaminants at any of the IRP sites have migrated into the groundwater. Results of the soil boring and sampling activities conducted at the 23 IRP sites are summarized in Table 3, along with conclusions regarding their significance. The significance of these results was determined from consideration of the amount and extent of contaminants present, their potential for migration, and the potential threat posed to human health and the environment.

RECOMMENDATIONS

Based on the results obtained, each of the 23 IRP sites was classified in one of three categories of recommendations. Category I sites are those for which no further action is required. Data for these sites are considered sufficient to conclude that no significant threat to human health or the environment exists. Category II sites are those which require additional monitoring or investigation (Phase II, Stage 2) to assess the extent of current or future contamination. Category III sites are those which require remedial actions (Phase IV), including long-term monitoring. Data for these sites are considered sufficient to characterize the extent of contamination or they indicate an immediate threat to human health or the environment exists.

TABLE 2

SUMMARY OF FIELD INVESTIGATION PROGRAM BY SITES

Site Identifier	Site Name/Description	Field Activities	Samples Analyzed	Laboratory Analytical Parameters
1-FCD2	Fuel-Contaminated Ditch	2-75 foot borings 2-70 foot borings 2-50 foot borings 2-30 foot borings 1-20 foot borings 3 surface samples	34 Soils	Total Petroleum Hydrocarbons, Volatile Aromatic Organics, and Volatile Halogenated Organics.
		sample well DW2-1 sample well FW2B	2 Waters	Purgeable Aromatics, and Purgeable Halocarbons.
2-PWD2	Paint Waste Disposal Ditch	5-50 foot borings	19 Soils	Total Oil and Grease, Volatile Aromatic Organics, Volatile Halogenated Organics, Total Phenolics, and Primary Metals
3-ERA7	Engine Run-up Area in Plant Site 3	4-20 foot borings	8 Soils	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.
4-VWT5	Vehicle Washrack and Leaking Underground Tank	2-50 foot borings 2-20 foot borings	11 Soils	Total Oil and Grease, Primary Metals, Volatile Aromatic Organics, and Volatile Halogenated Organics,

TABLE 2
SUMMARY OF FIELD INVESTIGATION PROGRAM BY SITES
(Continued)

Site Identifier	Site Name/Description	Field Activities	Samples Analyzed	Laboratory Analytical Parameters
5-AFTC	Abandoned Fire Training Area	1-50 foot boring 1-10 foot boring	4 Soils	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.
		1 surface sample	1 Soil	Primary Metals, and Organochlorine Pesticides/PCBs.
6-OFTC	Original Fire Training Area	1-50 foot boring	4 Soils	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.
		1 surface sample	1 Soil	Primary Metals, and Organochlorine Pesticides/PCBs.
7-ERA2	Engine Run-up Area in Plant Site 2	1-200 foot boring 1-100 foot boring 5-50 foot borings	30 Soils	Total Petroleum Hydrocarbons.
8-FTA8	Fuel Transfer Area	1-20 foot boring	2 Soils	Total Petroleum Hydrocarbons.
		sample well DW8-1	1 Water	Purgeable Aromatics, and Purgeable Halocarbons.

TABLE 2
SUMMARY OF FIELD INVESTIGATION PROGRAM BY SITES
(Continued)

Site Identifier	Site Name/Description	Field Activities	Samples Analyzed	Laboratory Analytical Parameters
9-PWW2	Paint Waste Disposal Area - West	2 surface samples	2 Soils	Total Oil and Grease, Total Phenolics, Volatile Aromatic Organics, and Volatile Halogenated Organics.
10-PWN2	Paint Waste Disposal Area - North	4 surface samples	4 Soils	Total Oil and Grease, Total Phenolics, Volatile Aromatic Organics, and Volatile Halogenated Organics.
11-DAA2	Disposal Area "A"	2-10 foot borings	2 Soils	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.
12-ERA1	Engine Run-up Area in Plant Site 1	2-20 foot borings	4 Soils	Total Oil and Grease.
		sample well DW1-1	1 Water	Purgeable Aromatics, and Purgeable Halocarbons.
13-DAB2	Disposal Area "B"	4 surface samples	4 Soils	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.

TABLE 2
SUMMARY OF FIELD INVESTIGATION PROGRAM BY SITES
(Continued)

Site Identifier	Site Name/Description	Field Activities	Samples Analyzed	Laboratory Analytical Parameters
14-EBA2	Engine Build-up Area	2-10 foot borings	2 Soils	Total Petroleum Hydrocarbons.
15-TEB2	TEB Disposal Area	2-10 foot borings	2 Soils	Total Petroleum Hydrocarbons.
16-EVP3	Evaporation Ponds	4-50 foot borings	15 Soils	Volatile Aromatic Organics, Volatile Halogenated Organics, Primary Metals, Nickel, and Total Cyanides.
		sample well DW3-1 sample well DW4-1	2 Waters	Puregeable Aromatics, Purgeable Halocarbons, Total Cyanides, and Nickel.
17-NFTC	New Fire Training Area	1-15 foot boring 1-35 foot boring	3 Soils	Total Oil and Grease.
		1 surface sample	1 Soil	Total Petroleum Hydrocarbons.
18-ADA2	Abandoned Disposal Area	1-20 foot boring	2 Soils	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.

TABLE 2
SUMMARY OF FIELD INVESTIGATION PROGRAM BY SITES
(Continued)

Site Identifier	Site Name/Description	Field Activities	Samples Analyzed	Laboratory Analytical Parameters
19-ERA3	Engine Run-up Area in Plant Site 3	2-10 foot borings	2 Soils	Total Oil and Grease.
20-NLA2	Noise Level Area	1-20 foot boring	2 Soils	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.
21-FDA7	Fuel Disposal Area	3-20 foot borings	6 Soils	Total Petroleum Hydrocarbons.
		sample well FW1	1 Water	Purgeable Aromatics, and Purgeable Halocarbons.
22-ERAT	Engine Run-up Area at Palmdale Air Terminal	2-10 foot borings	2 Soils	Total Oil and Grease.
23-BDD8	Building Ditch Discharge	2-20 foot borings	4 Soils	Total Oil and Grease, Volatile Aromatic Organics, Volatile Halogenated Organics, Primary Metals, and Secondary Metals.

FIGURE 4

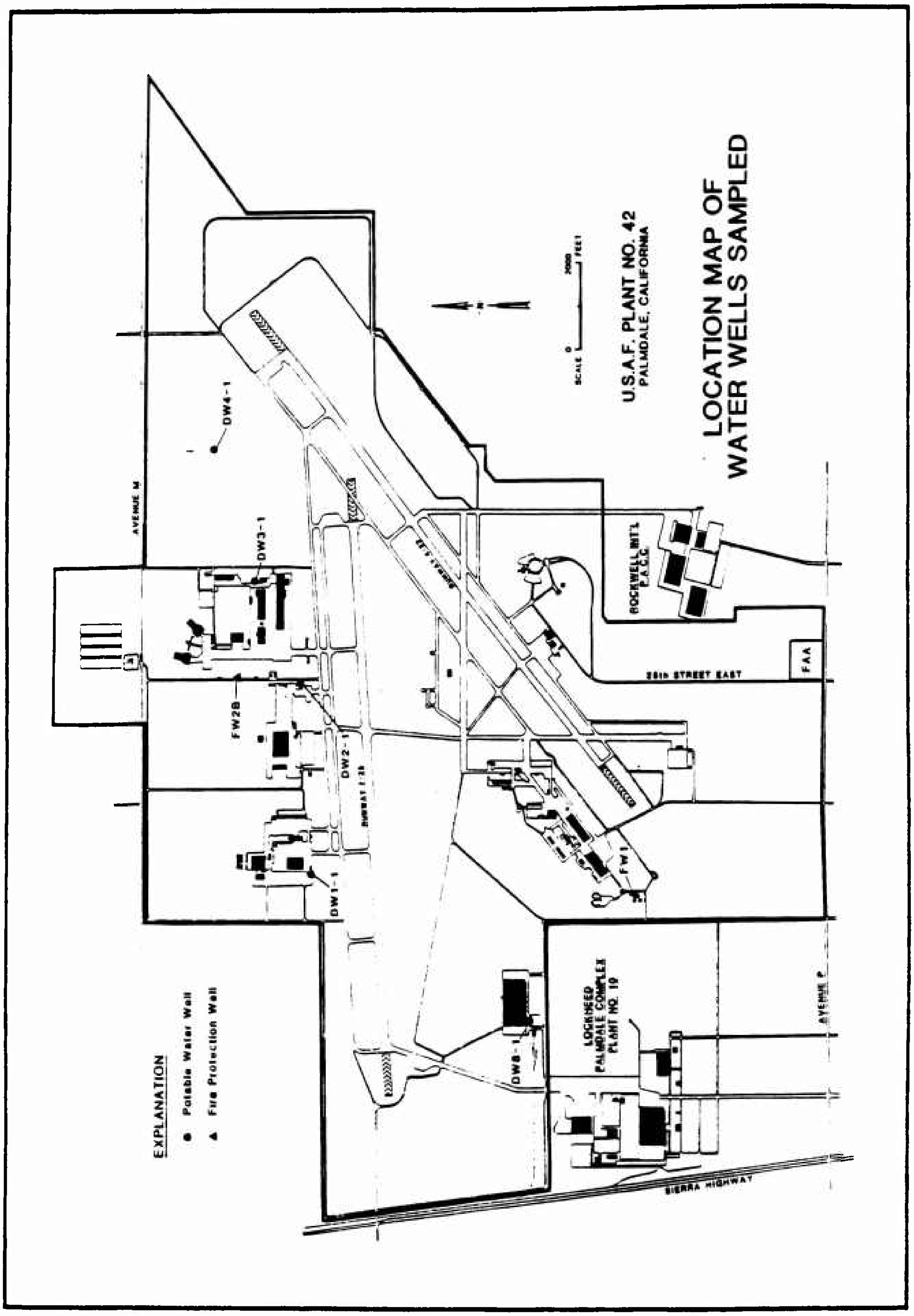

LOCATION MAP OF
WATER WELLS SAMPLED
U.S.A.F. PLANT NO. 42
PALMDALE, CALIFORNIA
EXPLANATION
Potable Water Well
Fire Protection Well
DW4-1
DW3-1
FW2B
DW2-1
DW1-1
DW8-1
FW1
ROCKWELL INT'L
P.A.C.C.
LOCKHEED
PALMDALE COMPLEX
PLANT NO. 10
25th STREET EAST
FAA
AVENUE M
AVENUE P
SIERRA HIGHWAY

TABLE 3
SUMMARY OF FINDINGS BY SITES

Site Identifier	Site Name/Description	Significant Results and Major Conclusions
1-FCD2	Fuel-Contaminated Ditch	Contaminants (petroleum hydrocarbons and volatile organics) were detected in 10 of 12 borings. Petroleum hydrocarbon values exceeded 1000 mg/kg in five borings, at depths up to 50 feet. The extent of contamination was well defined. Possible continuing sources of contaminants were identified.
2-PWD2	Paint Waste Disposal Ditch	Some contaminants were detected, but their location and amounts were not sufficient to be of concern.
3-ERA7	Engine Run-up Area in Plant Site 3	No apparent contamination was found at this site.
4-VWT5	Vehicle Washrack and Leaking Underground Tank	Some contaminants were detected, but their location and amounts were not sufficient to be of concern.
5-AFTC	Abandoned Fire Training Area	Contaminants (oil & grease, toluene, xylenes, other volatile organics) were detected in one location, where oil & grease values exceeded 1000 mg/kg to a depth of 30 feet. The extent of contamination at this site was not determined.

TABLE 3
SUMMARY OF FINDINGS BY SITES
(Continued)

Site Identifier	Site Name/Description	Significant Results and Major Conclusions
6-OFTC	Original Fire Training Area	Contaminants (oil & grease and volatile organics) were detected in one location, where oil & grease values exceeded 1000 mg/kg to a depth of 10 feet. The extent of contamination at this site was not determined.
7-ERA2	Engine Run-up Area in Plant Site 2	Contaminants (petroleum hydrocarbons) were detected in 4 of 7 borings. Petroleum hydrocarbon values exceeding 3000 mg/kg were detected at depths up to 30 feet in three of these, and up to 150 feet in the fourth. The extent of contamination at this site was partially defined. A possible continuing source of contaminants was identified.
8-FTA8	Fuel Transfer Area	No apparent contamination was found at this site.
9-PWW2	Paint Waste Disposal Area - West	No apparent contamination was found at this site.
10-PWN2	Paint Waste Disposal Area - North	No apparent contamination was found at this site.

TABLE 3
SUMMARY OF FINDINGS BY SITES
(Continued)

Site Identifier	Site Name/Description	Significant Results and Major Conclusions
11-DAA2	Disposal Area "A"	No apparent contamination was found at this site.
12-ERA1	Engine Run-up Area in Plant Site 1	No apparent contamination was found at this site.
13-DAB2	Disposal Area "B"	No apparent contamination was found at this site.
14-EBA2	Engine Build-up Area	No apparent contamination was found at this site.
15-TEB2	TEB Disposal Area	Contaminants (petroleum hydrocarbons) were detected in one location at a depth of 10 feet, where petroleum hydrocarbon values exceeded 3500 mg/kg. The extent of contamination at this site was not determined.
16-EVP3	Evaporation Ponds	No apparent contamination was found at this site.

TABLE 3
SUMMARY OF FINDINGS BY SITES
(Continued)

Site Identifier	Site Name/Description	Significant Results and Major Conclusions
17-NFTC	New Fire Training Area	No contaminants were detected in samples from one location, but the presence and extent of contaminants elsewhere at the site was not determined. Evidence of possible contamination at other locations was observed during field activities.
18-ADA2	Abandoned Disposal Area	No apparent contamination was found at this site.
19-ERA3	Engine Run-up Area in Plant Site 3	No apparent contamination was found at this site.
20-NLA2	Noise Level Area	No apparent contamination was found at this site.
21-FDA7	Fuel Disposal Area	No apparent contamination was found at this site.
22-ERAT	Engine Run-up Area at the Palmdale Air Terminal	No apparent contamination was found at this site.
23-BDD8	Building Ditch Discharge	No apparent contamination was found at this site.

Recommendations for the 23 individual sites are summarized in Table 4. Four sites were recommended for further investigation (IRP Phase II, Stage 2):

- o Abandoned Fire Training Area (5-AFTC),
- o Original Fire Training Area (6-OFTC),
- o TEB Disposal Area (15-TEB2), and
- o New Fire Training Area (17-NFTC).

The recommended Phase II, Stage 2 field investigation program for these sites are summarized in Table 5. Two other sites were recommended for remedial action (IRP Phase IV):

- o Fuel-Contaminated Ditch (1 FCD2), and
- o Engine Run-Up Area in Plant Site 2 (7-ERA2).

No further action was recommended for the remaining 17 IRP sites.

TABLE 4
SUMMARY OF RECOMMENDATIONS BY CATEGORY

Site Category	Site Identifiers	Recommendations	Rationale for Recommendation
CATEGORY I	3-ERA7, 8-FTAH, 9-PWW2, 10-PWN2, 11-DAA2, 12-ERA1, 13-DAB2, 14-EBA2, 16-EVP3, 18-ADA2, 19-ERA3, 20-NLA2, 21-FDA7, 22-ERAT, and 23-BDD8	No Further Action	No apparent contamination was found.
CATEGORY I	2-PWD2 and 4-VWT5	No Further Action	Location and amount of contaminants detected was not of concern.
CATEGORY II	5-AFTC, 6-OFTC, and 15-TEB2	Phase II, Stage 2 Investigation	Contaminants were detected at levels of concern, but the extent of contamination is unknown. Additional investigation is necessary to determine whether a threat to human health or the environment exists.
CATEGORY II	17-NFTC	Phase II, Stage 2 Investigation	Although no contaminants were detected in the samples analyzed, observations during field activities suggest that contamination may exist elsewhere at the site. Additional investigation is necessary to confirm the presence of contaminants, to determine the extent of contamination, and to determine whether a threat to human health or the environment exists.
CATEGORY III	1-FCD2 and 7-ERA2	Phase IV Remedial Actions	Contaminants were detected at levels of conern and the extent of contamination was defined. A potential threat to human health or the environment may exist. Possible continuing sources of contaminants were also identified.

TABLE 5

SUMMARY OF RECOMMENDED PHASE II, STAGE 2 INVESTIGATION BY SITES

Site Identifier	Site Name/Description	Description of Field Activities	Laboratory Analyses
5-AFTC 17-NFTC	Abandon Fire Training Area New Fire Training Area (both sites to be investigated together)	Soil-gas monitoring at 50-foot intervals (up to 200 readings). 14-50 foot soil borings with continuous sample collection. Soil permeability tests and determination of organic, silt, and clay fractions on 3 samples.	Oil & grease analysis on 4 soil samples from each boring (56 total).
6-OFTC	Original Fire Training Area	Soil-gas monitoring at 50-foot intervals (up to 64 readings). 6-50 foot soil borings with continuous sample collection. Soil permeability tests and determination of organic, silt, and clay fractions on 2 samples.	Oil & grease analysis on 4 soil samples from each boring (24 total).
15-TEB2	TEB Disposal Area	6-25 foot soil borings with continuous sampple collection. Soil permeability tests and determination of organic, silt, and clay fractions on 2 samples.	Oil & grease analysis on 3 soil samples from each boring (18 total).

SECTION 1.0

INTRODUCTION

SECTION 1.0

INTRODUCTION

1.1 BACKGROUND AND AUTHORITY

The United States Air Force, due to its primary mission of defense of the United States, has long been engaged in a wide variety of operations involving toxic and hazardous materials. Federal, State and local governments have developed strict regulations that require disposers to identify the locations and contents of past disposal sites and to take action to eliminate the hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA). Under Section 3012, State agencies are required to inventory past disposal sites, and EPA is required to provide information concerning such sites (including information obtained from other Federal agencies) at the request of the State agencies.

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

1.2 PURPOSE AND SCOPE

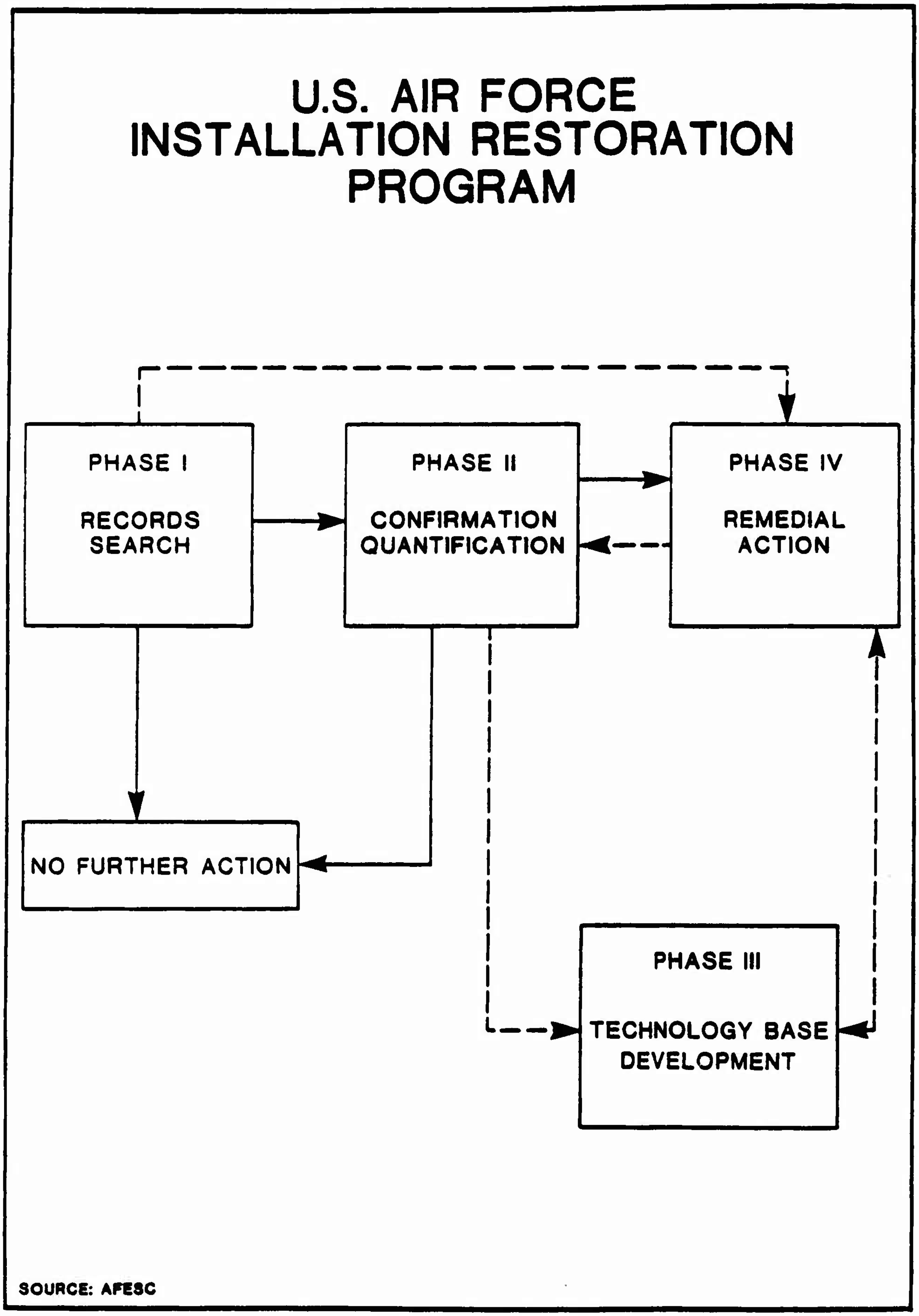
The IRP activities are divided into four phases designed to provide timely and cost-effective identification, confirmation/quantification, and remedial action at past waste-disposal and spill sites (Figure 1.1). Each phase is briefly described below:

- Phase I - Installation Assessment/Records Search - The purpose of Phase I is to identify past disposal sites that may pose a hazard to public health or the environment as a result of contaminant migration to surface or groundwaters, or that may have an adverse effect by the persistence of contaminants in the environment. The need for futher action to confirm an environmental hazard at site is also determined in this phase, and the Phase I report is the principal background document for the Phase II study. If a site requires immediate remedial action, such as removal of abandoned drums, the recommended site activity may be to proceed directly to Phase IV.

- Phase II - Confirmation/Quantification - The objectives of Phase II are to define and quantify, through preliminary and comprehensive environmental and/or ecological surveys, the presence or absence of contamination, the extent of contamination (including rate and direction of contaminant migration, when possible), and waste characteristics (when required by regulatory agencies). An additional objective is to identify sites or locations where remedial action is required in Phase IV. Research requirements identified during Phase II are addressed by Phase III efforts under the IRP.

- Phase III - Technology Base Development - The purpose of Phase III is to develop a sound technological data base for use in preparing a comprehensive remedial action plan, including the development of new technology for waste treatment and site remediation. This phase can also include implementation of research requirements and technology for objective assessment of adverse effects. A Phase III requirement can be identified at any time during the program.

FIGURE 1.1



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- Phase IV - Remedial Action - The primary purpose of Phase IV is to prepare and implement remedial action plans for contaminated sites identified in Phases I and II.

This report presents the results of the Phase II, Stage 1 (Confirmation/Quantification) investigation at USAF Plant 42 in Palmdale, California. The overall objectives of the Phase II effort are to define the magnitude, extent, direction and rate of movement of identified contaminants and to determine the need for remedial actions based on an assessment of risks to human health and the environment. To meet these objectives, a series of staged field investigations may be required. Specific objectives of the Stage 1 investigation were to:

- determine the presence or absence of contamination at the past spill and waste-disposal sites identified,
- determine the magnitude and extent of contamination and, where possible, the potential for migration of contaminants in the various environmental media,
- identify potential environmental consequences and health risks of known contaminants, based on State or Federal standards and guidelines, and
- identify any specific requirements for additional monitoring to confirm the magnitude, extent, migration, or identity of contaminants present.

1.3 PROGRAM SCHEDULE AND DURATION

The Phase I (Installation Assessment/Records Search) investigation of USAF Plant 42 was conducted by CH2M-Hill, Inc. and was completed in October 1983 with submittal of the Final Report (CH2M-Hill, 1983). The Phase II, Stage 1 Presurvey was conducted by Engineering-Science, Inc., under Agreement F33615-84-D-4403, Delivery Order 0003. The Presurvey began in September 1984 and was completed in December 1984 with submittal of the Draft Statement of Work. The Phase II, Stage 1 (Confirmation/Quantification) investigation was also conducted by Engineering-Science, Inc., under Delivery Order 0011, and began in September 1985.

Inital project activities included preparation and submittal of the Technical Operations Plan, a Health and Safety Plan, general project planning and mobilization, and subcontractor procurement. Field data collection began in late November 1985 and continued through the end of April 1986, with laboratory analytical work completed in June 1986.

1.4 PLANT LOCATION AND DESCRIPTION

USAF Plant 42 is located in southern California (Figure 1.2), in the northeast portion of Los Angeles County, approximately 80 miles from the City of Los Angeles, as shown in Figure 1.3. Situated between the communities of Palmdale and Lancaster in the southern corner of the Antelope Valley, USAF Plant 42 is on the western fringes of the Mojave Desert. A vicinity map is presented in Figure 1.4.

USAF Plant 42 is situated on approximately 5832 acres of land, and includes two 12,000-foot runways, each with a 1000-foot asphalt concrete overrun at both ends. The property boundaries (not including easements) are shown in Figure 1.5. About 1444 acres are dedicated to industrial sites, 288 acres are obstruction easements, and roughly 4100 acres are airfields and other common-use land.

There are eight industrial plant sites within USAF Plant 42, six of which house contractor-managed aircraft manufacturing and warehouse facilties. The two other sites are used for general administrative, operations, and maintenance activities. Figure 1.6 shows the location of these sites according to the site numbering system currently in use at USAF Plant 42. Among the facilities located in common areas are a sewage and waste treatment plant, two fire protection stations, and the Los Angeles County Palmdale Air Terminal (currently inactive). Two neighboring aircraft manufacturing facilities not owned by the Air Force also share use of the airfields at USAF Plant 42. These are Lockheed's Plant 10 and Rockwell's Palmdale Aircraft Construction Complex (PACC), both of which are shown in Figure 1.6.

1.5 PLANT ORGANIZATION, MISSION AND HISTORY

The host unit at USAF Plant 42, Production Flight Test Installation (PFTI) is Detachment 2, Air Force Contract Management Division (AFCMD), under the Air Force Systems Command. The primary mission of USAF Plant

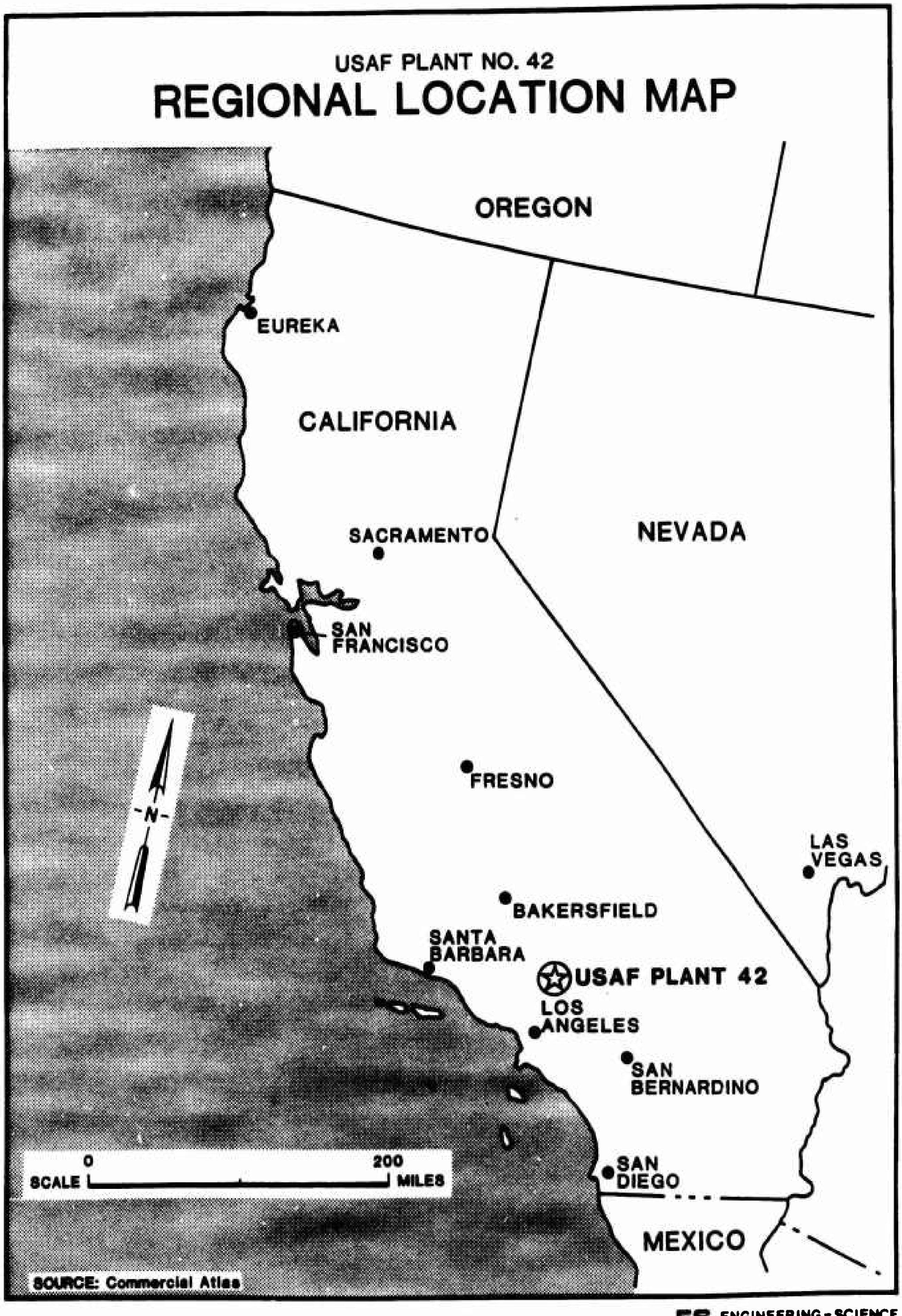
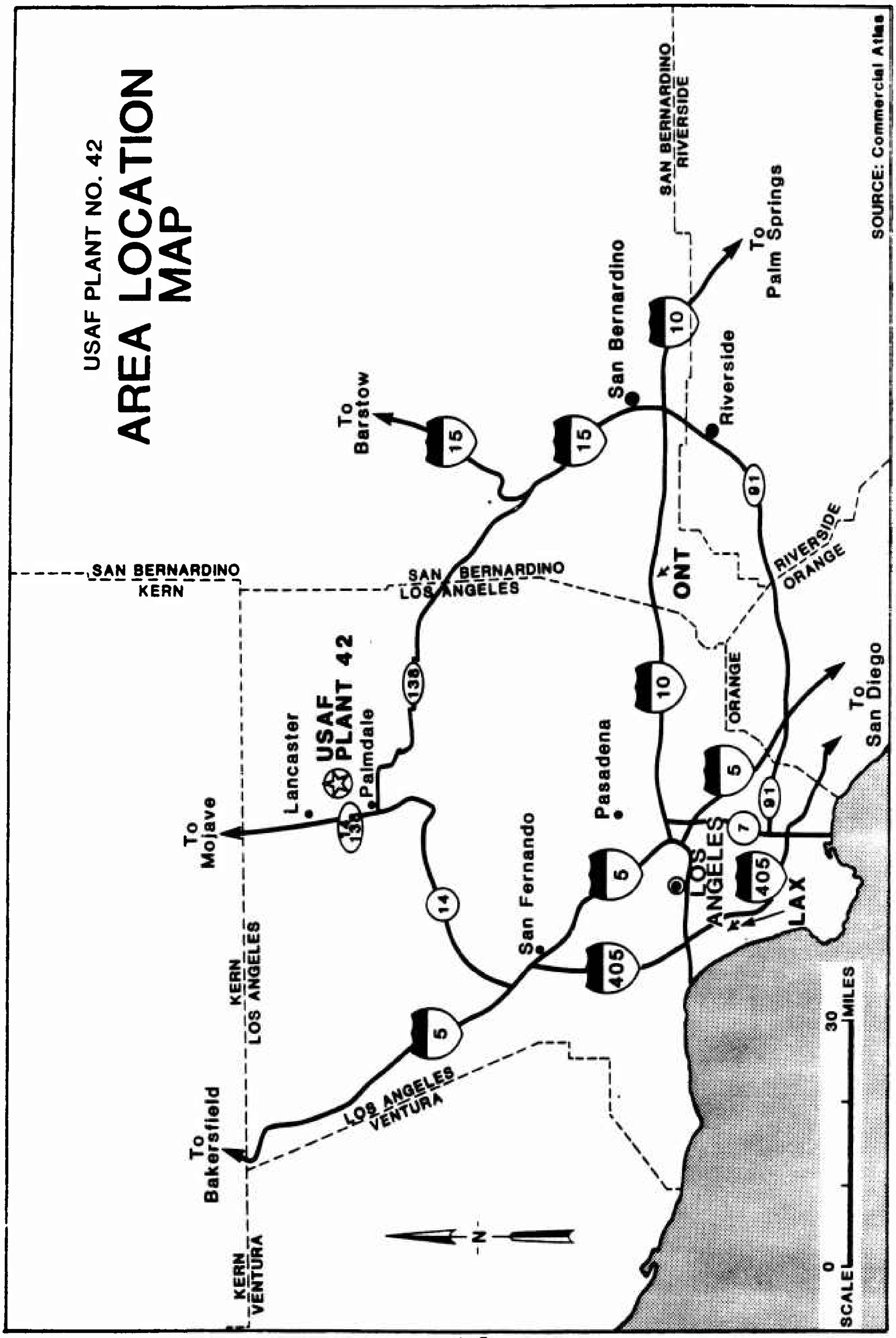

USAF PLANT NO. 42
REGIONAL LOCATION MAP
OREGON
EUREKA
CALIFORNIA
SACRAMENTO
NEVADA
SAN FRANCISCO
N
FRESNO
LAS VEGAS
BAKERSFIELD
SANTA BARBARA
USAF PLANT 42
LOS ANGELES
SAN BERNARDINO
SAN DIEGO
0
200
SCALE
MILES
MEXICO
SOURCE: Commercial Atlas

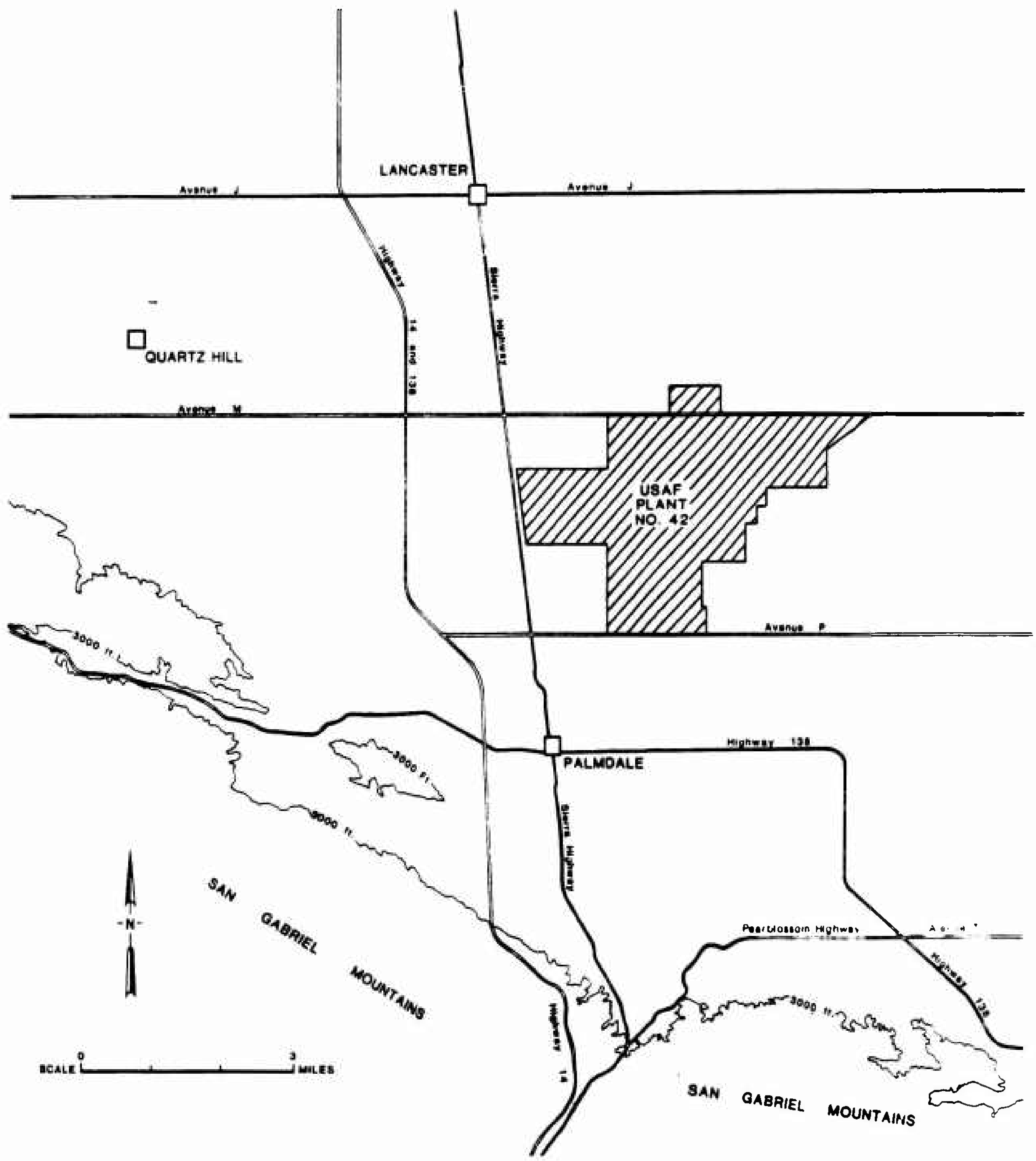
FIGURE 1.3



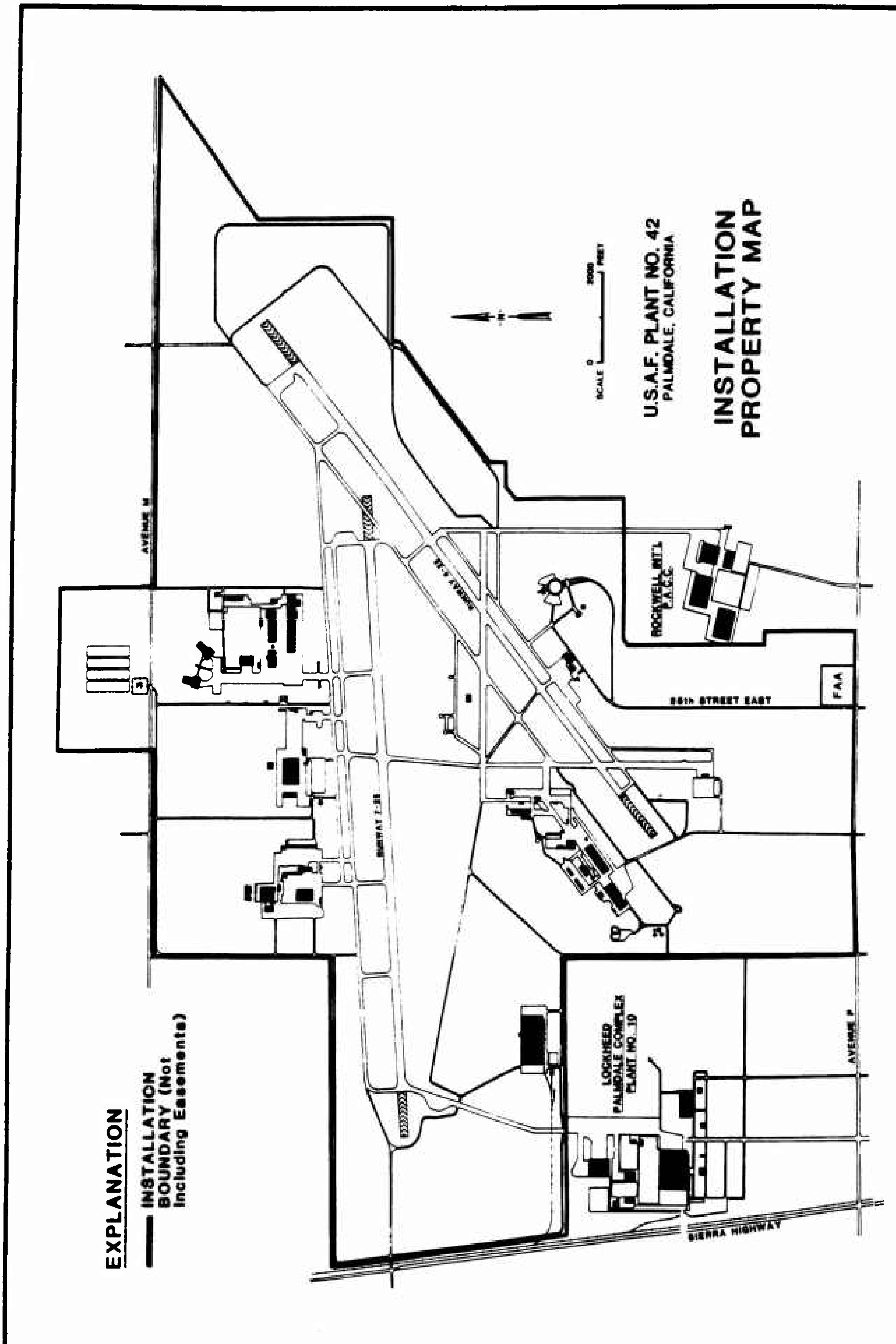
USAF PLANT NO. 42
AREA LOCATION MAP
To Barstow
15
15
San Bernardino
10
To Palm Springs
Riverside
91
SAN BERNARDINO
RIVERSIDE
SOURCE: Commercial Atlas
SAN BERNARDINO
KERN
SAN BERNARDINO
LOS ANGELES
RIVERSIDE
ORANGE
ONT
ORANGE
10
Lancaster
USAF PLANT 42
Palmdale
138
14
Pasadena
5
To San Diego
7
91
LOS ANGELES
405
LAX
To Mojave
San Fernando
5
405
KERN
LOS ANGELES
5
To Bakersfield
LOS ANGELES
VENTURA
KERN
VENTURA
N
SCALE
0
30
MILES

USAF PLANT NO. 42

VICINITY MAP



SOURCE: USGS Topographic Map



SOURCE: Installation Documents

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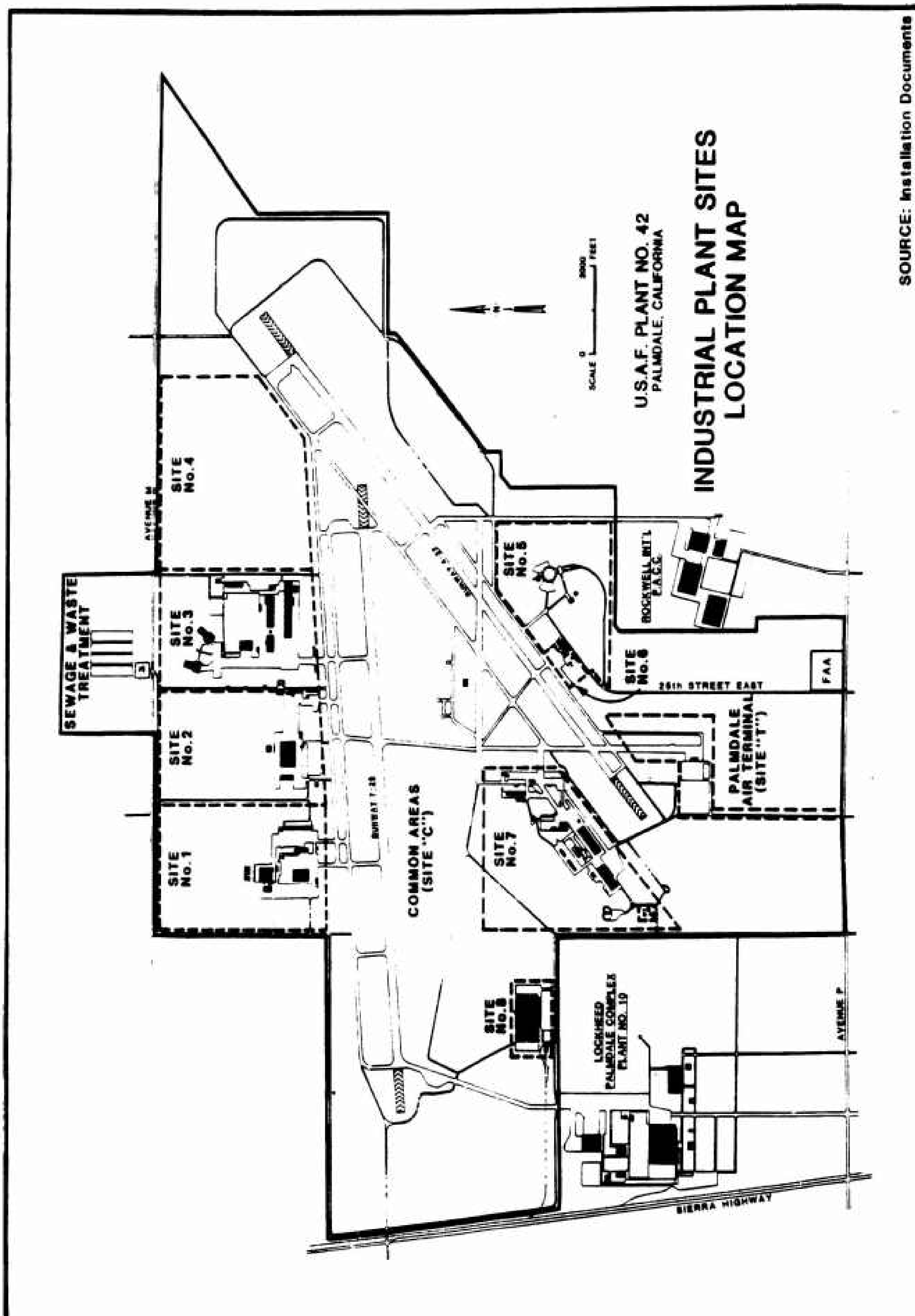
FIGURE 1.6



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42 is to provide and maintain facilities for: (1) final assembly of jet aircraft, (2) production engineering and flight testing programs, and (3) Air Force acceptance flight testing of high performance jet aircraft manufactured by DOD contractors assigned to USAF Plant 42. The AFCMD detachment commander also serves as installation commander, having responsibility for operational control, management, and maintenance of USAF Plant 42 facilities in support of the aircraft prduction programs located there.

The Palmdale Airport began as a U.S. Army Air Corps base in 1940 when the Works Progress Administration built the first concrete runways. The base was used during World War II as an emergency landing strip and for B-25 support training. The installation was declared surplus in 1946 and was purchased by Los Angeles County for use as an airport. The installation was reactivated by the Air Force in 1950 for use in final assembly and flight testing of jet aircraft, and was later repurchased from Los Angeles County.

In 1953, North American Aviation, Inc. was granted exclusive use of approximately 272 acres to support aircraft production and engineering flight testing programs. Northrop Corporation was also granted exclusive use of approximately 220 acres for a final production and Air Force acceptance flight test facility. Also during 1953, Lockheed Aircraft Corporation was authorized by the U.S. Government to construct joint use facilities and secure engineering design and architectural services. A primary result of this contract was the extension of the existing northeast-southwest runway (4-22) from 7,000 to 12,000 feet and construction of related taxiways.

After approval of the Master Plan in 1953, the Palmdale Airport officially became Air Force Plant 42 and ownership of the installation was tranferred to the Federal Government in 1954. The installation was assigned to the Aeronautical Systems Division in 1961, and officially became known as the Production Flight Test Installation, Air Force Plant No. 42, Palmdale, California, which remains the installation name today.

The eight industrial plant sites identified in Figure 1.6 are used by companies under contract with the Air Force to produce, maintain, and flight test various jet aircraft or to operate and maintain the plant industrial sites and common-use facilities. Since its activation, the following companies have had contracts at USAF Plant 42:

- o Consolidated Vultee Aircraft Company (Convair)
- o Douglas Aircraft Corporation
- o EG&G, Inc.
- o ITT Technical Services, Inc.
- o Lockheed Aircraft Corporation
- o Lockheed Air Terminal
- o Nero and Associates, Inc.
- o Northrop Aircraft Division
- o Rockwell International North American Aircraft Operations (Rockwell Aircraft)
- o Rockwell International Space Transportation and Systems Group (Rockwell Space)
- o Serv-Air, Inc.
- o Tumpane Company
- o Vinnel Corporation

Histories of individual contractors at USAF Plant 42 are summarized in Table 1.1, according to industrial plant site locations, period of operations, and primary activities.

1.6 IRP SITE IDENTIFICATION AND DESCRIPTIONS

During the Phase I (Installation Assessment/Records Search) IRP investigation, interviews were conducted with installation personnel to identify current and past disposal and spill sites at USAF Plant 42. A preliminary screening of these sites was performed, based on information obtained from the interviews and available records, to determine which sites might have potentially significant contamination, and whether contaminant migration from these sites might occur. The sites were then rated by the USAF Hazard Assessment Rating Methodology (HARM), developed jointly by the Air Force, CH2M-Hill, and Engineering-Science for specific use at Air Force facilities under the Installation Restoration Program.

TABLE 1.1
CONTRACTOR HISTORY AT USAF PLANT 42

Location	Contractor	Time Period	Primary Activities
Site No. 1	Rockwell Aircraft	1954 to 1958	XB-70 Aircraft
	Lockheed Aircraft Corporation	1958 to 1973	S-3A and F-104 Aircraft
	Rockwell Space	1973 to Present	NASA Space Shuttle
	Rockwell Aircraft*	1973 to Present	B-1 Aircraft
Site No. 2	Northrop Aircraft Division	1953 to 1958	F-89 Aircraft
	Douglas Aircraft Corporation	1958 to 1962	A4-D and A4-J Aircraft
	Rockwell Aircraft	1962 to 1964	XB-70, F-100, T-39, A3-J, & F-86 Aircraft
	Lockheed Aircraft Corporation	1964 to Present	SR-71, U-2, and TR-1 Aircraft
Site No. 3	Convair	1954 to 1961	F-102 and F-106 Aircraft
	Northrop Aircraft Division	1958 to 1963	F-89 Aircraft
	Douglas Aircraft Corporation	1959 to 1961	A-4 Aircraft
	Rockwell Aircraft	1961 to 1967	XB-70 Aircraft
	Douglas Aircraft Corporation	1967 to 1971	A-4 Aircraft
	Rockwell Aircraft	1971 to Present	B-1 Aircraft
Site No. 4	Under Construction	--	--
Site No. 5	Lockheed Air Terminal	1954 to 1963	Operations and Maintenance Contractor
	Vinnell Corporation	1963 to 1964	Operations and Maintenance Contractor
	ITT Technical Services, Inc.	1964 to 1973	Operations and Maintenance Contractor
	Tumpane Company	1973 to 1975	Operations and Maintenance Contractor
	ITT Technical Services, Inc.	1975 to 1978	Operations and Maintenance Contractor
	Serv-Air, Inc.	1978 to 1981	Operations and Maintenance Contractor
	Nero and Associates, Inc.	1981 to Present	Operations and Maintenance Contractor
Site No. 6**	E G & G, Inc.	1984 to Present	Service Contractor (Aircraft)
Site No. 7	Lockheed Aircraft Corporation*	1952 to 1972	F-104, TSV, T-33, and F-94 Aircraft
	Convair	1955 to 1957	F-102 Aircraft
	Northrop Aircraft Division	1963 to 1973	F-5 and T-38 Aircraft
	Douglas Aircraft Corporation	1970 to 1979	A-4 Aircraft
	Northrop Aircraft Division*	1973 to Present	F-5 and F-20 Aircraft
	Lockheed Aircraft Corporation	1979 to Present	TR-1 Aircraft
Site No. 8	Departmental Industrial Equipment Reserve Storage (DIERS)	1954 to 1956	Storage Warehouse
	Machinery Overhaul Company	1954 to 1966	Storage Warehouse/Maintenance
	Rockwell Aircraft	1966 to 1971	Storage Warehouse/Jet Engine Overhaul
	Lockheed Aircraft Corporation	1971 to 1983	Storage Warehouse
	Rockwell Aircraft	1983 to Present	Storage Warehouse
Terminal	Palmdale Airport	1954 to 1983	Commercial Flights
	Convair	1955 to 1957	F-102 Aircraft

* Designates Primary Tenant at Site during period indicated.
** Prior to 1984, when the sites were renumbered, Site 6 was part of Site 5.

The HARM considers four factors in assessing the hazard or risk presented by a specific site: (1) the receptors of contamination; (2) the waste and its characteristics; (3) potential pathways for contaminant migration; and (4) any efforts to contain the contaminants. Subscores are determined for each of these factors, based on a number of individual rating components, and these subscores are then totalled to determine the overall hazard rating or HARM score.

A total of 26 sites received HARM scores during the Phase I study, and 22 of these were identified for further investigation in Phase II. One additional site, which was not included in the Phase I Final Report (and therefore did not receive a HARM score), was also identified for study during Phase II. Table 1.2 presents a summary listing of all these sites investigated in the Phase II, Stage 1 investigation, along with their HARM scores from Phase I. The approximate locations of these 23 sites are shown in Figure 1.7.

The IRP sites investigated during Phase II, Stage 1 were each given a unique abbreviation (site identifier) to simplify record-keeping and reporting. These site identifiers, used throughout this report, consist of two parts separated by a hyphen. The first part is the site number, which corresponds to the priority ranking of the site based on its HARM score. The second part is a four-character code, in which the first three characters form an abbreviation of the site name and the fourth represents the site location within USAF Plant 42 ("T" for Palmdale Air Terminal area, "C" for common-use areas, and numerals from 1 to 8 for the eight industrial plant sites identified in Figure 1.6).

Following are brief descriptions of the 23 IRP sites investigated, including their histories, suspected contaminants, and other factors of concern.

1.6.1 Fuel-Contaminated Ditch (1-FCD2)

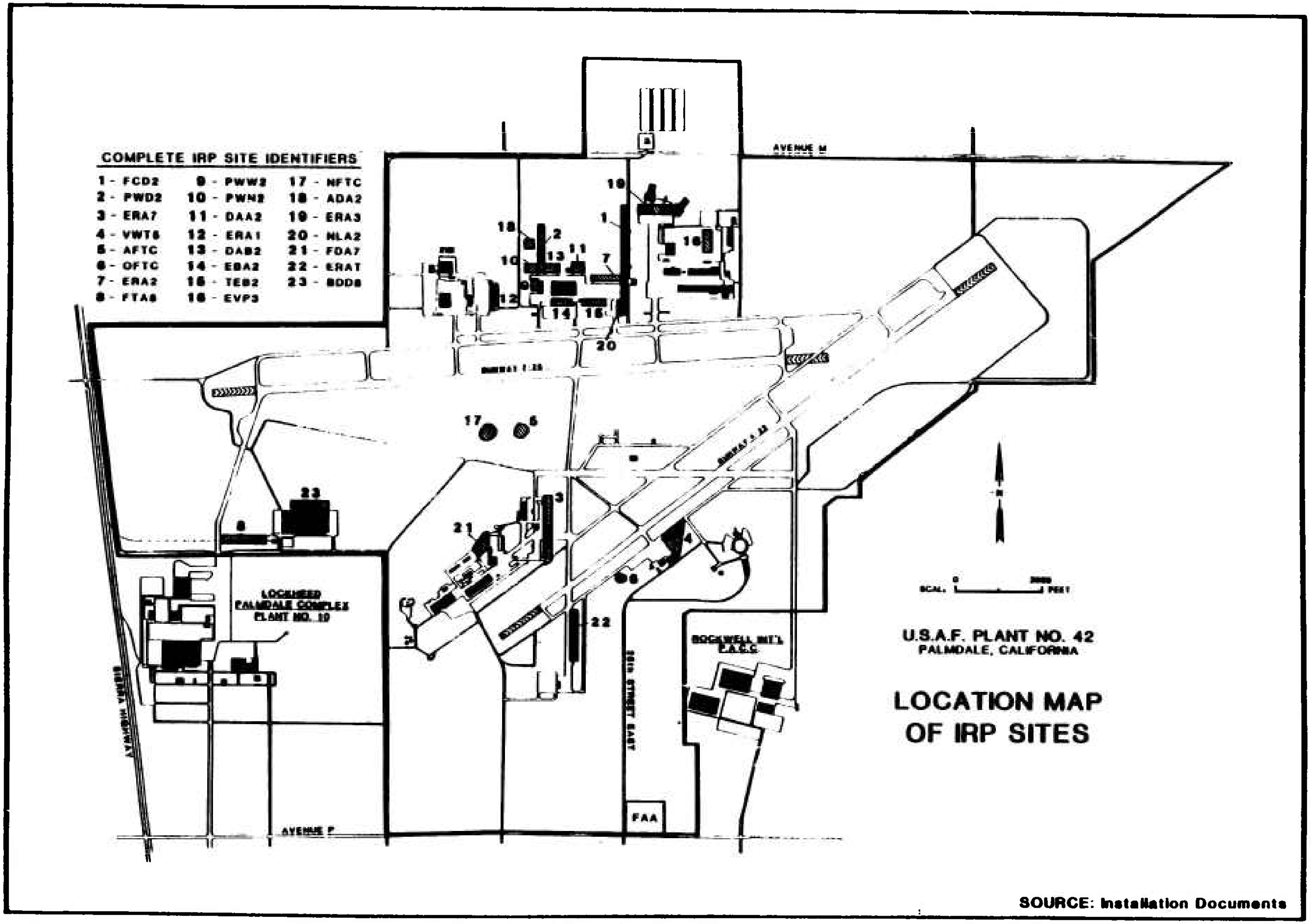
Site 1-FCD2 is a stormwater drainage ditch that flows from south to north between Sites 2 and 3, adjacent to the east fenceline of Site 2. The site location is shown in Figure 1.8. From 1954 to 1958 this ditch received waste discharges that contained JP-4, engine oil, hydraulic fluids, and solvents, in quantities estimated to average about 100 gallons per month of the commingled wastes. Subsequent sources of contamination in the ditch are thought to be related to the operation and maintenance of the SR-71 aircraft.

TABLE 1.2
SUMMARY OF SITES INVESTIGATED AT USAF PLANT 42

Site Number	Site Name/Description	Period of Use	Suspected Waste Materials Stored, Spilled, or Disposed at the Site	Phase I HARM Score
1-FDC2	Fuel-Contaminated Ditch	1954 to Present	Fuel, waste oils, solvents, hydraulic fluids	82
2-PWD2	Paint Waste Disposal Ditch	1954 to 1974	Paint residues, solvents, stripping compounds	82
3-ERA7	Engine Run-up Area in Plant Site 7	1956 to 1971	Fuel, waste oils, solvents, hydraulic fluids	71
4-VWTS	Vehicle Washrack & Leaking Underground Tank	1954 to Present	Fuel, waste oils, washrack runoff	62
5-AFTC	Abandoned Fire Training Area	1959 to 1981	Fuel, waste oils, solvents, hydraulic fluids	59
6-OFTC	Original Fire Training Area	1954 to 1959	Fuel, waste oils, solvents, hydraulic fluids	58
7-ERA2	Engine Run-up Area in Plant Site 2	1954 to Present	Fuel (JP-4 and JP-7)	55
8-FTA8	Fuel Transfer Area	1954 to 1984	Fuel (JP-7)	52
9-PWW2	Paint Waste Disposal Area-West	1954 to 1956	Paint residues, lacquer thinners, solvents	51
10-PWN2	Paint Waste Disposal Area-North	1954 to 1956	Paint residues, lacquer thinners, solvents	51
11-DAA2	Disposal Area A	1954 to 1981	Fuel, waste oils, solvents, hydraulic fluids, paint stripper	49
12-ERA1	Engine Run-up Area in Plant Site 1	Unknown	Fuel, waste oils, hydraulic fluids	48
13-DAB2	Disposal Area B	1954 to 1959	Waste photochemicals, solvents	48
14-EBA2	Engine Build-up Area	1954 to 1957	Waste oils, hydraulic fluids	48
15-TEB2	TEB Disposal Area	1964 to Present	Trietnyl borane (TEB) and hydraulic oil	48
16-EVP3	Evaporation Ponds	1963 to 1967	Nickel-cyanide plating wastes	48
17-NFTC	New Fire Training Area	1981 to Present	Fuel (JP-4)	48
18-ADA2	Abandoned Disposal Area	1954 to 1974	Construction debris, miscellaneous trash and rubble	47
19-EPA3	Engine Run-up Area in Plant Site 3	1957 to 1961	Fuels	47
20-NLA2	Noise Level Area	1954 to 1958	Fuel, waste oils, hydraulic fluids	45
21-FDA7	Fuel Disposal Area	Late 1950s	Fuels	45
22-ERAT	Engine Run-up Area at Palmdale Air Terminal	1955 to 1957	Fuel, waste oils, hydraulic fluids	45
23-BDD8	Building Ditch Discharge	1967 to 1971	Rinse water from chemical parts cleaning	*

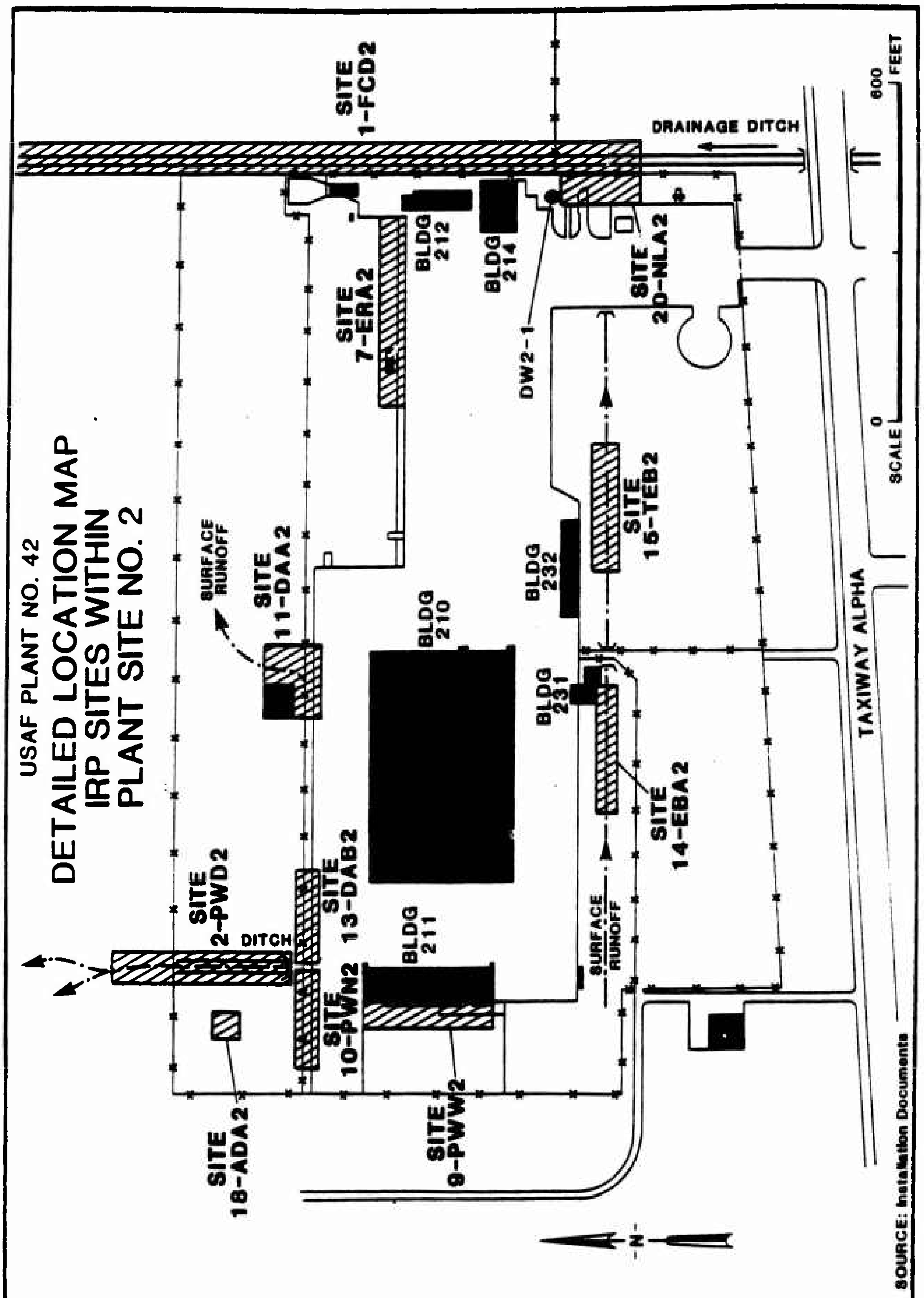
* Site 23 was not included in the Phase I investigation and therefore did not receive a HARM rating score.

FIGURE 1.7



COMPLETE IRP SITE IDENTIFIERS
1 - FCD2
2 - PWD2
3 - ERA7
4 - VWT6
5 - AFTC
6 - OFTC
7 - ERA2
8 - FTA8
9 - PWW2
10 - PWN2
11 - DAA2
12 - ERA1
13 - DAB2
14 - EBA2
15 - TEB2
16 - EVP3
17 - NFTC
18 - ADA2
19 - ERA3
20 - NLA2
21 - FDA7
22 - ERAT
23 - BDD8
AVENUE M
AVENUE P
SIERRA HIGHWAY
LOCKHEED PALMDALE COMPLEX PLANT NO. 10
ROCKWELL INT'L P.A.C.C.
FAA
U.S.A.F. PLANT NO. 42
PALMDALE, CALIFORNIA
LOCATION MAP
OF IRP SITES
SOURCE: Installation Documents

FIGURE 1.8



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Routine flightline operations result in unavoidable losses of JP-7 fuel from the SR-71 aircraft. During engine run-up operations, approximately 25 to 50 gallons of JP-7 is spilled from the aircraft. From 1964 to 1981, this fuel was washed with water along a 200 foot long concrete swale into the stormwater drainage ditch. (Local contamination around the flightline area and along the concrete swale are considered part of Site 7-ERA2.) In 1981, a 5000-gallon Herculon-lined catch basin was installed behind the flightline to capture the spilled fuel and prevent contamination of the ditch. When full, the catch basin was emptied by a contractor for disposal off USAF Plant 42 property. In 1983, the Herculon-lined catch basin was replaced by a 5000-gallon steel collection tank (originally from a tank truck) which is pumped out by a contractor on a monthly basis.

Operations in and around the Fuel Flow Test Facility (Building 214) are another possible source of JP-7 fuel contamination in the ditch. Visual evidence of surface discoloration and odors observed indicated that spilled fuel has occasionally flowed into the ditch through a concrete swale that runs along the south side of Building 214 and just north of the underground fuel-tank farm. No estimate of the quantities spilled could be made, however. Another source directly associated with the Building 214 operation is a 2000-gallon tank located within the ditch to collect JP-7 spilled during fuel-flow test operations. This tank, about 10 percent of which is below grade, is known to have overflowed approximately 150 gallons of JP-7 during May 1983. The fuel saturated soils were excavated and removed. Other possible sources in the same vicinity are the underground fuel storage area and the underground fuel pipeline that runs parallel to the ditch, east of Building 214 (see Figure 1.9).

In July 1982, six soil borings were performed within the ditch at Site 1-FCD2, as shown in Figure 1.9. These borings (numbers 7 to 12) were completed at depths ranging from 40 to 50 feet below the bottom of the ditch. Laboratory analyses revealed the presence of fuels in soil samples from all six borings, at concentrations ranging from 200 to 16,000 mg/Kg, and fuel was found at the maximum sampling depth in all but one boring (number 11). A section drawing of the site is presented in Figure 1.10 which illustrates the extent of contaminantion found in the ditch. Results from the investigation are presented in Appendix F.

USAF PLANT NO. 42

SOIL BORING LOCATION MAP FOR PREVIOUS INVESTIGATIONS AT IRP SITES 1-FCD2 AND 7-ERA2

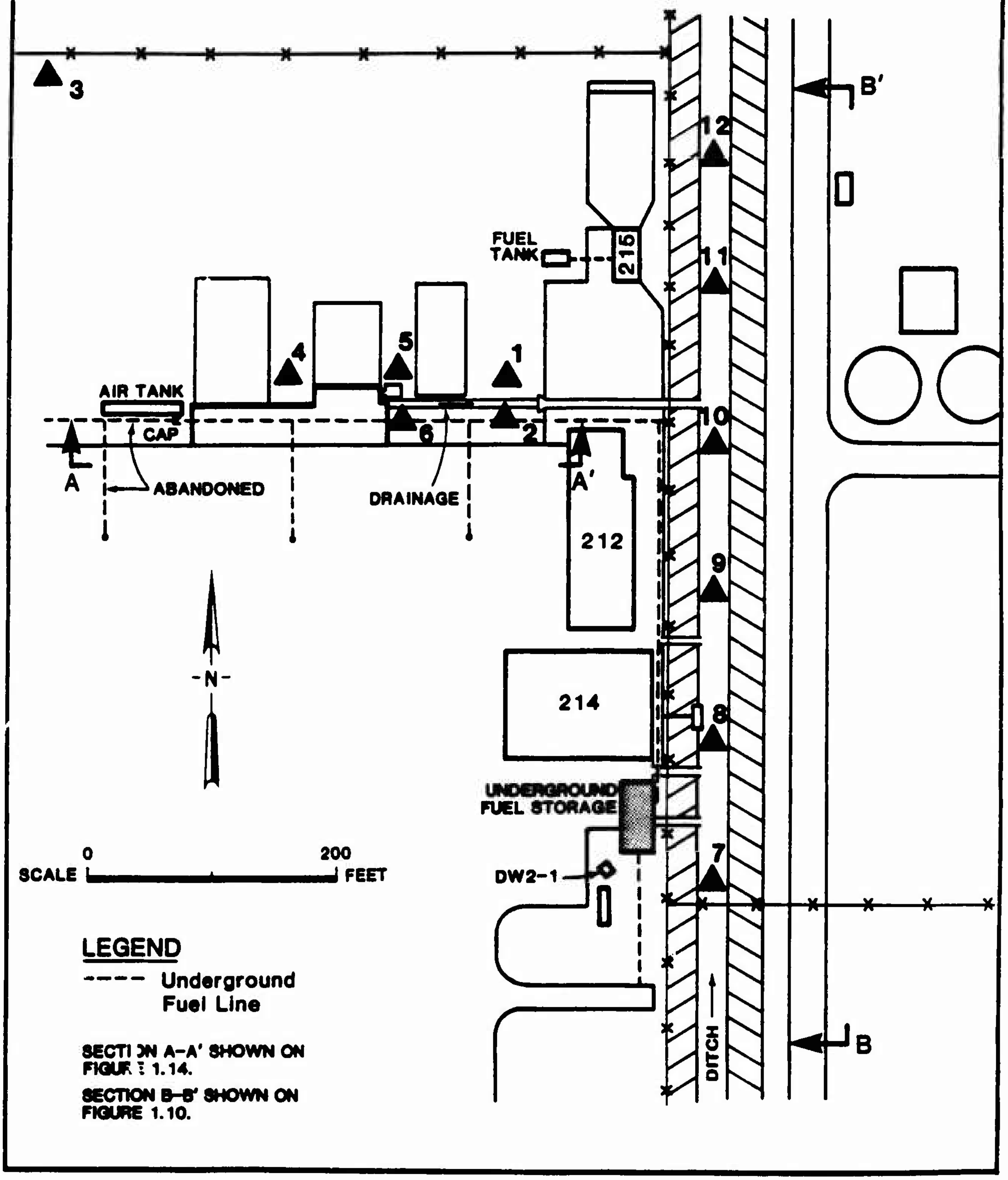
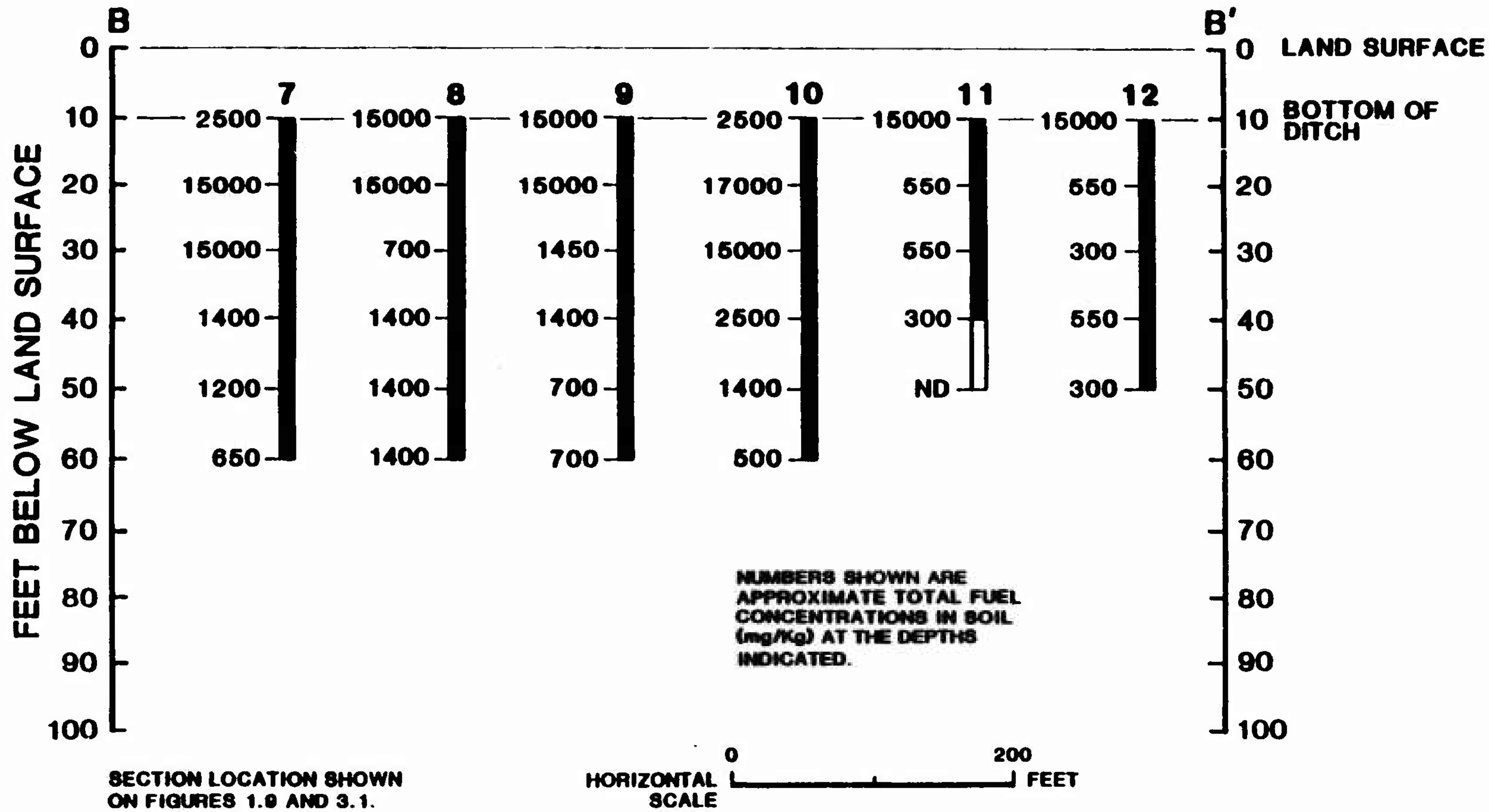


FIGURE 1.10

USAF PLANT NO. 42

VERTICAL SECTION OF IRP SITE 1-FCD2 BASED ON RESULTS OF PREVIOUS INVESTIGATIONS



Cleanup and Abatement Order No. 83-1 was issued on January 11, 1983 by the California Regional Water Quality Control Board, Lahontan Region. A Draft Problem Exploration, Confirmation, and Quantification Presurvey Report was completed for this site.

1.6.2 Paint Waste Disposal Ditch (2-PWD2)

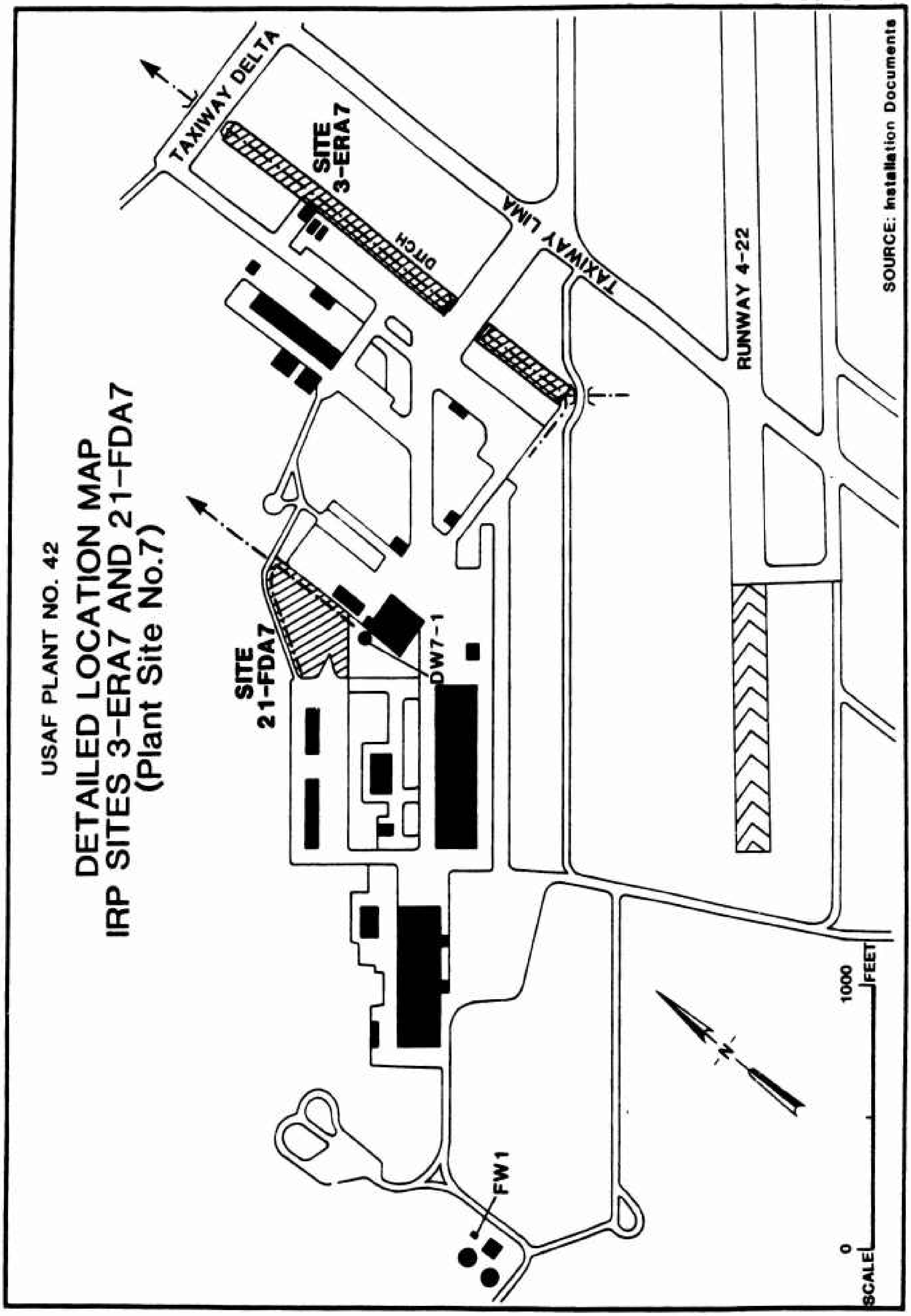
Site 2-PWD2 is a ditch running approximately north and south, located north of the paint hanger (Building 211) within Site 2, as shown in Figure 1.8. This ditch was used for disposal of wastes from the aircraft painting operations in Building 211 from approximately 1954 to 1974. About once every two weeks during the period from 1954 to 1958, approximately 250 gallons of commingled paint strippers, methyl-ethyl ketone, toluene, and paint residues were rinsed down the floor drain with washwater and out through a concrete culvert into the ditch. Shop personnel interviewed during Phase I reportedly assumed that this ditch was also used from 1958 to 1972 for disposal of waste paints, strippers, and desealant solvents, with approximately the same quantities being generated. From 1972 to 1974, two U-2 aircraft per year were stripped and painted in Building 211. Approximately 150 to 200 gallons of the paint stripper, Cee Bee, were rinsed with washwater into the ditch each time an aircraft was repainted. After 1974, an underground collection sump installed in Building 211 was used to collect waste materials (approximately 3000 gallons per month of rinsewater and waste) for disposal off USAF Plant 42 property.

1.6.3 Engine Run-up Area in Plant Site 7 (3-ERA7)

Site 3-ERA7 is located directly east of Site 7, in and along the stormwater drainage ditch running from south to north just outside the Site 7 fenceline, as shown in Figure 1.11. From 1956 to 1971, this ditch received approximately 20 gallons per day of wastes consisting of JP-4, engine oils, hydraulic fluids, and spent solvents from the engine run-up operations. Archival photographs indicate soil discoloration in the ditch north of the aircraft taxiway into Plant Site 7. From these photographs, approximately 600 linear feet of the ditch appeared to be contaminated.

1.6.4 Vehicle Washrack and Leaking Underground Tank (4-VWT5)

Site 4-VWT5 covers the area immediately east of Building 531 in Site 5 and extends north and east along a drainage ditch leading from



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the vehicle washrack located adjacent to Building 531, as shown in Figure 1.12. Since 1954, engine dirt, oils, fuels, and detergents from the vehicle washrack located adjacent to Building 531 have been washed into the drainage ditch. An underground waste oil tank located just east of the washrack was used to collect waste engine oils, hydraulic fluids, and small quantities of spent solvents from maintenance operations in Building 531. In 1983 this tank was found to be leaking and was taken out of commission. The tank was excavated and removed along with the visibly contaminated soil in its vicinity. The amount of material lost from the tank was not determined, nor was the amount of wastewater from the washrack estimated, although several vehicles are typically washed every weekday.

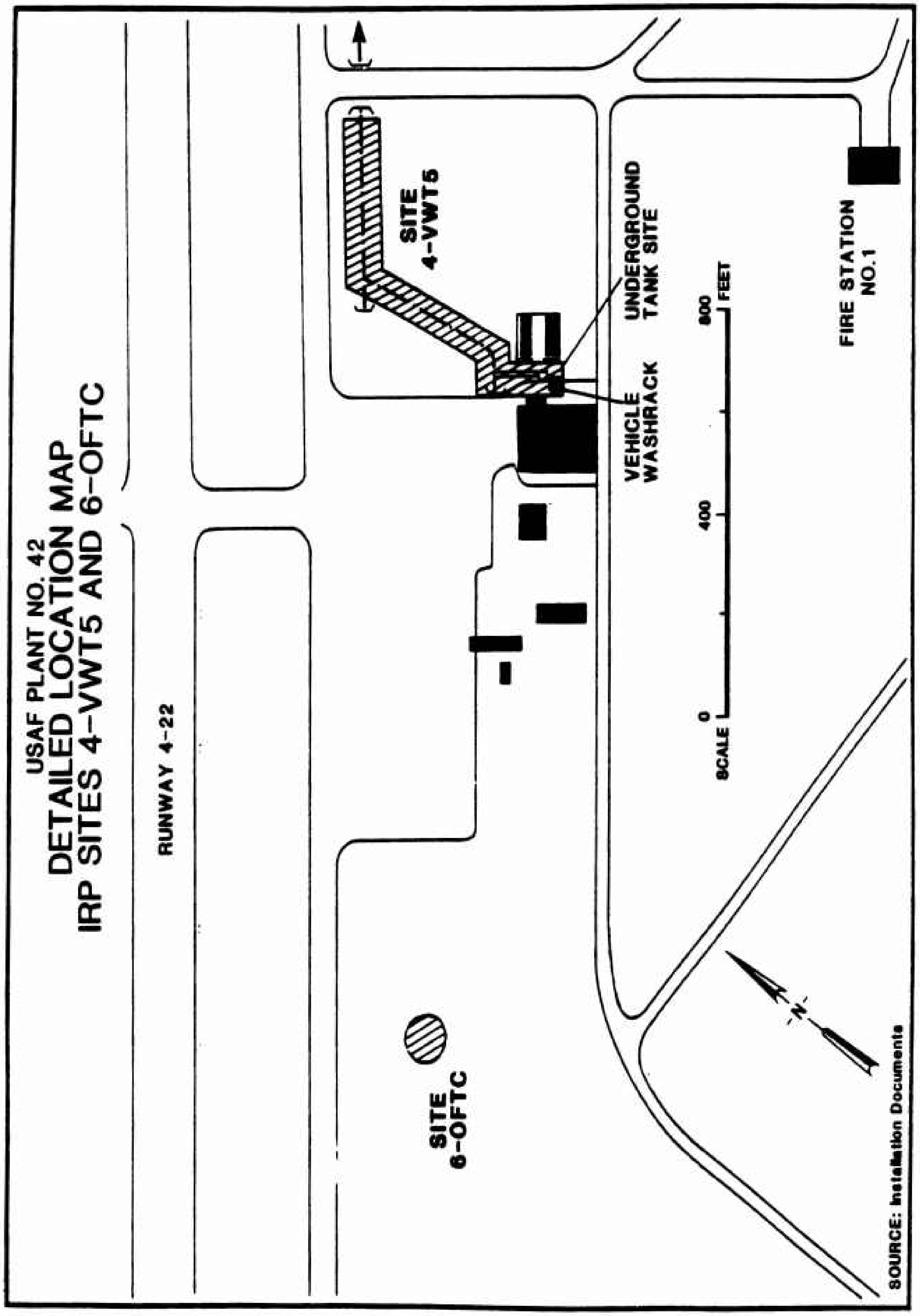
1.6.5 Abandoned Fire Training Area (5-AFTC)

Site 5-AFTC was used for fire department training activities from 1959 to 1981. As shown in Figure 1.13, this fire training area was located between Site 7 and Runway 7-25, and was laid out in a circular pattern approximately 100 feet in diameter. From 1959 to 1973, this area was used for disposal of 550 to 800 gallons of fuels, engine oil, hydraulic fluids, and spent solvents during fire department training activities conducted six times per quarter. Some waste materials were collected by the fire department and some were brought to the fire training area by contractors from the various plant sites. After 1973, fire department training activities were conducted approximately six times each quarter, using only 300 to 500 gallons of clean JP-4. While most of the material placed at this site was probably consumed in the fires, some percolation into the ground may have occurred.

1.6.6 Original Fire Training Area (6-OFTC)

Site 6-OFTC was used from 1954 to 1959 to conduct fire department training activities. Located approximately 500 feet southwest of Site 6 and 200 feet from the old Taxiway 3 (parallel to Runway 4-22), this fire training area was laid out in a circular pattern approximately 100 feet in diameter, as shown in Figure 1.12. Fuels, engine oils, hydraulic fluids, and solvents were brought to the area in 55-gallon drums and 300 gallon bowsers. Spent solvents from the city of Palmdale dry cleaners were also reportedly brought to the area. Approximately once each week, this area was used for disposal of 1100 gallons of wastes during fire

FIGURE 1.12



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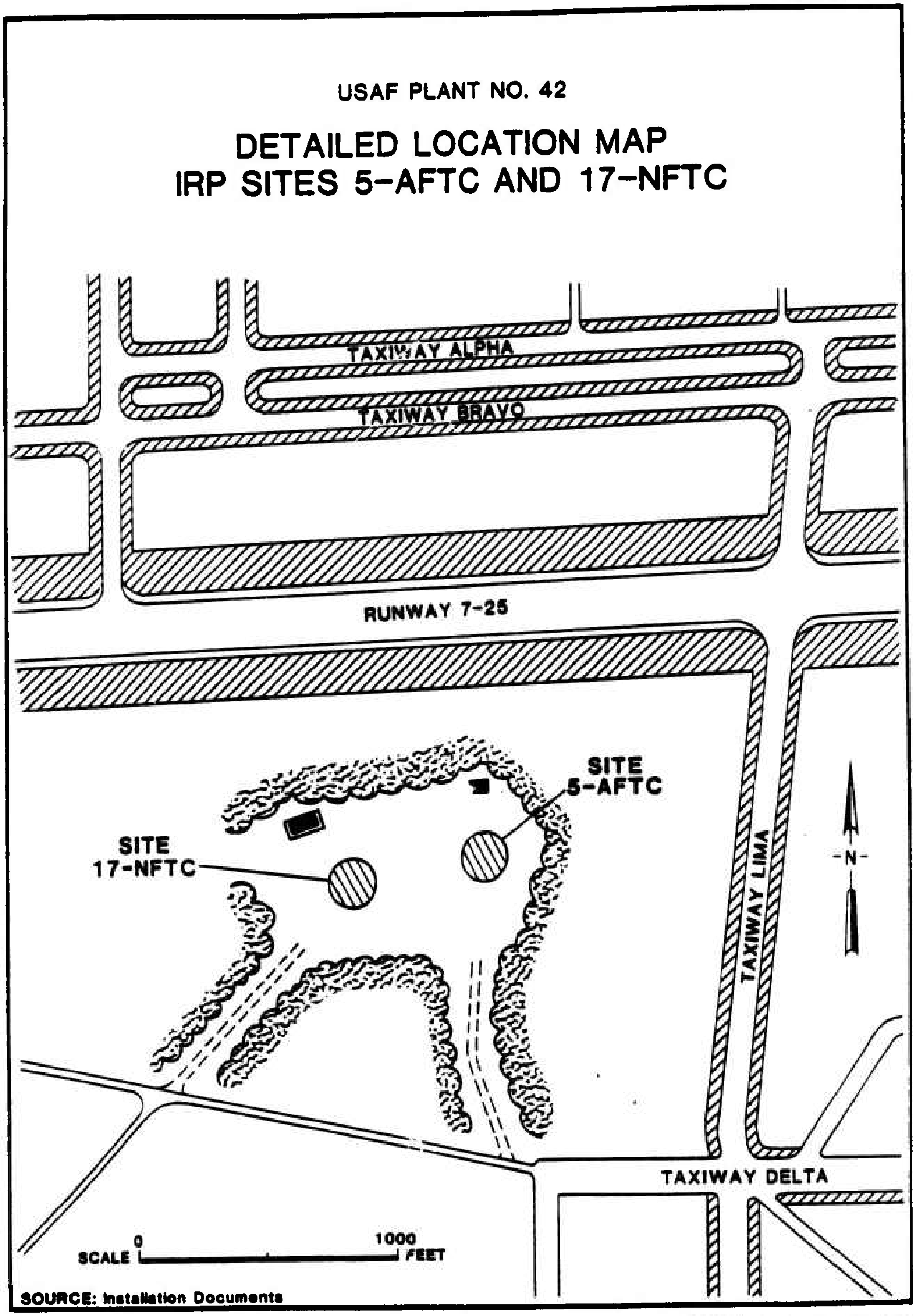

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department training exercises. While most of the material placed at this site was probably consumed in the fires, some percolation into the ground may have occurred.

1.6.7 Engine Run-up Area in Plant Site 2 (7-ERA2)

Site 7-ERA2 is the area located behind (north) of the flightline in Site 2, including the concrete drainage swale running east from the SR-71 engine run-up stands to the drainage ditch that was previously discussed as Site 1-FCD2. The extent and location of Site 7-ERA2 is shown in Figure 1.8. The entire area behind the flightline was used sporadically for disposal of recovered fuels, engine oils, and hydraulic fluids from approximately 1954 to 1962. When Lockheed moved into Site 2 in 1964, an underground fuel pipeline leaking JP-4 was discovered and repaired, and the portion of the fuel line extending west from the SR-71 engine run stands was taken out of service and capped off (see Figure 1.9). The quantity of JP-4 that was lost is not known. In 1978, a section of the fuel line was replaced after JP-7 was discovered to be leaking in the same area. The total area of suspected contamination is approximately 300 feet long and 5 feet wide.

In July 1982, six soil borings were performed at this site, as shown in Figure 1.9. These borings (numbers 1 to 6) were all completed at a depth of 50 feet below land surface. No contaminants were detected in borings 3 and 4; but all the other borings contained fuel at concentrations ranging from 300 to 15,000 mg/Kg, and fuel was detected at the maximum sample depth (50 feet) in each of these. A section drawing of the site is presented in Figure 1.14 which illustrates the extent of contamination found at this site. Results from the investigation are presented in Appendix F.

1.6.8 Fuel Transfer Area (8-FTA8)

Site 8-FTA8 is located along the railroad tracks between Site 8 and Taxiway Victor (which leads to Lockheed Plant 10), as shown in Figure 1.15. This area was used to transfer JP-7 from railcars into fuel trucks for distribution to Site 2. Small quantities of fuel reportedly were spilled from the fuel hoses during the transfer process, although no major spills are known to have occurred. This area was expanded and modified in 1984 to accommodate a new railcar unloading facility. While the original railbed was maintained, much of the area was disturbed by excavation required to add new sidings and modify a drainage ditch.

FIGURE 1.14

USAF PLANT NO. 42

VERTICAL SECTION OF IRP SITE 7-ERA2 BASED ON RESULTS OF PREVIOUS INVESTIGATIONS

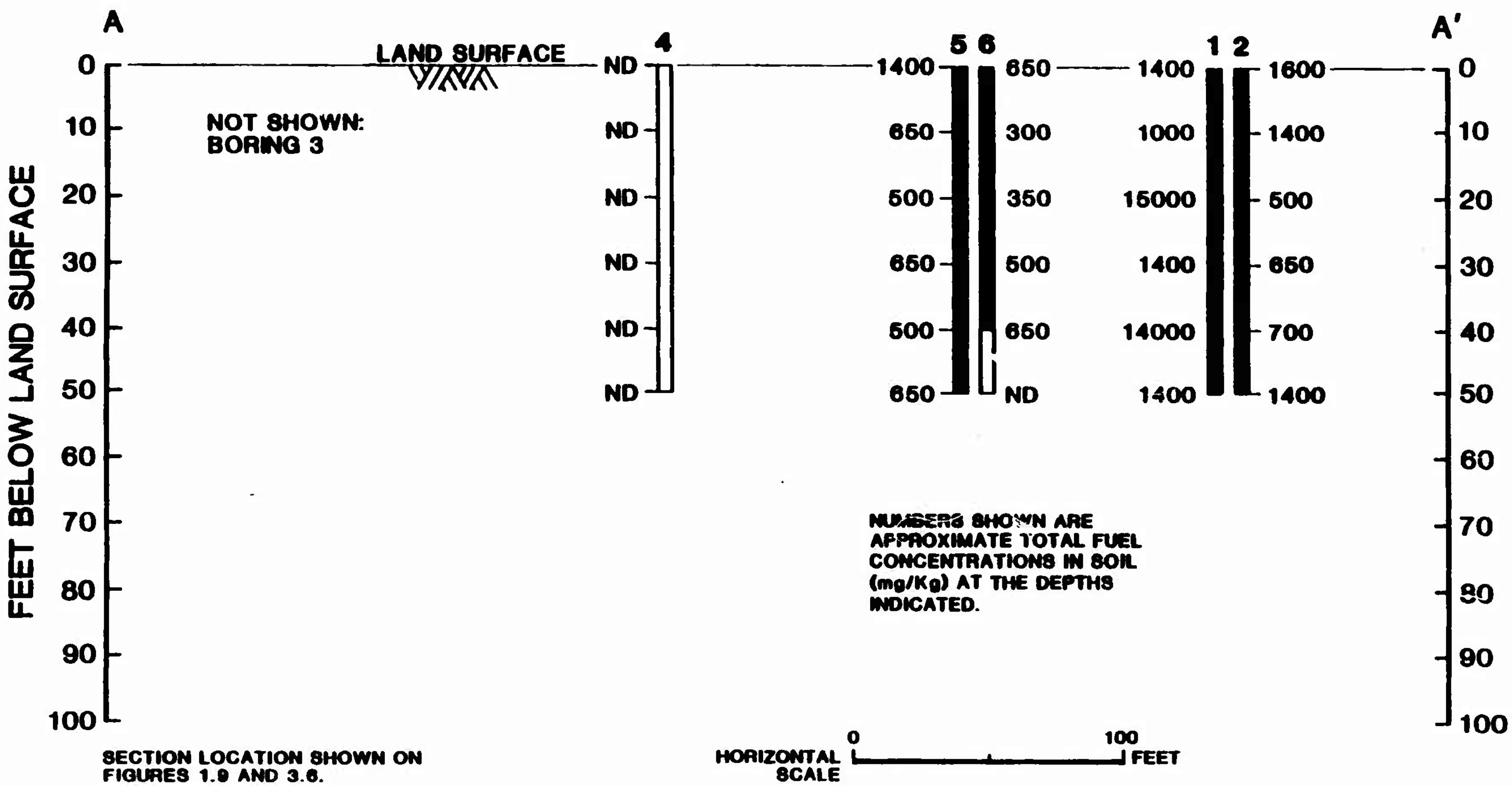

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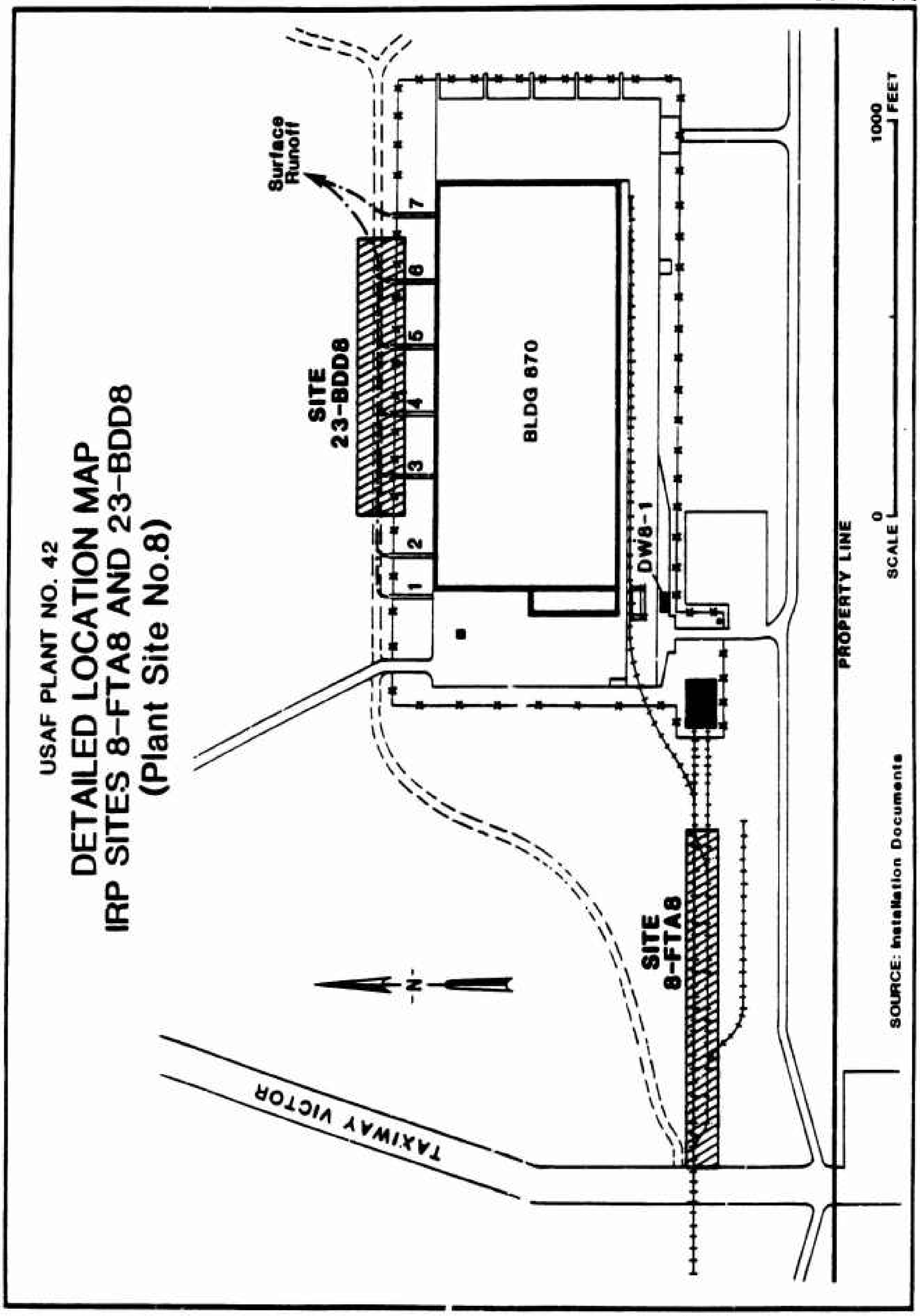
FIGURE 1.15



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1.6.9 Paint Waste Disposal Area - West (9-PWW2)

Site 9-PWW2 is located immediately west of Building 211, as shown in Figure 1.8. From 1954 to 1956, the site was reportedly used by shop personnel for disposal of paint residues and lacquer thinners generated while cleaning paint guns in Building 211. Approximately 20 gallons of waste materials were generated each day that may have been discharged in this area.

1.6.10 Paint Waste Disposal Area - North (10-PWN2)

Site 10-PWN2 is located north of Building 211, just off the pavement and outside the fence, as shown in Figure 1.8. This site was reportedly used by shop personnel for disposal of lacquer thinners, methyl-ethyl ketone, toluene, and other paint residues from 1954 to 1956. Approximately 25 gallons of wastes were generated each day that may have been discharged in this area.

1.6.11 Disposal Area "A" (11-DAA2)

Site 11-DAA2 is located just off the pavement and outside the fence north of the northeast corner of Building 210, as shown in Figure 1.8. From 1954 to 1981, this area received sporadic discharges of recovered fuels, hydraulic fluids, engine oils, spent solvents, and paint strippers. No information is available on the quantities discharged.

1.6.12 Engine Run-up Area in Plant Site 1 (12-ERA1)

Site 12-ERA1 was reportedly used for sporadic disposal of fuels, engine oils, and hydraulic fluids. Located east of the blast fences along the eastern side of Site 1, as shown in Figure 1.16, the site is now a paved parking area. No information on dates of operation or waste quantities is available.

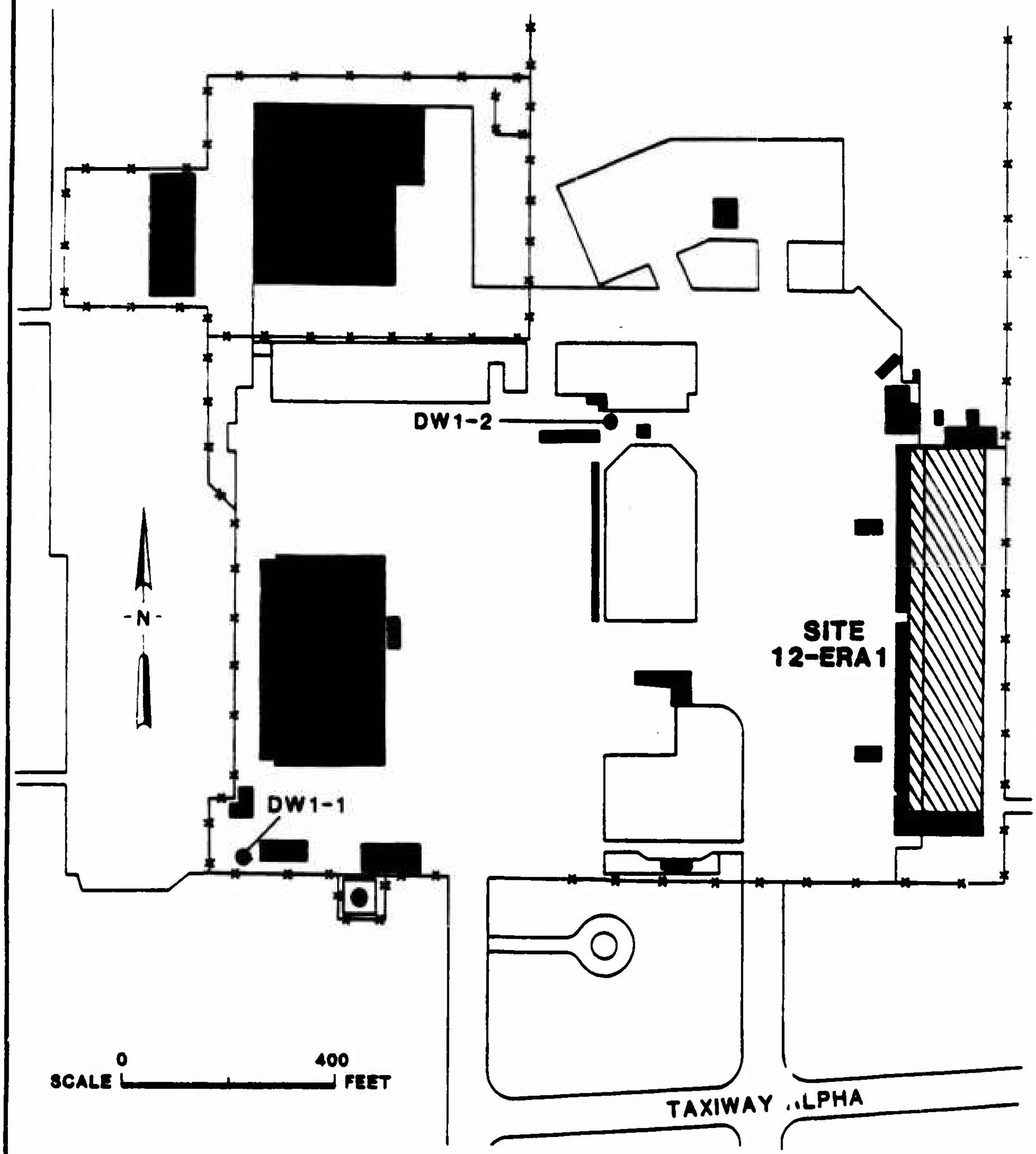
1.6.13 Disposal Area "B" (13-DAB2)

Site 13-DAB2 is located just off the pavement and outside the fence north of the northwest corner of Building 210, as shown in Figure 1.8. This area was used sporadically for disposal of photochemicals from the photolab and detergent wastes from the fire department from 1954 to 1958. This same area was also used for periodic disposal of spent solvents from the garage during the period from 1965 to 1969. No information is available on the quantities disposed.

FIGURE 1.16

USAF PLANT NO. 42

DETAILED LOCATION MAP
IRP SITE 12-ERA1
(Plant Site No.1)



SOURCE: Installation Documents

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1.6.14 Engine Build-up Area (14-EBA2)

Site 14-EBA2 is located along a ditch south and west of Building 231 (which currently houses a carpentry shop) and is shown in Figure 1.8. From 1954 to 1957 this area was used for engine build-up operations, and engine oils and hydraulic fluids reportedly drained into the ditch along with surface runoff. No information is available on quantities discharged.

1.6.15 TEB Disposal Area (15-TEB2)

Site 15-TEB2 has been used since 1964 for disposal of a mixture of triethyl borane (TEB) and hydraulic oil which was used to ignite JP-7 in the SR-71 aircraft. The area is located to the south and east of Building 232, as shown in Figure 1.8. Roughly four times per year, this area was used for disposal of 5 gallons of commingled TEB and hydraulic oil. Unused or old mixtures of TEB and hydraulic oil can be either stable or pyrophoric depending on the ratio of the two materials in the mixture. When the mixture ignites, most of the hydraulic oil and TEB are probably destroyed, but some may have percolated into the ground.

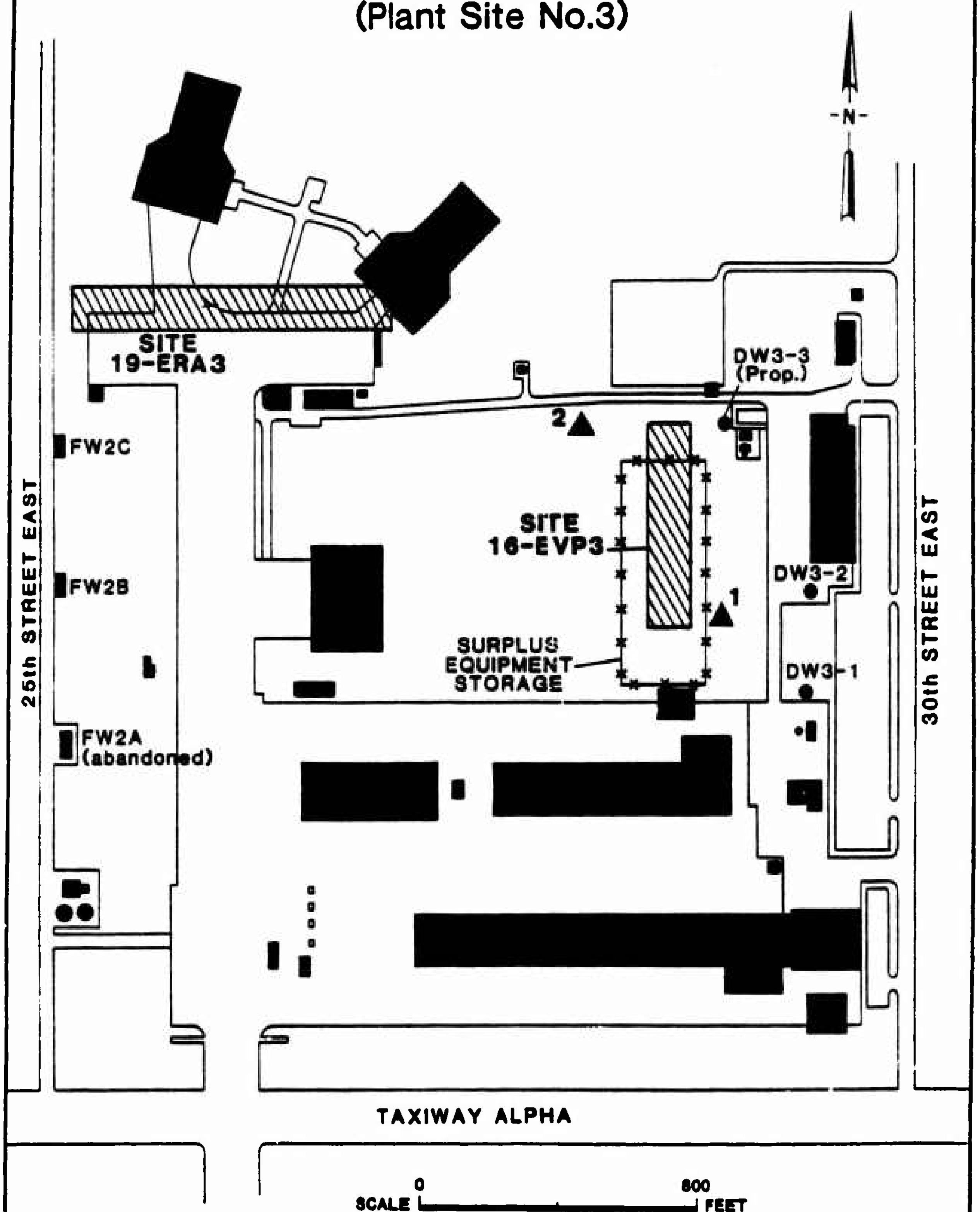
1.6.16 Evaporation Ponds (16-EVP3)

Site 16-EVP3 is located in the open area north of Building 307, as shown in Figure 1.17. From 1963 to 1967 this area was used to recover nickel from nickel-plating wastewaters generated during the XB-70 program. Aircraft parts were nickel plated in a batch system, and spent nickel-plating wastewater was hauled by truck to shallow plastic-lined evaporation ponds constructed in the area. After evaporation, the crystallized nickel plating waste residues were collected and recycled. Upon completion of the XB-70 program, the ponds were reportedly emptied, waste materials were hauled off USAF Plant 42 property, and the ponds were graded level.

In July 1985, two 50 foot soil borings were made in the vicinity of the site. Their approximate location is indicated by the triangles shown in Figure 1.17. Soil samples collected at three and ten foot depths from both borings were analyzed and all contained less than the threshold limit concentrations for both total and soluble heavy metals under the California hazardous waste regulations (CA Title 22:66699). Results from this investigation are presented in Appendix F.

USAF PLANT NO. 42

DETAILED LOCATION MAP
IRP SITES 16-EVP3 AND 19-ERA3
(Plant Site No.3)



SOURCE: Installation Documents

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1.6.17 New Fire Training Area (17-NFTC)

Site 17-NFTC is located near Site 5-AFTC in the common-use area between Site 7 and Runway 7-25, as shown in Figure 1.13. The fire training facilities at this site consist of a large (approximately 200 foot diameter) burning area that has around its perimeter a series of fuel hydrants connected by underground lines to a tank-trailer supply of JP-4. This facility was constructed in 1981 to replace a similar operation at Site 5-AFTC. Approximately six times per quarter, 300 to 500 gallons of clean JP-4 are burned during fire department training activities. While most of the fuel is probably consumed in the fires, some may percolate into the ground.

1.6.18 Abandoned Disposal Area (18-ADA2)

Site 18-ADA2 is located west of Site 2-PWD2, approximately 300 feet north of Building 211, as shown in Figure 1.8. The surrounding area was used from 1954 to 1974 for disposal of concrete and asphalt rubble, asbestos blast fencing, wooden crates, rubber hoses, drums (both empty and partially full), galvanized siding, light poles, fencing, and miscellaneous metals. The main feature at the site is a diked enclosure, constructed of steel drums and dirt, which was reported used to burn refuse from approximately 1968 to 1974. From 1979 to 1981, a cleanup campaign was conducted and several drums were removed for disposal off USAF Plant 42 property.

1.6.19 Engine Run-up Area in Plant Site 3 (19-ERA3)

Site 19-ERA3 is located in the northwest quadrant of Site 3, in the vicinity of the two hush-houses, as shown in Figure 1.17. The area was used for engine run-up tests from 1957 to 1961, and sporadic discharges of waste fuel were reportedly made along the northern edge of the flight apron.

1.6.20 Noise Level Area (20-NLA2)

Site 20-NLA2 is located south of the underground fuel-tank farm in Site 2, and includes the area surrounding the concrete ramp that extends east from the flightline, as shown in Figure 1.8. From 1954 to 1958, fuels, engine oils, and hydraulic fluids were periodically dumped onto the ground adjacent to the end of the ramp. The ramp is now used as a parking area for fuel trucks containing JP-7 and JP-4, but it was once used as a truck fill station servicing the underground fuel-tank farm.

1.6.21 Fuel Disposal Area (21-FDA7)

Site 21-FDA7 is located within Site 7, between the hazardous-waste storage facility and the drainage ditch to its north, as shown in Figure 1.11. The hazardous waste storage pad was used for aircraft fuel-flow testing during the late 1950's, and small quantities of waste fuels were reportedly discharged in the adjacent area.

1.6.22 Engine Run-up Area at the Palmdale Air Terminal (22-ERAT)

Site 22-ERAT is located along the eastern edge of the north-south taxiway leading to the Palmdale Air Terminal, as shown in Figure 1.18. This was used as an engine run-up area from 1955 to 1957, during which time fuels, engine oil, and hydraulic fluid were reportedly discharged in the adjacent area.

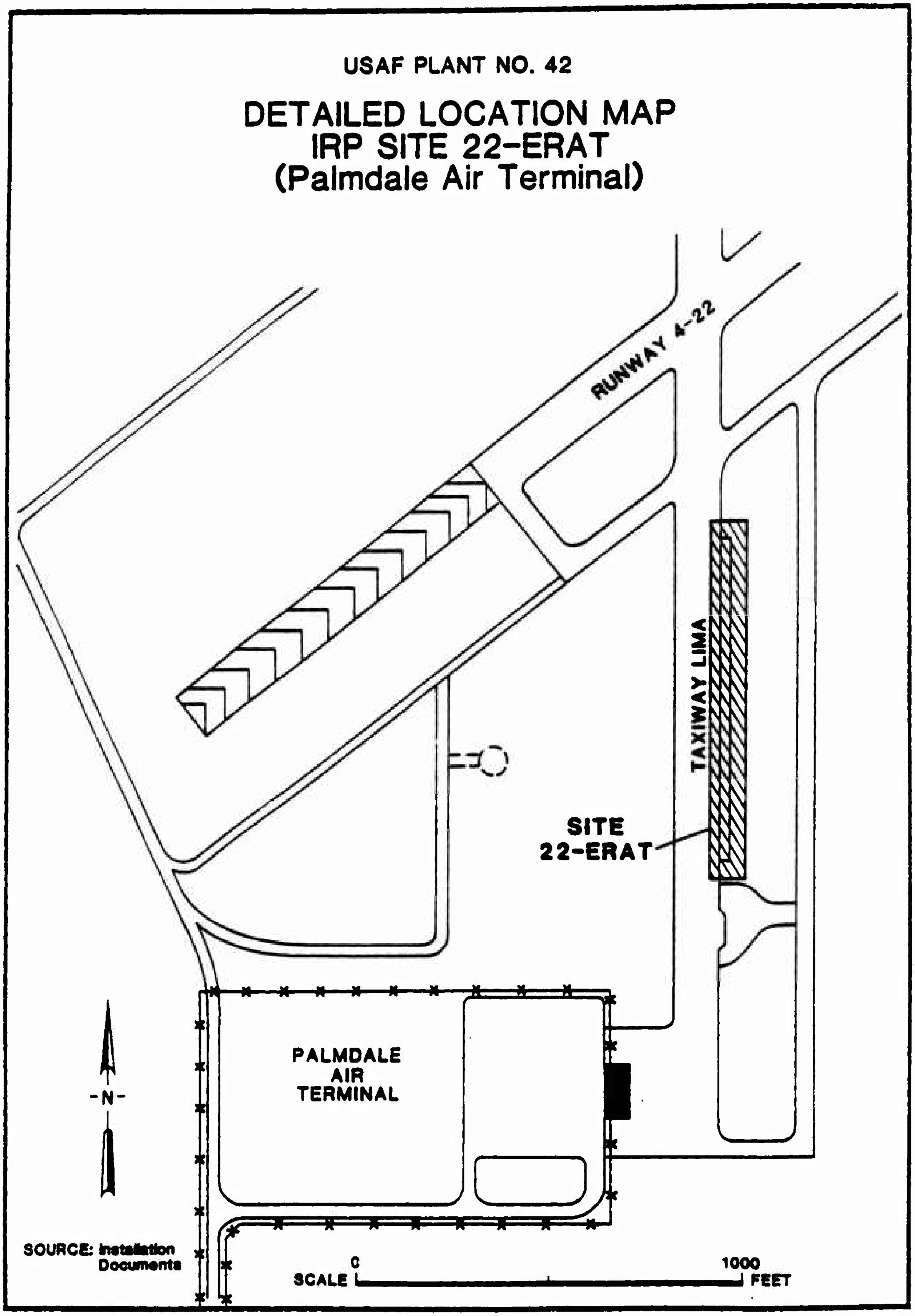
1.6.23 Building Ditch Discharge (23-BDD8)

Site 23-BDD8 is located outside the Site 8 fence, north of Building 870, as shown in Figure 1.15. During the period from 1967 to 1971, Building 870 housed a jet engine overhaul operation that included a parts-cleaning section. The cleaning operations included hot carbon remover, emulsion cleaner, alkaline rust remover, acid scale conditioner, alkaline permanganate, and nitric acid bath. These steps were each followed by cold water rinses. The resulting rinse water was discharged from Building 870, without treatment, to a percolation trench located north of the Site 8 fenceline (near the discharge of the third concrete drainway counted from the west end of the building). About 43,000 gallons per day of rinse water was discharged in this manner, under the approval of the Lahonton Regional Water Quality Control Board. Effluent limits established for this discharge were: 500 ppm total dissolved solids, 0.05 ppm hexavalent chromium, 1.4 ppm fluoride, and 70 percent sodium-adsorption ratio. The exact location and construction details of the percolation ditch were not determined, and the area today appears relatively undisturbed with no visible evidence of surface contamination or vegetative distress.

1.7 PROFILE OF SUSPECTED CONTAMINANTS

The Phase II, Stage 1 field investigation program at USAF Plant 42, described in Section 3.0, involved the collection and analysis of soil and groundwater samples from the 23 IRP sites. Samples were analyzed

FIGURE 1.18



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for a variety of suspected contaminants, based upon the individual site histories. These were:

Organics	Metals
Halogenated Volatile Organics	Arsenic (As)
Aromatic Volatile Organics	Barium (Ba)
Total Petroleum Hydrocarbons	Cadmium (Cd)
Total Oil & Grease	Chromium (Cr)
Total Cyanides	Lead (Pb)
Total Phenolics	Mercury (Hg)
Organochlorine Pesticides	Selenium (Se)
Polychlorinated Biphenyls (PCBs)	Silver (Ag)
	Nickel (Ni)
	Copper (Cu)
	Iron (Fe)
	Manganese (Mn)
	Zinc (Zn)

1.8 FACTORS OF CONCERN

The major environmental and public health concern at USAF Plant 42 is that spills or waste disposal practices may potentially result in contamination of groundwater supplies. As discussed in Section 2.0, groundwater in the Antelope Valley supplies both drinking water and agricultural irrigation. Continued growth in the area has resulted in greater demands for water, yet recharge to groundwater supplies is limited. Therefore, careful management and conservation of groundwater resources, including prevention and detection of contamination problems, is critically important.

The primary concern is whether contaminants may potentially migrate off USAF Plant 42 property and affect private or public wells used for drinking water supply. Also of importance is the potential for contamination of drinking water supply wells located on USAF Plant 42 property.

1.9 PROJECT TEAM

Engineering-Science, Inc. (ES) served as prime contractor to the Air Force in conducting the IRP Phase II, Stage 1 investigation at USAF Plant 42. The ES Project Team consisted of the following professionals:

- Dennis R. Kasper - Ph.D. in Environmental Engineering, M.S. in Civil Engineering, B.S. in Civil Engineering; Registered Professional Engineer (Arizona, California); 20 years professional experience; served as Project Manager.

- Ernest J. Schroeder - M.S. in Sanitary Engineering, B.S. in Civil Engineering; Registered Professional Engineer (Louisiana, Arkansas, Georgia, and Texas); 20 years professional experience; served as Technical Director.

- Mark A. Guthrie - M.S.C.E. in Environmental Engineering, B.S.E in Civil Engineering; Registered Professional Engineer (Florida, Georgia); 8 years professional experience; served as Environmental Engineer and Project Team Leader.

- Craig L. Sprinkle - M.S. in Geochemistry; B.S. in Civil Engineering; B.A. in Geology; 13 years professional experience; served as Geochemist and Hydrogeologist.

- Walker J. Duncan - B.S. in Geology; 10 years professional experience; served as Hydrogeologist.

- Laurel J. Izmirian - M.S. in Hydrology; A.B. in Geology; 2 years professional experience; served as Field Geologist.

- George Pilja - M.S. in Hydrogeology; B.S. in Geotechnics; 25 years professional experience; served as Field Geologist.

- Edward L. Grunwald - M.S. in Public Health (Toxicology), B.S. in Bacteriology; 8 years professional experience; served as Project Health and Safety Officer.

- Duane R. Boline - Ph.D. in Analytical Chemistry; M.S. in Chemistry; B.S.E. in Physical Science; 18 years professional experience; served as Project Quality Assurance Officer.

Complete biographical data on these individuals is presented in Appendix C.

Layne-Western Company (Bakersfield, California) performed the soil boring and split-spoon sampling activities, as a drilling subcontractor to Engineering-Science.

Laboratory analyses were performed by International Technology Analytical Services (Cerritos, California), an analytical subcontractor to Engineering-Science.

SECTION 2.0

ENVIRONMENTAL SETTING

SECTION 2.0

ENVIRONMENTAL SETTING

This section describes the environmental setting of USAF Plant 42, with primary emphasis on the features that influence contaminant migration, especially where potential exists for contaminants to move off Air Force property. A summary of the environmental setting is presented at the end of this section.

2.1 LOCATION

USAF Plant 42 is located in the high desert region of southern California, in the northeast portion of Los Angeles County, about 80 miles from the City of Los Angeles (see Figures 1.2 and 1.3). Situated between the communities of Palmdale and Lancaster in the southern corner of Antelope Valley, USAF Plant 42 is on the western fringes of the Mojave Desert.

2.2 METEOROLOGY

The climate within the Antelope Valley is typical of the arid southwest. Daily minimum and maximum air temperatures range from 30 to 60°F in the winter months, and from 55 to 95 °F in the summer months. A summary of meteorological data from USAF Plant 42 is presented in Table 2.1. Precipitation occurs mostly between November and April, and the average annual precipitation as rainfall is about five inches. Precipitation can be intense at times. As shown on Table 2.2, heavy rains of four to six inches over a 7-day period have occurred at the Palmdale gauge (about two miles southwest of USAF Plant 42). Rainfall intensities at USAF Plant 42 may be somewhat less, however, due to its greater distance from the mountains. Winds at USAF Plant 42 are generally from the southwest at speeds of 15 mph or less (USDC, 1974); winds in excess of 50 mph have a recurrence interval of about 25 years (USDA, 1970).

TABLE 2.1

SUMMARY OF METEOROLOGICAL DATA FROM USAF PLANT 42

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(a) Temperature, °F												
Normal Maximum	58	61	67	74	81	89	98	97	92	80	68	59
Normal Minimum	31	34	38	44	50	57	65	63	57	48	37	33
(b) Precipitation, inches												
24-hour maximum	1.54	1.33	1.20	0.91	0.25	0.29	0.56	1.55	0.67	0.81	2.52	1.32
Mean rainfall	1.13	0.82	0.58	0.39	0.06	0.03	0.07	0.12	0.16	0.21	0.88	0.71
Mean snowfall	2.3	trace	0.1	trace	0	0	0	0	0	trace	0.5	0.7

(a) Source: USDA (1970) at Palmdale, CA for period 1931-1960.

(b) Source: USDC (1974) at Palmdale Airport for period 1948-1973.

TABLE 2.2
SELECTED PRECIPITATION DATA FOR PALMDALE, CALIFORNIA

Date or Period	Total Rainfall (inches)	Maximum 24-hr Rainfall (inches)
1934 Oct 18	1.63	1.63
1935 Aug 25-27	1.28	0.52
1936 Dec 25-31	3.71	1.32
1938 Feb 28-Mar 4	5.57	2.39
Dec 14-22	4.76	1.07
1939 Sep 25-26	1.62	1.02
1941 Mar 1-5	2.76	1.28
1942 Aug 10	1.05	1.05
1943 Jan 22-27	5.48	2.40
Dec 10-12	4.51	3.43
1944 Feb 20-26	6.61	2.43
Nov 10-15	2.76	1.11
1946 Nov 12-14	2.84	1.63
1952 Jan 13-18	6.04	2.44
1958 Apr 1-7	2.26	0.88
1962 Feb 7-16	4.27	1.22

Source: Bloyd, 1967

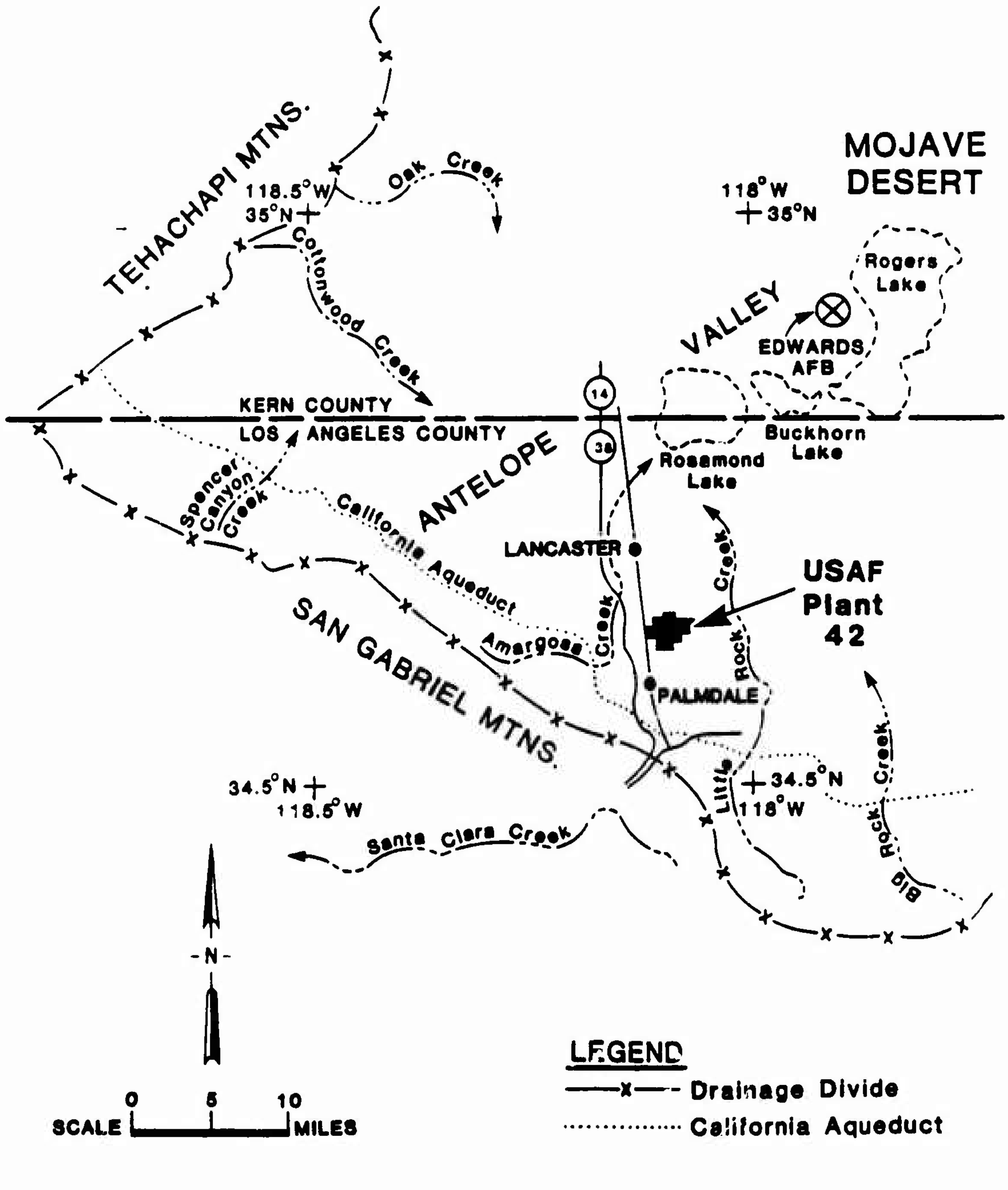
Annual evaporation from a standard 4-foot pan is more than 110 inches in the desert region of Antelope Valley and decreases to about 50 inches in the mountains; actual evaporation from lakes and reservoirs in the desert is about 65 percent of the pan evaporation (USDA, 1970). Evapotranspiration refers to the atmospheric discharge of water from the soil (rather than a surface water body) by both evaporation and transpiration from plants. Potential evapotranspiration is the water loss that would occur if the soil were at no time deficient of water for use by vegetation. Potential evapotranspiration for a 12 month period at USAF Plant 42 is about 35 inches per year, based on estimates for the desert regions of Antelope Valley (USDA, 1970). This indicates an annual net deficiency of atmospheric water (total precipitation minus potential evapotranspiration) of about 30 inches per year. In other words, rainfall at USAF Plant 42 is more likely to evaporate from the soil than to infiltrate into the water table.

2.3 GEOGRAPHY AND TOPOGRAPHY

USAF Plant 42 is located in the southern part of Antelope Valley, near the Los Angeles and Kern County line, as shown in Figure 2.1. Antelope Valley is a triangular-shaped, closed basin at the western edge of the Mojave Desert. The valley is bordered by a series of remnant volcanic peaks (buttes) to the east, by the the Tehachapi Mountains on the northwest, and by the San Gabriel Mountains on the southwest. Elevations in the mountains occasionally exceed 9,000 feet above mean sea level (msl), and ridge tops about five miles southwest of USAF Plant 42 exceed 5,000 feet msl. The mountains slope steeply to the margins of the valley, which are delineated by the 3,000-foot elevation contour. Land slopes decrease within Antelope Valley toward the center of the basin, where the lowest elevations (about 2270 feet msl) occur in the dry beds of Rogers, Rosamond, and Buckhorn Lakes.

Elevations within USAF Plant 42 range from about 2,590 feet msl in the southwest to about 2,470 feet msl along Avenue M in the north. The land surface at USAF Plant 42, as shown in Figure 2.2, is relatively flat. Only shallow drainage features and man-made structures break the otherwise gentle slope of the land surface, which ranges from 30 to 40 feet per mile toward the north-northeast.

PHYSIOGRAPHIC REGIONS AND PRINCIPAL STREAMS IN THE VICINITY OF USAF PLANT 42



SOURCE: Adapted from BLOYD (1967).

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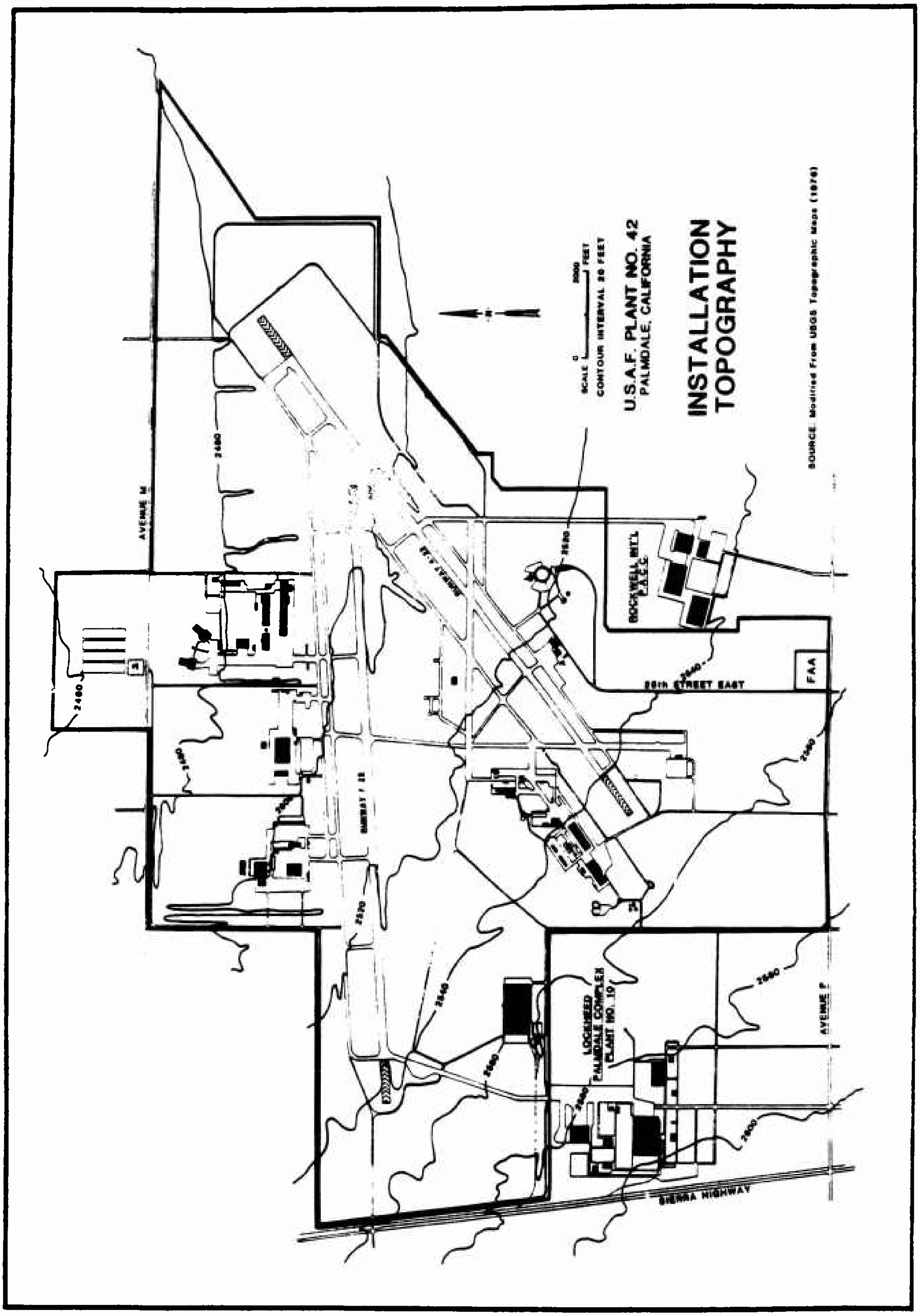

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2.4 GEOLOGY

2.4.1 Regional Geology

Antelope Valley lies in a graben, a down-dropped block between two faults. The graben was formed by numerous earth movements along the traces of the Garlock Fault and the San Andreas Rift Zone, which are shown in Figure 2.3. Erosion of the uplifted rocks during the Tertiary and Quarternary periods filled Antelope Valley with unconsolidated sediments. The rock units in the area are grouped into three main divisions: (1) pre-Tertiary crystalline (basement) rocks, (2) Tertiary volcanic, pyroclastic, and sedimentary rocks, and (3) Quarternary alluvium. The rocks of Tertiary age may be more than 1,500 feet thick in some areas, but the unconsolidated Quarternary deposits rest directly on the basement rocks in most of the valley.

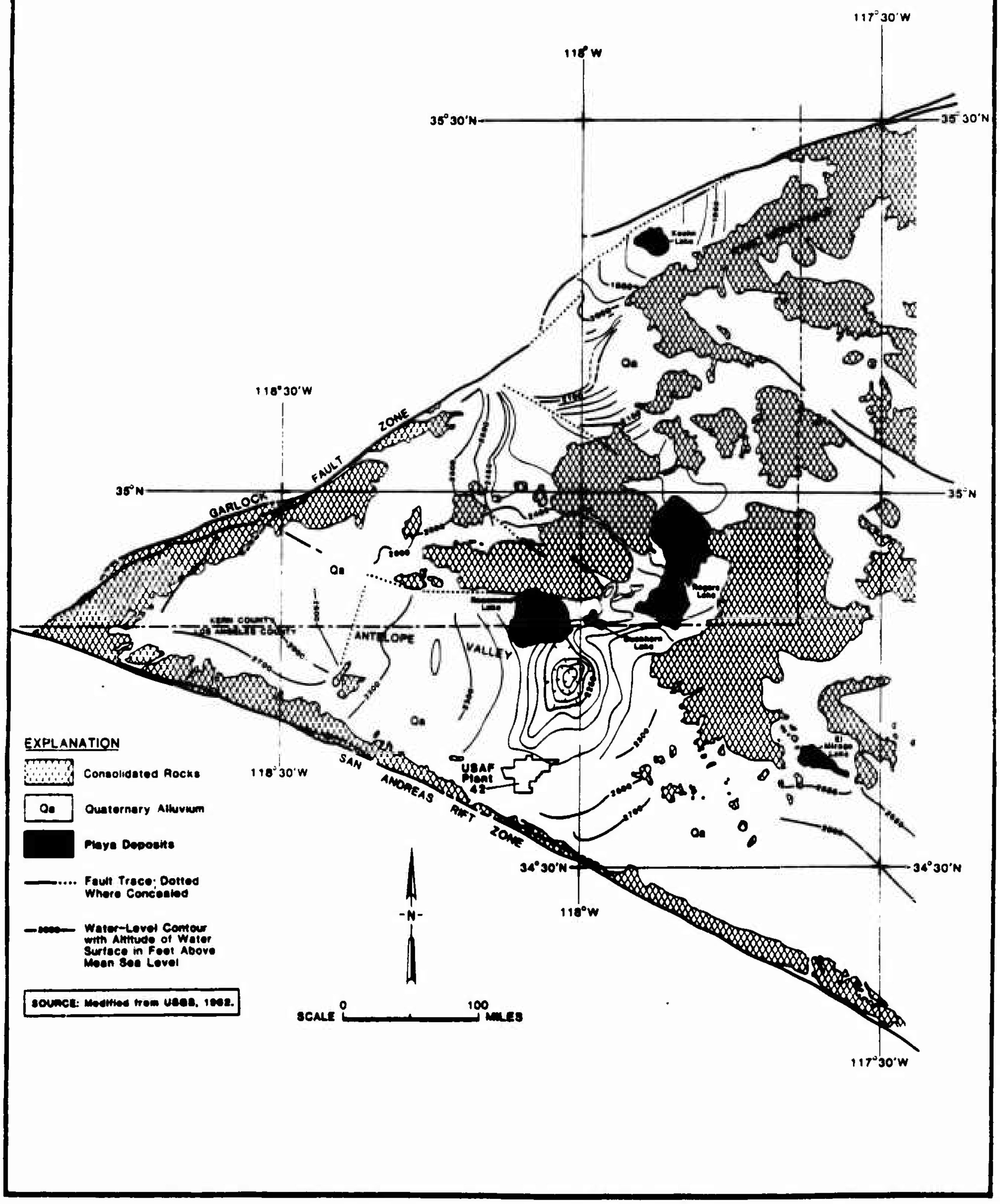
The geologic map of USAF Plant 42 and vicinity, shown in Figure 2.4, differentiates older and younger Quaternary alluvium, although these units are difficult to distinguish in drill cuttings. The older alluvium consists of poorly-sorted gravel, sand, silt, and clay of granitic origin. These deposits grade from coarse, poorly-sorted sediments near the margins of Antelope Valley to better-sorted, finer-grained deposits near the valley center. In some parts of Antelope Valley the older alluvium may be as much as 1,900 feet thick, but near USAF Plant 42 these sediments are much thinner (Figure 2.5). The younger alluvium consists of water-transported sediments and wind-transported dune sand, mostly of Recent age. These deposits of sand, angular gravel, cobbles and boulders contain small quantities of silt and clay. The younger alluvium is widespread over Antelope Valley but the deposits are generally less than 150 feet thick.

2.4.2 Local Geology

USAF Plant 42 lies approximately three miles from the San Andreas Rift Zone, but no active faults are known to occur at the site. Results of test borings on site indicate the younger alluvium is approximately 100 feet thick. Data from drilling logs were used to develop Figure 2.5 which shows two wells penetrate to the basement rock at USAF Plant 42. Data from these wells indicate that older alluvial deposits are only about 900 feet thick in the southern part of the installation. In the northern part these deposits are estimated to be more than 1,200 feet

FIGURE 2.3

GEOLOGIC MAP OF ANTELOPE VALLEY



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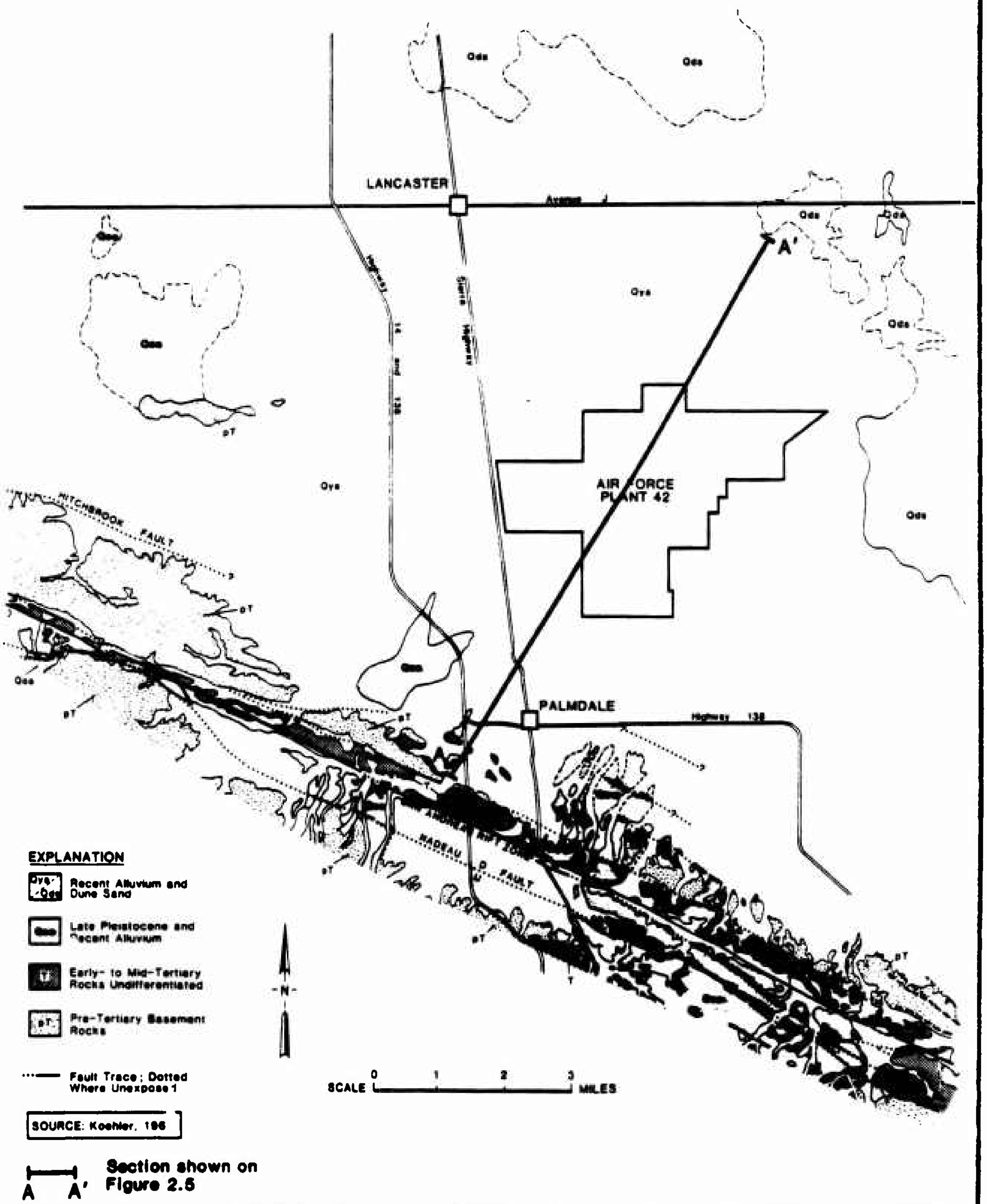
GEOLOGIC MAP OF USAF PLANT 42 AND VICINITY



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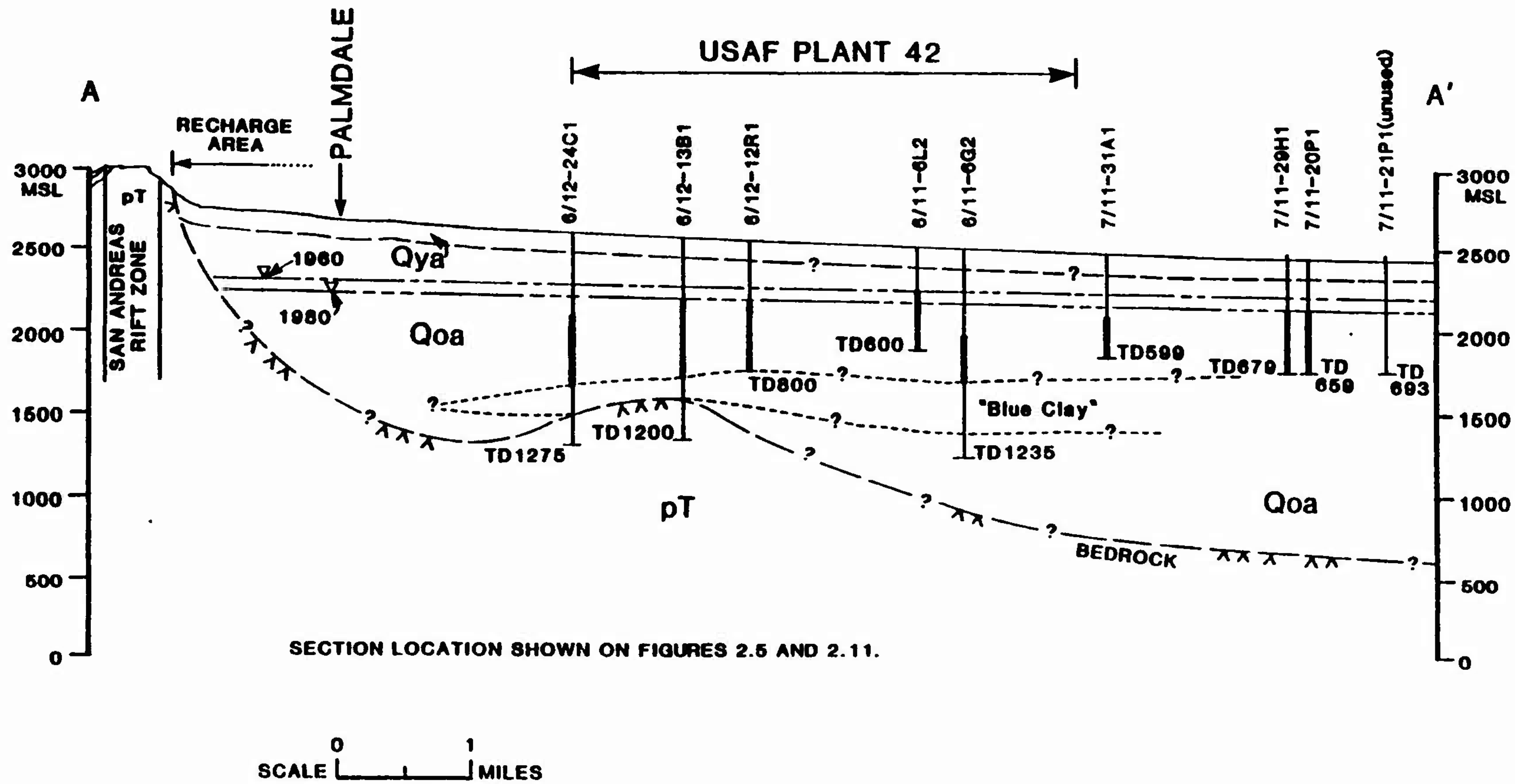
HYDROGEOLOGIC SECTION



SECTION LOCATION SHOWN ON FIGURES 2.5 AND 2.11.

SOURCE: Adapted from Koehler (1966) and Installation Documents.

thick. The typical lithologies of the alluvial deposits are shown in Figure 2.6.

The soils developed on the alluvial deposits are relatively immature sandy loams. These soils are low in abundance of clay and natural organic material. A generalized soil association map of USAF Plant 42 is presented in Figure 2.7, and Table 2.3 lists selected characteristics of the principal soils. The permeabilites of the C-H soils indicate that liquids spilled at land surface would infiltrate relatively rapidly (maximum rates of about 1.6 feet per hour). Infiltration rates through the A-R soils would be about one-tenth as fast. Soil permeabilities can be greatly affected by chemicals spilled or discharged onto the ground. For example, in fire training areas the fuels and oils that remain after fire exercises will tend to coat individual soil grains, decreasing porosity and permeability in the upper few feet of soil. By comparing Figures 1.6 and 2.7, it can be seen that Plant Sites 2, 3, 5, 6, 7, and the Palmdale Air Terminal are covered predominantly by A-R soils, while Plant Site 8 is covered predominately by C-H soils. Plant Sites 1 and 4 are covered by roughly equal amounts of both soil types.

2.5 SURFACE WATER HYDROLOGY

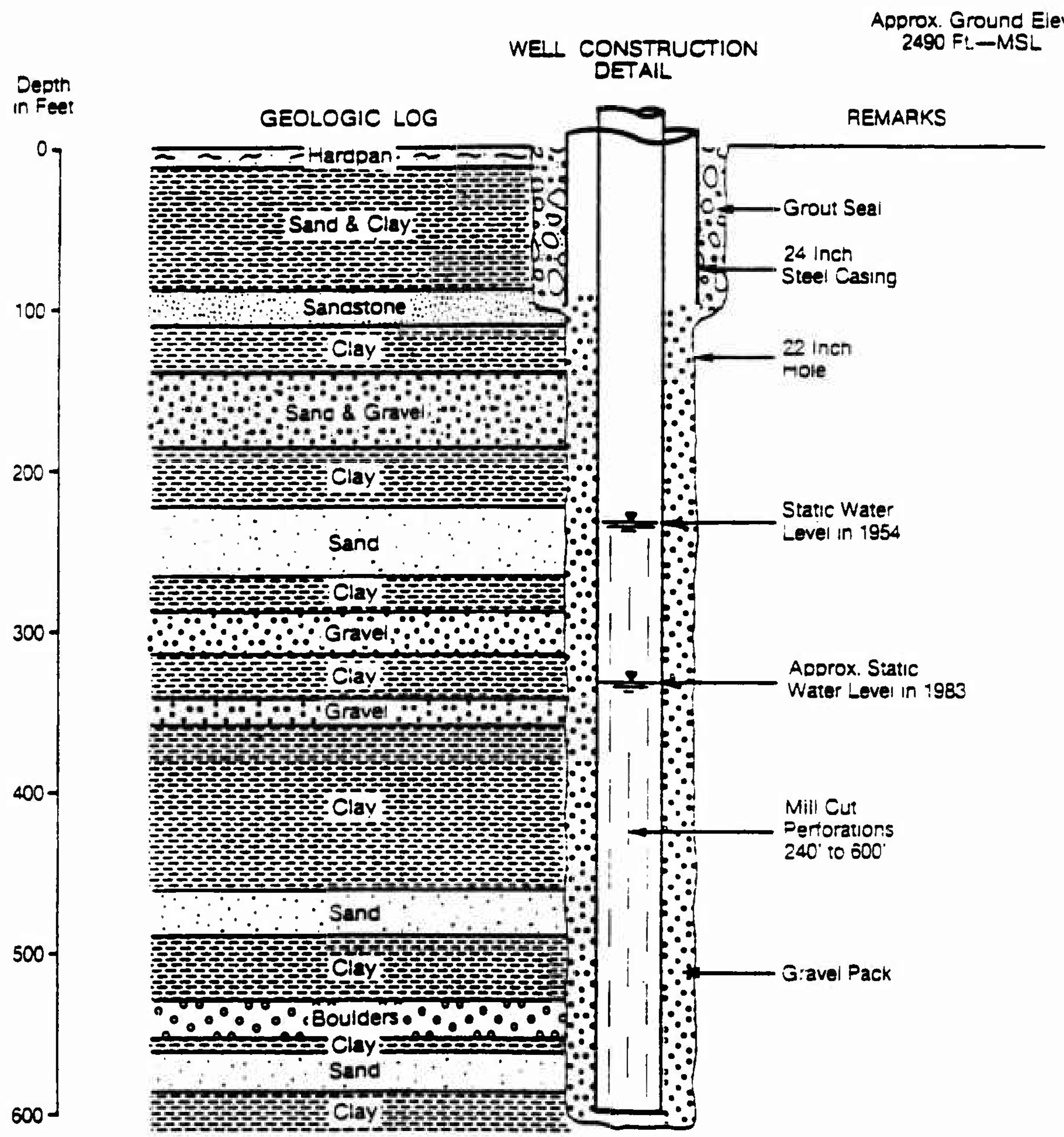
2.5.1 Regional Surface Water Drainage

The major streams in the region surrounding USAF Plant 42 are shown in Figure 2.1. These streams originate in the mountains where stream bed gradients are high. The gradients decline quickly as the streams leave the mountains and flow across alluvial fans at the margins of Antelope Valley. Stream bed gradients within the Antelope Valley are moderate to low. Most streams are dry except immediately after rains or during periods of snowmelt.

2.5.2 Local Surface Water Drainage

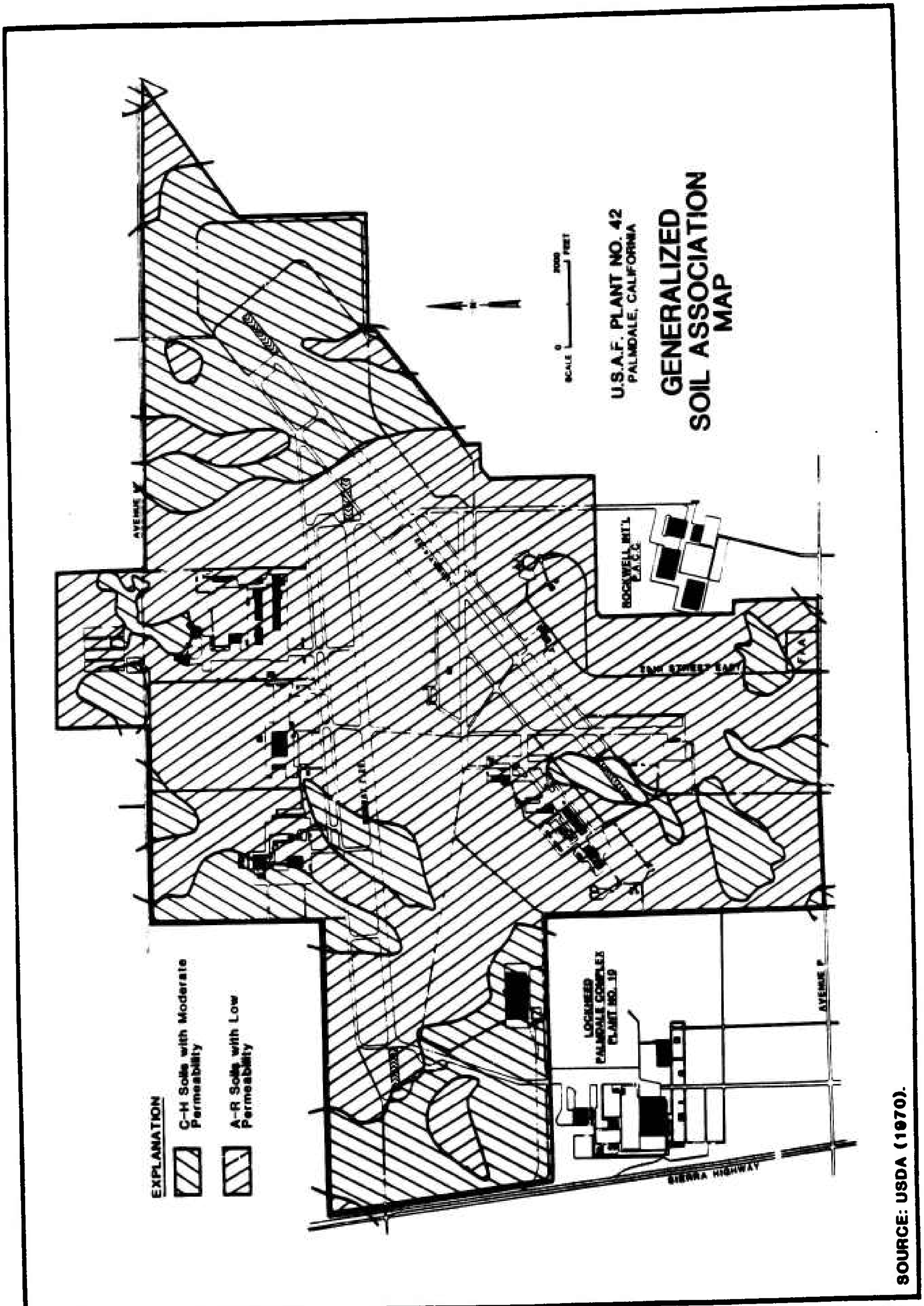
No major streams flow through USAF Plant 42 property. The perennial water bodies located near USAF Plant 42 are Lake Palmdale, Little Rock Reservoir, and the California Aqueduct. The nearest of these, Lake Palmdale, is located about four miles to the southwest, and none are located downstream of USAF Plant 42. Numerous stock-watering ponds are located north and east of USAF Plant 42, but the water in these ponds is supplied by wells.

USAF PLANT 42
CONSTRUCTION DETAIL AND GEOLOGIC LOG OF WELL DW1-2



Note: Geologic Log Developed from Original Drillers Log.

SOURCE: INSTALLATION DOCUMENTS



SOURCE: USDA (1970).

TABLE 2.3

PRINCIPAL SOILS AT USAF PLANT 42

	Shrink-Swell[a] Potential	Permeability[b] (cm/sec)	Remarks[c]
A-R Soils			
Adelanto coarse sandy loam	low	4.5×10^{-4} to 1.4×10^{-3}	1 sample: 2% clay @ 0-16" and 10% clay @ 41-50"
Rosamond loamy fine sand	low	4.5×10^{-4} to 1.4×10^{-3}	
Rosamond fine sandy loam	low	4.5×10^{-4} to 1.4×10^{-3}	
Rosamond loam	low	4.5×10^{-4} to 1.4×10^{-3}	
Cajon loamy sand, loamy substratum	moderate	4.5×10^{-4} to 1.4×10^{-3}	Permeability of soil at depth of 36 to 52 inches
C-H Soils			
Cajon loamy sand	low	4.2×10^{-3} to 1.4×10^{-2}	1 sample: 1% clay @ 9-24"
Cajon loamy fine sand	low	4.2×10^{-3} to 1.4×10^{-2}	
Hesperia fine sandy loam	low	1.4×10^{-3} to 4.2×10^{-3}	1 sample: 3% clay @ 22-54"
Hesperia loamy fine sand	low	1.4×10^{-3} to 4.2×10^{-3}	
Hesperia loam	low	1.4×10^{-3} to 4.2×10^{-3}	

(a) An approximate measure of abundance of clays in soil.
(b) To convert cm/sec to ft/day multiply value by 2.8×10^{3}.
(c) All soils are alkaline (pH ranges from 7.9-8.4).
Source: USDA, 1970.

Surface water drainage within USAF Plant 42 is shown in Figure 2.8. A system of buried storm drains and shallow ditches is maintained to discharge surface runoff into a percolation pond located at the northern end of the plant, along Avenue M. These drains and ditches are dry except after rainfall.

2.5.3 Surface Water Quality

Due to the intermittent character of streams in the region, records of stream-water quality are scarce. A contact with the U.S. Geological Survey (Water Resources Division) in San Bernardino indicated that no data on surface-water quality were available for Amargosa Creek (see Figure 2.1). Some data are available for Little Rock and Big Rock Creeks, as presented in Table 2.4. These data indicate the streams contain rather dilute water of a calcium or calcium-sodium bicarbonate nature.

2.6 GROUNDWATER HYDROLOGY

2.6.1 Regional Groundwater Hydrology

The older alluvial deposits comprise the principal source of groundwater in Antelope Valley. The Tertiary and pre-Tertiary units are saturated when they occur below the water table, but the rocks have very low permeability and are unlikely to yield useable quantities of water to wells. The younger alluvial sediments and dune sands are permeable but they are thin and occur above the water table in most areas. The depth to the water table varies by location; in the area of Lancaster and Palmdale saturation occurs at depths of between 250 and 400 feet. A clay-rich unit ("blue clay" on Figure 2.5) locally divides the alluvium into upper and lower members. The upper member is the principal aquifer in the area. Beneath USAF Plant 42, the clay unit ranges in thickness from about 200 to 300 feet. Near the valley margins the clay unit is thin or absent, and the two members become one continuous unit.

Recharge to the principal aquifer is from surface water runoff originating in the mountains. Recharge occurs as the flow from the mountain streams is absorbed by the coarse alluvium along the margins of Antelope Valley. Very little or no direct recharge occurs from precipitation in the valley itself, because of the high evapotranspiration rates. Estimates of the amount of stream discharge available to

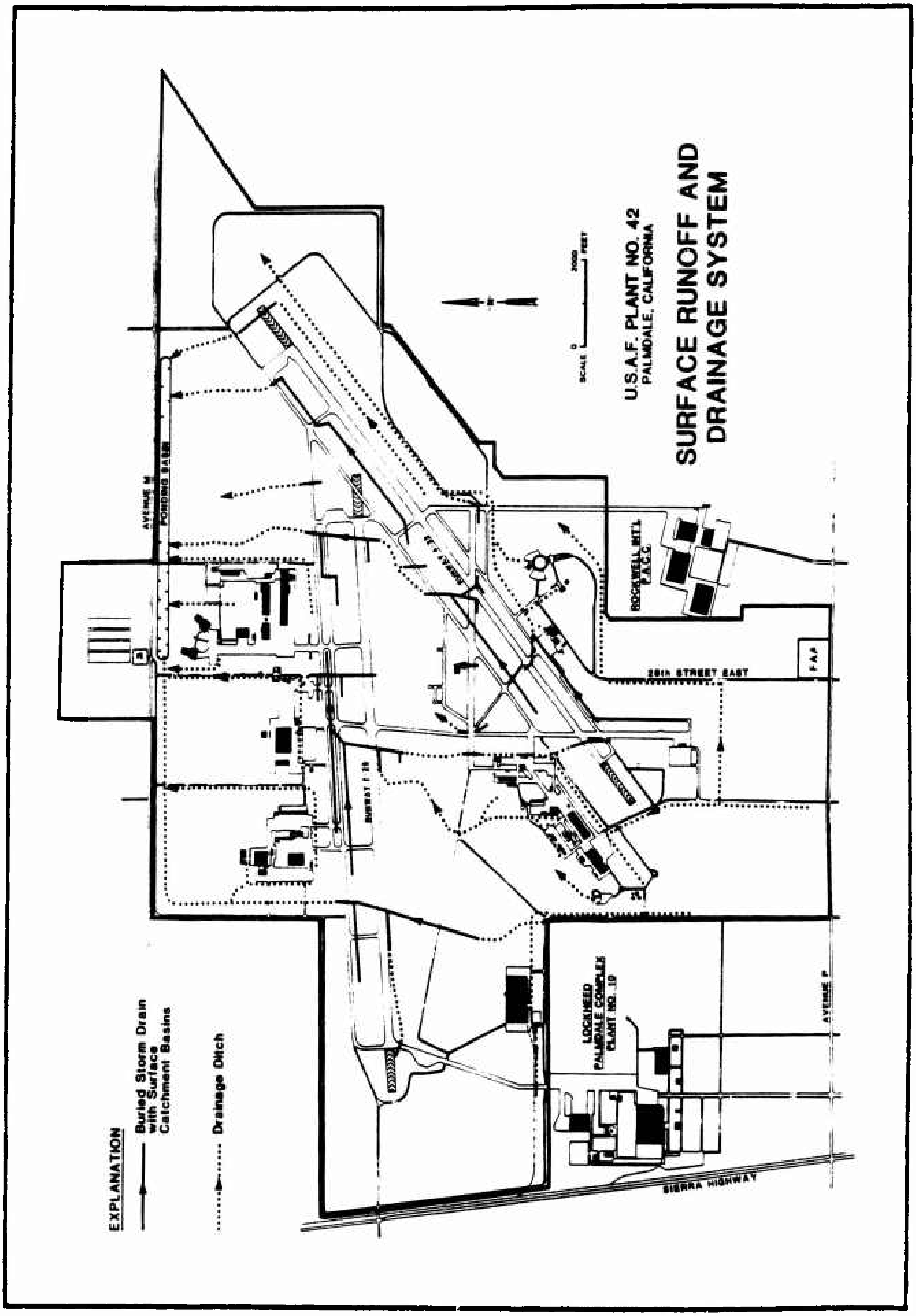

SURFACE RUNOFF AND DRAINAGE SYSTEM
U.S.A.F. PLANT NO. 42
PALMDALE, CALIFORNIA
SCALE 0 2000 FEET
EXPLANATION
Buried Storm Drain with Surface Catchment Basins
Drainage Ditch
AVENUE M
PONDING BASIN
ROCKWELL INT'L
25th STREET EAST
F.A.A.
LOCKHEED PALMDALE COMPLEX PLANT NO. 10
AVENUE P
SIERRA HIGHWAY

TABLE 2.4
CHEMICAL DATA FROM SURFACE STREAMS
NEAR USAF PLANT 42
(Concentrations are expressed as parts per million)

	Little Rock Creek		Big Rock Creek	
Constituent	Average*	Range	Average*	Range
Calcium	38	20-59	57	36-79
Magnesium	11	1-15	23	15-36
Sodium	21	9-48	19	9-28
Potassium	3	2-5	4	3-7
Carbonate	2	0-14	1	0-14
Bicarbonate	178	106-224	214	171-267
Chloride	6	2-10	5	0-23
Sulfate	31	9-66	88	22-187
Nitrate	0.6	0-3.5	6	0-12.6
Fluoride	0.3	0.1-0.7	0.3	0-0.9
Boron	0.08	0-0.5	0.15	0-0.5
Dissolved Solids	240	140-345	350	232-456
Total Hardness	141	83-180	236	170-297

*Average based on 20 and 21 samples from Little Rock and Big Rock Creeks, respectively.

Period: 1951 to 1963

Source: Fox, 1968

recharge the principal aquifer range from 58,000 to 66,000 acre-feet per year (Bloyd, 1967; Fox, 1968).

Groundwater gradients are generally from south to north in the area of Lancaster and Palmdale except where locally influenced by pumpage. Figure 2.3 shows historical gradients (circa 1960) in the Antelope Valley and illustrates the effects of heavy withdrawals from the principal aquifer in the area north and northeast of Lancaster. Pumpage in the Lancaster area has lowered groundwater levels at historic rates of four to five feet per year (Fox, 1968). More recent utilization of imported water from the California Aqueduct may have decreased local pumpage sufficiently for groundwater levels to stabilize. Records from the Palmdale Water District (Figure 2.9) indicate very little decline in average levels since 1975.

Where the lower alluvial member occurs, groundwater may be under artesian pressure. Pumpage from the principal aquifer may have substantially lowered this pressure, and gradients in the lower member today may be similar to those in the principal aquifer. Data from the lower aquifer are scarce and the degree of hydraulic continuity between the two members is not fully known.

In the Lancaster area, a semi-perched zone occurs at depths of less than 200 feet (Powers, 1970). Water in this zone has apparently infiltrated from the extensive irrigation in the area. The clay-silt units that sustain this semi-perched zone also serve as confining units for the principal aquifer. Wells made in the principal aquifer near the dry lakes northeast of Lancaster flowed at land surface until about 1955 (Kunkel, 1962). Today water-table conditions occur in the principal aquifer throughout the area.

The capability of the principal aquifer to supply water to wells is indicated by its transmissivity, which equals the permeability of the aquifer multiplied by the local saturated thickness. In the area of Lancaster and Palmdale, transmissivities in the principal aquifer may be estimated by the multiplying specific capacity (the pumping rate of a well in gpm divided by the amount of drawdown in feet) by 1750 (Fox, 1968). Records of specific capacity data (Table 2.5 and Appendix E) indicate transmissivities range from about 18,000 to 210,000 gpd/ft (2,400 to 28,500 ft^2/day). The higher values are probably typical of

FIGURE 2.9

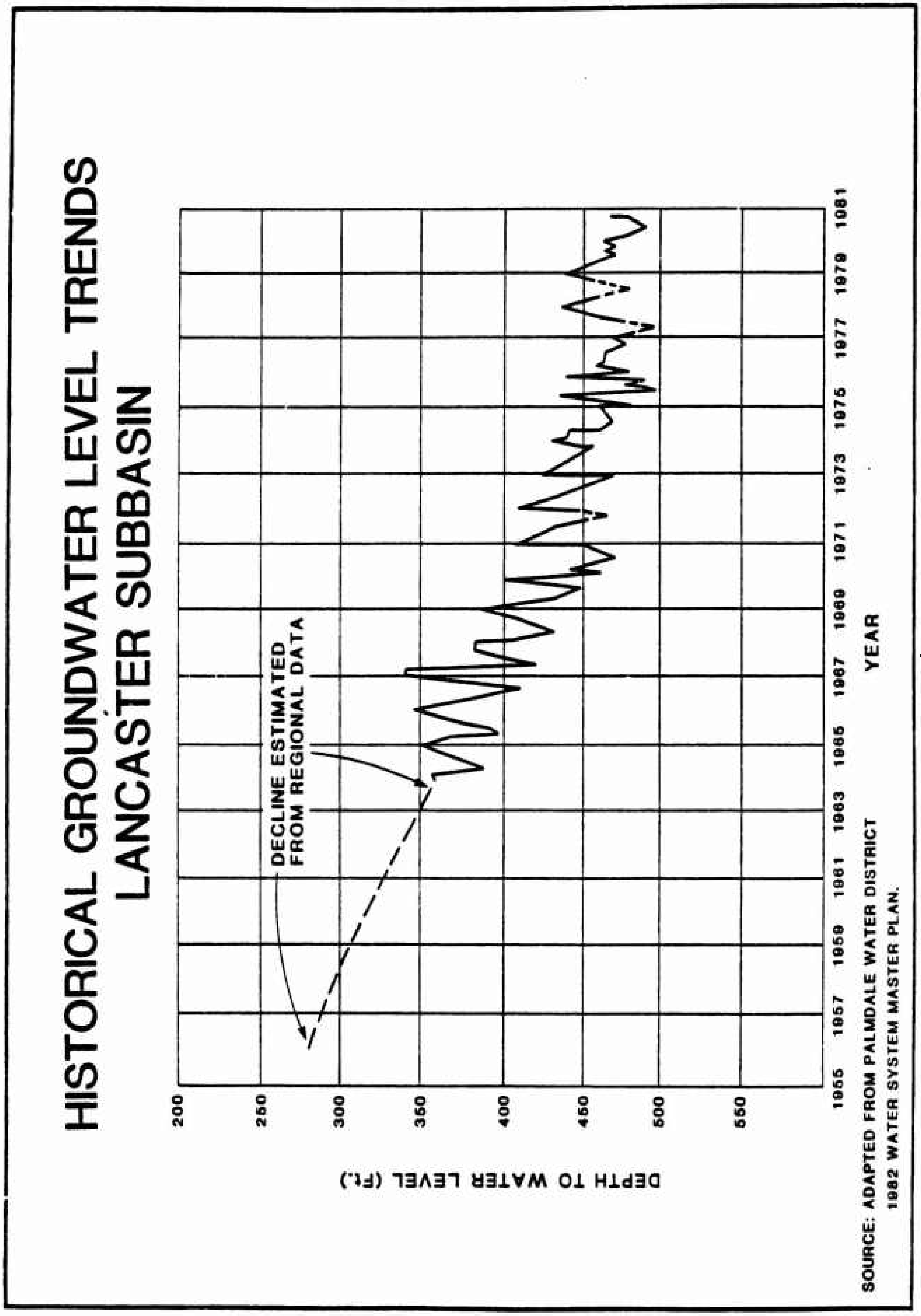


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TABLE 2.5
HYDRAULIC DATA FOR WELLS AT USAF PLANT 42

Map Number[a]	Well Number	Test Date	Pretest Depth to Water	Discharge (gpm)	Drawdown (ft)	Specific Capacity (gpm/ft)	Remarks
6N/12W-1K1	DW1-1	3/21/73(?)	317.0	185	9.3	20	Land Surface Datum (LSD)
		11/5/75(?)	335.2	147	7.6	19	2505 ft msl, 40 HP pump
		3/7/78	342.8	206	7.6	27	
		4/5/79	344.8	199	8.0	25	
		4/14/82	351.4	247	10.4	24	
		1/9/84	353.2	262	9.8	27	
		10/9/85	356.8	259	9.3	28	
6N/12W-1J1	DW1-2	5/15/63	265.8	529	17.2	31	LSD 2503 ft msl
		5/8/72	314.0	300	9.6	31	125 HP pump
		11/5/75	329.4	546	17.6	31	
		9/28/76	334.6	508	19.0	27	
		3/7/78	337.4	506	19.7	26	
		4/5/79	338.6	502	16.3	31	
		1/20/81	342.4	503	16.8	30	
		4/14/82	344.3	472	15.6	30	
		10/10/85	350.0	328	12.1	27	
6N/11W-6H1	DW3-2	5/14/63	269.6	829	36.2	23	LSD 2483 ft msl
		11/4/75	345.4	850	37.4	23	125 HP pump
		9/28/76	353.0	799	34.0	24	
		3/6/78	332.8	814	33.8	24	
		4/4/79	332.8	807	33.6	24	
		1/21/81	337.0	860	32.5	27	
		4/13/82	338.2	890	30.4	29	
		9/7/83	349.8	839	33.8	25	
		10/8/85	341.9	819	36.1	23	
6N/11W-6H2	DW3-1	11/75(?)	336.8	598	40.8	15	LSD 2484 ft msl
		3/20/78	325.4	623	45.2	14	100 HP pump
		4/4/79	324.8	616	46.8	13	
		1/21/81	328.7	613	41.5	15	
		4/13/82	328.2	608	38.2	16	
6N/12W-12M1	DW4-1	5/13/63	308.4	262	7.1	37	LSD 2560 ft msl
		2/15/66	318	680	41	17	50 HP pump
		9/8/83	409.7	237	18.5	13	
		10/10/85	413.5	225	15.7	14	
6N/11W-18A1	Rockwell west well PAAC	9/8/83	422.4	794	10.4	76	LSD 2535 ft msl
		10/7/85	423.1	807	10.9	74	150 HP pump
6N/11W-17D1	Rockwell east well PAAC	10/7/85	411.4	779	21.0	37	LSD 2536 ft msl 150 HP pump
6N/12W-13B1	Abandoned	2/2/69	330	1,000	61	16	LSD 2555 ft msl
		2/2/69	330	1,400	71	20	
		2/2/69	330	1,800	100	18	

(a) See Figure 2.11 and Table 2.7.

aquifer properties in the coarse-grained deposits near the mountains, while the lower values are more typical of the finer-grained sediments in the aquifer near the valley center.

2.6.2 Local Groundwater Hydrology

The principal aquifer occurs under water-table conditions at depths of about 350 feet below USAF Plant 42. Specific capacity data from wells at the plant (Table 2.5) indicate transmissivities in the principal aquifer range from about 22,000 to 65,000 gpd/ft. These values indicate the aquifer locally is moderately transmissive, but not as transmissive as in deposits nearer the mountains. Water-table gradients in the principal aquifer shown on Figure 2.10 indicate that groundwater beneath USAF Plant 42 moves toward the north and northeast. Pumpage from the large municipal wells south (upgradient) of USAF Plant 42 (Figure 2.11) could decrease gradients slightly. A listing of selected water-level data from wells near USAF Plant 42 is given in Table 2.6.

2.6.3 Well Locations

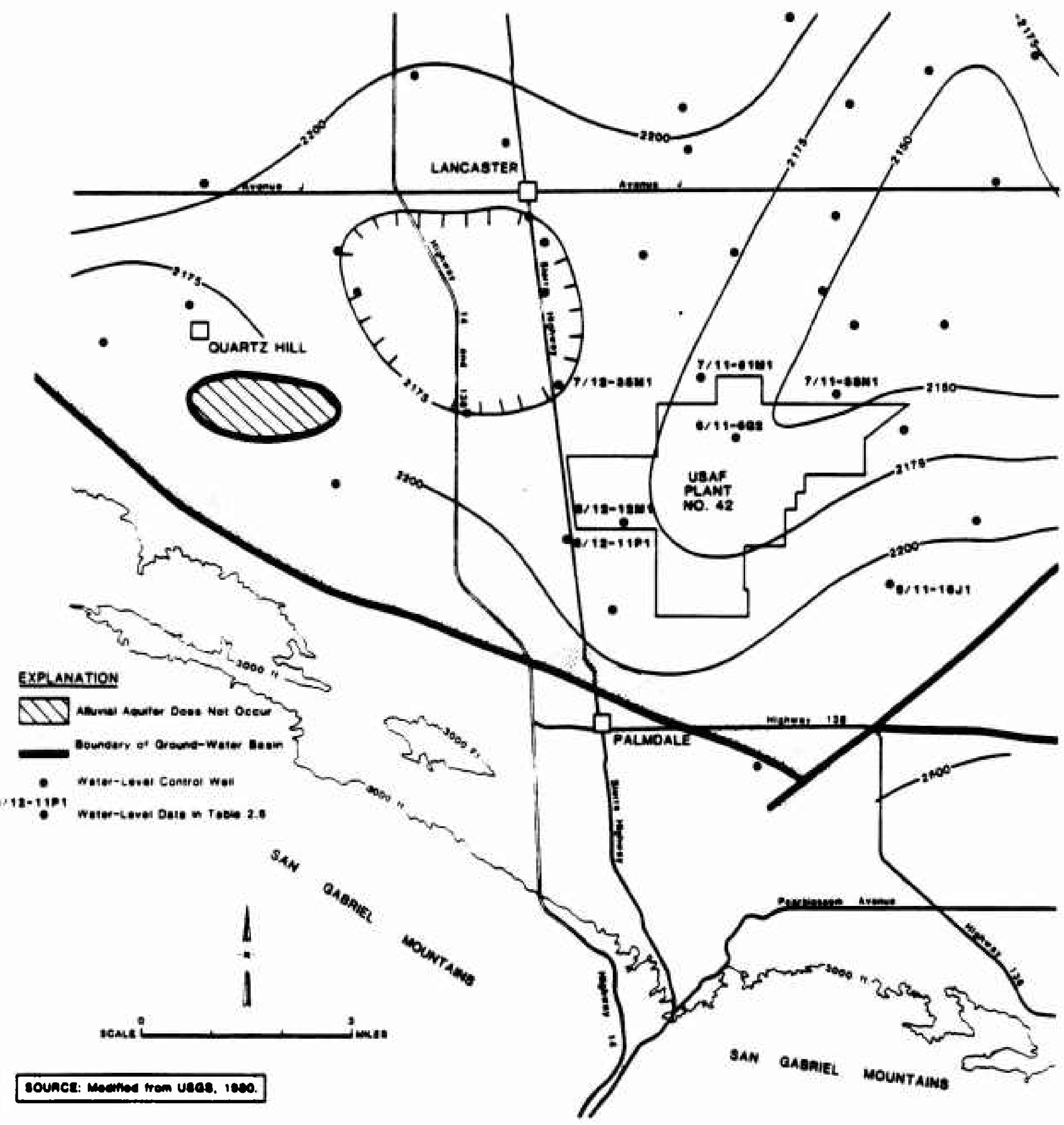
The water wells located in the vicinity of USAF Plant 42 are shown in Figure 2.11. Available well-construction and hydraulic data for these wells are presented in Appendix E. Active and abandoned wells located on USAF Plant 42 are shown in Figure 2.12. A list of well identifiers for comparison between Figures 2.11 and 2.12 is given in Table 2.7. Available drilling logs of the wells on USAF Plant 42 are given in Appendix E. A summary of available hydraulic testing data from these wells is presented in Table 2.5.

2.6.4 Groundwater Quality

Historical data from the U.S. Geological Survey and California Department of Water Resources (Koehler, 1966) indicate the groundwater in the vicinity of USAF Plant 42 is potable, generally low in dissolved solids, and ranges from soft to moderately-hard. Figure 2.13 shows Stiff diagrams of chemical data from selected wells in the vicinity of USAF Plant 42.

A few water samples from wells at USAF Plant 42 had been tested for trace organic compounds prior to this study. For example, wells DW10-1 and DW2-1 (Figure 2.12) were tested in April, 1985 for a variety of organic compounds, including volatile halocarbons, volatile aromatics,

WATER LEVELS IN PRINCIPAL AQUIFER (1979)



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WATER WELLS IN VICINITY OF USAF PLANT 42

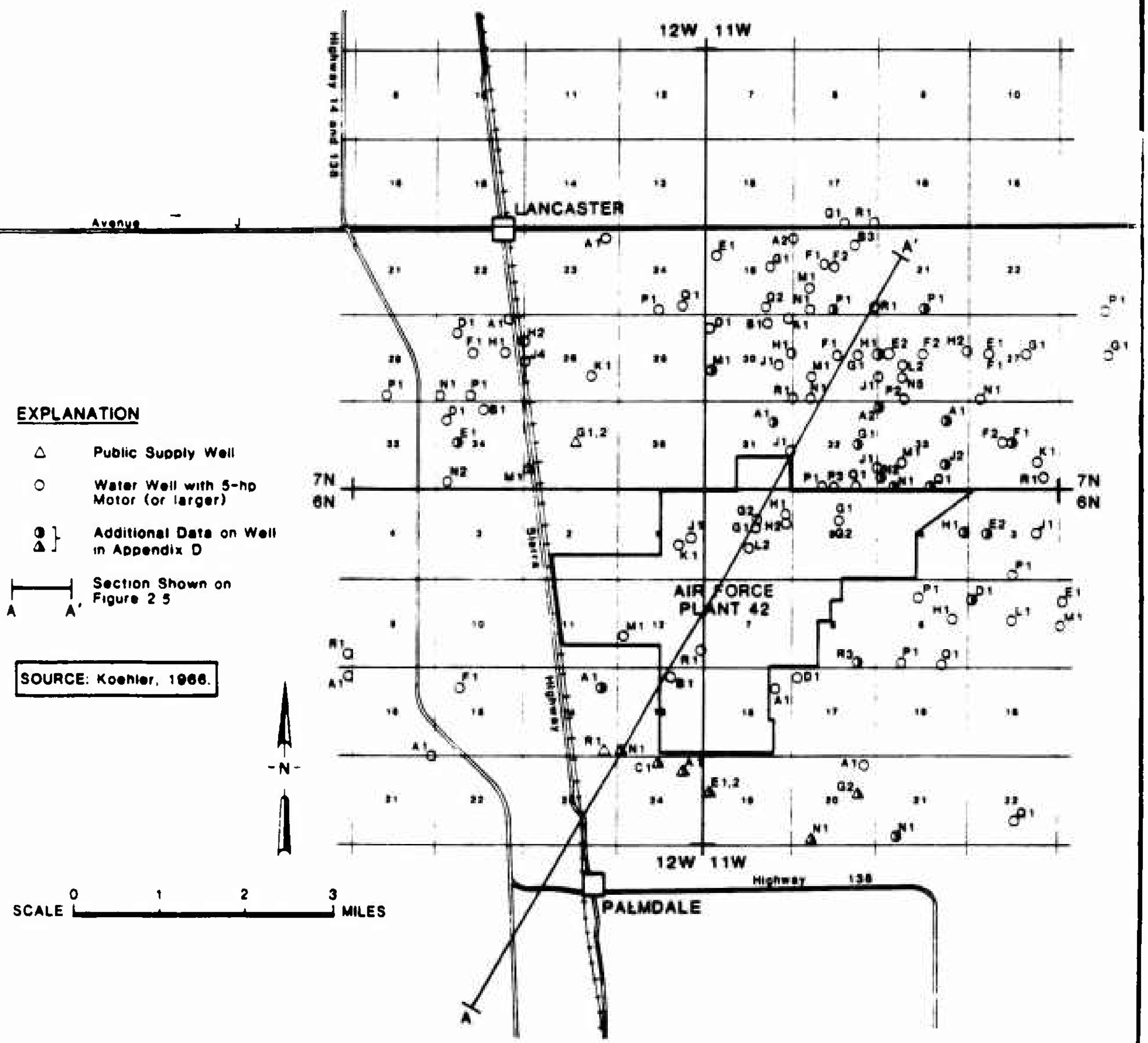

TABLE 2.6
SELECTED WATER LEVEL RECORDS OF WELLS NEAR USAF PLANT 42
(Water levels reported in feet below land surface datum)

Date	Water Level	Date	Water Level
Well 7/11-31M1 - Total Depth 385.6 ft. LSD 2,468 ft. msl			
17 Nov 1951	185.00	13 Mar 1980	299.30
09 Jan 1964	238.87	25 Mar 1985	307.12
27 Feb 1974	287.78	19 Mar 1986	307.69
Well 7/11-33N1 - Total Depth Unknown LSD 2,473 ft. msl			
17 Nov 1951	215.39	11 Feb 1975	326.97
15 Oct 1956	243.50	13 Mar 1980	320.09
16 Nov 1960	262.06	25 Mar 1985	314.39
13 Apr 1965	293.99	19 Mar 1986	307.43
17 Mar 1970	308.76		
Well 6/11-6G2 - Total Depth 1200 ft. LSD 2,480 ft. msl			
15 Mar 1967	282.40	13 Mar 1980	328.36
7 Jan 1970	294.00	27 Mar 1985	339.13
18 Feb 1975	322.90		
Well 6/12-12M1 - Total Depth 430 ft. LSD 2,560 ft. msl			
13 May 1963	308.40	27 Mar 1985	408.36
5 Oct 1982	403.09	27 Feb 1986	410.12
Well 6/12-11P1 - Total Depth 500 ft. LSD 2,595 ft. msl			
7 Nov 1951	283.30	13 Mar 1980	469.71
12 Sep 1963	344.71	26 Mar 1985	441.26
20 Feb 1975	409.94	26 Feb 1986	443.30
Well 6/11-16J1 - Total Depth 620 ft. LSD 2,547 ft. msl			
8 May 1964	319.97	10 Apr 1980	348.55
22 Oct 1970	370.65	27 Mar 1985	321.49
19 Feb 1975	344.10	28 Feb 1986	314.09
Well 7/12-35M1 - Total Depth 504.5 ft. LSD 2,512 ft. msl			
1948	209	13 Mar 1980	349.10
1957	239	25 Mar 1985	362.49
26 Aug 1963	272.26	19 Mar 1986	363.06
12 Feb 1975	331.84		

* See Figure 2.10 for well locations.

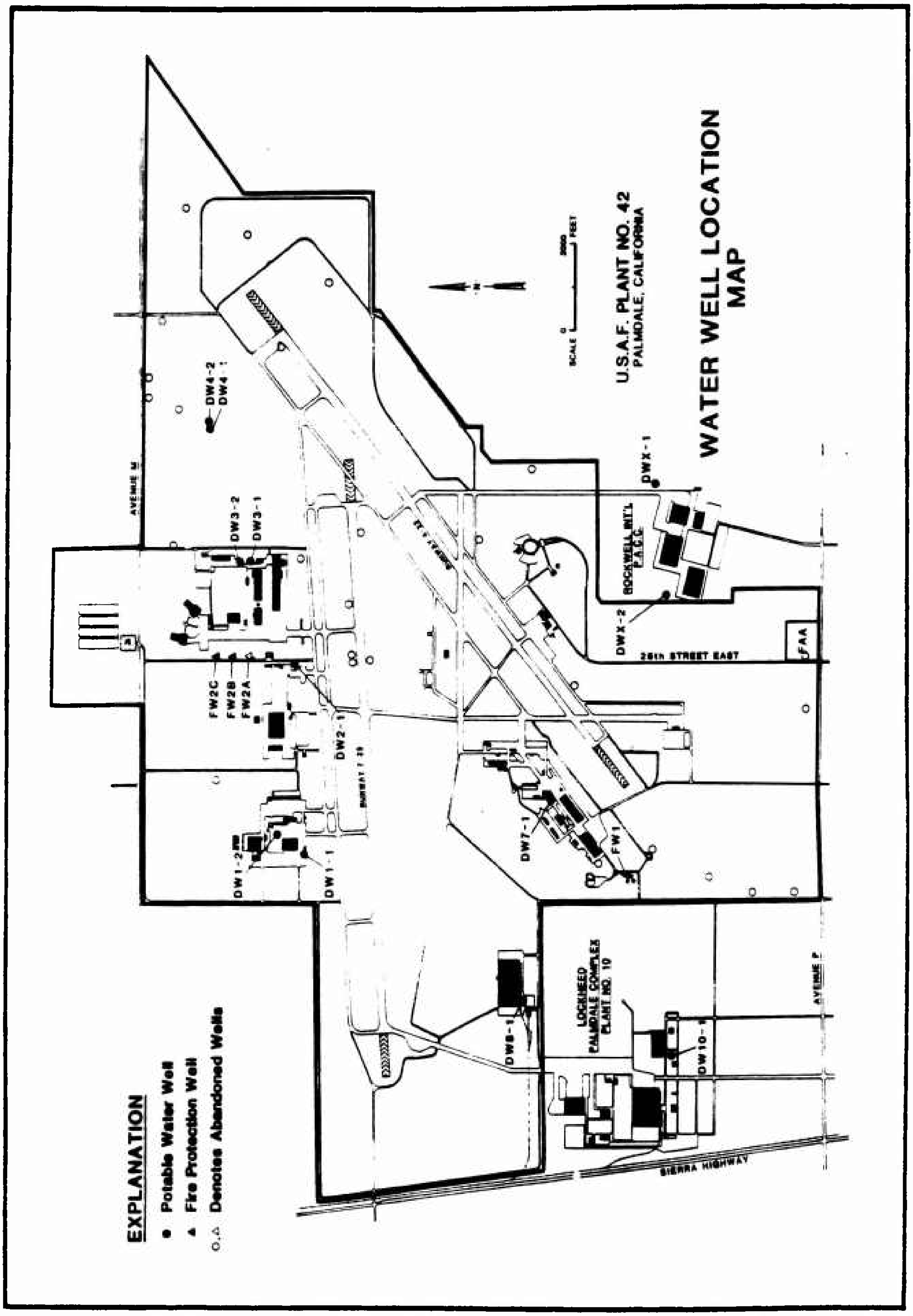

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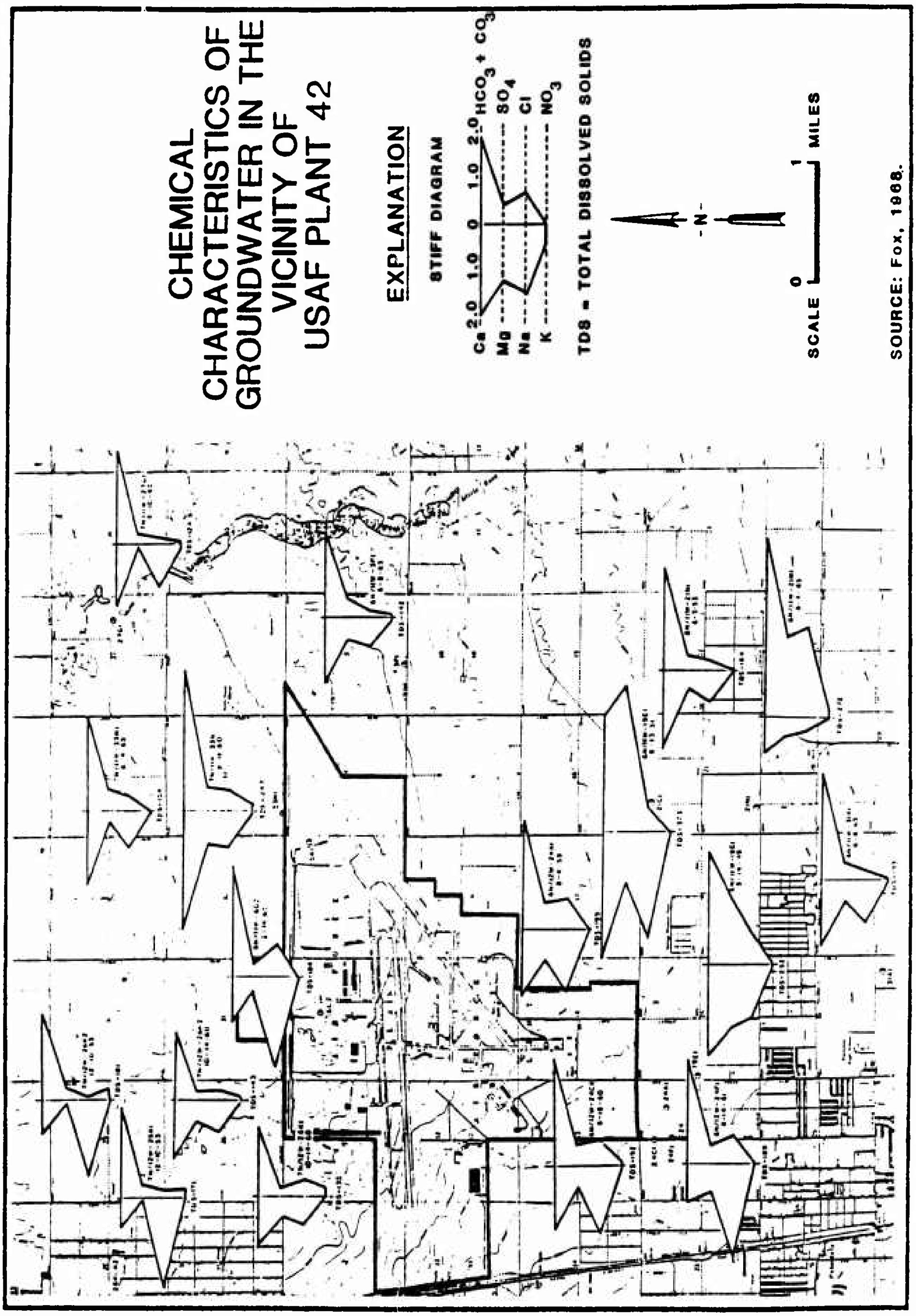
TABLE 2.7
IDENTIFICATION NUMBERS FOR WELLS ON USAF PLANT 42

Figure 2.11*	Figure 2.12	Remarks
6N/12W-1K1	DW1-1	Drilled 1952
6N/12W-1J1	DW1-2	Drilled 1957
6N/11W-6L2	DW2-1	Same well as 6N/11W-6L1 (drilled 1954?)
6N/11W-6H2	DW3-1	
6N/11W-6H1	DW3-2	
6N/11W-5G1	DW4-1	New well, drilled 1984
6N/11W-5G2	DW4-2	New well, drilled 1984
6N/12W-12R1	DW7-1	Drilled 1951
6N/12W-12M1	DW8-1	Installation records use Well 1, Site 4
6N/11W-6G1	FW2B	Fire Protection, drilled 1953
6N/11W-6G2	FW2C	Fire Protection, drilled 1964
6N/12W-13B1	FW1	Fire Protection, drilled 1969
6N/11W-6K1	FW2A	Abandoned Fire Protection Well 2A

* See Appendix E for description of well numbering system.



CHEMICAL CHARACTERISTICS OF GROUNDWATER IN THE VICINITY OF USAF PLANT 42

SOURCE: Fox, 1988.

base/neutral and acid-extractables, chloropicrin, atrazine, and simazine, none of which were detected (Gregg and Associates, 1985). Well DW2-1 is situated downgradient of several of the disposal and spill sites shown on Figure 1.8, while well DW10-1 is upgradient of all the disposal and spill sites identified at USAF Plant 42.

2.7 SUMMARY OF ENVIRONMENTAL SETTING

The principal environmental conditions that would affect movement of contaminants on USAF Plant 42 are summarized as follows:

- Average annual precipitation is less than 5 inches, and the potential evapotranspiration rate is about 35 inches per year.
- Rainfall can be intense at times, with rains of 4 to 6 inches recorded over a 7-day period recorded in nearby Palmdale. Such intense rainfall could produce surface runoff with potential for transporting contaminants dissolved in water or adsorbed to sediments.
- The local soils are sandy loams low in natural organic material with moderate to rapid permeabilities. Infiltration rates for liquids at land surface should range from about 0.05 to about 1.6 feet per hour.
- No major streams flow through USAF Plant 42, and no perennial surface-water bodies are located downslope.
- Surface runoff is discharged by a system of ditches and buried pipes to a percolation pond located within the installation boundaries.
- The principal aquifer occurs under water table conditions at a depth of about 350 feet beneath land surface at USAF Plant 42.
- The nearest large water-supply wells are located about one mile upgradient (south) of USAF Plant 42, but several wells located within the installation are used for drinking water supply.

These conditions produce an environmental setting with a low potential for contaminants to affect water supplies. There are no surface waters supplies downslope of USAF Plant 42, and spills or short-term discharges of liquids at the land surface are not likely to endanger local groundwater supplies because of:

- o high evapotranspiration rates,
- o great depth to water table,
- o lack of sustained hydraulic gradient (driving force), and
- o moderate adsorption potential of the alluvial sediments.

SECTION 3.0

FIELD INVESTIGATION PROGRAM

SECTION 3.0

FIELD INVESTIGATION PROGRAM

3.1 PROGRAM DEVELOPMENT

The IRP Phase II, Stage 1 field investigation program for USAF Plant 42 was based on results of the Phase I effort (CH2M-Hill, 1983) and subsequent technical and regulatory reviews by the Air Force, the U.S. Environmental Protection Agency (Region IX), and the Lahonton Regional Water Quality Control Board (Resources Agency of California). From these reviews came the following decisions concerning the Stage 1 field investigation program:

- determination of the specific sites to be investigated,
- identification of analytical requirements, based on suspected contaminants at these sites, and
- selection of field investigation and sampling techniques.

These decisions were the basis for a Phase II Presurvey conducted by Engineering-Science, Inc. (ES), which resulted in the preparation of a Draft Statement of Work (SOW). This was later refined and expanded in the revised SOW presented in Appendix D, which provided the technical guidance for the Phase II, Stage 1 field investigation program.

The field investigation program involved work at the 23 IRP sites identified in Table 1.2. Soil boring and sampling activities were conducted at each of these sites, with selected soil samples collected for chemical analysis. Groundwater samples were also collected for chemical analysis, from existing fire protection and drinking water supply wells throughout the installation, to obtain groundwater quality data characteristics in both upgradient and downgradient regions of USAF Plant 42.

3.2 SOIL BORING AND SAMPLING PROCEDURES

Soil samples were collected with a CME-55 or CME-75 drill rig, using the hollow-stem auger drilling technique. A center stem and reverse-spiral lead bit prevented free material from entering the center (hollow-stem) of the auger. Soil samples were collected using split-spoon samplers driven ahead of the drilling bit, through the center (hollow-stem) of the auger, into the undisturbed soil. Soil samples were thus collected for lithology and stratigraphic control purposes at the surface, and at 2.5-foot intervals to a depth of 15 feet. From 15 to 100 feet, samples were taken at 5-foot intervals; and below 100 feet, samples were taken at 10-foot intervals. Selected soil samples were also split for chemical analysis. Drilling, sampling, and soil classification were performed by the following methods:

- ASTM D1452-65, Soil Investigation and Sampling by Auger Boring
- ASTM D1586-67, Penetration Test & Split-Barrel Sampling of Soils
- ASTM D2487-83, Unified Soil Classificat on System
- ASTM D2488-69, Recommended Practices for Visual-Manual Description of Soils

Logs were kept during all drillings activities. Along with a description of the lithology samples, these logs included observations of discoloration, odors, organic vapor (photoionization meter) readings, and other anomalies. Logs of all the soil borings and sampling activities (including manually collected samples) are presented in Appendix F.

Upon completion of drilling and sampling, each borehole was filled from the bottom to the surface with a grout mixture of Type I portland cement and bentonite. Approximately three to five pounds of bentonite was mixed with each 94-pound sack of cement and 6.5 gallons of water. Clean sand was added to the grout mixture to form a hard protective cap in the top 2 feet of boreholes located in ditches and other areas subject to traffic or erosion.

Near-surface soil samples were collected manually. First, a hole was dug with a shovel and was cleaned out to the initial sampling depth (approximately 3 feet). The soil sample was then collected by digging downward into the undisturbed soil using a post-hole digger. A portion of the sample was packaged and shipped to the laboratory for chemical analysis, with the remainder being retained as a lithology sample. The resulting holes were then backfilled with native materials. A total of 16 near-surface samples were collected.

All drilling tools (augers, bits and center rods) were decontaminated between boreholes to prevent cross-contamination. Decontamination consisted of steam and detergent cleaning, clean-water rinse, methanol rinse, and a final distilled-water rinse. The clean equipment was air dried and then wrapped in plastic for storage until its next use. All tools used in soil sampling and packaging activities (split-spoon samplers, stainless steel mixing bowls, and sample-cutting knives) were decontaminated after the collection of each sample. This consisted of a detergent wash, clean-water rinse, methanol rinse, and a final distilled-water rinse. After the final rinse, the sampling equipment was allowed to air dry completely before again being used.

3.3 WELL SAMPLING PROCEDURES

All the wells sampled during the field investigation program were operating production wells in use either for fire protection or for drinking-water supply. Therefore, water-level measurements could not be obtained from these wells at the time of sampling (selected historical water-level data are presented in Section 2). The groundwater samples were collected directly from in-line spigots located immediately downstream of the well pumps and ahead of surge/storage tanks or chlorine addition points. Each pump was run for a minimum of 30 minutes before sampling began, to purge the well and ensure that fresh samples, representative of groundwater in the aquifer, were collected. Measurements of pH, temperature, and specific conductance were made in the field, immediately after sample collection.

3.4 SAMPLE NUMBERING SYSTEM

Each individual soil sample was assigned a unique sample identifier that describes exactly where the sample was collected. The same identifier was used in the drilling logs, on lithology sample labels, and on bottle labels, chain-of-custody forms, and laboratory reports for samples that were chemically analyzed. Each sample identifier consists of five groups of letters and numbers, separated by hyphens, as described below. A sixth group of letters was used to distinguish between duplicate samples shipped to different laboratories for chemical analysis.

1. IRP site number (see Table 1.2)
2. IRP site name abbreviation & plant location (see Table 1.2)
3. soil boring number (sequential for each IRP site)
4. soil sample number (from surface for each boring)
5. soil sample depth (feet from land surface)
6. destination laboratory (only on samples for chemical analysis)

For example, the sample identifier "7-ERA2-SB4-SS10-30-OEHL" refers to a soil sample from IRP Site 7-ERA2, the Engine Run-up Area in Site 2 (see Table 1.2). The sample was collected from the fourth soil boring at that site, and represents the tenth discrete soil sample collected from that boring, which was taken at a depth of 30 feet. In addition, the sixth group of letters, "OEHL", indicates that this sample was shipped to the USAF Occupational and Environmental Health Laboratory for chemical analysis.

The sample identifiers assigned to groundwater samples were, in effect, well-location codes. Well-location codes for the seven wells sampled during this investigation are presented in Subsection 3.8. The addition of a hyphen and an abbreviation of the destination laboratory completed the identifiers for groundwater samples. No additional information was required, since only one sample was collected from any given well.

Blind duplicate soil samples shipped to the laboratory for quality assurance (QA) purposes were also assigned unique sample identifiers. These differed from the originals only in that the assigned soil sample number was always 15. For example, "7-ERA2-SB4-SS15-30-OEHL" represents the blind duplicate of sample "7-ERA2-SB4-SS10-30-OEHL". While a soil sample numbered 15 was actually collected from many of the borings (as described in the drilling logs), none of these were among the samples shipped for chemical analysis. Therefore, except in the drilling logs, any soil sample identifier containing "-SS15-" refers to a blind duplicate sample shipped for QA purposes. Since only one blind duplicate groundwater sample was shipped, from well DW4-1, it was assigned the identifier DW4-2.

3.5 SAMPLE HANDLING, PACKAGING, AND SHIPPING

All groundwater samples were collected directly in pre-cleaned glass and plastic bottles for shipping to the laboratory. The field duplicates (including blind duplicates for QA purposes) were likewise collected directly in the sample bottles.

Soil samples collected for chemical analysis were cut from the split-spoon sampler and placed into a clean stainless-steel bowl. Only fairly homogeneous samples were chosen for chemical analysis, with a minimum of pebble-sized particles. Also, the top and bottom portions of soil collected with split-spoon samplers were excluded to ensure that only uncontaminated soil from a known depth was analyzed. A sample was then broken apart, using a clean stainless-steel spoon, and split among the various containers required for shipment to the laboratory, with a portion of the sample also being retained as the lithology sample.

Both water and soil samples for chemical analyses were placed in glass or plastic containers that were pre-cleaned according to EPA procedures (supplied by I-Chem Research, Inc., Hayward, California). When required, preservatives were added to the containers immediately after sample collection. Each sample container was sealed by a teflon lined cap that was taped shut using polyethylene tape to ensure it remained sealed during shipment. Individual sample containers were labelled with the following information:

- o project identifier (AFP 42, IRP-II),
- o sample identifier (as described above),
- o preservatives added,
- o date of sample collection,
- o time of sample collection, and
- o required analytical method (specific for each container).

The individual containers for one sample were all placed together in a sealed plastic bag to prevent cross-contamination in the event of container breakage during shipment. These bags were then placed into insulated shipping coolers, along with a sealed plastic bag of ice.

A chain-of-custody form containing the following information was completed and sealed inside each cooler in a waterproof envelope just prior to shipping:

- o project identifier (AFP 42, IRP-II),
- o name and signature of person who collected the samples,
- o sample identifiers (for all samples in the cooler),
- o date and time of sample collection,
- o number of individual containers for each sample,
- o required analytical methods for each sample.

The shipping coolers were sealed shut with security labels taped over opposite ends of the lid. The coolers were then placed in cardboard mailers and shipped for overnight delivery to the laboratory. Copies of the completed chain-of-custody forms obtained from the laboratory upon completion of analytical effort and sample disposal are presented in Appendix G.

Blind duplicates shipped for quality assurance (QA) purposes were routinely included in shipments along with other samples, and their unique sample identifiers (see above) should have made them indistinguishable from normal samples to the laboratory personnel.

As an additional quality assurance measure, duplicates of each sample shipped for chemical analysis (other than blind duplicates) were also shipped to the USAF Occupational and Environmental Health Laboratory (USAFOEHL/TSA) at Brooks AFB, Texas. These samples were given identical sample identifiers (except for the destination laboratory abbreviation).

3.6 CHEMICAL ANALYTICAL METHODS AND PROCEDURES

Soil and groundwater samples were analyzed in the laboratory for a selected parameters, according to their origin, as described below in Subsection 3.7. The analytical methods followed were all standard, published procedures, as summarized in Table 3.1. The detection limits achieved for each method are also presented in Table 3.1. In accordance with the SOW (Appendix D), second-column GC analysis was performed to

TABLE 3.1
CHEMICAL ANALYTICAL METHODS AND
DETECTION LIMITS

Analytical Parameter	Method Citation	Detection Limit
Groundwater Samples		
Purgeable Halocarbons	EPA 601	2.0 ug/L(a)
Purgeable Aromatics	EPA 602	1.0 ug/L(a)
Total Cyanides	SM 412B/412E	20 ug/L
Total Nickel	EPA 249.1	100 ug/L
pH (field)	EPA 150.1	--
Specific Conductance (field)	EPA 120.1	--
Temperature (field)	EPA 170.1	--
Soil Samples		
Halogenated Volatile Organics	SW 8010	0.01 mg/Kg(b)
Aromatic Volatile Organics	SW 8020	0.005 mg/Kg(b)
Total Oil & Grease	SW 3550 + EPA 413.2	2 mg/Kg
Total Petroleum Hydrocarbons	SW 3550 + EPA 418.1	2 mg/Kg
Total Cyanides	SM 412B/412E	0.5 mg/Kg
Total Phenolics	SM 510A/510C	0.1 mg/Kg
Organochlorine Pesticides & PCBs	SW 8080	(c)
Primary Metals:	CA Title 22:66700 (d)	
Arsenic		0.05 mg/L
Barium		<1.0 mg/L(e)
Cadmium		0.03 mg/L
Chromium		0.06 mg/L
Lead		0.2 mg/L
Mercury		0.001 mg/L
Selenium		0.005 mg/L
Silver		0.03 mg/L
Secondary Metals:	CA Title 22:66700 (d)	
Copper		0.07 mg/L
Iron		<8.0 mg/L(e)
Manganese		<8.0 mg/L(e)
Zinc		<0.2 mg/L(e)
Nickel	CA Title 22:66700 (d)	0.1 mg/L

(a) Detection limits for Purgeable Halocarbons and Aromatics were as specified for all individual compounds. Confirmation by second-column GC analysis was to be performed in accordance with the published methods when first-column results exceeded the following values for a particular compound.

TABLE 3.1
CHEMICAL ANALYTICAL METHODS AND
DETECTION LIMITS
(Continued)

Benzene	0.7 ug/L
Carbon Tetrachloride	4.0 ug/L
1,2-Dichloroethane	0.1 ug/L
Methylene Chloride	4.0 ug/L
Tetrachloroethylene	4.0 ug/L
Trichloroethylene	1.0 ug/L
Vinyl Chloride	1.0 ug/L
Dichlorobenzene isomers	Sum greater than 10 ug/L
Other organics	Greater than 10 ug/L

(b) Detection limits for Halogenated and Aromatic Volatile Organics were as specified for all individual compounds except where dilution was required due to matrix interferences. Confirmation by high second-column GC analysis was performed in accordance with the published methods when first-column results exceeded 10 mg/Kg for any individual compound.

(c) Target detection limits for Organochlorine Pesticides and PCBs were as specified for the individual compounds in SW Method 8080.

(d) CA Title 22:66700 specifies procedures followed in performing the Waste Extraction Test (WET); it also specifies that subsequent analysis of the resulting extract for individual metals shall in accordance with procedures presented in SW-846. Results from this method are reported as mg/L of the extract solution.

(e) Indicates lowest levels detected in any samples, which were above method detection limits.

confirm the identity of individual compounds detected in soil samples at concentrations exceeding 10 mg/Kg (for SW 8010 and SW 8020 analyses).

Soil samples were prepared for analysis in accordance with the published methods, except as noted in Table 3.1. Metals in soil samples were determined in accordance with the Waste Extraction Test (WET) published by the State of California (CA Title 22:66700). The WET method involves addition of 500 mL of 0.2 molar sodium citrate extraction solution (pH 4.9 to 5.1) to a 50 g soil sample. Metals are extracted from the soil sample by mechanical agitation over a period of 48 hours, at a temperature of 20 to 40 °C. The extract solution is then filtered, digested, and analyzed for the individual metals by atomic absorption spectroscopy (AAS) or inductively-coupled argon plasma spectroscopy (ICAP). Results are reported as the concentration of the metal in the extract solution (mg/L). Therefore, a value of 1.0 mg/L as determined by the WET method is equivalent to 10 mg/Kg of extractable metal in the original soil sample, because of the 1:10 dilution that occurs during extraction.

All groundwater samples were shipped and analyzed unfiltered.

Internal quality control (QC) samples were routinely run at a frequency of approximately 10 percent. These included matrix spikes, method blanks, and duplicates. A summary of QC and QA results is presented in Appendix H.

3.7 SITE-SPECIFIC SOIL BORING AND SAMPLING ACTIVITIES

Following is a description of specific field activities conducted at each IRP site, a summary of which is provided in Table 3.2. The identifiers of individual samples collected for chemical analysis from each boring are presented in Section 4.

3.7.1 Fuel-Contaminated Ditch (1-FCD2)

A total of nine soil borings were drilled at this site using a hollow-stem auger. Eight borings were located along the centerline of the ditch, between the underground fuel storage area to the south and the northern edge of the security perimeter to the north, as shown in Figure 3.1. These borings ranged in depth from 20 to 75 feet below the bottom of the ditch. The ninth boring was made about 30 feet east of the ditch centerline, alongside a service road that lies parallel to the ditch between Sites 2 and 3, directly across from Building 214.

TABLE 3.2

SUMMARY OF FIELD INVESTIGATION PROGRAM BY SITES

Site Number	Site Description	Field Activities	Sample Medium	Laboratory Analyses
1-FCD2	Fuel-Contaminated Ditch	2-75 foot borings 2-70 foot borings 2-50 foot borings 2-30 foot borings 1-20 foot borings 3 surface samples	Soil	Total Petroleum Hydrocarbons, Volatile Aromatic Organics, and Volatile Halogenated Organics.
		sample well DW2-1 sample well FW2B	Water	Purgeable Aromatics, and Purgeable Halocarbons.
2-PWD2	Paint Waste Disposal Ditch	5-50 foot borings	Soil	Total Oil and Grease, Volatile Aromatic Organics, Volatile Halogenated Organics, Total Phenolics, and Primary Metals
3-ERA7	Engine Run-up Area in Plant Site 3	4-20 foot borings	Soil	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.
4-VWT5	Vehicle Washrack and Leaking Underground Tank	2-50 foot borings 2-20 foot borings	Soil	Total Oil and Grease, Primary Metals, Volatile Aromatic Organics, and Volatile Halogenated Organics,

TABLE 3.2
SUMMARY OF FIELD INVESTIGATION PROGRAM BY SITES
(Continued)

Site Number	Site Description	Field Activities	Sample Medium	Laboratory Analyses
5-AFTC	Abandoned Fire Training Area	1-50 foot boring 1-10 foot boring	Soil	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.
		1 surface sample	Soil	Primary Metals, and Organochlorine Pesticides/PCBs.
6-OFTC	Original Fire Training Area	1-50 foot boring	Soil	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.
		1 surface sample	Soil	Primary Metals, and Organochlorine Pesticides/PCBs.
7-ERA2	Engine Run-up Area in Plant Site 2	1-200 foot boring 1-100 foot boring 5-50 foot borings	Soil	Total Petroleum Hydrocarbons.
8-FTA8	Fuel Transfer Area	1-20 foot boring	Soil	Total Petroleum Hydrocarbons.
		sample well DW8-1	Water	Purgeable Aromatics, and Purgeable Halocarbons.

TABLE 3.2
SUMMARY OF FIELD INVESTIGATION PROGRAM BY SITES
(Continued)

Site Number	Site Description	Field Activities	Sample Medium	Laboratory Analyses
9-PWW2	Paint Waste Disposal Area - West	2 surface samples	Soil	Total Oil and Grease, Total Phenolics, Volatile Aromatic Organics, and Volatile Halogenated Organics.
10-PWN2	Paint Waste Disposal Area - North	4 surface samples	Soil	Total Oil and Grease, Total Phenolics, Volatile Aromatic Organics, and Volatile Halogenated Organics.
11-DAA2	Disposal Area "A"	2-10 foot borings	Soil	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.
12-ERA1	Engine Run-up Area in Plant Site 1	2-20 foot borings	Soil	Total Oil and Grease.
		sample well DW1-1	Water	Purgeable Aromatics, and Purgeable Halocarbons.
13-DAB2	Disposal Area "B"	4 surface samples	Soil	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.

TABLE 3.2

SUMMARY OF FIELD INVESTIGATION PROGRAM BY SITES
(Continued)

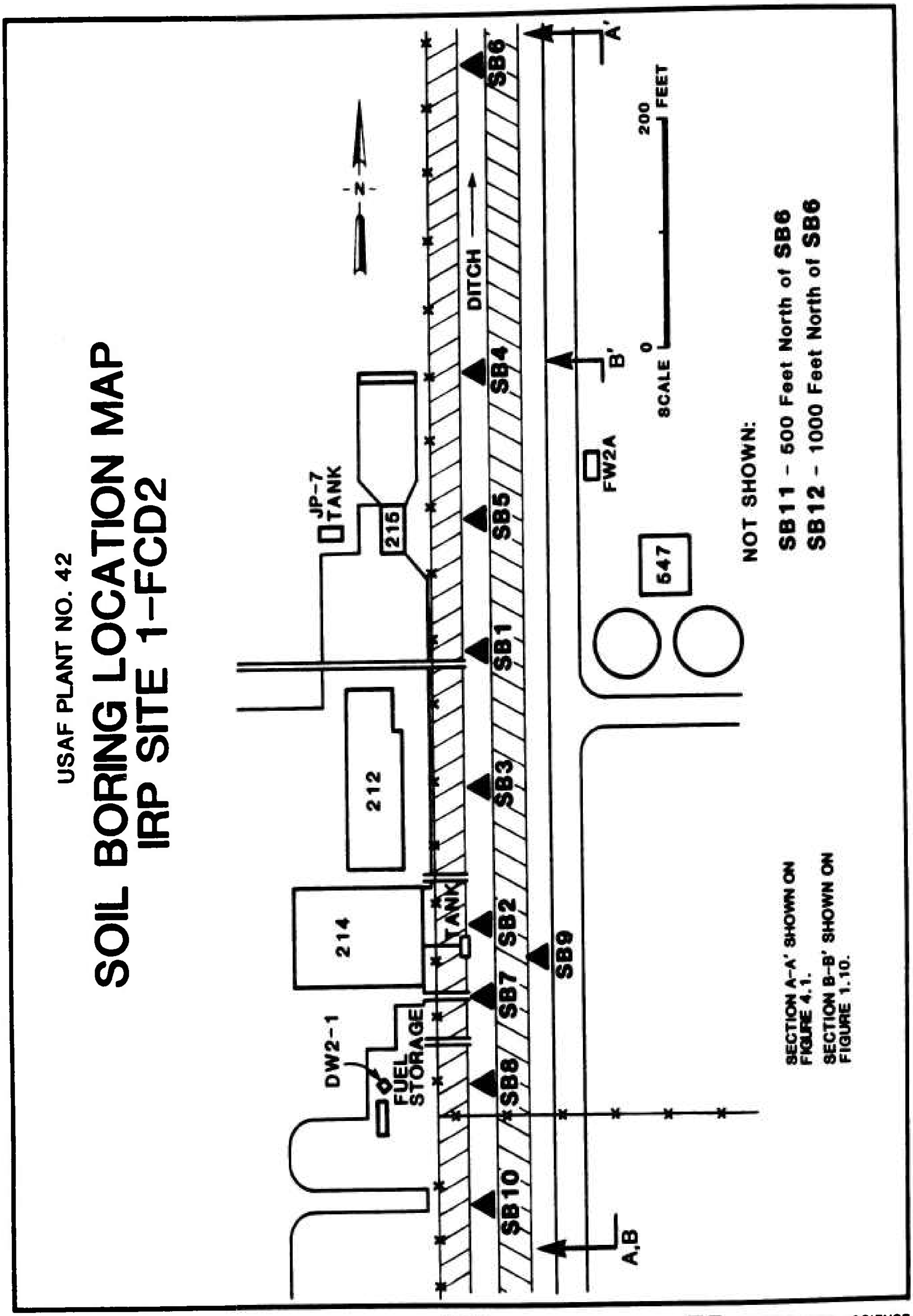
Site Number	Site Description	Field Activities	Sample Medium	Laboratory Analyses
14-EBA2	Engine Build-up Area	2-10 foot borings	Soil	Total Petroleum Hydrocarbons.
15-TEB2	TEB Disposal Area	2-10 foot borings	Soil	Total Petroleum Hydrocarbons.
16-EVP3	Evaporation Ponds	4-50 foot borings	Soil	Volatile Aromatic Organics, Volatile Halogenated Organics, Primary Metals, Nickel, and Total Cyanides.
		sample well DW3-1 sample well DW4-1	Water	Puregeable Aromatics, Purgeable Halocarbons, Total Cyanides, and Nickel.
17-NFTC	New Fire Training Area	1-15 foot boring 1-35 foot boring	Soil	Total Oil and Grease.
		1 surface sample	Soil	Total Petroleum Hydrocarbons.
18-ADA2	Abandoned Disposal Area	1-20 foot boring	Soil	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.

TABLE 3.2

SUMMARY OF FIELD INVESTIGATION PROGRAM BY SITES
(Continued)

Site Number	Site Description	Field Activities	Sample Medium	Laboratory Analyses
19-ERA3	Engine Run-up Area in Plant Site 3	2-10 foot borings	Soil	Total Oil and Grease.
20-NLA2	Noise Level Area	1-20 foot boring	Soil	Total Oil and Grease, Volatile Aromatic Organics, and Volatile Halogenated Organics.
21-FDA7	Fuel Disposal Area	3-20 foot borings	Soil	Total Petroleum Hydrocarbons.
		sample well FW1	Water	Purgeable Aromatics, and Purgeable Halocarbons.
22-ERAT	Engine Run-up Area at Palmdale Air Terminal	2-10 foot borings	Soil	Total Oil and Grease.
23-BDD8	Building Ditch Discharge	2-20 foot borings	Soil	Total Oil and Grease, Volatile Aromatic Organics, Volatile Halogenated Organics, Primary Metals, and Secondary Metals.

FIGURE 3.1


USAF PLANT NO. 42
SOIL BORING LOCATION MAP
IRP SITE 1–FCD2
JP–7 TANK
215
212
214
TANK
DW2–1
FUEL STORAGE
SB6
SB4
SB5
SB1
SB3
SB2
SB9
SB7
SB8
SB10
DITCH
N
A'
B'
A,B
FW2A
547
0
200
FEET
SCALE
NOT SHOWN:
SB11 - 500 Feet North of SB6
SB12 - 1000 Feet North of SB6
SECTION A–A' SHOWN ON FIGURE 4.1.
SECTION B–B' SHOWN ON FIGURE 1.10.

Three near-surface soil samples were also collected manually along the centerline of the ditch (see Figure 3.1), at a depth of 3 feet below the bottom of the ditch. One of these (SB10) was located approximately 100 feet south of SB8. The other two samples (SB11 and SB12) were collected approximately 500 and 1000 feet north of SB6, respectively.

A total of 34 soil samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, and Total Petroleum Hydrocarbons.

3.7.2 Paint Waste Disposal Ditch (2-PWD2)

Five soil borings were drilled along the centerline of the ditch north of Building 211, as shown in Figure 3.2. Each boring was completed at a depth of 50 feet below the bottom of the ditch. The five borings were spaced approximately 100 feet apart, beginning near the discharge point of the abandoned drain from Building 211, with the last boring located about 50 feet outside (north) of the Plant Site 2 security perimeter. Prior to drilling, a backhoe was used to widen the ditch at the bottom and to excavate a ramp for access by the drilling rig. Therefore, the top two to 3 feet of soil in the ditch was disturbed before drilling and sampling began.

A total of 19 soil samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, Total Oil & Grease, Eight Extractable Metals: As, Ba, Cd, Cr, Pb, Hg, Se and Ag, and Total Phenolics.

3.7.3 Engine Run-up Area in Site 7 (3-ERA7)

Four soil borings were drilled along the centerline of the ditch, each to a depth of 20 feet below the bottom of the ditch. One boring was placed to the south of the taxiway entering Site 7, with the other three evenly spaced between the taxiway and the northeast corner of the Site 7 security perimeter, as shown in Figure 3.3.

A total of eight soil samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, and Total Oil & Grease.

3.7.4 Vehicle Washrack and Leaking Underground Tank (4-VWT5)

Four soil borings were drilled at this site, as shown in Figure 3.4. One boring was made near the former location of the leaking underground waste-oil tank and was completed at a depth of 50 feet below land

USAF PLANT NO. 42

SOIL BORING LOCATION MAP
SITES 2-PWD2, 9-PWW2, 10-PWN2,
11-DAA2, 13-DAB2 AND 18-ADA2

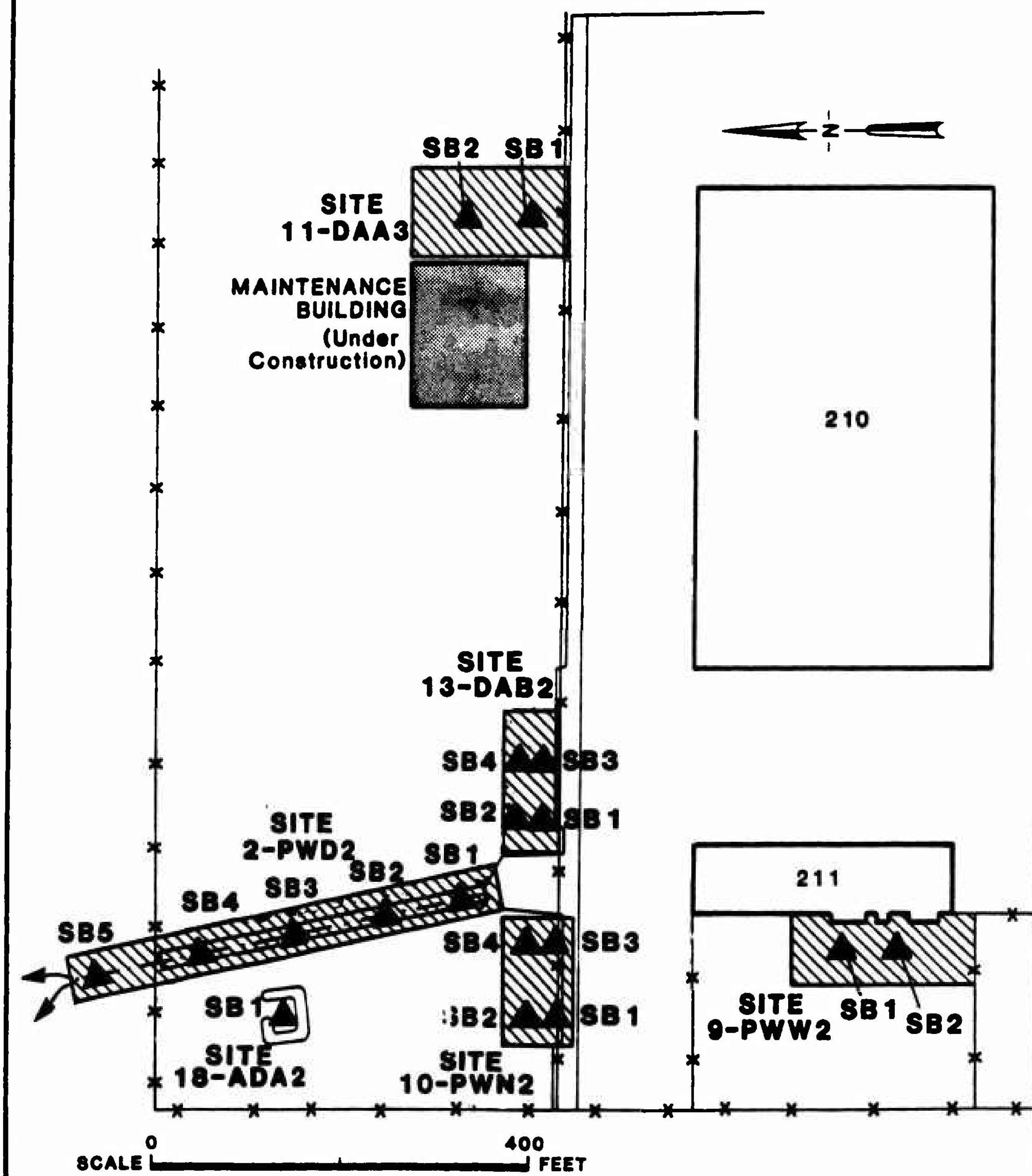


FIGURE 3.3

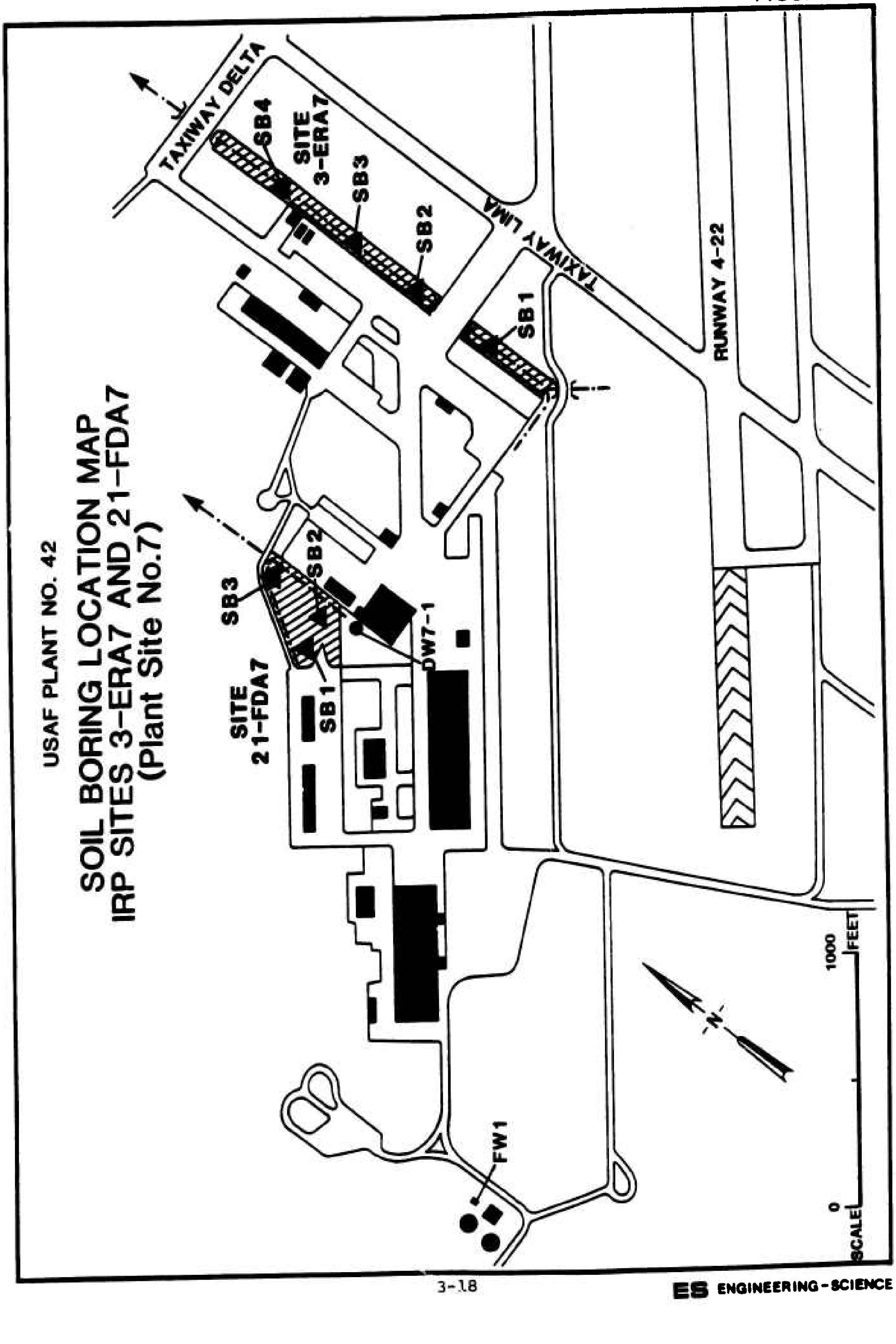
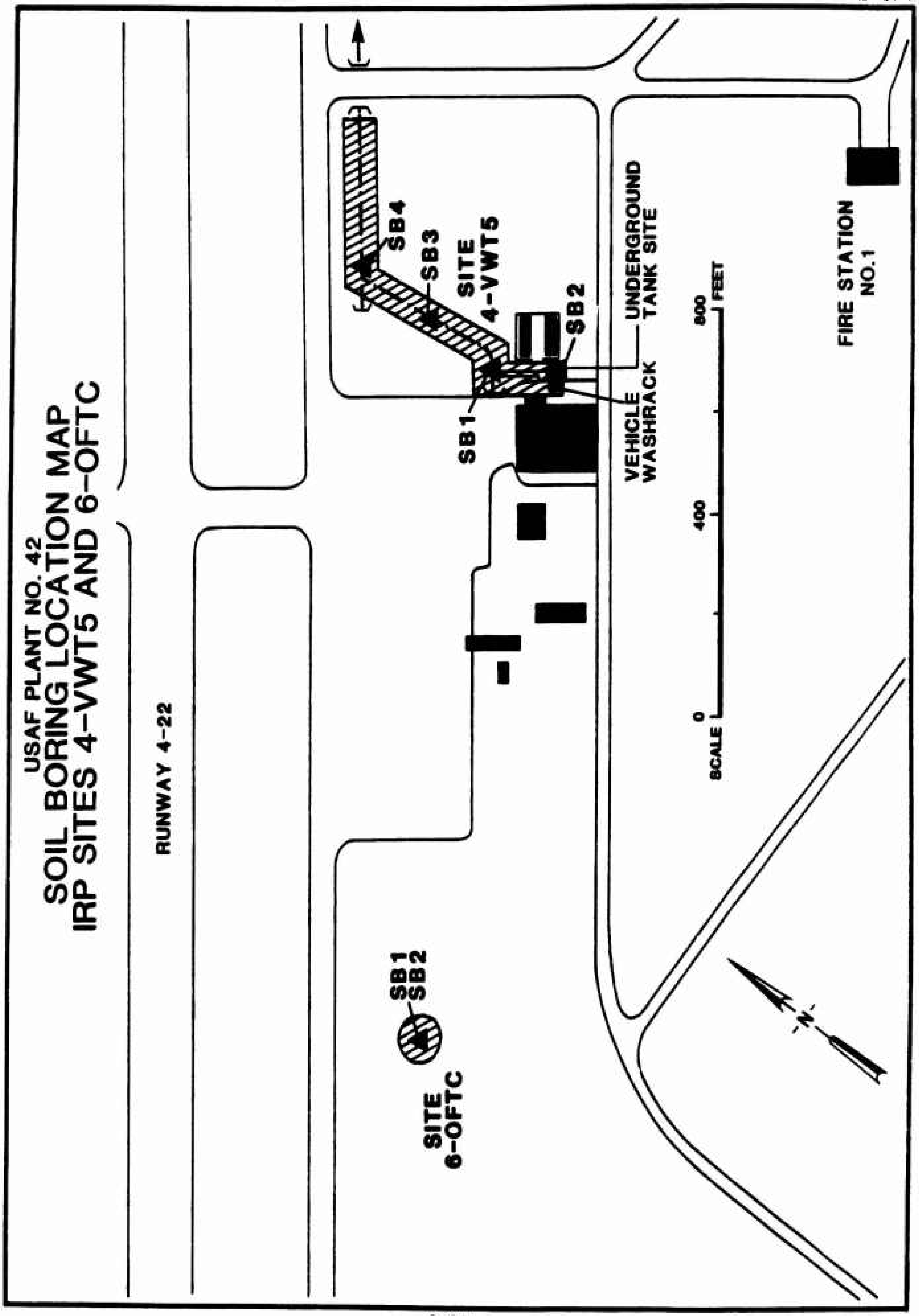

USAF PLANT NO. 42
SOIL BORING LOCATION MAP
IRP SITES 3-ERA7 AND 21-FDA7
(Plant Site No.7)
TAXIWAY DELTA
SITE
3-ERA7
SB4
SB3
SB2
SB1
TAXIWAY LIMA
RUNWAY 4-22
SITE
21-FDA7
SB3
SB2
SB1
DW7-1
FW1
N
SCALE
0
1000
FEET

FIGURE 3.4



USAF PLANT NO. 42
SOIL BORING LOCATION MAP
IRP SITES 4-VWT5 AND 6-OFTC

surface. The other three borings were made in the centerline of the drainage ditch leading away from the vehicle washrack. The first of these was located at the end of the ditch just northeast of Building 531 and was completed at a depth of 47.5 feet below the bottom of the ditch (at auger refusal). The other two borings were located downstream in the ditch, at intervals of approximately 100 feet, and were completed at a depth of 20 feet below the bottom of the ditch.

A total of 11 soil samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, Total Oil & Grease, and Eight Extractable Metals: As, Ba, Cd, Cr, Pb, Hg, Se and Ag.

3.7.5 Abandoned Fire Training Area (5-AFTC)

Two soil borings drilled with a hollow-stem auger were located near the center of the circular fire training area, shown in Figure 3.5. The first was stopped at a depth of only 7.5 feet because of health and safety concerns about fumes from the boring. A second, deeper boring was drilled about 3 feet away and was completed at 55 feet below the land surface. One near-surface soil sample was collected manually in the same area, at a depth of approximately 3 feet.

A total of four soil samples collected during the hollow-stem auger drilling were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, and Total Oil & Grease. The near-surface soil sample was analyzed for Organochlorine Pesticides & PCBs and Eight Extractable Metals: As, Ba, Cd, Cr, Pb, Hg, Se and Ag.

3.7.6 Original Fire Training Area (6-OFTC)

One soil boring was drilled with a hollow-stem auger to a depth of 50 feet, near the center of the circular fire training area, as shown in Figure 3.4. One near-surface soil sample was collected manually in the same immediate area, at a depth of approximately 3 feet.

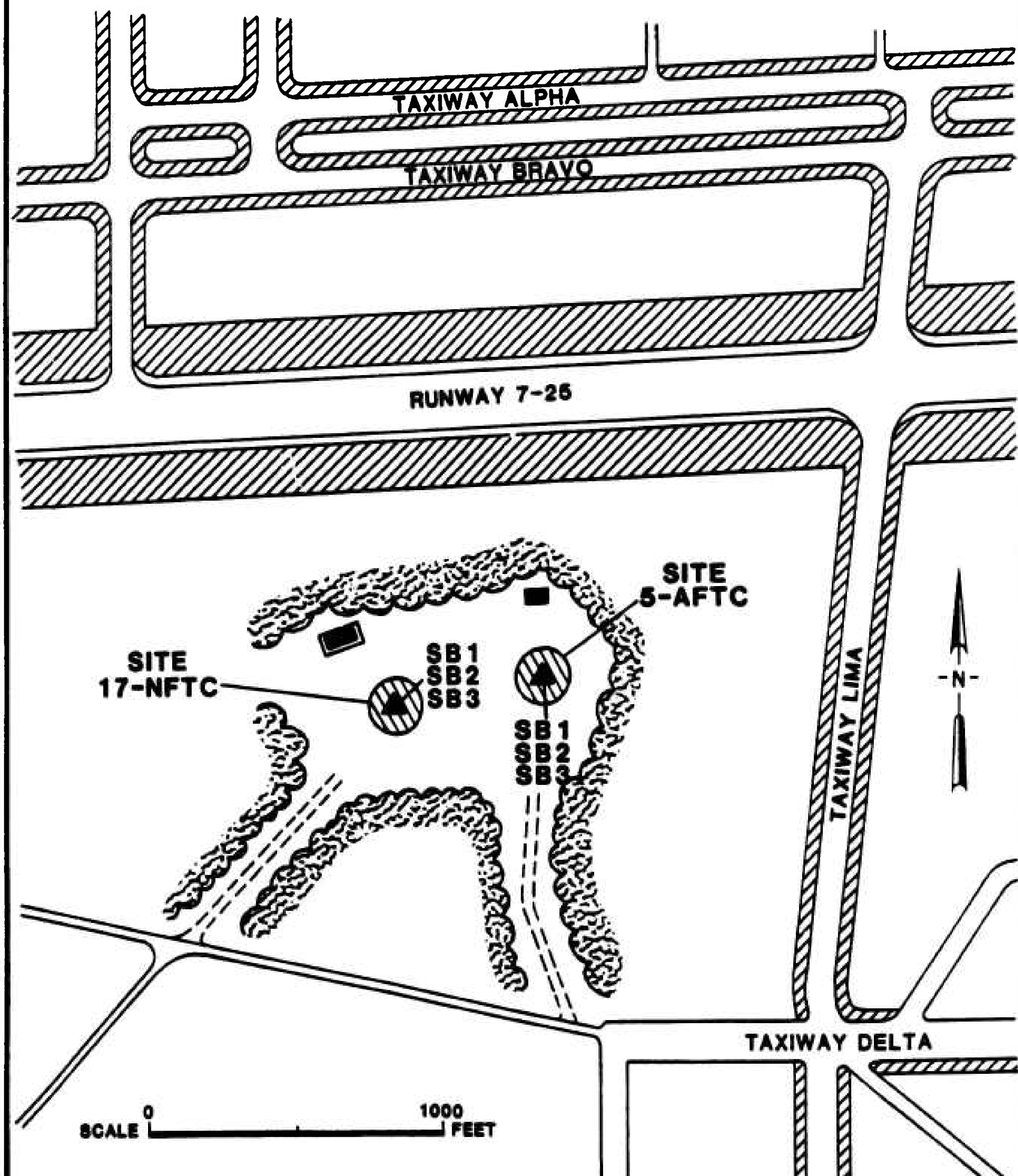
A total of four soil samples collected during the hollow-stem auger drilling were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, and Total Oil & Grease. The near-surface soil sample was analyzed for Organochlorine Pesticides & PCBs and Eight Extractable Metals: As, Ba, Cd, Cr, Pb, Hg, Se and Ag.

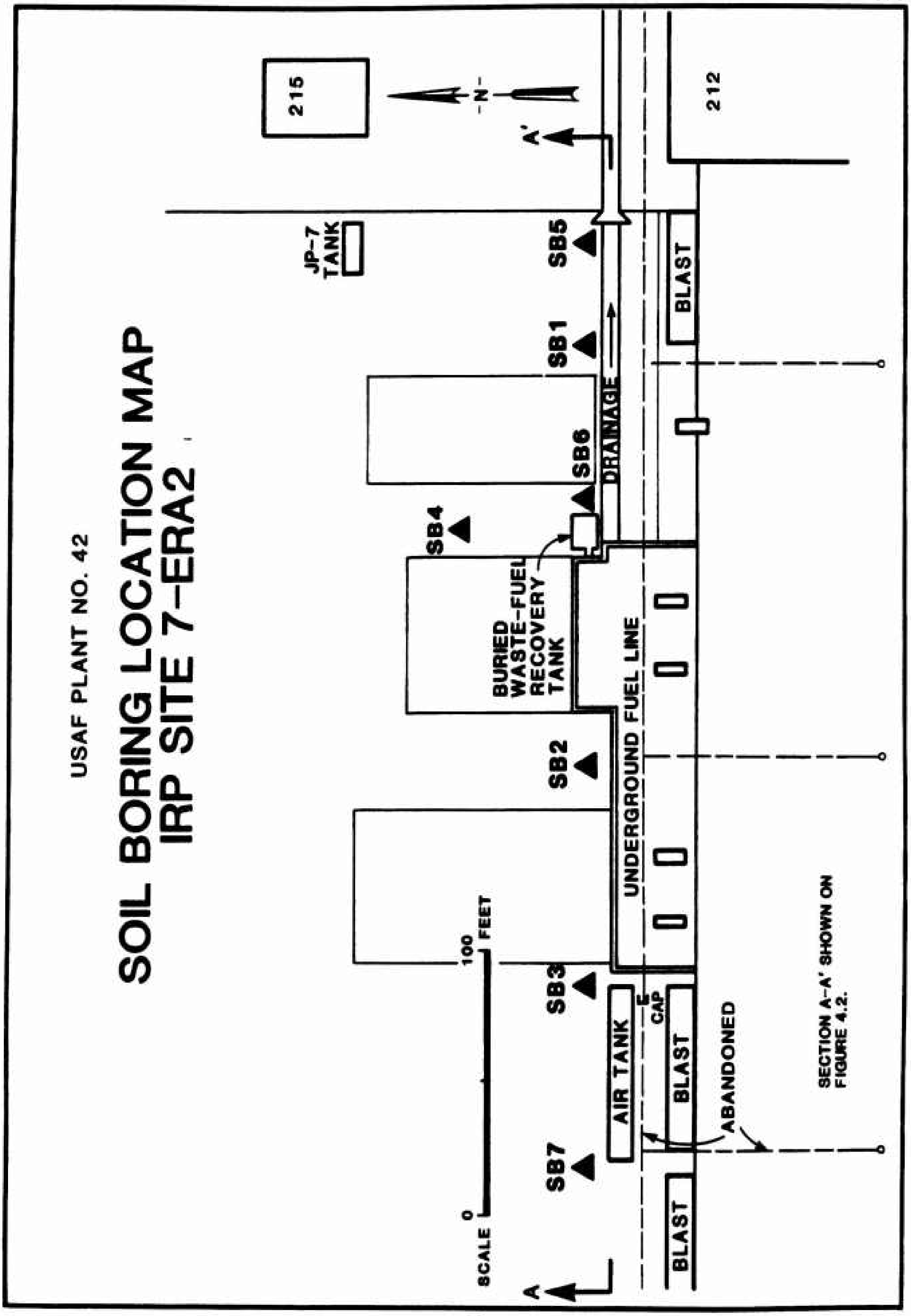
3.7.7 Engine Run-up Area in Site 2 (7-ERA2)

Seven soil borings were drilled at this site, ranging in depth from 50 to 200 feet below the land surface. As shown in Figure 3.6, six of

USAF PLANT NO. 42

SOIL BORING LOCATION MAP
IRP SITES 5-AFTC AND 17-NFTC




USAF PLANT NO. 42
SOIL BORING LOCATION MAP
IRP SITE 7-ERA2
215
212
-N-
A'
A
JP-7 TANK
SB1
SB2
SB3
SB4
SB5
SB6
SB7
DRAINAGE
BLAST
BLAST
BLAST
BURIED WASTE-FUEL RECOVERY TANK
UNDERGROUND FUEL LINE
AIR TANK
E CAP
ABANDONED
SCALE
0
100 FEET
SECTION A-A' SHOWN ON FIGURE 4.2.

the borings were located in a line parallel to and north of the engine run-up area in Site 2, from just west of the compressed air tank and extending to the bituminous pavement north of Building 212. The seventh boring, completed at a depth of 50 feet, was located approximately 50 feet north of the buried tank which receives runoff from the SR-71 engine run-up area. A total of 30 soil samples from this site were analyzed for Total Petroleum Hydrocarbons.

3.7.8 Fuel Transfer Area (8-FTA8)

One 20-foot deep soil boring was drilled between the two railroad sidings west of Building 871, as shown in Figure 3.7. The boring was located midway between the aircraft taxiway and the switch for the railroad siding leading to Building 870. A total of two soil samples collected from this site were analyzed for Total Petroleum Hydrocarbons.

3.7.9 Paint Waste Disposal Area - West (9-PWW2)

Two near-surface soil samples were collected manually from the unpaved area immediately west of Building 211, as shown in Figure 3.2. Both samples were taken at an approximate depth of 3 feet. One sample was collected at a point midway along Building 211 (from north to south), and the other was collected 50 feet further to the south. Both soil samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, Total Oil & Grease, and Total Phenolics.

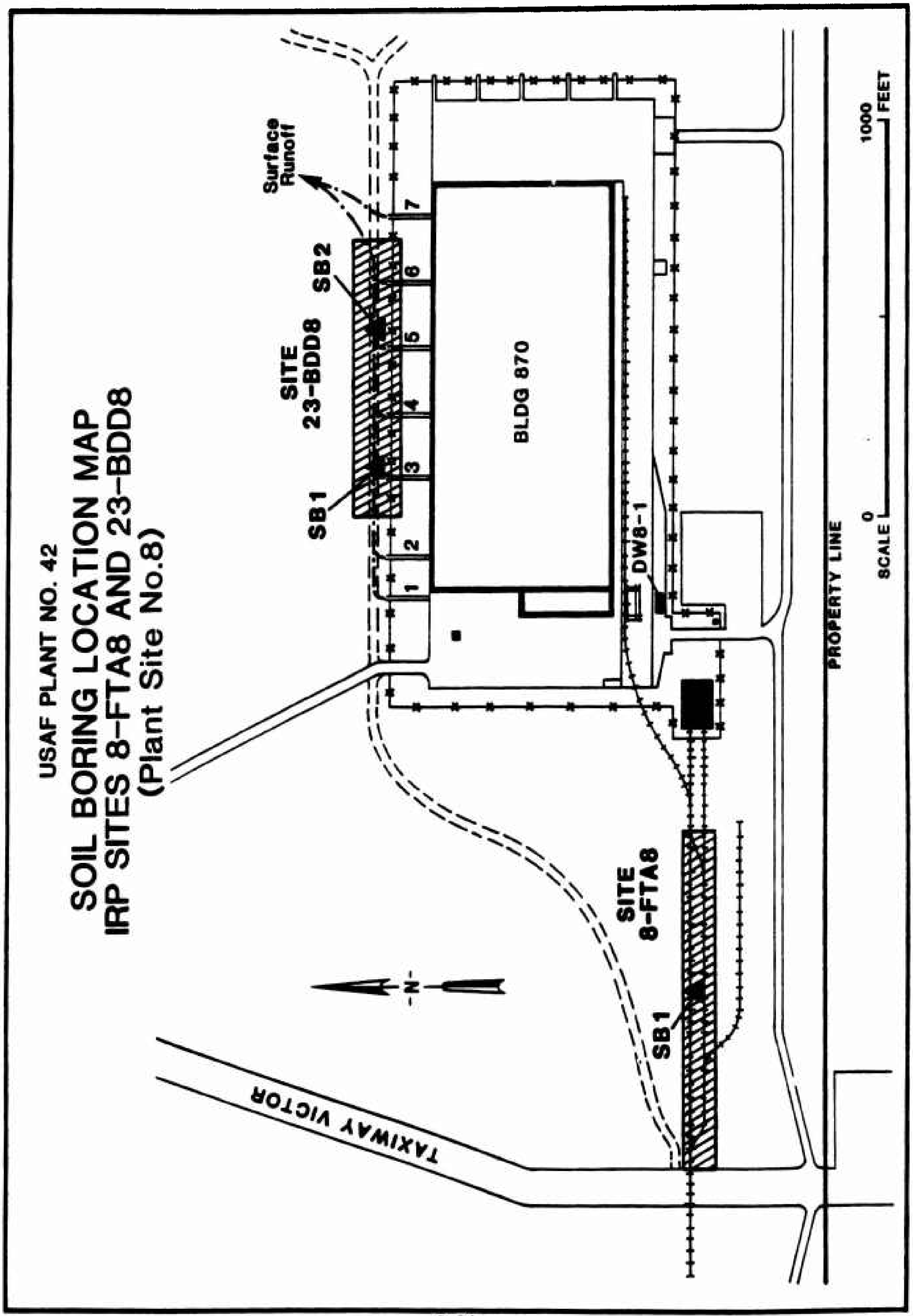
3.7.10 Paint Waste Disposal Area - North (10-PWN2)

Four near-surface soil samples were collected manually from the unpaved area southwest of the former paint waste disposal ditch (IRP Site 2-PWD2) and northwest of Building 211, as shown in Figure 3.2. Each sample was taken at an approximate depth of 3 feet. Two samples were collected about 10 feet north the pavement, approximately 50 and 150 feet west of the ditch centerline, respectively. The two other samples were collected approximately 40 feet north of these. All four soil samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, Total Oil & Grease, and Total Phenolics.

3.7.11 Disposal Area "A" (11-DAA2)

Two soil borings were drilled in the unpaved area north of the maintenance shop in Building 210, as shown in Figure 3.2. Both were

FIGURE 3.7


USAF PLANT NO. 42
SOIL BORING LOCATION MAP
IRP SITES 8-FTA8 AND 23-BDD8
(Plant Site No.8)
SITE 23-BDD8
SB1
SB2
Surface Runoff
1
2
3
4
5
6
7
BLDG 870
DW8-1
SITE 8-FTA8
SB1
-N-
TAXIWAY VICTOR
PROPERTY LINE
0
1000 FEET
SCALE

completed at a depth of 10 feet. The borings were located on a north-south line about 100 feet west of the eastern edge of Building 210, at distances of approximately 50 and 100 feet north of the pavement edge. One soil sample from each boring was analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, and Total Oil & Grease.

3.7.12 Engine Run-up Area in Site 1 (12-ERA1)

Two soil borings were drilled to a depth of 20 feet in the area behind (east of) the aircraft blast barrier located in the southeastern corner of Plant Site 1, as shown in Figure 3.8. The entire area is now covered with bituminous pavement and has extensive buried utilities. Both borings were therefore made about 25 feet east of the original concrete apron. One boring was located about 40 feet north of the central opening in the blast barrier and the other located about 30 feet south of the northern end of the blast barrier. Two soil samples from each boring were analyzed for Total Oil & Grease.

3.7.13 Disposal Area "B" (13-DAB2)

Four near-surface soil samples were collected manually from the unpaved area located southeast of the former paint waste disposal ditch (IRP Site 2-PWD2), as shown in Figure 3.2. Each sample was collected at a depth of approximately 3 feet. Two samples were collected about 10 feet north the pavement, approximately 50 and 100 feet east of the ditch centerline, respectively. The two other samples were collected approximately 40 feet north of these. All four soil samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, and Total Oil & Grease.

3.7.14 Engine Build-up Area (14-EBA2)

Two 10-foot deep soil borings were drilled in the drainage ditch south of Building 231, as shown in Figure 3.9. One boring was located approximately 30 feet south and 20 feet west of Building 231, and the other was located 50 feet further west. One sample from each boring was analyzed for Total Petroleum Hydrocarbons.

3.7.15 TEB Disposal Area (15-TEB2)

Two 10-foot deep soil borings were made in the drainage ditch south of Building 232, as shown in Figure 3.9. One boring was located approximately 70 feet south and 25 feet east of Building 232, with the other located 50 feet to the west (25 feet west of the eastern edge of

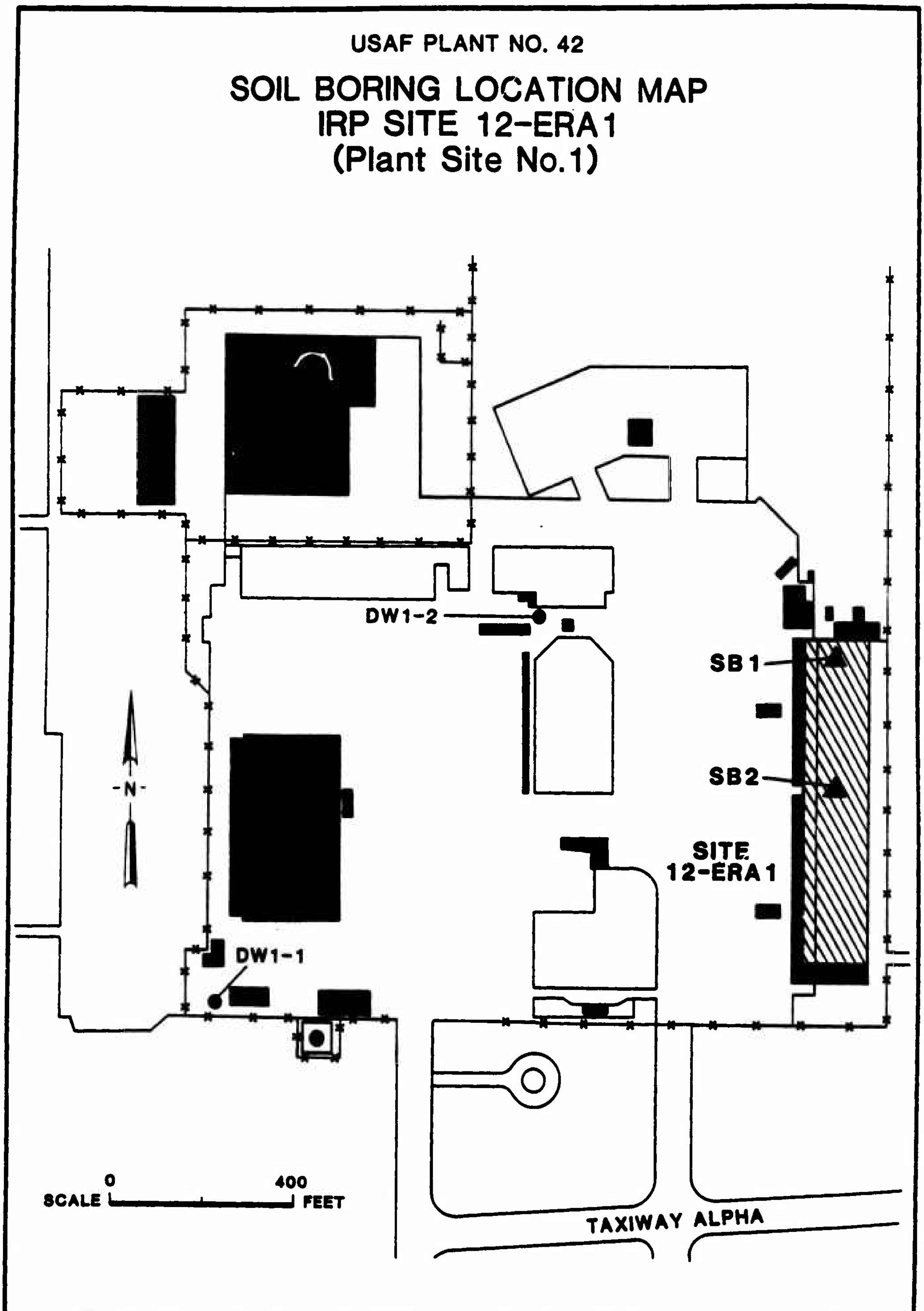
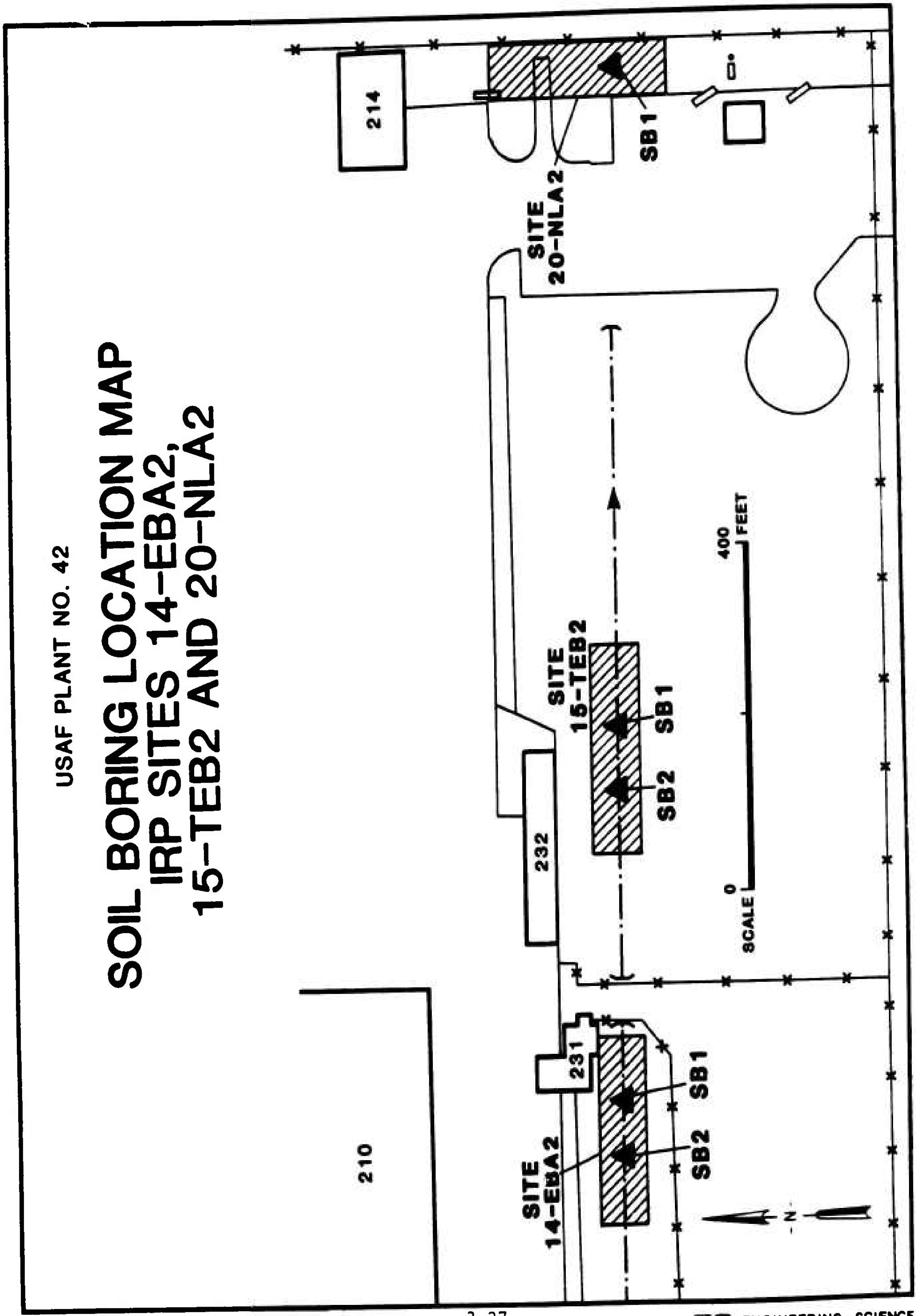

USAF PLANT NO. 42
SOIL BORING LOCATION MAP
IRP SITE 12-ERA1
(Plant Site No.1)
DW1-2
SB1
SB2
SITE
12-ERA1
DW1-1
-N-
0
400
SCALE
FEET
TAXIWAY ALPHA

FIGURE 3.9



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Building 232). One sample from each boring was analyzed for Total Petroleum Hydrocarbons.

3.7.16 <u>Evaporation Ponds (16-EVP3)</u>

Four soil borings were drilled north of Building 307, in the area currently used for surplus equipment storage area, as shown in Figure 3.10. The location of the former evaporation ponds was determined from an old aerial photograph (circa 1965). Three of the soil borings were located along the north-south centerline of the ponds at approximately 150 foot intervals. A fourth boring was located about 150 feet east of the central boring, outside the area of the former ponds but in the general direction of surface runoff.

A total of 15 soil samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, Total Cyanides, and Nine Extractable Metals: As, Ba, Cd, Cr, Pb, Hg, Se, Ag, and Ni.

3.7.17 <u>New Fire Training Area (17-NFTC)</u>

Two soil borings drilled with a hollow-stem auger were located near the center of the circular fire training area, as shown in Figure 3.5. The first was completed at a depth of 35 feet and the second, located about 3 feet away, was completed at 15 feet. One near-surface soil sample was collected manually, at a depth of approximately 3 feet, in the same immediate area. A total of three soil samples collected during hollow-stem auger drilling were analyzed for Total Oil & Grease. The near-surface sample was analyzed for Total Petroleum Hydrocarbons.

3.7.18 <u>Abandoned Disposal Area (18-ADA2)</u>

One soil boring was drilled in the center of the former burn pit located west of the former paint waste disposal ditch (IRP Site 2-PWD2), as shown in Figure 3.2. The boring was completed at a depth of 20 feet. A total of two soil samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, and Total Oil & Grease.

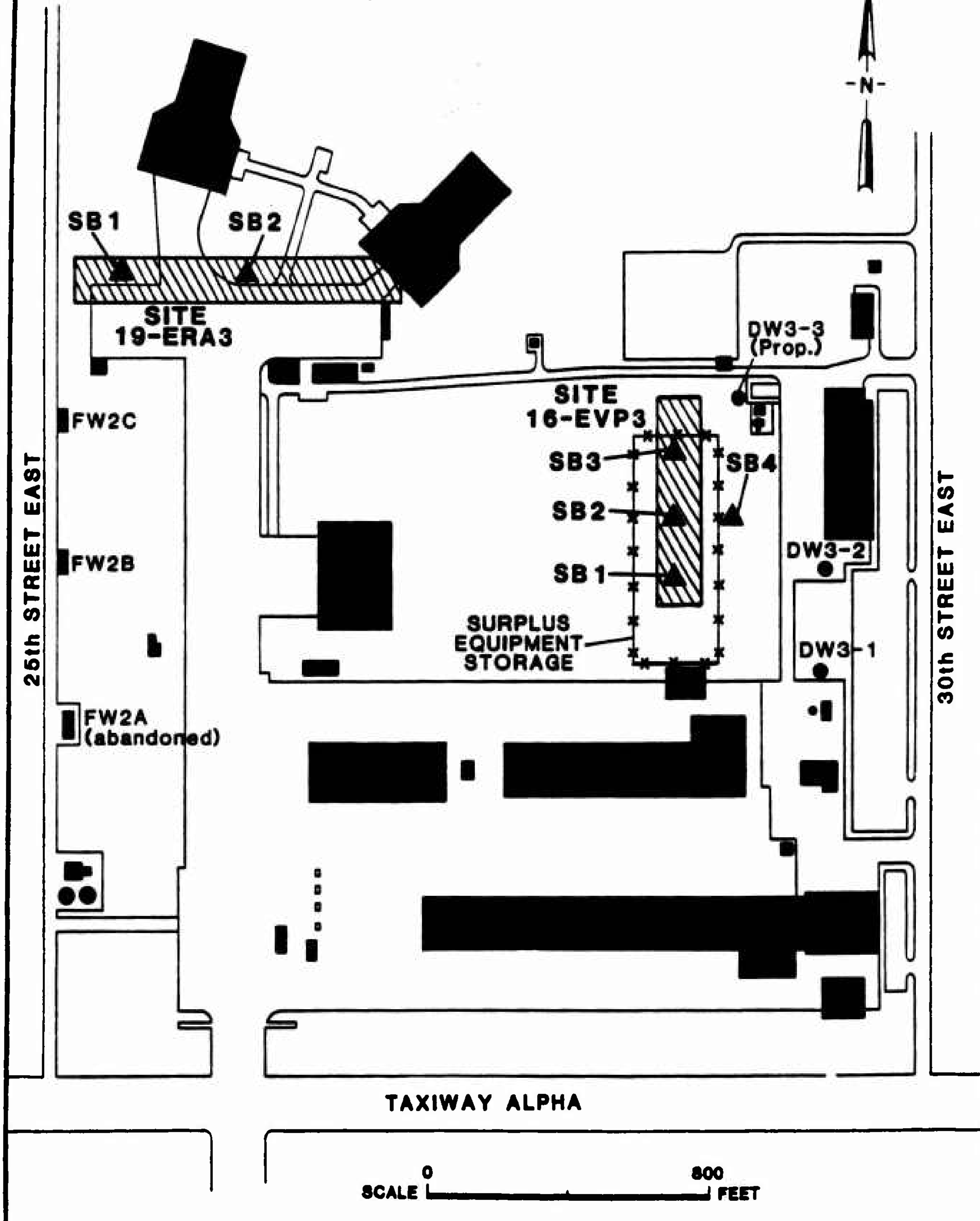
3.7.19 <u>Engine Run-up Area in Site 3 (19-ERA3)</u>

Two 10-foot deep soil borings were drilled along the former engine run-up area in the northwest corner of Plant Site 3. As shown in Figure 3.10, one boring was located midway between the western edge of the concrete apron and the ramp leading to the west hush-house. The other was drilled due east, midway between the ramp to the west hush-house and the electrical substation situated between the two hush-houses. Both

FIGURE 3.10

USAF PLANT NO. 42

SOIL BORING LOCATION MAP IRP SITES 16-EVP3 AND 19-ERA3 (Plant Site No.3)



borings were approximately 5 feet from the edge of the concrete. One sample from each boring was analyzed for Total Oil & Grease.

3.7.20 Noise Level Area (20-NLA2)

A single soil boring, 20 feet deep, was drilled about 100 feet south of the eastern end of the concrete ramp formerly used as a noise level area (currently used for parking fuel trucks and trailers). The approximate location is shown in Figure 3.9. Another boring was planned in the area north of the ramp, but numerous underground utilities and fuel lines made it impossible to drill safely in that area. Two soil samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, and Total Oil & Grease.

3.7.21 Fuel Disposal Area (21-FDA7)

Three 20-foot deep soil borings were drilled in the area north and east of the former fuel-flow test facility (currently used for hazardous waste storage). As shown in Figure 3.3, one boring was located north of the drum storage pad, midway to the drainage ditch. A second boring was located approximately 150 feet northeast of the drum storage area, in the direction of surface water runoff. The third boring was placed in the centerline of the main drainage ditch leading away from the area, approximately 250 feet north of the second boring. A total of six samples from this site were analyzed for Total Petroleum Hydrocarbons.

3.7.22 Engine Run-up Area at the Palmdale Air Terminal (22-ERAT)

Two 20-foot deep soil borings were drilled along the eastern edge of the old engine run-up area near the Palmdale Air Terminal. These borings were located about 3 feet off the bituminous pavement and, as shown in Figure 3.11, each was spaced at equal distances from the other boring and the nearer end of the engine run-up area. One soil sample from each boring was analyzed for Total Oil & Grease.

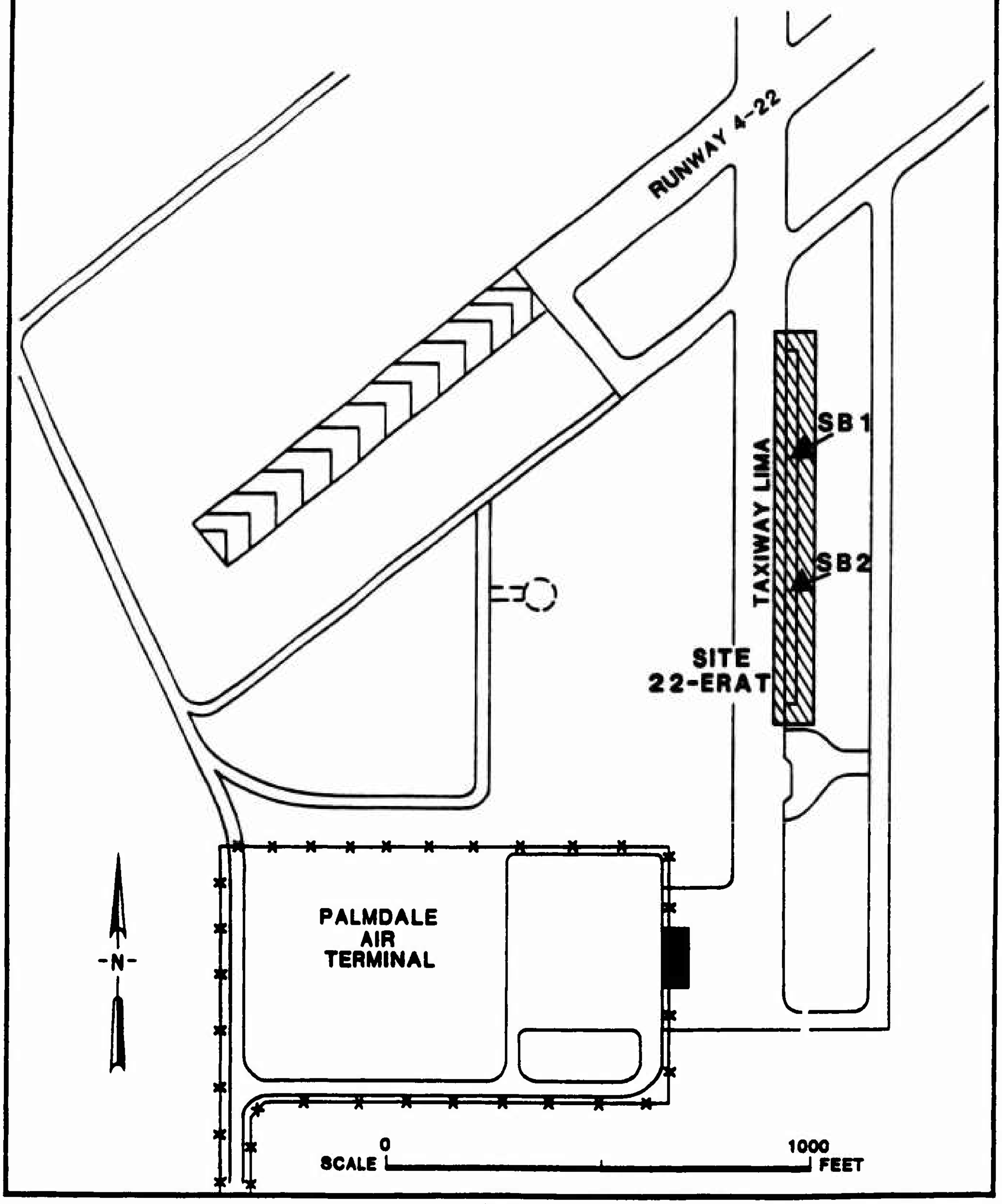
3.7.23 Building Ditch Discharge (23-BDD8)

Two soil borings were drilled along the unpaved road lying parallel to and just outside of the northern perimeter fence around Site 8. As shown in Figure 3.7, the first boring was located approximately 10 feet north of the third concrete drainage swale from Building 870, counted from the west end of the building. The other boring was located about 10 feet east and 25 feet north of the fifth concrete drainage swale, in the general path of surface runoff from the entire area. Both borings

FIGURE 3.11

USAF PLANT NO. 42

SOIL BORING LOCATION MAP
IRP SITE 22-ERAT
(Palmdale Air Terminal)



were 20 feet deep. Four samples from this site were analyzed for Halogenated Volatile Organics, Aromatic Volatile Organics, and Twelve Extractable Metals: As, Ba, Cd, Cr, Pb, Hg, Se, Ag, Cu, Fe, Mn and Zn. Two samples from SB1 were also analyzed for Total Oil & Grease.

3.8 SITE-SPECIFIC GROUNDWATER SAMPLING ACTIVITIES

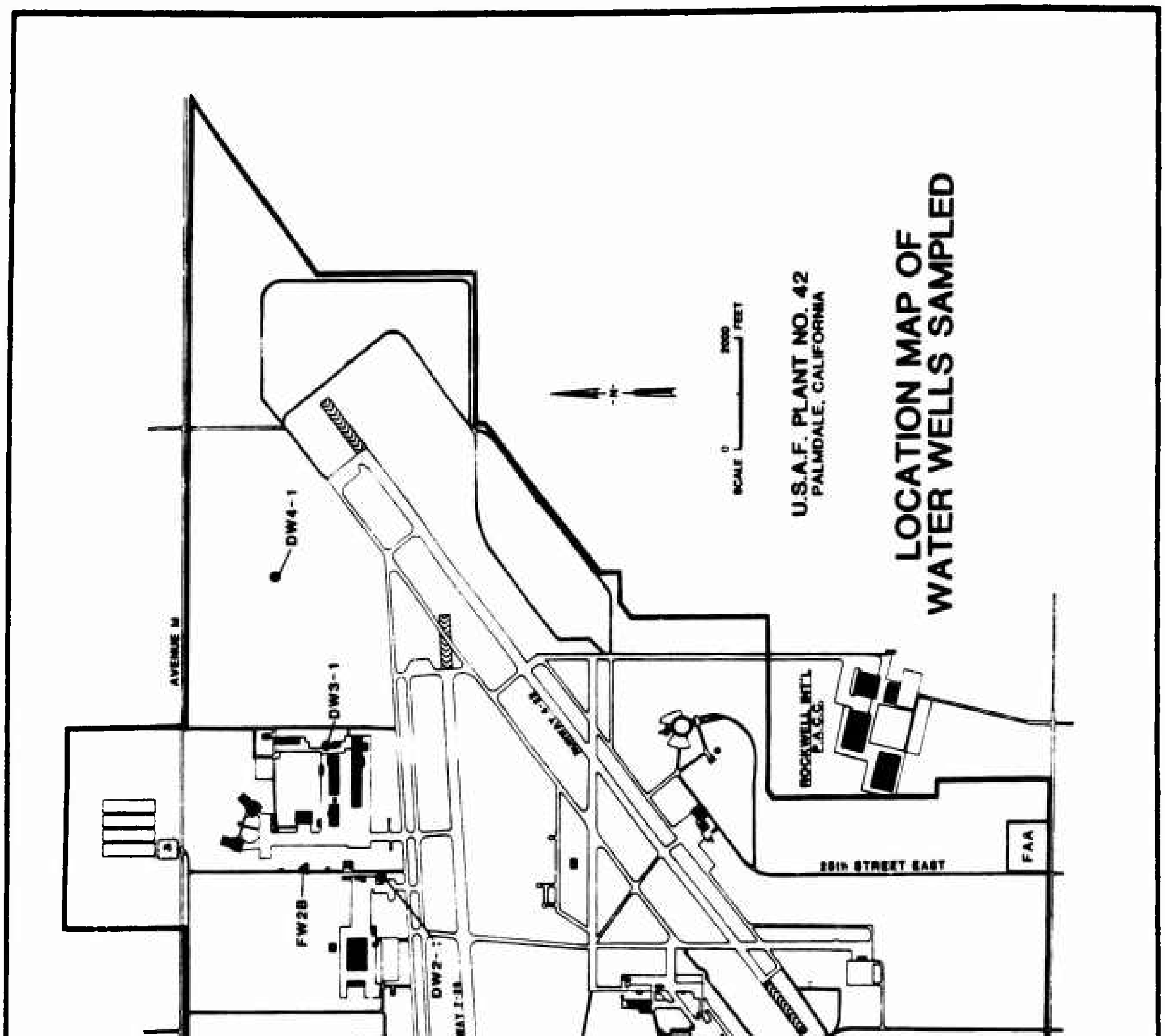
Seven existing production wells were sampled once to determine groundwater quality in both upgradient and downgradient parts of USAF Plant 42, and to seek evidence of possible groundwater contamination related to one or more of the 23 IRP sites. The wells that were sampled are shown in Figure 3.12. Since the general direction of groundwater flow at USAF Plant 42 is to the northeast (see Section 2), three of the wells sampled are considered upgradient of the IRP sites:

- o DW1-1, the drinking water supply well in the southwest corner of Site 1 (one of two wells in Site 1),
- o DW8-1, the drinking water supply well in the southwest corner of Site 8 (the only well within Site 8), and
- o FW1, the fire protection well at Pump Station No. 1, located to the southwest of Site 7.

Although these wells are generally upgradient, they could potentially be contaminated by materials related to the IRP sites or other sources. For example, well DW8-1 is located near a drainage ditch that flows from IRP Site 8-FTA8, located approximately 1500 feet to the west.

The other four wells were considered downgradient with respect to the overall installation and most of the individual IRP sites:

- o DW2-1, the drinking water supply well at the eastern edge of Site 2 (the only well within Site 2),
- o FW2B, fire protection well "B" at Pump Station No. 2, between Sites 2 and 3 (well "C" was not sampled, and "A" is abandoned),
- o DW3-1, the drinking water supply well at the eastern edge of Site 3 (the southernmost of two existing wells in Site 3), and
- o DW4-1, the westernmost of two wells located in Site 4.


LOCATION MAP OF
WATER WELLS SAMPLED
U.S.A.F. PLANT NO. 42
PALMDALE, CALIFORNIA
SCALE 0 2000 FEET
N
EXPLANATION
● Potable Water Well
▲ Fire Protection Well
AVENUE M
AVENUE P
25th STREET EAST
SIERRA HIGHWAY
ROCKWELL INT'L
P.A.C.C.
FAA
LOCKHEED
PALMDALE COMPLEX
PLANT NO. 10
DW4-1
DW3-1
DW2-1
DW1-1
DW8-1
FW2B
FW1
RUNWAY 7-25
RUNWAY 1-25

The IRP sites of greatest concern as potential sources of contamination to wells DW2-1 and FW2B were 1-FCD2, 7-ERA2, and 20-NLA2; however, any of the IRP sites located to the south and west of these wells could be a potential source of contamination. While all of the IRP sites were of potential concern with regard to wells DW3-1 and DW4-1, the greatest concern was about IRP Site 16-EVP3, due to its close proximity.

All seven groundwater samples were analyzed for Purgeable Halocarbons and Purgeable Aromatics, and field measurements were made of their pH, specific conductance, and temperature. Because of concerns about potential contamination from IRP Site 16-EVP3, wells DW3-1 and DW4-1 were also analyzed for Nickel and Total Cyanides.

3.9 SCHEDULE OF FIELD ACTIVITIES

The field investigation program was conducted in three phases during the period from December 1985 to April 1986. A summary of the drilling and soil sampling activities conducted during each phase is presented in Table 3.3, while Table 3.4 presents a summary of groundwater sampling activities.

The field work began with a project meeting held at USAF Plant 42 on December 2, 1985. Representatives from Engineering-Science, Layne-Western Company (drilling subcontractor), USAF Plant 42 (Det. 2, AFCMD), and the various tenant contractors were in attendance to review logistical, safety, and security concerns related to the field investigation program. The drilling equipment and crew arrived at the site on December 4, and drilling began the next day. The first phase was completed on December 21, when field work was stopped for the holidays.

The second phase began on January 29, 1986, with the collection of several groundwater samples. Drilling activities started on February 3. The second phase of work was completed on February 13.

The final phase of work began on April 8, with an interim project review meeting between representatives of Engineering-Science, USAF Plant 42 (Det. 2, AFCMD), and the OEHL Technical Program Monitor. Drilling activities began the same day. All field work was completed on April 30, 1986.

TABLE 3.3
SUMMARY OF SOIL BORING AND SAMPLING ACTIVITIES

Site	Boring	Depth	Number of Samples*
Phase One - 02 December to 21 December 1985			
22-ERAT	SB1	10	1
22-ERAT	SB2	10	1
17-NFTC	SB1	35	2
17-NFTC	SB2	15	1
5-AFTC	SB1	7.5	1
4-WWT5	SB1	47.5	4
4-WWT5	SB2	50	3
6-OFTC	SB1	50	4
7-ERA2	SB1	50	3
7-ERA2	SB2	50	3
7-ERA2	SB3	50	4
2-PWD2	SB1	50	4
2-PWD2	SB2	50	4
2-PWD2	SB3	50	4
2-PWD2	SB4	50	4
2-PWD2	SB5	50	3
18-ADA2	SB1	20	2
Phase Two - 29 January to 13 February 1986			
16-EVP3	SB1	50	4
16-EVP3	SB2	50	3
16-EVP3	SB3	50	4
16-EVP3	SB4	50	4
5-AFTC	SB2	55	3
4-WWT5	SB3	20	2
4-WWT5	SB4	20	2
23-BDD8	SB1	20	2
7-ERA2	SB4	50	3
15-TEB2	SB1	10	1
15-TEB2	SB2	10	1
14-EBA2	SB1	10	1
14-EBA2	SB2	10	1
20-NLA2	SB1	20	2
11-DAA2	SB1	10	1
11-DAA2	SB2	10	1
Phase Three - 08 April to 30 April 1986			
23-BDD8	SB2	20	2
1-FCD2	SB1	75	4
1-FCD2	SB2	75	4
1-FCD2	SB3	50	3
1-FCD2	SB4	30	3

TABLE 3.3 (Continued)
SUMMARY OF SOIL BORING AND SAMPLING ACTIVITIES

Site	Boring	Depth	Number of Samples*
1-FCD2	SB5	30	3
1-FCD2	SB6	20	2
1-FCD2	SB7	70	4
1-FCD2	SB8	50	3
1-FCD2	SB9	70	5
1-FCD2	SB10	**	1
1-FCD2	SB11	**	1
1-FCD2	SB12	**	1
9-PWW2	SB1	**	1
9-PWW2	SB2	**	1
7-ERA2	SB5	200	8
7-ERA2	SB6	100	5
7-ERA2	SB7	50	3
21-FDA7	SB1	20	2
21-FDA7	SB2	20	2
21-FDA7	SB3	20	2
8-FTA8	SB1	20	2
17-NFTC	SB3	**	1
19-ERA3	SB1	10	1
19-ERA3	SB2	10	1
12-ERA1	SB1	20	2
12-ERA1	SB2	20	2
3-ERA7	SB1	20	2
3-ERA7	SB2	20	2
3-ERA7	SB3	20	2
3-ERA7	SB4	20	2
5-AFTC	SB3	**	1
6-OFTC	SB2	**	1
10-PWN2	SB1	**	1
10-PWN2	SB2	**	1
10-PWN2	SB3	**	1
10-PWN2	SB4	**	1
13-DAB2	SB1	**	1
13-DAB2	SB2	**	1
13-DAB2	SB3	**	1
13-DAB2	SB4	**	1

* Number of samples does not include blind duplicates collected for laboratory quality assurance purposes.

** These samples were collected manually at an approximate depth of 3 feet.

TABLE 3.4
SUMMARY OF GROUNDWATER SAMPLING ACTIVITIES

Well Identifier	Well Location*	Sampling Date
DW1-1	SW corner of Site 1	30 January 1986
DW3-1	East side of Site 3	30 January 1986
DW8-1	SW Corner of Site 8	30 January 1986
FW2B	Between Sites 2 and 3	31 January 1986
FW1	Common area SW of Site 7	31 January 1986
DW2-1	East site of Site 2	23 April 1986
DW4-1	East site of Site 4	23 April 1986

* See Figure 3.12.

SECTION 4.0

DISCUSSION OF RESULTS AND SIGNIFICANCE OF FINDINGS

SECTION 4.0

DISCUSSION OF RESULTS AND SIGNIFICANCE OF FINDINGS

This section presents results of the field investigation program described in Section 3, along with general and site-specific discussions of the significance of findings at USAF Plant 42. Subsection 4.1 presents field observations and analytical results for the soils, and Subsection 4.2 presents analysis results for groundwater. Subsection 4.3 is a discussion of the criteria used to determine the significance of these results. The significance of findings at the individual IRP sites is presented in Subsection 4.4.

4.1 RESULTS OF SOIL SAMPLING AND ANALYSIS

4.1.1 Fuel-Contaminated Ditch (1-FCD2)

Soil samples were collected from twelve locations at this site (see Figure 3.1). Eight soil borings were made along the ditch centerline (SB1 to SB8) between the underground fuel storage area and the northern end of the Site 2 security perimeter. A ninth soil boring (SB9) was made about 40 feet east of the ditch centerline to determine whether contaminants had spread laterally from the ditch. Three near-surface soil samples (SB10, SB11 and SB12) were collected manually at other locations within the ditch (see Figure 3.1). A section drawing of the site is presented in Figure 4.1 which shows the extent of contamination, based on both field observations and chemical analytical results.

Table 4.1 presents observations made during drilling, which indicated the presence of contaminants at all but two sampling locations (SB9 and SB10) based on soil discoloration, fuel odors, and organic vapor readings. Based on these observations, the area of greatest contaminant concentration was between borings SB8 and SB3, near the waste fuel tank east of Building 214 (see Figure 4.1).

Table 4.2 presents the analytical results for 34 soil samples which confirmed the presence of contamination at the site. Total petroleum

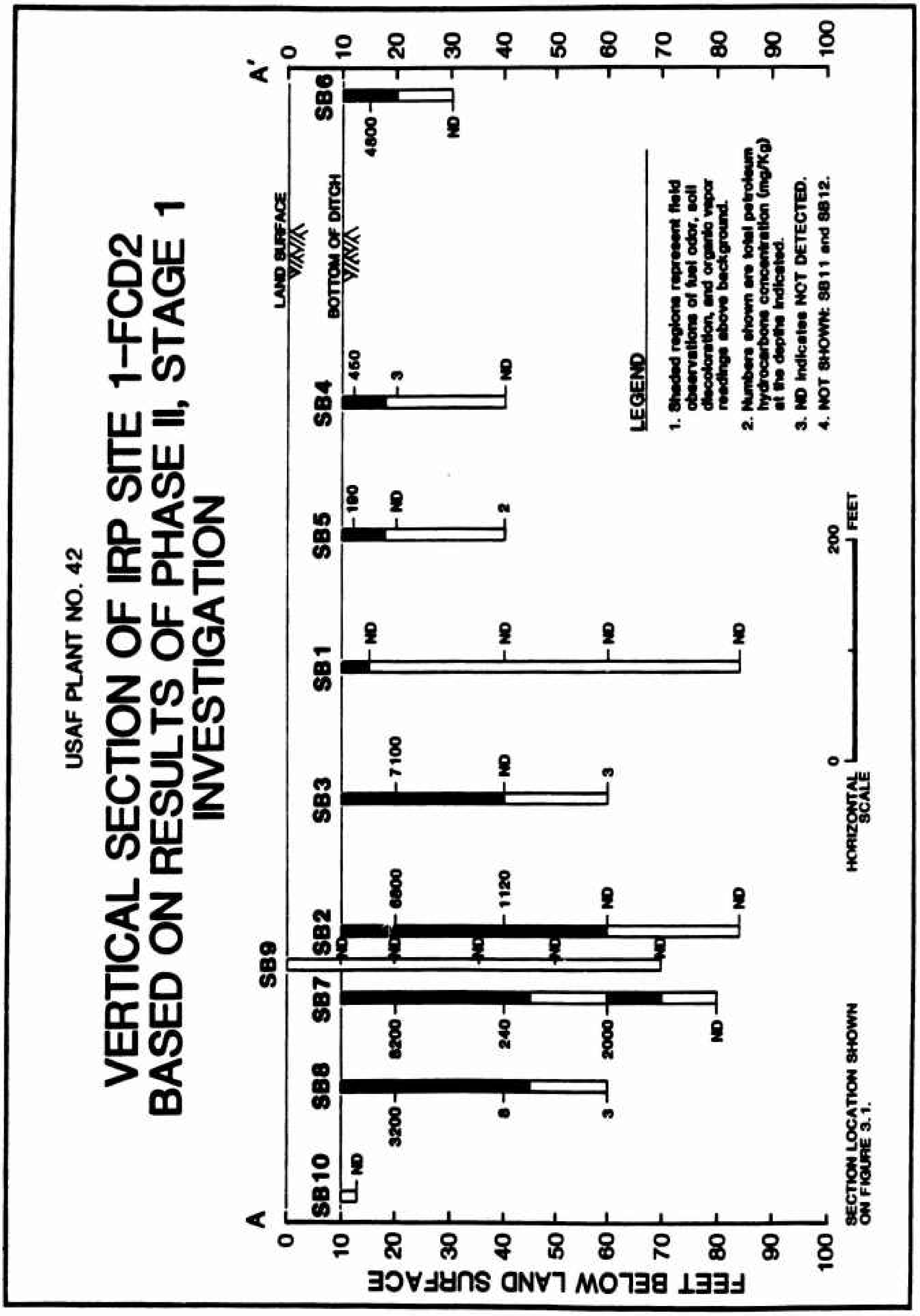


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TABLE 4.1

SUMMARY OF OBSERVATIONS DURING TEST DRILLING AT SITE 1-FCD2

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
1-FCD2-SB1	75	0-5	Gray-brown	Strong, fuel	30 ppm
		5-75	Normal (N)	No odor (NO)	Background (B)
1-FCD2-SB2	75	0-50	Green to gray	Fuel	28-60 ppm
		50-75	N	NO	B
1-FCD2-SB3	50	0-30	Gray-brown	Fuel	B-42 ppm
		30-50	N	NO	B
1-FCD2-SB4	30	0-7.5	Gray-brown	Fuel	9-23 ppm
		7.5-12.5	Gray-brown	NO	B-7 ppm
		12.5-30	N	NO	B
1-FCD2-SB5	30	0-7.5	Gray-brown	Fuel	19-30 ppm
		7.5-10	Gray-brown	NO	B-1 ppm
		10-30	N	NO	B
1-FCD2-SB6	20	0-10	Gray-brown	Fuel	15-30 ppm
		10-20	N	NO	B
1-FCD2-SB7	70	0-35	Green-gray-brown	Fuel	9-55 ppm
		35-50	N	NO	B-4 ppm
		50-60	N	Fuel	B-40 ppm
		60-70	N	NO	B
1-FCD2-SB8	50	0-35	Green-gray	Fuel	B-38 ppm
		35-50	N	NO	B
1-FCD2-SB9	70	0-70	N	NO	B
1-FCD2-SB10	3	0-3	N	NO	B
1-FCD2-SB11	3	0-3	Gray-brown	Slight, fuel	1 ppm
1-FCD2-SB12	3	0-3	Gray-brown	Slight, fuel	B

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

TABLE 4.2
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 1-FCD2

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Petroleum Hydrocarbons (SW 3550 and EPA 418.1) (mg/Kg)
1-FCD2-SB1-SS5-10	ND[a]	ND	ND
1-FCD2-SB1-SS10-30	ND[b,c]	ND[b,c]	ND[b,c]
1-FCD2-SB1-SS14-50	ND	ND	ND
1-FCD2-SB1-SS19-75	ND	ND	ND
1-FCD2-SB2-SS5-10	ND	[e]Ethyl benzene - 0.047	6800
1-FCD2-SB2-SS10-30	ND	ND	1120
1-FCD2-SB2-SS14-50	ND	ND[b]	ND; 3[b]
1-FCD2-SB2-SS19-75	ND	ND	ND[b]
1-FCD2-SB3-SS5-10	ND	[e]Dichlorobenzene isomers - ND <5.0[d]	7100
1-FCD2-SB3-SS10-30	ND[b]	[e]Dichlorobenzene isomers - ND <5.0[d]	ND
1-FCD2-SB3-SS14-50	ND	ND	3
1-FCD2-SB4-SS2-2.5	ND	[e]Dichlorobenzene isomers - ND <0.5[d]	450
1-FCD2-SB4-SS5-10	[e]1,1,1-Trichloroethane - 0.025	ND	3
1-FCD2-SB4-SS10-30	ND	ND	ND
1-FCD2-SB5-SS2-2.5	[e]1,1,1-Trichloroethane - 0.034	[e]Dichlorobenzene isomers - ND <5.0[d]	190
1-FCD2-SB5-SS5-10	[e]1,1,1-Trichloroethane - 0.025[c]	ND[b,c]	ND[c]

TABLE 4.2 (Continued)
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 1-FCD2

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Petroleum Hydrocarbons (SW 3550 and EPA 418.1) (mg/Kg)
1-FCD2-SB5-SS10-30	[e]1,1,1-Trichloroethane - 0.018	[e]1,2-Dichlorobenzene - 0.046	2
1-FCD2-SB6-SS3-5	[e]1,1,1-Trichloroethane - 0.027	ND	4800
1-FCD2-SB6-SS8-20	ND	ND	ND[b]
1-FCD2-SB7-SS5-10	ND	ND	8200
1-FCD2-SB7-SS10-30	ND	ND	240
1-FCD2-SB7-SS14-50	[e]1,1,1-Trichloroethane - 0.013	[e]Toluene - 0.024	2000
1-FCD2-SB7-SS18-70	ND[b]	ND	ND
1-FCD2-SB8-SS5-10	[e]1,1,1-Trichloroethane - 0.014	[e]1,3-Dichlorobenzene - 8.4 [e]Toluene - 2.4	3200
1-FCD2-SB8-SS10-30	[e]1,1,1-Trichloroethane - 0.019	ND	8
1-FCD2-SB8-SS14-50	[e]1,1,1-Trichloroethane - 0.017	ND	3
1-FCD2-SB9-SS5-10	ND	ND	6
1-FCD2-SB9-SS8-20	ND	ND	3
1-FCD2-SB9-SS11-35	ND	ND	3
1-FCD2-SB9-SS14-50	ND	ND	3[b]
1-FCD2-SB9-SS18-70	ND	ND	3

TABLE 4.2 (Continued)
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 1-FCD2

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Petroleum Hydrocarbons (SW 3550 and EPA 418.1) (mg/Kg)
1-FCD2-SB10-SS1-3	--	--	ND
1-FCD2-SB11-SS1-3	ND	ND	17
1-FCD2-SB12-SS1-3	ND[b]	[e]1,3-Dichlorobenzene and [e]1,4-Dichlorobenzene - 0.007[d]	4

a: ND = No compounds present above method detection limits.
b: Average of analyses of a field sample and an internal duplicate (QC) sample.
c: Average of analyses of a field sample and an external duplicate (QA) sample.
d: Laboratory stated that these compounds co-eluted; total amount is reported.
e: Identity of listed compound(s) was not confirmed.

hydrocarbon levels above 1000 mg/Kg were detected at 50 feet in SB7, at 30 feet in SB2, at 10 feet in SB3 and SB8, and at 5 feet in SB6. Levels between 100 and 1000 mg/Kg were also detected in the 2.5-foot samples from SB4 and SB5 (see Figure 4.1). In samples from the other borings (SB1, SB9, SB10, SB11 and SB12), total petroleum hydrocarbons were either not detected or were present at trace levels (< 20 mg/Kg). A single halogenated volatile organic compound was detected at trace levels (< 0.04 mg/Kg) in several samples, but its identity was not confirmed by second-column GC analysis since it was below 10 mg/Kg. Aromatic volatile organics were detected in samples from SB2, SB5, SB7, SB8, and SB12, but none exceeded 10 mg/Kg and the identity of these was therefore not confirmed by second-column GC analysis.

4.1.2 Paint Waste Disposal Ditch (2-PWD2)

Five 50-foot deep soil borings were made at 100-foot intervals along the centerline of the former paint waste disposal ditch (see Figure 3.2). Table 4.3 presents observations made during drilling at this site. Soil discoloration was observed from the surface to a depth of 30 feet in SB4, and to somewhat shallower depths in SB1, SB2 and SB3. Soil from SB5 had a normal color over the entire boring depth. Odors were also detected at shallow depths in the first four borings, but not in SB5.

Table 4.4 presents analytical results for 19 soil samples collected at this site. A single halogenated volatile organic was detected in one sample, at its detection limit of 0.01 mg/Kg. Also, several aromatic volatile organics were found in the 2.5-foot sample from SB1. Since none of these compounds exceeded 10 mg/Kg, their identities were not confirmed. Likewise, two aromatic compounds which appeared at trace levels (0.009 mg/Kg) in the 50-foot sample from SB1 were not confirmed. Total oil & grease was found at 980 mg/Kg in the 2.5 foot sample from SB1, but all the other samples contained less than 40 mg/Kg. Total phenolics in all samples were either not detected or were present at trace levels (< 1.0 mg/Kg). The metals values presented in Table 4.4 were determined using the WET extraction procedure (CA Title 22:66700), so a reported value of 1.0 mg/L (1 ppm) is roughly equivalent to a soil concentration of 10 mg/Kg (10 ppm) of extractable metal.

TABLE 4.3

SUMMARY OF OBSERVATIONS DURING TEST DRILLING AT SITE 2-PWD2

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
2-PWD2-SB1	50	0-5	Gray-green	Strong	Not reported (NR)
		5-7.5	Gray-green	Slight	NR
		7.5-50	Normal (N)	No odor (NO)	NR
2-PWD2-SB2	50	0-7.5	Green	Slight	NR
		7.5-50	N	NO	NR
2-PWD2-SB3	50	0-15	Dark green to black	Strong	NR
		15-20	N	Slight	NR
		20-50	N	NO	NR
2-PWD2-SB4	50	0-7.5	Gray-green to black	Strong	NR
		7.5-30	Gray	Slight	NR
		30-50	N	NO	NR
2-PWD2-SB5	50	0-50	N	NO	NR

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

TABLE 4.4
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 2-PWD2

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 & EPA 413.2) (mg/Kg)	Total Phenolics (SM 510A/510C) (mg/Kg)	Extractable Metals (CA Title 22) (mg/L)	
2-PWD2-SB1-SS2-2.5	ND[a,b]	[e]1,2-Dichlorobenzene - ND<0.5 [e]1,3-Dichlorobenzene - 4.8 [e]1,4-Dichlorobenzene - ND<0.5 [e]Ethyl benzene - 0.14 [e]Xylenes - 2.00	980	0.35	As - ND Ba - 3.7 Cd - 0.11 Cr - 0.7	Pb - 1.9 Hg - ND Se - 0.022 Ag - ND
2-PWD2-SB1-SS5-10	ND[b,c]	ND[c]	ND; 5; 3[c,d]	0.20[c]	As - ND[c] Ba - 4.5[c] Cd - ND[c] Cr - 0.2; ND[c]	Pb - 0.2; ND[c] Hg - 0.13; ND[c] Se - 0.02[c] Ag - ND[c]
2-PWD2-SB1-SS10-30	ND[b,d]	ND	ND	0.33	As - ND Ba - 3.8 Cd - ND Cr - ND	Pb - 6.4 Hg - ND Se - 0.02 Ag - ND
2-PWD2-SB1-SS14-50	ND[b]	[e]1,2-Dichlorobenzene - 0.009 [e]1,4-Dichlorobenzene - 0.009	27	0.21	As - ND Ba - 5.0 Cd - ND Cr - 0.1	Pb - ND Hg - 0.001 Se - 0.018 Ag - ND
2-PWD2-SB2-SS2-2.5	ND	ND	35	0.88	As - ND Ba - 2.1 Cd - 0.07 Cr - 0.52	Pb - 0.4 Hg - 0.011 Se - ND Ag - ND
2-PWD2-SB2-SS5-10	ND	ND	ND	ND	As - 0.054 Ba - 4.2 Cd - ND Cr - ND	Pb - 0.2 Hg - 0.008 Se - ND Ag - ND
2-PWD2-SB2-SS10-30	ND	ND	ND	ND	As - ND Ba - 4.8 Cd - ND Cr - ND	Pb - ND Hg - 0.025 Se - ND Ag - ND
2-PWD2-SB2-SS14-50	ND	ND	10	ND	As - ND Ba - 4.9 Cd - ND Cr - 0.07	Pb - ND Hg - 0.006 Se - ND Ag - ND

TABLE 4.4 (Continued)
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 2-PWD2

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 & EPA 413.2) (mg/Kg)	Total Phenolics (SM 510A/510C) (mg/Kg)	Extractable Metals (CA Title 22) (mg/L)	
2-PWD2-SB3-SS2-2.5	ND	ND[d]	ND	0.76	As - ND Ba - 3.9 Cd - 0.06 Cr - 0.16	Pb - ND Hg - 0.005 Se - ND Ag - ND
2-PWD2-SB3-SS5-10	ND	ND	ND	0.16	As - 0.085 Ba - 4.4 Cd - 0.05 Cr - 0.17	Pb - 0.2 Hg - 0.005 Se - ND Ag - ND
2-PWD2-SB3-SS10-30	ND[b,d]	ND	ND[d]	ND	As - ND Ba - 1.7 Cd - ND Cr - ND	Pb - ND Hg - 0.006 Se - ND Ag - ND
2-PWD2-SB3-SS14-50	ND[b]	ND	ND	ND	As - ND Ba - 3.3 Cd - ND Cr - ND	Pb - ND Hg - 0.005 Se - ND Ag - ND
2-PWD2-SB4-SS2-2.5	ND[b]	ND	3[d]	0.92	As - ND Ba - 6.4 Cd - ND Cr - ND	Pb - ND Hg - 0.003 Se - ND Ag - ND
2-PWD2-SB4-SS5-10	ND[b]	ND	ND	0.08	As - 0.06 Ba - 1.5 Cd - 0.04 Cr - 0.06	Pb - ND Hg - 0.005 Se - ND Ag - ND
2-PWD2-SB4-SS10-30	ND[b]	ND	ND	0.16	As - ND Ba - 2.3 Cd - ND Cr - 0.06	Pb - ND Hg - 0.003 Se - ND Ag - ND
2-PWD2-SB4-SS14-50	1,1-Dichloroethane - 0.010[b,e]	ND[d]	ND	0.08	As - ND Ba - 2.4 Cd - 0.07 Cr - 0.28	Pb - 0.2 Hg - 0.005 Se - ND Ag - ND
2-PWD2-SB5-SS5-10	ND[b]	ND	ND[d]	ND	As - ND Ba - 3.3 Cd - 0.04 Cr - 0.07	Pb - ND Hg - 0.004 Se - 0.012 Ag - ND

TABLE 4.4 (Continued)
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 2-PWD2

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 & EPA 413.2) (mg/Kg)	Total Phenolics (SM 510A/510C) (mg/Kg)	Extractable Metals (CA Title 22) (mg/L)	
2-PWD2-SB5-SS10-30	ND[b]	ND	ND	0.1	As - ND Ba - 3.0 Cd - ND Cr - ND	Pb - ND Hg - 0.004 Se - 0.019 Ag - ND
2-PWD2-SB5-SS14-50	ND[b]	ND	ND	ND	As - ND Ba - 5.8 Cd - ND Cr - 0.18	Pb - ND Hg - 0.004 Se - 0.022 Ag - ND

a: ND = No compounds present above method detection limits.
b: Laboratory atmosphere contaminated with dichloromethane. See text for discussion.
c: Average of analyses of a field sample and an external duplicate (QA) sample.
d: Average of analyses of a field sample and an internal duplicate (QC) sample.
e: Identity of listed compound(s) was not confirmed.

4.1.3 Engine Run-Up Area in Plant Site 7 (3-ERA7)

Four 20-foot soil borings were made along the centerline of the ditch (see Figure 3.3). No evidence of contamination was observed during drilling, as indicated in Table 4.5. Table 4.6 presents analytical results for eight soil samples from the site. Total oil & grease was detected only in the 5-foot sample from SB3, at a level of 45 mg/Kg. Trace levels (< 0.08 mg/Kg) of a few halogenated and aromatic volatile organic compounds were detected in some of the samples. Since none exeeded 10 mg/Kg, the identity of these was not confirmed.

4.1.4 Vehicle Washrack and Leaking Underground Tank (4-VWT5)

Four soil borings were made at this site (See Figure 3.4), three along the centerline of the drainage ditch leading from the vehicle washrack (SB1, SB3 and SB4) and one where the former underground waste-oil tank was located (SB2). No evidence of contamination was observed during drilling, as indicated in Table 4.7. Table 4.8 presents analytical results for eleven soil samples from this site. No halogenated or aromatic volatile organics were detected, and all but one sample had only trace levels (< 15 mg/Kg) of oil & grease or none was detected. The 5-foot sample from SB1 had an oil & grease concentration of 350 mg/Kg.

Soil samples from this site were analyzed for metals using two different methods, the results from which are not directly comparable. Samples from SB1 and SB2 were directly digested in nitric acid before analysis, so the reported values represent the total metals content in the soil. Total metals are reported in the units mg/Kg. Samples from SB3 and SB4 were prepared using the WET extraction procedure (CA Title 22:66700) before analysis, so the reported values represent the extractable fraction of metals in the soil. Extractable metals concentrations are reported as mg/L of extract, and 1.0 mg/L (1 ppm) is roughly equivalent to a soil concentration of 10 mg/Kg (10 ppm) of extractable metal. As would be expected, higher values were found in the samples analyzed by direct digestion. There was little or no difference in the results obtained for different samples analyzed by the same method, however.

4.1.5 Abandoned Fire Training Area (5-AFTC)

Two soil borings were made approximately in the center of the old burn area (see Figure 3.5). A near-surface sample was collected manually in the same immediate area. As indicated in Table 4.9, soil

TABLE 4.5
SUMMARY OF OBSERVATIONS DURING TEST DRILLING AT SITE 3-ERA7

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
3-ERA7-SB1	20	0-20	Normal (N)	No odor (NO)	Background (B)
3-ERA7-SB2	20	0-20	N	NO	B
3-ERA7-SB3	20	0-20	N	NO	B
3-ERA7-SB4	20	0-20	N	NO	B

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

TABLE 4.6

SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 3-ERA7

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 and EPA 413.2) (mg/Kg)
3-ERA7-SB1-SS3-5	[c]1,1,1-Trichloroethane - 0.030	[c]Xylenes - 0.020	ND[a]
3 ERA7-SB1-SS8-20	ND	ND	ND
3-ERA7-SB2-SS4-7.5	ND	ND	ND
3-ERA7-SB2-SS8-20	ND	[c]Xylenes - 0.013	ND[b]
3-ERA7-SB3-SS3-5	ND	[c]Toluene - 0.009 [c]Xylenes - 0.006	ND
3-ERA7-SB3-SS8-20	ND	[c]Toluene - 0.005	ND
3-ERA7-SB4-SS3-5	ND[b]	[c]Toluene - 0.005 [c]Xylenes - 0.026	45
3-ERA7-SB4-SS8-20	[c]1,1,1-Trichloroethane-0.078	[c]Toluene - 0.005; ND[b] [c]Xylenes - 0.020; ND[b]	ND

a: ND = No compounds present above method detection limits.
b: Average of analyses of field sample and an internal duplicate (QC) sample.
c: Identity of listed compound(s) was not confirmed.

TABLE 4.7

SUMMARY OF OBSERVATIONS DURING TEST DRILLING AT SITE 4-VWT5

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
4-VWT5-SB1	47.5	0-5	Normal (N)	No odor (NO)	<1 ppm
		5-47.5	N	NO	Background (B)
4-VWT5-SB2	50	0-50	N	NO	B
4-VWT5-SB3	20	0-20	N	NO	NR
4-VWT5-SB4	20	0-20	N	NO	NR

[a]Normal soil color ranges from tan to brown throughout USAF Plant 42.

TABLE 4.8
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 4-VWT5

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 and EPA 413.2) (mg/Kg)	Extractable Metals (CA Title 22, except as noted) (mg/L)	
4-VWT5-SB1-SS3-5	ND[a,b]	ND	350	As - ND[c,d] Ba - 80[c,d] Cd - 1.7[c,d] Cr - 25[c,d]	Pb - 20[c,d] Hg - 0.02[c,d] Se - 0.21[c,d] Ag - ND[c,d]
4-VWT5-SB1-SS5-10	ND[b]	ND[d]	6	As - 2.6[c] Ba - 80[c] Cd - 1.9[c] Cr - 24[c]	Pb - 16[c] Hg - 0.03[c] Se - 0.28[c] Ag - ND[c]
4-VWT5-SB1-SS10-30	ND	ND	ND	As - 2.6[c] Ba - 49[c] Cd - 1.6[c] Cr - 30[c]	Pb - 8[c] Hg - ND[c] Se - 0.45[c] Ag - ND[c]
4-VWT5-SB1-SS14-50	ND[b]	ND	ND[d]	As - 2.7[c] Ba - 37[c] Cd - 1.1[c] Cr - 15[c]	Pb - 9[c] Hg - ND[c] Se - 0.23[c] Ag - ND[c]
4-VWT5-SB2-SS5-10	ND	ND	12	As - 2.7[c] Ba - 40[c] Cd - 0.9[c] Cr - 14[c]	Pb - 7[c] Hg - ND[c] Se - ND[c] Ag - ND[c]
4-VWT5-SB2-SS10-30	ND[b]	ND	ND[d]	As - 2.5[c] Ba - 89[c] Cd - 2.0[c] Cr - 10[c]	Pb - 11[c] Hg - 0.01[c] Se - ND[c] Ag - ND[c]
4-VWT5-SB2-SS14-50	ND[d]	ND	6	As - 2.6[c,d] Ba - 47[c,d] Cd - 1.3[c,d] Cr - 17[c,d]	Pb - 9[c,d] Hg - ND[c,d] Se - ND[c,d] Ag - ND[c,d]
4-VWT5-SB3-SS3-5	ND	ND[d]	3	As - 0.037 Ba - 3.4 Cd - ND Cr - ND	Pb - ND Hg - 0.003 Se - ND Ag - ND
4-VWT5-SB3-SS8-20	ND	ND	ND	As - 0.032 Ba - 4.4 Cd - ND Cr - ND	Pb - ND Hg - 0.002 Se - ND Ag - ND

TABLE 4.8 (Continued)
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 4-VWT5

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 and EPA 413.2) (mg/Kg)	Extractable Metals (CA Title 22, except as noted) (mg/L)	
4-VWT5-SB4-SS3-5	ND	ND	ND	As - 0.035 Ba - 4.6 Cd - ND Cr - ND	Pb - ND Hg - 0.002 Se - ND Ag - ND
4-VWT5-SB4-SS8-20	ND	ND	ND[d]	As - ND[d] Ba - 2.6[d] Cd - ND[d] Cr - ND[d]	Pb - ND[d] Hg 0.002[d] Se - ND[d] Ag - ND[d]

a: ND = No compounds present above method detection limits.
b: Laboratory atmosphere contaminated with dichloromethane. See text for discussion.
c: Analysis by direct digestion (SW 3050). Results reported in mg/Kg by laboratory.
d: Average of analyses of a field sample and an internal duplicate (QC) sample.

TABLE 4.9
SUMMARY OF OBSERVATIONS DURING TEST DRILLING AT SITE 5-AFTC

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
5-AFTC-SB1	7.5	0-7.5	Green-gray	Strong, fuel	>200 ppm
5-AFTC-SB2	55	0-2.5	Normal (N)	No odor (NO)	Not Reported
		2.5-35	Gray-brown	Very strong, fuel	35-130 ppm
		35-50	Gray-brown	Fuel	3-5 ppm
		50-55	N	NO	Background (B)
5-AFTC-SB3	3	0-3	Green-gray	Strong, fuel	B

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

discoloration, fuel odors, and high organic vapor readings were detected to a depth of about 50 feet. Table 4.10 presents analytical results for five soil samples collected at this site. Several volatile organics were detected in samples collected at 2.5, 10, and 30 feet, but none were found in the 50 foot sample. The presence of toluene (10 mg/Kg), xylenes (48 mg/Kg), and ethylbenzene (4.9 mg/Kg) was confirmed by s-econd- column GC analysis in the 2.5 foot sample. No other compounds exceeded 10 mg/Kg in any of the samples, so their identities were not confirmed. Total oil & grease concentrations exceeded 1000 mg/Kg to a depth of 30 feet, but the 50-foot sample had only a trace amount present. No PCBs or organochlorine pesticides were detected in either of two duplicate near-surface samples.

4.1.6 Original Fire Training Area (6-OFTC)

One soil boring was made approximately in the center of the circular burn area (see Figure 3.4), and one near-surface sample was manually collected in the same immediate area. As indicated in Table 4.11 soil discoloration, odors, and high organic vapor readings were detected to a depth of about 25 feet. Table 4.12 presents analytical results for four soil samples collected at this site. Several volatile organics were found in the samples from 2.5 and 10 feet, but none exceeded 10 mg/Kg, so the identity of these compounds was not confirmed by second-column GC analysis. No volatile compounds were detected in samples from 30 and 50 feet. Total oil & grease concentrations exceeded 1000 mg/Kg in samples collected at 2.5 and 10 feet, but only 20 mg/Kg was found at 30 feet, and none was detected at 50 feet. Only a trace amount (0.032 mg/Kg) of Arochlor 1248 was detected in the near-surface sample during analysis for organochlorine pesticides and PCBs.

4.1.7 Engine Run-Up Area in Plant Site 2 (7-ERA2)

Seven soil borings were made at the site (see Figure 3.6). A section drawing of this site is presented in Figure 4.2 which shows the extent of contamination found, based on field observations and chemical analytical results. The observations made during drilling are presented in Table 4.13. Except at the surface, normal soil color was observed in all the borings. Fuel odors and high organic vapor readings were detected in all but three borings (SB2, SB4 and SB7). It is noted that neither odors or organic vapors were detected in SB3 or SB5 at depths

TABLE 4.10
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 5-AFTC

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 & EPA 413.2) (mg/Kg)	Extractable Metals (CA Title 22) (mg/L)	Pesticides/PCB's (SW 8080) (mg/Kg)
5-AFTC-SB1-SS2-2.5	ND[a]	Ethyl benzene - 4.9 Toluene - 10.0 Xylenes - 48.0	11,040	--	--
5-AFTC-SB2-SS5-10	[f]1,1,2,2-Tetrachloroethane and Tetrachloroethylene - 0.016[b,c,d]	[f]Benzene - ND<0.5 [f]Chlorobenzene - 2 [f]Dichlorobenzene isomers - ND<0.5 [f]Ethyl benzene - 3.2 [f]Toluene - 0.5 [f]Xylenes - ND<0.5	7,960	--	--
5-AFTC-SB2-SS10-30	ND[b]	[f]Benzene - 0.8 [f]Chlorobenzene - ND<0.5 [f]1,2-Dichlorobenzene - ND<0.5 [f]1,3-Dichlorobenzene - ND<0.5 [f]1,4-Dichlorobenzene - 7.2 [f]Ethyl benzene - ND<0.5 [f]Toluene - ND<0.5 [f]Xylenes - 2.1	1,400	--	--
5-AFTC-SB2-SS14-50	ND	ND	2	--	--
5-AFTC-SB3-SS1-3	--	--	--	As - 0.047[d,e] Ba - 3.8[d,e] Cd - ND[d,e] Cr - ND[d,e] Pb - ND[d,e] Hg - 0.006[d,e] Se - ND[d,e] Ag - 0.1;ND;ND[d,e]	ND[e]

a: ND = No compounds present above method detection limits.
b: Laboratory atmosphere contaminated by dichloromethane. See text for discussion.
c: Compounds co-elute; total is reported.
d: Average of analyses of field sample and an internal duplicate (QC) sample.
e: Average of analyses of field sample and an external duplicate (QA) sample.
f: Identity of listed compound(s) was not confirmed.

TABLE 4.11

SUMMARY OF OBSERVATIONS DURING TEST DRILLING AT SITE 6-OFTC

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
6-OFTC-SB1	50	0-25	Green-gray	Strong	Moderate to high
		25-50	Normal (N)	No odor	Background (B)
6-OFTC-SB2	3	0-3	N	Strong, fuel	B

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

TABLE 4.12

SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 6-OFTC

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 and EPA 413.2) (mg/Kg)	Extractable Metals (CA Title 22) (mg/L)	Pesticides/PCB's (SW 8080) (mg/Kg)
6-OFTC-SB1-SS2-2.5	[d]Trichloroethylene - 0.190[a]	ND[e]	15,600	--	--
6-OFTC-SB1-SS5-10	ND[a,b]	[d]1,2-Dichlorobenzene - 3.91 [d]1,3-Dichlorobenzene - 1.56 [d]1,4-Dichlorobenzene - 1.83 [d]Ethyl benzene - 0.011 [d]Xylenes - 1.28	1,500	--	--
6-OFTC-SB1-SS10-30	ND[a]	ND	20	--	--
6-OFTC-SB1-SS14-50	ND[a]	ND	ND	--	--
6-OFTC-SB2-SS1-3	--	--	--	As - ND Pb - ND Ba - 5.2 Hg - 0.016 Cd - ND Se - ND Cr - ND Ag - 0.1	[d]Aroclor 1248 - 0.32

a: Laboratory atmosphere contaminated with dichloromethane. See text for discussion.
b: ND = No compounds present above method detection limits.
c: Average of analyses of field sample and an internal duplicate (QC) sample.
d: Identity of listed compound(s) was not confirmed.
e: Second-column GC analysis failed to confirm any of the compounds detected.

FIGURE 4.2

USAF PLANT NO. 42

VERTICAL SECTION OF IRP SITE 7-ERA2 BASED ON RESULTS OF PHASE II, STAGE 1 INVESTIGATION

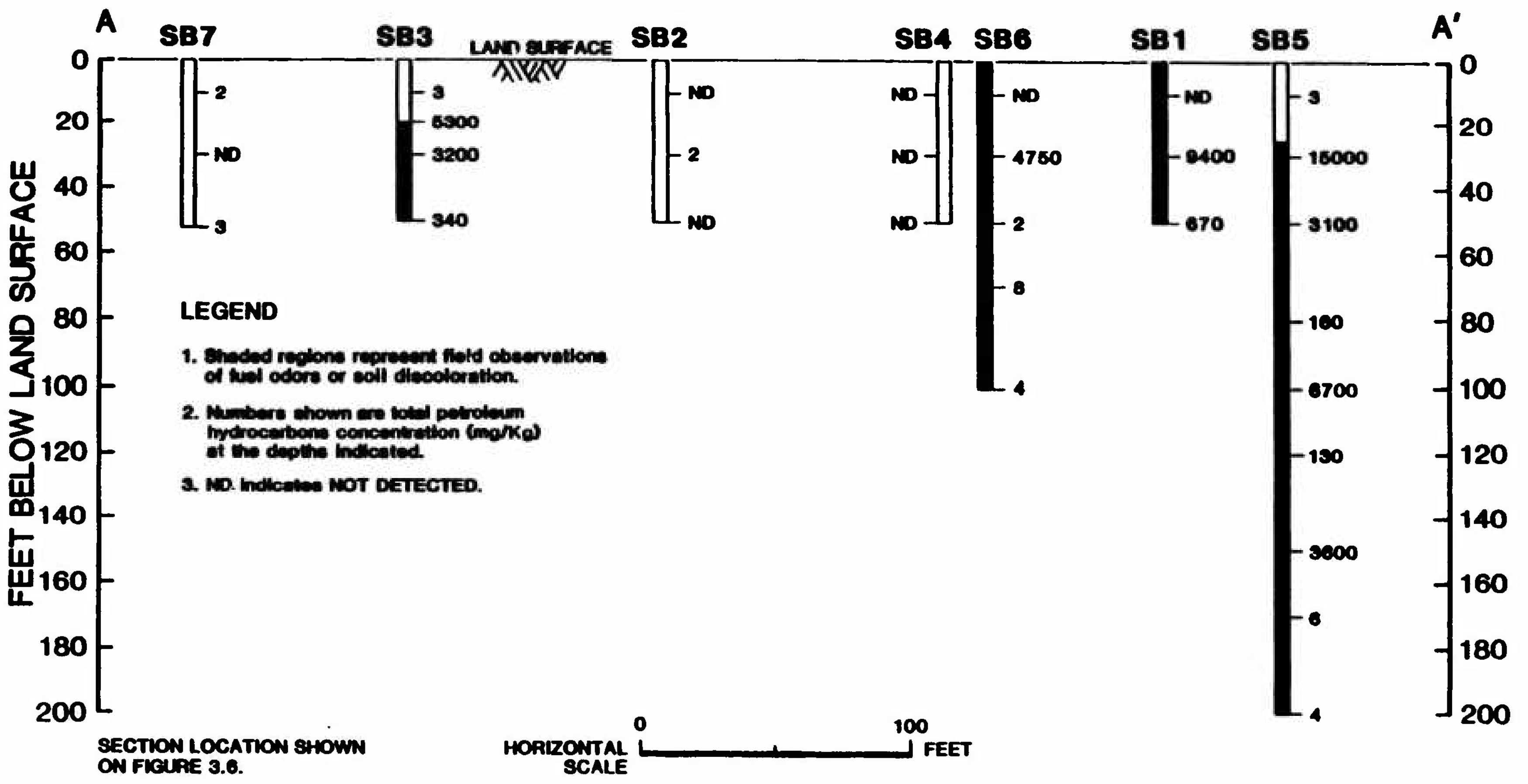

TABLE 4.13

SUMMARY OF OBSERVATIONS DURING TEST DRILLING AT SITE 7-ERA2

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
7-ERA2-SB1	50	0-50	Normal (N)	Slight, fuel	Low
7-ERA2-SB2	50	0-7.5	N	No odor (NO)	Background (B)
		7.5-50	N	NO	Not reported (NR)
7-ERA2-SB3	50	0-20	N	NO	NR
		20-50	N	Strong	NR
7-ERA2-SB4	50	0-50	N	NO	B
7-ERA2-SB5	200	0-2.5	Dark brown	NO	B
		2.5-25	N	NO	B
		25-190	N	Fuel	B-70 ppm
		190-200	N	Slight, fuel	B-1 ppm
7-ERA2-SB6	100	0-30	N	Slight, fuel	B-20 ppm
		30-65	N	Fuel	B-50 ppm
		65-100	N	Fuel	B-7 ppm
7-ERA2-SB7	50	0-50	N	NO	B

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

above 20 to 25 feet. Table 4.14 presents analytical results for thirty soil samples from this site analyzed for total petroleum hydrocarbons. Levels above 1000 mg/Kg were detected at 150 feet in SB5, and at 30 feet in SB1, SB3, and SB6. Levels between 100 and 1000 mg/Kg were found at 50 feet in SB1 and SB3. All samples from SB2, SB4 and SB7 contained only trace levels (< 10 mg/Kg) of petroleum hydrocarbons or none was detected.

4.1.8 Fuel Transfer Area (8-FTA8)

One 20-foot soil boring was made at this site (see Figure 3.7). As indicated in Table 4.15, fuel odor and organic vapor readings were detected to about 15 feet, but no soil discoloration was observed. Two samples were analyzed for total petroleum hydrocarbons, but none was detected in either sample (Table 4.15).

4.1.9 Paint Waste Disposal Area - West (9-PWW2)

Two near-surface soil samples were manually collected at this site (see Figure 3.2). As indicated in Table 4.16, no soil discoloration, odor, or organic vapor readings were observed. At trace amount (0.011 mg/Kg) of one halogenated volatile organic compound was detected, but its identity was not confirmed by second-column GC analysis since its concentration was below 10 mg/Kg. No aromatic volatile organics were detected, nor were total phenolics detected. Both samples contained trace levels (< 4 mg/Kg) of total oil & grease.

4.1.10 Paint Waste Disposal Area - North (10-PWN2)

Four near-surface soil samples were manually collected at this site (see Figure 3.2). As indicated in Table 4.17, no soil discoloration, odor, or organic vapor readings were observed. A trace amount (< 0.8 mg/Kg) of one halogenated volatile organic compound was detected in three samples, but its identity was not confirmed by second-column GC analysis since its concentration was less than 10 mg/Kg. No aromatic volatile organic compounds were detected. Total oil & grease was detected in only one sample, at the trace level of 9 mg/Kg. Trace amounts (< 0.2 mg/Kg) of total phenolics were detected in all four samples.

4.1.11 Disposal Area "A" (11-DAA2)

Two 10-foot soil borings were made at this site (see Figure 3.2). As indicated in Table 4.18, no soil discoloration, odor, or organic

TABLE 4.14
SUMMARY RESULTS OF CHEMICAL ANALYSES
OF SOIL SAMPLES FROM SITE 7-ERA2

Sample Identifier	Total Petroleum Hydrocarbons (SW 3550 and EPA 418.1) (mg/Kg)
7-ERA2-SB1-SS5-10	2;ND[a,b]
7-ERA2-SB1-SS10-30	9,420
7-ERA2-SB1-SS14-50	670
7-ERA2-SB2-SS5-10	ND[c]
7-ERA2-SB2-SS10-30	2
7-ERA2-SB2-SS14-50	ND
7-ERA2-SB3-SS5-10	3
7-ERA2-SB3-SS8-20	5,300
7-ERA2-SB3-SS10-30	3,200
7-ERA2-SB3-SS14-50	340
7-ERA2-SB4-SS5-10	ND[b]
7-ERA2-SB4-SS10-30	ND
7-ERA2-SB4-SS14-50	ND
7-ERA2-SB5-SS5-10	3
7-ERA2-SB5-SS10-30	15,000
7-ERA2-SB5-SS14-50	3,100
7-ERA2-SB5-SS20-80	160
7-ERA2-SB5-SS24-100	6,700
7-ERA2-SB5-SS26-120	126[b]
7-ERA2-SB5-SS29-150	3,600
7-ERA2-SB5-SS31-170	6
7-ERA2-SB5-SS34-200	4
7-ERA2-SB6-SS5-10	ND
7-ERA2-SB6-SS10-30	4,750
7-ERA2-SB6-SS14-50	[illegible]
7-ERA2-SB6-SS18-70	8
7-ERA2-SB6-SS24-100	4[b]

TABLE 4.14 (Continued)
SUMMARY RESULTS OF CHEMICAL ANALYSES
OF SOIL SAMPLES FROM SITE 7-ERA2

Sample Identifier	Total Petroleum Hydrocarbons (SW 3550 and EPA 418.1) (mg/Kg)
7-ERA2-SB7-SS5-10	ND;2;3[b,c]
7-ERA2-SB7-SS10-30	ND
7-ERA2-SB7-SS14-50	3

a: ND = Not detected.

b: Average of analyses of a field sample and an internal duplicate (QC) sample.

c: Average of analyses of a field sample and an external duplicate (QA) sample.

TABLE 4.15
SUMMARY OF RESULTS AT SITE 8-FTA8

Part A -- Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
8-FTA8-SB1	20	0-15	Normal (N)	fuel	<1-13 ppm
		15-20	N	No odor	Background

Part B -- Chemical Analyses of Soil Samples

Sample Identifier	Total Petroleum Hydrocarbons (SW 3550 and EPA 418.1) (mg/Kg)
8-FTA8-SB1-SS3-5	ND[b]
8-FTA8-SB1-SS8-20	ND

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.
b: ND = Not detected.

TABLE 4.16

SUMMARY OF RESULTS AT SITE 9-PWW2

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
9-PWW2-SB1	3	0-3	Normal (N)	No odor (NO)	Background (B)
9-PWW2-SB2	3	0-3	N	NO	B

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 & EPA 413.2) (mg/Kg)	Total Phenolics (SM 510A/510C) (mg/Kg)
9-PWW2-SB1-SS1-3	[d]1,1,1-Trichloroethane - 0.011	ND[b]	3[c]	ND
9-PWW2-SB2-SS1-3	ND	ND	2	ND[c]

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

b: ND = No compound present above method detection limits.

c: Average of analyses of field sample and an internal duplicate (QC) sample.

d: Identity of listed compound(s) was not confirmed.

TABLE 4.17
SUMMARY OF RESULTS AT SITE 10-PWN2

Part A -- Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
10-PWN2-SB1	3	0-3	Normal (N)	No odor (NO)	Background (B)
10-PWN2-SB2	3	0-3	N	NO	B
10-PWN2-SB3	3	0-3	N	NO	B
10-PWN2-SB4	3	0-3	N	NO	B

Part B -- Chemical Analyses of Soil Samples

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 & EPA 413.2) (mg/Kg)	Total Phenolics (SM 510A/510C) (mg/Kg)
10-PWN2-SB1-SS1-3	[e]1,1,1-Trichloroethane - 0.075	ND[b,c]	ND	0.12
10-PWN2-SB2-SS1-3	[e]1,1,1-Trichloroethane - 0.018	ND	ND	0.19
10-PWN2-SB3-SS1-3	ND	ND	9[c]	0.13
10-PWN2-SB4-SS1-3	[e]1,1,1-Trichloroethane - 0.039; ND; ND	ND[d]	ND[c,d]	0.14[c,d]

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.
b: ND = No compounds present above detection limits.
c: Average of analyses of field sample and an internal duplicate (QC) sample.
d: Average of analyses of field sample and an external duplicate (QA) sample.
e: Identity of listed compound(s) was not confirmed.

TABLE 4.18
SUMMARY OF RESULTS AT SITE 11-DAA2

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
11-DAA2-SB1	10	0-10	Normal (N)	No odor (NO)	Not reported (NR)
11-DAA2-SB2	10	0-10	N	NO	NR

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 & EPA 413.2) (mg/Kg)
11-DAA2-SB1-SS5-10	ND[b]	ND	ND
11-DAA2-SB2-SS5-10	ND	ND	ND

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.
b: ND = No compounds present above method detection limits.

vapor readings were observed in either boring. Samples were analyzed for halogenated and aromatic volatile organics, and for oil & grease, but none of these were detected (Table 4.18).

4.1.12 Engine Run-Up Area (12-ERA1)

Two 20-foot soil borings were made at this site (see Figure 3.8). As indicated in Table 4.19, no soil discoloration, odor, or organic vapor readings were observed in either boring. Two samples from each boring were analyzed for total oil & grease; one of these contained a trace amount (8 mg/Kg), while none was detected in the other three.

4.1.13 Disposal Area "B" (13-DAB2)

Four near-surface soil samples were manually collected at this site (see Figure 3.2). As indicated in Table 4.20, no soil discoloration, odor, or organic vapor readings were observed. Trace amounts (< 0.1 mg/Kg) of one halogenated volatile organic compound was detected in three of the samples, but its identity was not confirmed since its concentration was below 10 mg/Kg. No aromatic volatile organic compounds were detected. Total oil & grease was detected in only one sample, at the trace level of 3 mg/Kg.

4.1.14 Engine Build-up Area (14-EBA2)

Two 10-foot soil borings were made at this site (see Figure 3.9 . As indicated in Table 4.21, no soil discoloration, odor, or organic vapor readings were observed. One sample from each boring was analyzed for total petroleum hydrocarbons, but none was detected in either sample (Table 4.21).

4.1.15 TEB Disposal Area (15-TEB2)

Two 10-foot soil borings were made at this site (see Figure 3.9). Soil discoloration was observed near land surface, and both odors and organic vapor readings were detected to a depth of 10 feet, as shown in Table 4.22. One sample from each boring was analyzed for total petroleum hydrocarbons (Table 4.22). Although SB1 contained only a trace amount (17 mg/Kg), SB2 had a concentration of 3580 mg/Kg.

4.1.16 Evaporation Ponds (16-EVP3)

Four 50-foot borings were made in the area of the former evaporation ponds (see Figure 3.10). Table 4.23 presents the observations made during drilling. Soil discoloration was observed to a depth of 35 feet in SB3, and to 20 feet SB4. Slight odors were detected in at shallow

TABLE 4.19

SUMMARY OF RESULTS AT SITE 12-ERA1

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
12-ERA1-SB1	20	0-20	Normal (N)	No odor (NO)	Background (B)
12-ERA1-SB2	20	0-20	N	NO	B

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Total Oil & Grease (SW 3550 and EPA 413.2) (mg/Kg)
12-ERA1-SB1-SS4-7.5	ND[b]
12-ERA1-SB1-SS8-20	ND
12-ERA1-SB2-SS3-5	8
12-ERA1-SB2-SS8-20	ND

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

b: ND = Not detected.

TABLE 4.20
SUMMARY OF RESULTS AT SITE 13-DAB2

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
13-DAB2-SB1	3	0-3	Normal (N)	No odor (NO)	Background (B)
13-DAB2-SB2	3	0-3	N	NO	B
13-DAB2-SB3	3	0-3	N	NO	B
13-DAB2-SB4	3	0-3	N	NO	B

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 & EPA 413.2) (mg/Kg)
13-DAB2-SB1-SS1-3	[c]1,1,1-Trichloroethane - 0.013	ND[b]	3
13-DAB2-SB2-SS1-3	[c]1,1,1-Trichloroethane - 0.037	ND	ND
13-DAB2-SB3-SS1-3	[c]1,1,1-Trichloroethane - 0.068	ND	ND
13-DAB2-SB4-SS1-3	ND	ND	ND

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.
b: ND = No compounds present above method detection limits.
c: Identity of listed compound(s) was not confirmed.

TABLE 4.21

SUMMARY OF RESULTS AT SITE 14-EBA2

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
14-EBA2-SB1	10	0-10	Normal (N)	No odor (NO)	Background (B)
14-EBA2-SB2	10	0-10	N	NO	B

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Total Petroleum Hydrocarbons (SW 3550 and EPA 418.1) (mg/Kg)
14-EBA1-SB1-SS5-10	ND[b]
14-EBA1-SB1-SS5-10	ND

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

b: ND = Not detected.

TABLE 4.22

SUMMARY OF RESULTS AT SITE 15-TEB2

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
15-TEB2-SB1	10	0-5	dk brown (surface)	solvent(?)	Background (B)-2 ppm
		5-10	Normal (N)	slight	B
15-TEB2-SB2	10	0-5	dk brown (surface)	strong, solvent(?)	B-1 ppm
		5-10	N	strong	4-5 ppm

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Total Petroleum Hydrocarbons (SW 3550 and EPA 418.1) (mg/Kg)
15-TEB2-SB1-SS5-10	17
15-TEB2-SB2-SS5-10	3,580[b]

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.
b: Average of analyses of field sample and external duplicate (QA) sample.

TABLE 4.23
SUMMARY OF OBSERVATIONS DURING TEST DRILLING AT SITE 16-EVP3

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
16-EVP3-SB1	50	0-12.5	Normal (N)	Slight	Not reported (NR)
		12.5-50	N	No odor (NO)	NR
16-EVP3-SB2	50	0-7.5	Black	Slight	NR
		10-50	N	NO	NR
16-EVP3-SB3	50	0-20	Gray-black	Slight	NR
		20-30	N	NO	NR
		30-35	Gray-brown	Slight	NR
		35-50	N	NO	NR
		at 50	N	Slight	NR
16-EVP3-SB4	50	0-7.5	N	NO	NR
		7.5-20	Brown-gray	Slight	NR
		20-50	N	Slight, occasional	NR

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

depths in all four borings, but only SB3 and SB4 had detectable odors below a depth of 15 feet. Table 4.24 presents analytical results for fifteen samples collected at this site. A trace amount (0.009 mg/Kg) of one aromatic volatile organic compound was detected in the 2.5-foot sample from SB3, but its identity was not confirmed since its concentration was below 10 mg/Kg. No other aromatic or halogenated volatile organics were detected in any samples. Total cyanides were detected in only four samples, and at trace levels (< 0.7 mg/Kg). The metals values presented in Table 4.24 were determined using the WET extraction procedure (CA Title 22:66700), so a reported value of 1.0 mg/L (1 ppm) is roughly equivalent to a soil concentration of 10 mg/Kg (10 ppm) of the extractable metal.

4.1.17 New Fire Training Area (17-NFTC)

Two borings were made approximately in the center of the burn area, just west of the mock airplane cockpit (see Figure 3.5). One near-surface sample was manually collected in the same immediate area. As indicated in Table 4.25, soil discoloration, fuel odor, and organic vapor readings were observed to depths of 10 to 15 feet. Fuel odor was apparent during digging of SB3, its soil color and organic vapor readings were normal. Only trace amounts (< 4 mg/Kg) of either total oil & grease or total petroleum hydrocarbons were detected in samples from this site (Table 4.25).

4.1.18 Abandoned Disposal Area (18-ADA2)

One 20-foot boring was made approximately in the center of the diked area formerly used for burning trash and rubbish (see Figure 3.2). As indicated in Table 4.26, no soil discoloration or odor was detected. Two samples were analyzed for halogenated and aromatic volatile organics, and for oil & grease, but none of these was detected.

4.1.19 Engine Run-Up Area (19-ERA3)

Two 10-foot borings were made at this site (see Figure 3.10). As indicated in Table 4.27, no soil discoloration, odors, or organic vapor readings were observed in either boring. One sample from each boring was analysed for total oil & grease, but none was detected (Table 4.27).

4.1.20 Noise Level Area (20-NLA2)

One 20-foot boring was made at this site (see Figure 3.9). As indicated in Table 4.28, a slight odor was detected to a depth of 7.5

TABLE 4.24

SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 16-EVP3

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Extractable Metals (CA Title 22) (mg/L)		Total Cyanides (SM 412B/412E) (mg/Kg)
16-EVP3-SB1-SS2-2.5	ND[a,b]	ND	As - ND Ba - 4.8 Cd - ND Cr - ND Ni - 9.4	Pb - ND Hg - 0.009 Se - ND Ag - ND	0.65
16-EVP3-SB1-SS5-10	ND	ND	As - ND Ba - 3.4 Cd - ND Cr - ND Ni - 0.2	Pb - ND Hg - 0.008 Se - ND Ag - 0.3	ND
16-EVP3-SB1-SS10-30	ND	ND	As - ND Ba - 7.9 Cd - ND Cr - ND Ni - 0.7	Pb - ND Hg - 0.012 Se - ND Ag - ND	ND
16-EVP3-SB1-SS14-50	ND	ND[b]	As - ND[b] Ba - 2.3[b] Cd - ND[b] Cr - ND[b] Ni - 0.1[b]	Pb - ND[b] Hg - 0.010[b] Se - ND[b] Ag - ND[b]	ND
16-EVP3-SB2-SS3-5	ND	ND	As - ND Ba - 3.6 Cd - ND Cr - ND Ni - 3.3	Pb - ND Hg - ND Se - ND Ag - 0.6	ND
16-EVP3-SB2-SS8-20	ND	ND	As - ND Ba - 6.1 Cd - ND Cr - ND Ni - 0.2	Pb - ND Hg - ND Se - ND Ag - ND	ND
16-EVP3-SB2-SS14-50	ND	ND	As - ND[b] Ba - 2.1[b] Cd - ND[b] Cr - ND[b] Ni - 0.1; ND[b]	Pb - ND[b] Hg - ND[b] Se - ND[b] Ag - 0.03; ND[b]	ND

TABLE 4.24 (Continued)
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 16-EVP3

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Extractable Metals (CA Title 22) (mg/L)		Total Cyanides (SM 412B/412E) (mg/Kg)
16-EVP3-SB3-SS2-2.5	ND	[d]Toluene - 0.009	As - ND Ba - 3.5 Cd - ND Cr - ND Ni - 0.5	Pb - ND Hg - ND Se - ND Ag - ND	ND
16-EVP3-SB3-SS5-10	ND	ND	As - ND Ba - 2.8 Cd - ND Cr - ND Ni - 0.3	Pb - ND Hg - 0.01 Se - ND Ag - ND	0.67
16-EVP3-SB3-SS10-30	ND	ND	As - ND Ba - 4.1 Cd - ND Cr - ND Ni - 0.1	Pb - ND Hg - ND Se - ND Ag - ND	ND
16-EVP3-SB3-SS14-50	ND	ND	As - ND Ba - 1.7 Cd - ND Cr - ND Ni - ND	Pb - ND Hg - ND Se - ND Ag - ND	0.46
16-EVP3-SB4-SS2-2.5	ND	ND	As - ND Ba - 4.4 Cd - ND Cr - ND Ni - 0.4	Pb - ND Hg - 0.01 Se - ND Ag - ND	0.46
16-EVP3-SB4-SS5-10	ND[b,c]	ND[b,c]	As - ND[b,c] Ba - 3.0[b,c] Cd - ND[b,c] Cr - ND[b,c] Ni - 0.2[b,c]	Pb - 0.6; ND; ND[b,c] Hg - ND[b,c] Se - ND[b,c] Ag - ND[b,c]	ND[c]
16-EVP3-SB4-SS10-30	ND	ND[b]	As - ND Ba - 4.3 Cd - ND Cr - ND Ni - 0.3	Pb - ND Hg - ND Se - ND Ag - ND	ND

TABLE 4.24 (Continued)

SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 16-EVP3

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Extractable Metals (CA Title 22) (mg/L)		Total Cyanides (SM 412B/412E) (mg/Kg)
16-EVP3-SB4-SS14-50	ND	ND	As - ND	Pb - ND	ND
			Ba - 2.5	Hg - ND	
			Cd - ND	Se - ND	
			Cr - ND	Ag - ND	
			Ni - 0.1		

a: ND = No compounds present above method detection limits.
b: Average of analyses of a field sample and an internal duplicate (QC) sample.
c: Average of analyses of a field sample and an external duplicate (QA) sample.
d: Identify of listed compound(s) was not confirmed.

TABLE 4.25

SUMMARY OF RESULTS AT SITE 17-NFTC

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
17-NFTC-SB1	35	0-10	Normal (N) to dk brown	Fuel	Moderate
		10-35	N	No odor	Background (B)
17-NFTC-SB2	15	0-15	N to dk brown	Fuel	Moderate
17-NFTC-SB3	3	0-3	N	Fuel	B

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Total Oil & Grease (SW 3550 and EPA 413.2) (mg/Kg)	Total Petroleum Hydrocarbons (SW 3550 and EPA 418.1) (mg/Kg)
17-NFTC-SB1-SS5-10	ND[b,c]	--
17-NFTC-SB1-SS10-30	2[d]	--
17-NFTC-SB2-SS2-2.5	ND	--
17-NFTC-SB3-SS1-3	--	ND; 3[c]

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.
b: ND = Not detected.
c: Average of analyses of a field sample and an external duplicate (QA) sample.
d: Average of analyses of a field sample and an internal duplicate (QC) sample.

TABLE 4.26

SUMMARY OF RESULTS AT SITE 18-ADA2

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
18-ADA2-SB1	20	0-20	Normal	No odor	Not reported

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 & EPA 413.2) (mg/Kg)
18-ADA2-SB1-SS5-10	ND[b,c]	ND	ND
18-ADA2-SB1-SS8-20	ND[c]	ND	ND

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.
b: ND = No compounds present above method detection limits.
c: Laboratory atmosphere contaminated with dichloromethane. See text for discussion.

TABLE 4.27
SUMMARY OF RESULTS AT SITE 19-EBA3

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
19-ERA3-SB1	10	0-10	Normal (N)	No odor (NO)	Background (B)
19-ERA3-SB2	10	0-10	N	NO	B

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Total Oil & Grease (SW 3550 and EPA 413.2) (mg/Kg)
19-ERA1-SB1-SS5-10	ND[b]
19-ERA1-SB2-SS5-10	ND

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.
b: ND = Not detected.

TABLE 4.28

SUMMARY OF RESULTS AT SITE 20-NLA2

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
20-NLA2-SB1	20	0-7.5	Normal (N)	Slight	Background (B)
		7.5-20	N	No odor	B

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 & EPA 413.2) (mg/Kg)
20-NLA2-SB1-SS3-5	ND[b]	ND	4
20-NLA2-SB1-SS8-20	ND	ND[c]	ND[c]

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

b: ND = No compounds present above method detection limits.

c: Average of analyses of field sample and an internal duplicate (QC) sample.

feet, but no soil discoloration or organic vapor readings were observed. Two samples were analyzed for halogenated and aromatic volatile organics and total oil & grease. Only a trace amount (4 mg/Kg) of oil & grease was detected in the 5-foot sample.

4.1.21 Fuel Disposal Area (21-FDA7)

Three 20-foot borings were made at this site (see Figure 3.3). As indicated in Table 4.29, no soil discoloration or odors were observed, but organic vapor readings were slightly above background levels. Two samples from each boring were analyzed for total petroleum hydrocarbons, but none was detected in any of the samples.

4.1.22 Engine Run-Up/Terminal (22-ERAT)

Two 10-foot borings were made at this site (see Figure 3.11). As indicated in Table 4.30, no soil discoloration or odor was observed. Organic vapor readings were not made because the photoionization detector was broken. One sample from each boring was analyzed for total oil & grease (Table 4.30). A trace amount (4 mg/Kg) was found in SB1, but none was detected in SB2.

4.1.23 Building Ditch Discharge (23-BDD8)

Two 20-foot borings were made within the general path of surface runoff from the rinse-water discharge points identified in Building 870 (see Figure 3.7). As indicated in Table 4.31, no soil discoloration, odor, or organic vapor readings were observed. Analytical results are presented in Table 4.32. Two samples from each boring were analyzed for halogenated and aromatic volatile organics, but none were detected. The two samples from SB2 were also analyzed for total oil & grease, but none was detected. All four samples were analyzed for twelve metals using the WET extraction procedure (CA Title 22:66700); therefore, a reported value of 1.0 mg/L (1 ppm) is roughly equivalent to a soil concentration of 10 mg/Kg (10 ppm) of the extractable metal.

4.2 RESULTS OF WATER-WELL SAMPLING

Seven water wells were sampled during the IRP Phase II, Stage 1 investigation at USAF Plant 42 (see Figure 3.12). The analytical results are presented in Table 4.33. All seven samples were analyzed for purgeable halocarbons and purgeable aromatics. A trace amount (1.6 ug/L) of one purgeable halocarbon was detected in a duplicate sample

TABLE 4.29

SUMMARY OF RESULTS AT SITE 21-FDA7

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
21-FDA7-SB1	20	0-20	Normal (N)	No odor (NO)	Background (B)-<1 ppm
21-FDA7-SB2	20	0-20	N	NO	B-2 ppm
21-FDA7-[illegible]	20	0-20	N	NO	B-<1 ppm

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Total Petroleum Hydrocarbons (SW 3550 and EPA 418.1) (mg/Kg)
21-FDA7-SB1-SS3-5	ND[b]
21-FDA7-SB1-SS8-20	ND
21-FDA7-SB2-SS4-7.5	ND[c]
21-FDA7-SB2-SS8-20	ND
21-FDA7-SB3-SS3-5	ND
21-FDA7-SB3-SS8-20	ND

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

b: ND = Not detected.

c: Average of analyses of field sample and an internal duplicate (QC) sample.

TABLE 4.30

SUMMARY OF RESULTS AT SITE 22-ERAT

Part A - Observations During Test Drilling

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
22-ERAT-SB1	10	0-10	Normal (N)	No odor (NO)	Not reported (NR)
22-ERAT-SB2	10	0-10	N	NO	NR

Part B - Chemical Analyses of Soil Samples

Sample Identifier	Total Oil & Grease (SW 3550 and EPA 413.2) (mg/Kg)
22-ERAT-SB1-SS4-10	4
22-ERAT-SB2-SS4-10	ND[b]

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.
b: ND = Not detected.

TABLE 4.31

SUMMARY OF OBSERVATIONS DURING TEST DRILLING AT SITE 23-BDD8

Test Boring Identifier	Total Depth (Feet Below Land Surface)	Observation Depth (Feet Below Land Surface)	Observations Reported in Drilling Logs		
			Color[a]	Odor	Organic Vapors
23-BDD8-SB1	20	0-20	Normal (N)	No odor (NO)	Not reported
23-BDD8-SB2	20	0-20	N	NO	Background

a: Normal soil color ranges from tan to brown throughout USAF Plant 42.

TABLE 4.32
SUMMARY RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES FROM SITE 23-BDD8

Sample Identifier	Halogenated Volatile Organics (SW 8010) (mg/Kg)	Aromatic Volatile Organics (SW 8020) (mg/Kg)	Total Oil & Grease (SW 3550 and EPA 413.2) (mg/Kg)	Extractable Metals (CA Title 22) (mg/L)		
23-BDD8-SB1-SS3-5	ND[a,b]	ND	--	As - 0.044 Ba - 3.2 Cd - ND Cr - ND	Pb - ND Hg - 0.002 Se - ND Ag - ND	Fe - 23 Cu - 0.31 Mn - 14 Zn - 0.41
23-BDD8-SB1-SS8-20	ND	ND	--	As - 0.030[b] Ba - 2.5[b] Cd - ND[b] Cr - ND[b]	Pb - ND[b] Hg - 0.004[b] Se - ND[b] Ag - ND[b]	Fe - 22 Cu - 0.59 Mn - 9.7 Zn - 0.35
23-BDD8-SB2-SS3-5	ND	ND	ND[b]	As - ND[b] Ba - 3.6[b] Cd - ND[b] Cr - ND[b]	Pb - ND; 0.21[b] Hg - 0.010[b] Se - ND[b] Ag - ND; 0.11[b]	Fe - 10[b] Cu - ND[b] Mn - 8.1[b] Zn - 0.19[b]
23-BDD8-SB2-SS8-20	ND	ND	ND	As - ND Ba - 2.7 Cd - ND Cr - ND	Pb - ND Hg - 0.012 Se - ND Ag - ND	Fe - 8.2 Cu - 0.08 Mn - 8.8 Zn - 0.17

a: ND = No compounds present above method detection limits.
b: Average of analyses of field sample and an internal duplicate (QC) sample.

TABLE 4.33

SUMMARY RESULTS OF CHEMICAL ANALYSES OF WATER SAMPLES

Sample Identifier	Well Name	Date Sampled	Pumping Period Before Sampling	Field Measurements: Temperature (°C)	Field Measurements: pH (units)	Field Measurements: Specific Conductance (umhos/cm)	Purgeable Halocarbons (EPA 601) (ug/L)	Purgeable Aromatics (EPA 602) (ug/L)	Total Nickel (EPA 249.1) (ug/L)	Total Cyanide (SM 412D) (ug/L)
DW1-1	Site 1, Well 1	1/30/86	30	21.5	6[c]	255	ND	ND[b]	--	--
DW3-1	Site 3, Well 1	1/30/86	30	19.0	6[c]	275	ND[a,b]	ND	ND	ND[b]
DW8-1	Site 8, Well 1	1/30/86	30	23.0	6[c]	275	ND	ND	--	--
FW2B	Fire Well 2B	1/31/86	30	20.5	5.5[c]	270	ND	ND[b]	--	--
FW1	Fire Well 1	1/31/86	30	21.0	5.0[c]	290	ND	ND	--	--
DW2-1	Site 2, Well 1	4/23/86	15	24.0	7.7	325	ND	ND	--	--
DW4-1	Site 4, Well 1	4/23/86	15	21.0	7.8	340	1,1,1-Trichloroethane -[b] ND; ND; 1.6	ND[b]	ND[b]	ND[b]

a: ND = No compounds present above method detection limits.
b: Results reported are average of duplicate (or triplicate) QA/QC analyses.
c: Litmus paper used after malfunction of pH meter.
d: The identity of this compound was not confirmed.

from well DW4-1, but not in any other samples. The identity of this compound was not confirmed. No other purgeable halocarbons or purgeable aromatics were detected in any of the samples. Two samples (from DW3-1 and DW4-1) were also analyzed for total cyanides and nickel, but neither was detected in either sample. Field measurements of temperature, pH and specific conductance are also reported in Table 4.33.

4.3 CRITERIA FOR DETERMINING SIGNIFICANCE OF RESULTS

The mere presence of contaminants in the environment due to past waste handling or disposal practices does not mean the contaminants pose a significant (unacceptable) threat to human health or the environment. To ensure that resources for further investigation and remedial actions at past spill or disposal sites are efficiently and effectively committed, priorities must be established based on estimates of risk to human health and the environment. The objective of this subsection is to present criteria for determining the significance of the results presented in Subsections 4.1 and 4.2, so that more accurate estimates of risk can be made. Where applicable regulatory standards and guidelines exist, these are used as the criteria for establishing significance. While such regulations exist for surface water and groundwater quality, few have been established for soils. Therefore, established scientific principals must be used to determine the criteria for evaluating the significance of contaminants detected in soils.

4.3.1 Factors Determining Significance of Environmental Contaminants

Where available, regulatory standards and guidelines establish whether environmental contaminants are present at significant levels. In the absence of regulatory guidance, significance is determined by the potential threat to human health or the environment posed by contaminants at a particular site, which can be estimated by considering the following factors:

- Mobility (migration potential),
- Persistence in the environment,
- Bioaccumulation potential,
- Toxicity (including toxicity of degradation products),

- Environmental setting, and
- Environmental loading (areal extent, depth, and concentration of contaminants).

The first four factors are based on specific characteristics of an individual compound (or a group of closely-related compounds) and are determined by its chemical structure. Such characteristics are therefore fairly constant, making possible general predictions regarding a contaminant's mobility, persistence, bioaccumulation potential, and toxicity under a given set of environmental conditions.

The environmental setting is important for several reasons. It determines the conditions for evaluating a contaminant's mobility and persistence, it establishes potential pathways for contaminant migration, and it identifies potential receptors (including proximity to drinking water supplies) for which bioaccumulation and toxicity must be evaluated.

The environmental loading refers to the amount and extent of contamination present at a particular site, and is of obvious importance to the determination of significance. Also to be considered is whether the source of contaminants still exists or has been eliminated through remedial actions or changes in operating procedures.

The factors identified above (including regulatory standards and guidelines) are mostly contaminant-specific. Therefore, the remainder of this subsection discusses criteria for establishing the environmental significance of the specific contaminants detected at USAF Plant 42:

- Volatile/Purgeable Organic Compounds (VOCs),
- Total Oil & Grease and Total Petroleum Hydrocarbons,
- Metals,
- Total Phenolics,
- Total Cyanides, and
- Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs).

4.3.2 Volatile/Purgeable Organic Compounds

Volatile and purgeable organic compounds (VOCs) are low molecular weight compounds typically used as solvents, fuel additives, and raw materials for the production of more complex organics. The VOCs in soil samples from USAF Plant 42 were measured by EPA Methods SW 8010 (Halogenated Volatile Organics) and SW 8020 (Aromatic Volatile Organics). In water samples they were measured by EPA Methods 601 (Purgeable Halocarbons) and 602 (Purgeable Aromatics). These compounds are not usually detected as naturally occurring substances in soils, and their presence can therefore be considered the result of previous spills, releases, or discharges.

The only VOCs whose identities were confirmed (by second-column GC analysis) in soil samples at USAF Plant 42 were toluene, xylenes and ethylbenzene. Other VOCs were detected at concentrations below 10 mg/Kg, but their identities were not confirmed. These included benzene, chlorobenzene, dichlorobenzenes, ethylbenzene, trichloroethane, and trichloroethylene. No VOCs were detected in groundwater samples from USAF Plant 42.

The VOCs detected are all listed by the US EPA (40 CFR 261) and the California Department of Health Services (CA Title 22:66680) as toxic or hazardous chemicals. Some are known carcinogens, while others cause liver or kidney damage in animals. The potential human health risks associated with VOCs are primarily from chronic-exposure resulting from ingestion of the compounds in food and water; lesser risks are associated with inhalation of vapors and direct skin contact with contaminated soils or water. Therefore, the primary health concern is whether VOCs detected in the soil at USAF Plant 42 may potentially contaminate public drinking water supplies, particularly the water-table aquifer beneath Antelope Valley.

The regulatory standards and guidelines established for VOCs in drinking water are presented in Table 4.34. Had VOCs been detected in the groundwater at USAF Plant 42, these values would determine whether the levels detected were significant. No comparable federal or state guidelines exist for VOCs in soils (unsaturated zone), however. Without regulatory criteria, significance must be determined by considering the persistence, bioaccumulation, and potential for migration into the water table aquifer of the individual compounds detected.

The persistence of VOCs in the soil environment depends primarily on the rate at which biodegradation occurs. Photo-oxidation is not an

TABLE 4.34

SUMMARY OF FEDERAL AND STATE DRINKING WATER STANDARDS/GUIDELINES

Parameter	Concentration		Regulatory Criteria
Purgeable Halocarbons			
Carbon Tetrachloride	5 ug/L		California Recommended Action Level
1,2-Dichloroethane	1 ug/L		California Recommended Action Level
1,1-Dichloroethylene	6 ug/L		California Recommended Action Level
Methylene Chloride	40 ug/L		California Recommended Action Level
Tetrachloroethylene	4 ug/L		California Recommended Action Level
1,1,1-Trichloroethane	200 ug/L		California Recommended Action Level
Trichloroethylene	5 ug/L		California Recommended Action Level
Vinyl Chloride	2 ug/L(a)		California Recommended Action Level
Cis-1,2-Dichloroethylene	16 ug/L(a)		California Recommended Action Level
Trans-1,2-Dichloroethylene	16 ug/L		California Recommended Action Level
1,1-Dichloroethane	20 ug/L		California Recommended Action Level
Purgeable Aromatics			
Benzene	0.7 ug/L		California Recommended Action Level
Chlorobenzene	30 ug/L		California Recommended Action Level
1,2-Dichlorobenzene	130 ug/L(a)	[10] ug/L(b)	California Recommended Action Level
1,3-Dichlorobenzene	130 ug/L(a)	[20] ug/L(b)	California Recommended Action Level
1,4-Dichlorobenzene	130 ug/L(a)	[0.3] ug/L(b)	California Recommended Action Level
Toluene	100 ug/L		California Recommended Action Level
Ortho-Xylene	620 ug/L(a)		California Recommended Action Level
Para-Xylene	620 ug/L(a)		California Recommended Action Level
Meta-Xylene	620 ug/L(a)		California Recommended Action Level
Trace Metals			
Arsenic	50 ug/L		Federal Primary Drinking Water Standard
Barium	1,000 ug/L		Federal Primary Drinking Water Standard
Cadmium	10 ug/L		Federal Primary Drinking Water Standard
Chromium	50 ug/L		Federal Primary Drinking Water Standard
Copper	1,000 ug/L		Federal Secondary Drinking Water Standard
Mercury	2 ug/L		Federal Primary Drinking Water Standard
Nickel	150 ug/L		Proposed Federal Guidance Level
Lead	50 ug/L		Federal Primary Drinking Water Standard
Selenium	10 ug/L		Federal Primary Drinking Water Standard
Silver	50 ug/L		Federal Primary Drinking Water Standard
Zinc	5,000 ug/L		Federal Secondary Drinking Water Standard

TABLE 4.34
SUMMARY OF FEDERAL AND STATE DRINKING WATER STANDARDS/GUIDELINES
(continued)

Parameter	Concentration			Regulatory Criteria
<u>Pesticides - Chlorinated Hydrocarbons</u>				
Aldrin	0.05	ug/L(c)		California Recommended Action Level
alpha-Benzene hexachloride	0.70	ug/L		California Recommended Action Level
beta-Benzene hexachloride	0.30	ug/L		California Recommended Action Level
Chlordane	0.055	ug/L		California Recommended Action Level
Dieldrin	0.05	ug/L(c)		California Recommended Action Level
Heptachlor	0.02	ug/L		California Recommended Action Level
Heptachlor epoxide	0.10	ug/L		California Recommended Action Level
Pentachlorophenol	30.00	ug/L		California Recommended Action Level
<u>Miscellaneous Parameters</u>				
Phenol	--		[1.0] mg/L(b)	California Recommended Action Level
Total Dissolved Solids	500	mg/L		Federal Secondary Drinking Water Standard
pH	6.5 - 8.5			Federal Secondary Drinking Water Standard
Cyanide	0.75	mg/L		Proposed Federal Guidance Level

(a) Action Level applies to either a single isomer or the sum of all isomers.
(b) Action Levels in brackets are based on taste and odor threshold.
(c) Limit of quantification, if lower.

important elimination mechanism for the VOCs detected (VERSAR 1979), and soil conditions at USAF Plant 42 make significant chemical oxidation or reduction unlikely, leaving biodegradation as the main elimination mechanism for VOCs in the soil. (Simple evaporation into the atmosphere is addressed later.) Biodegradation rates for a given compound depend upon several factors including soil pH, temperature, moisture, nutrients present, oxygen content, and the concentration of the compound in the soil. Also important are the density, distribution, diversity, and acclimation of microorganisms present in the soil. The soils at USAF Plant 42 are relatively low in nutrients and moisture, and probably contain limited populations of soil microorganisms. Therefore, compared with moist soils rich in nutrients and organic carbon, biodegradation rates of the VOCs present in soils at USAF Plant 42 are probably much lower. Table 4.35 presents the relative biodegradation potential of the individual VOCs detected.

The bioaccumulation of VOCs is probably not significant at USAF Plant 42. Only two of the compounds detected have a high potential for bioaccumulation, as shown in Table 4.35, the rest being moderate or low (VERSAR 1979). There are no surface water bodies either within or downgradient from the installation, which eliminates concerns for bioaccumulation in aquatic species. Vegetation in the area is sparse and relatively slow growing, which reduces the significance of uptake by plants. Finally, animal populations densities are probably low and consist primarily of rodents, birds, and reptiles, few if any of which are consumed as food by man. While there may be potential for adverse effects on plants and animals resulting from direct exposure to locally high concentrations VOCs, the potential for bioaccumulation is limited and not considered significant at USAF Plant 42.

The mobility of individual VOCs is determined by their physical and chemical properties, especially water solubility, vapor pressure, and sorption potential (the tendency to adsorb onto soil particles and absorb into organics present in the soil). Values of these properties for individual VOCs detected at USAF Plant 42 are presented in Table 4.36. At shallow depths (less than five feet), vapor pressure is probably the controlling factor, resulting in upward migration and the evaporation and dispersion of VOCs into the atmosphere. At greater

TABLE 4.35
BIODEGRADATION AND BIOACCUMULATION POTENTIAL
OF SELECTED VOLATILE ORGANIC COMPOUNDS IN SOIL

Volatile Organic Compound	Relative Biodegradation Potential	Relative Bioaccumulation Potential
Benzene	moderate	low
Chlorobenzene	moderate to low	high
Dichlorobenzenes	moderate to low	high
Ethyl benzene	moderate	low
Toluene	moderate	low
Trichloroethane	low	moderate
Trichloroethylene	low	moderate
Xylenes	moderate	low

Source: adapted from discussions in VERSAR (1979).

TABLE 4.36
ESTIMATED MOBILITY OF SELECTED VOLATILE ORGANIC COMPOUNDS IN SOIL

Compound	Solubility in Water at 20°C[(a)] (mg/L)	Vapor pressure[(a)] (mm Hg at 20°C)	Log K_{ow}[(a)]	Log K_{oc}[(c)]	$K_{sw} = \frac{\text{Amount Sorbed}}{\text{Amount Dissolved}}$[(c)]	Relative Potential Mobility in Soils (based on depth in feet below land surface)
Benzene	1780	76	2.13	2.54	0.35	0-5: High >5: Moderate
Chlorobenzene	500	8.8	2.84	2.92	0.83	0-5: Moderate >5: Low to moderate
Dichlorobenzenes	90[(b)]	0.8[(b)]	3.38[(b)]	3.22	1.66	0-5: Low to moderate >5: Low
Ethylbenzene	152	7	3.15	3.09	1.23	0-5: Moderate >5: Low to moderate
Toluene	515	22	2.69	2.84	0.69	0-5: Moderate to high >5: Moderate
Trichloroethylene	1000	60	2.29	2.62	0.42	0-5: High >5: Moderate
Xylenes	187[(b)]	6[(b)]	3.04[(b)]	3.03	1.07	0-5: Moderate >5: Low to moderate

(a) Source: Verschueren, 1983.

(b) Average for all isomers.

(c) See text for explanations of K_{oc} and K_{sw}.

depths within the unsaturated zone, water solubility and sorption potential are more important, since the primary direction of contaminant migration is downward toward the water table.

Unlike water solubilities and vapor pressures, the sorption potential of a compound is difficult to determine. The following equation (LYMAN 1982) uses an easily measured physicochemical property, the octanol-water partition coefficient (K_{ow}), to estimate an overall sorption coefficient (K_{oc}) relative to the organic fraction in the soil:

$$\text{Log } K_{oc} = 0.544 \times (\text{Log } K_{ow}) + 1.377$$

The equilibrium ratio of the sorbed fraction to the dissolved fraction of a given compound can be estimated by multiplying K_{oc} by a known or assumed value for the organic fraction in the soil (f_{oc}):

$$K_{sw} = (f_{oc}) \times (K_{oc})$$

A value of K_{sw} greater than 1.0 indicates the compound is readily sorbed and most will be associated with the solid phase. A value of less than 1.0 indicates that the compound is not readily sorbed and most will be in solution, associated with the aqueous phase. The approach was used to estimate K_{sw} for several volatile compounds in the soils at USAF Plant 42, as shown in Table 4.36. Although measurements of the organic fraction in the soils at USAF Plant 42 were not made, the value of f_{oc} is likely to be small (see Section 2.0). The values for K_{sw} presented in Table 4.36 are based on an assumed organic fraction of 0.1 percent (f_{oc} = 0.001).

The estimated equilibrium sorption coefficient, K_{sw}, can be used to estimate equilibrium concentrations in either soil or water, if the concentration in the other medium is known. For example, Table 4.37 gives the estimated soil concentrations of several VOCs that would exist in equilibrium with groundwater containing these compounds at California's Recommended Action Levels for drinking water (from Table 4.34). The same approach can be used to predict equilibrium water concentrations from known soil concentrations at a given site.

TABLE 4.37
ESTIMATED SOIL CONCENTRATIONS
OF SELECTED VOLATILE ORGANIC COMPOUNDS
IN EQUILIBRIUM WITH WATER AT RECOMMENDED ACTION LEVELS

Compound	Estimated K_{sw} for Soils at USAF Plant 42	Recommended Action Level in Drinking Water (C = ug/L)	Estimated[(b)] Equilibrium Soil Concentration (S = mg/Kg)
Benzene	0.35	0.7	0.00025
Chlorobenzene	0.83	30	0.025
Dichlorobenzenes	1.66	130	0.215
Ethylbenzene	1.23	(a)	--
Toluene	0.69	100	0.069
Trichloroethylene	0.42	5	0.002
Xylenes	1.07	620	0.66

(a) Recommended action levels are not established for ethylbenzene.

(b) $S = (K_{sw}) \times (C)/(1000))$.

This approach is useful for determining worst-case conditions when estimating potential groundwater contamination, but it fails to consider other factors important to the issue of mobility. For example, rainfall at USAF Plant 42 probably does not infiltrate very deeply below land surface because of the low precipitation, high evapotranspirtation rates, and moderate soil permeabilities. Therefore, transport rates in the aqueous phase will be low. Further, estimates of the equilibrium aqueous concentrations should be made for a given depth based on actual soil concentrations at that depth. Both soil concentrations and the estimated aqueous concentrations will generally diminish considerably with depth due to sorption of the compound. For these reasons, the depth to groundwater below the soils where contaminants occur is very important to determining the significance of contaminant mobility.

4.3.3 Total Oil & Grease and Total Petroleum Hydrocarbons

Oil & grease and petroleum hydrocarbons are two nonspecific analytical parameters which measure fluorocarbon-113 extractable 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 (roughly half of gasoline is lost during the analysis). Nevertheless, both parameters are useful for determining the presence of complex mixtures of hydrocarbons, including gasoline and jet fuels. Total oil & grease measurements include biodegradable animal grease, vegetable oils, soaps, and waxes in addition to the relatively nonbiodegradable mineral oils measured in the total petroleum hydrocarbon analysis. The two parameters are similar enough to be discussed together, however, especially since there are no significant sources of oil & grease of animal or vegetable origin (such as landfills) known to exist at USAF Plant 42. One or both analyses were performed on soil samples from most of the IRP sites, but neither parameter was measured in groundwater samples.

The California Regional Water Quality Control Board (San Francisco Bay Region) has established guidelines, based on total petroleum hydrocarbons in soils, for determining appropriate remedial actions for fuel leaks (Guidelines for Addressing Fuel Leaks, 1985). More than 100 mg/Kg total petroleum hydrocarbons in soils is considered significant and generally requires further monitoring. When concentrations exceed 1000 mg/Kg, the soil is considered contaminated and remedial action is often required. No other applicable standards or guidelines exist for total oil & grease or total petroleum hydrocarbons in soils. In addition, no federal or state drinking water standards or guidelines exist for either parameter.

The aliphatic organics which constitute most of the recoverable oil & grease or petroleum hydrocarbons are generally less toxic than VOCs, and the primary health risk is associated with chronic exposures through ingestion of contaminated food and water.

Most compounds measured as total oil & grease or petroleum hydrocarbons are relatively persistent in the environment. Biodegredation is the main elimination mechanism and rates are fairly slow, especially for saturated hydrocarbons. Oil & grease of animal or vegetable origin is biodegraded more quickly, as are short-chain and branched compounds. Overall, the relative biodegradation potential for compounds measured by either test is low, and complete biodegradation may require many years or even decades.

The potential for migration of individual compounds measured as oil & grease or petroleum hydrocarbons is low. The aliphatic organics which represent most of these compounds have negligible water solubilities, low vapor pressures, and high sorption coefficients. For example, n-decane ($C_{10}H_{22}$), a medium molecular weight aliphatic organic, has a water solubility of only 0.009 mg/L and a vapor pressure of 2.7 mm Hg at 20 °C (VERSCHUEREN 1983). Its overall soil sorption coefficient (K_{oc}) can be estimated from its solubility (S, in mg/L) using the following equation (LYMAN 1982).

$$\text{Log } K_{oc} = -0.55 \text{ (Log S)} + 3.64$$

The Log K_{oc} for n-decane is thus estimated to be 4.77, which is greater than the values estimated for any VOCs detected at USAF Plant 42 (see Table 4.36). Based on an assumed organic fraction in the soil of 0.1 percent (f_{oc} = 0.001), the equilibrium constant (K_{sw}) for n-decane has a value of 58, compared to K_{sw} values of 0.35 to 1.66 estimated for the VOCs (Table 4.36). This represents a much greater sorption potential for n-decane than for any of the VOCs detected. The generally high sorption potential associated with aliphatic organics is the primary reason for concluding the mobility of compounds measured as oil & grease or petroleum hydrocarbons is low. Further, VOCs and other specific organic contaminants associated with oil & grease or petroleum hydrocarbons will generally have lower mobilities, due to partitioning or sorption of these compounds into the aliphatic compounds present. The significance of this is in proportion to a compound's octanol-water partition coefficient (K_{ow}); greater immobilization results for compounds with higher values of K_{oc}.

4.3.4 Metals

Soil samples from USAF Plant 42 were analyzed for thirteen metals: arsenic (As), barium (Ba), cadmium (Ca), chromium (Cr), lead (Pb), mercury (Hg), selenium (Se), silver (Ag), iron (Fe), copper (Cu), manganese (Mn), zinc (Zn), and nickel (Ni). Nickel was the only metal analyzed in any groundwater samples, and none was found. These metals are naturally occurring in soils at trace levels. Most are toxic to plants, animals, or man at fairly low concentrations. The primary health risks associated with heavy metals are derived from chronic exposures through ingestion of contaminated food or water, or inhalation of contaminated dust.

Soil samples from USAF Plant 42 were analyzed for extractable metals using the California Waste Extraction Test (CA Title 22:66700), as described in Section 3.0. This extraction procedure is intended to simulate natural leaching under mildly acidic conditions, such as might occur in a landfill. The fraction of total metals present in the soil that is measured by this procedure depends on the specific metal and the chemical composition of soil.

Existing standards for trace metal concentrations in drinking water are listed in Table 4.34. There are no federal or state standards or guidelines for metals in soils, but California has established standards for determining whether waste materials are hazardous based on their metals concentrations. Presented in Table 4.38, these include limits for both total and soluble metals, with solubility defined by a specific experimental procedure (Waste Extraction Test, CA Title 22:66700). For soils which exceed the standards in Table 4.38, one can reasonably conclude that significant contamination exists. This is not to imply,

TABLE 4.38
CALIFORNIA LIMITS FOR TRACE METALS IN WASTES

Substance	Soluble Threshold Limit (mg/L)	Total Threshold Limit (mg/Kg)
Arsenic	5.0	500
Barium (excluding barium sulfate)	100	10,000
Cadmium	1.0	100
Chromium VI	5	500
Chromium III	560	2,500
Copper	25	2,500
Lead	5.0	1,000
Mercury	0.2	20
Nickel	20	2,000
Selenium	1.0	100
Silver	5.0	500
Zinc	250	5,000

Source: CA Title 22:66699.

Note: Wastes that exceed these limits are classified as hazardous.

however, that no potential threat to human health or the environment exists just because the values in Table 4.38 are not exceeded. In such cases, the normal background level of individual metals in soils must be considered. Table 4.39 presents an average and range of typical metals concentrations found in soils.

Unlike organic compounds, metals (which are chemical elements) are not degradable through biological or chemical actions, and can be considered infinitely persistent in the environment. Metals can be oxidized or reduced through the activity of microorganisms, however, causing changes in their chemical and physical properties that affect mobility. For example, biomethylation of lead and mercury can greatly increase their mobility and reduce their soil-sorption potential.

All the metals listed above have a high potential for bioaccumulation, especially cadmium, copper, mercury, and zinc (VERSAR 1979). However, the environmental setting of USAF Plant 42 reduces the significance of this concern. Biological uptake and concentration of metals occurs to the greatest extent in aquatic environments, but no surface water bodies are located either on or downslope of the installation. Bioaccumulation will therefore occur mainly through uptake by terrestrial plants which are consumed by animals. Low population densities and relatively slow growth rates of plants and animals in the local area, combined with the fact that few if any plants or animals in the area are eaten by man, limit the potential adverse impacts of bioaccumulation.

The mobility of metals in the environment is generally low, with sorption being the most important factor controlling their mobility (VERSAR 1979). Most of the metals listed above are all readily sorbed by soils and, especially in the unsaturated zone, can be considered highly immobile. Exceptions are aresenic and selenium when these are present in the form of soluble oxyanions (AsO_4^{-3} and SeO_3^{-2}) and nickel, which has the greatest mobility of all the heavy metals listed. Several environmental factors can increase the mobility of metals, such as acidic conditions (low pH), biomethylation, and chemical oxidation or reduction, but these are generally only important in aquatic environments.

TABLE 4.39
TOTAL METAL CONCENTRATIONS IN UNCONTAMINATED SOILS

Heavy Metal	Average Concentration (mg/Kg)	Range of Concentrations (mg/Kg)
Arsenic (As)	6	0.1 - 40
Barium (Ba)	500	100 - 3,500
Cadmium (Cd)	0.5	0.01 - 0.7
Chromium (Cr)	100	5 - 3,000
Copper (Cu)	20	2 - 100
Mercury (Hg)	0.03	0.01 - 0.3
Nickel (Ni)	40	5 - 5,000
Lead (Pb)	10	2 - 2,000
Selenium (Se)	0.2	0.01 - 38
Silver (Ag)	0.1	0.1 - 5
Zinc (Zn)	50	10 - 300

Source: EPA SW-874 (1980)

Note: Data are for soils distant from known mineral deposits or contamination sites.

4.3.5 Total Phenolics

Total phenolics refers to an entire class of compounds which share the same basic chemical structure as phenol (hydroxybenzene). A wide variety of such compounds exists, which differ in the number, type, and location of substituent groups attached to the aromatic ring. The analytical procedure used to measure total phenolics in soil samples from USAF Plant 42 does not distinguish between these species, but includes them all in single value. No groundwater samples were analyzed for total phenolics.

While many phenolic compounds are naturally occurring, their concentrations in environmental samples are usually low, except through the actions of man. Other phenolics, particularly the chlorinated phenolic pesticides, are man-made compounds. All phenolic compounds can be considered toxic, but the range of toxicity exhibited by individual phenolic compounds varies considerably. Health risks associated with the environmental occurrence of phenolic compounds are primarily related to chronic exposures through ingestion of contaminated food or water.

California has published recommended action levels for two phenolic compounds in drinking water (Table 4.34). One of these, pentachlorophenol (a pesticide and wood preservative), also appears in California regulations with soluble and total concentrations limits that establish whether a waste is hazardous (see Table 4.40). The recommended action level of 1.0 mg/L established for phenol in drinking water is primarily intended to eliminate taste and odor problems associated with the formation of chlorophenols during chlorination of public drinking water supplies. Although several other phenolic compounds are listed by the US EPA as priority pollutants, there are no federal or state standards or guidelines established for these compounds in drinking water, and none of the regulations are based on total phenolics. There are also no applicable regulations which address the presence of phenolic compounds in soils.

The persistence of phenolic compounds in the environment is highly dependent on their individual chemical structure and their concentration in the environment. Most phenolics are subject to photo-oxidation, but this occurs only within the top few inches of soil where light can penetrate. Likewise, chemical oxidation and reduction are unlikely to

TABLE 4.40
CALIFORNIA LIMITS FOR ORGANIC COMPOUNDS IN WASTES

Compound(s)	Soluble Threshold Limit (mg/L)	Total Threshold Limit (mg/Kg)
Aldrin	0.14	1.4
Chlordane	0.25	2.5
DDT, DDE, DDD	0.1	1.0
2,4-D (2,4-Dichloro-phenoxyacetic acid)	10	100
Dieldrin	0.8	8.0
Endrin	0.02	0.2
Heptachlor	0.47	4.7
Lindane	0.4	4.0
Methoxychlor	10	100
Pentachlorophenol	1.7	17
PCBs	5.0	50
Toxaphene	0.5	5
2,4,5-T (Silvex)	1.0	10

Source: CA Title 22:66699.

Note: Wastes that exceed these limits are classified as hazardous.

be important in the soils at USAF Plant 42. Therefore, biodegradation is the only significant elimination mechanism. While some phenolic compounds, such as phenol itself, are readily biodegradable, others within the group, such as pentachlorophenol, can persist for years in the environment. Both acclimation and concentration have an important effect on biodegradation rates, since most phenolic compounds are toxic to the microorganisms which degrade them. The more toxic compounds, particularly the chlorophenols, also biodegrade more slowly. On the average, relative biodegradation rates for phenolic compounds in the unsaturated zone are probably moderate to slow.

The mobility of phenolic compounds is controlled primarily by their solubility in water and their tendency to become sorbed onto soil particles. Evaporation or volatilization is probably not a significant for most phenolic compounds. Different phenolic compounds can have greatly different water solubilities and sorption potentials. For example, phenol is soluble to 82,000 mg/L at 15 °C, while pentachlorophenol has a solubility of less than 14 mg/L at 15 °C (VERSCHUEREN 1983). Generally an inverse relationship exists between water solubility and sorption potential. In aqueous environments pH can have an important affect on both solubility and sorption potential, since some phenolic compounds behave as weak acids and dissociate to form ions in solution. The mobility of total phenolics as a group is therefore difficult to estimate, but in the unsaturated zone at USAF Plant 42, they should be fairly immobile.

4.3.6 Total Cyanides

Total cyanides were determined in selected soil and groundwater samples from USAF Plant 42 using an analysis that measures both free cyanide and metallocyanide complexes. Cyanides are toxic to animals and man at low levels, particularly when present as hydrogen cyanide gas (HCN). Therefore, the primary health risks are associated with acute and chronic exposures to cyanides through ingestion of contaminated food and water or inhalation of hydrogen cyanide gas or contaminated dust.

The proposed guidance level for total cyanides in drinking water is 0.75 mg/L (see Table 4.34). No federal or state standards or guidelines have been established for cyanides in soils. The potential for hydrogen cyanide gas generation is one of the criteria for determining whether waste materials are hazardous based on reactivity, however (40 CFR 261). In a US EPA memorandum dated 12 July 1986, the Director of the Characterization and Assesment Division proposed an interim threshold level for total available cyanide of 250 mg/kg, based on a proposed test procedure similar to the one used for measuring total cyanides (without chlorination to convert complexed cyanides to free cyanide).

Cyanides are only moderately persistent in the environment, being easily biodegraded at low concentrations, and they are not bioaccumulated.

The cyanide ion (CN^-) can react with several metals to form relatively insoluble metal cyanides, but when the ion is present in excess, metallocyanide complexes can be formed which are quite soluble in water. Cyanides are fairly mobile in soils, being weakly sorbed by organic materials and clay minerals (VERSAR 1979). Under neutral or acidic conditions, especially in aquatic environments, cyanides can form hydrogen cyanide gas which volatilizes and is dispersed in the atmosphere, with the rate of hydrogen cyanide formation increases as the pH decreases.

4.3.7 Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs)

Organochlorine pesticides and polychlorinated biphenyls (PCBs) represent two groups of organic compounds having sufficiently similar physical and chemical properties to be determined by the same basic analytical procedure (EPA Method SW 8080). Near-surface soil samples from two IRP sites (5-AFTC and 6-OFTC) were analyzed by this method. No groundwater samples were analyzed for these compounds. These two groups of compounds are considered toxic to animals and man, and the primary health risk associated with them is acute or chronic exposure through ingestion of contaminated food or water, with inhalation of contaminated dust being of lesser concern.

The State of California has established recommended action levels in drinking water for several of the organochlorine pesticides (see Table 4.34). No federal or state standards or guidelines have yet been established for PCBs in drinking water. Although regulations exist governing the handling, use, and disposal of both organochlorine pesticides and PCBs, there are no applicable standards or guidelines for these compounds in soils. Both PCBs and several organochlorine pesticides are among the individual organic compounds that determine whether a waste is hazardous under California regulations, as shown in Table 4.40. Both soluble and total threshold limits are established under the regulations.

One of the concerns associated with PCBs and the organochlorine pesticides is their persistence in the environment. The relative biodegradation potential for these compounds is generally very low. Most also bioaccumulate readily. Although not considered volatile, some of these compounds can slowly evaporate from surface waters or the top few feet of soils. Most of these compounds, especially the PCBs, have low water solubilities and are strongly sorbed by soils and organic matter, which greatly limits their mobility. The properties of individual compounds within either of these groups can vary considerably, but the general statements made above will usually apply.

4.4 SIGNIFICANCE OF FINDINGS AT INDIVIDUAL IRP SITES

The significance of analytical results and field observations made are discussed by site, based on the criteria established in Subsection 4.3. A summary of these findings is presented in Table 4.41.

4.4.1 Fuel-Contaminated Ditch (1-FCD2)

Observations of soil discoloration or fuel odors indicated the presence of contaminants in all the borings except SB9 and SB10 (see Figure 3.1), suggesting that contaminants had migrated neither upstream in the ditch nor laterally from it. The same evidence indicated that SB2, SB3, SB7 and SB8, those borings located nearest Building 214, contained contaminants at the greatest depths. These conclusions were confirmed by the analytical results.

Halogenated and aromatic volatile organics were detected above background levels in several soil samples from this site, and their presence within a major drainage ditch and in close proximity to an existing drinking water supply well (DW2-1) is cause for concern. Of greater concern, however, are the total petroleum hydrocarbon results, which showed levels above 1000 mg/Kg in five borings at depths of up to 50 feet. The extent and concentration of petroleum hydrocarbons, and their location in the ditch near drinking water well DW2-1 constitute a potential threat to human health and the environment. Perhaps even more

TABLE 4.41
SUMMARY OF FINDINGS BY SITES

Site Identifier	Site Name/Description	Significant Results and Major Conclusions
1-FCD2	Fuel-Contaminated Ditch	Contaminants (petroleum hydrocarbons and volatile organics) were detected in 10 of 12 borings. Petroleum hydrocarbon values exceeded 1000 mg/Kg in five borings, at depths up to 50 feet. The extent of contamination was well defined. Possible continuing sources of contaminants were identified.
2-PWD2	Paint Waste Disposal Ditch	Some contaminants were detected, but their location and amounts were not sufficient to be of concern.
3-ERA7	Engine Run-up Area in Plant Site 3	No apparent contamination was found at this site.
4-VWT5	Vehicle Washrack and Leaking Underground Tank	Some contaminants were detected, but their location and amounts were not sufficient to be of concern.
5-AFTC	Abandoned Fire Training Area	Contaminants (oil & grease, toluene, xylenes, other volatile organics) were detected in one location, where oil & grease values exceeded 1000 mg/Kg to a depth of 30 feet. The extent of contamination at this site was not determined.

TABLE 4.41
SUMMARY OF FINDINGS BY SITES
(Continued)

Site Identifier	Site Name/Description	Significant Results and Major Conclusions
6-OFTC	Original Fire Training Area	Contaminants (oil & grease and volatile organics) were detected in one location, where oil & grease values exceeded 1000 mg/Kg to a depth of 10 feet. The extent of contamination at this site was not determined.
7-ERA2	Engine Run-up Area in Plant Site 2	Contaminants (petroleum hydrocarbons) were detected in 4 of 7 borings. Petroleum hydrocarbon values exceeding 3000 mg/Kg were detected at depths up to 30 feet in three of these, and up to 150 feet in the fourth. The extent of contamination at this site was partially defined. A possible continuing source of contaminants was identified.
8-FTA8	Fuel Transfer Area	No apparent contamination was found at this site.
9-PWW2	Paint Waste Disposal Area - West	No apparent contamination was found at this site.
10-PWN2	Paint Waste Disposal Area - North	No apparent contamination was found at this site.

TABLE 4.41
SUMMARY OF FINDINGS BY SITES
(Continued)

Site Identifier	Site Name/Description	Significant Results and Major Conclusions
11-D[illegible]	Disposal Area "A"	No apparent contamination was found at this site.
12-ERA1	Engine Run-up Area in Plant Site 1	No apparent contamination was found at this site.
13-DAB2	Disposal Area "B"	No apparent contamination was found at this site.
14-EBA2	Engine Build-up Area	No apparent contamination was found at this site.
15-TEB2	TEB Disposal Area	Contaminants (petroleum hydrocarbons) were detected in one location at a depth of 10 feet, where petroleum hydrocarbon values exceeded 3500 mg/Kg. The extent of contamination at this site was not determined.
16-EVP3	Evaporation Ponds	No apparent contamination was found at this site.

TABLE 4.41
SUMMARY OF FINDINGS BY SITES
(Continued)

Site Identifier	Site Name/Description	Significant Results and Major Conclusions
17-NFTC	New Fire Training Area	No contaminants were detected in samples from one location, but the presence and extent of contaminants elsewhere at the site was not determined. Evidence of possible contamination at other locations was observed during field activities.
18-ADA2	Abandoned Disposal Area	No apparent contamination was found at this site.
19-ERA3	Engine Run-up Area in Plant Site 3	No apparent contamination was found at this site.
20-NLA2	Noise Level Area	No apparent contamination was found at this site.
21-FDA7	Fuel Disposal Area	No apparent contamination was found at this site.
22-ERAT	Engine Run-up Area at the Palmdale Air Terminal	No apparent contamination was found at this site.
23-BDD8	Building Ditch Discharge	No apparent contamination was found at this site.

important is the possibility that continuing sources of these contaminants exist. Considering both operating histories and their proximity to the ditch, the underground fuel storage area south of Building 214, the fuel-flow testing operations in Building 214 (including a waste-fuel tank in the ditch), and the underground fuel line that runs adjacent to the ditch must all be considered potential continuing sources of contaminants.

Compared with results of an earlier (July 1982) sampling effort, both the extent and magnitude of petroleum hydrocarbon contamination at Site 1-FCD2 appear to have decreased over four years (see Figures 1.10 and 4.1). Although it should be noted that different analytical methods were used to measure petroleum hydrocarbons during the two studies, and that this might explain the difference in concentrations reported, there is also a possiblity that volatilization, biodegredation, or downstream migration have resulted in the lower concentrations observed during this study. The observation of fuel odors and trace contaminant levels in downstream soil samples collected from the ditch (SB6, SB11, and SB12) suggest that some contaminant migration has occurred.

4.4.2 Paint Waste Disposal Ditch (2-PWD2)

The observation of soil discoloration and strong odors at shallow depths in soil borings SB1 through SB4 indicated the presence of contaminants within the ditch (see Figure 3.2). That no such observations were made at SB5 suggests that downstream migration of contaminants has not occurred. The probable reason for this is that the ditch was not created or maintained for discharge of surface water runoff, and most of the water entering it remains ponded in the ditch, within the Plant Site 2 security fenceline.

No halogenated volatile aromatics were detected at this site, and aromatic volatile organic compounds were below 0.01 mg/Kg in all but one sample: the 2.5-foot sample from SB1 (Table 4.4). The volatile organic compounds at this site are not significant contaminants because of the small amounts detected.

Oil & grease was detected at a concentration of 980 mg/Kg in the 2.5-foot sample from SB1 (the same sample mentioned above). None of the other samples exceeded 100 mg/Kg for this parameter. Therefore, oil & grease is not a significant contaminant at this site.

Trace levels of total phenolics were detected in several samples, but none exceeded 1.0 mg/Kg. The low levels detected, combined with the environmental setting at USAF Plant 42, leads to the conclusion that total phenolics are not significant contaminants at this site.

The only metals detected above background levels were cadmium, lead, and mercury. This conclusion was based on a comparison of extractable metals results, corrected for dilution, with the average values presented in Table 4.39. If the range of concentrations presented in Table 4.39 is considered instead of the average concentrations, however, the lead values detected appear normal. This is important since in one sample, the 30-foot sample from SB1, extractable lead was detected at a concentration of 6.4 mg/L, which exceeds the soluble threshold limit of 5.0 mg/L established by California hazardous waste regulations (Table 4.38). The other samples were below the soluble threshold limit for lead, and no sample contained cadmium, mercury, or any other metal at levels exceeding their soluble threshold limits. The most important factors in determining the significance of the metals results are the environmental setting at USAF Plant 42 and local conditions at IRP Site 2-PWD2. Given the great depth to groundwater (more than 300 feet) and the limited potential for surface runoff, it is unlikely that metals from this site will ever migrate into drinking water supplies. The relatively low concentrations detected further reduce this risk. For these reasons, it can be concluded that the metals detected are not significant at this site.

4.4.3 Engine Run-Up Area in Plant Site 7 (3-ERA7)

No evidence of contamination was observed during drilling, and analytical results confirmed that no significant contamination existed at this site. Although some halogenated and aromatic volatile organics were detected, none was present above 0.1 mg/Kg. Such low levels in soil samples are not significant, especially considering the environmental setting. The results obtained for oil & grease were likewise insignificant as no sample contained over 100 mg/Kg.

4.4.4 Vehicle Washrack and Leaking Underground Tank (4-VWT5)

No evidence of contamination was observed during drilling at this site. No halogenated or aromatic volatile organic compounds were detected in any of the samples analyzed. Oil & grease was present at a concentration of 350 mg/Kg in the 5-foot sample from SB1, but all other samples were well below 100 mg/Kg. Cadmium was the only metal which was present above normal background levels, based on the values presented in Table 4.39. However, the cadmium levels detected were roughly two orders of magnitude lower than the threshold limits established under California hazardous waste regulations (see Table 4.38). In fact, none of the samples contained any metals at levels which approached these limits. Therefore, the only result of potential significance is the single oil & grease value obtained at a shallow depth from the end of the ditch nearest the vehicle washrack. Consideration of this and the environmental setting at USAF Plant 42 leads to the conclusion that no significant contamination existed at this site.

4.4.5 Abandoned Fire Training Area (5-AFTC)

The observations of soil discoloration, strong fuel odors, and high organic vapor levels indicated that contaminants were present in the soil to a depth of about 50 feet.

Total oil & grease was detected at levels exceeding 1000 mg/Kg to a depth of 30 feet, and at 2.5 feet the oil & grease concentration exceeded 11,000 mg/Kg. The potential for contaminant migration is probably low, and only a trace amount of oil & grease (well below 100 mg/Kg) was detected at a depth of 50 feet. It should be noted, however, that no information was collected to determine the areal extent of contamination at the site.

Several halogenated and aromatic volatile organics were detected at concentrations above 1.0 mg/Kg in samples collected at 2.5, 10 and 30 feet. The presence of toluene, xylenes, and ethylbenzene in the 2.5 foot sample was confirmed by second-column GC analysis, their respective concentrations being 10, 48, and 4.9 mg/Kg. Especially in the absence of information describing the areal extent of contamination, the presence of volatile organic compounds at these levels is justification for further investigation of this site.

Extractable metals concentrations in the near-surface sample were all below background levels, based on the information in Table 4.39. No organochlorine pesticides or PCBs were detected at this site.

4.4.6 Original Fire Training Area (6-OFTC)

The results and conclusions for this site are similar those for IRP Site 5-AFTC. Observations of soil discoloration, strong fuel odors, and organic vapor readings indicated the presence of contaminants to a depth of 25 feet. Several halogenated and aromatic volatile organics were detected at concentrations between 1 and 10 mg/Kg to a depth of 10 feet. No volatile organics were detected in the samples from 30 and 50 feet. Total oil & grease was detected at levels exceeding 1000 mg/Kg in the 10-foot sample and 15,000 mg/Kg in the 2.5-foot sample. Only a trace (well below 100 mg/Kg) was detected at 30 feet and none was found at 50 feet. The levels of volatile organics and oil & grease detected are of concern, but the potential mobility of contaminants at this site is probably low, especially considering this site has not been used for fire training exercises since 1959 (see Table 1.2). No information was collected to determine the areal extent of contamination at this site.

Extractable metals concentrations in the near-surface sample were all below background levels, based on the information in Table 4.39. The analysis for organochlorine pesticides and PCBs showed only a trace amount (0.32 mg/Kg) of Arochlor 1248. This value is more than two orders of magnitude below the total threshold limit established in California hazardous waste regulations (Table 4.40), and given the limited mobility of PCBs in soils, the detected PCBs are not considered significant.

4.4.7 Engine Run-Up Area (7-ERA2)

Fuel odors and high organic vapor readings observed during drilling indicated the presence of contaminants in four of the seven borings, at depths to nearly 200 feet. Total petroleum hydrocarbon levels exceeding 1000 mg/Kg were detected to depths greater than 30 feet in the same four borings, one of which had a concentration of 3600 mg/Kg at 150 feet. In each of these borings, petroleum hydrocarbon levels were well below 100 mg/Kg at 10 feet, but were above 1000 mg/Kg below 20 feet.

Contamination beginning well below land surface is consistent with the suspicion of a leaking underground fuel line as the probable source. Of particular concern are several results suggesting that a continuing leak may exist. That three borings contained only trace amounts of petroleum hydrocarbons (well below 100 mg/Kg), considering their relative locations (see Figure 3.6), suggests that fuel is fairly immobile in the soil. The deepest contamination was found in boring SB5, which was located about 100 feet from the nearest known location of a fuel leak (near SB6). However, other borings located closer to this leak (SB1, SB4, and SB6) did not contain contaminants at such great depths (see Table 4.14). Therefore, the fuel detected in SB5 at 150 feet may be a result of slow leaks which have remained undiscovered for some period.

Compared with results of an earlier (July 1982) sampling effort, petroleum hydrocarbons were detected in the same general locations and at similar concentrations during this study (see Figures 1.14 and 4.2). However, soil borings made in additional locations (SB1 and SB3) and at greater depths (SB6 and SB5) revealed petroleum hydrocarbon contamination to be more widespread than indicated by the previous study. It is also interesting to note that, in both studies, higher concentrations were often found in soil samples collected at depths between samples having lower concentrations (within the same boring). Often two or more such isolated high concentration regions were found within a boring. This is likely a result of different soil conditions at various depths, which cause variations in both soil sorption potential and the rate of downward migration of contaminants through the soil.

4.4.8 Fuel Transfer Area (8-FTA8)

Fuel odors and organic vapor readings were the only evidence of contamination observed during drilling at this site. However, there is probably no significance to these observations since the boring was located between two active railroad sidings, where small leaks of fuel and hydraulic fluids occur frequently. Total petroleum hydrocarbons were not detected in the soil samples, so no apparent contamination was found at this site.

4.4.9 Paint Waste Disposal Area - West (9-PWW2)

No evidence of contamination was observed during collection of the near-surface soil samples, and analytical results confirmed that no significant contamination was found at this site. No aromatic volatile organics were detected and the trace amount (0.011 mg/Kg) of the single halogenated volatile compound detected is not significant. Likewise, the presence of trace levels of oil & grease (well below 100 mg/Kg) is not significant. Total phenolics were below detection limits.

4.4.10 Paint Waste Disposal Area - North (10-PWN2)

No evidence of contamination was observed during collection of the near-surface soil samples at this site. No aromatic volatile organics were found, and only trace amounts (less than 0.08 mg/Kg) of one halogenated volatile compound were detected. Oil & grease was present in only trace amounts (well below 100 mg/Kg), and only in some samples. Total phenolics were found in all four samples, but the concentrations were always below 0.2 mg/Kg. Considering the shallow depth from which the samples were collected (about three feet), no significant contaminants were found at this site.

4.4.11 Disposal Area "A" (11-DAA2)

Although some surface discoloration was observed in the area, no other evidence of contamination was observed during drilling at this site. No halogenated or aromatic volatile organics were detected, nor was any oil & grease detected. The site can therefore be considered uncontaminated.

4.4.12 Engine Run-Up Area in Plant Site 1 (12-ERA1)

No evidence of contamination was observed during drilling, and total oil & grease was below detection limits or was present at only trace levels (well below 100 mg/Kg) in all the samples analyzed. Therefore, no significant contaminants were found.

4.4.13 Disposal Area "B" (13-DAB2)

No evidence of contamination was observed during collection of the near-surface soil samples. No aromatic volatile organics were found, and only trace amounts (less than 0.07 mg/Kg) of a single halogenated volatile compound detected. When detected, oil & grease was present in only trace amounts (well below 100 mg/Kg). Considering the shallow depth from which the samples were collected (about three feet), no significant contaminants were found at this site.

4.4.14 Engine Build-up Area (14-EBA2)

No evidence of contamination was observed during drilling, and total petroleum hydrocarbons were below detection limits or present at only trace levels (well below 100 mg/Kg) in both samples. Therefore, no significant contamination was found.

4.4.15 TEB Disposal Area (15-TEB2)

Surface soil discoloration was observed throughout the area, and both odors and organic vapor readings were detected during drilling. These suggested the presence of contaminants in the soils at this site. While 10-foot sample from SB1 contained only a trace amount of total petroleum hydrocarbons (well below 100 mg/Kg), the 10-foot sample from SB2 had over 3500 mg/Kg. Combined with limited information on the possible extent of contamination, such a high concentration at a 10 foot depth is justification for futher investigation.

4.4.16 Evaporation Ponds (16-EVP3)

Occasional observations of soil discoloration and slight odors during drilling suggested the possible presence of contaminants, but none was found at significant levels. No halogentated volatile organics were detected, and only a trace amount (0.009 mg/Kg) of a single aromatic volatile compound was present in one sample.

Nickel was above local background levels in two shallow samples (2.5 and 5 feet deep), but it was still within the range of background concentrations presented in Table 4.39. The highest nickel concentration detected, 9.4 mg/L, is less than half the soluble threshold limit established under California hazardous waste regulations (Table 4.38). No other metals were present above background levels, nor did any exceed their solubility threshold limits. Therefore, no metals contamination was detected at this site.

Total cyanides were detected in four of the fifteen samples, but none exceeded 0.7 mg/Kg. This is far below the US EPA proposed interim threshold limit of 250 mg/Kg total available cyanide, the level for characterizing a waste as hazardous based its potential for hydrogen cyanide generation (reactivity). The limited extent of the cyanides detected, their low concentrations relative to the proposed guidance levels for drinking water (0.75 mg/L), and the environmental setting at USAF Plant 42 combined lead to the conclusion that the total cyanide levels detected are not significant.

4.4.17 New Fire Training Area (17-NFTC)

Observations during of soil discoloration, fuel odors, and organic vapor readings during drilling indicated the presence of contaminants at depths of 10 to 15 feet; no evidence of contamination was observed between 15 and 35 feet. Neither total oil & grease or total petroleum hydrocarbons were detected above trace levels (all samples were below 100 mg/Kg) in any of the samples collected during soil boring activities. However, these samples were collected from only one location, and contaminants might be found in samples collected elsewhere. This conclusion is based on the observation of fuel odors and organic vapor readings above background levels in the surface soils over most of the fire training area. Therefore, contamination is suspected of being present at this site, despite the fact that no contaminants were found in the samples analyzed.

4.4.18 Abandoned Disposal Area (18-ADA2)

No evidence of contamination was observed during drilling at this site. Further, the samples analyzed contained no detectable halogenated or aromatic volatile organics, nor did they contain any oil & grease. Therefore, no contaminants were found at this site.

4.4.19 Engine Run-Up Area in Plant Site 3 (19-ERA3)

No evidence of contamination was observed during drilling; and total oil & grease values were below detection limits in both samples analyzed. Therefore, no contaminants were found at this site.

4.4.20 Noise Level Area (20-NLA2)

The only evidence of contamination observed during drilling at this site was a slight odor in samples collected near land surface. The samples analyzed contained no detectable halogenated or aromatic volatile organics, and had only a trace amount (well below 100 mg/Kg) of oil & grease. Therefore, no significant contaminants were found at this site.

4.4.21 Fuel Disposal Area (21-FDA7)

Low organic vapor readings were the only evidence of possible contamination observed during drilling, and total petroleum hydrocarbons were below detection limits in all the samples analyzed. Therefore, no contaminants were found at this site.

4.4.22 Engine Run-Up Area at the Palmdale Air Terminal (22-ERAT)

No evidence of contamination was observed during drilling; and total oil & grease was below detection limits or was present in only trace amounts (well below 100 mg/Kg) in both samples. Therefore, no significant contaminants were found at this site.

4.4.23 Building Ditch Discharge (23-BDD8)

No evidence of contamination was observed during drilling. No halogenated or aromatic volatile organics were detected, nor was any oil & grease detected. None of the metals were present above background levels (see Table 4.39), and none exceeded the soluble threshold limits established under California hazardous waste regulations (Table 4.38). Therefore, no contaminants were found at this site.

4.5 SIGNIFICANCE OF FINDINGS FOR GROUNDWATER SAMPLES

No purgeable halocarbons or aromatics were detected in any of the groundwater samples, discounting the trace amount (1.6 ug/L) of a single halocarbon detected in one of two duplicate samples from well DW4-1. Total cyanides and nickel were likewise not detected in either groundwater sample for which they were analyzed (DW3-1 and DW4-1). These results, along with field measurements of pH, temperature, and specific conductance are the basis for concluding that the groundwater beneath USAF Plant 42 was not contaminated.

SECTION 5.0

ALTERNATIVE MEASURES

SECTION 5.0

ALTERNATIVE MEASURES

This section identifies and discusses the major alternatives for future activities under the Installation Restoration Program at each of the sites investigated, based on the results presented in Section 4. These alternatives can be classified into three categories:

- No further action,
- Additional site investigations (IRP-Phase II, Stage 2),
- Remedial actions (IRP-Phase IV).

Alternative activities identified within each of these categories are discussed for individual sites, when appropriate.

5.1 <u>FUEL-CONTAMINATED DITCH (1-FCD2)</u>

High levels of total petroleum hydrocarbons (> 1000 mg/Kg) were detected at depths up to 50 feet in five borings at this site, and levels exceeding 100 mg/Kg were found in two other borings. Several volatile organic compounds were also detected. The concentrations and extent (vertical and lateral) of these contaminants in a major storm-water drainage ditch, and their proximity to drinking water well DW2-1, constitute a potential threat to human health and the environment. Of further concern is the possibility that continuing sources of contaminants may exist. Therefore, the alternative of no further action is not appropriate at this site.

The alternative of conducting additional site investigations is certainly justifiable, if only to determine whether continuing sources of contaminants exist. Four suspected sources have been identified:

- The underground fuel (JP-7) storage area south of Building 214,
- The underground fuel (JP-7) line running adjacent to the ditch from the fuel storage area to a point north of Building 212,

- The waste-fuel collection system in Building 214, including the waste-fuel storage tank located in the ditch, and
- Surface runoff into the ditch from several sources, including the engine run-up area (IRP Site 7-ERA2).

The current extent of contamination within the ditch is well established. No significant contaminant migration appears to have occurred either upstream or laterally in the eastward direction. Whether contaminants exist along the western edge of the ditch is not known; but the results suggest that any such contamination would probably be from past or continuing sources rather than due to migration from the ditch. For these reasons, the main objectives of any additional site investigations should be (1) to determine the extent of contaminants along the west side of the ditch, and (2) to identify sources of contaminants, both past and continuing. Such investigations should also be closely coordinated with further activities at IRP Site 7-ERA2, since two of the suspected continuing sources of contaminants are associated with this site as well (see Subsection 5.7).

The field investigation program should include soil-gas monitoring to determine extent of contamination and to identify possible sources of contaminants, followed by soil boring and sampling activities to determine contaminant concentrations (petroleum hydrocarbons) in selected areas. Other activities should include performance of hydraulic conductivity and percolation tests on selected soil core samples, along with determination of soil organic content and silt and clay fractions, to estimate potential contaminant migration rates.

Another alternative is to move directly to site remediation. Based on the contamination known to exist, remedial action will eventually be necessary to reduce the potential for contaminants to migrate downstream or vertically into the groundwater. Results of the additional site investigations described above will be needed to evaluate remedial alternatives and complete the remedial design. The consideration of several issues leads to a conclusion that moving directly to site remediation is the most prudent choice. There is sufficient contamination documented at this site to conclude that remediation will be required; the only uncertaintly is about what type of remedial action(s) may be necessary. To conduct site investigations separately from the remedial program will likely increase the overall time before remedial actions can begin at the site. Meanwhile, contaminants may migrate farther from their current location, thereby increasing the magnitude and cost of the remedial program.

Possible remedial alternatives include (1) excavation and removal of contaminated soil from the site, (2) aeration of the soil to remove volatile organics, and (3) construction of an enclosed (buried) drainage system within the ditch, such as a steel or concrete culvert, covered with an impermeable cap to eliminate the driving force for contamiant migration. In addition, the remedial activities should include removal or elimination of any continuing sources of contamination.

5.2 PAINT WASTE DISPOSAL DITCH (2-PWD2)

Although contaminants were detected in the former paint waste disposal ditch, their potential threat to human health or the environment appears limited. Contaminants were located primarily at shallow depths in the upstream end of the ditch, and were present at relatively low concentrations. Further, the potential for these contaminants to migrate away from the site or down into the groundwater is very low. Therefore, one alternative is to take no further action at this site.

Arguments against the alternative of no further action include uncertainty about the extent of contamination and actual rates of contaminant migration. The assessment of migration potential was based on considerations of environmental setting, site conditions, the apparent extent of contamination, and literature information about the specific contaminants present; no testing was conducted to confirm the conclusions made. From what is known about the behavior of contaminants in the unsaturated zone, there is a low probability that contaminants have spread laterally from the ditch to any significant degree, or that any significant potential exists for contaminants to migrate very far from their present location. Therefore, the argument against conducting additional investigations at this site is that any results obtained will probably not change the conclusions already made.

A third alternative for this site is to conduct remedial actions to eliminate or reduce whatever potential exists for contaminant migration. The value of performing any remedial actions at this site is questionable, however, considering the small amount of contaminants detected and their low potential for migration.

For the reasons discussed above, the alternative of no further action at this site seems the most appropriate choice.

5.3 ENGINE RUN-UP AREA IN PLANT SITE 7 (3-ERA7)

No significant contamination was found at this site. Therefore, the alternative of no further action seems the only appropriate choice.

5.4 VEHICLE WASHRACK AND LEAKING UNDERGROUND TANK (4-VWT5)

No significant contamination was found at this site, and plans are underway to install an oil/water separator immediately downstream of the vehicle washrack to capture any future fuel or oil spills that might occur before they enter the ditch. Therefore, the alternative of no further action seems the only appropriate choice.

5.5 ABANDONED FIRE TRAINING AREA (5-AFTC)

High concentrations of oil & grease (> 1000 mg/Kg) were found to depths exceeding 30 feet at this site. Also detected were xylenes (up to 48 mg/Kg), toluene (up to 10 mg/Kg), ethylbenzene (up to 4.9 mg/Kg), and several other aromatic volatile organic compounds. Although the presence of contaminants was confirmed, the vertical and lateral extent of contaminants over the entire site was not determined. Therefore, the potential threat to human health and the environment cannot be accurately determined. For these reasons, the alternative of no further action at this site is not appropriate.

The alternative of conducting additional site investigations to determine the extent of contamination and the potential threat to human health and the environment seems appropriate, however. The field investigation program should include soil-gas monitoring over the entire site to determine extent of contamination, followed by soil boring and sampling activities to determine contaminant concentrations (total oil & grease) in selected areas. Other activities should include performance of hydraulic conductivity and percolation tests on selected soil core samples, along with determination of soil organic content and silt and clay fractions, to estimate potential contaminant migration rates. An additional feature of this program would be to coordinate investigations at this site with any further investigations conducted at IRP Site 17-NFTC. The proximity of these two sites (see Figure 3.5) and the similarity of suspected contaminants at each makes a combined study the most logical approach (see Subsection 5.17).

Another alternative would be to move directly to site remediation. Based on the contaminants detected, possible remedial alternatives would include (1) aeration of the soils to remove volatile organics present, (2) construction of an impermeable cap over the site to eliminate the driving force for contaminant migration, and (3) excavation and removal of contaminated soil from the site. None of these options seems appropriate at the present time, however. There is no evidence of any immediate danger which justifies remedial action at this time. It has not even been determined that the presence of contaminants at this site poses a significant threat to human health or the environment, and remedial actions such as discussed may be unnecessary. Further, the vertical and lateral extent of contamination must be known before a meaningful evaluation of remedial alternatives can be made, and the additional investigations described above would be a necessary part of remedial activities. Therefore, the alternative of site remediation seems inappropriate at this time.

For the reasons discussed above, the alternative of conducting additional site investigations seems the most appropriate choice.

5.6 ORIGINAL FIRE TRAINING AREA (6-OFTC)

The results and conclusions for this site are similar to those discussed for IRP Site 5-AFTC. High concentrations of total oil & grease (> 1000 mg/Kg) were found to depths exceeding 10 feet at this site. Also detected were several aromatic volatile organic compounds. Although the presence of contaminants at this site was confirmed, the vertical and lateral extent of contaminants over the entire site was not determined. Therefore, the potential threat to human health and the environment cannot be accurately determined. For these reasons, the alternative of no further action at this site is not appropriate.

As with IRP Site 5-AFTC, the alternative of moving directly to site remediation seems inappropriate. There is also no evidence of any immediate danger which justifies remedial action at this time, and it has not been determined that the presence of contaminants at this site even poses a significant threat to human health or the environment that would make remedial actions necessary. Further, the evaluation of remedial alternatives requires knowledge of the vertical and lateral extent of contamination which is not currently available. Therefore, conducting additional site investigations, for the purpose of determining the extent of contamination and the potential threat to human health and the environment, seems the most appropriate alternative at this site.

The field investigation program should include soil-gas monitoring over the entire site to determine extent of contamination, followed by soil boring and sampling activities to determine contaminant concentrations (total oil & grease) in selected areas. Additional activities should include performance of hydraulic conductivity and percolation tests on selected soil core samples, along with analysis of soil organic content and silt and clay fractions, to estimate potential contaminant migration rates.

5.7 ENGINE RUN-UP AREA IN PLANT SITE 2 (7-ERA2)

High levels of total petroleum hydrocarbons (> 1000 mg/Kg) were detected at this site to a depth of 30 feet in three borings, and to a depth 150 feet in a fourth boring. The concentration and extent (especially vertical) of contaminants found, along with the proximity of this site to drinking water well DW2-1, constitute a potential threat to human health and the environment. Further, continuing sources of contaminants are suspected to exist at the site. Therefore, the alternative of no further action at this site is not appropriate.

The alternative of conducting additional site investigations to determine the extent of contamination and establish whether continuing sources of contaminants exist is certainly justifiable. The underground fuel (JP-7) line running adjacent to flightline (see Figure 3.6) is a suspected continuing source of contaminants at this site, as discussed in Section 4.0. The extent of contamination around the SR-71 engine run-up area is fairly well established, but the paved area between Buildings 212 and 215, which also contains underground fuel lines, has not been investigated. Therefore, efforts should be concentrated on this area to determine extent of contamination along the underground fuel line and to detect possible leaks. Any additional site investigations should be closely coordinated with activities at IRP Site 1-FCD2, since both sites share the underground fuel line as a suspected source of continuing contamination.

The field investigation program should include soil-gas monitoring to determine extent of contamination and identify possible sources of contaminants, followed by soil boring and sampling activities to determine contaminant concentrations (petroleum hydrocarbons) in selected areas. Other activities should include performance of hydraulic conductivity and percolation tests on selected soil core samples, along with determination of soil organic content and silt and clay fractions, to estimate potential contaminant migration rates.

Another alternative is to move directly to site remediation. Based on the contamination known to exist, remedial action will eventually be necessary to reduce the potential for contaminants to migrate away laterally from the site or down into the groundwater. Results of the additional site investigations described above will be needed to evaluate remedial alternatives and complete the remedial design, however.

The consideration of several issues leads to a conclusion that moving directly to site remediation is the most prudent choice. There is sufficient contamination documented at this site to conclude that remediation will be required; the only uncertainty is about what type of remedial action(s) may be necessary. To conduct site investigations separately from the remedial program will likely increase the overall time before remedial actions can begin at the site. Meanwhile, contaminants may migrate farther from their current location, thereby increasing the magnitude and cost of the remedial program. Based on this reasoning, the alternative of moving directly to site remediation seems the most appropriate choice.

Possible remedial alternatives include (1) excavation and removal of contaminated soil from the site, (2) aeration of the soil to remove volatile organics, and (3) construction of an impermeable cap (pavement) to eliminate the driving force for contaminant migration. In addition, the remedial activities should include removal or elimination of any continuing sources of contamination.

5.8 FUEL TRANSFER AREA (8-FTA8)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.9 PAINT WASTE DISPOSAL AREA - WEST (9-PWW2)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.10 PAINT WASTE DISPOSAL AREA - NORTH (10-PWN2)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.11 DISPOSAL AREA "A" (11-DAA2)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.12 ENGINE RUN-UP AREA IN PLANT SITE 1 (12-ERA1)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.13 DISPOSAL AREA "B" (13-DAB2)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.14 ENGINE BUILD-UP AREA (14-EBA2)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.15 TEB DISPOSAL AREA (15-TEB2)

Total petroleum hydrocarbons were detected at a concentration of 3580 mg/Kg in one of two samples collected at a depth of 10 feet, which was also the greatest depth sampled. This, along with the observation of odors and surface staining elsewhere at the site, suggested the vertical and lateral extent of contamination were not fully determined. Therefore, the potential threat to human health and the environment posed by contaminants at this site cannot be accurately determined. For these reasons, the alternative of no further action is not appropriate.

The alternative of conducting additional site investigations to determine the extent of contamination and the potential threat to human health and the environment seems appropriate, however. The field investigation program would consist of soil boring and sampling activities over the entire site, with total oil & grease as the analytical parameter.

Another alternative would be to move directly to site remediation, but there is no evidence of any immediate danger which justifies remedial action at this time. In fact, whether the contaminants at this site pose any threat to human health or the environment is not known. Further, the vertical and lateral extent of contamination must be known to properly evaluate remedial alternatives. Therefore, the alternative of site remediation seems inappropriate.

For the reasons discussed above, the alternative of conducting additional site investigations seems the most appropriate choice.

5.16 EVAPORATION PONDS (16-EVP3)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.17 NEW FIRE TRAINING AREA (17-NFTC)

As discussed in Section 4.0, only limited conclusions can be made from the data collected. Although analytical results failed to confirm the presence of contaminants, soil discoloration and fuel odors were detected to depths of 10 to 15 feet during drilling. Fuel odors and organic vapor readings were observed in surface soils over a wide area at this site, but soil samples for analysis were collected from only one location. The data collected are insufficient for determining the potential threat to human health and the environment posed by contaminants at this site. For this reason, the alternative of no further action at this site is not appropriate.

For many of the same reasons just discussed, the alternative of moving directly to site remediation seems inappropriate. There is no evidence of any immediate danger which justifies remedial action at this time, and it has not been determined that contaminants at this site, if confirmed to be present, would pose a significant threat to human health or the environment making remedial actions necessary. Further, the evaluation of remedial alternatives requires knowledge of the vertical and lateral extent of contamination which is not currently available. Therefore, conducting additional site investigations, to determine the presence and extent of contamination, and the potential threat to human health and the environment, seems the most appropriate alternative at this site.

The field investigation program should include soil-gas monitoring over the entire site to determine extent of contamination, followed by soil boring and sampling activities to determine contaminant concentrations (petroleum hydrocarbons or total oil & grease) in selected areas. Additional work should include performance of hydraulic conductivity and percolation tests on selected soil core samples, along with determination of soil organic content and silt and clay fractions, to estimate potential contaminant migration rates. As previously discussed (Subsection 5.5), any further investigation at this site should be coordinated with work performed at IRP Site 5-AFTC. Both the proximity of these two sites (see Figure 3.5), and the similarity of suspected contaminants at each, make a combined site investigation desirable.

5.18 ABANDONED DISPOSAL AREA (18-ADA2)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.19 ENGINE RUN-UP AREA IN PLANT SITE 3 (19-ERA3)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.20 NOISE LEVEL AREA (20-NLA2)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice. (This conclusion applies to the area south of the concrete ramp. The area north of the ramp, including the underground fuel storage area, is addressed under the discussion of IRP Site 1-FCD2 in Subsection 5.1.)

5.21 FUEL DISPOSAL AREA (21-FDA7)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.22 ENGINE RUN-UP AREA AT THE PALMDALE AIR TERMINAL (22-ERAT)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

5.23 BUILDING DITCH DISCHARGE (23-BDD8)

No significant contamination was found at this site. Therefore, the alternative of no further action is the only appropriate choice.

SECTION 6.0

RECOMMENDATIONS

SECTION 6.0

RECOMMENDATIONS

This section presents recommendations for the three categories of sites at USAF Plant 42, based on results of the IRP Phase II, Stage 1 investigation. Category I sites are those for which no further action is required. Data for these sites are considered sufficient to conclude that no significant threat to human health or the environment exists. Category II sites are those which require additional monitoring or investigation (Phase II, Stage 2) to assess the extent of current or future contamination. Category III sites are those which will require remedial actions (Phase IV), including long-term monitoring. Data for these sites are considered sufficient to characterize the extent of contamination or they indicate an immediate threat to human health or the environment exists. Recommendations for the 23 individual sites are summarized in Table 6.1.

6.1 CATEGORY I SITES: NO FURTHER ACTION

No significant contamination was found at several of the sites, as discussed in Section 4.0. Therefore, these sites are not considered to pose a threat to human health or the environment and require no further actions. Individual sites included in this category are:

- Paint Waste Disposal Ditch (2-PWD2),
- Engine Run-up Area in Plant Site 7 (3-ERA7),
- Vehicle Washrack and Leaking Underground Tank (4-VWT5),
- Fuel Transfer Area (8-FTA8),
- Paint Waste Disposal Area - West (9-PWW2),
- Paint Waste Disposal Area - North (10-PWN2),
- Disposal Area "A" (11-DAA2),
- Engine Run-up Area in Plant Site 1 (12-ERA1),
- Disposal Area "B" (13-DAB2),

TABLE 6.1
SUMMARY OF RECOMMENDATIONS BY CATEGORY

Site Category	Site Identifiers	Recommendations	Rationale for Recommendation
CATEGORY I	3-ERA7, 8-FTA8, 9-PWW2, 10-PWN2, 11-DAA2, 12-ERA1, 13-DAB2, 14-EBA2, 16-EVP3, 18-ADA2, 19-ERA3, 20-NLA2, 21-FDA7, 22-ERAT, and 23-BDD8	No Further Action	No apparent contamination was found.
CATEGORY I	2-PWD2 and 4-VWT5	No Further Action	Location and amount of contaminants detected was not of concern.
CATEGORY II	5-AFTC, 6-OFTC, and 15-TEB2	Phase II, Stage 2 Investigation	Contaminants were detected at levels of concern, but the extent of contamination is unknown. Additional investigation is necessary to determine whether a threat to human health or the environment exists.
CATEGORY II	17-NFTC	Phase II, Stage 2 Investigation	Although no contaminants were detected in the samples analyzed, observations during field activities suggest that contamination may exist elsewhere at the site. Additional investigation is necessary to confirm the presence of contaminants, to determine the extent of contamination, and to determine whether a threat to human health or the environment exists.
CATEGORY III	1-FCD2 and 7-ERA2	Phase IV Remedial Actions	Contaminants were detected at levels of conern and the extent of contamination was defined. A potential threat to human health or the environment may exist. Possible continuing sources of contaminants were also identified.

- Engine Build-up Area (14-EBA2),
- Evaporation Ponds (16-EVP3),
- Abandoned Disposal Area (18-ADA2),
- Engine Run-up Area in Plant Site 3 (19-ERA3),
- Noise Level Area (20-NLA2),
- Fuel Disposal Area (21-FDA7),
- Engine Run-up Area at the Palmdale Air Terminal (22-ERAT), and
- Building Ditch Discharge (23-BDD8).

6.2 CATEGORY II SITES: IRP-PHASE II, STAGE 2 INVESTIGATIONS

Results from four sites indicated the presence of contaminants at levels of concern, but the data were insufficient to determine the extent of contamination. The potential threat to human health and the environment posed by contaminants present at these sites therefore could not be determined. Additional monitoring or investigation is recommended at these sites, as discussed below. Table 6.2 presents a summary of the recommended Phase II, Stage 2 investigation by sites.

6.2.1 Abandoned and New Fire Training Areas (5-AFTC and 17-NFTC)

The Abandoned Fire Training Area (5-AFTC) and the New Fire Training Area (17-NFTC) are located close together in a relatively isolated part of USAF Plant 42, shown in Figure 3.5. The presence of total oil & grease, toluene, xylenes, and other aromatic volatile organic compounds at levels of concern was confirmed at one location within IRP Site 5-AFTC, but insufficient data were collected to determine the extent of contamination at this site. Likewise, the extent of contamination at IRP Site 17-NFTC was not determined. Although no contaminants were detected in the soil samples analyzed, these samples were collected from only one location within the site, and other evidence suggested that fuel contamination might exist elsewhere. Due to their physical proximity and the similar nature of their suspected contaminants (primarily fuels), it is recommended that these two sites be combined for further investigation during Stage 2.

The recommended field investigation program consists of soil-gas monitoring, drilling and soil sampling, and chemical analysis and testing of soil samples. The purpose of soil-gas monitoring is to determine the approximate areal extent of contamination based on volatile organic

TABLE 6.2
SUMMARY OF RECOMMENDED PHASE II, STAGE 2 INVESTIGATION BY SITES

Site Identifier	Site Name/Description	Description of Field Activities	Laboratory Analyses
5-AFTC 17-NFTC	Abandon Fire Training Area New Fire Training Area	Soil-gas monitoring at 50-foot intervals (ur to 200 readings). 14-50 foot soil borings with continuous sample collection. Soil permeability tests and determination of organic, silt, and clay fractions on 3 samples.	Oil & grease analysis on 4 soil samples from each boring (56 total).
(both sites to be investigated together)			
6-OFTC	Original Fire Training Area	Soil-gas monitoring at 50-foot intervals (up to 64 readings). 6-50 foot soil borings with continuous sample collection. Soil permeability tests and determination of organic, silt, and clay fractions on 2 samples.	Oil & grease analysis on 4 soil samples from each boring (24 total).
15-TEB2	TEB Disposal Area	6-25 foot soil borings with continuous sampple collection. Soil permeability tests and determination of organic, silt, and clay fractions on 2 samples.	Oil & grease analysis on 3 soil samples from each boring (18 total).

compounds in the soil. Readings should be taken on a grid pattern with 50 foot spacing between readings over the entire cleared area used for fire training activites (past and present), the approximate dimensions of which are 500 by 1000 feet, for a total of up to 200 readings. Drilling and soil sampling should be performed to confirm the presence of contaminates indicated by the soil-gas monitoring results, to measure contaminant concentrations, and to determine the vertical extent of contamination at the site. A total of 14 soil borings up to 50 feet deep should be made with continuous sample collection, for a maximum of 700 feet of drilling at this site. Four discrete samples selected from each boring should be analyzed for oil & grease, for a total of 56 samples. Representative soil column samples should also be collected at three locations for permeability testing, determination of organic fraction, and silt and clay fractions.

6.2.2 Original Fire Training Area (6-AFTC)

The presence of total oil & grease and aromatic volatile organic compounds at levels of concern was confirmed at one location, but insufficient data were collected to determine the extent of contamination over the entire site.

The recommended field investigation program consists of soil-gas monitoring, drilling and soil sampling, and chemical analysis and testing of soil samples. Soil-gas monitoring should be used to determine the approximate areal extent of contamination, based upon volatile organic compounds in the soil. Readings should be taken on a grid pattern with 50 foot spacing between readings over the entire area used for past fire training activites, the approximate dimensions of which are 400 by 400 feet, for a total of up to 64 readings. Drilling and soil sampling should be performed to confirm the presence of contaminates indicated by soil-gas monitoring results, to measure contaminant concentrations, and to determine the vertical extent of contamination at the site. A total of 6 soil borings up to 50 feet deep should be made with continuous sample collection, for a maximum of 300 feet of drilling at this site. Four discrete samples selected from each boring should be analyzed for oil & grease, for a total of 24 samples. Representative soil column samples should also be collected at two locations for permeability testing, determination of organic fraction, and silt and clay fractions.

6.2.3 TEB Disposal Area (15-TEB2)

The presence of total petroleum hydrocarbons at levels of concern was confirmed at one of two sampling locations, but insufficient data were collected to determine the extent of contamination over the entire site.

The recommended field investigation program consists of drilling and soil sampling, with chemical analysis of soil samples, to measure contaminant concentrations and to determine the vertical and lateral extent of contamination at the site. A total of 6 soil borings up to 25 feet deep should be made with continuous sample collection, for a maximum of 150 feet of drilling at this site. Three discrete samples selected from each boring should be analyzed for oil & grease, for a total of 18 samples. Representative soil column samples shall also be collected at two locations for permeability testing, determination of organic fraction, and silt and clay fractions.

6.3 CATEGORY III SITES: IRP-PHASE IV REMEDIAL ACTIONS

Results from IRP Sites 1-FCD2 and 7-ERA2 indicated the presence of contaminants in sufficient amounts and locations to constitute a potential threat to human health and the environment. Petroleum hydrocarbons were detected at concentrations greater than 1000 mg/Kg in four borings at IRP Site 7-ERA2 (up to 150 feet deep), and in five borings at IRP Site 1-FCD2 (up to 50 feet deep). Volatile organics were also detected at IRP Site 1-FCD2. The extent of contamination is well defined at both sites, but possible continuing sources of contaminants were identified which could increase the potential for further contaminant migration. For these reasons, IRP Sites 1-FCD2 and 7-ERA2 are both recommended for remedial actions. It is further recommended that the two sites be combined for an evaluation of remedial alternatives, due to their physical proximity, the similarity of their contaminants (primarily fuels), and the fact that both share at least one possibile continuing source of contaminants.

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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APPENDIX B

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

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GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

AA: Atomic Absorption, an instrumental analytical method for quantitation of metal elements.

ACIDS: Chemical compounds that yield hydrogen ions in aqueous solution.

ACIDIC: Refers to water having a pH value of less than 7, aqueous solutions containing dissolved acids.

ADSORPTION: The attachment of dissolved matter to the surface of solids through weak chemical interactions which are usually reversible.

AF: Air Force (U.S. Air Force).

AFSC: Air Force Systems Command.

AFCMD: Air Force Contract Management Division (AFSC).

Ag: Chemical symbol for silver.

ALIPHATICS: Organic chemical compounds having an open-chain structure, as distinguished from aromatic compounds.

ALKALINE: Refers to water having a pH value of more than 7, aqueous solutions containing dissolved bases.

ALLUVIAL: Pertaining to or composed of alluvium or deposited by a stream or running water.

ALLUVIUM: Materials eroded, transported and deposited by streams.

ALLUVIAL FAN: A fan-shaped deposit formed by a stream either where it issues from a narrow mountain valley into a plain or broad valley, or where a tributary stream joins a main stream.

ANION: A negatively charged ion in solution.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding useable quantities of water to a well or spring.

AROMATICS: Organic chemical compounds having a stable six-carbon ring as their basic structure, such as benzene, toluene, and xylenes.

ARTESIAN: A condition of confined aquifers in which water levels in wells rise above the top of the aquifer.

As: Chemical symbol for arsenic.

ASD: Aeronautical Systems Division (AFSC).

Ba: Chemical symbol for barium.

BASE: Chemical compounds that yield hydroxide ions in aqueous solution.

BEDROCK: Any solid rock in place; may be exposed at the surface of the earth or overlain by unconsolidated material.

BIOACCUMULATION: Refers to tendency of some chemical elements or compounds to become concentrated in the tissues of living organisms as a result of chronic exposures, mainly ingestion and inhalation.

BIODEGRADABLE: Refers to organic compounds that are broken down into simpler chemical compounds or elements by natural microorganisms in the environment.

Ca: Chemical symbol for calcium.

$CaCO_3$: Chemical symbol for calcium carbonate.

CARBONATE ROCKS: A rock consisting chiefly of carbonate minerals, such as limestone and dolomite.

CATION: A positively charged ion in solution.

Cd: Chemical symbol for cadmium.

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act (the Superfund Act).

CIRCA: About, indicates an approximate date or time.

CN: Chemical symbol for cyanide.

CONFINED AQUIFER: An aquifer bounded by impermeable strata or geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: A low-permeability layer which restricts the movement of ground water.

Cr: Chemical symbol for chromium.

Cu: Chemical symbol for copper.

DARCY'S LAW: An equation describing the flow of fluids in porous media based on the assumption that the flow is laminar and that inertia can be neglected.

DENSITY: Physical property of materials equal to mass per unit volume.

DOD: Department of Defense.

DOWNGRADIENT: In the direction of decreasing hydraulic head; the direction in which ground water flows.

DRAINAGE BASIN: The land area from which all surface runoff drains into one stream channel or system of channels, or to a lake resevoir, or other body of water.

DRAWDOWN: The difference between the static water level and the water level in a well that is pumped.

EP: Extraction Procedure, a US EPA standard laboratory procedure for simulating leachate generation.

EPA: U.S. Environmental Protection Agency.

EPHEMERAL: Short-lived or temporary, for example an ephemeral stream contains-flowing water only for short periods of time.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

ES: Engineering-Science, Inc.

EVAPOTRANSPIRATION: Loss of water from a land area through transpiration of plants and evaporation from the soil.

FAA: Federal Aviation Administration.

FAULT: A fracture in rock along which the adjacent rock surfaces have been displaced.

Fe: Chemical symbol for iron.

FLOW LINES (PATHS): Lines indicating the direction of ground-water movement toward points of discharge. Flow lines are perpendicular to equipotential lines.

GC: Gas chromatograph, an analytical laboratory instrument used for the quantitation and identification of organic compounds.

GC/MS: Gas chromatograph/mass spectrophotometer, an analytical laboratory instrument used for the quantitation and identification of organic compounds.

GROUNDWATER: Water beneath the land surface in the saturated zone.

HALIDES: Refers to the salts of halogen elements, or the anions formed by halogens in aqueous solution.

HALOGEN: Refers to any one of a group of chemical elements including fluorine, chlorine, bromine, and iodine.

HALOGENATED ORGANIC: Refers to any organic compound that contains one or more halogens as a substituent group.

HARDNESS: A property of water causing formation of an insoluble residue when the water is used with soap.

HARM: Hazard Assessment Rating Methodology.

HEAVY METALS: Metal elements, including the transition elements, with atomic weight greater than 50. Many of these elements are required for plant and animal nutrition in trace concentrations, but are toxic at higher concentrations.

HNU Meter: An instrument that uses a photoionization detector to measure organic vapors.

Hg: Chemical symbol for mercury.

HYDRAULIC CONDUCTIVITY: The rate of flow of water through a unit cross section of porous media under a unit hydraulic gradient, at the prevailing temperature.

HYDRAULIC HEAD: Energy contained in a water mass, produced by elevation, pressure and velocity.

HYDROCARBONS: Organic chemical compounds composed of hydrogen and carbon atoms. Hydrocarbons may be straight chain, cyclic, branched chain, aromatic, or polycyclic, depending upon arrangement of carbon atoms. Halogenated hydrocarbons are hydrocarbons in which one or more hydrogen atoms has been replaced by a halogen atom.

ICAP: Induction-Coupled Argon Plasma, an instrumental analytical method for quantitation of metal elements.

IGNEOUS ROCKS: Rocks that are solidified from molten or partly molten material.

INFILTRATION: The movement of water through land surface into the ground.

IRP: Installation Restoration Program.

JP-4: Jet propulsion fuel number four (contains kerosene and gasoline fractions, used in most military jet aircraft).

JP-7: Jet propulsion fuel number seven (a low-volatility fuel used in only a few aircraft, such as the TR-1 and SR-71).

LEACHING: The process by which soluble materials in soils or a landfill dissolve in water. The resulting leachate may percolate down into lower layers or, in a secure landfill, is collected for treatment.

LITHOLOGY: The description of the physical character of rocks and soil.

LOAM: A permeable soil composed of a friable mixture of relatively equal proportions of clay, silt, and sand particles, and usually containing organic matter (humus) with a minor amount of gravel.

METAMORPHIC ROCKS: Any rock derived from pre-existing rocks due to marked changes in temperature, pressure, shearing stress, and chemical environment, that occur at depth in the Earth's crust.

ug/g: Micrograms (10^{-6} grams) per gram, equals one part per million.

ug/L: Micrograms (10^{-6} grams) per liter.

mg/L: Milligrams (10^{-3} grams) per liter.

Mn: Chemical symbol for manganese.

msl: Mean Sea Level.

Ni: Chemical symbol for nickel.

NOAA: National Oceanic and Atmospheric Administration (USDC).

OEHL: USAF Occupational and Environmental Health Laboratory, located at Brooks AFB, Texas.

ORGANIC: Refers to chemical compounds having carbon atoms as their main skeletal structure. Most organic chemicals are created by living organisms or from their remains (such as fossel fuels) and occur naturally in the environment; other organic chemicals are man-made.

OUTCROP: Zone or area where a geologic unit or formation occurs at or near land surface. "Outcrop area" is an important factor in studies of aquifers as this zone usually corresponds to the point where significant recharge occurs. Occasionally, this term is used as an intransitive verb: "Where the unit crops out....."

Pb: Chemical symbol for lead.

PCBs: Polychlorinated biphenyls, liquid halogenated polycyclic organic compounds commonly used as insulating and cooling fluids in electrical equipment. Commercial mixtures of PCBs are refered to as Arochlors.

PERCHED WATER TABLE: Unconfined ground water separated from an underlying water table by an unsaturated zone.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERMEABILITY: A measure of the relative ease of fluid flow through a porous medium. The USDA, Soil Conservation Service describes permeability qualitatively as follows:

very slow	<0.06	inches/hour
slow	0.06 to 0.2	inches/hour
moderately slow	0.2 to 0.6	inches/hour
moderate	0.6 to 2.0	inches/hour
moderately rapid	2.0 to 6.0	inches/hour
rapid	6.0 to 20	inches/hour
very rapid	>20	inches/hour

PESTICIDE: A chemical agent used to destroy pests, includes specialty groups known as herbicides, fungicides, insecticides, rodenticides, etc.

pH: A measure of the acidic or alkaline nature of aqueous solutions, specifically the negative logarithm of the hydrogen ion concentration.

POLYCYCLIC COMPOUND: An organic compound in which the carbon atoms are arranged into two or more six-carbon rings, usually aromatic in nature.

POROSITY: The percentage of the bulk volume of a rock or soil that is occupied by interstices, whether isolated or interconnected.

ppb: Parts per billion by weight.

ppm: Parts per million by weight.

PRECIPITATION: Rainfall and snowfall.

QUATERNARY: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2-3 million years.

QA/QC: Quality assurance and quality control.

RCRA: Resource Conservation and Recovery Act.

RECEPTORS: Individuals or groups of organisms or resources that are potentially affected by a contamination source.

RECHARGE AREA: The part of an aquifer that receives water by infiltration from surface water, precipitation, or an overlying aquifer. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the zone of saturation by natural or artificial processes.

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SCS: Soil Conservation Service (USDA).

Se: Chemical symbol for selenium.

SEDIMENTARY ROCKS: Rocks formed by the consolidation of loose sediments that have accumulated in layers.

SPECIFIC CAPACITY: The rate of discharge of a water well per unit of drawdown, commonly expressed in gpm/ft or m^3/day/m.

STATIC WATER LEVEL: The level of water in a well that is not being affected by withdrawal of groundwater.

TCA: Trichloroethane, a solvent and suspected carcinogen.

TCE: Trichloroethylene, a solvent and suspected carcinogen.

TDS: Total Dissolved Solids.

TOC: Total Organic Carbon.

TOX: Total Organic Halides.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRACE METALS: Metal elements that occur in low abundances in natural materials.

TRANSMISSIVITY: A measure of an aquifer's capability to yield water; the rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TRANSPIRATION: The process by which water absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface.

UPGRADIENT: In the direction of increasing hydraulic head; the direction opposite to the prevailing flow of groundwater.

USAF: United States Air Force.

USDA: United States Department of Agriculture.

USDC: United States Department of Commerce.

USGS: United States Geological Survey.

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

Zn: Chemical symbol for zinc.

APPENDIX C

PROJECT TEAM BIOGRAPHICAL DATA

APPENDIX C

PROJECT TEAM BIOGRAPHICAL DATA

Biographical data for the Engineering-Science Project Team members is presented in this appendix. These individuals and their responsibilities were as follows:

- Boline, D. R. - Quality Assurance Officer
- Duncan, W. J. - Hydrogeologist
- Grunwald, E. L. - Health and Safety Officer
- Guthrie, M. A. - Field Team Leader, Environmental Engineer
- Izmirian, L. J. - Field Geologist
- Kasper, D. R. - Project Manager
- Schroeder, E. J. - Technical Director
- Sprinkle, C. L. - Geochemist, Hydrogeologist
- Pilja, G. - Field Geologist

Biographical Data

DUANE R. BOLINE

Analytical Chemist

PII Redacted [redacted]

Education

B.S.E., Physical Science, Emporia State University, 1962
M.S., Chemistry, Emporia State University 1965
Ph.D., Analytical Chemistry, Kansas State University, 1975

Professional Affiliations

American Chemical Society
Society for Applied Spectroscopy

Awards, Honors, Scholarships

Emporia State University Endowment Association Academic Scholarship
Emporia State University Athletic Scholarship
National Science Foundation Fellowship
Lamba Delta Lamba Honorary Physical Science Fraternity

Experience Record

1962-1968	Kansas Public Schools, Science Teacher and Basketball Coach
1968-1980	Assistant Professor; Associate Professor of Chemistry
	Taught undergraduate and graduate analytical chemistry courses in addition to maintaining an active Master's Degree research group. Major research interests were trace metal analysis by atomic absorption spectroscopy, the enhancement of sensitivity obtained in flame atomic absorption by the use of organic solvents, and environmental chemistry.
	This work included an investigation of the trace metal content of metalloenzymes separated by liquid chromatography by use of graphite furnace atomic absorption spectroscopy. The activity of the purified enzymes was investigated after removal or complexation of the metal and compared to the activity of the normal enzyme.

Served as an Associate Referee for the Association of Official Analytical Chemists for the methods of determination of copper, zinc and cobalt in plants (1975-1980).

Provided extensive consulting and chemical analysis services to industries in Eastern Kansas. This work included determinations of wastewater quality and chemical analysis of products and by-products for QA purposes.

Participated in projects which required analysis for inorganic and organic pollutants in fresh water streams and lakes for the U.S. Army Corps of Engineers. This included work on environmental impact studies and water quality studies of reservoirs in Southern Kansas. In addition to teaching the traditional courses in undergraduate general and analytical chemistry, a series of laboratory-oriented, one-hour credit, graduate level courses entitled 'Topics in Analytical Chemistry' was developed. This was a series of self-contained courses in Ultraviolet and Visible Spectroscopy, Infrared Spectroscopy, Nuclear Magnetic Resonance Spectroscopy, Atomic Absorption Spectroscopy, Flame Photometry, Gas Chromatography, High Performance Liquid Chromatography, Potentiometry, and Polarography.

Served as faculty advisor to the student American Chemical Society affiliate, and received a special student-originated award as the Outstanding Chemistry Professor in 1976.

Invited to work as a temporary research chemist for the National Institute of Environmental Health Science. Prepared a summary document of the literature pertaining to the speciation and mechanisms of trace metals in biological systems. A review of analytical techniques for the determination of trace elements in mammals was prepared and several areas of proposed research were outlined.

1980-1984 Radian Corporation, Austin, Texas

Staff Scientist (1980-81). Co-Project Director for National Toxicology Program Chemical Repositories. Served as chemical analysis task leader and project manager for Hazardous Materials Laboratory Operations.

Senior Scientist (1981)

Group Leader of the Inorganic Analysis Group. Had responsibility for the technical and personnel management of the Atomic Spectroscopy and water quality laboratories which provided analytical support for synfuels/coal gasification, environmental, and hazardous waste assessment projects.

Director of Analytical Services (1982-1984)

Responsible for management of one of four profit centers within the company. Provided the marketing, technical, financial and personnel management for the Analytical Services Laboratories as located in Austin, Texas and Sacramento, California. The Analytical Services Laboratories provided chemical analysis for commercial and governmental clients.

Provided analytical support and technical consultation to clients in the chemical, petrochemical, wood and paper, electronics, synfuels, and other related fields.

These laboratories offered a full range of chemical analysis capabilities including: Atomic Absorption Spectroscopy, Inductively Coupled Plasma Emission Spectroscopy, Gas Chromatography, Mass Spectroscopy, and conventional wet chemical analyses, and featured a computerized laboratory management system.

Had responsibility for proposal preparation and project management for RCRA, NPDES, and other related projects. Obtained EPA Contract Laboratory Program projects for both organic and inorganic chemical analysis.

1984-Present — Engineering-Science, Atlanta, Georgia, Director of Laboratory Services

Management of chemical analysis laboratory providing support to engineering-services. Major projects require analysis of samples from hazardous waste sites involved in remedial action assessment. In addition to laboratory management, technical support is provided to the engineering staff for proposal and report preparation.

Dr. Boline has directed the activities of analytical chemistry laboratories providing both organic and inorganic analyses. These laboratories use EPA recommended procedures for anayzing samples of air, water and solids. The methods utilized include gas chromatography/mass spectrometry, gas chromatography, high performance liquid chromatography, ion chromatography, atomic absorption spectrometry, inductively coupled plasma emission spectroscopy, moleculor absorption spectroscopy (U.V./Vis and I.R.) colorimetry, potentiometry and miscellaneous wet chemical test methods. Dr. Boline has provided the technical expertise for selection and proper execution of these various techniques to obtain the information required for each project.

Dr. Boline has written or participated in the writing of over 50 detailed General Work Plans for the EPA, other governmental agencies and commercial clients. His participation in Work Plan preparation has included selection of test parameters and applicable analysis methods, quality assurance and quality control protocols, health and safety factors, scheduling and estimated costs. During the past year Dr. Boline participated in the preparation of eight Site-Specific test plans and Quality Assurance Project Plans. These Site-Specific plans provide the client and the project team members with a detailed description of the sampling and analysis procedures to be used during the investigation.

One of Dr. Boline's primary responsibilities is the review and evaluation of analytical methods proposed for specific projects in work plans prepared by ES personnel. He works closely with project managers and task leaders to ensure the analyses recommended will provide the desired data with the precision and accuracy required. His experience and familiarity with EPA test procedures has enabled ES to utilize screening procedures and multi-element analysis methods to provide pertinent information to clients and achieve significant cost reductions.

Dr. Boline participates in the analysis of the overall program objectives in order to understand the specific information desired. He can therefore recommend specific procedures and QA/QC protocols to ensure the acquisition of pertinent data backed with adequate documentation. During the past year he has reviewed specific test requests for four military base phase II waste site investigations, and three EPA designated hazardous waste site investigations.

Data obtained by chemical analyses for use in regulatory enforcement actions, compliance evaluation or development and validation of methods to be used for these purposes must be technically valid and properly documented. Dr. Boline has reviewed data from previous studies at hazardous waste sites for two commercial clients in the past year. His recommendations have been utilized to ensure subsequent testing would provide adequate data to support, repute or further define the previous test results. He has recently completed a review of test results from a previous study to develop methods for determining inorganic ions and radicals in a caustic scrubber brine used to minimize inorganic oxide emissions from a military incinerator. His recommendationsenabled ES chemists to develop and validate modified analysis methods which provide the required accuracy and precision specified by the client.

Management Training Courses and Seminars

Group Leader Training Course - Radian Corporation
Project Director Training Course - Radian Corporation
Program Management Training Course - Radian Corporation
Laboratory Management Seminar - McGraw-Hill Corporation, Oscar Milnar, Leader
Laboratory Manager Training Course - Radian Corporation, prepared and presented by Duane R. Boline

Publications/Reports

Boline, Duane R., L. H. Keith and D. B. Walters, "Management of a Chemical Repository for Chemicals Used in Coded Toxicity Testing," Chapter 17, pp. 213 - 220 in Chemistry For Toxicity Testing, C. W. Jameson, D. B. Walters, editors, Butterworth Publishers, 1983.

Boline, Duane R., L. H. Keith, and D. B. Walters, "Inventory Management and Data Storage for Chemicals Used in Coded Toxicity Testing," American Chemical Society Meeting, Las Vegas, NV, 1982.

Boline, Duane R., L. H. Keith, and D. B. Walters, "A Computerized Data Management System for a Hazardous Materials Laboratory," American Chemical Society Meeting, New York, NY, 1981.

Boline, Duane R., "Some Speciation and Mechanistic Aspects of Trace Metals in Biological Systems," Chapter 44 in Environmental Health Chemistry--Chemistry of Environmental Agents as Potential Hazards, James McKinney, editor, Ann Arbor Press, Ann Arbor, MI, 1980.

Boline, Duane R. and W. G. Schrenk, "Atomic Absorption Spectroscopy of Copper and Iron in Plant Material," J.A.O.A.C., 60, 1170-1174, 1977.

Boline, Duane R. and W. G. Schrenk, "A Method for Determination of Cadmium in Plant Materials by Atomic Absorption Spectroscopy," J. Appl. Spectros., 30, 607-610, 1976.

Daub, Robert and Duane R. Boline, "A Comparison of the Growth Rate and Chlorophyll Production of Egulena Gradilis as a Function of Copper Content in the Organism," Kansas Academy of Science Meeting, Fort Hays, KS, 1980.

Parli, Joseph and Duane R. Boline, "A Method for the Determination of Boron by Electrically Heated Tantalum Ribbon Atomic Absorption Spectroscopy," Midwest Regional American Chemical Society Meeting, St. Louis, MO, 1979.

Hiebert, Greg and Duane R. Boline, "A Comparison of the Sensitivity Obtained for the Determination of Copper by Atomic Absorption Spectroscopy, as a Function of Physical Properties of Non-Aqueous Solvents, "Kansas Academy of Science, Wichita, KS, 1979.

Parli, Joseph and Duane R. Boline, "A Method for the Determination of Copper in Plant Material by Atomic Absorption of Spectroscopy Using an Acidic Methanol Solvent," Midwest Regional American Chemical Society Meeting, Fayettville, AR, 1978.

Boline, Duane R. and W. G. Schrenk, "A Method for the Determination of Copper and Iron in Plant Material by Atomic Absorption Spectroscopy," National AOAC Meeting, Washington, DC (1976) and Rocky Mountain Conference on Applied Spectroscopy, Denver, CO, 1975.

Boline, Duane R. and W. G. Schrenk, "A Method for the Determination of Cadmium by Atomic Absorption Spectroscopy," Rocky Mountain Conference on Applied Spectroscopy, Denver, CO, 1974.

Biographical Data

WALKER J. DUNCAN

Hyrdogeologist

PII Redacted [redacted]

Education

B.S. Geology, Georgia State University, Atlanta, 1976.

Professional Affiliations

National Water Well Association
Geological Society of America

Experience Record

1976-1977	Howard Schoenike and Associates, Consulting Geologists, Houston, Texas. Mine Geologist at a surface coal mine in northwest Georgia. Responsible for site and regional coal exploration.
1977-1980	Atlanta Testing and Engineering Company, Geotechnical Engineers, Norcross, Georgia. Staff Geologist. Responsibilities included boring layout, drilling supervision, logging of drill holes, seismic investigations.
1980-1985	WAPORA, Inc., Environmental Consultants, Norcross, Georgia. Geologist. Responsibilities included preparation of groundwater, soils, and geology sections for EIS's and EAs; design and review of groundwater monitoring plans; preparation of RCRA Part B permits; groundwater assessments including well installation; surface water and groundwater monitoring plan design and implementation.
1985-present	Engineering-Science, Atlanta, Georgia. Geologist. Responsible for collection and assessment of data for contamination assessment and remedial design at hazardous waste sites.

Walker J. Duncan
(continued)

Project responsibilities have included supervision of field data collection and interpretation for the U. S. Air Force's Installation Restoration Program for Edwards AFB, March AFB, and AF Plant 42, in California. These programs are Phase II and Phase IV work and have included soil sampling, monitoring well layout and installation, geophysical log interpretation, pumping tests and data interpretation, ground water sampling, plume delineation, and report preparation. Other project responsibilities have included implementation of hydrogeological programs for industrial clients where groundwater contamination was suspected.

Biographical Data

EDWARD L. GRUNWALD
Health and Safety Manager

Experience Summary

Extensive experience in the development and management of safety and quality assurance programs. Responsible for health and safety activities and quality assurance programs for hazardous waste investigations.

Experience Record

1985-Date Engineering-Science. Corporate Health and Safety Manager. Responsible for the development and implementation of Engineering-Science's health and safety program. Additional responsibilities include the development of quality assurance plans and standard operating procedures for hazardous waste site investigations and remedial projects.

1983-1985 NUS Corporation. Regional Safety Manager, Quality Assurance Manager. Worked as a member of a multi-disciplinary field investigation team (FIT) under contract with the U.S. Environmental Protection Agency for the investigation of uncontrolled hazardous waste sites. Duties as a safety officer included the training of field personnel in instrumentation and site safety considerations, determination of the type of respiratory and percutaneous protection needed for each field activity, development of safety procedures and guidelines for the office, and scheduling of personnel for medical examinations. Also responsible for all the Quality Assurance/Control activities in the office. These duties included the development of Quality Assurance/Control Guidelines and the auditing of projects to insure compliance with EPA's, NEIC's, and NUS's Quality Assurance Control Procedures. Instructed U.S. EPA Region IV FIT Office personnel in the philosophy and procedures of the Quality Assurance Program.

As a toxicologist, authored the Endangerment Assessment Sections to four RI/FS studies. Experience included environmental fate modeling and carcinogenic and noncarcinogenic risk assessment.

Project Manager for eight superfund sites.

1982 Johns Hopkins Hospital. Research Programmer. Responsibilities included computer management and the processing of research data.

1980-1982 University of Massachusetts. Interned as a Laboratory Health Manager. Duties were to inspect the laboratories on campus and make suggestions as to safety improvements.

1980-1981 University of Massachusetts. Teaching Assistant for courses in Microbiology and Industrial Hygiene for the Public Health Department.

1978-1979 Johns Hopkins Hospital. Research Assistant in the Cardiology Department. Research focus was on the enzyme creatine kinase and the role it has in ischemic heart disease.

Education

B.S., Bacteriology, 1978, Ohio Wesleyan University
M.S., Public Health (Toxicology Specialization), 1982, University of Massachusetts

Professional Affiliations

Society of Environmental Toxicology and Chemistry

Honors and Awards

National Science Foundation Research Participation Program Winner

Publications

"Ozone-Induced Decrease of Erythrocyte Survival in Adult Rabbits," Advances in Modern Environmental Toxicology, Volume 5, 1982.

"Protection By Ascorbate Against Acetylphenylhydrazine Induced Heinz Body Formation in Normal Human and Sheep Erythrocytes," The Journal of Environmental Science and Health, Volume 6, pp. 897-902, 1982.

Papers and Presentations

"The Salmonella/Mammilian-Microsome Mutagenicity Test." Presented before the Honor Society at Ohio Wesleyan University, June 1978.

"Ozone-Induced Decrease of Erythrocyte Survival in Adult Rabbits," presented at the U.S. EPA-sponsored International Symposium on Ozone Toxicology, Pinehurst, North Carolina, March, 1982.

Biographical Data

MARK A. GUTHRIE, P.E.
Environmental Engineer

Experience Summary

Wide variety of technical experience in hazardous and industrial waste treatment processes and hazardous waste site investigations. Experience includes extensive background in field sampling, laboratory analyses, treatability testing, and process engineering, with emphasis on the identification, development, and evaluation of waste treatment and site remediation alternatives.

Experience Record

1985-Date Engineering-Science, Atlanta - Hazardous Wastes Group Project Manager. Involved in a variety of activities related to hazardous waste management, including remedial investigation and feasibility studies (RI/FS), and remedial design and construction at uncontrolled hazardous waste sites. Representative project experience is described below.

Conducted IRP Phase II - Confirmation/Quantification investigations at USAF Plant 42 (Palmdale, California) and MacDill AFB, Florida under the Air Force Installation Restoration Program (IRP). These surveys involved the collection of field data on past waste disposal and spill sites to determine the presence extent of environmental contamination, and to recommend appropriate remedial actions and long-term monitoring. Activities included soil boring and sampling, monitoring well installation, ground & surface water sampling, chemical analysis of environmental samples, geophysical surveys, and public health and environmental risk assessments.

Performed conceptual design of ground-water recovery, treatment and disposal systems for source control and remediation at a former waste oil reclamation facility included on the National Priorities List (NPL). The project was conducted for the Florida Department of Environmental Regulation. Activities included contamination assessment, ground-water flow and recovery system testing, treatability testing, and alternatives evaluation with estimates of capital and operating costs for the proposed systems.

Conducted treatability testing and conceptual design of an on-site wastewater treatment system for remedial action at an abandoned hazardous waste treatment site. The system consisted of oil separation, metals precipitation, solids removal, multimedia filtration, and activated carbon adsorption. Specific contaminants included waste oils, PCB, phenol, and heavy metals.

1981-1985 Engineering-Science, Atlanta - Industrial Wastes Group Project Manager and Project Engineer. Conducted field studies, preliminary engineering, and process design of treatment and disposal technologies for industrial wastes. Activities included waste characterization studies, treatability testing, process sizing and design criteria development, technical and economic alternatives evaluations, process design, performance and capacity evaluations of existing systems, and operations assistance for industrial waste treatment facilities. Extensive experience in biological systems and anaerobic treatment facilities.

Specific industrial experience includes: synthetic fibers and intermediates, cellulose acetate, silicones, herbicides and pesticides, synthetic pharmaceuticals, industrial enzymes, citric acid, phenolic plastic resins, ABS plastics, textile dyes, and electronics manufacturing.

1978-1980 Purdue University, West Lafayette - Graduate Research Assistant. Developed and evaluated an experimental protocol for determining the biodegradability and fate of specific organic priority pollutants during the anaerobic digestion of wastewater sludges. Activities included bioassays to determine toxicity of specific compounds, enrichment techniques for acclimation of methanogenic cultures, bench-scale anaerobic digester operation, experiments to quantify sorption and volatilization of test compounds, determination of extent of biodegradation, and analysis of test compounds by gas-liquid chromatography. Dimethyl phthalate and pentachlorophenol were used for protocol evaluation.

Education

B.S.E. in Civil Engineering, 1978, Duke University
M.S.C.E. in Environmental Engineering, 1983, Purdue University

Professional Affiliations

Registered Professional Engineer (Georgia)
American Chemical Society
American Society for Microbiology
Association of Ground Water Scientists and Engineers (NWWA)
International Association for Water Pollution Research and Control
Water Pollution Control Federation

MARK A. GUTHRIE, P.E.
Environmental Engineer
Page 3

Publications

"Fate of Pentachlorophenol in Anaerobic Digestion", M. A. Guthrie, E. J. Kirsch, R. F. Wukasch, and C. P. L. Grady, Jr., Proceeding of the 1981 Conference on Environmental Engineering, A.S.C.E., 1981.

"Experimental Strategy for Evaluating the Fate of Priority Pollutants in Wastewater Treatment Systems", E. J. Kirsch, C. P. L. Grady, Jr., M. A. Guthrie, L. P. Moos, and R. F. Wukasch, Proceedings of the Fifth International Symposium on Biodeterioration, Eds. T. A. Oxley and S. Barry, Pub. John Wiley and Sons Ltd., 1983.

"Development and Evaluation of an Experimental Protocol for Determining the Biodegradability and Fate of Specific Organic Chemicals During Anaerobic Digestion: Dimethylphthalate and Pentachlorophenol", M. A. Guthrie, M.S.C.E. thesis presented to Purdue University, 1983.

"Pentachlorophenol Biodegradation II - Anaerobic", M. A. Guthrie, E. J. Kirsch, R. F. Wukasch, and C. P. L. Grady, Jr., Water Research, Volume 18, Number 4, 1984.

"Fermentation Industry Wastewater Treatment - Aerobic vs Anaerobic", M. A. Guthrie, M. R. Hockenbury, P. A. Turpin, J. I. Cooper, V. R. Worrell, Proceedings of the Industrial Wastes Symposia, 57th Annual Water Pollution Control Federation Conference, 1984.

"Treatment and Disposal Technologies for Liquid Hazardous Wastes as Alternatives to Subsurface Injection", G. C. Patrick, M. A. Guthrie, and T. N. Sargent, Proceedings of the International Symposium on Subsurface Injection of Liquid Wastes, sponsered by Underground Injection Practices Council, National Water Well Association, and U.S. Environmental Protection Agency, 1986.

"Economic Impacts of Alternative Technologies for Treatment and Disposal of Liquid Hazardous Wastes", M. A. Guthrie, G. C. Patrick, and T. N. Sargent, Proceedings of the International Symposium on Subsurface Injection of Liquid Wastes, sponsered by Underground Injection Practices Council, National Water Well Association, and U.S. Environmental Protection Agency, 1986.

Evaluation of Current Underground Injection of Hazardous Waste in Illinois, R. D. Brower, A. P. Visocky, I. G. Krapac, B. D. Hensel, G. R. Peyton, J. S. Nealon, and M. A. Guthrie, published by Illinois Department of Energy and Natural Resources, Hazardous Waste Research and Information Center, 1986.

"Study of Current Underground Injection Control Regulations and Practices in Illinois," A. P. Visocky, J. S. Nealon, R. D. Brower, I. G. Krapac, B. D. Mensel and M. A. Guthrie, Ground Water Monitoring Review, Volume 6, Number 3, 1986.

Biographical Data

LAUREL J. IZMIRIAN

Hydrogeologist

PII Redacted [redacted]

Education

M.S. in Hydrology, 1984, New Mexico Institute of Mining and Technology, Socorro, New Mexico

A.B. in Geology (Cum Laude), 1982, Occidental College, Los Angeles, California

Professional Affiliations

American Geophysical Union
National Water Well Association

Experience Record

1981 (summer) U.S. Department of Interior, Geological Survey, Menlo Park, California. Geologic Field Assistant. Assisted with reconnaissance mapping of a batholithic terrain, Doe Mountain Quadrangle, north central Washington. Interpreted aerial photographs, mapped, collected rock samples. Responsible for researching work area during geologist's absence.

1985-Present Engineering-Science, Inc. Hydrogeologist. Participated in the Installation Restoration Program for the cleanup of hazardous waste sites at various military installations in the western United States. Responsibilities have included conducting geophysical surveys utilizing magentics, electromagnetics, and electrical resistivity methods, preparation of geologic logs, well logs, performance of grain size analysis, and monitoring for combustible gases. Also responsible for the supervision of soil boring operations, monitoring well installation, and equipment decontamination procedures. Performed pump and recovery tests. Directed gas probe installations and monitored for combustible gases for the Metro Rail Project in Los Angeles, California.

Biographical Data

DENNIS R. KASPER, Ph.D.

Environmental and Sanitary Engineer

PII Redacted [redacted]

Education

B.S. in Civil Engineering, 1966, Loyola University, Los Angeles, California
M.S. in Civil Engineering, 1967, California Institute of Technology, Pasadena
Ph.D. in Environmental Engineering, 1971, California Institute of Technology, Pasadena

Professional Affiliations

Registered Sanitary Engineer (Arizona and California)
American Water Works Association
International Desalination Environmental Association
Water Pollution Control Federation
Water Supply Improvement Association

Honorary Affiliations

Alpha Sigma Nu
Tau Beta Phi

Experience Record

1972-1976 University of Arizona, Phoenix, Arizona. Assistant Professor. Provided graduate and undergraduate instruction in civil engineering. Directed research involving removal of particulate matter from water by coagulation and flocculation, fates of metal ions leached from tailing ponds, filtration of algae from treated wastewaters, and transport of metal ions through porous media.

Also provided special consulting services to public utility companies, government agencies, and private corporations for development, design, and evaluation of water supply and water and wastewater treatment programs. Evaluated reverse osmosis treatment of brackish water and seawater, developed groundwater resource protection programs, and directed applied research program to identify cause of reverse osmosis membrane degradation for Oceanic Construction Company. Provided technical guidance in water and wastewater

Dennis R. Kasper, Ph.D. (Continued)

quality evaluations, establishment of long-term groundwater monitoring program, and design and modification of municipal water supply and sewage treatment systems.

1976-1982 PRC Toups Engineers. Senior Engineer (1976- 1980), Principal Engineer (1980-1981), and Associate Vice President (1981-1982). Responsible for direction and management of major projects involving water supply, water and wastewater treatment, water reclamation and reuse, and the assessment of quality interactions in groundwater systems. Specialized in study, evaluation, design, and start-up of desalination systems including reverse osmosis, electrodialysis/ultrafiltration, and ion exchange for the treatment of municipal, agricultural, and industrial wastewaters for reuse in irrigation, groundwater recharge, and industrial processes.

Served as technical director and project manager of feasibility study evaluating brackish water and seawater reverse osmosis for the Hong Kong Office of the Water Authority. Managed Desalting Demonstration Module design project for California Department of Water Resources to evaluate pretreatment and membrane systems for proposed 400-mgd agricultural wastewater desalting plants. Directed preliminary design of well fields, collection system, plant site, and reverse osmosis process for desalination of brackish water to supplement potable water supply on New Providence Island, Bahamas. Developed portable reverse osmosis pretreatment unit for naval field operations. On behalf of the U.S. Navy, developed a program to determine the extent of oil contamination on Diego Garcia and to define cleanup options.

Also specialized in environmental evaluation of mining operations and disposal of wastes generated by development of uranium, copper, silver, shale, and phosphate ore deposits. Managed extensive geologic and hydrologic investigation of silver mine site for 3M Inc. Served as technical director of study for a major energy company evaluating alternative methods for in situ disposal of uranium mining process and restoration wastewaters. Identified regulatory requirements and evaluated potential environmental impacts of in situ mining of various ores including phosphate, copper, and uranium deposits in Wyoming, Texas, New Mexico, Colorado, Nevada, and Arizona. Analyzed potential surface water and groundwater quality impacts of large-scale development of the

Dennis R. Kasper, Ph.D. (Continued)

Chattanooga shale uranium resource for the U.S. Department of Energy.

1982-Date Engineering-Science. Project Manager. Provides technical support and supervision for major national and international water supply, water reclamation, and desalination projects.

Publications

"Pretreatment for Membrane Desalination Systems," Journal of the National Water Supply Improvement Association, Vol. 6, No. 2, July 1979.

"Microbiological Investigation at the Yuma Desalting Test Facility," Technical Proceedings, National Water Supply Improvement Association Annual Conference, San Francisco, California, July 1980 (Coauthor K.M. Trompeter).

"Optimization of Reverse Osmosis Treatment of in situ Wastewaters," 55th Annual Conference Proceedings, Society of Petroleum Engineers of American Institute of Mining, Metallurgical and Petroleum Engineers, Dallas, Texas, 21-24 September 1980.

"Pilot Evaluations of Commercially Available Seawater Reverse Osmosis Membranes for Potential Use in Hong Kong," Technical Proceedings, National Water Supply Treatment Associates Annual Conference, Washington, D.C., May 1981 (Coauthors C.W. Lake, T.H. Lau, and M.Y. Pau).

"Energy Recovery at Paradise Island Seawater RO: 13 kWh/1,000 Gallons," Journal of the Water Supply Improvement Association, July 1982 (Coauthors L.C. Jenkinson, E. Ramsey, and N. Carey).

"Agricultural Wastewater Desalting in California DWR: Test Facility Description," Journal of the Water Supply Improvement Association, July 1982 (Coauthors B.E. Smith, D.B. Brice, and W.R. Everest).

Papers and Presentations

"Applications of Polymeric Coagulant in Water and Wastewater Treatment," presented to Arizona Water Pollution Control Association, Yuma, Arizona, April 1972.

"Defluoridation Technology Alternatives and Costs," presented to Arizona Water Pollution Control Association, Tucson, Arizona, April 1977.

"Water Pollution Caused by Inactive Ore and Mineral Deposits," presented to Northwest Mining Association, Spokane, Washington, 1977.

Dennis R. Kasper, Ph.D. (Continued)

"The Effects of Solution Composition on the Effectiveness of Polymeric Flocculants," presented at American Water Works Association Annual Conference, Atlantic City, New Jersey, June 1978.

"Compliance with Environmental Regulations for *in situ* Uranium Mining: From Discovery to Closure," presented at Bureau of Mines Technology Transfer Seminar on *in situ* Leaching and Borehole Mining of Uranium, Denver, Colorado, 26 July 1978 (Coauthor W. H. Engelmann).

"Reverse Osmosis Membrane Degradation," presented at National Water Supply Improvement Association Annual Conference, Sarasota, Florida, July 1978.

"Environmental Regulations for *in situ* Uranium Mining: From Exploration to Restoration," presented at AAPG Conference, Houston, Texas, 1 April 1979 (Coauthor W. H. Engelmann).

"Desalination Post-treatment: Systems Selection and Optimization," presented at National Water Supply Improvement Association Annual Conference, New Orleans, Louisiana, September 1979.

"Desalination Technology for Treatment of Wastewaters for Reuse," presented at Water Reuse Symposium II, Washington, D.C., 23-28 August 1981 (Coauthor S. Ellis).

Biographical Data

ERNEST J. SCHROEDER
Environmental Engineer

Experience Summary

Nine years of environmental engineering experience with Union Carbide working in research, engineering, construction and operations plus ten years of environmental consulting experience conducting industrial waste treatment and hazardous waste management projects. Very actively involved, during the last six (6) years, in remedial action projects at hazardous waste sites.

Experience Record

1976-Date Technical Director for Eastern Group Hazardous Waste Projects (1985 - Date). Responsible for technical review and direction of hazardous waste projects conducted by Engineering-Science Eastern Group.

Engineering-Science, Inc., Manager of Solid and Hazardous Waste Group in the Atlanta, Georgia office (1980-date). Responsible for the supervision of solid and hazardous waste project managers and project engineers and the management of solid and hazardous waste projects in the office. Project activities have included permit and regulatory assistance, environmental audits, waste management program development, delisting partitions, ground-water monitoring, landfill evaluations, landfill closure design, hazardous waste management, waste inventory, waste recovery/recycle evaluation, waste disposal alternative evaluation, transportation evaluation, and spill control and countermeasure planning, HRS evaluations, preparation of remedial investigations and feasibility studies, and design and construction supervision for hazardous waste site cleanup.

Project Manager for Phase I Installation Restoration Program projects for the U.S. Air Force, environmental audits (air, water and solid waste) at industrial facilities, contamination assessment and hazardous waste site cleanup projects conducted for industrial clients as part of consent degree agreements, and four Remedial Investigation/ Feasibility Studies projects.

Engineering-Science, Inc., Manager of the Industrial Waste Group in the Atlanta, Georgia office (1978-1980). Responsible for the supervision of industrial waste project managers and project engineers and the management of industrial waste studies conducted in the office. Also directly involved in project management consulting with clients on environmental studies and environment assessment projects, e.g., project manager for several spill control and wastewater treatability projects and for a third-party EIS for a new phosphate mine in Florida.

Engineering-Science, Inc., Project Manager (1976-1978). Engineering and project management of various industrial wastewater and hazardous waste projects.

1967-1976 Union Carbide Corporation, Environmental Protection Project Engineer, Toronto, Ontario, Canada (1975-1976). Responsible for the environmental permitting and engineering design of waste treatment systems associated with a new refinery.

Union Carbide Corporation, Environmental Protection Department, Texas City, Texas (1969-1975). Project Engineer and Engineering Supervisor. Responsible for various aspects of plant pollution abatement programs, including preparation of state and federal permits for wastewater treatment activities, operations representative on $8 million regional wastewater treatment project (process design, detailed design, construction and startup), and supervisor for operation of wastewater collection and treatment facilities.

Union Carbide Technical Center, Engineering Department, South Charleston, West Virginia (1967-1968). Project Engineer. Responsible for environmental protection engineering projects for various organic chemicals and plastics plants.

Education

B.S. in Civil Engineering, 1966, University of Arkansas
M.S. in Sanitary Engineering, 1967, University of Arkansas

Professional Affiliations

Registered Professional Engineer (Arkansas No. 3259, Georgia No. 10618, Texas No. 33556 and Louisiana No. 21685)
American Academy of Environmental Engineers (Diplomate)
Water Pollution Control Federation

Honarary Affiliations

Chi Epsilon

Publications

"Activated Carbon Adsorption for Textile Wastewater Pollution Control," Symposium Proceedings: Textile Industry Technology, Williamsburg, Virginia, December 1978 (Coauthor A. W. Loven, Ph.D).

"Pilot Plant Evaluation of the 1974 BATEA Guidelines for the Textile Industry," Proceedings of 35th Industrial Waste Conference, Purdue University, Indiana, May 1980 (Coauthor W. A. Storey).

Papers and Presentations

"Filamentous Activated Sludge Treatment of Nitrogen Deficient Waste," Masters of Science Research Paper, University of Arkansas, Fayetteville, Arkansas, 1967.

"Summary Report of the BATEA Guidelines (1974) Study for the Textile Industry," presented to North Carolina Section of AWAA/WPCA, Pinehurst, North Carolina, November 1979.

"Industrial Solid Waste Management Proogram to Comply with RCRA," engineering short course presented at Auburn University, Alabama, October 1980.

"Technical and Economic Impact of RCRA on Industrial Solid Waste Management," presented to Florida Section of American Chemical Society, May 1981.

"Hazardous Waste Site Rating Systems," presented to Textile Wastewater Treatment and Air Pollution Control Conference, Hilton Head Island, South Carolina, January 1983 (Coauthor T. N. Sargent).

Biographical Data

CRAIG L. SPRINKLE
Geochemist

Experience Summary

Extensive theoretical and practical experience in aqueous (low temperature) geochemistry spanning 13 years of professional practice. Responsible for design, conduct, and reporting of results of studies of natural and contaminated water-chemistry on sites ranging in size from a square mile to multi-state regions of the U.S.

Experience Record

1986-Date — Engineering-Science. Geochemist. Responsible for evaluation and interpretation of chemical results obtained from USAF IRP studies and other hazardous-waste site investigations.

1975-1986 — U.S. Geological Survey-WRD. Staff Hydrologist (1985-1986). Principal Division expert in field of hydrochemistry; reviewed Division's operational and research activities throughout U.S. involving ground-water quality and geochemistry. Coordinator for EPA-USGS cooperation on ground-water protection and USAF-USGS cooperation on IRP program.

Hydrologist (1975-1985). Responsible for conducting areal studies and writing interpretive reports dealing with natural and contaminated water quality in parts of six southeastern states.

1973-1975 — Tennessee Department of Public Health - Division of Solid Waste Management. Geologist. Responsible for site investigations of existing and potential sanitary and hazardous-waste landfills. Reports were basis for acceptance/certification of sites by State.

Education

B.A., Geology, 1970, Vanderbilt University
M.S., Geochemistry, 1973, Vanderbilt University
B.S., Civil Engineering, 1977, University of Tennessee

Professional Affiliations

Geological Society of America
American Geophysical Union
International Association of Hydrologists
Geochemical Society
National Water Well Association

Publications

"A study of factors controlling the chemical quality of water in Cartwright Creek Basin, Williamson County, Tennessee," Water Resources Research Center Report No. 42, University of Tennessee-Knoxville, 1974.

"Hydrogeochemistry in a carbonate basin-geomorphic and environmental implication," Water Resources Research Center Report No. 44, University of Tennessee-Knoxville, 1975.

"Leachate migration from a pesticide waste disposal site in Hardeman County, Tennessee," U.S. Geological Survey WRI 78-128, 1978.

"Sulfate concentration in water from the upper permeable zone of the Tertiary limestone aquifer system, southeastern United States," U.S. Geological Survey WRI 81-1101, 1982.

"Total hardness of water from the upper permeable zone of the Tertiary limestone aquifer system, southeastern United States," U.S. Geological Survey WRI 81-1102, 1982.

"Chloride concentration in water from the upper permeable zone of the Tertiary limestone aquifer system, southeastern United States," U.S. Geological Survey WRI 81-1103, 1982.

"Dissolved-solids concentration in water from the upper permeable zone of the Tertiary limestone aquifer system, southeastern United States," U.S. Geological Survey WRI 82-94, 1982.

"Summary of hydrologic testing in Tertiary limestone aquifer, Tenneco offshore exploratory well Atlantic OCS, lease block 427 (Jacksonville NH 17-5)," U.S. Geological Survey Water-Supply Paper 2180, 1982.

"Evaluation of ground-water quality data from Kentucky," U.S. Geological Survey WRI 83-210, 1983.

"Authigenic fluorite in dolomitic rocks of the Floridan aquifer," Geology, 1985.

"Geochemistry of the Floridan aquifer system in Florida and in parts of Georgia, South Carolina, and Alabama," U.S. Geological Survey Prof. Paper 1403-I, in press.

CRAIG L. SPRINKLE
Geochemist
Page 3

Papers and Presentations

"Downstream effects of strip mining on water quality in the New River Basin, Tennessee," presented at symposium on environment and mining research at University of Tennessee-Knoxville, 1978.

"Sampling for organic contaminants associated with the pesticide waste dump in Hardeman County, Tennessee," presented at American Geophysical Union fall meeting, 1979.

"Mapping water quality of the Tertiary limestone aquifer system, southeastern United States," presented at Geological Society of America annual meeting, 1980.

"Geochemistry of water from two wells in the Tertiary limestone aquifer system, Georgia and Florida," presented at Geological Society of American southeastern section meeting, 1982.

"Modeling mass transfer in the Tertiary limestone aquifer system, southeastern United States," presented at Geological Society of America southeastern section meeting, 1983.

Biographical Data

GEORGE PILJA

Assistant Project Manager
Senior Engineer/Resident Engineer

PII Redacted

[redacted]

Education:

B.S. in Geotechnics, 1961, Technical School of Geology, Belgrade, Yugoslavia
M.S. in Hydrogeology (Engineering Geology), 1968, University of Belgrade, Yoguslavia

Experience Record:

1961-1962 and 1964 — Geozavod SRGG, Titograd, Yugoslavia. Technician. Responsible for geochemical and hydrogeologic testing in connection with a program to produce a geological map of Yugoslavia.

1969 — University of Belgrade, Yugoslavia. Research Engineer. Conducted determinations of hydrogeologic, hydrologic, and hydraulic parameters in porous media by statistical interpretation of hydrogeological data (work performed as part of the International Hydrologic Decade).

1969-1972 — Republic Steel Corporation, Chicago, Illinois. Management Trainee /Environmental Engineer. Responsible for operation wastewater treatment facilities, including clarifiers, cooling towers, deep-bed filters, and pumping stations. Performed required analyses for water quality control.

1972-Date — Aquatechnics, Inc. (an Engineering-Science Company), Oak Brook and Naperville, Illinois. Senior Engineer. Responsible for design of industrial water and wastewater treatment facilities, including field studies, treatability testing, preliminary and final design and facility start up. Project experience includes design of hot mills oil skimming pits and associated in-mill piping, and several blast furnace recycle systems and associated tretment systems for Inland Steel Company, East Chicago, Indiana and for Republic Steel Corporation, Cleveland, Ohio; hot mill recycle system and blast furnace recycle system for Crucible Steel Company of America.

GEORGE PILJA, BIO (Cont'd)

Experience Record (Cont'd):

1972-Date (Cont'd)

Design and calculation of liquid sodium cooling system for experimental model reactors and precooling and preheating systems for energy saving program for Argonne National Laboratory.

Supervised test programs including sampling, flow measurement, dye studies, verifying process and wastewater piping, interview mill personnel, treatability studies, correlate and analyze data, and preparation of technical memoranda including completing mass balances at Inland Steel Company, Indiana Harbor Works, Jones & Laughlin Steel Corporation, Aliquippa Works, Republic Steel Corporation, Cleveland District, Youngstown Sheet & Tube Company, Indiana Harbor Works; and Republic Steel Corporation, South Chicago District.

Design of major HVAC system for pump station and wastewater treatment facility, including particulate removal using bag houses, electrostatic precipitators cyclones and wet gas scrubbers.

Field survey, hydrologic study, thermal study, and preliminary design of industrial water recycle systems for blast furnaces, power houses, open hearth, structural mills, forging water, purifying plants and boiler blowdown for the United States Steel Corporation, Homestead Works, Homestead, Pennsylvania.

Design, purchasing, construction inspection and start up for Illinois Tool Works for Elgin, Illinois and Russellville, Kentucky. Included was a modification of a plating wastewater treatment system for cyanide, chrome and oily waste.

Hazardous waste project under RCRA Regulations for the United States Steel Corporation, Gary Works, South and Joliet Works Division, and for Amerwire, Inc. The projects included: identification and quantification of hazardous waste material and assessment of associated waste management practices; preparation of preliminary notification forms, hazardous waste permit forms, RCRA compliance planning report, training programs, closure and post-closure plans and related cost estimates; conducted groundwater monitoring program for United States Steel, Gary Works consisting of field supervision for well drillings and installation, well water sampling, and analyses for EP Toxicity Tests.

GEORGE PILJA, BIO (Cont'd)

Experience Record (Cont'd):

1972-Date (Cont'd)	Recent work includes design of Wastewater Treatment Plant and By-Products Plant for DynaGel, Inc., Calmet City, Illinois and resident engineer for the wastewater treatment plant being constructed for Salisbury Labs in Charles City, Iowa (for Engineering-Science).

APPENDIX D

STATEMENT OF WORK

CONTRACTOR'S COPY

REF 68X (cls) 68X

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. PAGE 1 OF 25

2. PROC INSTRUMENT ID NO. (PIIN)	3. SPIIN	4. EFFECTIVE DATE	5. REQUISITION/PURCHASE REQUEST PROJECT NO.	6. DOC/DMS RATING
F33615-84-D-4403	001102	86AUG29	FY7624-86-01802	

7. ISSUED BY CODE FQ8419
DEPARTMENT OF THE AIR FORCE
AIR FORCE SYSTEMS COMMAND
AERONAUTICAL SYSTEMS DIV/PMRSC
WRIGHT-PATTERSON AFB, OH 45433-6503
NEGOTIATOR: JANA L. GORDIN
PHONE: (513) 255-5633

8. ADMINISTERED BY (IF OTHER THAN BLOCK 7) CODE S1103A
DCASMA ATLANTA
805 WALKER STREET
MARIETTA GA 30060-2789

9. CONTRACTOR NAME AND ADDRESS CODE 4W803 FACILITY CODE
ENGINEERING-SCIENCE
57 EXECUTIVE PARK SOUTH, N.E.
SUITE 590
ATLANTA GA 30329

(COUNTY: DE KALB)
PHONE: (404) 325-0770

IF "9" FOR MULTIPLE ...

MAILING DATE
SEP 30 1986
DUPLICATE ORIGINAL

10. SECURITY CLAS U

11. DISCOUNT FOR PROMPT PAYMENT
NET DAYS
1ST % DAYS
OTHER
2ND % DAYS IF "9" SEE SECT "E"
3RD % DAYS

12. PURCHASE OFFICE POINT OF CONTACT
LQF/L72/LQF

13. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 17. The hour and date specified for receipt of Offers ☐ is extended ☐ is not extended

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended by one of the following methods:

(a) By signing and returning ____ copies of this amendment, (b) By acknowledging receipt of this amendment on each copy of the offer submitted, or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter provided such telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

14. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS

_ THIS CHANGE IS ISSUED PURSUANT TO ____ THE CHANGES SET FORTH HEREIN ARE MADE TO THE ABOVE NUMBERED CONTRACT/ORDER.

_ THE ABOVE NUMBERED CONTRACT IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (SUCH AS CHANGES IN PAYING OFFICE, APPROPRIATION DATA, ETC.) SET FORTH HEREIN.

X THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF THE "CHANGES" CLAUSE OF THE CONTRACT CLAUSES. IT MODIFIES THE ABOVE NUMBERED CONTRACT AS SET FORTH HEREIN.

_ THIS MODIFICATION IS ISSUED PURSUANT TO ____

15. CONTRACT ADMINISTRATION DATA

A. KIND OF MOD	B. MOD ABST RECIPIENT ADP PT	C. DATE OF SIGNATURE MODIFICATION	D. CHANGE IN CONTRACT AMOUNT INCREASE (+) DECREASE (-)	E. LOSING PO CAO ON TRANSFER	F. GAINING PO CAO ON TRANSFER	G. SVC/AGENCY USE
C			$			

16. ENTER ANY APPLICABLE CHANGES

A. PAY CODE	B. EFFECTIVE DATE OF AWARD	C. CONTRACT (1) TYPE (2) KIND	D. TYPE CONTR	E. SURV CRIT	F. SPL CONTR PROVISIONS	G. PAYING OFC CODE	H. DATE SIGNED	I. SECURITY (1) CLAS (2) DATE OF DD 254

17. REMARKS (Except as provided herein, all items and conditions of the contract, as heretofore changed, remain unchanged and in full force and effect.)

SUBJECT: REVISED TASK DESCRIPTION AND FUND CITE MODIFICATION
MONITORING LAB: USAF OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY
PROJECT ENGINEER: EMILE BALADI, USAFOEHL/TS, BROOKS AFB TX 78235-5501
FINANCE OFFICE: (S1102A) DCASR ATLANTA, 805 WALKER STREET, MARIETTA GA 30060-2789

18. ☐ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT [X] CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 1 COPIES TO ISSUING OFFICE

19. CONTRACTOR/OFFEROR (Signature of person authorized to sign) BY [signature]

22. UNITED STATES OF AMERICA (Signature of Contracting Officer) BY Howard E. Marks Jr.

20. NAME AND TITLE OF SIGNER (Type or print)	21. DATE SIGNED	23. NAME OF CONTRACTING OFFICER (Type or print)	24. DATE SIGNED
T. N. Sargent, Vice President	9/25/86	HOWARD E. MARKS, JR.	9/26/86

AFSC FORM 702 AUG 84 PREVIOUS EDITION WILL BE USED. D-1 AFSC—Andrews AFB DC 1984

SCHEDULE OF CHANGES

FIRST: The Task Description dated 86 Aug 01 is superseded by the Task Description dated 86 Jun 09 as shown in pages 3 thru 23 herein.

SECOND: By amending Section G, AFSC Form 703 (69K) to include the information shown on page 24 herein.

THIRD: This action will result in no dollar increase or decrease to the total not-to-exceed price ($63,440.22) of the order.

FOURTH: This Supplemental Agreement constitutes full settlement of any claims of the Contractor under the contract, including the clause entitled "Changes", arising out of or by reason of the changes effected, hereby.

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION (STAGE 1)*
USAF Plant 42, Palmdale, Califorina

I. DESCRIPTION OF WORK

The overall objective of the Phase II investigation is to define the magnitude, extent, direction and rate of movement of identified contaminants. A series of staged field investigations may be required to meet this objective. The contractor shall recommend any additional investigations required beyond this stage (Stage 1), including an estimate of costs.

The purpose of this task is to undertake a field investigation at Plant 42, California: (1) to determine the presence or absence of contamination within the specified areas of investigation; (2) if possible, to determine the magnitude of contamination and the potential for migration of those contaminants in the various environmental media; and (3) to identify significant public health and environmental hazards of migrating pollutants based on State or Federal standards for those contaminants.

The Phase I IRP Report (mailed under separate cover) incorporates the background and description of the sites/zones for this task. To accomplish this survey effort, the contractor shall take the following actions:

A. General

1. The contractor shall monitor all exploratory well drilling and borehole operations with a photoionization meter or equivalent organic vapor analyzer to identify potential generation of hazardous and/or toxic materials. In addition, the contractor shall monitor drill cuttings for discoloration and odor. During drilling operations, if soil cuttings are suspected to be hazardous, the contractor shall containerize them in new, unused drums and test them for EP Toxicity and waste solvents. The results of these tests shall be included in boring logs. A maximum of 20 samples shall be collected for EP Toxicity and waste solvents. In addition, the contractor shall comply with all applicable EPA, AFOSH, OSHA, State and any other agencies' regulations/procedures concerning safety during drilling, sampling, and analysis procedures. If required, a safety plan shall be filed directly with the agencies.

2. All water samples collected shall be analyzed on site by the contractor for pH, temperature, and specific conductance. Sampling, maximum holding time, and preservation of samples shall strictly comply with the following references: Standard Methods for the Examination of Water and Wastewater, 15th ed. (1980), pp.35-42; ASTM, Section 11, Water and Environmental Technology; Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057; and Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pp.xiii to xix (1983). All chemical analyses (water and soil) shall meet the

*Modifications underscored.

required limits of detection for the applicable EPA method identified in Appendix 1.

3. Locations where surface or sediment samples are taken or where soil exploratory borings are drilled shall be marked with a permanent marker; and the location marked on a project map of the site.

4. Field data collected for each site shall be plotted and mapped. The nature, magnitude, and potential for contaminant flow within each zone to receiving streams and groundwaters shall be estimated. Upon completion of the sampling and analysis, the data shall be tabulated in the next R & D Status Report as specified in Item VI below. All raw data shall be in the lab for one year, and will be provided to the USAF upon request.

5. Determine the areal extent of the sites by reviewing available aerial photos of the plant, both historical and the most recent panchromatic and infrared. If Possible, remote sensing photos may be acquired from the Plant; USDA Agricultural Stabilization and Conservation Service's Aerial Photography Division at 2505 Parleys's Way, Salt Lake City, UT 84109; EROS Data Center, Sioux Falls, SD 57198; or USGS National Cartographic Information Center, Mail Stop 507, National Center, Reston, VA 22092.

6. Split all water and soil samples as part of the contractor's specific Quality Assurance/Quality Control (QA/QC) protocols and procedures. One set of samples shall be analyzed by the contractor. The other set of samples shall be forwarded for analysis through overnight delivery to the laboratory listed below. At the same time of collection, samples may be split with the State of California agencies and the County of Los Angeles. The agencies will provide their own sample containers. The contractor shall inform the agencies two weeks before executing field sampling.

USAF OEHL/SA
Bldg 140
Brooks AFB, TX 78235-5501

The samples sent to the USAF OEHL/SA shall be accompanied by the following information:

(a) Purpose of sample (analyte)
(b) Installation name (base)
(c) Sample number (on container)
(d) Source/location of sample
(e) Contract task numbers and title of project
(f) Method of collection (bailer, suction pump, air-lift pump, etc.)
(g) Volumes removed before sample taken
(h) Special conditions (use of surrogate standard, special nonstandard preservations, etc.)
(i) Preservatives used
(j) Date and time of sampling
(k) Sampler's name

Forward this information with each sample by properly completing an AF Form 2752 (copy of form and instruction on proper completion mailed under separate cover). In addition, copies of field logs documenting sample colection should accompany the samples.

Maintain chain-of-custody records for all samples, field blanks, and quality control samples.

7. Analyze an additional 10% of all samples, as duplicates, for each parameter, for quality control purpose, as indicated in Appendix 1. Include all quality control procedures and data in draft and final reports.

8. Measure water levels at all monitoring wells as feet below the ground surface or below the top of casing elevation to the nearest 0.01 feet. Report water level in terms of feet above Mean Sea Level (MSL). Measure static water levels in wells prior to sampling and at time of well development.

For the production wells that are in operation, the contractor shall ensure that sufficient time is given for the well to recover to its approximate static level before taking measurement and record the time lag between pump shut off and measurement. The contractor shall also notice the possible interference of other production/fire protection wells nearby to the well which water level measurement is taken.

9. The exact location and number of borings and augerings for each site shall be determined in the field by the contractor in consultation with the USAF OEHL project manager and Plant representatives. The approximate locations and recommended number and depth of of borings and augerings for sites under investigation are given in the site specific section of the task. Borings at all landfill sites shall be drilled around the perimeter of the landfill areas unless the geophysical aurvey indicates that there is no safety problems or buried drums.

10. Drill all borings using the following specifications:

(a) Drill all borings by the hollow-stem auger technique using a center stem and reverse spiral lead bit to prevent free material from entering the center (hollow-stem) of the auger. Collect soil samples for chemical analysis and lithological control using split-spoon samplers to be driven ahead of the drilling bit through the center (hollow-stem) of the auger. Soil samples shall be taken for lithology and stratigraphic control purposes at the surface and at 2.5-foot intervals to a depth of 15 feet. From 15 to 100 feet, these samples shall be taken at 5-foot intervals; and below 100 feet, samples shall be taken at 10-foot intervals. Record and store lithology samples for one year.

The contractor shall follow ASTM D1452-65, Soil investigation and sampling by Auger Boring; ASTM D1586-67, Penetration Test and Split-Barrel Sampling of Soils; ASTM D2487-83, Unified Soil Classification System; and ASTM D2488-69, Rec. Practices for Visual-Manual Description of Soils. The contractor shall also correlate the strata with local geological formations. Any visual observation of discoloration, odor, organic vapor or photonization meter readings, or other anomalies shall be recorded on soil boring logs. Include all boring logs in the Draft and Final Reports (as specified in Item VI below).

Near-surface soil samples (less than 5 feet deep) shall be collected manually. An initial hole is to be dug using a shovel or hand auger and cleaned out to the initial sampling depth. The sample shall then be collected by digging downward, into the undisturbed soil in the bottom of this hole, using a post-hole digger or Shelby-tube sampler. A portion of this sample shall be retained for lithology purpose.

(b) Total footage of all borings in this task shall not exceed 2150 linear feet. The maximum depth of individual soil boring is 200 ft. After soil sampling, place Type I Portland cement and bentonite grout from the bottom of the hole to the land surface using tremie pipe with pressure grouting. The suggested proportions are 3 to 5 lbs of bentonite per 94 lbs sack of cement mixed with 6.5 gal of water. Clean sand may be mixed with the grout to form a hard protective cap in the top two feet of the hole, for use in ditches and other areas subject to traffic or erosion.

(c) The total number of near-surface samples collected manually shall not exceed 16, and the maximum depth of any such boring shall be 5 feet. These holes shall be backfilled with native materials and compacted to prevent a tripping hazard.

11. Purge all production/fire protection wells prior to sampling. Purging will be complete when three wellbore volumes of water have been displaced or until pH, temperature, specific conductance, color, and odor of the discharge is stabilized. Conduct purging operation using a submersible pump. Conduct all sampling using a Teflon bailer.

For existing plant production/fire protection wells, sampling with Teflon bailer is not possible. Water samples should be collected using spigot near the well head and before the pressure tank. The contractor shall minimize the potential of losing volatile organics in the water by agitation and depressurization.

12. Decontamination Procedures

(a) All sampling equipment, including components of sampling interface, shall be decontaminated prior to use between samples, and between sampling locations to avoid cross-contamination. Sampling equipment and interface shall be thoroughly washed with a laboratory-grade detergent followed by clean water, solvent (methanol), and distilled water rinses. Sufficient time shall be allowed for the solvent to evaporate and for the equipment to dry completely. The monofilament line or steel wire used to lower bailers into the well shall be dedicated to each well or discarded after each use. The calibrated water level indicator for measuring well volume and product elevation must be decontaminated before use in each well. Water sampling shall be conducted from the background monitoring wells to the "least" contaminated and finally the "most" contaminated wells, if possible.

(b) The drilling rig and tools shall receive thorough initial cleaning and be decontaminated after each borehole. As a minimum, drilling bits shall be steam cleaned after each borehole is installed. Drilling shall proceed from the "least" to the "most" contaminated areas, if possible.

13. Second-column confirmation shall be required when detection limits exceed values identified in Attachment 1 for EPA Methods 8010, 8020, 608, 601 and 602 and for Standard Methods 509A and 509B. Conduct second-column confirmation on a maximum of 50% of the samples collected for these analyses. Total number of samples for Methods 8010, 8020, 608, 509A, 509B, 601, and 602 in Appendix 1 include these confirmation analyses. Report all procedures and conditions used. Second column results and parameters shall be reported with the other analysis results.

14. The maximum depth of soil borings, excluding shallow soil augering, shall be 200 feet for individual hole. Perform a maximum of 60 borings. Collect soil samples for chemical analysis at depths suspected of being contaminated and at major soil interface. Otherwise, collect samples at 10-foot depth in a 10-foot boring; at 5 and 20-foot depths in 20-foot borings; at 10, 30, and 50 foot depths in 50-foot borings; at 10, 30, 50, 70, and 100 foot depths in 100-foot borings; and at 10, 30, 50, 70, 100, 150 and 200 foot depths in 200-foot borings. The maximum number of samples collected for chemical analysis from any individual borehole shall be one in boreholes up to 10 feet deep; two in boreholes from 10 to 20 feet deep; three in boreholes from 20 to 30 feet deep; four in boreholes from 30 to 50 feet deep; five in boreholes from 50 to 75 feet deep; six in boreholes from 75 to 100 feet deep; seven in boreholes from 100 to 150 feet deep; and eight in boreholes from 150 to 200 feet deep. Obtain stainless steel split-spoon soil samples for chemical analysis using ASTM D-1586, except for near-surface samples collected manually.

15. Whenever possible, measure water levels in all boreholes after the water level has stabilized.

16. Conduct a literature search to complement the Phase I Report (mailed under separate cover) for local hydrogeologic conditions. Data generated in this literature search shall complement Phase I Report data such that the following list will be complete. This list of data shall be utilized by the contractor to pinpoint well locations, sampling points, etc. In addition, this data shall be included in Appendix D of the Final Report of this effort.

a. Topographic data

b. Geologic data

(1) Structure
(2) Stratigraphy
(3) Lithology

c. Hydrologic data

(1) Location of existing wells, observation holes and springs within a one-mile radius of sites to be investigated
(2) Groundwater table and potentiometric contours
(3) Depth to water
(4) Quality of water
(5) Recharge, discharge, and contributing areas

d. Data on existing wells, observation holes, and springs within a 1-mile radius of sites to be investigated

(1) Location, depth, diameter, type of wells, and logs
(2) Static and pumping water level, hydrographs, yield, specific capacity, quality of water
(3) Present and projected groundwater development and use
(4) Corrosion, incrustation, well interference, and similar operation and maintenance problems
(5) Location, type, geologic setting, and hydrographs of springs
(6) Observation well networks
(7) Existing water sampling sites

e. Aquifer data

(1) Type, such as unconfined, artesian, or perched
(2) Thickness, depths, and formational designation
(3) Boundaries
(4) Transmissivity, storativity, and permeability
(5) Specific retention
(6) Discharge and recharge
(7) Ground and surface water relationship
(8) Aquifer models

f. Climatic data

(1) Precipitation
(2) Evapotranspiration

17. All well drilling, development, purging, and sampling methods must conform to State and other applicable regulatory agencies' standards (give references).

18. Summarize sampling methods used, detection levels, and holding times in a table included in the Appendix of the Final Report. The sample holding times shall not be exceeded. The contractor shall coordinate with his(her) laboratory before executing field sampling to assure the holding time

will not be exceeded.

19. Include second column confirmation results in the report. These shall include what columns were used, conditions, and the two different retention times for major components.

20. Internal quality control procedures and data (lab blanks, lab spikes, and lab duplicates) as well as field quality control measures shall be included in the draft finals and final reports.

21. Include in the report an inventory of all wells on base (active and abandoned).

B. In addition to items delineated in Section A above, conduct the following specific actions at following sites (Appendices 2 and 3):

1-FCD2, Fuel-Contaminated Ditch (Old Site 2-9)

a. Perform two soil borings up to 75 feet deep, two soil borings up to 70 feet deep, two soil borings up to 50 feet deep, two soil borings up to 30 feet deep, and one soil boring up to 20 feet deep, for a maximum of 470 linear feet of hollow-stem auger drilling. Also collect three near-surface (< 5 feet) soil samples manually. Collect a maximum of 34 samples to be analyzed for petroleum hydrocarbon (SW3550 then EPA 418.1) and volatile organics (SW 8010 and 8020).

b. The contractor shall review the 1982 study of this site (Report of F[illegible] Contact Analysis of Soil at Site 2 AF Plant 42. This repo[illegible] is mailed under separate cover.), and use the information contained therein, along with field reconnaissance, to locate deepest boreholes in area where the potential for contamination is the greatest.

c. Collect two groundwater samples one each from the drinking water well in Site 2 (DW2-1) and fire water well 2B (FW-2B) to be analyzed for purgeable organics (EPA 601 and 602).

2-PWD2, Paint Waste Disposal Ditch (Old Site 2-1)

Install five, 50-foot soil borings and collect a maximum of 19 soil samples to be analyzed for oil and grease (SW 3550, then EPA 413.2), phenols (SM 510A then 510C), purgeable orgaincs(EPA 8010 and 8020), and eight primary metals (California Assessment Methods for Hazardous Waste Title 22).

3-ERA7, Engine Run-Up Area (Old Site 5-1)

Conduct four, 20-foot soil borings. Collect a maximum of eight soil samples to be analyzed for oil and grease (SW 3550/EPA 413.2) and purgeable orgaincs (EPA 8010 and 8020).

4-VWT5, Vehicle Washrack and Leaking Underground Storage Tank (Old Site 7-1)

Install two, 50-ft borings and two, 20-ft borings. Collect a maximum of 11 soil samples for oil and grease (SW 3550, then EPA 413.2), purgeable organics (EPA 8010 and 8020), and eight primary heavy metals (CAM Title 22).

5-AFTC, Abandoned Fire Department Training Area (Old Site C-1)

a. Install one, 50 ft soil boring and one, 10-ft boring. Collect a maximum of four samples to be analyzed for oil and grease (SW 3550, then EPA 413.2) and purgeable organics (EPA 8010 and 8020).

b. Collect one near-surface (< 5 feet) soil sample to be analyzed for PCBs (SW 8080) and eight primary metals (CAM).

6-OFTC, Original Fire Department Training Area (Old Site 7-2)

a. Install one, 50-foot soil boring. Collect a maximum of four soil sample to be analyzed for oil and grease (EPA 3550, then 413.2) and purgeable orgaincs (EPA 8010 and 8020).

b. Collect one near-surface (< 5 feet) soil sample to be analyzed for PCBs (SW 8080) and eight metals (CAM).

7-EAR2, Engine Run-Up Area (Old Site 2-7)

Perform one soil boring up to 200 feet, one boring up to 100 feet, and five borings up to 50 feet deep for a maximum of 550 linear feet. Collect a maximum of 30 samples to be analyzed for petroleum hydrocarbon (SW 3550, then EPA 418.1).

8-FTA8, Fuel Transfer Area (Old Site 4-1)

Install one, 20-ft boring. Collect a maximum of two soil samples to be analyzed for petroleum hydrocarbon (SW 3550 then 418.1).

9-PWW2, Paint Waste Disposal Area--West (Old Site 2-2)

Collect two, near-surface (< 5 feet) soil samples to be analyzed for oil and grease (SW 3550, then EPA 413.2), phenols (SM 510A/510C) and purgeable organics (EPA 8010 and 8020).

10-PWN2, Paint Waste Disposal Area--North (Old Site 2-3)

Collect four near-surface (<5 feet) soil samples to be analyzed for soil and grease (SW 3550/EPA 413.2), phenols (SM 510A then 510C), and purgeable organics (SW 8010 and 8020).

11-DAA2, Disposal Area -- A (Old Site 2-6)

Install two, 10-ft soil borings. Collect a maximum of two soil samples to be analyzed for oil and grease (SW 3550/EPA 413.2) and purgeable organics (EPA 8010 and 8020).

12-ERA1, Engine Run-Up Area (Old Site 1-1)

a. Perform two soil borings up to 20 feet deep. Collect a maximum of four samples to be analyzed for oil and greease (SW 3550/EPA 413.2).

b. Collect one groundwater sample from one of the western-most of the two drinking water wells in Site 1 (DW1-1) to be analyzed for purgeable organics (EPA 601 and EPA 602).

13DAB2, Disposal Area--B (Old Site 2-5)

Collect four, near-surface (< 5 ft) soil samples to be analyzed for oil and grease (SW 3550/EPA 413.2) and purgeable orgaincs (EPA 8020 and 8010).

14-EBA2, Engine Build-Up Area (Old Site 2-8)

Install two, 10-foot borings. Collect one sample (total of two) from each hole. Analyze for oil and grease (SW 3550, then EPA 413.2).

15-TEB2, TEB Disposal Area (Old Site 2-12)

Install two, 10-foot soil borings. Collect two samples (one at each hole) to be analyzed for oil and and grease (SW 3550, then EPA 413.2).

16-EVP3, Evaporation Ponds (Old Site 3-2)

a. Perform four soil borings up to 50-ft deep, for a maximum of 200 linear feet. Collect a maximum of 15 soil samples for purgeable organics (SW 8010 and 8020), eight primary metals (CAM Title 22), nickel (SW 3010/7520), and total cyanide (SM412B/412E).

b. Collect two groundwater samples from Site 3 (DW3-1) well and Site 4 (DW4-1) well to be analyzed for purgeable organics (EPA 601 and 602), cyanide (SM 412B/412E), and nickel (EPA 249.1).

17-NFTC, New Fire Department Training Area (Old Site C-2)

a. Perform one soil boring up to 15-ft deep and one soil boring up to 35-ft deep. Collect a maximum of three samples to be analyzed for oil and grease (SW 3550/EPA 413.2).

b. Collect one near-surface (< 5-ft) sample to be analyzed for petroleum hydrocartbon (SW 3550/EPA 418.1).

18-ADA2, Abandoned Disposal Area (Old Site 2-4)

Install one, 20-ft soil boring. Collect two soil samples to be analyzed for oil and grease (SW 3550, then EPA 413.2) and purgeable orgaincs(EPA 8010 and 8020).

19-ERA3, Engine Run-Up Area (Old Site 3-1)

Install two, 10-ft borings. Collect two soil samples (one from each borings) to be analyzed for oil and grease (SW 3550/EPA 413.2).

20-NLA2, Noise Level Area (Old Site 2-11)

Install one, 20-ft boring. Collect a maximum of two samples to be analyzed for for oil and grease (SW 3550, then EPA 413.2) and purgeable orgaincs (EPA 8010 and 8020).

21-FDA7, Fuel Disposal Area (Old Site 5-2)

a. Install three, up to 20-ft soil borings. Collect a maximum of six soil samples to be analyzed for petroleum hydrocarbon (SW 3550/EPA 419.1).

b. Collect one groundwater sample from the fire water well one (FW-1) to be analyzed for purgeable organics (EPA 601 and 602).

22-ERAT, Engine Run-Up Area and Flightline (Old Site 6-1)

Install two, 10-ft soil borings. Collect two soil samples (one from each boring) to be analyzed for oil and grease (SW 3553, then EPA 413.2).

23-BDD8, Building 27 Ditch Discharge (New Site 4-3)

a. Install two soil borings up to 20-ft deep. Collect a maximum of four soil samples to be analyzed for oil and grease (SW3550/EPA 413.2), purgeable organics (SW 8010 and 8020), four secondary metals (CAM Title 22) and eight primary metals (CAM Title 22).

b. Collect one groundwater sample from Well DW8-1 in Site 8 to be analyzed for purgeable orgaincs (EPA 601 and 602).

C. Borehole Cleanup

Remove all boring area drill cuttings and clear the general area following the completion of each boring. Only those drill cuttings suspected as being a hazardous waste (based on discoloration, odor, or organic vapor detection instrument) shall be properly containerized and moved to locations within the installation (according to Plant 42 commander designation) for temporary storage by the contractor. The suspected hazardous waste shall be tested by the contractor for EP Toxicity, if liquid waste, ignitibility, and solvents. The contractor will be responsible for the disposal of the hazardous drill cuttings. Insure that hazardous waste are properly labeled and arranged for licensed transporter to dispose of in a permitted landfill. Plant 42 will act as the generator, and be responsible for manifesting and tracking of chain of custody records for the waste cuttings.

D. Health and Safety

Comply with USAF, OSHA, EPA, State and local health and safety regulations regarding the proposed work effort. Use

EPA guidelined for designating the appropriate levels of protection at study sited. Prepare a written Health and Safety Plan for the proposed work and coordinate it directly with applicable regulatory agencies. Provide an information copy of the Health and Safety Plan to the USAF OEHL prior to commencing field operations (i.e., drilling and sampling).

E. Data Review

1. Tabulate field and analytical laboratory results, including field and laboratory parameters and QA/QC data, and incorporate them into the monthly R&D Status Reports. Forward them to the USAF OEHL for review as soon as they become available as specified in Item VI below. Field and laboratory parameters shall include time and dates for sample collection, extraction, and analysis.

2. Upon completion of all analyses, tabulate and incorporate all results into an Informal Technical Information Report (Attch 1, Seq 2 as specified in Item VI below) and forward the report to USAF OEHL for review.

3. Data/results, generated through this undertaking, indicating a possibility of health risk (e.g., contaminated drinking water aquifer) shall be reported immediately via telephone to the USAF OEHL Program Manager.

F. Reporting

1. A draft report delineating all findings of this field investigation shall be prepared and forwarded to the USAF OEHL (as specified in Item VI below) for Air Force review and comment. This report shall include a discussion of the regional/site specific hydrogeology, well and boring logs, data from water level surveys, groundwater surface and gradient maps, water quality and soil analysis results, available hydrogeologic cross sections, and laboratory and field quality assurance/quality control information. The report shall follow the USAF OEHL format (mailed under separate cover). The format is an integral part of this delivery order.

2. The results section of the report shall include water and soil analysis results, field quality control sample data, internal laboratory control data (lab blanks, spikes, and duplicates), and laboratory quality assurance procedures. Provide second column confirmation results and include which columns were used, the conditions, and retention times. Summarize the specific collection techniques, analytical method, holding time, and limit of detection for each analyte (Standard Methods, EPA, etc. .

3. The recommendation section shall address each site and list them by categories. Category I shall consist of sites where no further action (including remedial action) is required. Data for these sites are considered sufficient to rule out significant public health or environmental hazards. Category II sites are those requiring additional monitoring or work to quantify or further assess the extent of current or future contamination. Category III sites are sites that

will require remedial actions (ready for IRP Phase IV actions). Recommendations for Category III sites shall include any possible influence on sites in Category I and/or II due to their connection to the same hydrologic system. Any dependency between sites in different categories shall be clearly stated.

The contractor shall include a list of candidate remedial action alternatives including Long Term Monitoring (LTM) as remedial action and corresponding rationals, that, as a minimum, should be considered in selecting the remedial action for a given site. The list shall encompass alternatives that could potentially attain applicable environmental standards. For contaminants that do not have standards, the contractor may use EPA recommended safe levels for non-carcinogens (Health Advisory of Suggested-No-Adverse-Response Levels) and target levels for carcinogens (one-one milliointh cancer risk level).

If not specifically requested, comprehensive cost or technical analyses of alternatives shall not be included. However, in those situations where field survey data indicate immediate corrective action is necessary, the contractor shall present specific, detailed recommendations. For each category above, the contractor shall summarize the results of field data, environmental or regulatory criteria, or other pertinent information supporting conclusions and recommendations.

4. For those sites in need of additonal Phase II effort, identify specific requirements, if any, for future monitoring needed to determine the magnitude, extent, and direction of movement of detected contaminants. Identify potential environmental consequences of discovered contamination, where known. Provide estimates of costs by line items for additional investigations beyond this stage along with estimates of time required to accomplish the investigation. Furnish the cost data in a separately bound appendix to the final report.

5. A Technical Operation Plan (TOP) shall be prepared (site specific) based on the technical requirements specified in this task description. This plan will be explicit with regards to field procedures. It will include, but is not limited to, field decontamination operations, health and safety procedures, sampling protocal, QA/QC field procedures, updated field schedule, etc.

6. The contractor shall prepare a briefing package for presentation. Presentation shall be site by site and include the following:

a. a brief description of each site with overheads or slides included;
b. a summary of the investigation of each site, i.e., work done, parameters examined, and methods used'
c. the findings of each site;
d. the recommendations for each site; and
e. an overview of all sites.

Upon completion of Phase II work (second draft report), an out briefing will be presented by the contractor to all concerned parties. Presentation materials shall be given to the government for future use as a part of the Phase II data requirement.

G. MEETINGS

The contractor's project leader shall attend three (3) meetings to take place at times to be specified by the USAF OEHL. The meetings shall take place at Plant 42 for a duration of one day each.

II. SITE LOCATION AND DATES;

- o Plant 42, Palmdale, California
- o Date to be established

III. BASE SUPPORT:

1. Plant personnel will be assign the temporary storage points within the installation of all hazardous drill cuttings. A plant representative will be designated to sign manifest for the disposal of hazardous cuttings.

2. Assist with field identification and location of underground utilities, (clear the site from drilling).

3. Provide site area identification passes and necessary security escort within Sites 3 & 8.

4. Clear access to locations identified for testing by the IRP Phase I report.

5. An equipment storage area, approximately 75'x75' at Site 3.

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACTS:

A. OEHL Monitor

Dr. John K. Yu
USAF OEHL/TSS
Brooks AFB, TX 78235-5501
(512) 536-2158
AV 240-2158

B. Plant Monitor

Mr. Frank M. Wood
DET 2,AFSC (DE-1)
Air Force Plant 42
2503 East Avenue P
Palmdale, CA 93550
(805) 947-214601-0179
AV 350-2092

C. MAJCOM Monitor

Maj. Gary A. Fishburn
USAF Hosp. Edwards/SGPB
Edwards AFB, CA 93523-5000
(805) 277-3272
AV 350-3272

D. MAJCOM

Col. M. J. Humerickhouse
HQ AFSC/SGAR
Andrews AFB, DC 20334-5000
(301) 981-5235
AV 858-5235

VI. CONTRACT L TA ITEM DESCRIPTIONS (DID)

In addition to sequence numbers 1, 5, and 11 in Attachment 1 to the contract, which are applicable to all orders, the sequence numbers listed below are applicable to this order. Also shown are data applicable to this order.

Seq.No.	Block 10	Block 11	Block 12	Block 13	Block 14
3	O/TIME	*	**	-	5
4	ONE/R	86 Sep 19	86 Oct 06	87 Jul 31	***
7	O/TIME	85 Sep 20	85 Sep 23		7
9	ONE/R	86 Sep 19	87 Jan 30	87 Jul 31	1
14	MNTHLY	85 Oct 15	85 Nov 01	****	3
15	MNTHLY	85 Oct 15	85 Nov 01	****	3

* As required by analytical methodology

** Upon completion of analytical effort before submission of 1st draft report.

*** Two draft reports (25 copies each) will be required. After incorporating Air Force comments concerning the first draft report, the contractor shall supply the USAF OEHL with one copy of the second draft report. Upon acceptance of the second draft, the USAF OEHL will furnish a distribution list for the remaining 24 copies of the second draft. The contractor shall supply 50 copies plus the original camera ready copy of the final report.

**** Monthly thereafter.

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Appendix 1
AF PLANT 42 - PHASE II, Stage 1
Analytical Methods, Detection Limits, and Number of Samples

Parameter	Method	Detection Limit	No. of Samples	No. of QA Samples	Total Samples
Ground-Water Samples					
Purgeable Organics	EPA 601/602	(a)	7	1	12(b)
Cyanide	SM 412B/412E	10 ug/L	2	1	3
Nickel	EPA 249.1	100 ug/L	2	1	3
pH (field)	EPA 150.1	-	7	-	7
Conductance (field)	-	-	7	-	7
Temperature (field)	-	-	7	-	7
Soil Samples					
Purgeable Organics	SW 8010/8020	(c)	115	11	189(d)
Oil & Grease	SW 3550/EPA 413.2	-	81	8	89
Petrol Hydrocarbons	SW 3550/EPA 418.1	-	73	7	80
Total Phenolics	SM 510A/510C	-	25	2	27
Cyanide	SM 412B/412E	200 ug/g	15	1	16
PCBs	SW 8080	(e)	2	1	3
Primary Metals:	(f)				
Arsenic	EPA 206.3	1 ug/g	51	5	56
Barium	EPA 208.2	20 ug/g	51	5	56
Cadmium	EPA 213.2	1 ug/g	51	5	56
Chromium (VI)	SM 312B	5 ug/g	51	5	56
Lead	EPA 239.2	2 ug/g	51	5	56
Mercury	EPA 245.1	0.1 ug/g	51	5	56
Selenium	EPA 270.2	1 ug/g	51	5	56
Silver	EPA 272.1	1 ug/g	51	5	56

R E V I S E D

Appendix 1 (cont.)

AF PLANT 42 - PHASE II, Stage 1

Analytical Methods, Detection Limits, and Number of Samples

Parameter	Method	Detection Limit	No. of Samples	No. of QA Samples	Total Samples
Second Metals:	(f)				
Copper	EPA 220.1	25 ug/g	4	0	4
Iron	EPA 236.1	50 mg/g	4	0	4
Manganese	EPA 243.1	50 ug/g	4	0	4
Zinc	EPA 289.1	25 ug/g	4	0	4
Other Metals:	(f)				
Nickel	EPA 249.1	10 ug/g	15	1	16

(a) Detection limits for Purgeable Organics (Halocarbons and Aromatics) shall be as specified for the compounds by EPA Methods 601 and 602. Methods 601 and 602 for Purgeable Organics require positive confirmation by a second gas chromatographic column. This must be done before reporting positive values. Methods 601 and 602 specify the two columns to use. Second column confirmation is required when values exceed:

Benzene	0.7 ug/L
Carbon Tetrachloride	4.0 ug/L
1,2 Dichloroethane	0.1 ug/L
Methylene Chloride	4.0 ug/L
Tetrachloroethylene	4.0 ug/L
Trichloroethylene	1.0 ug/L
Vinyl Chloride	1.0 ug/L
Dichlorobenzene isomers	Sum greater than 10 ug/L
Other organics	Greater than 10 ug/L

Retention times on both columns must match before reporting positive value. If no match, it will be considered an interference.

If questions are encountered about certain contaminants, both chromatograms will be available for inspection by OEHL to rule out possible interference.

(b) Total of 12 determinations includes second column confirmation for up to 50% of the samples.

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Appendix 1 (cont.)
AF PLANT 42 - PHASE II, Stage 1
Analytical Methods, Detection Limits, and Number of Samples

(c) Detection limits for Volatile Organics (Halogenated and Aromatic) shall be as specified for compounds by SW Methods 8010 and 8020. If analytes analyses exceed 10 ug/g in soil, second column confirmation is required.

(d) Total of 189 determination includes second column confirmation for up to 50% of the samples.

(e) Detection limits for PCBs shall be as specified for compounds by SW Method 8080.

(f) Where it is applicable, use extraction procedures published in the California Assessment manual for Hazardous Test Method. If CAM is used, the contractor needs not to use EPA extraction procedures. Following extraction, ICAP (Inductively Coupled Argon Plasma) spectrometer or AAS (Atomic Absorption Spectrophotometer) may be used for metal detection.

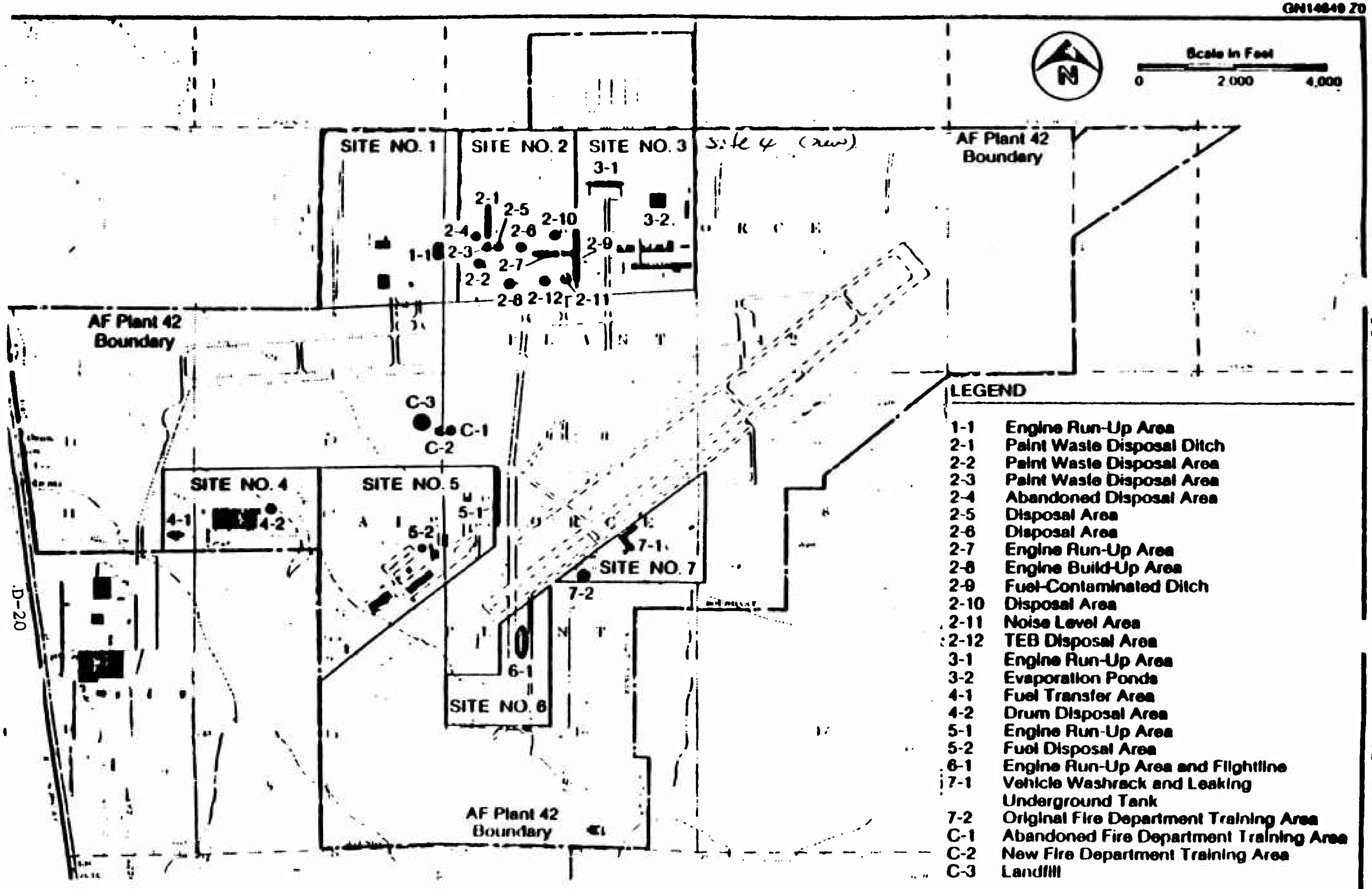

FIGURE 19.
Location Map of Identified Disposal and Spill Sites at AF Plant 42

-4403/001102

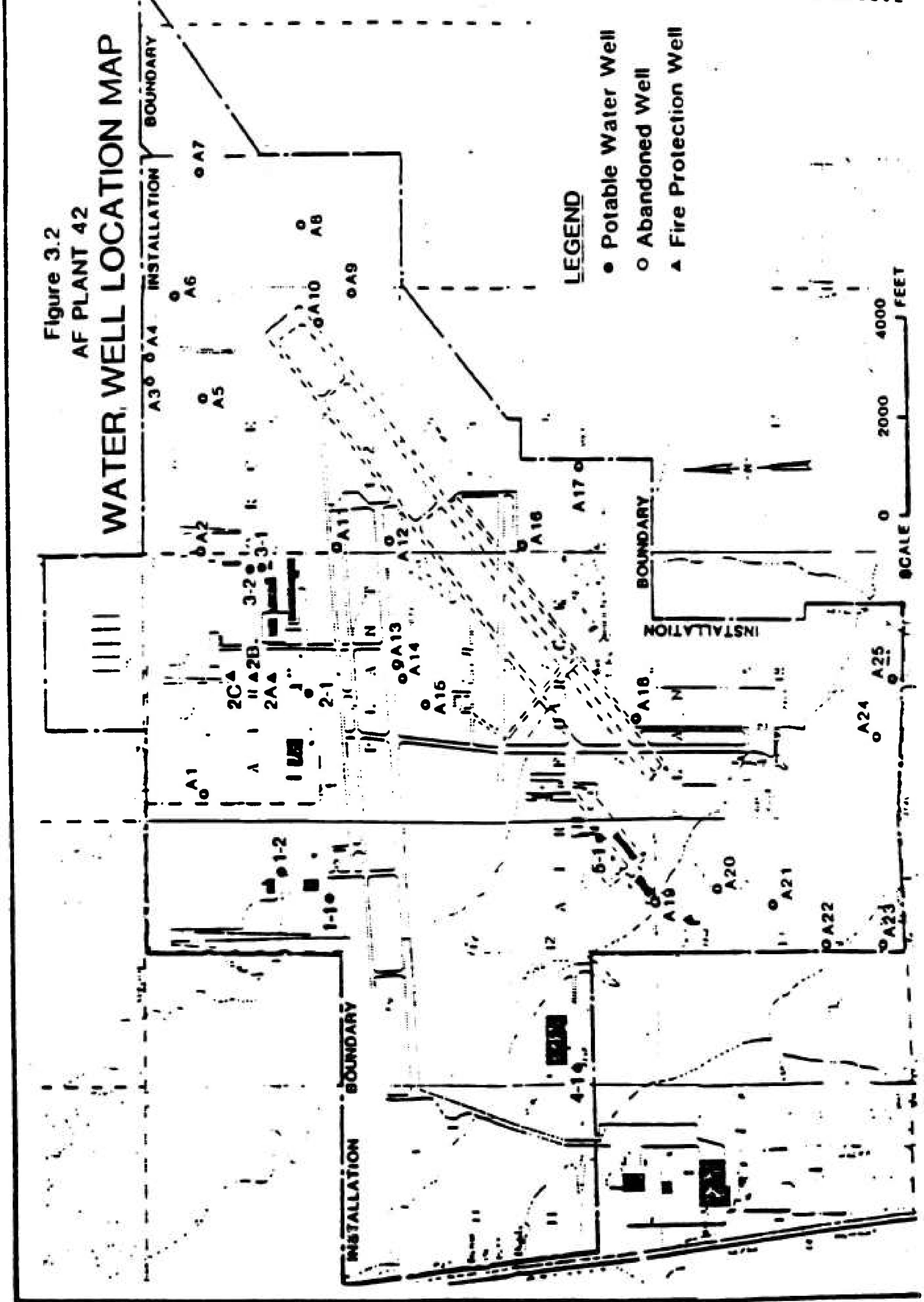
Figure 3.2
AF PLANT 42
WATER WELL LOCATION MAP
LEGEND
• Potable Water Well
o Abandoned Well
▲ Fire Protection Well
INSTALLATION BOUNDARY
SCALE
0
2000
4000
FEET
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
A19
A20
A21
A22
A23
A24
A25
1-1
1-2
2-1
2A
2B
2C
3-1
3-2
4-1
5-1

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Appendix 4

AF PLANT 42 - PHASE II, Stage 1

Site Specific Work Plan Summary Table

Site Number	Site Description	Activity	Analyses#
1-FCD2	Fuel Contam Ditch	2-75 foot borings 2-70 foot borings 2-50 foot borings 2-30 foot borings 1-20 foot borings 3 surface samples	TPH, VO's
		sample well DW2-1 sample well FW-2B	PO's
2-PWD2	Paint Waste Ditch	5-50 foot borings	O&G, VO's, Phenolics, Primary Metals
3-ERA7	Engine Run-up Area	4-20 foot borings	O&G, VO's
4-VWT5	Vehicle Wash/Tank	2-50 foot borings 2-20 foot borings	O&G, Primary Metals, VO's
5-AFTC	Abandoned Fire Trn	1-50 foot boring 1-10 foot boring	O&G, VO's
		1 surface sample	Primary Metals, PCB's
6-OFTC	Original Fire Trn	1-50 foot boring	O&G, VO's
		1 surface sample	Primary Metals, PCB's
7-ERA2	Engine Run-up Area	1-200 foot boring 1-100 foot boring 5-50 foot borings	TPH
8-FTA8	Fuel Transfer Area	1-20 foot boring	TPH
9-PWW2	Paint Waste West	2 surface samples	O&G, Phenolics, VO's
10-PWN2	Paint Waste North	4 surface samples	O&G, Phenolics, VO's
11-DAA2	Disposal Area A	2-10 foot borings	O&G, VO's

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Appendix 4 (cont.)
AF PLANT 42 - PHASE II, Stage 1

Site Number	Site Description	Activity	Analyses
12-ERA1	Engine Run-up Area	2-20 foot borings	O&G
		sample well DW1-1	PO's
13-DAB2	Disposal Area B	4 surface samples	O&G, VO's
14-EBA2	Engine Build Area	2-10 foot borings	O&G
15-TEB2	TEB Disposal Area	2-10 foot borings	O&G
16-EVP3	Evaporation Ponds	4-50 foot borings	VO's, Primary Metals, Cyanide, Nickel
		sample well DW3-1 sample well DW4-1	PO's, Nickel, Cyanide
17-NFTC	New Fire Trn Area	1-15 foot boring 1-35 foot boring	O&G
		1 surface sample	TPH
18-ADA2	Aban Disposal Area	1-20 foot boring	O&G, VO's
19-ERA3	Engine Run-up Area	2-10 foot borings	O&G
20-NLA2	Noise Level Area	1-20 foot boring	O&G, VO's
21-FDA7	Fuel Disposal Area	3-20 foot borings	TPH
		sample well FW-1	PO's
22-ERAT	Engine Run/Terminal	2-10 foot borings	O&G
23-BDD8	Bldg Ditch Dischrg	2-20 foot borings	O&G, Primary Metals, Secondary Metals, VO's

#TPH = petroleum hydrocarbon
VO's = PO's = purgeable organics

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APPENDIX E

DATA ON WELLS IN THE VICINITY OF USAF PLANT 42

APPENDIX E

DATA ON WELLS IN THE VICINITY OF USAF PLANT 42

Wells in Antelope Valley are identified according to a numbering system that has been used by the U.S. Geological Survey since 1940. This system has also been adopted by the California Department of Water Resources and by the California Water Quality Control Board for use throughout the state. Wells are assigned numbers according to their location in the rectangular system or the subdivision of public land. For example, in the well number 7N/12W-34E1, the symbols preceding the slash indicate the township (Township 7 North), the symbol between the slash and the hyphen indicate the range (Range 12 West), and the number following the hyphen indicates the section (Section 34). The letter following the section number refers to a specific 40-acre tract of the section, as defined below.

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Therefore, Tract E refers to the southwest quarter of the northwest quarter of Section 34. Within a 40-acre tract the wells are numbered serially as indicated by the final digit. Thus, well 7N/12W-34E1 is the first well to be listed in Tract E of Section 34. Townships and ranges in the Antelope Valley are measured from the San Bernardino baseline.

The following data are from the California Department of Water Resources (Koehler 1966).

6N/11W-3E2. F. J. Michiels. Drilled by Evans Bros Drilling Co. in 1960. 16-inch casing 0-700 ft, perforated 325-700 ft. Altitude about 2,493 ft.

	Thickness (feet)	Depth (feet)
Sand and gravel	40	40
Sand and clay	20	60
Clay, sandy	20	80
Sand, hard, and streaks of clay	74	154
Sand with streaks of sandy clay	9	163
Gravel and streaks of sand	55	218
Sand, hard, and streaks of clay	55	273
Sand, hard	8	281
Sand, soft, and clay	13	294
Sand, hard	61	355
Sand and clay	15	370
Sand, hard	8	378
Sand and clay	22	400
Sand, soft	15	415
Sand, hard	8	423
Sand	22	445
Sand and streaks of clay	61	506
Gravel and sand	7	513
Clay and sand	11	524
Gravel and sand	13	537
Clay	12	549
Sand and streaks of clay	46	595
Clay	13	608
Clay and thin streaks of sand and gravel	42	650
Clay, sandy	15	665
Sand, hard	10	675
Sand and gravel, with streaks of clay	22	700

6N/11W-4H1. F. J. Michiels. Drilled by A. Lyon in 1936. 20-inch casing 0-722 ft, perforated 170-650 ft. Altitude about 2,489 ft.

	Thickness (feet)	Depth (feet)
No record	--	--
Soil, sand, and clay		170
Gravel, "very good"	5	175
Clay and sand	23	198
Sand and red "muck"	6	204
Sand and coarse gravel	6	210
Clay and sand	4	214
Gravel with streaks of clay	6	220
Clay	1	221
Gravel, "good"	5	226
Clay, hard	2	228
Sand and gravel	6	234
Clay	4	238
Sand, "muck" and a little gravel	19	257
Clay	7	264
Sand, "mucky"	18	282
Clay	52	334
Sand, "mucky"	4	338
Clay, hard	2	340
Gravel	4	344
Clay and "mucky sand"	38	382
Gravel	2	384
Clay	16	400
Gravel	2	402
Clay	6	408
Gravel	2	410
Clay, sandy	6	416
Sand	2	418
Clay, hard	4	422
Sand, coarse, and gravel	14	436
Clay	12	448
Gravel, "good"	4	452
Clay, hard, sticky	8	460
Gravel, "good"	20	480
Clay	16	496
Gravel, "good"	6	502
Clay, hard, sandy	41	543
Silt, packed	5	548
Clay, hard, sticky, sandy	14	562
Gravel, "good"	6	568
Clay, hard	8	576
Gravel, "good"	2	578
Clay, "gravelly"	36	614
Granite, decomposed, and clay	4	618
Clay and gravel	6	624
Gravel, "good"	4	628
Clay, hard; sand, and gravel	12	640
Sand and gravel	7	647
Clay, sandy, hard	11	658
Gravel, "loose"	4	662
Clay, sandy, hard	30	692
Clay, sticky, with "mucky streaks"	10	702
Clay and rock	6	708
Shale, brown	11	719
Clay, sandy, hard	3	722

6N/11W-5N1. U.S. Air Force, formerly Mrs. Fredine. Drilled by F. Rottman in 1945. 14-inch casing 0-215 ft, 10-inch perforated casing 204-504 ft. Altitude about 2,499 ft.

	Thickness (feet)	Depth (feet)
Clay	14	14
Clay and boulders	21	35
Sand, hard	5	40
Clay and boulders	50	90
Sand	3	93
Clay and boulders	47	140
Rock	10	150
Clay and boulders	60	210
Sand and boulders	4	214
Clay	16	230
Sand and boulders	3	233
Clay and rocks	17	250
Clay	10	260
Gravel and boulders	5	265
Clay	10	275
Gravel and boulders	3	278
Clay	7	285
Gravel and boulders	5	290
Clay	15	305
Clay and rock	3	308
Clay	17	325
Boulders and sand	3	328
Clay	12	340
Boulders and sand	5	345
Clay, soft	10	355
Clay, hard	10	365
Clay, soft	5	370
Clay and boulders	3	373
Clay, soft	17	390
Clay and rock	6	396
Clay, hard	14	410
Clay and boulders	5	415
Clay, soft	15	430
Boulders and gravel	3	433
Clay, hard	7	440
Rock and gravel	20	460
Clay, hard	44	504

6N/11W-6G1. U.S. Air Force. Drilled by Sloan Drilling Co. in 1953. 14-inch casing 0-599 ft, perforated 339-599 ft. Altitude about 2,485 ft.

	Thickness (feet)	Depth (feet)
Hardpan, sand, and silt	12	12
Clay, sandy	48	60
Clay	30	90
Sandstone, "dry"	22	112
Clay	30	142
Sand and gravel, "dry"	46	188
Clay	34	222
Sand, "dry"	15	237
Sandstone	4	241
Sand, water-bearing	24	265
Shale and clay	23	288
Gravel and sand, coarse, black-brown-white, water-bearing	30	318
Clay, brown	24	342
Gravel, coarse, all colors, water-bearing	16	358
Sand, fine, and clay	24	382
Sand and clay, cemented	44	426
Clay, brown	39	465
Sand, fine to coarse	27	492
Clay	16	508
Clay, sandy	22	530
Granite, decomposed, and rock, very hard	22	552
Shale, white, and clay	4	556
Sand and gravel, fine to very coarse, water-bearing	32	588
Clay, sandy	11	599

6N/11W-8R3. R. E. A. Rancho. Drilled by F. & C. Drilling Co. in 1946. 16-inch casing 0-708 ft, perforated 252-708 ft. Altitude about 2,523 ft.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface sand and clay	90	90	Clay, sandy	35	383
Sand, coarse, and clay	77	167	Gravel, coarse	9	392
Clay	11	178	Clay, sandy	40	432
Sand, coarse, hard	27	205	Gravel, coarse	6	438
Sand, loose	8	213	Shale, sandy	46	484
Sand, hard	11	224	Shale, sticky	23	507
Sand and gravel	25	249	Shale, sandy	8	515
Clay	6	255	Sand and gravel	36	551
Sand and gravel	23	278	Shale, sandy	13	564
Clay	37	315	Sand and gravel	28	592
Sand	25	340	Gravel, coarse	96	688
Clay	8	348	Sand, soft	2	690
			Gravel	17	707
			Sandstone, hard	2	709

6N/11W-10D1. Palmdale Project, formerly E. T. Earl. Drilled by R. H. Orr in 1915. 16-inch casing 0-165 ft, 10-inch perforated casing 165-445 ft. Altitude about 2,508 ft.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	20	20	"Water"	5	175
Boulders, small	6	26	Clay	15	190
Clay	9	35	Granite, gray, very hard	13	203
Clay, hard	20	55	Clay	4	207
Clay	15	70	"Water"	12	219
Sand	2	72	C[illegible]	28	247
Clay	8	80	"Water"	10	257
"Water"	1	81	Clay	30	287
Boulders	10	91	"Water"	5	292
"Very hard"	7	98	Clay	18	310
"Water"	6	104	"Water"	5	315
Sand and rock	16	120	Clay	42	357
"Water"	1	121	"Water"	3	360
Sand and rock	4	125	Clay, hard, and "cement"	19	379
Sand	16	141	Clay, hard	4	383
"Water"	2	143	"Water"	3	386
Sand and rock, very hard	12	155	Clay	44	430
"Water"	1	156	"Water"	1	431
Sand and rock	9	165	"Hard cement"	14	445
Clay	5	170			

NOTE: The entry "water" is presumed to apply to water-bearing material.

	Thickness (feet)	Depth (feet)

6N/11W-19E2. Palmdale Irrigation District. Drilled by Evans Bros. Drilling Co. in 1960. 16-inch casing 0-848 ft, no casing 848-868 ft, perforated 396-848 ft. Altitude about 2,584 ft.

	Thickness (feet)	Depth (feet)
Surface sand and hardpan ------------	10	10
Sand and gravel, with streaks of clay ----	30	40
Clay with streaks of sand ---------------	62	102
Clay with thin streaks of sand ------------	63	165
Sand, packed, with streaks of clay ----	47	212
Clay, sandy, and sand ---------------	18	230
Sand, hard, with streaks of clay ----	31	261
Sand and gravel, with streaks of clay ----	6	267
Sand, hard, with streaks of clay ----	24	291
Sand and gravel, with streaks of clay ----	21	312
Sand, firm, with streaks of clay ----	23	335
Sand, hard, with thin streaks of soft clay ---------------	65	400
Clay and sand --------	65	465
Sand, with streaks of clay -----------	81	546
Sand and rocks, with streaks of clay ---	6	552
Sand with thin streaks of clay ---	13	565
Sand, firm, with thin streaks of clay ---	7	572
Sand, with some clay-	8	580
Sand, firm ----------	6	586
Clay and a small amount of sand ----	14	600
Clay with streaks of sand -----------	85	685
Clay with streaks of sand and thin streaks of sandy shale -------------	55	740
Clay, with thin streaks of sand and brown shale -------	95	835
Sand and brown shale-	13	848
Sand, hard ----------	3	851
Clay with thin streaks of sand ---	17	868

6N/12W-1J1. North American Aviation. Drilled by Evans Bros. Drilling Co. in 1957. 12-inch casing 0-581 ft. Altitude about 2,503 ft.

	Thickness (feet)	Depth (feet)
Surface soil and sandy clay ---------	30	30
Clay, sandy ----------	45	75
Clay, sandy, with streaks of sand ----	29	104
Sand ----------------	116	220
Clay, sandy ----------	10	230
Sand -----------------	62	292
Clay with streaks of coarse sand --------	48	340
Clay, sandy, with streaks of clay ---	55	395
Sand with streaks of clay -------------	35	430
Clay ----------------	80	510
Clay, sandy, with streaks of sand and gravel ------------	68	578
Sand, hard ----------	3	581

6N/12W-12R1. Lockheed Aircraft Corp. Drilled by F. Rottman in 1951. 16-inch casing 0-800 ft, perforated 380-800 ft. Altitude about 2,538 ft.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil ---------	50	50	Clay and boulders ---	35	462
Sand, fine -----------	33	83	Gravel --------------	14	476
Gravel, fine ---------	25	108	Gravel with streaks of clay -----------	15	491
Clay -----------------	29	137	Clay ----------------	44	535
Gravel and clay ------	25	162	Clay, boulders, and gravel ------------	47	582
Clay -----------------	35	197	Clay and gravel -----	45	627
Gravel ---------------	29	226	Clay ----------------	45	672
Gravel, sand, and boulders -----------	45	271	Gravel --------------	21	693
Gravel and clay ------	34	305	Clay, boulders, and gravel ------------	44	737
Gravel and boulders, with streaks of clay ---------------	76	381	Clay and gravel -----	22	759
Clay and gravel ------	19	400	Gravel --------------	22	781
Clay -----------------	27	427	Clay ----------------	19	800

6N/12W-13N1. Palmdale Irrigation District. Drilled by F. Rottman in 1960. 16-inch casing 0-800 ft, perforated 420-800 ft. Altitude about 2,591 ft.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil ---------	20	20	Sand, hard, packed --	45	475
Gravel ---------------	20	40	Sand and clay -------	30	505
Clay and gravel ------	30	70	Sand with clay streaks -----------	30	535
Sand with clay streaks ------------	20	90	Sand, hard ----------	30	565
Sand, clay, and coarse gravel ------	60	150	Clay and sand -------	80	645
Sand with clay streaks ------------	30	180	Sand, hard, packed --	30	675
"Fire sand" ----------	40	220	Sand, with clay streaks -----------	60	735
Sand and gravel ------	60	280	Sand, hard ----------	30	765
Sand with clay streaks ------------	35	315	Sand, fine, hard ----	30	795
Gravel ---------------	30	345	Sand, fine, and clay-	55	850
Sand, hard, packed ---	30	375	Sand, firm, and clay with layers of cemented formation-	20	870
Sand, coarse ---------	55	430	Sand, hard, sharp ---	10	880

6N/12W-24C1. Palmdale Irrigation District. Drilled by Evans Bros. Drilling Co. in 1963. 16-inch casing 0-900 ft, no casing 900-1,275 ft, perforated 504-900 ft. Altitude about 2,585 ft.

	Thickness (feet)	Depth (feet)
Surface soil	4	4
Hardpan	4	8
Sand, coarse	12	20
Clay	45	65
Clay, brown	11	76
Clay, brown, with streaks of sand	17	93
Sand, coarse, and sandy brown clay	15	108
Clay, brown, with streaks of sand	17	125
Sand, hard, and clay with streaks of gravel	53	178
Sand with streaks of clay and hard sand	37	215
Clay with streaks of sand	13	228
Sand with streaks of clay	27	255
Clay and sand	23	278
Clay, brown, with streaks of gravel	12	290
Clay, brown	8	298
Clay, brown, with streaks of sand	20	318
Clay, sand, and gravel	3	321
Clay, brown, and gravel	18	339
Sand and sandy brown clay	21	360
Sand, hard, and brown clay	9	369
Sand, coarse to medium with streaks of clay	31	400
Clay, brown, with thin streaks of sand	50	450
Sand and gravel, some clay	20	470
Clay, brown, with streaks of sand	5	475

	Thickness (feet)	Depth (feet)
Clay, brown, with thin streaks of sand	100	575
Sand with streaks of clay and cobblestones	95	670
Clay with streaks of sand	58	728
Clay, brown, and sand	28	756
Clay, brown, with streaks of medium to coarse sand	20	776
Sand, medium, with streaks of clay	13	789
Clay, brown and sand	57	846
Sand and brown clay	54	900
Clay, brown, and some blue shale	17	917
Sand, very hard	3	920
Clay, blue, with streaks of shale	87	1,007
Shale, soft, with streaks of medium to coarse sand	23	1,030
Shale	5	1,035
Shale and blue clay with streaks of medium to coarse sand	61	1,096
Sand and shale	5	1,101
Clay, blue, and medium to coarse sand, some white clay	5	1,106
Shale, hard, with streaks of sand	9	1,115
Shale, blue, with streaks of sand	95	1,210
Shale, blue, with streaks of sand brown clay	26	1,236
Shale, blue, and sand with large flakes of mica	13	1,249
Shale, blue, sand, and cobblestones	26	1,275

7N/11W-30M1. John Granicy. Drilled by Evans Bros. Drilling Co. in 1962. 14-inch casing 0-666 ft, perforated 265-666 ft. Altitude about 2,447 ft.

	Thickness (feet)	Depth (feet)
Sand and gravel with thin streaks of clay and rocks	152	152
Sand and gravel with thin streaks of red and brown clay	88	240
Sand with thin streaks of gravel and clay	73	313
Gravel, hard, with streaks of brown clay	72	385
Sand, hard	16	401
Sand, hard, with streaks of brown clay	35	436
Sand and brown clay	141	577
Clay, brown, with streaks of sand	89	666

7N/11W-31A1. Palmcaster Co. Drilled by Evans Bros. Drilling Co. in 1952. 14-inch casing 0-599 ft, perforated 359-599 ft. Altitude about 2,450 ft.

	Thickness (feet)	Depth (feet)
Clay	40	40
Gravel and clay	30	70
Rock and gravel	30	100
Gravel, few boulders	50	150
Sand, hard	64	214
Clay	16	230
Sand, hard, with streaks of clay	10	240
Clay and sand	20	260
Sand	20	280
Sand and boulders	60	340
Clay and gravel	22	362
Clay with streaks of gravel	61	423
Gravel and boulders	25	448
Sand, hard, and boulders	12	460
Sand	80	540
Sand with streaks of clay	25	565
Clay with streaks of sand	15	580
Sand	19	599

7N/11W-32A2. El Patio Ranch. Drilled by Evans Bros. Drilling Co. in 1962. 14-inch casing 0-823 ft, perforated 360-823 ft. Altitude about 2,453 ft.

	Thickness (feet)	Depth (feet)
Sand	10	10
Clay	13	23
Sand, coarse, and gravel	22	45
Sand with thin streaks of brown clay	35	80
Clay, brown, with streaks of coarse sand and small gravel	141	221
Sand, coarse, and gravel, with streaks of clay	159	380
Clay with streaks of sand	70	450
Clay, brown, with streaks of coarse sand	63	513
Clay, brown, with streaks of sand	41	554
Sand, coarse, with thin streaks of brown clay	247	801
Sand with streaks of light blue clay	22	823

7N/11W-33J2. F. Seminario. Drilled by Evans Bros. Drilling Co. in 1963. 16-inch casing 0-770 ft, perforated 374-770 ft. Altitude about 2,471 ft.

	Thickness (feet)	Depth (feet)
Sand, gravel, and clay	35	35
Sand and gravel, with streaks of brown clay	69	104
Clay, brown, sandy, with streaks of sand and gravel	39	143
Sand, hard	2	145
Sand, cemented	14	159
Clay, brown, with streaks of sand	70	229
Sand, coarse, and brown clay	21	250
Sand, cemented	28	278
Sand, with thin streaks of brown clay	96	374
Gravel with streaks of cemented sand and brown clay	16	390
Sand, hard, and clay	10	400
Clay, brown, with streaks of sand	51	451
Sand, cemented	2	453
Clay, brown, with streaks of sand	31	484
Sand and brown clay	5	489
Sand with thin streaks of brown clay	86	575
Clay, brown, and sand	50	625
Sand, hard	2	627
Clay, brown, with streaks of sand	6	633
Cobblestones and brown clay	8	641
Clay with streaks of sand	39	680
Clay with streaks of hard sand	20	700
Clay, brown, and sand	60	760
Clay, brown, with thin streaks of sand	9	769
Clay, blue	1	770

7N/11W-33N2. Lancaster Milling Co. Drilled by Evans Bros. Drilling Co. in 1959. 16-inch casing 0-622 ft. Altitude about 2,470 ft.

	Thickness (feet)	Depth (feet)
Surface soil	5	5
Sand and gravel	45	50
Clay	15	65
Sand with streaks of clay	30	95
Clay with streaks of sand and gravel	105	200
Clay, sandy	10	210
Clay with streaks of sand	55	265
Clay with streaks of sand and gravel	32	297
Gravel, coarse	5	302
Clay	18	320
Clay with streaks of sand	150	470
Clay	30	500
Clay with streaks of sand and gravel	118	618
Clay	4	622

	Thickness (feet)	Depth (feet)

7N/11W-33Q1. F. Seminario. Drilled by Evans Bros. Drilling Co. 16-inch casing 0-700 ft, perforated 318-700 ft. Altitude about 2,468 ft.

Surface soil	7	7
Sand	9	16
Sand and gravel	18	34
Clay	6	40
Sand and gravel, with streaks of clay	42	82
Clay, sandy	18	100
Sand	6	106
Gravel, hard, with streaks of sand	14	120
Sand	18	138
Sand with streaks of clay	42	180
Gravel and sand, with streaks of clay	43	223
Sand and gravel	37	260
Sand, hard, and clay	8	268
Sand and clay	44	312
Sand with streaks of sandy clay	46	358
Sand, hard, and clay	7	365
Sand and clay	20	385
Sand with streaks of clay	20	405
Sand, hard, with streaks of clay	47	452
Clay, soft, and sand	38	490
Sand and clay	28	518
Sand, hard, and clay	17	535
Sand and clay	22	557
Sand, hard	18	575
Clay, brown, soft, with streaks of sand	27	602
Clay, hard	3	605
Clay and sand	5	610
Clay and large gravel	90	700

TABLE 1: CONSTRUCTION INFORMATION ON WATER SUPPPLY WELLS AT SITE 2, AIR FORCE PLANT 42 AND LOCKHEED PLANT 10

	SITE 2	PLANT 10
General		
Well Number:	6N/11W-06L02	6N/12W-14A1
Address:	20th St. East & Ave. M Palmdale, Calif.	1011 Lockheed Way Palmdale, Calif.
Location:	Sec6,T6N,R11W	Sec14,T6N,R12W
Use:	Domestic/Potable	Domestic/Fire Protection
Date Drilled:	1954	1968
Driller:	Sloan Drilling Co.	Unknown
Static Water Level (Depth):	217 Ft. in 1954 333 Ft. in 1983	360 Ft. in 1968 -----
Pumping Water Level (Depth):	349 Ft.	478 Ft. at 1350 GPM
Construction Data		
Total Depth Drilled:	600 Ft.	900 Ft.
Casing Depth:	600 Ft.	885 Ft.
Casing Diameter (O.D.):	14 Inches	16 5/8 Inches
Casing Composition:	Steel with 20% Copper	Steel with 20% Copper
Depth to Highest Perforation:	240 Ft.	525 Ft.
Surface Sealed?	Yes	Yes
Gravel Pack?	Yes	Yes
Pump Data		
Make:	U.S. Pump	Byron-Jackson
Type:	Vertical Line Shaft Turbine	Submersible
Capacity :	1500 GPM	870 GPM at 700 Ft.
Power:	Electrical	Electical
Horseposer:	40 H.P.	200 H.P.

Well number	Source of data	Depth of well (feet)	Date tested	Pumping rate (gpm)	Static water level (feet)	Drawdown (feet)	Specific capacity (gpm/ft of dd)
6N/11W-3E2	SCE	700	10- 9-63	800	311.0	10.4	76.9
4H1	SCE	722	10-12-54	1,544	244.4	21.2	72.8
	SCE		12- 7-55	1,414	241.2	20.5	69.0
	SCE		9-25-57	1,188	264.4	17.2	69.1
	SCE		12-23-58	1,199	258.2	13.8	86.9
	SCE		9-24-59	1,289	276.3	16.7	77.2
	SCE		10- 9-60	1,131	312.8	16.2	69.8
8R3	DWR	708	8-17-56	720	195	20	36
19E1	SCE	473	12- 8-30	1,130	187.5	26.1	43.3
	SCE		1-28-31	1,280	185.5	23.0	55.6
	SCE		2-11-31	1,188	188.7	23.1	51.4
	P		8-26-48	490	254.0	21.5	22.8
	P		8-26-48	506	254.0	25.5	19.8
	P		8-26-48	580	254.0	27.5	21.1
	P		8-26-48	635	254.0	30.0	21.2
	SCE		10-24-51	465	269.0	21.0	22.1
	SCE		6-17-52	847	277.5	24.9	34.0
	SCE		5-21-54	511	292.8	16.0	31.9
	SCE		10-24-54	465	269.6	21.0	22.1
	SCE		11-29-55	888	295.6	19.9	44.6
	SCE		12- 8-55	1,121	297.1	26.8	41.8
	SCE		3-27-58	1,227	300.0	35.8	34.3
	SCE		6-13-58	1,269	311.2	51.0	24.9
	SCE		9-25-63	721	348.6	29.4	24.5
19E2	D	848	12- 8-60	2,300	328	24	96
	SCE		6- 9-61	1,706	331.6	19.7	86.6
	SCE		9-24-63	1,604	354.9	13.2	122
19E3	SCE	604	10-24-51	324	274.7	6.1	53
	SCE		5-21-54	1,275	294.0	23.5	54.3
	SCE		12- 2-55	1,121	297.1	26.8	41.5
	SCE		3-27-58	1,227	300.0	35.8	34.3
	SCE		6-13-58	1,269	311.2	51.0	24.9
20G2	SCE	694	9-26-63	767	329.3	73.2	10.5
20N1	SCE	500	12- 2-55	689	274.1	42.3	16.3
	SCE		9-25-63	544	314.5	47.4	11.5
6N/12W-13N1	D	800	2-12-60	1,750	325	44	40
24A1	SCE	502	5- 8-52	1,390	281.3	27.2	51.1
	SCE		3-17-54	1,251	278.6	27.1	47.9
	SCE		6-13-58	1,099	302.2	27.4	40.1
24C1	SCE	900	9-24-63	1,074	358.0	28.7	37.4

Well number	Source of data	Depth of well (feet)	Date tested	Pumping rate (gpm)	Static water level (feet)	Drawdown (feet)	Specific capacity (gpm/ft of dd)
7N/11W-30M1	D	666	1-22-62	1,000	205	23	43.5
	D		1-22-62	1,100	205	29	37.9
	D		1-22-62	1,200	205	33	36.4
	D		1-22-62	1,400	205	40	35.0
	D		1-22-62	1,600	205	50	32.0
	D		1-22-62	1,800	205	62	29.0
	D		1-22-62	2,000	205	74	27.0
	D		1-22-62	2,100	205	80	26.2
32A2	D	823	2- 1-62	1,000	262	30	33.3
	D		2- 1-62	1,200	262	38	31.6
	D		2- 1-62	1,400	262	51	27.4
	D		2- 1-62	1,600	262	63	25.4
	D		2- 1-62	1,800	262	73	24.6
	D		2- 1-62	2,050	262	77	26.6
32G1	WRB	610	6----56	1,250	246	34	37
33A1	SCE		10-12-54	906	230.8	12.2	74.3
	SCE		12-23-58	1,401	241.6	19.1	73.4
	SCE		9-24-59	1,353	260.8	16.5	82.0
	SCE		10- 9-62	1,353	292	29.6	45.7
33J2	D	770	2-26-63	1,200	296	17	70.6
	D		2-26-63	1,400	296	20	70.0
	D		2-26-63	1,600	296	23	69.6
	D		2-26-63	1,800	296	27	66.7
	D		2-26-63	2,000	296	31	64.5
	D		2-26-63	2,200	296	34	64.7
	D		2-26-63	2,300	296	36	63.9
	D		2-26-63	2,360	296	37	63.8
33N2	D	622	2-10-59	1,390	256	25	56
33Q1	D	700		1,000	260	46	32.6
	D			1,100	260	50	32.0
	D			1,200	260	55	30.9
	D			1,300	260	59	30.5
	D			1,400	260	66	31.8
	D			1,500	260	46	32.6
	D			1,600	260	50	32.0
	D			1,700	260	55	30.9
	D			1,800	260	59	30.5
	D			2,100	260	66	31.8
	SCE		10- 9-62	1,084	316.2	24.6	44.1
34F1	SCE	507	7----63	499	298.0	12.3	40.6

Well number	Date of collection	Depth of well (feet)	Water temperature (°F)	Results in parts per million (ppm): Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids: Calculated (Sum of determined constituents)	Dissolved solids: Residue on evaporation at 180°C	Hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$	Percent sodium	Specific conductance (micromhos at 25°C)	pH	Analyzing laboratory and sample number
U S Public Health Service drinking-water standards (1962)					0.3							250	250	0.7	45		500	500						
6N/11W-19K1	5-10-49	473								152	0		30											FC 1419
	9-14-49	473			0	40	17	27		148	0	71	24		0	.5	252	198	170	48	26		7.0	FC 1557
	2- 1-50	473								140	0		8											FC 1664
	6-28-50	473				96	13	0		140	0	66	20		0	.5	268	334	293	172	0		9.6	FC 1965
	8-13-51	473			0	56	13	53		148	0	153	20		5		373	244	193	72	37		6.5	FC 2981
21C1	9-15-50	350				48	12	b26		122		45	53		2.1	0	246		169	69	25		7.9	DWR 967
21M1	6- 3-53	589	68			34	4.9	20	2.0	137	0	18	9.6	.1	2.5	0	158	164	105	0	29	258	7.6	DWR P-683
	10-19-54	589	72			34	4.0	20	1.7	134		23	7.0	.4	2.4	.10	159	177	101	0	29	250	7.8	DWR R-391
	12-13-56	589		22		34	8.0	24	2.0	150	0	27	13	.1	4.2	.05	208	235	118	0	30	325	7.6	DWR T-5326
	9- 4-58	589	72	25		34	3.0	17	1.8	134	0	16	7.0	.1	5.0	.04	175	161	97	0	27	272	8.2	DWR R-2212
	6- 9-61	589	70							144	0		7.0						101	0		284	7.1	DWR 12878
	7-30-63	589		21		33	3.8	23	1.8	139	0	20	6.0	.2	2.4	.03	179	180	98	0	33	295	8.0	DWR L-4915
	3-27-64	589		19		33	4.5	24	1.9	145	0	24	7.1	.2	2.6	.05	187	184	101	0	33	300	7.8	DWR L-6525
6N/12W-24A1	8- 4-55	502				29	8.3	31		151	0	28	24		0		199		106	0	35	362	7.9	FC 4679
24F1	8-18-60	610	76	25		28	7.0	35	1.2	146	0	22	21	.2	5.0	.03	216	192	99	0	43	350	7.4	DWR R-3508
	8-22-60	610				25	7.0	42		156	0	26	21		0		198		91	0	50	337	8.0	FC 6765
24L2	9-14-46					36	13	b13		136	0	31	20		0	.5	180	158	143	32	16		8.7	FC 1142
7N/11W-3M1	8-18-60		70	24		54	9.0	18	2.3	186	0	24	16	.2	6.8	.03	246	243	172	20	18	418	7.4	DWR R-3507
	4-17-61			26		62	10	17	2.3	198	0	25	20	.2	4	.01	274	278	196	33	16	465	7.6	DWR R-3866
7N/12W-34A2	8-15-50	400				23	7.0	b29		122		15	4.0		1.0	.01	139		86	0	42	230	8.3	DWR 968
34E1	3-11-57	555	69			14	1.0	40	.9	131	0	19	4.0	.7	1.9	.14	147	166	39	0	68	240	7.9	DWR R-1497
	9- 5-58	555	75	26		27	5.0	40	1.1	134	0	30	7.0	.3	3.5	.11	196	199	88	0	42	313	8.1	DWR R-2225
	7- 6-59	555	74							146	0		10						81	0		305	7.3	DWR 10414
	4-13-62	555	73	22		17	4.0	37	.9	130	0	16	8.0	.4	0	0	169	186	59	0	58	260	7.7	DWR R-2575
	7-30-63	555	73	21		22	0	38	.9	128	0	19	5.3	.2	1.9	.08	171	158	55	0	59	270	8.1	DWR L-4813
35M1	6- 3-53	540				14	1.6	44	.8	132	0	15	5.3	.2	4.3	0	150	176	42	0	69	276	7.9	DWR P-682
	2-17-55	540				10	2.0	38	.8	124	0	15	2.0	.4	0	.02	129	158	33	0	71	236	7.9	DWR 5367
	9- 5-58	540		20		15	3.0	36	1.0	124	0	15	9.0	.6	2.0	.02	163	180	50	0	60	246	7.9	DWR 9446
	6-11-61	540		24		8.9	5.6	38	.6	124	0	13	6.0	.3	2.2	.03	160	133	45	0	64	248	7.2	DWR 12881
	7-30-63	540		[illegible]		21	2.8	40	.8	120	0	17	15	.2	5.3	.08	177	148	64	0	54	280	7.6	DWR L-4814
	3-27-64	540		[illegible]		14	.6	41	.9	123	0	16	4.3	.2	1.7	.11	159	182	37	0	70	250	8.0	

APPENDIX F

SELECTED RESULTS FROM PREVIOUS INVESTIGATIONS

RESULTS FROM PREVIOUS INVESTIGATIONS

AT IRP SITE 1-FCD2

FUEL-CONTAMINATED DITCH

LOCKHEED-CALIFORNIA COMPANY

A DIVISION OF LOCKHEED CORPORATION

PALMDALE, CALIFORNIA 93550

21 October 1982

California Regional Water Quality Control Board
Lahouton Region (6)
15371 Bonaza Road
Victorville, California 92392

FCC #10164

Attention: Nelson Wong

Subject: REPORT OF FUEL CONTACT ANALYSIS OF SOIL AT SITE 2 A.F. PLANT 42

Attachments: I) Report of Fuel Content Analysis of Soil dated 9 August 1982 from Osborne Labs to Lockheed

II) Supplementary Report (To the Report of Fuel Content Analysis of Soil) dated 6 October 1982 from Osborne Labs to Lockheed

III) Site 2 Plot Plan Approximate Sample Location

Attachments I and II comprise the lab report which was submitted, in preliminary form, at our meeting 3 August 1982. Attachment II is a supplement to Attachment I. After receiving and reviewing the lab report (Attachment I) in August 1982, I requested that Osborne Labs make a supplement (Attachment II) to it which I received on 20 October 1982. I requested the supplement based on the apparent difficulty that was encountered by everyone at that August meeting in understanding the report. The quantitative information in both the report and the supplement is the same. However the supplement contains the percentage by weight of fuel in the soil sample.

The supplement in addition to containing more technical information also has more detail on the standards used to develop the test methods. In addition to the standards detailed in the supplement, the Osborne Labs chemist, David Ramirez, consulted with Tom Maricich, a chemistry professor at Cal State University, Long Beach (PHd in chemistry), for help in establishing the methods used to conduct the lab tests. Tom Maricich based his lab test recommendations primarily on two sources. The first source was Chapter 4 "Simulated Distillation by Gas Chromatography" by R. D. Butler, Fuels Branch, Air Force Aero Propulsion Lab, Wright-Patterson Air Force Base, Ohio from the book Chromatography in Petroleum Analysis published by Marcel Dekker, Inc. The second source was the Proceedings of the Joint Conference on Prevention and Control of Oil Spills held in March 1973 in Washington, D.C. jointly sponsored by the American Petroleum Institute, the EPA, and the U.S. Coast Guard from which two articles were used. One was "Petroleum Residues in the Sargasso Sea and on Bermuda Beaches" by B. F. Morris, Bermuda Biological Station for Research, St. George's West, Bermuda, and J. N. Butler, Division of Engineering and Applied Physics Harvard University, Cambridge, Massachusetts; the other was "The Fate of a Bunker Fuel in Beach Sand" by H. E. Guard and A. B. Cobet of the Naval Biomedical Research Laboratory School of Public Health University of California, Berkeley.

The results of the lab analysis indicate that eight of the sample hole locations (#1, 2, 5, 7, 8, 9, 10, 12) will have to be resampled by a drill rig capable of sampling to a greater depth than 50' which was the limit of the drill rig used for this report. The next largest drill rig has a capability of drilling to 200' without the use of drilling mud (which would destroy the value of any samples taken from this type of drilling). The cost to take these additional samples including the lab analysis would be $45,000. At the August meeting you expressed some disatisfaction with the method of obtaining samples from the sample holes. To avoid misunderstandings as to the sampling method, the number of samples to be taken, and the location of the sample holes, I do not want to initiate the next phase of sampling without your written comments on this report and your requirements for the new samples to be taken. Additionally, without something from you in writing concerning this it will be most difficult for me to justify to my management and obtain from them the $45,000 necessary to accomplish the next phase of sampling.

I have received no reply from the Air Force on the inquiries I made earlier this year about the funding for the waste fuel tanks at Site 2. It is very doubtful that this project will be funded this year. I will resubmit it for next year when the budget call comes in December. In the meantime we are continuing our interim measures to prevent further contamination of the soil from leaked or spilled aircraft fuel.

If further information is required, please contact me at (805) 272-2480.

Sincerely,

LOCKHEED-CALIFORNIA COMPANY

P. L. Coupland
Government Property
Facilities Administration

PLC:pjb

ATTACHMENT I

Osborne LABORATORIES. INC.

[illegible] CLARK STREET • SANTA FE SPRINGS, CALIFORNIA [illegible]
[illegible] • [illegible] • [illegible]

Report to:	Lockheed California Company Dept. 72-55, Bldg. 420, Site 5 1011 Lockheed Way Palmdale, California 93250
Attention:	Mr. Phil Coupland
Project:	FUEL SPILL CLEANUP SITE 2 AIR FORCE PLANT (AFP) #42
Subject:	Report of Fuel Content Analysis of Soil
Laboratory Number:	12-06-026
Date:	August 9, 1982
Specification:	Client

At the request of Mr. Phil Coupland of Lockheed California Company, our laboratory sampled soil from the AFP Site 2 (fuel spill area) at 12 locations and performed fuel content analysis on these specimens. A summary of test results is as follows:

Extraction Method for Soil Samples

A representative soil sample (50g) from the drilling samples was extracted with 100 ml of methylene chloride solvent. The extraction method involved first suspension of the sample in about 50 ml of solvent and allowing the mixture to stand overnight. This was then distilled to 200°C. The balance of the solvent was added to the residue in the distilling flask for three successive distillations to remove as much of the volatiles as possible. The distilled extracts separated into solvent and water layers. The water was separated (approximately 5 to 10 ml per sample) and constituted approximately 10 to 20 percent of the soil samples. The solvent layers were filtered through filter paper to remove the cloudiness and the volume was brought up to 100 ml for gas chromatography analysis.

Extraction Efficiency Compared with Standards

Analysis of the samples for volatile hydrocarbons by gas chromatography was based upon chromatography patterns produced from standards of jet fuels (JP4, JP7, and JPTS) made up in the same solvent (methylene chloride). The efficiency of the extraction of jet fuels from soils was determined by adding specific amounts of jet fuel to control samples of soil known not to be contaminated (by location of drilling and lack of odor). The efficiency of the extraction method was determined to be 98 ± 1%. Results reported are corrected to 100% recovery.

Composition of Jet Fuel Types in Samples

Identification of the type(s) of jet fuel in each samples was based upon the fingerprint pattern of the components of each fuel shown by gas chromatography. JP4 is characterized by a higher level of lower boiling components, while JP7 is characterized by a narrower range of higher boiling components. JPTS has a pattern intermediate between these.

Definitive assignments of the soil extracts could be hampered by partial evaporation of the more volatile fractions before passing into the soil. Furthermore, since each fuel has many of the same components, but in different concentrations, mixtures of different types of jet fuels would be difficult to assign. Assignment is also difficult for samples containing low concentrations.

Organic Components Other Than Jet Fuel in Samples

An additional organic (Combustible) component was detected in the soil samples. It is not known whether it is of natural origin. Its concentration was only noticed in samples containing less than 80 ppm of jet fuel.

Analysis results are tabulated on the following pages.

If you have any questions in this matter, please call us.

Respectfully submitted,
OSBORNE LABORATORIES, INC.

Edward V. Regan
Laboratory Supervisor

EVR/km:2

ANALYSIS RESULTS

Hole Number	Drilling Depth In Feet	Volatile Organics in Percent	Type of Jet Fuel	Approximate Amount of Jet Fuel In: mg/50g of soil	Comments
1	Surface	2.654	JP7	~70	
	10	2.902	JP7	~50	
	20	9.131	JP7	>700	
	30	9.596	JP7	~70	
	40	9.106	JP7	~700	
	50	7.754	JP7	~70	
2	Surface	9.823	JPTS	>70	Trace of JP4
	10	7.179	JPTS	70	Trace of JP4
	20	9.253	*	<35	*Concentration too low for I.D.
	30	8.283	JPTS	<35	
	40	9.122	JPTS	35	
	50	8.487	JPTS	70	
3	Surface	2.622	-	-	Uncontaminated Area
	10	8.783	-	-	
	20	7.683	-	-	
	30	6.900	-	-	
	40	6.384	-	-	
	50	6.013	-	-	
4	Surface	3.282	-	-	Uncontaminated Area
	10	9.082	-	-	
	20	10.821	-	-	
	30	7.852	-	-	
	40	8.845	-	-	
	50	6.528	-	-	
5	Surface	9.912	JPTS	70	Traces of JP4
	10	7.489	*	<35	*No I.D. of Type
	20	9.805	*	<<35	
	30	8.625	*	<35	
	40	8.276	*	<<35	
	50	7.2704	*	<35	

Continued on the following page.

Lockheed California Company
Page Four - Lab. No. 12-06-026

ANALYSIS RESULTS

Hole Number	Drilling Depth in Feet	Volatile Organics in Percent	Type of Jet Fuel	Approximate Amount of Jet Fuel In: mg/50g of Soil	Comments
6	Surface	2.823	JP4, JP7	<35	
	10	6.919	None Detected	<<35	
	20	7.698	None Detected	<<35	
	30	7.756	None Detected	<35	
	40	8.666	None Detected	<35	
	50	6.965	None Detected		
7	Surface	8.384	JP7	>70	
	10	10.837	JP7	>700	
	20	11.734	JP7	~700	
	30	9.297	JP7	~70	
	40	9.257	JP7	<70	
	50	10.118	*	<35	*No I.D. of type
8	Surface	6.936	JPTS	>700	
	10	9.173	JPTS, JP7	>700	
	20	6.824	JPTS, JP7	~35	
	30	8.325	JPTS, JP7	~70	
	40	7.846	JPTS, JP7	~70	
	50	9.527	JPTS	~70	
9	Surface	11.262	JPTS	>700	
	10	8.103	JPTS	>>700	
	20	9.546	JPTS	>70	
	30	10.323	JPTS	~70	
	40	10.926	JPTS	~35	
	50	11.356	JPTS	~35	
10	Surface	5.309	JP4, JP7	<700	
	10	8.799	JP4, JP7	>>700	
	20	10.395	JP7	>700	
	30	9.983	JP7	<700	
	40	9.995	JP7	~70	
	50	11.395	*	<35	*No I.D. of type

Continued on the following page.

Lockheed California Company
Page Five - Lab. No. I2-06-026

ANALYSIS RESULTS

Hole Number	Drilling Depth in Feet	Volatile Organics in Percent	Type Of Jet Fuel	Approximate Amount of Jet Fuel in: mg/50g of Soil	Comments
11	Surface	9.715	JPT8	>700	
	10	7.679	*	<35	*No I.D. of type
	20	7.388	*	<35	*No I.D. of type
	30	8.052	JPT8	~35	
	40	8.141	None Detected	-	
12	Surface	7.536	JPTS	>700	
	10	6.392	JPT8	<35	
	20	9.072	*	<<35	*No I.D. of type
	30	9.313	JPT8	<35	
	40	8.916	*	<<35	*No I.D. of type

SYMBOLS USED IN REPORT

<< = Much less than
~ = Approximately the same as
>> = Much greater than
> = Greater than

Osborne LABORATORIES. INC.
12060 CLARK STREET • SANTA FE SPRINGS, CALIFORNIA 90670
(213) 685-7901 • (213) 944-6438 • (714) 523-1941

ATTACHMENT II

Report to:	Lockheed California Company Department 72-55, Building 420, Site 5 1011 Lockheed Way Palmdale, California 93250
Attention:	Mr. Phil Coupland
Reference:	Laboratory Number 12-06-026 (August 9, 1982)
Project:	FUEL SPILL CLEANUP, SITE 2 AIR FORCE PLANT (AFP) #42
Subject:	Supplementary Report
Date:	October 6, 1982

Dear Mr. Coupland:

The following information addends our original report per your request.

A. Volatile Contaminants in Percent.

For this partial analysis, we followed the ASTM D-3607 Standard Method for removing Volatile Contaminants from used engine oils by stripping. In this special application, we used this method for "Volatile Contaminants in Soil".

The tabulations in this column include: All the volatiles removed under 90C with a nitrogen flow of 200-300 cc/min. for a period of 4.5 hours.

The composition of the Volatile Contaminants was determined on a few of the more highly contaminated soil samples (such as hole #8 surface) the volatiles were greater than 99% water.

B. Approximate Amount of Jet Fuel in mg/50g of Soil

In addition to the mg. of jet fuel per 50g of soil, the results have been expressed in percent by weight of jet fuel present in the soil sample.

Thank you for the opportunity to be of service in this project. Please contact us at your convenience should you require additional information.

Respectfully submitted,
OSBORNE LABORATORIES, INC.

Edward V. Regan
Laboratory Supervisor

Attachment II

EVR/lm Attachments:

Lockheed Ca..cornia Company
Page Two - Lab. No. 12-06-026 (Addendum)
ANALYSIS RESULTS

Hole Number	Drilling Depth In Feet	Volatile Contaminants in Percent (greater than 99% water)	Type of Jet Fuel	Approximate Amount of Jet Fuel in Percent	mg/50g of Soil	Comments
1	Surface	2.654	JP7	0.14	70	
	10	2.902	JP7	0.10	50	
	20	9.131	JP7	1.4 to 1.6	700 to 800	
	30	9.596	JP7	0.14	70	
	40	9.106	JP7	1.4	700	
	50	7.754	JP7	0.14	70	
2	Surface	9.823	JPTS	0.14 to 0.18	70 to 90	Trace of JP4
	10	7.179	JPTS	0.14	70	Trace of JP4
	20	9.253	*	0.04 to 0.06	20 to 30	*No ID of type
	30	8.283	JPTS	0.06 to 0.07	30 to 35	
	40	9.122	JPTS	0.07	35	
	50	8.487	JPTS	0.14	70	
3	Surface	2.622	-	-	-	Uncontaminate Area
	10	8.783	-	-	-	
	20	7.683	-	-	-	
	30	6.900	-	-	-	
	40	6.384	-	-	-	
	50	6.013	-	-	-	
4	Surface	3.282	-	-	-	Uncontaminate Area
	10	9.082	-	-	-	
	20	10.821	-	-	-	
	30	7.852	-	-	-	
	40	8.845	-	-	-	
	50	6.528	-	-	-	
5	Surface	9.912	JPTS	0.14	70	Traces of JP4
	10	7.489	*	0.06 to 0.07	30 to 35	*No ID of type
	20	9.805	*	0.04 to 0.06	20 to 30	*No ID of type
	30	8.625	*	0.06 to 0.07	30 to 35	*No ID of type
	40	8.276	*	0.04 to 0.06	20 to 30	*No ID of type
	50	7.270	*	0.06 to 0.07	30 to 35	*No ID of type

Continued on the following page.

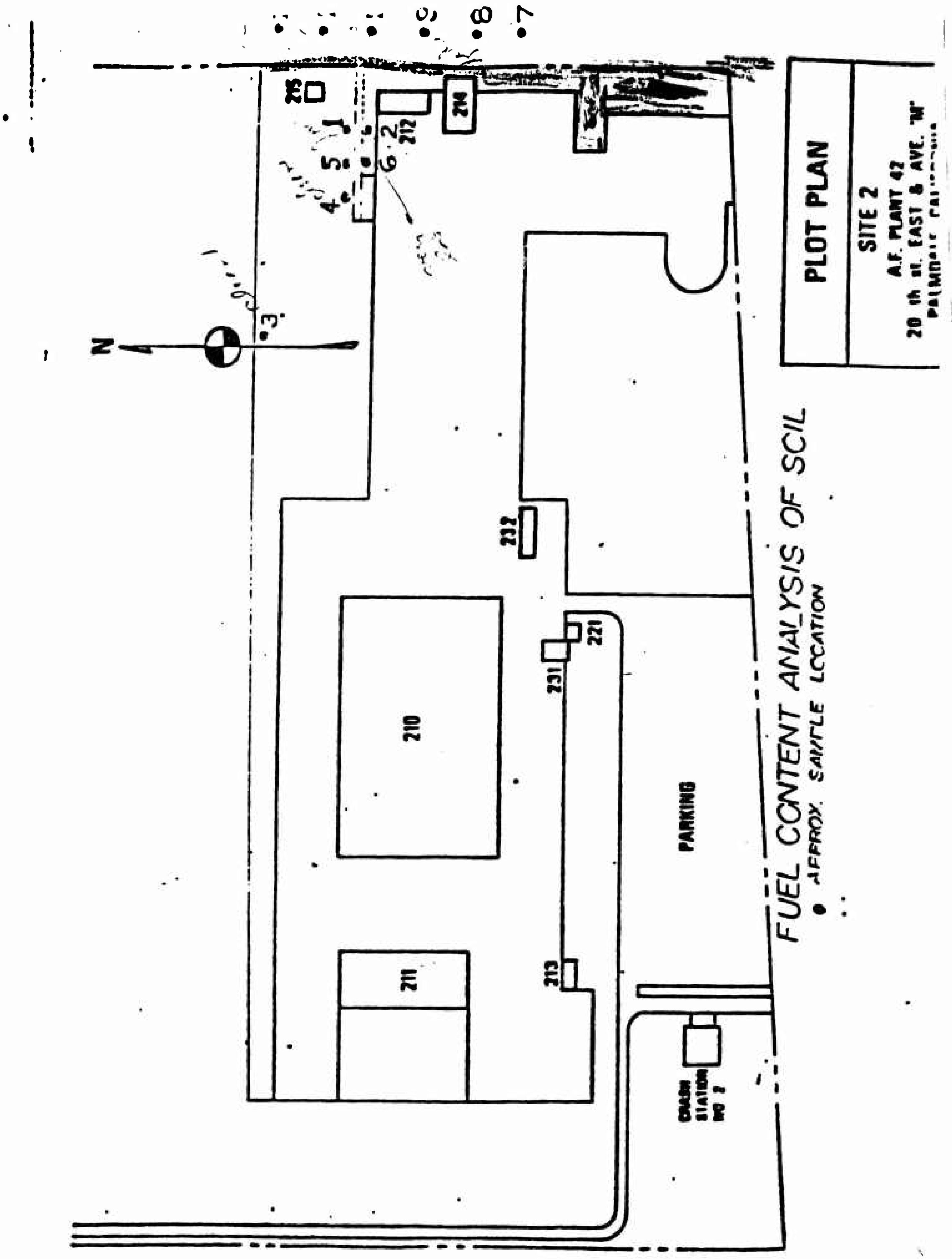
Lockheed Ca   ornia Company
Page Three - Lab. No. 12-06-026 (Addendum)
ANALYSIS RESULTS

Hole Number	Drilling Depth In Feet	Volatile Contaminants in Percent (greater than 99% water)	Type of Jet Fuel	Approximate Amount of Jet Fuel in Percent	mg/50g of Soil	Comments
6	Surface	2.823	JP4, JP7	0.06 to 0.07	30 to 35	
	10	6.919	*	0.02 to 0.04	10 to 20	*No ID of type
	20	7.698	*	0.03 to 0.06	15 to 30	*No ID of type
	30	7.756	*	0.04 to 0.06	20 to 30	*No ID of type
	40	8.666	*	0.06 to 0.07	30 to 35	*No ID of type
	50	6.965	None Detected	-	-	
7	Surface	8.384	JP7	0.20 to 0.30	100 to 150	
	10	10.837	JP7	1.4 to 1.6	700 to 800	
	20	11.734	JP7	1.4 to 1.6	700 to 800	
	30	9.297	JP7	0.14	70	
	40	9.257	JP7	0.10 to 0.14	50 to 70	
	50	10.118	*	0.06 to 0.07	30 to 35	*No ID of type
8	Surface	6.936	JPT8	1.4 to 1.6	700 to 800	
	10	9.173	JPT8, JP7	1.4 to 1.6	700 to 800	
	20	6.824	JPT8, JP7	0.07	35	
	30	8.325	JPT8, JP7	0.14	70	
	40	7.846	JPT8, JP7	0.14	70	
	50	9.527	JPT8	0.14	70	
9	Surface	11.262	JPT8	1.4 to 1.6	700 to 800	
	10	8.103	JPT8	1.6 to 1.8	700 to 800	
	20	9.546	JPT8	0.14 to 0.15	70 to 75	
	30	10.323	JPT8	0.14	70	
	40	10.926	JPT8	0.07	35	
	50	11.356	JPT8	0.07	35	
10	Surface	5.309	JP4, JP7	0.20 to 0.30	100 to 150	
	10	9.799	JP4, JP7	1.6 to 1.8	800 to 900	
	20	10.395	JP7	1.4 to 1.6	700 to 800	
	30	9.983	JP7	0.20 to 0.30	100 to 150	
	40	9.995	JP7	0.14	70	
	50	11.395	*	0.03 to 0.07	15 to 35	*No ID of type

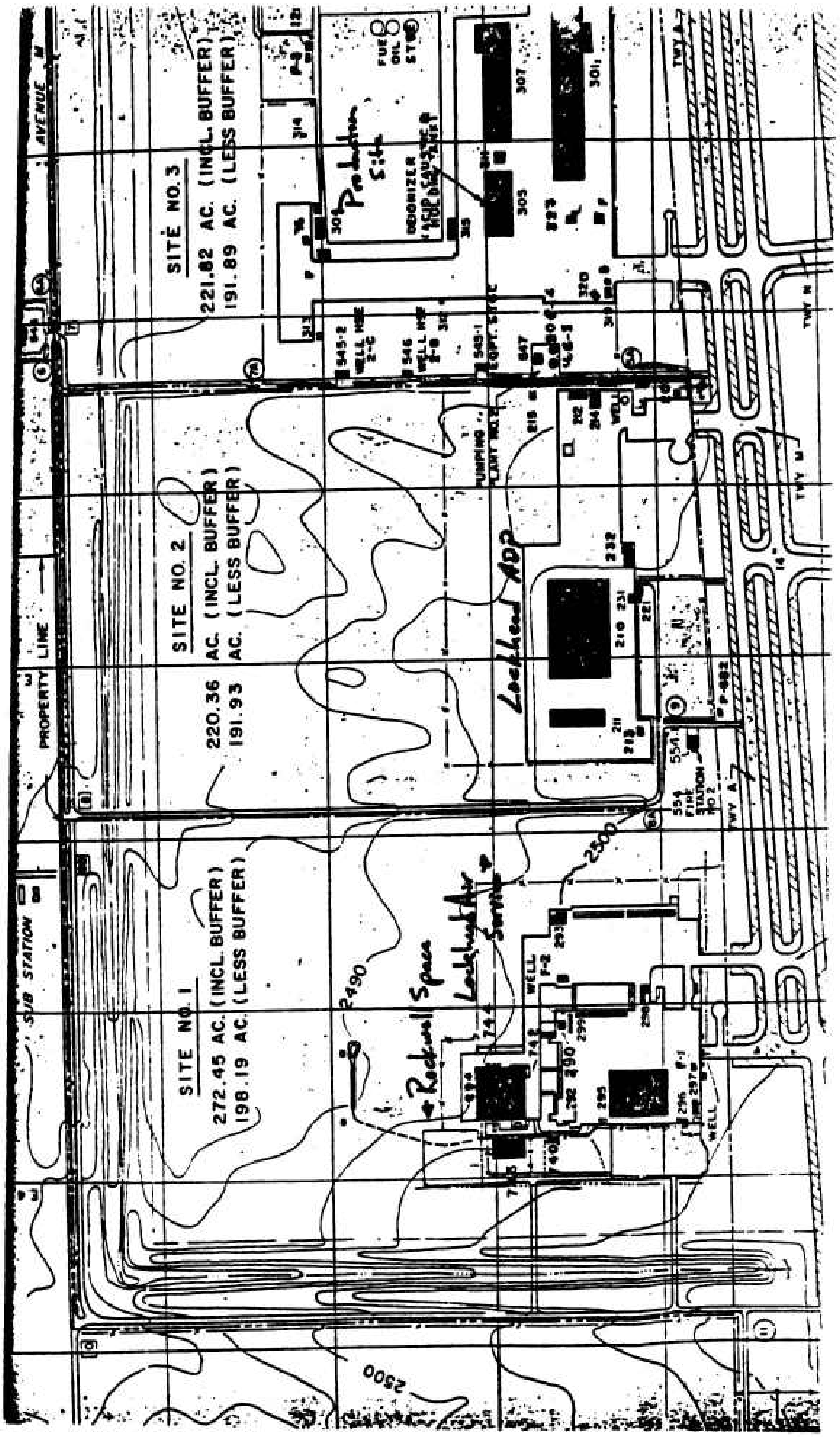
Continued on the following page.

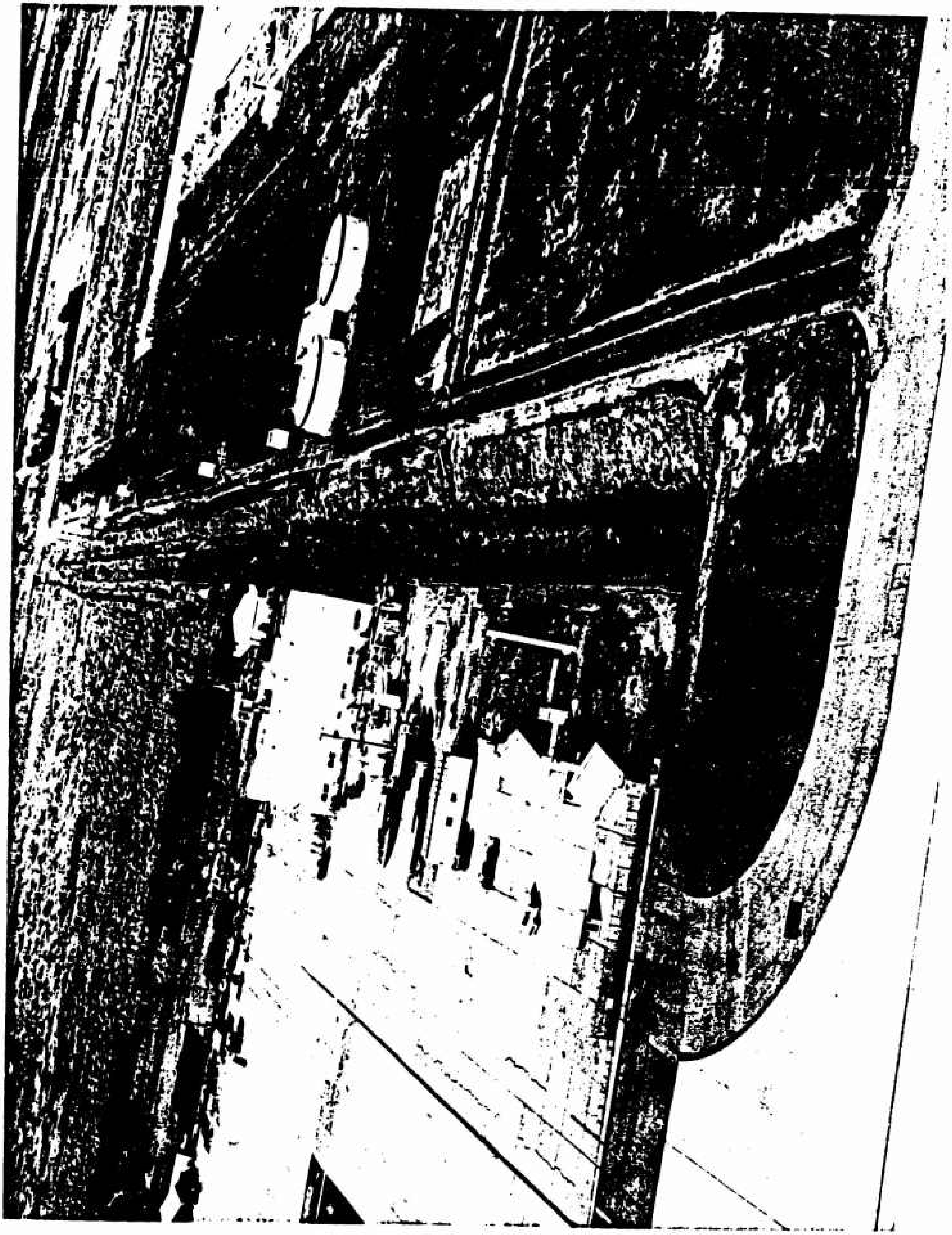
Lockheed California Company
Page Four - Lab. No. 12-06-026 (Addendum)
ANALYSIS RESULTS

Hole Number	Drilling Depth in Feet	Volatile Contaminants in Percent (greater than 99% water)	Type of Jet Fuel	Approxiamte Amount of Jet Fuel in Percent	mg/50g of Soil	Comments
11	Surface	9.715	JPTS	1.4 to 1.6	700 to 800	
	10	7.679	*	0.04 to 0.07	20 to 35	*No ID of type
	20	7.388	*	0.04 to 0.07	20 to 35	*No ID of type
	30	8.052	JPTS	0.07	35	
	40	8.141	None Detected	-	-	
12	Surface	7.536	JPTS	1.4 to 1.6	700 to 800	
	10	6.392	JPTS	0.04 to 0.07	20 to 35	
	20	9.072	*	0.020 to 0.04	10 to 20	*No ID of type
	30	9.313	JPTS	0.04 to 0.07	20 to 35	
	40	8.916	*	0.020 to 0.04	10 to 20	*No ID of type



Attachment III


SITE NO. 3
221.82 AC. (INCL. BUFFER)
191.89 AC. (LESS BUFFER)
SITE NO. 2
220.36 AC. (INCL. BUFFER)
191.93 AC. (LESS BUFFER)
SITE NO. 1
272.45 AC. (INCL. BUFFER)
198.19 AC. (LESS BUFFER)
AVENUE "M"
PROPERTY LINE
SUB STATION
FUEL OIL STG
DEIONIZER
Production Site
Lockheed ADP
Rockwell Space
Lockheed Air Service
FIRE STATION NO 2
2490
2500



RESULTS FROM PREVIOUS INVESTIGATIONS AT

IRP SITE 16-EVP3 EVAPORATION PONDS

REFERENCE
649-RSS-85-244

Buena Engineers, Inc.

42326 - 10th STREET WEST • P.O. BOX 2866 • LANCASTER, CALIFORNIA 93534 • PHONE (805) 948 7538

July 11, 1985 B-2378-L01

Rockwell International
North American Aircraft Operations
P.O. Box 92098
Los Angeles, California 90009

ATTENTION: Carol Brophy

Subject: **Soil Sampling**
Site 3, Plant 42
Palmdale, California

On April 24, 1985 Buena Engineers, Inc. drilled two exploratory soil borings at the above referenced site. Boring locations were determined for our drill crew by Mr. Bob Melvold of Rockwell International (See Figure 1). Boring 1 was located at a previous waste site. (plastic liners exposed at the surface indicate boundaries of the abandoned storage pits). Boring 2 which was used for a background check, is located in the open field approximately 1,100 feet northeast of the paint hangar. The purpose of these borings was to obtain soil samples to be tested for contaminants listed in California Title 22, Chapter 30, Division #66680, specifically for those contaminants that may be present due to chemical plating operations such as nickle cyanide. All samples were taken using the standard penetration sampler (SPT, ASTM D 1586-84). A representative of BTC Laboratories handled all sampling. Samples were obtained at the surface, 3, and 5 feet , and at five foot intervals thereafter. Soils ranged from clay to silty-clay sands to relatively clean sands and gravels. Soils were moist, however no free ground water was encountered in any of the borings. A copy of the boring logs are attached for your use. Test results indicate the soils tested contain a non-hazardous amount of contaminants as defined by Title 22. Test results are attached.

ENGINEERING OFFICES: VENTURA (805) 642-6727 LANCASTER (805) 948-7538

FIELD OFFICES THOUSAND OAKS SANTA BARBARA PALM SPRINGS SAN LUIS OBISPO

We trust this is the information you requested. If you need more information or clarification of the above information, please contact the undersigned.

Respectfully submitted,

BUENA ENGINEERS, INC.

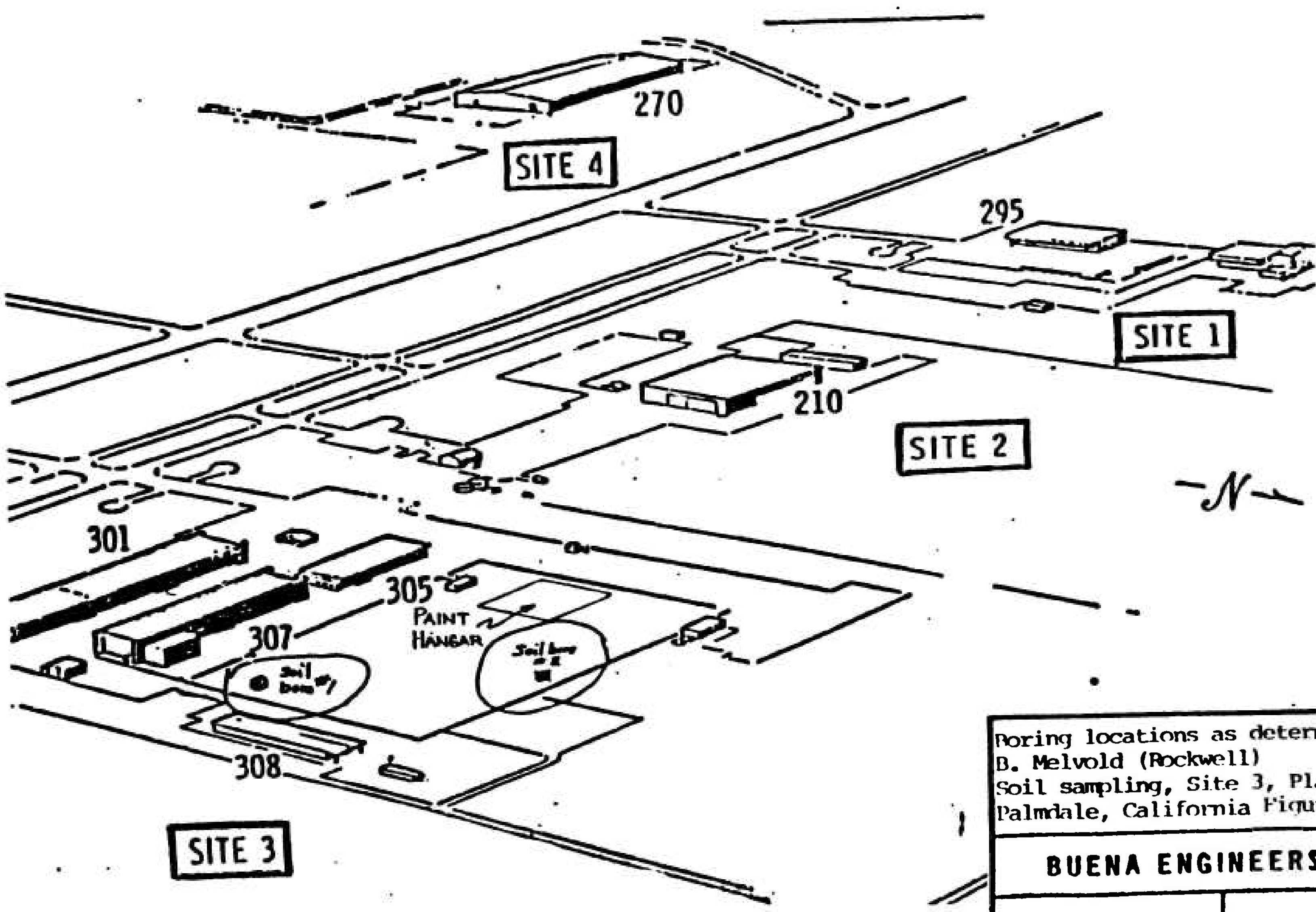
R. Layne Richins
Staff Geologist

Reviewed:

Michael V. Smith
R.G. #3273
C.E.G. #956

RLR/MVS/sam

cc: 4 - Client
1 - file



No Scale

Boring locations as determined by B. Melvold (Rockwell)
Soil sampling, Site 3, Plant 42
Palmdale, California Figure 1

BUENA ENGINEERS, INC.

DATE: 6-25-85 | FILE NO. B-2378-I01

BUENA ENGINEERS, INC.

LOG OF BORING

FOR

DATE 4-24-85 BORING NO 1 LOCATION Per Plan

DEPTH FEET	DESCRIPTION	UNIT DRY WT LB/CU FT	MOISTURE PERCENT	SOIL TYPE	Blows/Foot* Penetration	REMARKS AND ANALYSIS (% SAND - % SILT - % CLAY)
0	Tan to brown, silty, very fine to medium sand with coarse sand, dry.			SM	18	*ASTM D 1586-84
	Brown, clay, very fine to medium sand, moist.			SC	5	Gray material - See attached soil analysis results.
5	Brown, silty fine to medium sand with clay, moist.			SM	22	
				SC		Gray material - See attached soil analysis results
10	Brown, silty, fine to medium sand, with slight clay, moist.			SM	23	No pit liner found.
				SC SM		
15	Brown silty, very fine to medium sand with clay, moist.				19	
				CL		
20	Brown, slightly silty, clay, moist				14	
25	Slightly gray to brown, silty, clay moist.				28	
				SC/CL		
30	Brown, very clay, very fine to medium sand, very moist.				34	
35	Brown, very clay, very fine to medium sand, saturated at sampler tip.				27	
40	Brown, silty, very fine to medium sand, with ¼-3/8" gravel, moist.			SM	53	
				SP		Stratification lines represent approximate boundaries between soil types. The actual transition may be gradual.
45	Gray to brown, medium to coarse sand with, slight ¼" gravel, very moist.				83	Boring terminated at 51 feet. No free ground water encountered. No caving.
50	Gray to brown fine to medium sand with coarse sand, moist				84	

FORM 401

BUENA ENGINEERS, INC.

LOG OF BORING

FOR

DATE 4-24-85 BORING NO 2 LOCATION Per Plan

DEPTH FEET	SYMBOL	CORE	DESCRIPTION	UNIT DRY WT LB/CU FT	MOISTURE PERCENT	SOIL TYPE	Blows/Foot* Penetration	REMARKS AND ANALYSIS (% SAND - % SILT - % CLAY)
0			Brown, silty, fine to medium sand with coarse sand, slightly moist.			SM	10	*ASTM D 1586-84
			Brown slightly silty, clay with, very fine sand, moist.			CL	26	See attached soil analysis results.
5			Brown, clay, fine to medium sand, with slight silt, slightly moist.				31	
10			Brown very fine to fine sand with medium sand, slightly moist.			SP	22	See attached soil analysis results.
15			Brown, silty, fine sand with medium sand, slightly moist			SM	13	
20			Brown clay, fine sand with silt, moist.			SC	14	
25			Brown, very fine to fine sand with medium sand, slightly moist.			SP	35	
30			Brown clay, fine sand with medium sand, moist.			SC	19	Slight cave in @ 29 feet.
35			Brown clay, fine sand with medium sand, moist.				15	
40			Brown, very clay, fine sand with medium, moist.			SC/CL	79	Stratification lines represent approximate boundaries between soil types. The actual transition may be gradual.
45			Dark gray, fine to medium sand, with coarse sand, and ¼-3/8" gravel, moist.			SP	110/15"	Boring terminated at 51 feet No free ground water encountere Caving at 29 feet.
50			Brown to gray fine to coarse sand, with very fine sand moist.				63	

IDENTIFICATION AND ANALYSIS OF HAZARDOUS MATERIAL
METAL ANALYSIS SUMMARY

SAMPLE: Plating Waste Dump Site (Rockwell) - 3 foot level Boring #1
DATE RECEIVED: 4-24-85
DATE OF ANALYSIS: 4-29-85

Hazardous Characteristic	Results (in mg/L for metals)
Aquatic Toxicity	-
Flammability	-
Reactivity	Cyanide 0.05 mg/kg
Corrosivity	-

Metals:	Total (mg/kg)	WET (mg/L)	Allowable TTLC (mg/kg)	Allowable STLC (mg/L)
Antimony	<2	-	500	15
Arsenic	1.0	-	500	5
Barium	140	8.0	10,000	100
Beryllium	0.5	-	75	0.75
Cadmium	0.5	-	100	1.0
Chromium (3+)	45.0	-	2500	560
Chromium (6+)	<1	-	500	5
Cobalt	6.0	-	8000	80
Copper	29.0	0.24	2500	25
Fluoride	<10	-	18,000	180
Lead	4.0	-	1000	5
Mercury	<0.05	-	20	0.2
Molybdenum	<2	-	3500	350
Nickel	280	10.5	2000	20
Selenium	<0.05	-	100	1.0
Silver	<0.2	-	500	5.0
Thallium	<2	-	700	7.0
Vanadium	95	0.5	2400	24
Zinc	100	-	5000	250

"<" denotes less than or none detected.

... AND ANALYSIS OF HAZARDOUS MATERIAL

METAL ANALYSIS SUMMARY

SAMPLE: Plating Waste Dump Site (Rockwell) - 10 foot level BORING #1
DATE RECEIVED: 4-24-85
DATE OF ANALYSIS: 4-29-85

Hazardous Characteristic	Results
Aquatic Toxicity	-
Flammability	-
Reactivity	Cyanide <0.05 mg/kg
Corrosivity	-

Metals:	Total (mg/kg)	WET (mg/L)	Allowable (mg/L) STLC
Antimony	-	-	-
Arsenic	-	-	-
Barium	-	4.0	100
Beryllium	-	-	-
Cadmium	-	-	-
Chromium (3+)	-	-	-
Chromium (6+)	-	-	-
Cobalt	-	-	-
Copper	-	0.16	25
Fluoride	-	-	-
Lead	-	-	-
Mercury	-	-	-
Molybdenum	-	-	-
Nickel	-	0.45	20
Selenium	-	-	-
Silver	-	-	-
Thallium	-	-	-
Vanadium	-	1.0	24
Zinc	-		

SAMPLE: Background Sample near dump site - 3 foot level *Boring #2*
DATE RECEIVED: 4-24-85
DATE OF ANALYSIS: 4-29-85

Hazardous Characteristic	Results (in mg/L for metals)
Aquatic Toxicity	-
Flammability	-
Reactivity	0.03 mg/kg
Corrosivity	-

Metals:	Total (mg/kg)	WET (mg/L)	Allowable TTLC(mg/kg)	Allowable STLC(mg/L)
Antimony	<2	-	500	15
Arsenic	0.5	-	500	5
Barium	120	4.0	10,000	100
Beryllium	0.5	-	75	0.75
Cadmium	0.5	-	100	1.0
Chromium (3+)	45	-	2500	560
Chromium (6+)	<1	-	500	5
Cobalt	7.0	-	8000	80
Copper	27.5	0.18	2500	25
Fluoride	<10	-	10,000	180
Lead	4.0	-	1000	5
Mercury	<0.05	-	20	0.2
Molybdenum	<2	-	3500	350
Nickel	38	0.36	2000	20
Selenium	<0.5	-	100	1.0
Silver	<0.2	-	500	5.0
Thallium	<2	-	700	7.0
Vanadium	95	1.0	2400	24
Zinc	70	-	5000	250

IDENTIFICATION AND ANALYSIS OF HAZARDOUS MATERIAL
METAL ANALYSIS SUMMARY

SAMPLE: Background Sample near dump site - 10 foot level *Boreing #2*
DATE RECEIVED: 4-24-85
DATE OF ANALYSIS: 4-29-85

Hazardous Characteristic	Results
Aquatic Toxicity	-
Flammability	-
Reactivity	Cyanide <0.05 mg/kg
Corrosivity	-

Metals:	Total (mg/kg)	WET (mg/L)	Allowable STLC (mg/L)
Antimony	-	-	-
Arsenic	-	-	-
Barium	-	4.0	100
Beryllium	-	-	-
Cadmium	-	-	-
Chromium (3+)	-	-	-
Chromium (6+)	-	-	-
Cobalt	-	-	-
Copper	-	0.06	25
Fluoride	-	-	-
Lead	-	-	-
Mercury	-	-	-
Molybdenum	-	-	-
Nickel	-	<0.05	20
Selenium	-	-	-
Silver	-	-	-
Thallium	-	-	-
Vanadium	-	1.0	24
Zinc	-	-	-

DEPARTMENT OF THE AIR FORCE
DET 2, AIR FORCE CONTRACT MANAGEMENT DIVISION (AFSC)
PRODUCTION FLIGHT TEST INSTALLATION, AF PLANT 42
2503 EAST AVE P, PALMDALE, CA 93550

REPLY TO ATTN OF: DE

4 Feb 85

SUBJECT: Installation Restoration Program, Evaporation Ponds 3-2, Site 3, AF Plant 42

TO: USAF OEHL/TSS
Attn: Dr. John K. Yu
Brooks AFB, Texas 78235

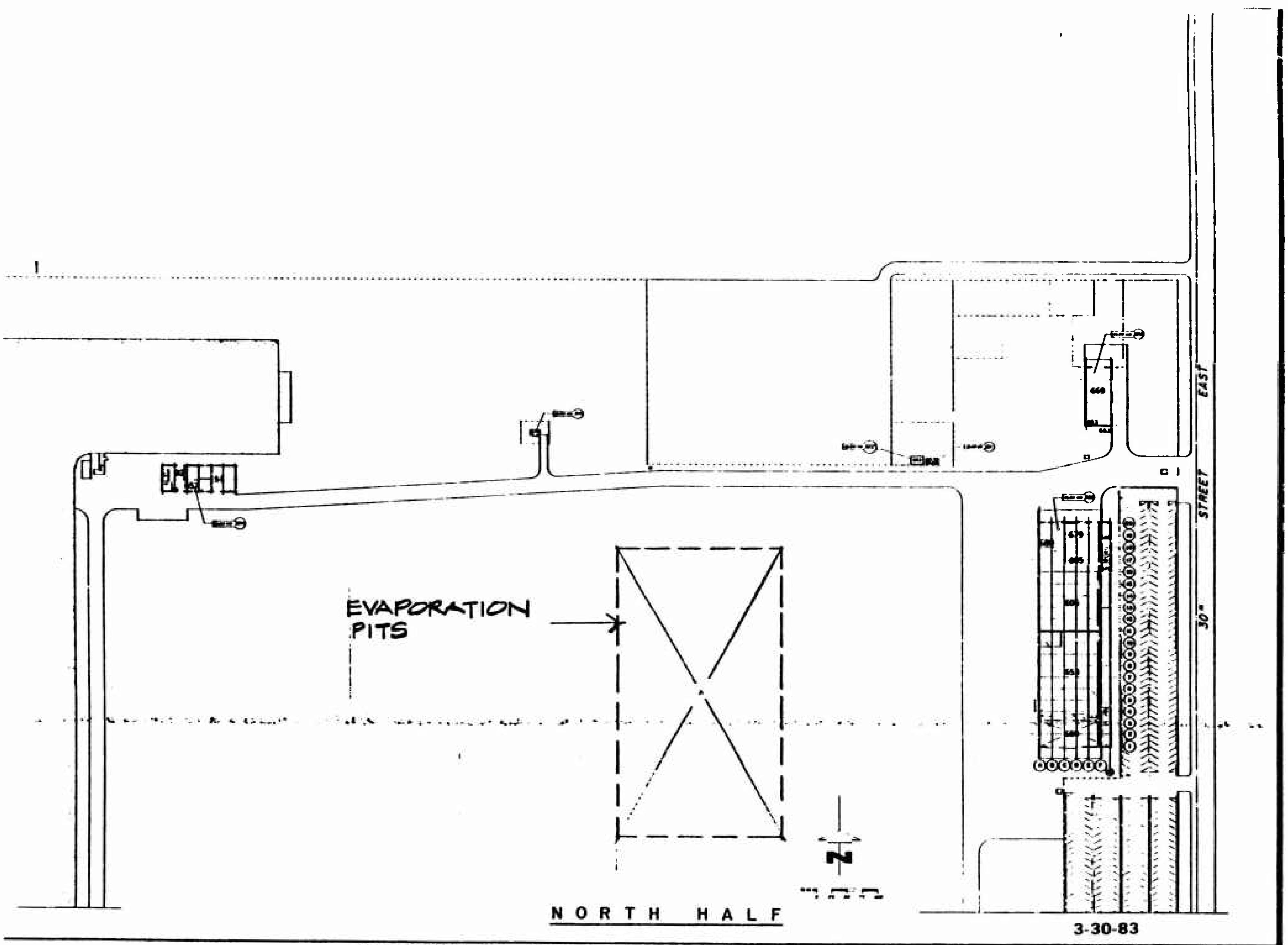
1. The attached photograph and drawing provides location Information for the IRP Evaporation Ponds designated 3-2, at Site 3, AF Plant 42, Palmdale CA.

2. Should you have any questions concerning this matter please contact the undersigned at AV 350-2092 or (805) 947-2146.

Frank M. Wood
FRANK M. WOOD
Deputy Facility Engineer

2 Atch
1. Photograph
2. Drawing

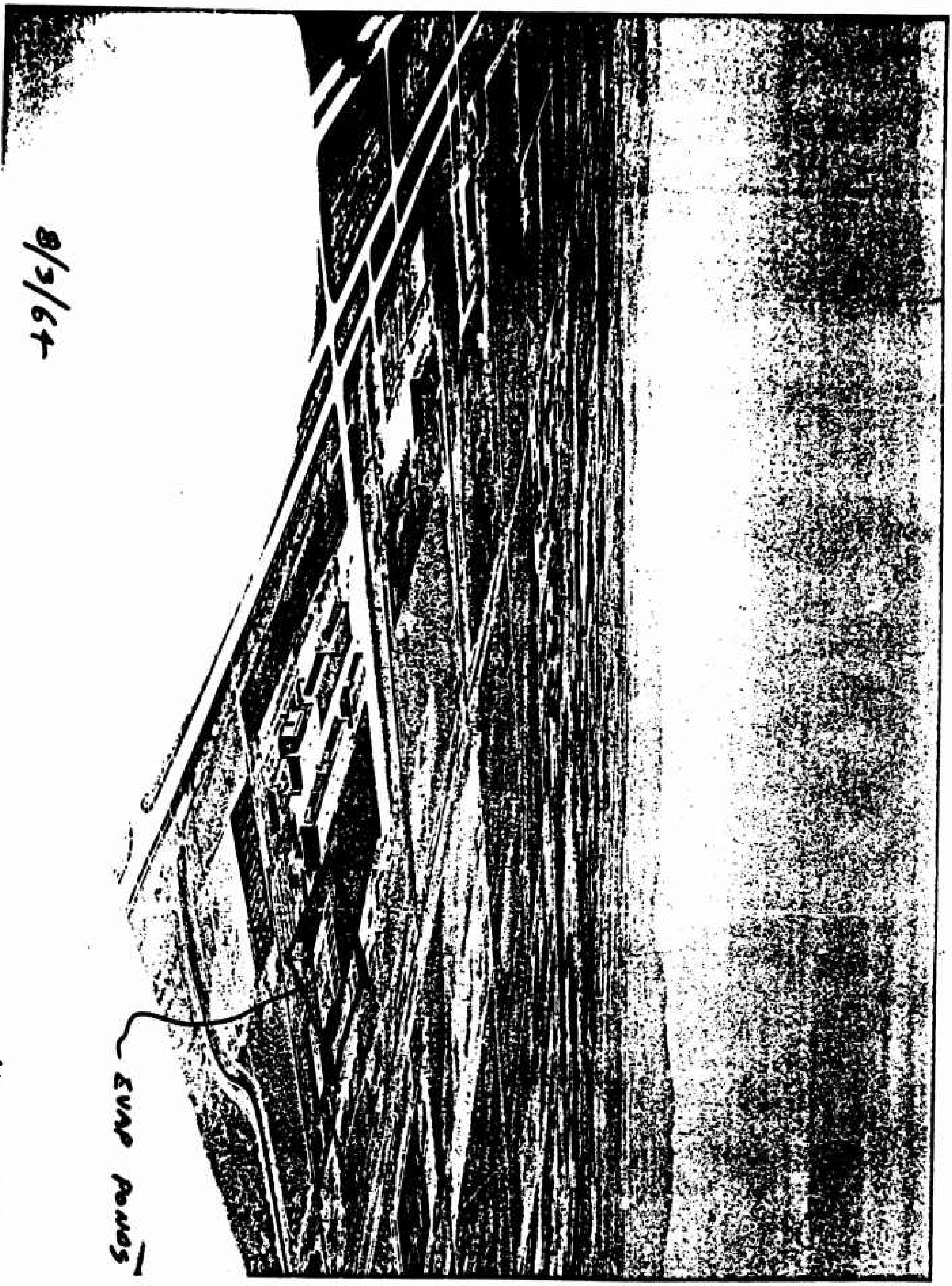
cc: Engineering Science



MASTER DEPARTMENTAL LAYOUT
PALMDALE FACILITY - SITE 3

120-872

8/3/67



ATCH #1

APPENDIX G

DRILLING LOGS

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB1	**DRILLING STARTED:**	9 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	9 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with some gravel (to 1/2"), brown, gray	Strong fuel odor HNu - 30 ppm
2.5	4-7-8		SS2	Sand - fine to medium, with some rock fragments (to 1"), brown	HNu - background (B)
5	4-8-7		SS3		HNu - B
7.5	2-4-9		SS4	Clay, silty, brown	HNu - B
10	5-11-13		SS5	Clay, silty, with some fine sand, brown	HNu - B
12.5	5-9-16		SS6	Sand - fine, silty	HNu - B
15	10-12-16		SS7	Sand - fine, clay and silt, brown	HNu - B
20	4-24-18		SS8	Sand - fine to medium, brown	HNu - B
25	4-6-8		SS9	Clay, silty, with some fine to medium sand, brown	HNu - B
30	13-16-16		SS10	Sand - fine to coarse, some gravel (to 1/2"), and silt, trace clay, brown	HNu - B

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 1-FCD2-SB1	DRILLING STARTED: 9 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 9 April 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
35	16-18-20		SS11		HNu - B
40	20-25-33		SS12	8": Sand - fine to coarse, with gravel (to 1 1/2", subangular to subrounded), brown	HNu - B
45	24-28-18		SS13	Same as above, with gravel to 2"	HNu - B
50	8-24-25		SS14	Sand - fine to medium, some clay and silt	HNu - B
55	9-19-19		SS15		HNu - B
60	10-13-19		SS16	Sand - fine to medium, some clay, red brown	HNu - B
65	10-15-30		SS17	Sand - fine to medium, with trace silt and clay, red brown	HNu - B
70	30-58-65		SS18	Sand - fine to medium, with some gravel (to 1 1/4", angular to subangular), red brown	HNu - B
75	23-30-21		SS19	Same as above, brown	HNu - B
				BT @ 75'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB2	**DRILLING STARTED:**	10 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	10 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, brown, green - gray	Fuel odor HNu - 42 ppm
2.5	4-8-9		SS2	Sand - fine, green - gray	Fuel odor HNu - 40 ppm
5	2-4-5		SS3	Sand with silt, green - gray	Fuel odor HNu - 54 ppm
7.5	2-2-5		SS4	Clay, with silt and sand, brown - gray	Fuel odor HNu - 33 ppm
10	6-6-6		SS5	Clay and sand - fine to medium, green - gray	Fuel odor HNu - 48 ppm
12.5	3-5-6		SS6	Sand - fine, some silt, gray	Fuel odor HNu - 35 ppm
15	3-6-8		SS7	Sand - fine to medium, some silt, green - gray	Fuel odor HNu - 35 ppm
20	2-10-11		SS8	Clay, with sand - fine to medium and silt, gray - tan	Fuel odor HNu - 48 ppm
25	2-6-8		SS9	Clay, with silt and sand, brown - gray	Fuel odor HNu - 54 ppm

ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID: 1-FCD2-SB2	**DRILLING STARTED:** 10 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 10 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
30	6-11-18		SS10	Hard clay with sand - fine to medium, brown - gray	Fuel odor HNu - 28 ppm
35	10-11-16		SS11	Sand - fine to medium, with silt and clay, brown - gray	Fuel odor HNu - 40 ppm
40	4-8-11		SS12		Fuel odor HNu - 50 ppm
45	16-22-36		SS13	Sand - fine to medium, with clay and silt, brown - gray	Fuel odor HNu - 60 ppm
50	11-15-16		SS14		HNu - background (B)
55	18-34-45		SS15	Sand - fine to coarse, with gravel (to 2", subangular to subrounded), brown	HNu - B
60	6-19-20		SS16	Clay, with fine sand, red brown	HNu - B
65	6-12-16		SS17		HNu - B
70	24-37-39		SS18	Sand - fine to coarse, red brown	HNu - B

865J88

ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB2	DRILLING STARTED:	10 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED:	10 April 1986
PROJECT NO:	56394	DRILLING METHOD:	Hollow-stem Auger
DRILLER:	Layne-Western	SAMPLING METHOD:	Split Spoon
LOGGER:		STATIC WATER LEVEL:	Dry
GEOLOGIST:	Laurel Izmirian	WATER LEVEL DATE:	
SIGNATURE:		WATER LEVEL DATUM:	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
75	26-65-88		SS19	Sand - fine to coarse, with gravel (to 2", sub-angular to subrounded), tan	HNu - B
				BT @ 75'	

865J88

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB3	**DRILLING STARTED:**	11 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	11 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to coarse, brown - gray	Fuel odor HNu - 42 ppm
2.5	4-8-10		SS2	Sand - fine to coarse, with gravel (to 3/4", subangular), gray - tan	Fuel odor HNu - 8 ppm
5	4-9-11		SS3	Sand - fine, some silt, gray - tan	Fuel odor HNu - 14 ppm
7.5	9-10-13		SS4	Sand - fine to medium, with clay, gray - brown	Fuel odor HNu - 30 ppm
10	9-11-12		SS5	Sand - fine to medium, with some clay, brown - gray	Fuel odor HNu - 34 ppm
12.5	9-11-11		SS6	Sand - fine, brown - gray	Fuel odor HNu - 34 ppm
15	4-8-7		SS7	Sand - with silt and clay, gray - brown	Fuel odor HNu - 6 ppm
20	3-5-9		SS8	Sand - fine to medium, with silt and clay, brown - gray	Fuel odor HNu - background (B)

865J88

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 1-FCD2-SB3	**DRILLING STARTED:** 11 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 11 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
25	16-23-11		SS9	Sand - fine to medium, with clay, red brown	Fuel odor HNu - 30 ppm
30	8-16-25		SS10		HNu - B
35	6-12-18		SS11	Sand - fine to medium, and clay, brown	HNu - B
40	5-13-13		SS12	Hard clay with sand - fine to medium, brown	HNu - B
45	8-16-		SS13	Sand - fine to medium, with clay and silt, brown	HNu - B
50	10-20-35		SS14	Same as above, with occasional coarse sand	HNu - B
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 1-FCD2-SB4	**DRILLING STARTED:** 12 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 12 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-Stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand-fine to coarse, with occasional gravel (to 1/2", subrounded), gray - brown	Fuel odor HNu-23 ppm
2.5	2-4-7		SS2	Same as above, with gravel (to 1"), brown - gray	Fuel odor HNu-9 ppm
5	4-6-7		SS3	Sand - fine to medium, with silt and trace clay, brown, some gray	Fuel odor HNu-18 ppm
7.5	5-7-7		SS4	Silt, with trace clay	HNu - background (B)
10	2-4-7		SS5	Clay, with silt and occasional medium sand, brown - gray	HNu-7 ppm
12.5	5-7-9		SS6	Silt and clay, brown	HNu-B
15	7-10-13		SS7	Sand - fine to medium, with clay and silt, gray-brown	HNu-B
20	7-7-10		SS8	Silt and clay, brown	HNu-B
25	5-8-9		SS9		HNu-B
30	3-13-19		SS10	Clay, with silt and sand - fine to medium, brown	HNu-B
				BT @ 30'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB5	**DRILLING STARTED:**	12 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	12 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with some gravel (to 1/2" subrounded), gray - brown	Fuel odor HNu - 30 ppm
2.5	5-9-9		SS2	Sand - fine to coarse, with gravel (to 1 1/2", sub-angular to subrounded), brown - gray	Fuel odor HNu - 12 ppm
5	4-3-5		SS3	Silt, gray	Fuel odor HNu - 19 ppm
7.5	5-5-4		SS4	Silt, brown	HNu - 1 ppm
10	3-5-7		SS5	Clay, with fine sand, brown	HNu - background (B)
12.5	no sample		SS6		
15	5-6-7		SS7	Sand - fine to medium, with silt, brown	HNu-B
20	10-17-20		SS8	Clay, with fine sand, brown	HNu-B
25	6-10-15		SS9	Clay, brown	HNu-B

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 1-FCD2-SB5	**DRILLING STARTED:** 12 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 12 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
30	10-20-15		SS10	Sand - fine to coarse, with gravel (to 2", sub-angular), brown BT @ 30 feet	HNu-B

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	1-FCD -SB6	DRILLING STARTED:	12 April 1986
LOCATION:	Air Force Plant Palmdale, CA	DRILLING COMPLETED:	12 April 1986
PROJECT NO:	56394	DRILLING METHOD:	Hollow-stem Auger
DRILLER:	Layne-Western	SAMPLING METHOD:	Split Spoon
LOGGER:		STATIC WATER LEVEL:	Dry
GEOLOGIST:	Laurel Izmirian	WATER LEVEL DATE:	
SIGNATURE:		WATER LEVEL DATUM:	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		ss1	sand - fine to medium, with silt, gray - brown	Fuel odor HNu-30 ppm.
2.5	5-14-19		SS2	Sand - fine to coarse, with gravel (to 3/4", angular), gray-brown	Fuel odor HNu-14.5 ppm
5	5-6-5		SS3	Sand - fine to medium, with silt, clay and occasional gravel (to 2"), gray - tan	Fuel odor HNu-14.5 ppm
7.5	2-5-6		SS4	Clay, brown	HNu - background (B)
10	5-8-9		SS5	Sand - fine, with silt, brown	HNu - B
12.5	5-10-10		SS6		HNu - B
15	6-8-11		SS7	Silt, with clay, brown	HNu - B
20			SS8	Silt, with trace clay, brown	HNu - B
				BT @ 20'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 1-FCD2-SB7	**DRILLING STARTED:** 14 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 14 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to coarse, with gravel (to 1", subrounded)	Fuel Odor HNu - 55 ppm
2.5	4-7-8		SS2	Silt, with some clay and occasional fine sand, green-gray	Fuel Odor HNu - 40 ppm
5	4-7-5		SS3	Silt, green-gray	Fuel Odor HNu - 40ppm
7.5	6-7-5		SS4	Sand - fine to medium, with clay, gray - tan	Fuel Odor HNu - 36 ppm
10	7-7-7		SS5	Sand - fine, with silt and clay, green-gray	Fuel Odor HNu - 41 ppm
12.5	3-6-9		SS6	Silt, with some clay, green-gray	Fuel Odor HNu - 38 ppm
15	7-13-16		SS7	Sand - fine to coarse, with some clay, green-gray	Fuel Odor HNu - 34 ppm
20	13-18-19		SS8	Sand - fine to coarse, with some gravel (to 1"), green-gray and tan	Fuel Odor HNu - 48 ppm

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB7	DRILLING STARTED:	14 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED:	14 April 1986
PROJECT NO:	56394	DRILLING METHOD:	Hollow-stem Auger
DRILLER:	Layne-Western	SAMPLING METHOD:	Split Spoon
LOGGER:		STATIC WATER LEVEL:	Dry
GEOLOGIST:	Laurel Izmirian	WATER LEVEL DATE:	
SIGNATURE:		WATER LEVEL DATUM:	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
25	3-6-9		SS9	Clay, with fine sand, some silt, green - brown	Fuel odor HNu - 15 ppm
30	10-27-25		SS10	Clay, with sand - fine to coarse, brown	Fuel odor HNu - 8.5 ppm
35	9-30-30		SS11	Clay, with sand - fine to coarse, and gravel (to 1", sub-rounded), light brown	HNu - 4 ppm
40	6-10-29		SS12	Clay and sand - fine to coarse, some gravel (to 1 1/4", sub-angular to subrounded), brown	HNu - background (B)
45	6-11-16		SS13	Clay, with silt, brown	HNu - B
50	5-12-17		SS14	Clay, with silt and fine sand, occasional gravel (to 1/2"), brown	Fuel odor HNu - 40 ppm
55	10-19-40		SS15	Sand - fine to coarse, with clay, brown	HNu - B Organic Odor between 55' and 60'

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DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB7	**DRILLING STARTED:**	14 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	14 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
60	6-14-24		SS16	Clay and sand - fine to medium, some silt, brown	HNu - B
65	16-21-22		SS17	Sand - fine to medium, with clay, brown	HNu - B
70	21-58-85		SS18	Sand - fine to coarse, with gravel (to 1 3/4", subangular to subrounded)	HNu - B
				BT @ 70'	

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 1-FCD2-SB8	DRILLING STARTED: 15 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 15 April 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to coarse, with occasional gravel (to 3/4", subrounded), green-gray	Fuel Odor HNu - 38 ppm
2.5	4-4-4		SS2	Silt, with clay, green-gray	Fuel Odor HNu - 26 ppm
5	2-3-4		SS3	Clay, with silt, green-gray	Fuel Odor HNu - 20 ppm
7.5	2-3-4		SS4	Clay, with silt and sand - fine to medium, green-gray	Fuel Odor HNu - 19.5 ppm
10	3-5-7		SS5	Clay, with silt, green-gray	Fuel Odor HNu - 28 ppm
12.5	2-4-9		SS6		Fuel Odor HNu - 16 ppm
15	7-8-12		SS7	Sand - fine, with some clay, green-gray	Fuel Odor HNu - 25 ppm
20	7-18-18		SS8	Clay, with silt and fine sand, green-gray	Fuel Odor HNu - 5 ppm

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB8	**DRILLING STARTED:**	15 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	15 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
25	2-4-6		SS9	Clay, with some silt, light green-gray	Fuel Odor HNu - 25 ppm
30	10-30-31		SS10	Clay, with some sand - fine to coarse, brown	Fuel odor HNu - background (B)
35	8-19-26		SS11	Sand - fine to coarse, with some fine gravel (1/4"), brown	HNu - B
40	5-10-19		SS12	Silt and clay, brown	HNu - B
45	3-10-19		SS13	Clay, with some silt and occasional medium sand, brown	HNu - B
50	8-27-33		SS14	Clay, with sand - fine to medium, and silt, occasional gravel (to 1/2"), brown	HNu - B
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB9	DRILLING STARTED:	16 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED:	16 April 1986
PROJECT NO:	56394	DRILLING METHOD:	Hollow-stem Auger
DRILLER:	Layne-Western	SAMPLING METHOD:	Split Spoon
LOGGER:		STATIC WATER LEVEL:	Dry
GEOLOGIST:	Laurel Izmirian	WATER LEVEL DATE:	
SIGNATURE:		WATER LEVEL DATUM:	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Silt, with sand - fine to medium, light brown	HNu - background (B)
2.5	9-18-6		SS2	Same as above, very hard	HNu - B
5	10-19-21		SS3	Same as above, moderate hard	HNu - B
7.5	4-8-10		SS4	Sand - fine to coarse, orange-brown and black	HNu - B
10	5-9-10		SS5	Sand - fine to coarse, with gravel (to 1 1/2", subangular), light brown	HNu - B
12.5	6-10-12		SS6	Silt, with sand - fine to medium, tan	HNu - B
15	6-10-8		SS7	Silt, with trace clay and medium sand, tan	HNu - B
20	2-4-6		SS8	Clay, brown	HNu - B
25	3-7-8		SS9	Clay, with some silt, brown	HNu - B
30	9-13-19		SS10	Sand - fine to medium, tan	HNu - B
35	6-11-11		SS11	Silt and clay, occasional gravel (to 1 1/2", angular), brown	HNu - B

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB9	DRILLING STARTED:	16 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED:	16 April 1986
PROJECT NO:	56394	DRILLING METHOD:	Hollow-stem Auger
DRILLER:	Layne-Western	SAMPLING METHOD:	Split Spoon
LOGGER:		STATIC WATER LEVEL:	Dry
GEOLOGIST:	Laurel Izmirian	WATER LEVEL DATE:	
SIGNATURE:		WATER LEVEL DATUM:	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
40	6-20-26		SS12	Sand - fine to coarse, with clay, some gravel (to 1/2", subangular), brown	HNu - B
45	9-19-26		SS13		HNu - B
50	9-30-31		SS14	Sand - fine to coarse, with gravel (to 1", angular to subrounded), trace clay, brown	HNu - B
55	9-15-18		SS15	Silt and clay, brown	HNu - B
60	15-27-39		SS16	Sand - fine to medium, tan	HNu - B
65	13-18-24		SS17	Silt, with clay, light brown	HNu - B
70	10-17-24		SS18	Silt and clay, brown	HNu - B
				BT @ 70'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 1-FCD2-SB10	**DRILLING STARTED:** 25 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 25 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Post Hole Digger
DRILLER: Layne-Western	**SAMPLING METHOD:** Grab
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Sand - fine to medium, brown	HNu - background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	1-FCD2-SB11	**DRILLING STARTED:**	16 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	16 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Post Hole Digger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Grab
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Clay and sand - fine to medium, some silt, gray-brown	Fuel odor HNu - 1 ppm
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 1-FCD2-SB12	**DRILLING STARTED:** 16 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 16 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Post Hole Digger
DRILLER: Layne-Western	**SAMPLING METHOD:** Grab
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					Slight fuel odor
3			SS1	Clay and sand - fine to medium, with some silt, gray-brown	HNu - background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	2-PWD2-SB1	**DRILLING STARTED:**	16 Dec 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	16 Dec 1985
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	George Pilja	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine, with silt, gray-green	Moist to wet, strong odor
2.5	6-7-6		SS2		
5	9-8-11		SS3		Moist, slight odor
7.5	13-27-34		SS4	Sand - fine, light brown	Damp
10	9-16-18		SS5	Clay, with silt and sand	Damp
12.5	10-18-24		SS6		
15	13-19-22		SS7		
20	20-21-23		SS8	Sand - fine, with silt	Damp
25	18-32-65		SS9	Clay with sand and silt	Damp
30	14-43-115		SS10	Sand - fine, with clay and silt	Damp
35	52-100-105		SS11	Sand - fine to coarse, with gravel (to 1/2")	Dry
40	18-44-61		SS12	Clay with silt and sand - fine to coarse	Damp

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 2-PWD2-SB1	DRILLING STARTED: 16 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 16 Dec 1985
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: George Pilja	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
45			SS13		
50			SS14	Same as above.	
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 2-PWD2-SB2	**DRILLING STARTED:** 16 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 17 Dec 1985
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: George Pilja	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay with silt and sand	Damp, slight odor
2.5	14-17-18		SS2	Sand - fine to medium, with silt, green	Wet, strong odor
5	13-13-13		SS3		Damp, slight odor
7.5	12-15-18		SS4	Clay, with silt and fine sand, light brown	Damp
10	7-13-25		SS5	Same as above, but less sand and silt	
12.5	9-11-19		SS6		
15	19-23-27		SS7	Sand - fine	Damp
20	16-19-20		SS8	Clay with silt and sand	Damp
25	15-27-44		SS9		
30	25-55-100		SS10		
35	45-81-98		SS11	Sand - fine to coarse, with gravel (to 1/2")	Dry

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 2-PWD2-SB2	DRILLING STARTED: 16 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 17 Dec 1985
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: George Pilja	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
40	17-30-81		SS12	Sand - fine to medium, with silt	Damp
45	40-63-94		SS13	Same as above, with sand - fine to coarse	
50	27-61-102		SS14	Clay with silt and sand - fine to coarse	Damp
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	2-PWD2-SB3	**DRILLING STARTED:**	17 Dec 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	18 Dec 1985
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	George Pilja	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay with silt and sand - fine to medium, dark green	Moist, strong odor
2.5	24-34-54		SS2		
5	11-13-34		SS3	Sand - fine, with silt, black	Damp, strong odor
7.5	15-34-59		SS4		
10	11-22-39		SS5	Sand - fine, gray-green	Damp, strong odor
12.5	6-18-42		SS6		
15	4-9-17		SS7		Damp, slight odor
20	9-13-22		SS8	Clay, with silt and fine sand, brown	
25	18-61-82		SS9	Sand - fine to coarse, with some gravel (to 1 1/2")	Dry
30	22-48-103		SS10	Sand - fine to medium	
35	21-39-62		SS11	Clay, with silt and fine sand, some feldspar	Damp
40	9-35-55		SS12		
45	19-54-65		SS13		

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 2-PWD2-SB3	DRILLING STARTED: 17 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 18 Dec 1985
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: George Pilja	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
50	20-68-86		SS14	Sand - fine to coarse	Moist
				BT @ 50'	

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID: 2-PWD2-SB4	**DRILLING STARTED:** 18 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 19 Dec 1985
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: George Pilja	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay, with silt and sand - fine to medium, green-gray	Moist, strong odor
2.5	15-27-44		SS2	Same as above, black	
5	17-21-25		SS3	Sand - fine, gray with black spots	Damp, strong odor
7.5	18-38-40		SS4		Damp, slight odor
10	13-42-66		SS5	Sand - fine to coarse, with some gravel (to 1/2"), gray	Damp, slight odor
12.5	23-48-56		SS6	Same as above with fine gravel	Damp, slight odor
15	16-32-55		SS7	Sand - fine, gray	Damp, slight odor
20	5-19-30		SS8		
25	36-37-45		SS9	Clay, with silt and fine sand, gray	Damp, slight odor
30	11-27-39		SS10	Same as above, but with less sand, brown	Damp
35	16-20-34		SS11		
40	31-64-95		SS12	Sand - fine to coarse, with fine gravel	Dry

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	2-PWD2-SB4	**DRILLING STARTED:**	18 Dec 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	19 Dec 1985
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	George Pilja	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
45	18-66-102		SS13	Clay, with silt and fine sand, some feldspar gravel	Damp
50	25-60-110		SS14	Sand - fine to coarse, some gravel (to 2")	Dry
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 2-PWD2-SB5	**DRILLING STARTED:** 19 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 19 Dec 1985
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: George Pilja	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine	
2.5	18-21-34		SS2	Sand - fine to medium, with some silt	Damp
5	16-20-28		SS3	Sand - fine, with some silt	Damp
7.5	6-12-40		SS4	Sand - fine	Damp
10	10-17-25		SS5	Clay, with silt and fine sand	Damp
12.5	7-25-41		SS6	Sand - fine, with some silt	Damp
15	7-19-29		SS7		
20	5-12-17		SS8	Clay, with silt and sand	Damp
25	8-26-46		SS9		
30	29-130-70		SS10	Sand - fine	Damp
35	13-26-42		SS11	Clay, with some sand and silt	Damp
40	12-38-44		SS12	Sand - fine to coarse, with some silt	Damp
45	23-77-94		SS13	Clay, with silt and sand - fine to coarse, some feldspar gravel	Damp

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 2-PWD2-SB5	DRILLING STARTED: 19 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 19 Dec 1985
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: George Pilja	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
50	26-48-111		SS14	Same as above BT @ 50'	Damp

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ENGINEERING-SCIENCE

DRILLING RECORD

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WELL/BORING ID: 3-ERA7-SB1	DRILLING STARTED: 29 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 29 April 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to coarse, some fine gravel (subrounded), trace clay, brown	HNu - background (B)
2.5	2-5-6		SS2	Clay and sand - fine to medium, brown	HNu - B
5	4-5-8		SS3	Same as above, with occasional gravel (to 1 1/2", subangular)	HNu - B
7.5	3-3-4		SS4		HNu - B
10	2-2-3		SS5	Clay, with some sand - fine to medium, brown	HNu - B
12.5	2-5-6		SS6	Sand - fine to medium, brown	HNu - B
15	4-4-4		SS7	Clay, with some sand - fine to medium, brown	HNu - B
20	3-5-6		SS8	Clay, with sand - fine to coarse, some fine gravel, brown BT @ 20'	HNu - B

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	3-ERA7-SB2	**DRILLING STARTED:**	29 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	29 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, occasionally coarse, brown	HNu - background (B)
2.5	2-4-6		SS2	Silt, with some fine sand and trace clay, brown	HNu - B
5	4-8-12		SS3	Clay and silt, with some sand - fine to medium, brown	HNu - B
7.5	6-9-11		SS4	Sand - fine to coarse, with gravel (to 1 3/8", angular to subangular), brown	HNu - B
10	4-9-11		SS5	Silt, with trace clay, light brown	HNu - B
12.5	3-6-6		SS6	Sand - fine to medium, with clay, brown	HNu - B
15	2-3-4		SS7	Clay, with silt and occasional fine sand, brown	HNu - B
20	5-8-12		SS8	Sand - fine to coarse, with some gravel (to 1", sub-angular), light brown	HNu - B
				BT @ 20'	

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID:	3-ERA7-SB3	**DRILLING STARTED:**	29 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	29 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	‿ayne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with silt, brown	HNu - background (B)
2.5	4-4-6		SS2	Silt, with some fine sand, brown	HNu - B
5	4-4-7		SS3	Clay, with silt and some fine sand, brown	HNu - B
7.5	6-8-10		SS4	Silt, with sand - fine to medium, trace clay, brown	HNu - B
10	7-12-13		SS5	Sand - fine to coarse, with gravel (to 2", subangular to sub-rounded), tan	HNu - B
12.5	4-5-13		SS6	Clay, with silt and some fine sand, brown	HNu - B
15	7-6-4		SS7	Sand - fine to coarse, some silt and clay, some fine gravel (to 1/2"), brown	HNu - B
20	3-4-7		SS8	Silt and clay, with some fine sand, brown	HNu - B
				BT @ 20'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 3-ERA7-SB4	DRILLING STARTED: 29 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 29 April 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Silt and sand - fine to medium, brown	HNu - background (B)
2.5	3-2-3		SS2		HNu - B
5	6-9-11		SS3	Silt, with some sand - fine to medium, tan	HNu - B
7.5	5-6-11		SS4	Sand - fine to coarse, with silt and clay, occasional gravel (to 1 1/8", subangular), brown	HNu - B
10	5-7-11		SS5	Sand - fine to coarse, with occasional gravel (to 3/4", subrounded), tan, black and orange	HNu - B
12.5	6-6-9		SS6	Sand - fine to coarse, with silt, brown	HNu - B
15	4-7-8		SS7	Silt and clay, with fine sand, brown	HNu - B
20	7-8-11		SS8	Silt, with trace clay and some fine sand	HNu - B
				BT @ 20'	

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID:	4-VWT5-SB1	**DRILLING STARTED:**	9 Dec. 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	10 Dec. 1985
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	George Pilja	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay, with silt and fine sand, light brown	Damp
2.5	3-6-5		SS2	Same as above, with gravel (to 3/4")	Damp, HNu > 1
5.0	4-7-8		SS3	Same as above, but with gravel to 1/2"	Damp
7.5	5-11-9		SS4	Sand - fine to medium, with silt, some gravel	Damp
10	8-14-20		SS5	Sand - fine	Damp
12.5	7-7-16		SS6		
15	5-14-21		SS7		
20	7-15-18		SS8		
25	24-53-56		SS9	Sand - fine to medium, with some medium gravel	Damp
30	30-74-58		SS10		
35	30-86-80		SS11	Sand - fine, with gravel	Damp
40	30-170		SS12	Clay, with silt and sand, some feldspar gravel	Damp

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	4-VWT5-SB1	**DRILLING STARTED:**	9 Dec. 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	10 Dec. 1985
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	George Pilja	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
45	30-100-70		SS13	Sand - fine to medium, with fine gravel	
47.5	68-135		SS14		Auger refusal
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

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WELL/BORING ID: 4-VWT5-SB2	DRILLING STARTED: 10 Dec. 1985
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 10 Dec. 1985
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: George Pilja	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay, with silt and sand, light brown	Moist
2.5	4-3-6		SS2		
5	3-6-8		SS3		
7.5	4-5-7		SS4		
10	6-9-7		SS5		Damp
12.5	8-8-4		SS6		
15	8-8-9		SS7		
20	9-11-24		SS8	Sand - fine to medium, with gravel, loose	Damp
25	18-52-48		SS9	Sand - fine to coarse, and gravel	Damp
30	16-38-43		SS10		
35	18-39-55		SS11	Sand - fine	Damp
40	7-36-43		SS12	Clay, with silt and fine sand	
50	26-65-74			BT @ 45'	

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID: 4-VWT5-SB3	DRILLING STARTED: 10 Feb. 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 10 Feb. 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with clay and silt, brown	Wet
2.5	4-3-2		SS2	Sand - fine to coarse, and clay, brown	
5	2-3-7		SS3	Clay, with sand - fine to medium, brown	
7.5	4-10-7		SS4	Sand - fine to coarse, with gravel (to 1/2", sub-angular) and some clay, brown	
10	6-12-8		SS5	Clay and silt with sand - fine to coarse, and gravel (to 3/4", subrounded), brown	
12.5	4-6-10		SS6	Sand - fine to coarse, with silt and clay, brown	
15	4-6-12		SS7	Sand - fine, some clay, brown	
20	4-10-17		SS8	BT @ 20'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 4-VWT5-SB4	**DRILLING STARTED:** 10 Feb. 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 10 Feb. 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to coarse, with some fine gravel (1/4"), brown	Wet
2.5	2-2-4		SS2	Clay, with trace sand - fine to medium, brown	
5	4-5-7		SS3	Sand - fine to coarse, with trace silt and clay, occasional fine gravel, brown	
7.5	7-11-14		SS4	Sand - fine to coarse, and gravel (to 1 1/2", sub-rounded), light brown	
10	3-4-5		SS5	Clay, with silt, brown	
12.5	6-10-11		SS6	Clay, with occasional coarse gravel (to 1", sub-angular), brown	
15	4-8-12		SS7	Clay and sand - fine to medium, with some coarse gravel (to 3/4", sub-angular), brown	
20	15-22-25		SS8	Sand - fine to coarse, with gravel (to 1 1/4", angular to sub-angular), brown	
				BT @ 20'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	5-AFTC-SB1	**DRILLING STARTED:**	6 Dec. 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	6 Dec. 1985
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	George Pilja	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, green-gray just below surface	Strong fuel odor
2.5			SS2	Sand - fine to medium, with fine gravel, green-gray	Strong fuel odor
5			SS3	Same as above, with some coarse sand, green-gray	Strong fuel odor
7.5			SS4	Same as above	Strong fuel odor
				BT @ 5'	

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID: 5-AFTC-SB2	**DRILLING STARTED:** 7 Feb. 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 7 Feb. 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to coarse, with some gravel (to 1/2", sub-angular and flat), dark brown	
2.5	5-12-8		SS2	Sand - fine to medium, with silt, dark gray	Strong fuel odor HNu - 75 ppm
5	2-4-8		SS3	Sand - fine to coarse, with some gravel (to 5/8", sub-angular, flat and elongated), gray-brown	Strong fuel odor HNu - 35 ppm
7.5	11-16-19		SS4	Sand - fine to medium, with silt, gray-brown	Very strong fuel odor; HNu - 190 ppm
10	11-13-17		SS5	Sand - fine, with silt, gray-brown	Very strong fuel odor; HNu - 130 ppm
12.5	3-6-9		SS6	Sand - fine to medium, with silt, gray-brown	Very strong fuel odor; HNu - 180 ppm
15	7-11-16		SS7	Sand - fine to coarse, gray	Very strong fuel odor; HNu - 200 ppm
20	11-15-18		SS8	Sand - fine to coarse, with gravel, gray	Very strong fuel odor; HNu - 170 ppm

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 5-AFTC-SB2	**DRILLING STARTED:** 7 Feb. 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 7 Feb. 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
25	11-13-15		SS9	Sand - fine to coarse, with silt, some clay and some gravel (to 1/2"), gray	Very strong fuel odor HNu - 130 ppm
30	12-17-19		SS10	Sand - fine to coarse, with some gravel (to 1"), gray-brown	Very strong fuel odor HNu - 60 ppm
35	5-14-14		SS11	Sand - to medium	Fuel odor HNu - 5 ppm
40	13-19-23		SS12	Sand - fine to medium, with occasional coarse gravel, gray-brown	Fuel odor HNu - 3 ppm
45	25-45-44		SS13	Silt and sand - fine to coarse, with gravel (to 1 1/4", subrounded), gray and light brown	Fuel odor HNu - 3 ppm
50	13-14-17		SS14	Silt, with clay and fine sand, occasional coarse gravel (3/4", subangular, elongated), brown	HNu - background (B)
55	22-36-45		SS15	Sand - fine to coarse, brown	HNu - B
				BT @ 55'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 5-AFTC-SB3	**DRILLING STARTED:** 29 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 29 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Post Hole Digger
DRILLER: Layne-Western	**SAMPLING METHOD:** Grab
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Silt, with sand - fine to medium, green - gray	Strong fuel odor HNu - background
				BT @ 3'	

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID: 6-OFTC-SB1	**DRILLING STARTED:** 11 Dec. 1985
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 12 Dec. 1985
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: George Pilja	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay, with silt and fine sand, gray-green	Damp, slight odor, HNu>1
2.5	4-4-6		SS2	Same as above, but dark green	Damp, strong odor, HNu>1
5	3-6-5		SS3		
7.5	8-11-15		SS4		
10	6-13-14		SS5	Sand - fine to coarse, light brown with green	Damp, strong odor, HNu>1
12.5	9-12-18		SS6	Clay, with silt and sand, gray-green and brown	Damp, strong odor, HNu>1
15	11-16-29		SS7	Sand - fine to coarse, with some gravel (to 1/2") and clay, gray-green and brown	Damp, strong odor, HNu>1
20	16-20-28		SS8		
25	15-23-39		SS9		HNu - background (B)
30	25-42-52		SS10		HNu - B
35	26-48-63		SS11	Same as above, with gravel (to 3/4"), light brown	HNu - B

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 6-OFTC-SB1	**DRILLING STARTED:** 11 Dec. 1985
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 12 Dec. 1985
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: George Pilja	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
40	33-61-100		SS12		HNu - B
45			SS13		HNu - B
50			SS14	Sand - fine to coarse, with gravel	HNu - B
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	6-OFTC-SB2	DRILLING STARTED:	29 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED:	29 April 1986
PROJECT NO:	56394	DRILLING METHOD:	Post Hole Digger
DRILLER:	Layne-Western	SAMPLING METHOD:	Grab
LOGGER:		STATIC WATER LEVEL:	Dry
GEOLOGIST:	Laurel Izmirian	WATER LEVEL DATE:	
SIGNATURE:		WATER LEVEL DATUM:	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Silt, with some sand - fine to medium, brown	Strong fuel odor HNu - background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB1	**DRILLING STARTED:**	12 Dec. 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	12 Dec. 1985
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	George Pilja	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay, with silt and fine sand	Moist
2.5	5-7-11		SS2	Sand - fine to coarse, loose	Damp, slight fuel odor, HNu>1
5	7-14-14		SS3	Same as above, with gravel (to 1/2")	
7.5	9-10-13		SS4	Sand - fine to medium, loose	Damp, fuel odor, HNu>1
10	7-18-24		SS5	Sand - fine to medium, loose	Damp, fuel odor, HNu>1
12.5	9-16-28		SS6		
15	16-34-51		SS7	Sand - fine to medium	Damp, fuel odor, HNu>1
20	14-29-33		SS8	Sand - fine, with silt	Damp, fuel odor, HNu>1
25	5-18-33		SS9	Clay, with silt and sand	Damp, fuel odor, HNu>1
30	27-48-59		SS10	Sand - fine	Damp, fuel odor, HNu>1
35	16-21-33		SS11	Clay, with silt and sand, hard	Damp, fuel odor, HNu>1
40	17-36-48		SS12		

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 7-ERA2-SB1	DRILLING STARTED: 12 Dec. 1985
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 12 Dec. 1985
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: George Pilja	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
45	27-86-103		SS13	Sand - fine to coarse, with gravel (to 3/4")	Damp, fuel odor, HNu>1
50	39-105-100		SS14	Same as above	Damp, fuel odor, HNu>1
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB2	**DRILLING STARTED:**	13 Dec. 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	13 Dec. 1985
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	George Pilja	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay, with silt and fine sand	Moist, HNu - background (B)
2.5	4-8-12		SS2	Same as above, with more sand - fine to coarse	Moist, HNu - B
5	7-15-20		SS3	Clay with silt and sand - fine to medium	Damp, HNu - B
7.5	8-15-25		SS4	Sand - fine to coarse, with gravel (to 3/4")	Damp, HNu lamp broken
10	16-18-20		SS5		
12.5	12-14-28		SS6	Sand - fine, with silt	Damp
15	9-26-30		SS7		
20			SS8	Sand - fine, gray	Dry
25	9-25-80		SS9	Sand - fine to coarse, with fine gravel	Damp
30	25-94-115		SS10		
35	29-43-85		SS11	Clay, with silt and fine sand	Moist
40	16-45-79		SS12		Damp

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB2	**DRILLING STARTED:**	13 Dec. 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	13 Dec. 1985
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	George Pilja	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
45	20-91-75		SS13	Sand - fine to coarse, with gravel (to 1/2")	Damp
50	22-92-132		SS14	Same as above, but with gravel to 1 1/2"	Damp
				BT @ 50'	

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DRILLING RECORD

WELL/BORING ID: 7-ERA2-SB3	DRILLING STARTED: 13 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 14 Dec 1985
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: George Pilja	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay, with silt and fine sand	Moist
2.5	5-13-10		SS2	Sand-fine to coarse with gravel (to 3/4")	Damp
5	6-11-9		SS3	Clay, with silt and fine sand	Moist
7.5	12-20-17		SS4	Same as above, with more coarse sand	Damp
10	7-11-13		SS5	Sand-fine to coarse, with gravel (to 1/2")	Damp
12.5	20-36-45		SS6		
15	31-30-48		SS7	Sand-fine, with some silt	Damp
20	16-28-37		SS8	Same as above with more silt	Damp, strong odor
25	20-36-57		SS9		
30	15-27-38		SS10		
35	11-35-53		SS11	Sand-fine to coarse, with some fine gravel (to 1/2")	Damp, strong odor

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB3	DRILLING STARTED:	13 Dec 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED:	14 Dec 1985
PROJECT NO:	56394	DRILLING METHOD:	Hollow-stem Auger
DRILLER:	Layne-Western	SAMPLING METHOD:	Split Spoon
LOGGER:		STATIC WATER LEVEL:	Dry
GEOLOGIST:	George Pilja	WATER LEVEL DATE:	
SIGNATURE:		WATER LEVEL DATUM:	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
40	38-82-96		SS12	Sand-fine	Damp, strong odor
45	16-75-130		SS13		
50	41-69-85		SS14	Sand-fine to coarse, with gravel (to 1 1/2")	Damp, strong odor
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB4	**DRILLING STARTED:**	11 Feb 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	11 Feb 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Silt, with some sand - fine to medium, tan	Dry, HNu-back-ground (B)
2.5	15-40-70		SS2	Silt, cemented, some sand - fine to medium, light brown with gray veins	Dry, HNu - B
5	21-29-35		SS3	Same as above, with occasional fine gravel (1/4")	HNu - B
7.5	6-10-14		SS4	Sand-fine to coarse, with gravel (to 2"), light brown and gray	HNu-B
10	11-16-22		SS5	Sand-fine to coarse, with gravel, brown	HNu-B
12.5	8-9-9		SS6	Silt and sand - fine to medium, brown	HNu-B
15	5-7-9		SS7	Silt and clay, with fine sand, brown	HNu-B
20	10-15-18		SS8		
25	8-11-27		SS9	Silt, with fine sand and trace clay, brown with gray veins	HNu-B

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB4	**DRILLING STARTED:**	11 Feb 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	11 Feb 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
30	19-26-30		SS10	Sand-fine to coarse, with some gravel (to 3/4"), light brown	HNu-B
35	13-25-20		SS11	Sand-fine to medium, with silt, brown	HNu-B
40	29-38-41		SS12	Sand-fine to coarse, with silt and occasional fine gravel, brown	HNu-B
45	13-42-33		SS13	Sand-fine to medium, with some silt, brown	HNu-B
50	26-43-50		SS14	Sand-fine to coarse, with gravel (to 1 1/2"), brown	HNu-B
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB5	DRILLING STARTED:	17 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED:	19 April 1986
PROJECT NO:	56394	DRILLING METHOD:	Hollow-stem Auger
DRILLER:	Layne-Western	SAMPLING METHOD:	Split Spoon
LOGGER:		STATIC WATER LEVEL:	Dry
GEOLOGIST:	Laurel Izmirian	WATER LEVEL DATE:	
SIGNATURE:		WATER LEVEL DATUM:	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand-fine to coarse, with silt, some clay and some gravel (to 3/4", sub-rounded), brown	Some surface contamination visible in general area HNu-background (B)
2.5	4-8-12		SS2	Clay, with silt and fine sand, brown	HNu-B
5	5-8-10		SS3	Sand-fine to medium, with silt and clay, brown	HNu-B
7.5	4-7-9		SS4	Sand-fine to medium, with occasional gravel (to 1", subrounded), light brown	HNu-B
10	5-7-9		SS5	Same as above, but darker brown	HNu-B
12.5	3-5-7		SS6	Clay, some silt and sand-fine to medium, brown	HNu-B
15	5-7-9		SS7	Silt, with some sand - medium to coarse, brown	HNu-B
20	8-11-11		SS8		HNu-B
25	9-14-14		SS9		Fuel odor HNu - 37 ppm
30	10-13-16		SS10	Silt, with some clay and sand - medium to coarse	Fuel odor HNu - 52 ppm

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 7-ERA2-SB5	DRILLING STARTED: 17 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 19 April 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
35	8-16-18		SS11		Fuel odor HNu - 52 ppm
40	16-19-21		SS12	Sand-fine to medium, with silt, brown	Fuel odor HNu - 50 ppm
45	9-14-14		SS13	Clay, with sand - fine to medium, brown	Fuel odor HNu - 47 ppm
50	18-30-40		SS14	Sand-fine to coarse, with gravel (to 1 1/2", sub-angular to subrounded), tan	Fuel odor HNu - 50 ppm
55	8-19-16		SS15	Silt, with trace clay, brown	Fuel odor HNu - 50 ppm
60	7-11-18		SS16	Clay, with silt, brown	Fuel odor HNu - 40 ppm
65	17-31-40		SS17	Sand-fine to medium, light brown	Fuel odor HNu - 35 ppm
70	26-41-38		SS18	Sand-fine to coarse,tan	Fuel odor HNu - 70 ppm
75	20-25-39		SS19	Clay, with sand-fine to medium, brown	Fuel odor HNu-B
80	34-45-41		SS20	Sand-fine to coarse, with gravel (to 1/2", sub-angular to angular), tan	Fuel odor HNu - 35-40 ppm

DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB5	**DRILLING STARTED:**	17 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	19 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
85	15-29-30		SS21		Fuel odor HNu - 50 ppm
90	18-38-58		SS22	Sand-fine to coarse, with silt, red brown	Fuel odor HNu - 60 ppm
95	72-130		SS23	Sand-fine to coarse, tan	Fuel odor HNu - 52 ppm
100	10-58-119		SS24	Sand-fine to medium, with clay and silt, brown	Fuel odor HNu - 65 ppm
110	20-40-47		SS25	Sand-fine to medium, with silt, tan	Fuel odor HNu - 20 ppm
120	24-40-53		SS26	Sand-fine to medium, red brown	Fuel odor HNu - 60 ppm
130	14-64-86		SS27	Sand-fine to medium, with some silt and clay, brown	Fuel odor HNu - 40 ppm
140	14-31-42		SS28	Silt, with some clay and sand - fine to medium	Fuel odor HNu - 48 ppm
150	30-54-76		SS29	Sand-fine to medium, tan	Fuel odor HNu - 50-70 ppm
160	35-70-76		SS30	Sand-fine to coarse, tan	Fuel odor HNu - 50 ppm

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 7-ERA2-SB5	DRILLING STARTED: 17 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 19 April 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
170	29-27-44		SS31	Sand-fine, with silt and clay, red brown	Fuel odor HNu - 4 ppm
180	30-77-85		SS32	Sand-fine to coarse, with silt, tan	Fuel odor HNu - 2 ppm
190	52-250/5.5"		SS33		Faint fuel odor HNu-B
200	51-157/12"		SS34	Same as above	Fuel odor HNu - 1 ppm
				BT @ 200'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB6	**DRILLING STARTED:**	21 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	21 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand-fine to medium, with some clay, brown	Slight fuel odor HNu - 3 ppm
2.5	4-6-11		SS2	Sand-fine to medium, with some clay and silt, brown and gray	Slight fuel odor HNu - 8 ppm
5	4-8-9		SS3	Sand-fine to medium, with clay and silt, brown	Fuel odor HNu - 20 ppm
7.5	4-8-10		SS4	Sand-medium to coarse, with some clay and some gravel (to 1 1/2"), brown	Slight fuel odor HNu - 3 ppm
10	4-8-9		SS5		Slight fuel odor HNu- background (B)
12.5	2-5-7		SS6	Clay, with some silt, brown	HNu-B
15	5-6-11		SS7	Silt, with trace clay, brown	HNu-B
20	6-10-13		SS8		HNu-B
25	8-17-18		SS9		Slight fuel odor HNu - 1 ppm

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 7-ERA2-SB6	DRILLING STARTED: 21 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 21 April 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
30	8-9-12		SS10	Silt, with sand - fine to coarse, some clay and gravel (to 5/8", subangular to subrounded), brown	Fuel odor HNu - 50 ppm
35	17-30-38		SS11	Silt, with some sand - fine to medium, tan	Fuel odor HNu - 40 ppm
40	9-12-16		SS12	Sand-fine to medium, with silt and clay, brown	Fuel odor HNu - 3 ppm
45	10-20-25		SS13	Sand-fine to medium, brown	Fuel odor HNu-B
50	13-33-34		SS14	Sand-fine to coarse, with silt, some gravel (to 2", angular to sub-angular), brown	Fuel odor HNu-B
55	18-24-31		SS15	Sand-fine to coarse, brown	Fuel odor HNu-B
60	7-9-14		SS16	Silt, with trace clay, brown	Fuel odor HNu - 45 ppm
65	16-28-46		SS17	Silt, with trace clay and some sand - medium to coarse, some gravel (to 3/8"), brown	Fuel odor HNu-B
70	21-31-36		SS18	Sand-fine to coarse, with some gravel (to 1", sub-rounded to subangular)	Fuel odor HNu - 7 ppm

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB6	**DRILLING STARTED:**	21 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	21 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
75	7-12-17		SS19	Clay, with sand - fine to medium, brown	Fuel odor HNu-B
80	8-29-42		SS20	Silt, with sand - fine to medium, and trace clay, brown	Fuel odor HNu - 1 ppm
85	20-45-42		SS21	Sand-fine to coarse, with some gravel (to 3/8", subangular), brown	Fuel odor HNu - 1 ppm
90	17-34-54		SS22	Sand-fine to medium, with trace clay, red brown	Fuel odor HNu-B
95	17-36-54		SS23		Fuel odor HNu-B
100	18-48-87		SS24	Sand-fine to coarse, brown	Fuel odor HNu-B
				BT @ 100'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 7-ERA2-SB7	**DRILLING STARTED:** 22 April 1986
LOCATION: Air Force Plant, Palmdale, CA	**DRILLING COMPLETED:** 22 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay, with some silt, brown	HNu-background (B)
2.5	5-5-6		SS2	Sand-fine to coarse, brown	HNu-B
5	3-5-7		SS3	Clay, with some silt and sand - fine to medium, brown	HNu-B
7.5	6-12-12		SS4	Sand-fine to medium, and clay, brown	HNu < 1 ppm
10	3-6-7		SS5	Sand-fine to medium, with occasional fine gravel (to 3/8", subrounded), brown	HNu-B
12.5	6-12-14		SS6	Silt, with some sand - fine to medium, trace clay, brown	HNu-B
15	4-6-12		SS7	Clay, with trace silt, brown	HNu-B
20	6-12-13		SS8	Silt, brown	HNu-B
25	5-9-10		SS9	Clay, with trace fine sand, brown	HNu-B
30	4-8-10		SS10	Silt and clay, brown	HNu-B
35	4-7-12		SS11	Clay and silt, some sand - medium, brown	HNu-B

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID:	7-ERA2-SB7	DRILLING STARTED:	22 April 1986
LOCATION:	Air Force Plant, Palmdale, CA	DRILLING COMPLETED:	22 April 1986
PROJECT NO:	56394	DRILLING METHOD:	Hollow-stem Auger
DRILLER:	Layne-Western	SAMPLING METHOD:	Split Spoon
LOGGER:		STATIC WATER LEVEL:	Dry
GEOLOGIST:	Laurel Izmirian	WATER LEVEL DATE:	
SIGNATURE:		WATER LEVEL DATUM:	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
40	13-21-25		SS12	Sand-fine to medium, with trace clay, brown	HNu-B
45	14-36-40		SS13	Sand-fine to medium, brown	HNu-B
50	19-34-37		SS14	Sand-fine to coarse, and gravel (to 3", angular to subangular), brown	HNu-B
				BT @ 50"	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 8-FTA8-SB1	**DRILLING STARTED:** 25 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 25 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand-fine to coarse, with some silt, brown	Fuel odor HNu - 13 ppm
2.5	6-7-9		SS2		Fuel odor HNu - 10 ppm
5	5-8-10		SS3	Sand-fine to coarse, with some gravel (to 5/8", sub-rounded), red-brown	Fuel odor HNu <1 ppm
7.5	8-10-13		SS4		Fuel odor HNu <1 ppm
10	9-15-16		SS5		Fuel odor HNu - 2 ppm
12.5	10-14-14		SS6	Same as SS3 above, with more silt and fine sand	Fuel odor HNu <1 ppm
15	9-13-15		SS7		HNu-background (B)
20	8-12-16		SS8	Sand-fine to medium, with some gravel (to 1", sub rounded), brown	HNu-B
				B.T. @ 20'	

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID: 9-PWW2-SB1	**DRILLING STARTED:** 17 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 17 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Post Hole Digger
DRILLER: Layne-Western	**SAMPLING METHOD:** Grab
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Sand-fine to medium, with occasional fine gravel (to 1/2", subangular), brown	HNu-background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 9-PWW2-SB2	DRILLING STARTED: 17 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 17 April 1986
PROJECT NO: 56394	DRILLING METHOD: Post Hole Digger
DRILLER: Layne-Western	SAMPLING METHOD: Grab
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Sand-fine to medium, brown	HNu-background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	10-PWN2-SB1	**DRILLING STARTED:**	28 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	28 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Post Hole Digger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Grab
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Sand - fine to medium, brown	HNu - background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 10-PWN2-SB2	DRILLING STARTED: 28 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 28 April 1986
PROJECT NO: 56394	DRILLING METHOD: Post Hole Digger
DRILLER: Layne-Western	SAMPLING METHOD: Grab
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Sand - fine to medium, with occasional gravel (to approx. 1", subrounded), brown	HNu - background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 10-PWN2-SB3	DRILLING STARTED: 28 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 28 April 1986
PROJECT NO: 56394	DRILLING METHOD: Post Hole Digger
DRILLER: Layne-Western	SAMPLING METHOD: Grab
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Sand - fine to medium, brown	HNu - background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 10-PWN2-SB4	DRILLING STARTED: 28 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 28 April 1986
PROJECT NO: 56394	DRILLING METHOD: Post Hole Digger
DRILLER: Layne-Western	SAMPLING METHOD: Grab
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Silt and sand - fine to medium, brown	HNu - background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 11-DAA2-SB1	**DRILLING STARTED:** 12 Feb. 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 12 Feb. 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine, with silt, brown	
2.5	2-5-6		SS2	Sand - fine, with silt and clay, brown	
5	5-8-10		SS3	Sand - fine to medium, with clay and some silt	
7.5	5-5-9		SS4	Sand - fine, with silt, brown	
10	6-10-11		SS5	Sand - fine, with some silt and trace clay, brown	
				BT @ 10'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 11-DAA2-SB2	**DRILLING STARTED:** 12 Feb. 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 12 Feb. 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	Cuttings		SS1	Sand - fine to medium, with some silt, brown	
2.5	2-3-4		SS2	Sand - fine, with silt and some clay, brown	
5	3-5-6		SS3		
7.5	5-9-14		SS4	Sand - fine to medium, with silt and trace clay, brown	
10	10-13-19		SS5		
				BT @ 10'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 12-ERA1-SB1	**DRILLING STARTED:** 28 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 28 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings below asphalt		SS1	Sand - fine to coarse, brown	HNu - background (B)
2.5	2-3-4		SS2		HNu - B
5	3-4-5		SS3		HNu - B
7.5	2-4-4		SS4	Silt and clay, with some sand - fine to coarse, brown	HNu - B
10	4-6-8		SS5	Sand - fine to medium, with occasional gravel (to 1/2"), brown	HNu - B
12.5	7-11-14		SS6	Clay, with silt and some sand - fine to medium, brown	HNu - B
15	6-8-9		SS7	Silt, with sand - fine to medium, trace clay, brown	HNu - B
20	7-6-6		SS8	Silt, with clay, brown	HNu - B
				BT @ 20'	

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 12-ERA1-SB2	**DRILLING STARTED:** 28 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 28 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, brown	HNu - background (B)
2.5	2-3-4		SS2		HNu - B
5	3-4-6		SS3	Sand - fine to coarse, brown	HNu - B
7.5	3-4-5		SS4	Sand - fine to medium, with clay, brown	HNu - B
10	3-5-10		SS5	Sand - fine to medium, with silt and trace clay, brown	HNu - B
12.5	5-6-9		SS6	Sand - fine to medium, brown	HNu - B
15	5-7-8		SS7	Silt, with some sand - fine to medium, trace clay	HNu - B
20	10-12-15		SS8	Sand - fine to coarse, with some gravel (to 1", subangular to sub-rounded), tan	HNu - B
				BT @ 20'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	13-DAB2-SB1	**DRILLING STARTED:**	28 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	28 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Post Hole Digger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Grab
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Sand - fine to medium, brown	HNu-background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 13-DAB2-SB2	**DRILLING STARTED:** 28 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 28 April 1986
PROJECT NO: 56394	**DRILLING METHOD:** Post Hole Digger
DRILLER: Layne-Western	**SAMPLING METHOD:** Grab
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Sand - fine to medium, brown	HNu-background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	13-DAB2-SB3	**DRILLING STARTED:**	28 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	28 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Post Hole Digger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Grab
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Sand - fine to medium, brown	HNu-background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 13-DAB2-SB4	DRILLING STARTED: 28 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 28 April 1986
PROJECT NO: 56394	DRILLING METHOD: Post Hole Digger
DRILLER: Layne-Western	SAMPLING METHOD: Grab
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0					
3			SS1	Silt and sand - fine to medium, brown	HNu-background
				BT @ 3'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	14-EBA2-SB1	**DRILLING STARTED:**	12 Feb 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	12 Feb 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-Stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with some silt and plant roots, brown	HNu-background (B)
2.5	3-4-6		SS2	Sand - fine to medium, with some silt and trace clay, brown	HNu-B
5	4-6-9		SS3	Sand - fine to medium, with some silt, brown	HNu-B
7.5	7-9-10		SS4	Sand - fine to coarse, with some gravel (to 1/2", subangular, some flat and elongated), brown	HNu-B
10	8-10-13		SS5	Sand - fine to coarse, with some gravel (to 1/2", subangular to subrounded), brown	HNu-B
				BT @ 10'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	14-EBA2-SB2	**DRILLING STARTED:**	12 Feb 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	12 Feb 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-Stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with trace clay and plant roots, brown	HNu-background (B)
2.5	2-4-6		SS2	Clay, with sand and plant roots, brown	HNu-B
5	6-12-12		SS3	Sand - fine to medium, with trace clay, brown	HNu-B
7.5	7-9-11		SS4		HNu-B
10	4-11-15		SS5	Sand - fine to coarse, and gravel (to 1/2", subangular), brown	
				BT @ 10'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 15-TEB2-SB1	**DRILLING STARTED:** 11 Feb 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 11 Feb 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	Cuttings		SS1	Sand-fine, with clay and silt, dark brown at surface	Solvent (?) odor HNu-background (B)
2.5	4-9-11		SS2	Same as above, brown	Solvent (?) odor HNu - 1 ppm
5	4-6-11		SS3	Sand-fine to medium, with silt, clay and plant roots, brown	Solvent (?) odor HNu - 2 ppm
7.5	5-8-13		SS4	Sand-fine to coarse, with some gravel (1/2"), brown	Slight odor HNu-B
10	4-8-9		SS5	Sand-fine to medium, with silt and some clay, brown	Slight odor HNu-B
				BT @ 10'	

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ENGINEERING-SCIENCE

DRILLING RECORD

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WELL/BORING ID:	15-TEB2-SB2	**DRILLING STARTED:**	11 Feb 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	11 Feb 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	Cuttings		SS1	Sand - fine to medium, with silt, some clay and plant roots, dark brown with some gray-green at surface	Strong odor (solvent?); HNu-background (B)
2.5	5-7-8		SS2	Sand - fine to medium, with clay and some gravel (to 1"), brown	Strong odor HNU - 1 ppm
5	7-8-10		SS3		Strong odor HNu - 5 ppm
7.5	6-8-11		SS4	Sand - fine to coarse, some gravel (to 1/4"), brown	Strong odor HNu - 5 ppm
10	6-8-9		SS5	Sand - fine to medium, with silt, brown	Strong odor HNu - 4 ppm
				BT @ 10'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	16-EVP3-SB1	**DRILLING STARTED:**	3 Feb 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	3 Feb 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Silt, with sand - fine to medium, trace gravel (to 1/2") and organic lumps, brown	Organic odor
2.5	4-4-5		SS2	Silt, with some clay and sand - fine to medium, brown	Organic odor
5	6-11-20		SS3	Silt and clay, with some fine sand, brown	Organic odor
7.5	9-12-19		SS4	Sand - fine to medium, and silt, light brown	Slight organic odor
10	9-9-14		SS5	Sand - fine to medium, with clay and silt, light brown with gray veins	Slight organic odor
12.5	6-9-20		SS6		
15	8-9-13		SS7	Sand - fine to medium, with clay and silt, some gravel (1/8", angular and flat), light brown	
20	5-6-7		SS8	Clay, with silt, brown	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 16-EVP3-SB1	DRILLING STARTED: 3 Feb 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 3 Feb 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
25	5-7-16		SS9	Silt, with clay and sand - fine to medium, brown with gray veins	
30	5-8-12		SS10	Sand - fine to medium, with some silt, some clay and gravel (to 1/4"), brown	
35	8-12-25		SS11	Sand - fine to medium, with some clay, brown	
40	7-21-32		SS12	Clay, with silt and sand - fine to medium, brown	
45	28-44-52		SS13	Sand - fine to very coarse, and fine gravel (to 1/2"), tan	
50	43-50-33		SS14	Sand - fine to coarse, light brown	
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	16-EVP3-SB2	**DRILLING STARTED:**	3 Feb 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	5 Feb 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, and silt, with some fine gravel (approx. 1/2", angular), brown with gray and black organic lumps (to 1")	Organic odor
2.5	5-4-5		SS2	Silt and sand - fine to medium, brown with black organic matter	Faint odor
5	6-12-19		SS3	Silt and clay, with some sand - fine to medium, brown with black lumps of organic matter.	Faint odor
7.5	6-12-14		SS4	Sand - fine to medium, with some silt and clay, occasional fine gravel (1/4"), light brown	Faint odor
10	6-11-15		SS5	Sand - fine to medium, with clay and silt, light brown	
12.5	10-11-15		SS6	Same as above, but brown with gray veins and occasional rust colored areas	
15	9-13-20		SS7	Sand - fine to coarse, with clay and silt, some fine gravel (to 3/8"), brown with gray veins	

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	16-EVP3-SB2	**DRILLING STARTED:**	3 Feb 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	5 Feb 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
20	4-10-13		SS8	Clay, with silt, brown	
25	5-8-11		SS9	Sand - fine to medium, some clay and silt, brown and gray	
30	6-16-23		SS10	Sand - fine to coarse, with some silt, occasional gravel (to 3/4", subangular, flat and elongated)	
35	6-12-21		SS11	Clay, with silt and fine sand, gray	
40	11-25-39		SS12	Sand - fine, with some silt and clay, brown	
45	20-27-43		SS13	Sand - fine to coarse, some some silt and clay, some gravel (to 1", subangular), brown	
50	16-29-30		SS14	Sand - fine to coarse, with gravel (to 1", subangular to angular), light brown	
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 16-EVP3-SB3	**DRILLING STARTED:** 5 Feb 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 5 Feb 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-Stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	Cuttings		SS1	Sand - fine to medium, and silt, brown	Organic odor
2.5	3-6-9		SS2	Sand - fine to medium, with some silt and clay, brown	Slight odor
5	10-19-20		SS3	Same as above, gray-brown with black organic matter	Slight odor
7.5	6-8-11		SS4	Silt and clay, with some sand - fine to medium, brown with gray	Slight odor
10	6-9-11		SS5	Sand - fine to coarse, brown	Slight odor
12.5	3-4-5		SS6	Sand - fine to coarse, with silt, clay and occasional fine gravel (1/4"), brown with gray	Slight odor
15			SS7	Clay, with silt and sand, brown and gray	Slight odor

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	16-EVP3-SB3	**DRILLING STARTED:**	5 Feb 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	5 Feb 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
20	4-4-8		SS8	Clay and silt, with occasional medium sand, brown with some tan	
25	6-12-18		SS9	Silt with clay and fine sand, occasional fine gravel (3/8", subrounded), brown and gray	
30	10-18-23		SS10	Silt with clay and sand - fine to coarse, some gravel (to 1-1/4"), brown and gray	Slight odor
35	12-21-23		SS11	Silt with clay and some sand - fine to medium, brown	
40	15-47-60		SS12	Sand - fine to coarse, with clay and some silt, brown	
45	41-53-63		SS13	Sand - fine to coarse with fine gravel, light brown	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	16-EVP3-SB3	**DRILLING STARTED:**	5 Feb 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	5 Feb 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
50	23-25-35		SS14	Sand - fine to coarse, with some gravel (to 1-1/2", subangular to well rounded), light brown	Slight odor
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 16-EVP3-SB4	**DRILLING STARTED:** 5 Feb 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 6 Feb 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Silt, with some sand - fine to medium, trace clay and occasional gravel (1/2"; subangular), brown	
2.5	5-7-14		SS2	Silt, with clay and some fine sand, brown	
5			SS3		
8	15-52-79		SS4	Silt and sand - fine to medium, cemented, light brown and gray	Very hard
10	18-34-36		SS5		
12.5	12-17-23		SS6	Sand - fine to medium, with silt, light brown with gray	
15	8-12-13		SS7	Sand - fine to medium, with silt, some clay, brown with gray	Slight organic odor
20	6-16-18		SS8	Clay, with some silt, some fine sand, occasional fine gravel	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 16-EVP3-SB4	**DRILLING STARTED:** 5 Feb 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 6 Feb 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
25	5-10-16		SS9	Clay, with silt, fine sand and occasional fine gravel, brown with gray and rust	
30	7-16-30		SS10	Sand - fine to medium, and clay, light brown	Slight organic odor
35	8-13-16		SS11	Same as above, but brown with gray	
40	6-64-117		SS12	Clay and sand - fine to coarse, light brown	Slight odor
45			SS13	Sand - fine to coarse, tan	
50			SS14	Sand - fine to coarse, with some silt, trace clay, brown	
				BT @ 50'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 17-NFTC-SB1	**DRILLING STARTED:** 5 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 6 Dec 1985
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: George Pilja	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with gravel (to 3/4"), light brown, loose	Moist, slight odor, HNu>1
2.5	4-5-5		SS2		Slight odor, HNu>1
5	4-10-13		SS3	Clay, with silt and sand - fine to medium, some medium gravel, light brown	Moist, slight odor, HNu>1
7.5	9-11-13		SS4		
10	12-15-17		SS5	Sand - fine to medium, with some silt, some gravel, light brown	Moist, HNu<1
12.5	9-10-13		SS6		
15	24-34-29		SS7	Clay, with silt and fine sand, light brown and gray, loose	Moist, HNu - background (B)
20	24-25-32		SS8	Sand - fine to medium, with some fine gravel and some silt, light brown, loose	Moist, HNu-B
25	25-38-37		SS9	Sand - fine to coarse, with fine gravel and silt, light brown, loose	Moist, HNu-B

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 17-NFTC-SB1	DRILLING STARTED: 5 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 6 Dec 1985
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: George Pilja	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
30	9-23-34		SS10	Clay, with silt and sand	Moist, HNu-B
35	49		SS11		Auger stuck
				BT @ 35'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 17-NFTC-SB2	**DRILLING STARTED:** 6 Dec 1985
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 6 Dec 1985
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: George Pilja	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0				Drilled as offset to 17-NFTC-SB1	
15					
				BT @ 14.5'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 18-ADA2-SB1	**DRILLING STARTED:** 19 Dec. 1985
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 19 Dec. 1985
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: George Pilja	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine, with some silt	
2.5	16-20-29		SS2	Same as above	
5	13-13-12		SS3	Clay, with silt and very fine sand, light brown	
7.5	15-16-37		SS4		
10	38-50-55		SS5	Same as above, with more sand	
12.5	20-24-50		SS6		
15	20-38-45		SS7	Sand - fine to coarse, with some silt	
20	11-26-30		SS8	BT @ 20'	

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ENGINEERING-SCIENCE
DRILLING RECORD

WELL/BORING ID: 19-ERA3-SB1	DRILLING STARTED: 25 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 25 April 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay, with fine sand, brown	HNu - background (B)
2.5	4-6-8		SS2	Sand - fine, and silt, brown	HNu-B
5	6-12-18		SS3	Clay, with some sand - fine to medium, brown	HNu-B
7.5	6-8-9		SS4	Sand - fine to medium, and clay, brown	HNu-B
10	6-7-9		SS5	Sand - fine to coarse, with some gravel (to 1", sub-angular to subrounded), brown	HNu-B
				BT @ 10'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	19-ERA3-SB2	**DRILLING STARTED:**	25 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	25 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Clay, with fine sand, brown	HNu-background (B)
2.5	5-6-10		SS2	Sand - fine, and silt, brown	Moist HNu-B
5	5-12-22		SS3	Clay, with some sand - fine to medium, occasional fine gravel (to 3/8"), brown	HNu-B
7.5	8-11-12		SS4	Sand - fine to coarse, and clay, with some gravel (to 3/4"), brown	HNu-B
10	5-7-8		SS5	Sand - fine to coarse, brown	HNu-B
				BT @ 10'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 20-NLA2-SB1	**DRILLING STARTED:** 12 Feb. 1986
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 12 Feb. 1986
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: Laurel Izmirian	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with silt and clay, brown	Solvent (?) odor HNu-background (B)
2.5	6-10-13		SS2	Silt, with clay and some fine sand, brown	Solvent (?) odor HNu-B
5	11-11-16		SS3	Sand - fine to medium, with silt and clay, brown	Solvent (?) odor HNu-B
7.5	5-6-12		SS4	Same as above	HNu-B
10	10-15-16		SS5	Sand - fine to coarse, and gravel (to 1/2", subangular), light brown	HNu-B
12.5	9-14-18		SS6	Sand - fine, and clay, with some silt, brown	HNu-B
15	7-8-7		SS7	Sand - fine to medium, and clay, with some silt, brown	HNu-B
20	4-6-8		SS8	Clay and silt, brown	HNu-B
				BT @ 20'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	21-FDA7-SB1	DRILLING STARTED:	24 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED:	24 April 1986
PROJECT NO:	56394	DRILLING METHOD:	Hollow-stem Auger
DRILLER:	Layne-Western	SAMPLING METHOD:	Split Spoon
LOGGER:		STATIC WATER LEVEL:	Dry
GEOLOGIST:	Laurel Izmirian	WATER LEVEL DATE:	
SIGNATURE:		WATER LEVEL DATUM:	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with with some silt and trace clay, brown	HNu - background (B)
2.5	6-7-7		SS2		HNu-B
5	4-5-3		SS3	Silt, with some sand - fine to medium, trace clay, brown	HNu-B
7.5	2-3-4		SS4		HNu-B
10	5-6-7		SS5	Sand - fine to coarse, with silt, some gravel (to 3/8", subrounded), brown	HNu <1ppm
12.5	3-5-6		SS6	Silt, with some clay, occasional sand - medium to coarse, brown	HNu <1ppm
15	3-3-5		SS7		HNu-B
20	9-10-11		SS8	Sand - fine to coarse, with gravel (to approx. 1", angular to subangular), tan	Lost sample; went back down hole with catcher
				BT @ 20'	

ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	21-FDA7-SB2	**DRILLING STARTED:**	24 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	24 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with silt, some black organic lumps (to 3/4"),occasional gravel (to 1", subrounded), brown	HNU-background (B)
2.5	5-6-8		SS2	Silt, with fine sand and clay brown	HNu-B
5	5-7-8		SS3	Silt, with clay, brown	HNu-B
7.5	5-5-8		SS4	Silt, with trace clay, some sand - fine to medium and occasional gravel (to 1/2"), brown	HNu <1ppm
10	4-4-4		SS5	Same as above, but no clay	HNu-B
12.5	4-4-5		SS6	Silt, with trace clay, brown	HNu - 2 ppm
15	2-4-5		SS7	Clay, with some silt and sand - fine to medium, brown	HNu <1ppm
20	5-6-8		SS8	Sand - fine to coarse, with silt, some clay, some gravel (to approx. 1/2"), brown	HNu-B
				BT @ 20'	

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ENGINEERING-SCIENCE
DRILLING RECORD

PAGE 1 OF 1

WELL/BORING ID: 21-FDA7-SB3	DRILLING STARTED: 24 April 1986
LOCATION: Air Force Plant 42, Palmdale, CA	DRILLING COMPLETED: 24 April 1986
PROJECT NO: 56394	DRILLING METHOD: Hollow-stem Auger
DRILLER: Layne-Western	SAMPLING METHOD: Split Spoon
LOGGER:	STATIC WATER LEVEL: Dry
GEOLOGIST: Laurel Izmirian	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Silt and sand - fine to medium, some clay, brown	HNu - background (B)
2.5	2-3-4		SS2	Silt, with sand - fine to medium, brown	HNu-B
5	3-4-6		SS3		HNu-B
7.5	4-7-8		SS4	Silt, with trace clay, brown	HNu-B
10	4-5-6		SS5	Silt and clay with sand - fine to medium, tan	HNu-B
12.5	4-5-8		SS6	Silt, with some medium sand and trace clay, brown	HNu-B
15	4-5-7		SS7	Sand - fine to medium, with some clay and silt, brown	HNu <1ppm
20	4-6-8		SS8	Silt, with clay, brown	HNu-B
				BT @ 20'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID: 22-ERAT-SB1	**DRILLING STARTED:** 5 Dec. 1985
LOCATION: Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:** 5 Dec. 1985
PROJECT NO: 56394	**DRILLING METHOD:** Hollow-stem Auger
DRILLER: Layne-Western	**SAMPLING METHOD:** Split Spoon
LOGGER:	**STATIC WATER LEVEL:** Dry
GEOLOGIST: George Pilja	**WATER LEVEL DATE:**
SIGNATURE:	**WATER LEVEL DATUM:**

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings			Silt, with clay and very fine sand, some gravel (to 1"), loose	Moist
2.5	7-9-7		SS1	Same as above, but with less coarse gravel, light brown	
5	7-6-8		SS2	Silt, with clay and some sand - very fine to coarse, light brown	
7.5	11-21-27		SS3	Clay and silt with sand - very fine to medium, light brown, compacted	Moist
10	12-18-18		SS4	Sand - fine to coarse, with clay and silt, light brown and gray, loose	Moist
				BT @ 10'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	22-ERAT-SB2	**DRILLING STARTED:**	5 Dec. 1985
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	5 Dec. 1985
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	George Pilja	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings			Silt, with clay and sand, some gravel, dark brown	Moist
2.5	6-7-8		SS1	Clay, with silt and sand - very fine to coarse, light brown	
5	5-6-8		SS2	Same as above, with more sand, loose	Moist
7.5	7-16-21		SS3	Same as above, with gravel (to 1/2")	Moist
10	16-18-15		SS4		
				BT @ 10'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	23-BDD8-SB1	**DRILLING STARTED:**	10 Feb. 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	10 Feb. 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, with some asphalt, brown	
2.5	2-5-10		SS2	Sand - fine to medium, with silt and some clay, brown	Wet
5	5-7-9		SS3		
7.5	4-9-11		SS4	Sand - fine to coarse, with gravel (to 1"), brown	
10	4-9-10		SS5	Sand - fine to medium, light brown	
12.5	10-14-14		SS6	Same as above, with more coarse sand and gravel (to 2"), brown	
15	6-12-18		SS7	Sand - fine to coarse, with gravel (to 2"), brown	
20	9-14-25		SS8	Sand - fine to medium, with gravel (to 1/2"), brown	
				BT @ 20'	

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ENGINEERING-SCIENCE

DRILLING RECORD

WELL/BORING ID:	23-BDD8-SB2	**DRILLING STARTED:**	8 April 1986
LOCATION:	Air Force Plant 42, Palmdale, CA	**DRILLING COMPLETED:**	8 April 1986
PROJECT NO:	56394	**DRILLING METHOD:**	Hollow-stem Auger
DRILLER:	Layne-Western	**SAMPLING METHOD:**	Split Spoon
LOGGER:		**STATIC WATER LEVEL:**	Dry
GEOLOGIST:	Laurel Izmirian	**WATER LEVEL DATE:**	
SIGNATURE:		**WATER LEVEL DATUM:**	

DEPTH IN FEET BELOW LS.	SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE ID	SAMPLE DESCRIPTION	NOTES
0	cuttings		SS1	Sand - fine to medium, light brown	HNu-background (B)
2.5			SS2	Same as above, with more medium sand	HNu-B
5	3-5-7		SS3		HNu-B
7.5	4-5-8		SS4		HNu-B
10	4-8-9		SS5		HNu-B
12.5	8-10-12		SS6		HNu-B
15	9-13-16		SS7	Same as above, with more coarse sand, and occasional gravel (to 1", sub-rounded, flat and elongated), brown	HNu-B
20	8-13-14		SS8	Sand - fine to coarse, with gravel (to 1 1/2", sub-angular to sub-rounded)	HNu-B
				BT @ 20'	

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APPENDIX H

CHAIN OF CUSTODY FORMS

ENGINEERING–SCIENCE

CHAIN OF CUSTODY RECORD

ES JOB NO. 56394

PROJECT NAME/LOCATION AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550, 413.2	8010	8020	REMARKS
12-5	15:00	17-NFTC-SB1-SS10-30'-ITC	1	X			
12-5	15:00	17-NFTC-SB1-SS5-10'-ITC	1	X			
12-5	15:00	17-NFTC-SB1-SS15-10'-ITC	1	X			
12-5	13:00	22-ERAT-SB2-SS4-10'-ITC	1	X			
12-5	09:30	22-ERAT-SB1-SS4-10'-ITC	1	X			
12-6	09:00	17-NFTC-SB2-SS2-2.5'-ITC	1	X			
12-6	12:00	5-AFTC-SB1-SS2-2.5'-ITC	5	X	X	X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12-7 11:00				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
		Cecilia Lai (IT Corp)	12/7/[illegible] 3:35 p.m.	

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

35288

001 -

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 for 413.2	5010	8020	CAM 17-Metals*	REMARKS
12-9	0900	4-VWTS-SB1-SS3-5'-ITC	6	X	X	X	X	
12-9	0900	4-VWTS-SB1-SS5-10'-ITC	6	X	X	X	X	
12-9	0900	4-VWTS-SB1-SS10-30'-ITC	6	X	X	X	X	
[illegible]								
12/10	0900	4-VWTS-SB1-SS14-50'-ITC	6	X	X	X	X	

*CAM 17-Metals: As, Ba, Cd, Cr VI, Pb, Hg, Se, Ag

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12-10 1400				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

ES JOB NO. 56394

PROJECT NAME/LOCATION AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 + 413.2	8010	8020	CAM P-Metals*	REMARKS
12-10	1500	4-VWT5-SB2-SS14-30'-ITC	6	X	X	X	X	
12-10	1200	4-VWT5-SB2-SS10-30'-ITC	6	X	X	X	X	
12-10	1200	4-VWT5-SB2-SS5-10'-ITC	6	X	X	X	X	

REMARKS: *CAM P-Metals: As Ba Cd Cr VI Pb Hg Se Ag

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12-11 1500				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

ES JOB NO.	PROJECT NAME/LOCATION	SHIP TO:
56394	AF PLANT 42 IRP	IT CORPORATION 17605 Fabrica Way Cerritos, CA 90701 (213)921-9831

SAMPLER(S): (Signature) [signature]

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CON-TAINERS	3550, Thru 413.2	8010	8020	3550, Thru 418.1	REMARKS
12-11	1200	6-OFTC-SB1-SS2-2.5'-ITC	6	X	X	X		
12-11	1200	6-OFTC-SB1-SS5-10'-ITC	6	X	X	X		
12-11	1200	6-OFTC-SB1-SS10-30'-ITC	6	X	X	X		
12-12	1600	6-OFTC-SB1-SS14-50'-ITC	6	X	X	X		
12-12	1200	7-ERA2-SB1-SS5-10'-ITC	1 ✓				X	
12-12	1200	7-ERA2-SB1-SS10-30'-ITC	1 ✓				X	
12-12	1200	7-ERA2-SB1-SS14-50'-ITC	1 ✓				X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12-13 1200				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

35345

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

005

ES JOB NO. 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

	DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550, Thm 418.1							REMARKS
A	12-13	1200	7-ERA2-SB2-SS5-10'-ITC	1	X							
B	12-13	1200	7-ERA2-SB2-SS10-30'-ITC	1	X							
C	12-13	1200	7-ERA2-SB2-SS14-50'-ITC	1	X							
D	12-13	1200	7-ERA2-SB2-SS15-10'-ITC	1	X							
E	12-14	0900	7-ERA2-SB3-SS5-10'-ITC	1	X							
F	12-14	0900	7-ERA2-SB3-SS8-20'-ITC	1	X							
G	12-14	0900	7-ERA2-SB3-SS10-30'-ITC	1	X							
H	12-14	0900	7-ERA2-SB3-SS14-50'-ITC	1	X							

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12-14 1300	[signature]			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

~~35357~~ ~~35357~~ 35357

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

006

ES JOB NO. 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 Am 413.2	8010	8020	SM 510A Am 510B	CAM P-Metals*				REMARKS
12-16	0900	2-PWD2-SB1-SS2-2.5'-ITC	6	X	X	X	X	X				
12-16	0900	2-PWD2-SB1-SS5-10'-ITC	6	X	X	X	X	X				
12-16	0900	2-PWD2-SB1-SS10-30'-ITC	6	X	X	X	X	X				
12-16	0900	2-PWD2-SB1-SS14-50'-ITC	6	X	X	X	X	X				
12-16	0900	2-PWD2-SB1-SS15-10'-ITC	6	X	X	X	X	X				
												*CAM P-Metals: As, Ba, Cd, Cr-VI, Pb, Hg, Se, Ag by CAM extraction

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12-17 1100				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

O-II

ENGINEERING-SCIENCE

35374

CHAIN OF CUSTODY RECORD

007

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

ANALYSES REQUIRED: 3550 Mn 413.2 | 8010 | 8020 | SM 510A/510B | CAM P. metals *

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 Mn 413.2	8010	8020	SM 510A/510B	CAM P. metals *			REMARKS
12-16	1500	2-PWD2-SB2-SS2-2.5'-ITC	6	X	X	X	X	X			
12-16	1500	2-PWD2-SB2-SS5-10-ITC	6	X	X	X	X	X			
~~12-16~~											
12-17	0900	2-PWD2-SB2-SS10-30'-ITC	6	X	X	X	X	X			
12-17	0900	2-PWD2-SB2-SS14-50'-ITC	6	X	X	X	X	X			

REMARKS: * CAM PRIMARY METALS: As, Ba, Cd, Cr VI, Pb, Hg, Se, Ag by CAM extraction

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12-18 / 1100				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

35371

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

008

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CON-TAINERS	3510, Fm 413.2	8010	8020	SM 510A/510B	CAM - P-Metals*				REMARKS
12-17	1200	2-PWD2-SB3-SS2-2.5'-ITC	6	X	X	X	X	X				
12-17	1200	2-PWD2-SB3-SS5-10'-ITC	6	X	X	X	X	X				
12-17	1200	2-PWD2-SB3-SS10-30'-ITC	6	X	X	X	X	X				
12-18	0900	2-PWD2-SB3-SS14-50'-ITC	6	X	X	X	X	X				
												*CAM PRIMARY METALS
												As, Ba, Cd, CrVI
												Pb, Hg, Se, Ag

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12-18 1100				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

009

ES JOB NO.: 56394
PROJECT NAME/LOCATION: AF PLANT 42 - IRP-II
SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 Tr. 418.1	8010	8020	SM 510A/510B	CAM P. Metals*				REMARKS
12-18	1200	2-PWD2-SB4-SS2-2.5'-ITC	6	X	X	X	X	X				
12-18	1200	2-PWD2-SB4-SS5-10'-ITC	6	X	X	X	X	X				
12-18	1400	2-PWD2-SB4-SS10-30'-ITC	6	X	X	X	X	X				
12-19	0900	2-PWD2-SB4-SS14-50'-ITC	6	X	X	X	X	X				
												*CAM Primary Metals
												As, Ba, Cd, CrVI
												Pb, Hg, Se, Ag
												by CAM extraction

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12-19 1100				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

ENGINEERING-SCIENCE

35401

CHAIN OF CUSTODY RECORD

010

ES JOB NO. SE394

PROJECT NAME/LOCATION AF PLANT 42 IRP II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

ANALYSES REQUIRED

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 Pre 413.2	8010	8020	SM 510A/510B	CAM P-Metals *				REMARKS
12-19	1100	18-ADA2-SB1-SS5-10'-ITC	5	X	X	X						
12-19	1100	18-ADA2-SB1-SS8-20'-ITC	5	X	X	X						
12-19	1600	2-PWD2-SB5-SS5-10'-ITC	6	X	X	X	X	X				
12-20	0900	2-PWD2-SB5-SS10-30'-ITC	6	X	X	X	X	X				
12-20	0900	2-PWD2-SB5-SS14-50'-ITC	6	X	X	X	X	X				

REMARKS: *CAM Priority Metals As, Ba, Cd, Cr VI, Pb, Hg, Se, Ag by CAM extraction

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12-20 1200				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

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35'13

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

011

ES JOB NO. 56394

PROJECT NAME/LOCATION AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	ANALYSES REQUIRED: 412E with ~~SIZE~~	CYANIDE	249.1 NICKEL	601 VOH	602 VOA				REMARKS
1-30	0900	DW3-1-ITC	6	X	X		X	X				
1-30	1030	DW1-1-ITC	4				X	X				
1-30	1200	DW8-1-ITC	4				X	X				
												~~NOTE: USE [illegible] EXTRACTION FOR NICKEL (249.1)~~

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	1-30-86 1500	[signature] 1-31-86			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

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55742

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

012

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

ANALYSES REQUIRED: 601 VOH, 602 VOA

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CON-TAINERS	601 VOH	602 VOA						REMARKS
1-31	0830	FW2B-ITC	4	X	X						
1-31	0930	FW1-ITC	4	X	X						

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	1-31 / 1600	[signature]			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

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35778

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

013

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	8010	8020	SM 412D (cyanide)	NICKEL (total)	CAM Primary Metals	REMARKS
2-3	0300	16-EVP3-SB1-SS2-2.5-ITC	6	X	X	X	X	X	
2-3	0300	16-EVP3-SB1-SS5-10-ITC	6	X	X	X	X	X	
2-3	0300	16-EVP3-SB1-SS10-30-ITC	6	X	X	X	X	X	
2-3	0300	16-EVP3-SB1-SS14-50-ITC	6	X	X	X	X	X	
									CAM Primary Metals: As, Ba, Cd, Cr VI, Pb, Hg, Se, Ag, +Ni

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	2-4 1500	FEDERAL EXPRESS			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
FEDERAL EXPRESS	2-5-86 0945	IT Cerritos [signature]	2-5-86 0945	

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35790

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

014

ES JOB NO.: SB394
PROJECT NAME/LOCATION: AF PLANT 42 - IRP-II
SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	8010	8020	SM412D (CYANIDE)	NICKEL (239.1)	CAM P. Metals*				REMARKS
2-3	1500	16-EVP3-SB2-SS3-5-ITC	6	X	X	X	X	X				
2-3	1500	16-EVP3-SB2-SS8-20-ITC	6	X	X	X	X	X				
2-5	0900	16-EVP3-SB2-SS14-50-ITC	6	X	X	X	X	X				
2-5	1130	16-EVP3-SB3-SS2-2.5-ITC	6	X	X	X	X	X				

*CAM PRIMARY Metals: As, Ba, Cd, Cr VI, Pb, Hg, Se, Ag + Ni

Relinquished by: (Signature)	Date/Time		Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	2-5	1500	FEDERAL EXPRESS			
Relinquished by: (Signature)	Date/Time		Received for Laboratory by: (Signature)	Date/Time		Remarks
			IT CERRITOS [signature]	2-6-86	1000	

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35803

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

015

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

ANALYSES REQUIRED

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	8010	8020	SM412D (CN)	2424 (Ni)	CAM P-metals				REMARKS
2-5	1130	16-EVP3-SB3-SS5-10-ITC	6	X	X	X	X	X				
2-5	1130	16-EVP3-SB3-SS10-30-ITC	6	X	X	X	X	X				
2-5	1130	16-EVP3-SB3-SS14-50-ITC	6	X	X	X	X	X				
2-5	1530	16-EVP3-SB4-SS2-2.5-ITC	6	X	X	X	X	X				
												Note: CAM P-Metals are
												As, Ba, Cd, Cr VI,
												Pb, Hg, Se, Ag + Ni

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	2-5 1200	FEDERAL EXPRESS			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
FEDERAL EXPRESS	2-7-84 1000	IT Cerritos [signature]	2-7-84 1000	

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ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

016

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	8010	8020	SM412D (CN)	7421 (Ni)	CAM P-Metals				REMARKS
2-5	1530	16-EVP3-SB4-SS5-10-1TC	6	X	X	X	X	X				
2-5	1530	16-EVP3-SB4-SS10-30-1TC	6	X	X	X	X	X				
2-5	1530	16-EVP3-SB4-SS15-10-1TC	6	X	X	X	X	X				
2-6	0830	16-EVP3-SB4-SS14-50-1TC	6	X	X	X	X	X				
												Note CAM P-Metals: As, Ba, Cd, Cr VI, Pb, Hg, Se, Ag+Ni

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	2-6 1200	FEDERAL EXPRESS			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
FEDERAL EXPRESS	2-7-81 1000	[signature] IT CERRITOS	2-7-81 1000	

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35812

ENGINEERING-SCIENCE

C IAIN OF CUSTODY RECORD

017

ES JOB NO.	PRO Ir NAME/LOCATION	SHIP TO:
56394	PLANT 42 IRP-II	IT CORPORATION 17605 Fabrica Way Cerritos, CA 90701 (213)921-9831

SAMPLER(S): [signature] nature) [signature]

DATE	TI	SAMPLE DESCRIPTION	NO. OF CON-TAINERS	8010	8020	3550 [illegible] 4132						REMARKS
-7		5-AFTC-SB2-SS5-10-ITC	5	X	X	X						
2-7		5-AFT SB2-SS10-30-ITC	5	X	X	X						
2-7	0900	5-A -SB2-SS14-50-ITC	5	X	X	X						

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	2-7 1500	[signature]			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
		IT Cerritos [signature]	2-8-86 10^00	

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35847

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

018

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	8010	8020	3550 Thru 413.2	CAM P-Metals					REMARKS
2-10	1000	4-VWT5-SB3-SS3-5-ITZ	6	X	X	X	X					
2-10	1000	4-VWT5-SB3-SS8-20-ITZ	6	X	X	X	X					
2-10	1200	4-VWT5-SB4-SS3-5-ITZ	6	X	X	X	X					
2-10	1200	4-VWT5-SB4-SS8-20-ITZ	6	X	X	X	X					
												CAM Primary Metals:
												As, Ba, Cd, Cr VI
												Pb, Hg, Se, Ag

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	2-10 1400		[signature]		

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
[signature]	[illegible]	IT Cerritos [signature]	[illegible] /1000	

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35863

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

C19

ES JOB NO.	PROJECT NAME/LOCATION	SHIP TO:
56394	AF PLANT 42 IRP-II	IT CORPORATION 17605 Fabrica Way Cerritos, CA 90701 (213)921-9831

SAMPLER(S): (Signature) [signature]

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CON-TAINERS	8010	8020	CAM P-Metals	3550 Tm 418.1	3550 Tm 413.2	CAM S-Metals			REMARKS
✓ 2-10	1600	23-BDD8-SB1-SS3-5-1TC	5	X	X	X			X			
2-10	1600	23-BDD8-SB1-SS8-20-1TC	5	X	X	X			X			~~[illegible]~~
2-11	840	7-ERA2-SB4-SS5-10-1TC	1				X					CAM Primary Metals:
2-11	840	7-ERA2-SB4-SS10-30-1TC	1				X					As, Cd, Ba, Cr VI
2-11	840	7-ERA2-SB4-SS14-50-1TC	1				X					
~~2-11~~	~~1615~~											Pb, Hg, Se, Ag
2-11	1515	15-TEB2-SB1-SS5-10-1TC	1					X				
2-11	1615	15-TEB2-SB2-SS5-10-1TC	1					X				
2-11	1615	15-TEB2-SB2-SS15-10-1TC	1					X				CAM Secondary Metals:
2-12	0830	14-EBA2-SB1-SS5-10-1TC	1					X				Fe, Cu, Mn, Zn
2-12	0945	14-EBA2-SB2-SS5-10-1TC	1					X				

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	2-12 1400	[signature]			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
		[signature]	2-13-86 1137	

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35893

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

020

ES JOB NO. 56394

PROJECT NAME/LOCATION AFPLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	8010	8020	3550 Mod 413.2						REMARKS
2-12	1100	20-NLA2-SB1-SS3-5-ITZ	5	X	X	X						
2-12	1100	20-NLA2-SB1-SS8-20-ITZ	5	X	X	X						
2-12	1530	11-DAA2-SB1-SS5-10-ITZ	5	X	X	X						
2-12	1600	11-DAA2-SB2-SS5-10-ITZ	5	X	X	X						

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	2-13 1400	[signature]			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

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ENGINEERING-SCIENCE

36506

CHAIN OF CUSTODY RECORD

021

ES JOB NO.: S6394

PROJECT NAME/LOCATION: AF PLANT 42 IRP II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 413.2	3550 418.1	CAM Metals (12)	8010	8020				REMARKS
4-8	1530	23-BDD8-SB2-SS3-5-ITC	6	X		X	X	X				
4-8	1530	23-BDD8-SB2-SS8-20-ITC	6	X		X	X	X				
4-9	0930	1-FCD2-SB1-SS5-10-ITC	5		X		X	X				
4-9	0930	1-FCD2-SB1-SS10-30-ITC	5		X		X	X				CAM Metals include
4-9	0930	1-FCD2-SB1-SS14-50-ITC	5		X		X	X				As, Ba, Cd, Cr VI, Pb,
4-9	0930	1-FCD2-SB1-SS15-30-ITC	5		X		X	X				Hg, Se, Ag, Fe, Cu,
~~[illegible]~~		~~[illegible]~~ MAH										Mn, Zn
												by CAM extraction

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	4-9 1500	J. Fiala			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

36515

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 thru 418.1	8010	8020	REMARKS
4-9	0930	1-FCD2-SB1-SS19-75-ITC	5	X	X	X	
4-10	0830	1-FCD2-SB2-SS5-10-ITC	5	X	X	X	
4-10	0830	1-FCD2-SB2-SS10-30-ITC	5	X	X	X	
4-10	0830	1-FCD2-SB2-SS14-50-ITC	5	X	X	X	
4-10	0830	1-FCD2-SB2-SS19-75-ITC	5	X	X	X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	4-10 1500		[signature]		

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
[signature]		Fiala	4-11-86 1 15	

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36546

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

023

ES JOB NO. 58394

PROJECT NAME/LOCATION AF PLANT 42 ICP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

ANALYSES REQUIRED

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550/mod 418.1	8010	8020						REMARKS
4-11	1045	1-FCD2-SB3-SS5-10-ITL	5	X	X	X						
4-11	1045	1-FCD2-SB3-SS10-30-ITL	5	X	X	X						
4-11	1045	1-FCD2-SB3-SS14-50-ITL	5	X	X	X						
4-12	0900	1-FCD2-SB4-SS2-2.5-ITL	5	X	X	X						
4-12	0900	1-FCD2-SB4-SS5-10-ITL	5	X	X	X						
4-12	0900	1-FCD2-SB4-SS10-30-ITL	5	X	X	X						
4-12	1030	1-FCD2-SB5-SS2-2.5-ITL	5	X	X	X						
4-12	1030	1-FCD2-SB5-SS5-10-ITL	5	X	X	X						

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	1:14 / 4/2				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
		[signature]	4-15-8 / 1030	

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36555

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

C24.

ES JOB NO.	PROJECT NAME/LOCATION	SHIP TO:
[illegible]	AF PLANT 42 [illegible] II	IT CORPORATION 17605 Fabrica Way Cerritos, CA 90701 (213)921-9831

SAMPLER(S): (Signature) [signature]

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	ANALYSES REQUIRED								REMARKS
1-12	[illegible]	1-FC02 S6[illegible]-SS10-30-172	5	✓	✓	✓						
4-12	[illegible]	1-FC02-S6[illegible] SS15-10 172	5	✓	✓	✓						
1-12	[illegible]	1-FC02 S6[illegible] [illegible] 172	5	✓	✓	✓						
1-12	1230	1-FC02 S6[illegible] [illegible]-20 172	5	✓	✓	✓						
4-14	0900	1-FC02 S67-SS5-10-172	5	✓	✓	✓						
4-14	0900	1-FC02 S67-SS10-30-172	5	✓	✓	✓						
4-14	0900	1-FC02-S67-SS14-50 172	5	✓	✓	✓						
4-14	0900	1-FC02 S67-SS15-30-172	5	✓	✓	✓						
4-14	0900	1-FC02 S67-SS18-70 172	5	✓	✓	✓						

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	4-14 / 1[illegible]		[signature]		

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
[signature]		[signature]	4-14-84 / 1030	

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025

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature)

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CON-TAINERS	3550+418.1	8010	8020	REMARKS
4-15	0930	1-FCD2-SB8-SS5-10-ITC	5	X	X	X	
4-15	0930	1-FCD2-SB8-SS10-30-ITC	5	X	X	X	
4-15	0930	1-FCD2-SB8-SS14-50-ITC	5	X	X	X	
4-16	0830	1-FCD2-SB9-SS5-10-ITC	5	X	X	X	
4-16	0830	1-FCD2-SB9-SS8-20-ITC	5	X	X	X	
4-16	0830	1-FCD2-SB9-SS11-35-ITC	5	X	X	X	
4-16	0830	1-FCD2-SB9-SS14-50-ITC	5	X	X	X	
4-16	0830	1-FCD2-SB9-SS18-70-ITC	5	X	X	X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	4-16 1500				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
		[signature]	4-17-86 10:00	

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36605

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

026

Total Phenolics

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CON-TAINERS	3550+418.1	8010	8020	510A/5108	3550+413.2				REMARKS
4-16	1100	1-FCD2-SB11-SS1-3-[illegible] ITC	5	X	X	X						
4-16	1130	1-FCD2-SB12-SS1-3-[illegible] ITC	5	X	X	X						
4-17	0845	7-ERA2-SB5-SS5-10 [illegible] ITC	1	X								
4-17	0845	7-ERA2-SB5-SS10-30 -[illegible] ITC	1	X								
4-17	0845	7-ERA2-SB5-SS14-50 -[illegible] ITC	1	X								
4-17	0845	7-ERA2-SB5-SS20-80-[illegible] ITC	1	X								
4-17	1400	9-PWW2-SB1-SS1-3-[illegible] ITC	6		X	X	X	X				
4-17	1400	9-PWW2-SB2-SS1-3-[illegible] ITC	6		X	X	X	X				
4-18	0800	7-ERA2-SB5-SS24-100 -[illegible] ITC	1	X								
4-18	0800	7-ERA2-SB5-SS26-120 -[illegible] ITC	1	X								

[initials]

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	4-18 1900	Fed Ex			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
Fed Ex	4-19-86 9:15	[signature]	4-21-86 9:15	

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36658

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

027

ES JOB NO.: SB 394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature)

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 Pr 418.1								REMARKS
4-18	0800	7-ERA2-SB5-SS29-150-1TC	1	X								
4-18	0800	7-ERA2-SB5-SS31-170-1TC	1	X								
4-19	0800	7-ERA2-SB5-SS34-200-1TC	1	X								
4-21	1130	7-ERA2-SB6-SS5-10-1TC	1	X								
4-21	1130	7-ERA2-SB6-SS10-30-1TC	1	X								
4-21	1130	7-ERA2-SB6-SS14-50-1TC	1	X								
4-21	1130	7-ERA2-SB6-SS18-70-1TC	1	X								
4-22	0800	7-ERA2-SB6-SS24-70-1TC	1	X								
		sample # SS24-100-1R										

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	4-22 / 1400		[signature]		

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
[signature]		[signature]	4-23-84 / 1030	

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36675

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

028

ES JOB NO.	PROJECT NAME/LOCATION	SHIP TO:
58394	AF PLANT 42 IRP-II	IT CORPORATION 17605 Fabrica Way Cerritos, CA 90701 (213)921-9831

SAMPLER(S): (Signature) [signature]

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CON-TAINERS	3550 Rev 4/81	601	602	Ni 249.1	CN SM412D				REMARKS
4-22	1230	7-ERA2-SB7-SS5-10-ITC	1	X								soil
4-22	1230	7-ERA2-SB7-SS10-30-ITC	1	X								soil
4-22	1230	7-ERA2-SB7-SS14-50-ITC	1	X								soil
4-22	1230	7-ERA2-SB7-SS15-10-ITC	1	X								soil
4-23	1030	DW2-1-ITC	4		X	X						water
4-23	1100	DW 4-1-ITC	6	[crossed out]	X	X	X	X				water
4-23	1100	DW 4-2-ITC	6		X	X	X	X				water

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	4-23 / 1900		[signature]		

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
[signature]		Fiala	4-24-86 / 1030	

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36679

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

029

ES JOB NO. SB394

PROJECT NAME/LOCATION AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CON-TAINERS	ANALYSES REQUIRED: 3550 + 418.1								REMARKS
4-24	0900	21-FDA7-SB1-SS3-5-ITZ	1	X								
4-24	0900	21-FDA7-SB1-SS8-20-ITZ	1	X								
4-24	1000	21-FDA7-SB2-SS4-7.5-ITZ	1	X								
4-24	1000	21-FDA7-SB2-SS8-20-ITZ	1	X								
4-24	1100	21-FDA7-SB3-SS3-5-ITZ	1	X								
4-24	1100	21-FDA7-SB3-SS8-20-ITZ	1	X								
4-25	0815	8-FTA8-SB1-SS3-5-ITZ	1	X								
4-25	0815	8-FTA8-SB1-SS8-20-ITZ	1	X								
4-25	1000	17-NFTZ-SB3-SS1-3-ITZ	1	X								
4-25	1000	17-NFTZ-SB3-SS15-3-ITZ	1	X								
4-25	1500	1-FCDZ-SB10-SS1-3-ITZ	1	X								

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	4-26 1500				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
		[signature]	4-28 10:10	

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030

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature) [signature]

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 thru 413.2	8010	8020	SM510A/508					REMARKS
4-25	1400	19-ERA3-SB1-SS5-10-ITZ	1	X								
4-25	1430	19-ERA3-SB2-SS5-10-ITZ	1	X								
4-28	1100	10-PWN2-SB1-SS1-3-ITZ	6	X	X	X	X					
4-28	1115	10-PWN2-SB2-SS1-3-ITZ	6	X	X	X	X					
4-28	1130	10-PWN2-SB3-SS1-3-ITZ	6	X	X	X	X					
4-28	1145	10-PWN2-SB4-SS1-3-ITZ	6	X	X	X	X					
4-28	1145	10-PWN2-SB4-SS15-ITZ	6	X	X	X	X					

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	4-29 / 1500		[signature]		

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
[signature]		IT Cerritos [signature]	4-30-86 / 1030	

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ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

031

ES JOB NO. 56394

PROJECT NAME/LOCATION: AF PLANT 42 IRP-II

SAMPLER(S): (Signature)

SHIP TO: IT CORPORATION, 17605 Fabrica Way, Cerritos, CA 90701, (213) 921-9831

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	3550 mod 413.2	8010	8020	8080 (PCBs)	CAM T. Metals *	REMARKS
4-28	0900	12-EXA1-SB1-SS4-7.5-ITZ	1	X					
4-28	0900	12-EXA1-SB1-SS8-20-ITZ	1	X					
4-28	1005	12-EXA1-SB2-SS3-5-ITZ	1	X					
4-28	1000	12-EXA1-SB2-SS8-20-ITZ	1	X					
4-28	1200	13-DAB2-SB1-SS1-3-ITZ	5	X	X	X			
4-28	1245	13-DAB2-SB2-SS1-3-ITZ	5	X	X	X			
4-28	1230	13-DAB2-SB3-SS1-3-ITZ	5	X	X	X			
4-28	1245	13-DAB2-SB4-SS1-3-ITZ	5	X	X	X			*CAM Primary Metals;
4-29	1200	5-APTZ-SB3-SS1-3-ITZ	2				X	X	As Ba Cd Cr VI Pb
4-29	1200	5-APTZ-SB3-SS15-3-ITZ	2				X	X	Hg Se Ag
4-29	1230	6-OFTZ-SB2-SS1-3-ITZ	2				X	X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	4-29 1500				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
		Cerritos [signature]	4-30-88 1030	

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36762

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

032

ES JOB NO.: 56394

PROJECT NAME/LOCATION: AF PLANT 42

SAMPLER(S): (Signature)

SHIP TO:
IT CORPORATION
17605 Fabrica Way
Cerritos, CA 90701
(213)921-9831

ANALYSES REQUIRED: 8330 (rev 4/13.2), 8010, 8020

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	8330	8010	8020	REMARKS
4-29	0800	3-ERA7-SB1-SS3-5-ITZ	5	X	X	X	
4-29	0800	3-ERA7-SB1-SS8-20-ITZ	5	X	X	X	
4-29	0915	3-ERA7-SB2-SS4-7.5-ITZ	5	X	X	X	
4-29	0915	3-ERA7-SB2-SS8-20-ITZ	5	X	X	X	
4-29	1030	3-ERA7-SB3-SS3-5-ITZ	5	X	X	X	
4-29	1030	3-ERA7-SB3-SS8-20-ITZ	5	X	X	X	
4-29	1130	3-ERA7-SB4-SS3-5-ITZ	5	X	X	X	
4-29	1130	3-ERA7-SB4-SS8-20-ITZ	5	X	X	X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	4-30 / 1400				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
			5-1-90 / 103	

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H-32

APPENDIX I

ANALYTICAL QA/QC DATA

APPENDIX I

ANALYTICAL QA/QC DATA

This appendix contains summary tables of information related to the quality of analytical results obtained during the IRP-Phase II study at USAF Plant 42. The first table presents the analytical methods used and the method detection limits achieved by the laboratory. Tables I.2 and I.3 list sequentially all soil and water samples collected during the investigation, and identify the laboratory report (see Appendix I) containing the analytical results for each sample. Also listed in these tables are the laboratory holding times for each analysis performed. Tables I.4 through I.6 summarize the analytical results for blind duplicate field samples submitted for quality assurance (QA) purposes. Table I.7 through I.11 provide results of the laboratory's internal quality control (QC) analyses. These QC results were obtained from routine analyses of blank, duplicate, and matrix spike samples. Table I.7 is included to help the reader locate in Appendix J the QC reports for gas-chromatographic analyses.

TABLE I.1
SUMMARY OF CHEMICAL ANALYTICAL METHODS AND DETECTION LIMITS

Analytical Parameter	Method Citation	Detection* Limit
Groundwater Samples		
Purgeable Halocarbons	EPA 601	2 ug/L
Purgeable Aromatics	EPA 602	1 ug/L
Total Cyanides	SM 412B/412E	20 ug/L
Total Nickel	EPA 249.1	100 ug/L
pH (field)	EPA 150.1	--
Specific Conductance (field)	EPA 120.1	--
Temperature (field)	EPA 170.1	--
Soil Samples		
Halogenated Volatile Organics	SW 8010	0.01 mg/Kg
Aromatic Volatile Organics	SW 8020	0.005 mg/Kg
Total Oil & Grease	SW 3550 + EPA 413.2	2 mg/Kg
Total Petroleum Hydrocarbons	SW 3550 + EPA 418.1	2 mg/Kg
Total Cyanides	SM 412B/412E	0.5 mg/Kg
Total Phenolics	SM 510A/510C	0.1 mg/Kg
Organochlorine Pesticides & PCBs	SW 8080	**
Primary Metals:	CA Title 22:66700	
Arsenic		0.05 mg/L
Barium		<1 mg/L
Cadmium		0.03 mg/L
Chromium		0.06 mg/L
Lead		0.2 mg/L
Mercury		0.001 mg/L
Selenium		0.005 mg/L
Silver		0.03 mg/L
Secondary Metals:	CA Title 22:66700	
Copper		0.07 mg/L
Iron		<8 mg/L
Manganese		<8 mg/L
Zinc		<0.2 mg/L
Nickel	CA Title 22:66700	0.1 mg/L

*Refers to method detection limits in relatively clean samples. Some samples had higher detection limits because of required dilution or matrix interferences.

**Varies with individual compounds from 0.001 to 0.02 mg/Kg.

Table I.2
SUMMARY OF HOLDING TIMES FOR SOIL SAMPLE ANALYSES

Field Sample Identifier	Lab Report Number	Date Sample Collected	Date Analyzed (Holding Time in Days)						
			Halogen Vols 8010	Aromatic Vols 8020	Oil & Grease 3550 + 413.2	Petrol Hydr 3550 + 418.1	Extr Metals CA Title 22	Total Phenols SM 510A/C	Total Cyanides SM 412B/E
22-ERAT-SB1-SS4-10	35250	12-05-85	--	--	12-13-85 (8)	--	--	--	--
22-ERAT-SB2-SS4-10	35250	12-05-85	--	--	12-13-85 (8)	--	--	--	--
17-NFTC-SB1-SS5-10	35250	12-05-85	--	--	12-13-85 (8)	--	--	--	--
17-NFTC-SB1-SS10-30	35250	12-05-85	--	--	12-13-85 (8)	--	--	--	--
17-NFTC-SB1-SS15-10	35250	12-05-85	--	--	12-13-85 (8)	--	--	--	--
17-NFTC-SB2-SS2-2.5	35250	12-06-85	--	--	12-13-85 (7)	--	--	--	--
5-APTC-SB1-SS2-2.5	35250	12-06-85	12-09-85 (3)	12-09-85 (3)	12-13-85 (7)	--	--	--	--
4-VWT5-SB1-SS3-5	35288	12-09-85	12-18-85 (9)	12-18-85 (9)	12-30-85 (21)	--	* 12-16-85 (7)	--	--
4-VWT5-SB1-SS5-10	35288	12-09-85	12-18-85 (9)	12-18-85 (9)	12-30-85 (21)	--	* 12-16-85 (7)	--	--
4-VWT5-SB1-SS10-30	35288	12-09-85	12-18-85 (9)	12-18-85 (9)	12-30-85 (21)	--	* 12-16-85 (7)	--	--
4-VWT5-SB1-SS14-50	35288	12-10-85	12-18-85 (8)	12-18-85 (8)	12-30-85 (20)	--	* 12-16-85 (6)	--	--
4-VWT5-SB2-SS5-10	35303	12-10-85	12-13-85 (3)	12-13-85 (3)	01-02-86 (23)	--	* 12-16-85 (6)	--	--
4-VWT5-SB2-SS10-30	35303	12-10-85	12-13-85 (3)	12-13-85 (3)	01-02-86 (23)	--	* 12-16-85 (6)	--	--
4-VWT5-SB2-SS14-50	35303	12-10-85	12-13-85 (3)	12-13-85 (3)	01-02-86 (23)	--	* 12-16-85 (6)	--	--
6-OFTC-SB1-SS2-2.5	35328	12-11-85	12-18-85 (7)	12-18-85 (7) 12-31-85 (20)	01-03-86 (23)	--	--	--	--
6-OFTC-SB1-SS5-10	35328	12-11-85	12-18-85 (7)	12-18-85 (7) 12-31-85 (20)	01-03-86 (23)	--	--	--	--
6-OFTC-SB1-SS10-30	35328	12-11-85	12-18-85 (7)	12-18-85 (7)	01-03-86 (23)	--	--	--	--
6-OFTC-SB1-SS14-50	35328	12-12-85	12-18-85 (6)	12-18-85 (6)	01-03-86 (22)	--	--	--	--
7-ERA2-SB1-SS5-10	35328	12-12-85	--	--	--	01-03-86 (22)	--	--	--
7-ERA2-SB1-SS10-30	35328	12-12-85	--	--	--	01-03-86 (22)	--	--	--
7-ERA2-SB1-SS14-50	35328	12-12-85	--	--	--	01-03-86 (22)	--	--	--
7-ERA2-SB2-SS5-10	35345	12-13-85	--	--	--	01-03-86 (21)	--	--	--
7-ERA2-SB2-SS10-30	35345	12-13-85	--	--	--	01-03-86 (21)	--	--	--
7-ERA2-SB2-SS14-50	35345	12-13-85	--	--	--	01-03-86 (21)	--	--	--
7-ERA2-SB2-SS15-10	35345	12-13-85	--	--	--	01-03-86 (21)	--	--	--
7-ERA2-SB3-SS5-10	35345	12-14-85	--	--	--	01-03-86 (20)	--	--	--
7-ERA2-SB3-SS8-20	35345	12-14-85	--	--	--	01-03-86 (20)	--	--	--
7-ERA2-SB3-SS10-30	35345	12-14-85	--	--	--	01-03-86 (20)	--	--	--
7-ERA2-SB3-SS14-50	35345	12-14-85	--	--	--	01-03-86 (20)	--	--	--
2-PWD2-SB1-SS2-2.5	35357	12-16-85	12-30-85 (14)	12-30-85 (14) 01-02-86 (17)	01-02-86 (17)	--	12-24-85 (8)	12-28-85 (12)	--
2-PWD2-SB1-SS5-10	35357	12-16-85	12-30-85 (14)	12-30-85 (14)	01-02-86 (17)	--	12-24-85 (8)	12-28-85 (12)	--
2-PWD2-SB1-SS10-30	35357	12-16-85	12-30-85 (14)	12-31-85 (15)	01-02-86 (17)	--	12-24-85 (8)	12-28-85 (12)	--
2-PWD2-SB1-SS14-50	35357	12-16-85	12-30-85 (14)	12-30-85 (14)	01-02-86 (17)	--	12-24-85 (8)	12-28-85 (12)	--
2-PWD2-SB1-SS15-10	35357	12-16-85	12-30-85 (14)	12-31-85 (15)	01-02-86 (17)	--	12-24-85 (8)	12-28-85 (12)	--

Table I.2
(Continued)
SUMMARY OF HOLDING TIMES FOR SOIL SAMPLE ANALYSES

Field Sample Identifier	Lab Report Number	Date Sample Collected	Date Analyzed (Holding Time in Days)						
			Halogen Vols 8010	Aromatic Vols 8020	Oil & Grease 3550 + 413.2	Petrol Hydr 3550 + 418.1	Extr Metals CA Title 22	Total Phenols SM 510A/C	Total Cyanides SM 412B/E
2-PWD2-SB2-SS2-2.5	35374	12-16-85	12-31-85 (15)	01-02-86 (17)	01-06-86 (21)	--	12-24-85 (8)	12-21-85 (5)	--
2-PWD2-SB2-SS5-10	35374	12-16-85	12-31-85 (15)	01-02-86 (17)	01-06-86 (21)	--	12-24-85 (8)	12-21-85 (5)	--
2-PWD2-SB2-SS10-30	35374	12-17-85	12-31-85 (14)	01-02-86 (16)	01-06-86 (21)	--	12-24-85 (7)	12-21-85 (4)	--
2-PWD2-SB2-SS14-50	35374	12-17-85	12-31-85 (14)	01-02-86 (16)	01-06-86 (21)	--	12-24-85 (7)	12-21-85 (4)	--
2-PWD2-SB3-SS2-2.5	35374	12-17-85	12-31-85 (14)	01-02-86 (16)	01-06-86 (21)	--	12-24-85 (7)	12-21-85 (4)	--
2-PWD2-SB3-SS5-10	35374	12-17-85	12-31-85 (14)	01-02-86 (16)	01-06-86 (21)	--	12-24-85 (7)	12-21-85 (4)	--
2-PWD2-SB3-SS10-30	35374	12-17-85	01-02-86 (16)	01-02-86 (16)	01-06-86 (21)	--	12-24-85 (7)	12-21-85 (4)	--
2-PWD2-SB3-SS14-50	35374	12-18-85	12-31-85 (13)	01-02-86 (15)	01-06-86 (21)	--	12-24-85 (6)	12-21-85 (3)	--
2-PWD2-SB4-SS2-2.5	35393	12-18-85	01-02-86 (15)	01-03-86 (16)	01-02-86 (15)	--	12-24-85 (6)	12-21-85 (3)	--
2-PWD2-SB4-SS5-10	35393	12-18-85	01-02-86 (15)	01-03-86 (16)	01-02-86 (15)	--	12-24-85 (6)	12-21-85 (3)	--
2-PWD2-SB4-SS10-30	35393	12-18-85	01-02-86 (15)	01-03-86 (16)	01-02-86 (15)	--	12-24-85 (6)	12-21-85 (3)	--
2-PWD2-SB4-SS14-50	35393	12-19-85	01-02-86 (15)	01-03-86 (16)	01-02-86 (14)	--	12-24-85 (5)	12-21-85 (2)	--
18-ADA2-SB1-SS5-10	35401	12-19-85	12-30-85 (11)	12-30-85 (11)	01-02-86 (14)	--	--	--	--
18-ADA2-SB1-SS8-20	35401	12-19-85	12-30-85 (11)	12-30-85 (11)	01-02-86 (14)	--	--	--	--
2-PWD2-SB5-SS5-10	35401	12-19-85	12-30-85 (11)	12-30-85 (11)	01-02-86 (14)	--	12-26-85 (7)	01-03-86 (15)	--
2-PWD2-SB5-SS10-30	35401	12-20-85	12-30-85 (10)	12-30-85 (10)	01-02-86 (13)	--	12-26-85 (6)	01-03-86 (14)	--
2-PWD2-SB5-SS14-50	35401	12-20-85	12-30-85 (10)	12-30-85 (10)	01-02-86 (13)	--	12-26-85 (6)	01-03-86 (14)	--
16-EVP3-SB1-SS2-2.5	35778	02-03-86	02-10-86 (7)	02-07-86 (4)	--	--	02-11-86 (8)	--	02-06-86 (3)
16-EVP3-SB1-SS5-10	35778	02-03-86	02-07-86 (4)	02-07-86 (4)	--	--	02-11-86 (8)	--	02-06-86 (3)
16-EVP3-SB1-SS10-30	35778	02-03-86	02-10-86 (7)	02-07-86 (4)	--	--	02-11-86 (8)	--	02-06-86 (3)
16-EVP3-SB1-SS14-50	35778	02-03-86	02-07-86 (4)	02-07-86 (4)	--	--	02-11-86 (8)	--	02-06-86 (3)
16-EVP3-SB2-SS3-[illegible]	35790	02-03-86	02-11-86 (8)	02-12-86 (9)	--	--	02-14-86 (11)	--	02-07-86 (4)
16-EVP3-SB2-SS8-20	35790	02-03-86	02-11-86 (8)	02-11-86 (8)	--	--	02-14-86 (11)	--	02-07-86 (4)
16-EVP3-SB2-SS14-50	35790	02-05-86	02-11-86 (6)	02-12-86 (7)	--	--	02-14-86 (9)	--	02-07-86 (2)
16-EVP3-SB3-SS2-2.5	35790	02-05-86	02-11-86 (6)	02-11-86 (6)	--	--	02-14-86 (9)	--	02-07-86 (2)
16-EVP3-SB3-SS5-10	35803	02-05-86	02-12-86 (7)	02-14-86 (9)	--	--	02-14-86 (9)	--	02-07-86 (2)
16-EVP3-SB3-SS10-30	35803	02-05-86	02-12-86 (7)	02-14-86 (9)	--	--	02-14-86 (9)	--	02-07-86 (2)
16-EVP3-SB3-SS14-50	35803	02-05-86	02-12-86 (7)	02-14-86 (9)	--	--	02-14-86 (9)	--	02-07-86 (2)
16-EVP3-SB4-SS2-2.5	35803	02-05-86	02-12-86 (7)	02-14-86 (9)	--	--	02-14-86 (9)	--	02-07-86 (2)
16-EVP3-SB4-SS5-10	35802	02-05-86	02-11-86 (6)	02-13-86 (8)	--	--	02-14-86 (9)	--	02-07-86 (2)
16-EVP3-SB4-SS10-30	35802	02-05-86	02-11-86 (6)	02-12-86 (7)	--	--	02-14-86 (9)	--	02-07-86 (2)
16-EVP3-SB4-SS14-50	35802	02-06-86	02-11-86 (5)	02-12-86 (6)	--	--	02-14-86 (8)	--	02-07-86 (1)
16-EVP3-SB4-SS15-10	35802	02-05-86	02-11-86 (6)	02-13-86 (8)	--	--	02-14-86 (9)	--	02-07-86 (2)
5-AFTC-SB2-SS5-10	35812	02-07-86	02-12-86 (5)	02-20-86 (13)	03-04-86 (24)	--	--	--	--
5-AFTC-SB2-SS10-30	35812	02-07-86	02-12-86 (5)	02-21-86 (14)	03-04-86 (24)	--	--	--	--
5-AFTC-SB2-SS14-50	35812	02-07-86	02-12-86 (5)	02-19-86 (12)	03-04-86 (24)	--	--	--	--

Table 1.2
(Continued)
SUMMARY OF HOLDING TIMES FOR SOIL SAMPLE ANALYSES

Field Sample Identifier	Lab Report Number	Date Sample Collected	Date Analyzed (Holding Time in Days) Halogen Vols 8010	Aromatic Vols 8020	Oil & Grease 3550 + 413.2	Petrol Hydr 3550 + 418.1	Extr Metals CA Title 22	Total Phenols SM 510A/C	Total Cyanides SM 412B/E
4-VWT5-SB3-SS3-5	35847	02-10-86	02-13-86 (3)	02-18-86 (8)	02-13-86 (3)	--	02-18-86 (8)	--	--
4-VWT5-SB3-SS8-20	35847	02-10-86	02-13-86 (3)	02-18-86 (8)	02-13-86 (3)	--	02-18-86 (8)	--	--
4-VWT5-SB4-SS3-5	35847	02-10-86	02-13-86 (3)	02-18-86 (8)	02-13-86 (3)	--	02-18-86 (8)	--	--
4-VWT5-SB4-SS8-20	35847	02-10-86	02-13-86 (3)	02-18-86 (8)	02-13-86 (3)	--	02-18-86 (8)	--	--
23-BDD8-SB1-SS3-5	35863	02-10-86	02-13-86 (3)	02-18-86 (8)	--	--	--	--	--
	36257	02-10-86	--	--	--	--	05-29-86 (108)	--	--
23-BDD8-SB1-SS8-20	35863	02-10-86	02-13-86 (3)	02-19-86 (9)	--	--	--	--	--
	36257	02-10-86	--	--	--	--	05-29-86 (108)	--	--
7-ERA2-SB4-SS5-10	35863	02-11-86	--	--	--	2-19-86(8)	--	--	--
7-ERA2-SB4-SS10-30	35863	02-11-86	--	--	--	2-19-86(8)	--	--	--
7-ERA2-SB4-SS14-50	35863	02-11-86	--	--	--	2-19-86(8)	--	--	--
15-TEB2-SB1-SS5-10	35863	02-11-86	--	--	--	2-19-86(8)	--	--	--
15-TEB2-SB2-SS5-10	35863	02-11-86	--	--	--	2-19-86(8)	--	--	--
15-TEB2-SB2-SS15-10	35863	02-11-86	--	--	--	2-19-86(7)	--	--	--
14-EBA2-SB1-SS5-10	35863	02-12-86	--	--	--	2-19-86(7)	--	--	--
14-EBA2-SB2-SS5-10	35863	02-12-86	--	--		--	--	--	--
20-NLA2-SB1-SS3-5	35878	02-12-86	02-14-86 (2)	02-24-86 (12)	03-04-86 (20)	--	--	--	--
20-NLA2-SB1-SS8-20	35878	02-12-86	02-14-86 (2)	02-24-86 (12)	03-04-86 (20)	--	--	--	--
11-DAA2-SB1-SS5-10	35878	02-12-86	02-14-86 (2)	02-04-86 (12)	03-04-86 (20)	--	--	--	--
11-DAA2-SB2-SS5-10	35878	02-12-86	02-14-86 (2)	02-04-86 (12)	03-04-86 (20)	--	--	--	--
23-BDD8-SB2-SS3-5	36506	04-08-86	04-14-86 (6)	04-14-86 (6)	04-12-86 (4)	--	04-15-86 (7)	--	--
23-BDD8-SB2-SS8-20	36506	04-08-86	04-14-86 (6)	04-14-86 (6)	04-12-86 (4)	--	04-15-86 (7)	--	--
1-FCD2-SB1-SS5-10	36506	04-09-86	04-14-86 (5)	04-14-86 (5)	--	04-12-86 (3)	--	--	--
1-FCD2-SB1-SS10-30	36506	04-09-86	04-14-86 (5)	04-14-86 (5)	--	04-12-86 (3)	--	--	--
1-FCD2-SB1-SS14-50	36506	04-09-86	04-14-86 (5)	04-14-86 (5)	--	04-12-86 (3)	--	--	--
1-FCD2-SB1-SS15-30	36506	04-09-86	04-14-86 (5)	04-14-86 (5)	--	04-12-86 (3)	--	--	--
1-FCD2-SB1-SS19-75	36515	04-09-86	04-14-86 (5)	04-16-86 (7)	--	04-15-86 (6)	--	--	--
1-FCD2-SB2-SS5-10	36515	04-10-86	04-14-86 (4)	04-16-86 (6)	--	04-15-86 (5)	--	--	--
1-FCD2-SB2-SS10-30	36515	04-10-86	04-15-86 (5)	04-16-86 (6)	--	04-15-86 (5)	--	--	--
1-FCD2-SB2-SS14-50	36515	04-10-86	04-15-86 (5)	04-16-86 (6)	--	04-15-86 (5)	--	--	--
1-FCD2-SB2-SS19-75	36515	04-10-86	04-14-86 (4)	04-16-86 (6)	--	04-15-86 (5)	--	--	--
1-FCD2-SB3-SS5-10	36546	04-11-86	04-23-86 (12)	04-25-86 (14)	--	04-25-86 (14)	--	--	--
				05-01-86 (20)					
1-FCD2-SB3-SS10-30	36546	04-11-86	04-21-86 (10)	04-25-86 (14)	--	04-25-86 (14)	--	--	--
				05-01-86 (20)					
1-FCD2-SB3-SS14-50	36546	04-11-86	04-21-86 (10)	04-25-86 (14)	--	04-25-86 (14)	--	--	--
1-FCD2-SB4-SS2-2.5	36546	04-12-86	04-21-86 (9)	04-25-86 (13)	--	04-25-86 (13)	--	--	--
				05-01-86 (19)					
1-FCD2-SB4-SS5-10	36546	04-12-86	04-23-86 (11)	04-28-86 (16)	--	04-25-86 (13)	--	--	--
1-FCD2-SB4-SS10-30	36546	04-12-86	04-21-86 (9)	04-25-86 (13)	--	04-25-86 (13)	--	--	--
1-FCD2-SB5-SS2-2.5	36546	04-12-86	04-23-86 (11)	04-28-86 (16)	--	04-25-86 (13)	--	--	--
				05-01-86 (20)					

Table I.2
(Continued)
SUMMARY OF HOLDING TIMES FOR SOIL SAMPLE ANALYSES

Field Sample Identifier	Lab Report Number	Date Sample Collected	Date Analyzed (Holding Time in Days)						
			Halogen Vols 8010	Aromatic Vols 8020	Oil & Grease 3550 + 413.2	Petrol Hydr 3550 + 418.1	Extr Metals CA Title 22	Total Phenols SM 510A/C	Total Cyanides SM 412B/E
1-FCD2-SB5-SS5-10	36546	04-12-86	04-23-86 (11)	04-28-86 (16)	--	04-25-86 (13)	--	--	--
1-FCD2-SB5-SS10-30	36555	04-12-86	04-24-86 (12)	04-17-86 (5)	--	4-26-86(14)	--	--	--
1-FCD2-SB5-SS15-10	36555	04-12-86	04-24-86 (12)	04-17-86 (5)	--	4-26-86(14)	--	--	--
1-FCD2-SB6-SS3-5	36555	04-12-86	04-24-86 (12)	04-17-86 (5)	--	4-26-86(14)	--	--	--
1-FCD2-SB6-SS8-20	36555	04-12-86	04-24-86 (12)	04-18-86 (6)	--	4-26-86(14)	--	--	--
1-FCD2-SB7-SS5-10	36555	04-14-86	04-24-86 (10)	04-18-86 (4)	--	4-26-86(12)	--	--	--
1-FCD2-SB7-SS10-30	36555	04-14-86	04-24-86 (10)	04-18-86 (4)	--	4-26-86(12)	--	--	--
1-FCD2-SB7-SS14-50	36555	04-14-86	04-24-86 (10)	04-22-86 (8)	--	4-26-96(12)	--	--	--
1-FCD2-SB7-SS15-30	36555	04-14-86	04-24-86 (10)	04-22-86 (8)	--	4-26-86(12)	--	--	--
1-FCD2-SB7-SS18-70	36555	04-14-86	04-24-86 (10)	04-22-86 (8)	--	4-26-86(12)	--	--	--
1-FCD2-SB8-SS5-10	36574	04-15-86	04-25-86 (10)	05-06-86 (21)	--	04-29-86 (14)	--	--	--
1-FCD2-SB8-SS10-30	36574	04-15-86	04-25-86 (10)	05-05-86 (20)	--	04-29-86 (14)	--	--	--
1-FCD2-SB8-SS14-50	36574	04-15-86	04-25-86 (10)	05-01-86 (16)	--	04-29-86 (14)	--	--	--
1-FCD2-SB9-SS5-10	36574	04-16-86	04-25-86 (9)	05-05-86 (19)	--	04-29-86 (13)	--	--	--
1-FCD2-SB9-SS8-20	36574	04-16-86	04-25-86 (9)	05-05-86 (19)	--	04-29-86 (13;	--	--	--
1-FCD2-SB9-SS11-35	36574	04-16-86	04-25-86 (9)	05-02-86 (16)	--	04-29-86 (13)	--	--	--
1-FCD2-SB9-SS14-50	36574	04-16-86	04-25-86 (9)	05-02-86 (16)	--	04-29-86 (13)	--	--	--
1-FCD2-SB9-SS18-70	36574	04-16-86	04-25-86 (9)	05-01-86 (15)	--	04-29-86 (13)	--	--	--
1-FCD2-SB11-SS1-3	36608	04-16-86	04-28-86 (12)	05-02-86 (16)	--	04-30-86 (14)	--	--	--
1-FCD2-SB12-SS1-3	36608	04-16-86	04-28-86 (12)	05-02-86 (16)	--	04-30-86 (14)	--	--	--
7-ERA2-SB5-SS5-10	36608	04-17-86	--	--	--	04-30-86 (13)	--	--	--
7-ERA2-SB5-SS10-30	36608	04-17-86	--	--	--	04-30-86 (13)	--	--	--
7-ERA2-SB5-SS14-50	36608	04-17-86	--	--	--	04-30-86 (13)	--	--	--
7-ERA2-SB5-SS20-80	36608	04-17-86	--	--	--	04-30-86 (13)	--	--	--
7-ERA2-SB5-SS24-100	36608	04-18-86	--	--	--	04-30-86 (12)	--	--	--
7-ERA2-SB5-SS26-120	36608	04-18-86	--	--	--	04-30-86 (12)	--	--	--
9-PWW2-SB1-SS1-3	36608	04-17-86	04-28-86 (11)	05-02-86 (15)	04-30-86 (13)	--	--	04-21-86 (4)	--
9-PWW2-SB2-SS1-3	36608	04-17-86	04-28-86 (11)	05-02-86 (15)	04-30-86 (13)	--	--	04-21-86 (4)	--
7-ERA2-SB5-SS29-150	36658	04-18-86	--	--	--	05-01-86 (13)	--	--	--
7-ERA2-SB5-SS31-170	36658	04-18-86	--	--	--	05-01-86 (13)	--	--	--
7-ERA2-SB5-SS34-200	36658	04-19-86	--	--	--	05-01-86 (12)	--	--	--
7-ERA2-SB6-SS5-10	36658	04-21-86	--	--	--	05-01-86 (10)	--	--	--
7-ERA2-SB6-SS10-30	36658	04-21-86	--	--	--	05-01-86 (10)	--	--	--
7-ERA2-SB6-SS14-50	36658	04-21-86	--	--	--	05-01-86 (10)	--	--	--
7-ERA2-SB6-SS18-70	36658	04-21-86	--	--	--	05-01-86 (10)	--	--	--
7-ERA2-SB6-SS24-100	36658	04-22-86	--	--	--	05-01-86 (9)	--	--	--
7-ERA2-SB7-SS5-10	36675	04-22-86	--	--	--	05-01-86 (9)	--	--	--
7-ERA2-SB7-SS10-30	36675	04-22-86	--	--	--	05-01-86 (9)	--	--	--
7-ERA2-SB7-SS14-50	36675	04-22-86	--	--	--	05-01-86 (9)	--	--	--
7-ERA2-SB7-SS15-10	36675	04-22-86	--	--	--	05-01-86 (9)	--	--	--

Table 1.2
(Continued)
SUMMARY OF HOLDING TIMES FOR SOIL SAMPLE ANALYSES

Field Sample Identifier	Lab Report Number	Date Sample Collected	Date Analyzed (Holding Time in Days)						
			Halogen Vols 8010	Aromatic Vols 8020	Oil & Grease 3550 + 413.2	Petrol Hydr 3550 + 418.1	Extr Metals CA Title 22	Total Phenols SM 510A/C	Pesticides/PCBs 8080
21-FDA7-SB1-SS3-5	36699	04-24-86	--	--	--	05-06-86 (12)	--	--	--
21-FDA7-SB1-SS8-20	36699	04-24-86	--	--	--	05-06-86 (12)	--	--	--
21-FDA7-SB2-SS4-7.5	36699	04-24-86	--	--	--	05-06-86 (12)	--	--	--
21-FDA7-SB2-SS8-20	36699	04-24-86	--	--	--	05-06-86 (12)	--	--	--
21-FDA7-SB3-SS3-5	36699	04-24-86	--	--	--	05-06-86 (12)	--	--	--
21-FDA7-SB3-SS8-20	36699	04-24-86	--	--	--	05-06-86 (12)	--	--	--
8-FTA8-SB1-SS3-5	36699	04-25-86	--	--	--	05-06-86 (11)	--	--	--
8-FTA8-SB1-SS8-20	36699	04-25-86	--	--	--	05-06-86 (11)	--	--	--
17-NFTC-SB3-SS1-3	36699	04-25-86	--	--	--	05-06-86 (11)	--	--	--
17-NFTC-SB3-SS15-3	36699	04-25-86	--	--	--	05-06-86 (11)	--	--	--
1-FCD2-SB10-SS1-3	36699	04-25-86	--	--	--	05-06-86 (11)	--	--	--
19-ERA3-SB1-SS5-10	36732	04-25-86	--	--	05-22-86 (27)	--	--	--	--
19-ERA3-SB2-SS5-10	36732	04-25-86	--	--	05-22-86 (27)	--	--	--	--
10-PWN2-SB1-SS1-3	36732	04-28-86	05-06-86 (8)	05-15-86 (17)	05-22-86 (24)	--	--	05-05-86 (7)	--
10-PWN2-SB2-SS1-3	36732	04-28-86	05-06-86 (8)	05-15-86 (17)	05-22-86 (24)	--	--	05-05-86 (7)	--
10-PWN2-SB3-SS1-3	36732	04-28-86	05-06-86 (8)	05-15-86 (17)	05-22-86 (24)	--	--	05-05-86 (7)	--
10-PWN2-SB4-SS1-3	36732	04-28-86	05-06-86 (8)	05-15-86 (17)	05-22-86 (24)	--	--	05-05-86 (7)	--
10-PWN2-SB4-SS15-3	36732	04-28-86	05-06-86 (8)	05-15-86 (17)	05-22-86 (24)	--	--	05-15-86 (7)	--
12-ERA1-SB1-SS4-7.5	36732	04-28-86	--	--	05-22-86 (24)	--	--	--	--
12-ERA1-SB1-SS8-20	36732	04-28-86	--	--	05-22-86 (24)	--	--	--	--
12-ERA1-SB2-SS3-5	36732	04-28-86	--	--	05-22-86 (24)	--	--	--	--
12-ERA1-SB2-SS8-20	36732	04-28-86	--	--	05-22-86 (24)	--	--	--	--
13-DAB2-SB1-SS1-3	36732	04-28-86	05-06-86 (8)	05-15-86 (17)	05-22-86 (24)	--	--	--	--
13-DAB2-SB2-SS1-3	36732	04-28-86	05-06-86 (8)	05-15-86 (17)	05-22-86 (24)	--	--	--	--
13-DAB2-SB3-SS1-3	36732	04-28-86	05-06-86 (8)	05-15-86 (17)	05-22-86 (24)	--	--	--	--
13-DAB2-SB4-SS1-3	36732	04-28-86	05-06-86 (8)	05-15-86 (17)	05-22-86 (24)	--	--	--	--
5-AFTC-SB3-SS1-3	36732	04-29-86	--	--	--	--	05-19-86 (20)	--	05-21-86 (22)
5-AFTC-SB3-SS15-3	36732	04-29-86	--	--	--	--	05-19-86 (20)	--	05-21-86 (22)
6-OFTC-SB2-SS1-3	36732	04-29-86	--	--	--	--	05-19-86 (20)	--	05-17-86 (18)
3-ERA7-SB1-SS3-5	36762	04-29-86	05-07-86 (8)	05-15-86 (16)	05-22-86 (23)	--	--	--	--
3-ERA7-SB1-SS8-20	36762	04-29-86	05-07-86 (8)	05-15-86 (16)	05-22-86 (23)	--	--	--	--
3-ERA7-SB2-SS4-7.5	36762	04-29-86	05-07-86 (8)	05-15-86 (16)	05-22-86 (23)	--	--	--	--
3-ERA7-SB2-SS8-20	36762	04-29-86	05-07-86 (8)	05-15-86 (16)	05-22-86 (23)	--	--	--	--
3-ERA7-SB3-SS3-5	36762	04-29-86	05-07-86 (8)	05-16-86 (17)	05-22-86 (23)	--	--	--	--
3-ERA7-SB3-SS8-20	36762	04-29-86	05-07-86 (8)	05-16-86 (17)	05-22-86 (23)	--	--	--	--
3-ERA7-SB4-SS3-5	36762	04-29-86	05-07-86 (8)	05-16-86 (17)	05-22-86 (23)	--	--	--	--
3-ERA7-SB4-SS8-20	36762	04-29-86	05-07-86 (8)	05-16-86 (17)	05-22-86 (23)	--	--	--	--

*Metals analyzed after direct digestion (SW 3050) rather than CA Title 22 extraction.

TABLE I.3
SUMMARY OF HOLDING TIMES FOR GROUND-WATER ANALYSES

Field Sample Identifier	Lab Report Number	Date Sample Collected	Date Analyzed (Holding Time in Days)			
			Purgeable Halocarbons EPA 601	Purgeable Aromatics EPA 602	Nickel EPA 249.1	Total Cyanides SM 412B/E
DW3-1	35730-RR	01-30-86	02-03-86(4)	02-03-86(4)	02-06-86(6)	not reported
DW1-1	35730-RR	01-30-86	02-03-86(4)	02-03-86(4)	--	--
DW8-1	35730-RR	01-30-86	02-03-86(4)	02-03-86(4)	--	--
FW2B	35742-R	01-31-86	02-03-86(3)	02-04-86(4)	--	--
FW1	35742-R	01-31-86	02-03-86(3)	02-04-86(4)	--	--
DW2-1	36675-R	04-23-86	04-29-86(6)	04-30-86(7)	--	--
DW4-1	36675-R	04-23-86	04-29-86(6)	04-30-86(7)	04-25-86(2)	04-25-86(2)
DW4-2 (dup)	36675-R	04-23-86	04-29-86(6)	04-30-86(7)	04-25-86(2)	04-25-86(2)

TABLE I.4
SUMMARY OF QUALITY ASSURANCE RESULTS
HALOGENATED VOLATILE ORGANICS (SW 8010)
(Compounds Not Detected Are Not Listed)

Blind Duplicate Field Samples		Laboratory Report Number	Detection Limit (mg/Kg)	Analytical Results (mg/Kg)			
Sample 1	Sample 2			Sample 1	Sample 2	Average	Relative % Difference
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357					
All SW 8010 compounds below detection limits			0.010	--	--	--	--
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802					
All SW 8010 compounds below detection limits			0.010	--	--	--	--
1-FCD2-SB1-SS10-30	1-FCD2-SB1-SS15-30	36506					
All SW 8010 compounds below detection limits			0.010	--	--	--	--
1-FCD2-SB5-SS5-10	1-FCD2-SB5-SS15-10	36546/36555					
1,1,1-Trichloroethane*			0.010	0.025	.024	.024	4
1-FCD2-SB7-SS10-30	1-FCD2-SB7-SS15-30	36555					
All SW 8010 compounds below detection limits			0.010	--	--	--	--
10-PWN2-SB4-SS1-3	10-PWN2-SB4-SS15-3	36732					
1,1,1-Trichloroethane*			0.010	<0.010	0.039	--	--

*Compound was not confirmed by second-column analysis.

TABLE I.5
SUMMARY OF QUALITY ASSURANCE RESULTS
AROMATIC VOLATILE ORGANICS (SW 8020)
(Compounds Not Detected Are Not Listed)

Blind Duplicate Field Samples		Laboratory Report Number	Detection Limit (mg/Kg)	Analytical Results (mg/Kg)			
Sample 1	Sample 2			Sample 1	Sample 2	Average	Relative % Difference
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357					
All SW 8020 compounds below detection limits			0.005	--	--	--	--
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802					
All SW 8020 compounds below detection limits			0.005	--	--	--	--
1-FCD2-SB1-SS10-30	1-FCD2-SB1-SS15-30	36506					
All SW 8020 compounds below detection limits			0.005	--	--	--	--
1-FCD2-SB5-SS5-10	1-FCD2-SB5-SS15-10	36546/36555					
All SW 8020 compounds below detection limits			0.005	--	--	--	--
1-FCD2-SB7-SS10-30	1-FCD2-SB7-SS15-30	36555					
All SW 8020 compounds below detection limits			0.005	--	--	--	--
10-PWN2-SB4-SS1-3	10-PWN2-SB4-SS15-3	36732					
All SW 8020 compounds below detection limits			0.005	--	--	--	--

TABLE 1.6
SUMMARY OF QUALITY ASSURANCE RESULTS
MISCELLANEOUS PARAMETERS MEASURED IN SOIL SAMPLES

Blind Duplicate Field Samples		Laboratory Report Number	Analytical Results (mg/Kg)			
Sample 1	Sample 2		Sample 1	Sample 2	Average	Relative % Difference
Total Petroleum Hydrocarbons (SW 3550 + EPA 418.1)						
7-ERA2-SB2-SS5-10	7-ERA2-SB2-SS15-10	35345	ND<2*	ND<2	ND<2	--
1-PCD2-SB1-SS10-30	1-PCD2-SB1-SS15-30	36506	ND<2	ND<2	ND<2	--
1-PCD2-SB5-SS5-10	1-PCD2-SB5-SS15-10	36546/36555	ND<2	ND<2	ND<2	--
1-PCD2-SB7-SS10-30	1-PCD2-SB7-SS15-30	36555	8200	220	4210	190
7-ERA2-SB7-SS5-10	7-ERA2-SB7-SS15-10	36675	ND<2*	3	--	--
17-NFTC-SB3-SS1-3	17-NFTC-SB3-SS15-3	36699	3	ND<2	--	--
Total Oil & Grease (SW 3550 + EPA 413.2)						
17-NFTC-SB1-SS5-10	17-NFTC-SB1-SS15-10	35250	ND<2	ND<2	ND<2	--
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357	5	ND<2	--	--
15-TEB2-SB2-SS5-10	15-TEB2-SB2-SS15-10	35863				
10-PWN2-SB4-SS1-3	10-PWN2-SB4-SS15-3	36732	ND<2	ND<2	ND<2	--
Total Phenolics (SW 510A/510C)						
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357	0.24	0.16	0.20	40
10-PWN2-SB4-SS1-3	10-PWN2-SB4-SS15-3	36732	0.18	0.10	0.14	57
Arsenic (CA Title 22:66700)						
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357	ND<0.05	ND<0.05	ND<0.05	--
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802	ND<0.03	ND<0.03	ND<0.03	--
5-AFTC-SB3-SS1-3	5-AFTC-SB3-SS15-3	36732	.038	0.044	0.041	15
Barium (CA Title 22:66700)						
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357	4.5	4.4	4.5	2
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802	4.4	2.4	3.4	59
5-AFTC-SB3-SS1-3	5-AFTC-SB3-SS15-3	36732	3.7	4.0	3.9	8
Cadmium (CA Title 22:66700)						
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357	ND<0.03	ND<0.03	ND<0.03	--
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802	ND<0.03	ND<0.03	ND<0.03	--
5-AFTC-SB3-SS1-3	5-AFTC-SB3-SS15-3	36732	ND<0.03	ND<0.03	ND<0.03	--
Chromium (CA Title 22:66700)						
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357	0.2	ND<0.07	--	--
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802	ND<0.06	ND<0.06	ND<0.06	--
5-AFTC-SB3-SS1-3	5-AFTC-SB3-SS15-3	36732	ND<0.06	ND<0.06	ND<0.06	--

TABLE I.6
(Continued)
SUMMARY OF QUALITY ASSURANCE RESULTS
MISCELLANEOUS PARAMETERS MEASURED IN SOIL SAMPLES

Blind Duplicate Field Samples		Laboratory Report Number	Analytical Results (mg/Kg)			
Sample 1	Sample 2		Sample 1	Sample 2	Average	Relative % Difference
Lead (CA Title 22:66700)						
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357	0.2	ND<0.2	--	--
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802	0.6	ND<0.2	--	--
5-AFTC-SB3-SS1-3	5-AFTC-SB3-SS15-3	36732	ND<0.2	ND<0.2	ND<0.2	--
Mercury (CA Title 22:66700)						
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357	0.13	ND<0.001	--	--
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802	ND<0.001	ND<0.001	ND<0.001	--
5-AFTC-SB3-SS1-3	5-AFTC-SB3-SS15-3	36732	0.014	0.001	0.008	173
Selenium (CA Title 22:66700)						
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357	ND<0.02	ND<0.027	ND	--
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802	ND<0.003	ND<0.003	ND<0.003	--
5-AFTC-SB3-SS1-3	5-AFTC-SB3-SS15-3	36732	ND<0.005	ND<0.005	ND<0.005	--
Silver (CA Title 22:66700)						
2-PWD2-SB1-SS5-10	2-PWD2-SB1-SS15-10	35357	ND<0.03	ND<0.03	ND<0.03	--
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802	ND<0.03	ND<0.03	ND<0.03	--
5-AFTC-SB3-SS1-3	5-AFTC-SB3-SS15-3	36732	0.1	ND<0.03	--	--
Nickel (CA Title 22:66700)						
16-EVP3-SB4-SS5-10	16-EVP3-SB4-S ,5-10	35802	0.2	0.2	0.2	0
Cyanide (SM 412B/412E)						
16-EVP3-SB4-SS5-10	16-EVP3-SB4-SS15-10	35802	ND<0.5	ND<0.5	ND<0.5	--

*ND = not detected; constituent concentrations were below limit of detection.

TABLE I.7
KEY TO LABORATORY QUALITY CONTROL REPORTS FOR GC ANALYSES

Lab Report	Number of Soil Samples	Halogenated Volatiles		Aromatic Volatiles		Number of Water Samples Analyzed	Purgeable Halocarbons		Purgeable Aromatics	
		QC Report Number	QC Report Found In	QC Report Number	QC Report Found In		QC Report Number	QC Report Found In	QC Report Number	QC Report Found In
35250	1	8010-5	35303	8020-5	35288	0	--	--	--	--
35288	4	8010-5	35303	8020-5	35288	0	--	--	--	--
35303	3	8010-5	35303	8020-5	35288	0	--	--	--	--
35328	4	8010-7	35328	8020-6	35310*	0	--	--	--	--
35345	0	--	--	--	--	0	--	--	--	--
35357	5	8010-11	35357	8020-11	35374	0	--	--	--	--
35374	8	8010-12	35374	8020-11	35374	0	--	--	--	--
35393	4	8010-12	35374	8020-12	35393	0	--	--	--	--
35401	5	8010-12	35374	8020-12	35393	0	--	--	--	--
35730	0	--	--	--	--	3	601-13	35730	602-13	357
35742	0	--	--	--	--	2	601-13	35730	602-14	35
35778	4	8010-14	35778	8020-15	35778	0	--	--	--	
35790	4	8010-14	35778	8020-15	35778	0	--	--	--	--
35803	4	8010-15	35802	8020-16	35803	0	--	--	--	--
35802	4	8010-15	35802	8020-15	35778	0	--	--		--
				8020-15A	35802					
35812	3	8010-16	35812	8020-16	35803	0	--	--	--	--
35847	4	8010-16	35812	8020-17	35847	0	--	--	--	--
35863	2	8010-17	35863	8020-17	35847	0	--	--	--	--
35878	4	8010-17	35863	8020-18	3587[illegible]	0	--		--	--
36257	0	--	--	--	-					
36506	6	8010-21	36506	8020-19	36506	0	--	--	--	--
36515	5	8010-21	36506	8020-20	36515	0	--	--	--	--
36546	8	8010-24	36546	8020-[illegible]	36546	0		--	--	--
36555	9	8010-26	36555	8020-21	36555	0	--	--	--	--
36574	8	8010-26	36555	8020-22	36546	0	--	--	--	--
36608	4	8010-27	36608	8020-22	36546	0	--	--	--	--
36658	0	--	--	--	--		--	--	--	--
36675	0	--	--	--	--		601-28	36675	602-20	?
36699	0	--	-	--	--	0	--	--	--	--
36732	9	8010-29	3[illegible]732	8020-24	36732	0	--	--	--	--
36762	8	8010-30	36762	8020-25	36762	0	--	--	--	--

*This report contains results of IT Corp analyses of samples from another job site.

TABLE I.8
SUMMARY OF QUALITY CONTROL RESULTS
HALOGENATED VOLATILE ORGANICS (SW 8010)
(Compounds Not Detected Are Not Listed)

Compound	Number of Duplicates	Relative % Difference			Number of Spikes	Spike Concentration (mg/Kg)	Percent Recovery		
		Low	Average	High			Low	Average	High
Bromodichloromethane	14	--	ND	--	14	0.050	76	98	114
Bromoform	14	--	ND	--	14	0.050	82	107	166
Carbon tetrachloride	14	--	ND	--	14	0.050	58	88	110
Chlorobenzene	14	--	ND	--	14	0.050	70	90	106
Chloroform	14	--	ND	--	14	0.050	82	97	104
Dibromochloromethane	14	--	ND	--	6	0.155	94	100	103
					3	0.175	85	90	94
					4	0.178	88	98	108
					1	0.180	--	111	--
1,1-Dichloroethane	14	--	ND	--	14	0.050	66	95	106
1,2-Dichloroethane	14	--	ND	--	14	0.050	60	99	112
1,1-Dichloroethylene	14	--	ND	--	14	0.050	50	86	140
trans-1,2-Dichloro-ethylene	14	--	ND	--	14	0.050	64	94	108
Dichloromethane*	13	--	ND	--	11	0.050	62	98	160
1,2-Dichloropropane	14	--	ND	--	10	0.050	52	99	132
					4	0.073	79	93	103
1,3-Dichloropropylene	14	--	ND	--	1	0.045	--	100	--
					5	0.155	94	100	103
					4	0.175	86	96	114
					4	0.178	88	98	108
1,1,2,2-Tetrachloroethane	14 (13ND)	--	25	--	14	0.100	75	92	115
Tetrachloroethylene	14 (13ND)	--	25	--	14	0.100	75	92	115
1,1,1-Trichloroethane	14	--	ND	--	14	0.050	62	95	160
1,1,2-Trichloroethane	14	--	ND	--	6	0.155	94	100	103
					4	0.175	85	96	114
					4	0.178	88	98	108
Trichloroethylene	14	--	ND	--	14	0.050	74	98	140

*Laboratory atmosphere contaminated by dichloromethane during analysis of some samples.

TABLE I.9
SUMMARY OF QUALITY CONTROL RESULTS
AROMATIC VOLATILE ORGANICS (SW 8020)
(Compounds Not Detected Are Not Listed)

Compound	Number of Duplicates	Relative % Difference			Number of Spikes	Spike Concentration (mg/Kg)	Percent Recovery		
		Low	Average	High			Low	Average	High
Benzene	15	--	ND	--	15	.0127-.064	68	87	130
Chlorobenzene	15	--	ND	--	15	.0111-.056	60	86	129
1,2-Dichlorobenzene	15	--	ND	--	15	.0205-.103	57	86	126
1,3-Dichlorobenzene	15	--	ND	--	15	.0203-.102	55	86	124
1,4-Dichlorobenzene	15	--	ND	--	15	.0175-.088	55	85	129
Ethyl benzene	15	--	ND	--	15	.0111-.064	61	80	125
Toluene	15	--	ND	--	15	.0111-.060	51	85	210

TABLE I.10
SUMMARY OF QUALITY CONTROL RESULTS
WATER SAMPLES
(Compounds Not Detected Are Not Listed)

Compound	Number of Duplicates	Relative % Difference			Number of Spikes	Spike Concentration (mg/Kg)	Percent Recovery		
		Low	Average	High			Low	Average	High
EPA METHOD 601									
Bromodichloromethane	2	---	ND	--	2	10	112	--	120
Bromoform	2	--	ND	--	2	10	95	--	116
Carbon tetrachloride	2	--	ND	--	2	10	110	--	119
Chlorobenzene	2	--	ND	--	2	1-10	108	--	110
Chloroform	2	--	ND	--	2	10	110	--	119
Dibromochloromethane	2	--	ND	--	2	31-35	97	--	122
1,1-Dichloroethane	2	--	ND	--	2	10	110	--	116
1,2-Dichloroethane	2	--	ND	--	2	10	110	--	112
1,1-Dichloroethylene	2	--	ND	--	2	10	120	--	144
trans-1,2-Dichloroethylene	2	--	ND	--	2	10	107	--	110
Dichloromethane	2	--	ND	--	2	10	65	--	110
1,2,-Dichloropropane	2	--	ND	--	2	10-14	107	--	125
1,3-Dichloropropylene	2	--	ND	--	2	31-35	97	--	122
1,1,2,2-Tetrachloroethane	2	--	ND	--	2	20	105	--	108
Tetrachloroethylene	2	--	ND	--	2	20	105	--	108
1,1,1-Trichloroethane	2	--	ND	--	2	10	93	--	97
1,1,2-Trichloroethane	2	--	ND	--	2	31,35	97	--	122
Trichloroethylene	2	--	ND	--	2	10	100	--	120
EPA METHOD 602									
Benzene	2	--	ND	--	2	10	120	--	140
Chlorobenzene	2	--	ND	--	2	10-11	109	--	110
1,2-Dichlorobenzene	2	--	ND	--	2	11-12	100	--	100
1,3-Dichlorobenzene	2	--	ND	--	2	12-13	100	--	100
1,4-Dichlorobenzene	2	--	ND	--	2	10-11	100	--	109
Ethyl benzene	2	--	ND	--	2	10-11	110	--	120
Toluene	2	--	ND	--	2	10	64	--	130

TABLE I.11
SUMMARY OF QUALITY CONTROL RESULTS
MISCELLANEOUS PARAMETERS MEASURED ON SOIL SAMPLES
(Compounds Not Detected Are Not Listed)

Compound	Number of Duplicates	Relative % Difference			Number of Spikes	Spike Concentration	Percent Recovery		
		Low	Average	High			Low	Average	High
Total Petroleum Hydrocarbons (SW 3550 & EPA 418.1)	11	0	9	40	11	17-33 (mg/Kg)	78	92	106
Total Oil & Grease (SW 3550 & EPA 413.2)	14	0	15	89	13	15-39 (mg/Kg)	77	102	120
					1	6,003	--	100	--
Total Phenols (SM 510A/510C)	2	0	--	33	2	2 (mg/L)	55	--	71
Arsenic (CA Title 22:66700)	9	0	5	29	1*	0.5 (mg/L)	--	90	--
Barium (CA title 22:66700)	9	0	14	56	1	5 (mg/L)	--	90	--
Cadmium (CA Title 22:66700)	9	0	12	94	1	5 (mg/L)	--	96	--
Chromium (CA Title 22:66700)	9	0	1	12	1	5 (mg/L)	--	98	--
Lead (CA Title 22:66700)	9	0	5	40	1	5 (mg/L)	--	92	--
Mercury (CA Title 22:66700)	9	0	26	100	1	1 (mg/L)	--	108	--
Selenium (CA Title 22:66700)	9	0	5	48	1	0.5 (mg/L)	--	82	--
Silver (CA Title 22:66700)	9	--	0	--	1	1 (mg/L)	--	88	--
Nickel (CA Title 22:66700)	5	0	1	5	2	4-5 (mg/L)	97	--	106
Cyanide (SM 412B/412E)	4	0	3	8	5	5-19.99 (mg/L)	47	78	112

TABLE I.11
SUMMARY OF QUALITY CONTROL RESULTS
MISCELLANEOUS PARAMETERS MEASURED ON SOIL SAMPLES
(Compounds Not Detected Are Not Listed)
(Continued)

Compound	Number of Duplicates	Relative % Difference			Number of Spikes	Spike Concentration	Percent Recovery		
		Low	Average	High			Low	Average	High
Iron (CA Title 22:66700)	2	0	--	4	1	5 (mg/L)	--	70	--
Copper (CA Title 22:66700)	2	0	--	3	1	5 (mg/L)	--	98	-
Manganese (CA Title 22:66700)	2	0	--	6	1	5 (mg/L)	--	75	--
Zinc (CA Title 22:66700)	2	0	--	5	1	5 (mg/L)	--	103	--

*Some spike analyses of trace metals not reported due to improper laboratory methods.