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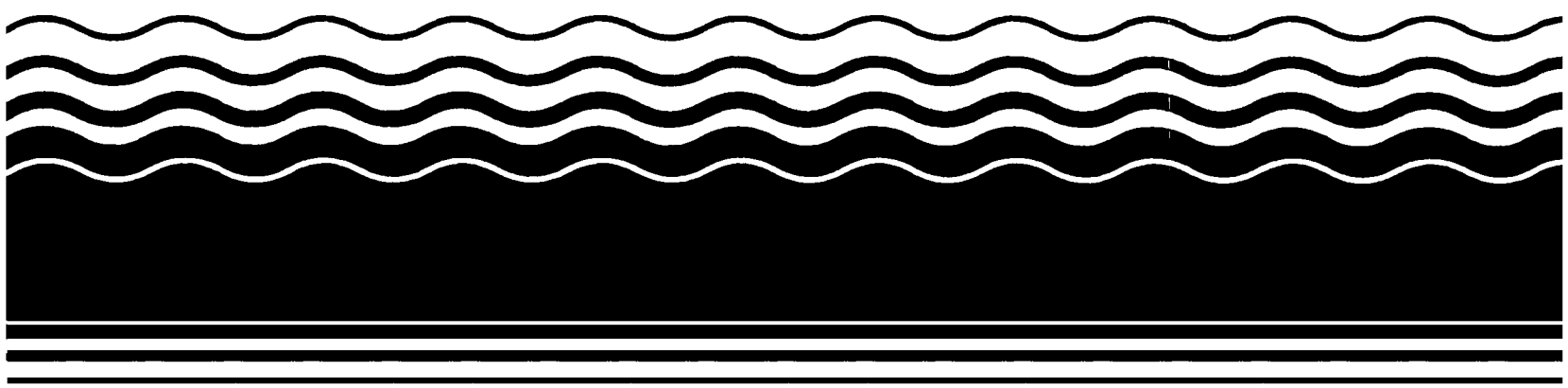
EPA Superfund
Record of Decision:

Williams Air Force Base
OU 5
Chandler, AZ
10/14/1997



INSTALLATION RESTORATION PROGRAM

WILLIAMS AIR FORCE BASE, ARIZONA

FINAL
RECORD OF DECISION

OPERABLE UNIT 5

CONTRACT NUMBER F41624-94-D-8047, ORDER D0011

Project No. 409881

September 1997

Williams Air Force Base, Arizona

Final
Record of Decision

Operable Unit 5

Prepared for:

Air Force Center for Environmental Excellence
HSC/PKVCB
Headquarters Human Systems Center
Brooks Air Force Base, Texas 78235-5353
Delivery Order 0011

Project No. 409881

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September 1997

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List of Acronyms

ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AFB	Air Force Base
AST	aboveground storage tank
ATC	Air Training Command
AV	AeroVironment, Inc.
bgs	below ground surface
BHC	beta hexachlorocyclohexane
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
COPC	contaminant of potential concern
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DOD	U.S. Department of Defense
E/A	evaluation/assessment
EM	electromagnetic
EPA	U.S. Environmental Protection Agency
ES	Engineering-Science, Inc.
ESD	Explanation of Significant Difference
FFA	Federal Facilities Agreement
FS	feasibility study
FSP	field sampling plan
HBGL	health-based guidance level
HI	hazard index
HQ	hazard quotient
HSP	health and safety plan
ILCR	incremental lifetime cancer risk
IRP	Installation Restoration Program
IT	IT Corporation
JP-4	jet petroleum grade 4
mg/kg	milligrams per kilogram
µg/kg	micrograms per kilogram

List of Acronyms *(Continued)*

msl	mean sea level
NCP	National Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PPM	priority pollutant metal
PRG	preliminary remediation goals
PVC	polyvinyl chloride
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	record of decision
RWCD	Roosevelt Water Control District
SARA	Superfund Amendment and Reauthorization Act
SLRA	screening level risk assessment
SVOC	semivolatile organic compound
TPH	total petroleum hydrocarbon
TRC	Technical Review Committee
TWG	Technical Working Group
UCL	upper confidence limit
USAF	U.S. Air Force
USGS	U.S. Geological Survey
UST	underground storage tank
VOC	volatile organic compound
WWTP	wastewater treatment plant

1.0 Declaration

1.1 Site Name and Location

Williams Air Force Base (AFB) is located in Maricopa County, Mesa, Arizona (Figure 1-1). The following sites constitute Operable Unit (OU) 5:

- Airfield Underground Storage Tanks (UST) (ST-25)
- Paint Shop Leach Field (WP-27)
- Sewage Sludge Trenches (DP-28)
- Prime Beef Yard (SS-29)
- Golf Course Maintenance Area (SS-31)
- Building 1070 (SS-32)
- Munitions Incinerator (Facility 1119, SS-34)
- Concrete Hardfill Drum Removal Area (LF-26)
- Sewage Sludge Stockpile Area (Area 28).

The U.S. Environmental Protection Agency (EPA) issued a guidance in a memorandum on August 23, 1994 that encourages and supports efforts to accelerate and develop streamlined approaches to the cleanup of hazardous wastes at federal facilities. These sites were selected to be included as one operable unit, OU-5, based on the results of the evaluation/assessment (E/A) performed at 30 areas at Williams. It appeared that the nature and extent of contamination was such that through investigations and/or simple removal actions no further action would be required.

Following EPA guidance, an action memorandum (IT, 1995a) was issued in June 1995 outlining removal actions recommended for OU-5 sites at Williams AFB. These removal actions were completed in July 1995 . Excavations at six of the OU-5 sites noted above were performed to remove suspected contamination previously identified in the final and Phase II evaluation/assessment (E/A) reports, facilities assessment report, or during other investigations. Confirmatory soil samples were collected in accordance with Section 4.1 of the approved field sampling plan (FSP) (IT Corporation [IT], 1995b) to verify that contaminants with concentrations exceeding the Arizona health-based guidance level (HBGL) or EPA Region IX residential preliminary remediation goals (PRG) had been removed and properly disposed.

1.2 Statement and Basis of Purpose

This record of decision (ROD) substantiates the no-action remedy for the sites that constitute OU-5 at Williams AFB. The ROD was developed in accordance with the Comprehensive

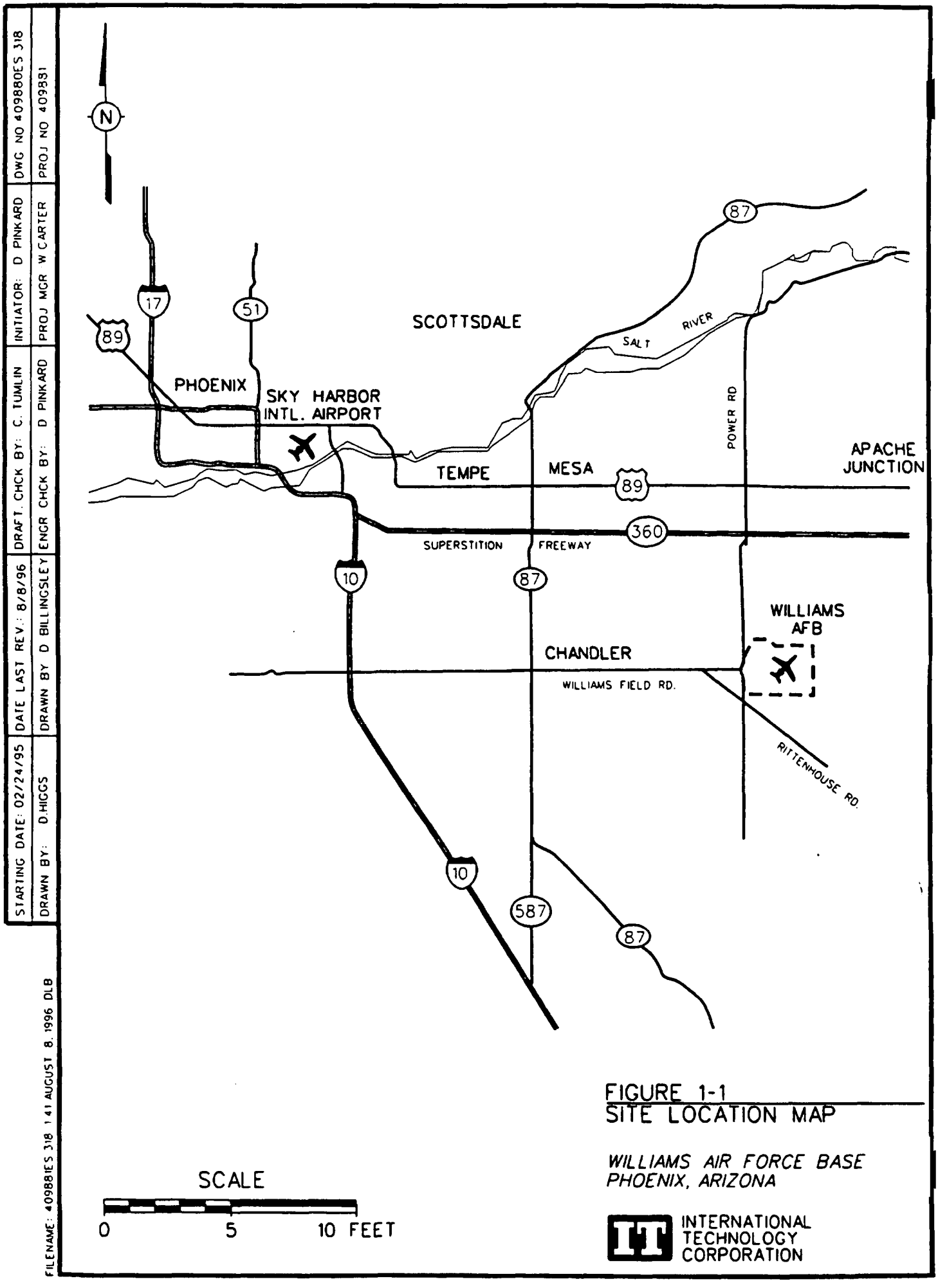

FIGURE 1-1
SITE LOCATION MAP

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 02/24/95 | DATE LAST REV.: 8/8/96 | DRAFT. CHCK BY: C. TUMLIN | INITIATOR: D PINKARD | DWG NO 409880ES 318
DRAWN BY: D.HIGGS | DRAWN BY D BILLINGSLEY | ENGR CHCK BY: D PINKARD | PROJ MGR W CARTER | PROJ NO 409831

FILENAME: 409881ES 318 1 41 AUGUST 8, 1996 DLB

Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendment and Reauthorization Act (SARA), and, to the extent practicable, the National Contingency Plan (NCP). This decision is based on the Administrative Record for this OU.

EPA and state of Arizona concur with the selected remedy for OU-5.

This ROD only reiterates that cleanup via capping of the Sewage Sludge Trenches (DP-28) were included as part of the final remedy for the Landfill (LF-04) in OU-1 (IT, 1995c). The capping of DP-28 was also included as part of the Explanation of Significant Difference (ESD) that was approved in June 1994.

1.3 Description of the Selected Remedy

As with many Superfund sites, the environmental problems at Williams AFB are complex. As a result, the U.S. Air Force (USAF) has organized the work into the following OUs.

- OU-1 addresses soil and groundwater contamination at the following ten sites:
  - Landfill (LF-04)
  - Fire Protection Training Area No. 1 (FT-03)
  - Northwest Drainage System (SD-10)
  - Radioactive Instrumentation Burial Area (RW-11)
  - Pesticide Burial Area (DP-13)
  - Hazardous Materials Storage Area (SS-01)
  - USTs at four areas (ST-05, ST-06, ST-07, and ST-08).
- OU-2 addresses soil and groundwater at the Liquid Fuels Storage Area (ST-12).
- OU-3 addresses soil and groundwater at the following two sites:
  - Fire Protection Training Area No. 2 (FT-02)
  - Southwest Drainage System (SD-09).
- OU-4 addresses investigations of contamination at 11 sites.
  - Electroplating/Chemical Cleaning (Facility 1085, Site SS-16)
  - Old Pesticide/Paint Shop (Facility 742, Site SS-17) (This has been moved to OU-6)
  - Oil/Water Separator - Petroleum, Oil, and Lubricant (Facility 550, Site SD-18)
  - Former Skeet Range at Former South Desert Village (Site SS-19)
  - Firing Range/Skeet Range (Facility 927, Site SS-20)

- Facilities 1020 and 1051 (Site SS-21)
- Aboveground Storage Tanks (AST) 556 and 557 (Site ST-22)
- Building 1069 (Site SS-23)
- Building 1010 (Site SS-24)
- Concrete Hardfill Area (Site LF-26)
- Facility 1004 (Area 14).

- OU-5 addresses soil contamination actions at the nine sites listed in Section 1.1.

- OU-6 addresses soil and potential groundwater contamination at the Old Pesticide/Paint-Shop (Facility 724, Site SS-17).

The USAF, EPA, and state of Arizona have approved RODs implementing cleanup remedies for OU-1, OU-2, and OU-3 sites. The deep soils at ST-12 (unsaturated soils below 25 feet) were included in an amendment to the OU-2 ROD. Investigations and feasibility study (FS) have been completed for OU-4 sites. Investigations, RI Report, Proposed Plan, and ROD are to be completed at OU-6. OU-5 is the subject of this ROD. This ROD recommends no action because previous removal actions resulting from the OU-5 action memorandum have either lowered the contamination levels below Arizona HBGL or EPA Region IX residential PRGs or the risk associated with the remaining contamination concentration will not pose an unacceptable risk to human health and the environment.

1.4 Declaration Statement

Previous removal actions associated with the OU-5 action memorandum have lowered the health risks associated with exposure to contaminated soil at the OU-5 sites so that they pose no unacceptable risk to human health or the environment under a conservative screening level residential exposure scenario. Therefore, no further remedial action is required for soil in any of the sites identified in OU-5. Soil removal, sampling, and analyses occurred during the July 1995 field activities. No action is required for groundwater as the result of any contaminants at these sites because soil contamination was limited to shallow surface soil (i.e., less than 25 feet) and there is no contaminant source. These two factors when combined with depth to groundwater of 150 feet eliminated concerns for groundwater contamination. Because the concentrations of contaminants in the residual soil are within health-protective levels, and no engineering controls were required as part of previous removal action, the OU-5 sites may be released for unrestricted use and no 5-year review will be required for any OU-5 site.

This record of decision for OU-5 at Williams AFB, Arizona may be executed and delivered in any number of counterparts, each of which when executed and delivered shall be deemed to be an original, but such counterparts shall together constitute one and the same document.

Albert F. Lowas, Acting Director
U.S. Air Force, Base Conversion Agency

9/30/97
Date

Daniel Opalski, Director
Federal Facilities Cleanup Office
U.S. Environmental Protection Agency, Region IX

10/14/97
Date

Russell F. Rhoades, Director
Arizona Department of Environmental Quality

2/20/98
Date

Rita Pearson, Director
Arizona Department of Water Resources

3.5.98
Date

2.0 Decision Summary

2.1 Site Name, Location, and Description

Williams AFB located in Maricopa County, Arizona is approximately 30 miles southeast of Phoenix and just east of Chandler (Figure 1-1). The Base is relatively isolated from any large metropolitan area. Smaller urban areas such as Mesa, Chandler, Gilbert, and Apache Junction are located 5 to 15 miles northeast and northwest of the Base. The Queen Creek and Chandler Heights areas are approximately 5 miles south and west of the Base boundary, respectively. Table 2-1 lists these towns and others with distance and direction from Williams AFB; the population of the towns are included. These areas are separated from the Base by cultivated and uncultivated land.

Williams AFB was constructed on 4,042 acres of government land in 1941 to be used as a flight training base. Training activities with jet aircraft began in 1949. Runway and airfield operations, industrial areas, housing, and recreational facilities are located on the Base. In 1992, as a result of U.S. Department of Defense (DOD) downsizing, the Base was recommended for closure and subsequently closed September 30, 1993.

2.1.1 Demography and Land Use

During its active status, 3,029 military personnel and 869 civilian employees were stationed at the Base. The total population actually living on Base, including dependents, was approximately 2,700. Many of the military personnel lived off Base in one of the surrounding areas. On an average workday, the population of the Base increased to more than 5,000 because of the influx of both civilian employees and military personnel living off Base (Cost Branch Controller Division, 1987).

The Base is surrounded primarily by agricultural land in a valley that has had a long history of intensive agricultural use, predominantly for crops of citrus, cotton, and alfalfa.

A development plan for the region (Sunregion Associates, 1987), if implemented, will dramatically alter the region surrounding Williams AFB. The portions of the development plan of most importance to the Base are the East Mesa Subarea Plan and the Queen Creek-Chandler Heights Plan. The former proposes development for portions of the City of Mesa, the Town of Gilbert, the City of Apache Junction, and the land area north of Williams AFB. The proposed land area for the Queen Creek-Chandler Heights Plan is east of Chandler, just south of the Base

Table 2-1

Cities Surrounding Williams Air Force Base, Arizona

City	Direction Relative to Williams AFB	Distance from Williams AFB (miles)	Population[a]
Apache Junction	North-Northeast	10	21,354
Chandler	West	5	119,227
Gilbert	Northwest	5	51,074
Mesa	North-Northwest	15	313,649
Queen Creek	South	5	3082
Tempe	Northwest	20	144,289
Phoenix	Northwest	25	1,048,949

[a]July 1, 1994 Census.

in the approximate location of the Town of Queen Creek. The plan is to develop the proposed area residentially and commercially over a 25-year period. If implemented, this development will dramatically impact the demographics and population around the Base. The transition of Williams AFB to the Williams Gateway Airport Authority will also impact the region.

2.1.2 Air/Climate

The climate of Williams AFB is similar to that of Phoenix and the rest of the Salt River Valley. The temperature ranges from very hot in the summer to mild in winter. Rain comes mostly in two seasons: from late November until early April, and in July and August. Average annual precipitation is approximately 7.1 inches. Humidity ranges from approximately 30 percent in winter to 10 percent in summer. Williams AFB is also characterized by light winds. The mean annual pan evaporation is approximately 100 inches and the annual lake evaporation for the area is approximately 72 inches (National Oceanic and Atmospheric Administration [NOAA], 1977).

2.1.3 Geology

Williams AFB lies in the eastern portion of the Basin and Range Physiographic Lowlands Province of south-central Arizona, which is located in the Salt River Valley. The local topography is controlled by large-scale normal faulting that has resulted in the formation of broad, flat, alluvial-filled valleys separated by steep isolated hills and mountain ranges. Arizona Department of Water Resource's hydrologic maps show the Base bounded to the north by the Usery Mountains, to the east by the Superstition Mountains, to the south by the Santan Mountains, and to the west by South Mountain.

The topography of the Base slopes gently to the west with a generally less than 1 percent grade. Elevations range from 1,326 feet above mean sea level (msl) on the west side of the Base to 1,390 feet above msl at the southeast corner of the Base.

According to Laney and Hahn (1986), the area of the Base is underlain by six geologic units: crystalline rocks, extrusive rocks, red unit, lower unit, middle unit, and upper unit. The crystalline and extrusive rocks compose the surrounding mountains and the basement complex underlying the consolidated and unconsolidated sediments of the valley. The four units overlying the basement complex are of sedimentary origin and have the surrounding mountains and local drainage as their source areas.

The red unit immediately overlies the basement complex and is composed of well-cemented breccia, conglomerate, sandstone, and siltstone of continental origin with interbedded extrusive

flow rocks. The lower unit overlies the red unit and consists of playa, alluvial fan, and fluvial deposits with evaporites and interbedded basaltic flows present in lower sections (Laney and Hahn, 1986). The middle unit overlies the lower unit and is composed of playa, alluvial fan, and fluvial deposits with no associated evaporites. The middle unit received its sediment primarily from the Salt River, whereas the red and lower units had the local mountains as the principal source. The youngest unit in the stratigraphic sequence is referred to as the upper unit. This unit consists of channel, floodplain, terrace, and alluvial fan deposits of largely unconsolidated gravel, sand, silt, and clay.

Two major soil associations are found in the vicinity of Williams AFB. The Mohall-Contine Association is found over much of the Base, and the Gillman-Estrella-Avondale Association is found at the southern boundary of the Base. The Mohall-Contine and the Gillman-Estrella-Avondale Associations have generally the same characteristics, being well drained and nearly level with slopes of less than 1 percent.

2.1.4 Hydrogeology

Groundwater elevation contour maps have been produced for the western half of the Base, where groundwater monitoring wells exist. This information is presented in the OU-1 and OU-2 remedial investigation (RI) reports (IT, 1992a,b), and the OU-3 RI report (IT, 1994a). The maps indicate that groundwater flows to the north and east on a Basewide scale. These maps are consistent with other groundwater elevation contour maps presented for the area (Laney and Hahn, 1986; AeroVironment, Inc. [AV], 1987).

A general rise in groundwater elevations has been observed in monitoring periods from December 1989 to present at a rate of 3 to 5 feet per year. Rising groundwater levels may be attributed to decreased local pumping due to urbanization and larger surface water use, increased recharge from additional agricultural irrigation, and increased recharge from unusually rainy periods over the past 10 to 15 years.

There are at least 90 domestic permitted wells within a 3-mile radius of the Base. These wells are not affected by contamination at OU-5.

2.1.5 Surface Water

There are no major surface water bodies within a 10-mile radius of the Base. The Base lies between the 100-year and 500-year flood level for streams in the Gila River Basin (U.S. Department of Housing and Urban Development, 1979). Storm drainage on the Base is directed to a

combination of open channels used to drain most of the Base and underground drainage structures. Storm drainage from the Base flows either to the Roosevelt Water Control District (RWCD) floodway that flows southward in the vicinity of the Base or directly to the floodway west of the Base, or into the wastewater treatment plant.

2.2 Site History and Enforcement Activities

Williams AFB was a flight training base that opened in 1942. It was immediately commissioned as a flight training school, and training activities with jet aircraft began in 1949. Throughout its history, pilot training was the primary activity at Williams AFB. At various times, bombardier, bomber pilot, instrument bombing specialist, and fighter gunnery training schools were also housed on Base. Over the years, a wide variety and large number of aircraft have been housed at Williams AFB.

The Installation Restoration Program (IRP) was implemented by the DOD in 1980 to identify and control environmental contamination from past hazardous materials use and disposal activities at USAF installations. The IRP is DOD's equivalent of the national Superfund program. SARA, passed by Congress in 1986, required cleanup of federal facilities to meet Superfund requirements.

IRP guidance was received at Williams AFB in July 1983 and the initial assessment study (designated as Phase I) was completed by Engineering-Science, Inc. (ES) in 1984. Based on a review of available records pertaining to chemical handling and disposal practices, interviews with site personnel, and a site survey of activities at Williams AFB, the study identified the following nine potential sites where hazardous materials have been handled or disposed:

- Landfill (LF-04)
- Fire Protection Training Area No. 1 (FT-03)
- Fire Protection Training Area No. 2 (FT-02)
- Northwest Drainage System (SD-10)
- Southwest Drainage System (SD-09)
- Radioactive Instrumentation Burial Area (RW-11)
- Pesticide Burial Area (DP-13)
- Hazardous Materials Storage Area (SS-01)
- Liquid Fuels Storage Area (ST-12).

A second investigation (designated as Phase II) was conducted by AV from September 1984 to December 1985 (AV, 1986). This investigation was initiated to confirm the information in the ES report and to verify the presence and quantify the extent of contamination. In 1987, AV

completed an additional investigation (Phase II, Stage 2) to define the most likely pathways for contaminant migration from each site and to confirm the presence or absence of contamination along those pathways.

In 1987, as a result of AV investigations, IT, under a contract with Martin Marietta Energy Systems, Inc. through the Hazardous Waste Remedial Actions Program, performed a simple remedial action (IT, 1987a). This activity involved designing soil cementing and a concrete cap for approximately 350 feet of the uppermost portion of SD-09. Plans and specifications were issued in September 1987 (IT, 1987b) and the work was completed that year.

In October 1988, the Air Training Command (ATC) contracted Martin Marietta Energy Systems and its subcontractor, IT, through the U.S. Department of Energy to complete the RI/FS, proposed plan, and ROD at Williams AFB. As part of these efforts, a work plan and quality assurance project plan (QAPP) (IT, 1991a), which includes a health and safety plan (HSP), and an FSP (IT, 1991b), were issued. The continuation of the RI was initiated in January 1989. The sites investigated include the nine original sites plus four UST sites (ST-05, ST-06, ST-07, ST-08).

Williams AFB was added to the National Priorities List (NPL) on November 21, 1989. The NPL primarily serves as an information tool for EPA to identify sites that possibly warrant further investigation and remedial action.

As a consequence of inclusion on the NPL listing, negotiations were completed and a Federal Facilities Agreement (FFA) was signed on September 21, 1990. The FFA establishes a co-operative and participatory framework among the federal and state agency members, defines their roles and responsibilities, and develops a process to resolve any disputes that may arise during the study and execution phases of the IRP. In addition, the FFA prioritizes and schedules the investigation and remedial actions at Williams AFB through the designation of OUs that aid in managing these activities. Parties to the FFA include the USAF, the EPA, the Arizona Department of Environmental Quality (ADEQ), and the Arizona Department of Water Resources (ADWR).

The FFA divided the Base into two OUs. OU-1 included eight areas identified in previous investigations, plus four UST areas (IT, 1992a; 1994b,c). OU-2 comprised the groundwater contamination and shallow (less than 25 feet) soil contamination at the Liquid Fuels Storage Area (IT, 1992b,c,d). OU-3 was subsequently identified to consider sites not included in OU-1,

the portion of the storm line from Building 53 to the headworks of SD-09, and the Fire Protection Training Area No. 2. OU-1, OU-2, and OU-3 sites have been investigated and the results reported (IT, 1994a).

In 1992, after the Base was nominated for closure, there was a question of whether all the areas on the Base with potential contamination had been included in the administrative record. This question led to the facilities assessment, which began in February 1992 and was concluded in 1993 (IT, 1993a).

The facilities assessment report documented the actions that have been taken to assess facilities not included under the IRP. The report also reviewed the background of each facility and any contamination that might pose a risk to human health or the environment at that location. This process resulted in assessing 92 facilities/areas. Forty-nine facilities/areas were recommended to be eliminated from further consideration, 29 were recommended for further investigation, 12 were recommended for inclusion as part of the State Compliance Program, and 1 was recommended for addition as an IRP site. One area (Southwest Drainage System) was already identified as an IRP site. The Golf Course Maintenance Area was subsequently added to the sites recommended for further investigation, increasing the list for further investigation to 30 areas.

In 1993, field and sampling activities were conducted by IT at the 30 areas designated for the E/A. The purpose of this investigation was to evaluate the areas for the presence or absence of contamination that may have resulted from operations at the Base. The resultant E/A report (IT, 1994c) summarizes the results of this investigation. Areas where the presence and extent of contamination was confirmed were recommended for limited removal action and/or risk screening and were designated as OU-5 sites. Areas recommended for further investigation under CERCLA were designated as OU-4 sites.

A ROD for OU-2 was signed in December 1992. Deep soil at ST-12 from (25 feet to groundwater) was incorporated into OU-3 for final characterization of the vertical and areal extent of contamination. Once this characterization was completed, the deep soils were reincorporated into OU-2 via an OU-2 ROD amendment. The OU-2 ROD amendment was signed in August 1996. A ROD for OU-1 was signed May 18, 1994 and a ROD for OU-3 was signed in May 1996.

This ROD addresses remedial actions for OU-5, which is composed of the following sites:

- Airfield Underground Storage Tanks (Site ST-25)
- Paint Shop Leach Field (Site WP-27)
- Sewage Sludge Trenches (Site DP-28)
- Prime Beef Yard (SS-29)
- Golf Course Maintenance Area (SS-31)
- Building 1070 (SS-32)
- Munitions Incinerator (Facility 1119, SS-34)
- Concrete Hardfill Drum Removal Area (LF-26)
- Sewage Sludge Stockpile Area (Area 28).

The criteria used to determine which sites would be included in OU5, history of past waste practices, environmental investigations, enforcement activities, and remedial actions for each OU-5 site is presented in the following sections.

2.2.1 Characterization of Background Conditions

Regional background concentrations for inorganic species in soils were obtained from surficial soils in Gila, Maricopa, Pima, Pinal, and Yuma Counties in Arizona. Each of the U.S. Geological Survey (USGS) samples was collected from alluvial materials with a geologic provenance similar to the Base. The regional ranges of inorganic species concentrations are shown in Table 2-2. For information regarding elements that were not analyzed by the USGS, normal soil ranges were obtained from *Heavy Metals in Soils* (Alloway, 1990). The data in the Alloway report are based on worldwide averages for uncontaminated soils and have been included to provide additional perspective for values measured at the Base.

All organics generally associated with anthropogenic activity were considered to be site-related, with the exception of polynuclear aromatic hydrocarbon (PAH). Background concentrations were considered for PAHs because these compounds can be naturally distributed throughout the environment, primarily from the combustion of fossil fuels with subsequent atmospheric dispersion and deposition (Gschwend and Hites, 1981; Kawamura and Kaplan, 1983; LaFlamme and Hites, 1978; Thomas, 1986).

2.2.1.1 Base-Specific Background Samples

There was agreement among the Parties to the FFA that it was necessary to establish Base-specific background levels for inorganic constituents in surface soil as recommended in the OU-1 RI report (IT, 1992a). It was on this basis that ten Base-specific background surface soil samples were collected and analyzed in September 1993. The three areas sampled (Figure 2-1) were

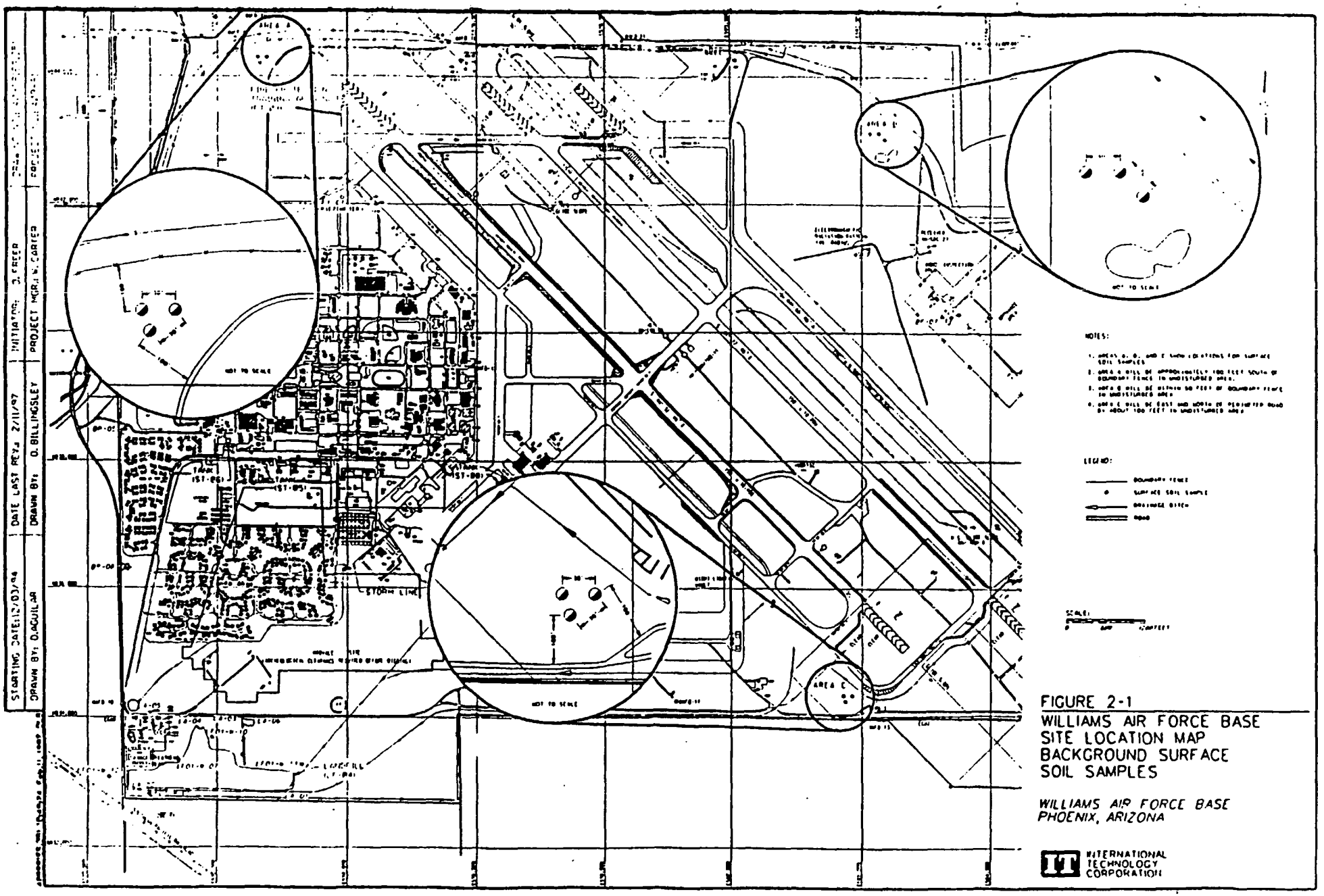

FIGURE 2-1
WILLIAMS AIR FORCE BASE
SITE LOCATION MAP
BACKGROUND SURFACE
SOIL SAMPLES

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

INTERNATIONAL TECHNOLOGY CORPORATION

Table 2-2

Background Inorganic Species Concentrations in Soil
Operable Unit 5
Williams Air Force Base

Constituent	Soil (mg/kg)	
	Base-Specific Range[a]	Regional Range[b]
Antimony	ND[c] (<12)	< 1
Arsenic	2.3 to 4.3	2 to 97
Barium	NA[d]	--[e]
Beryllium	1.0 to 1.6	1.0 to 1.5
Cadmium	ND (<1)	0.01 to 2.0[f]
Chromium	16.9 to 24.8	15 to 100
Cobalt	NA	--
Copper	ND (<5)	15 to 200
Lead	10.4 to 19.4	10 to 100
Mercury	ND (<0.2)	0.01 to 0.5[f]
Nickel	15.6 to 24.7	7 to 50
Selenium	0.21 to 0.24	0.1 to 5[f]
Silver	ND (<2)	0.01 to 8[f]
Thallium	ND (<2)	0.1 to 0.8[f]
Zinc	ND (<4)	25 to 150

[a]The range presents the low and high values for the ten samples.
[b]Data obtained from surficial soils in Gila, Caricopy, Pima, and Yuma counties.
[c]ND - Not detected.
[d]NA - Not analyzed because this chemical is not a priority pollutant metal. Base-specific background samples were analyzed for priority pollutant metals in accordance with the approved work plan.
[e]"--" Not available.
[f]Data obtained from *Heavy Metals in Soils* (Alloway, 1990).

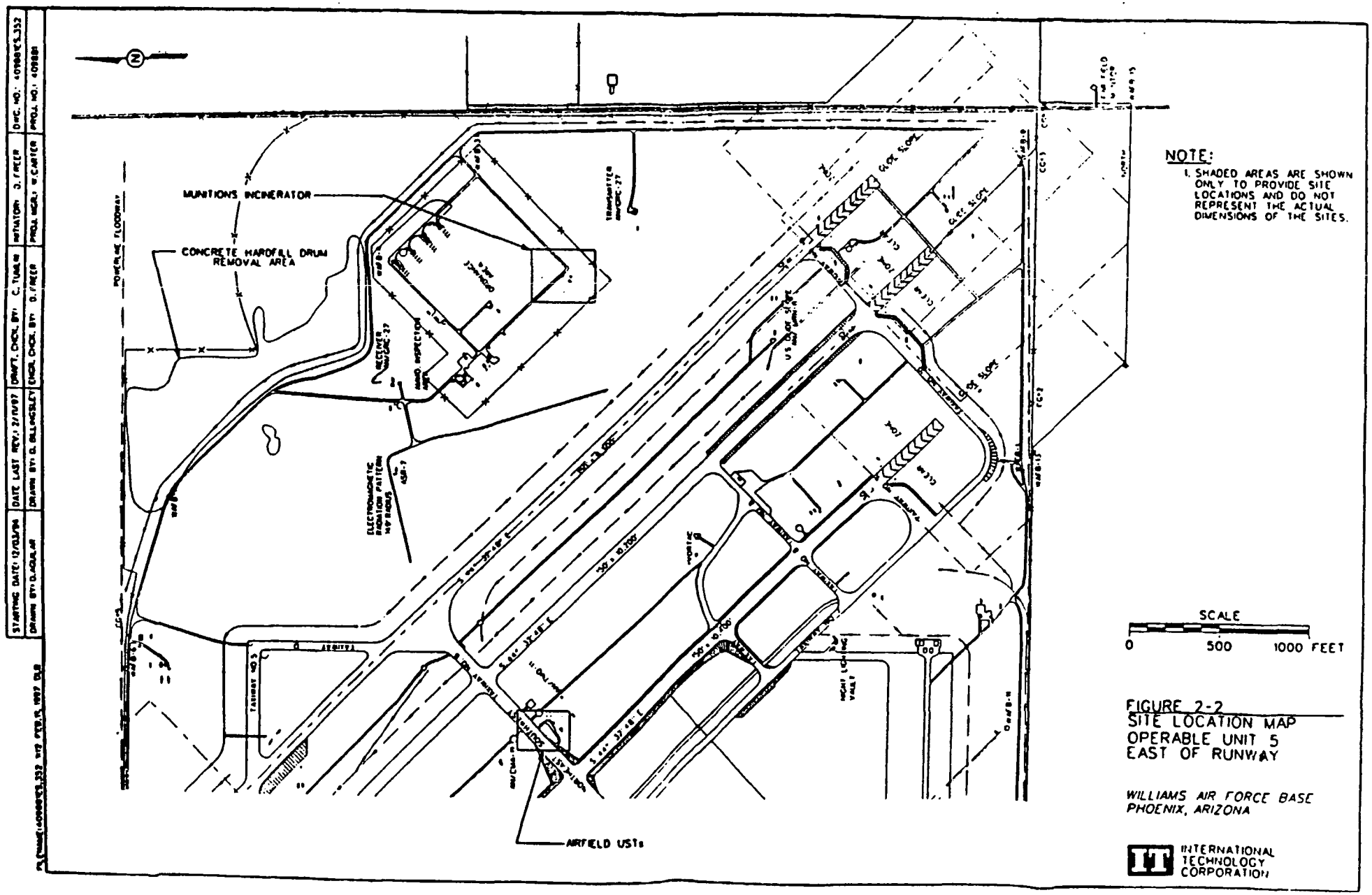

FIGURE 2-2
SITE LOCATION MAP
OPERABLE UNIT 5
EAST OF RUNWAY

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

INTERNATIONAL TECHNOLOGY CORPORATION

selected based on information from aerial photographs, ecological assessment observations, and a site walk at the Base to determine areas that were undisturbed. Locations were chosen based on having no historic photographic evidence of activity that would have disturbed the soil and on visual review of each area to ensure that there had been no recent activity. This factor relied to an extent on observations from the ecological assessment team, who examined the size and type of vegetation and absence of any indication of human intrusion. Three locations were selected based on recommendations from risk assessment personnel so that there would be statistically significant results compiled from an adequate number of samples. The areas north, south, and northeast of the runways were designated because they satisfied all criteria. It was recognized that there could be residual material from jet exhaust, but considering the use of the Base, prevailing wind direction, and the fact that all surface portions of the Base east of the runways were disturbed, these areas best represent surface background conditions. Areas off the Base have been more disturbed than on the Base due to agricultural use, and also could have been affected by exhaust from jets as well as crop dusting planes. The background metals that were analyzed for included antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.

The OU-3 FSP addendum (IT, 1993b), and OU-1 RI work plan addendum (IT, 1993c) specified the exact locations and techniques that were approved by the FFA Parties. Nine surface soil samples and a duplicate were collected and the analytical results were averaged to determine a Base-specific background concentration for each inorganic constituent. All Base-specific background concentrations and the regional range of concentrations detected for inorganic species in soil are presented in Table 2-2.

Comparison of site inorganic data to background data is performed in the risk assessment (Section 4.2.3). An inorganic constituent was considered to be present at background levels if the site mean was less than or equal to the background mean. If the site mean marginally exceeded the background mean, a student's t-test was performed to determine if the background concentrations were exceeded (Section 4.2.3).

2.2.2 Site-Specific Descriptions, History, and Investigation

This section includes the site selection criteria, investigation, removal action, and postremoval sampling for sites at OU-5. Individual site descriptions, histories, and summary of post sampling results are included in the sections that follow. The site selection criteria used for determining OU-5 sites was based on results from the investigations in the E/A phase of areas with possible contamination. These areas were identified from historic photos. The nine areas selected for

OU-5 were ones with very low levels of contaminants detected during the E/A phases. The investigation work plan was written to gain data to the type and any concentration of contamination in soil at these sites. It was anticipated that the contaminant concentrations would be low enough to require no further action. Due to the low concentrations of contaminants measured in soil in the E/A phase, it was determined that no groundwater monitoring wells would be installed in the OU-5 investigations. The actions at OU-5 were performed prior to the promulgation of the Arizona Amended Soil Remediation Rules (April, 1996). These rules address soil concentrations and constituents, which could affect groundwater.

The screening criteria used to determine if remedial action was required at the sites at OU-5 included comparison to: (1) EPA Region IX residential preliminary remediation goals and (2) base background concentrations for metals in soil. The constituent concentrations were used in a screening level residential risk assessment (Chapter 4.0) to determine if there was an acceptable risk to human health. If the risk assessment determined that human health risk would be acceptable for residential use then no action was required. On the other hand if human health risk was acceptable for nonresidential use only, a VEMUR would be filed and no other action would be taken. If the risk criteria for both residential and nonresidential use were exceeded then a remedial action would have been necessary. In the case of OU-5 all the above criteria were met so no further action was necessary at any site. See Section 4.0 for the results of the risk assessment. Descriptions of the nine OU-5 sites and their locations are summarized in Table 2-3 and Figures 2-2 and 2-3.

A summary of the history leading to the site selection; investigation; removal action; and post removal sampling is included in the following paragraphs. Initially, the areas that constitute these sites were identified as a result of photogrammetric interpretation of historic aerial photographs. The areas were identified in the facilities assessment report issued in 1993 as areas requiring further investigation. The initial assessment and records search of the areas identified was conducted under the E/A Phase I. The E/A Phase II confirmed the concentrations of contaminants in the areas and whether these concentrations posed a risk to human health and the environment. This evaluation was preparatory to consideration in the CERCLA process. Based on the results of the Phase II E/A, certain areas were designated to be considered for further investigation under OU-4 because the nature and concentration of contaminants appeared to eliminate a simple removal action or no action. Immediate removal action was considered prudent at other sites as specified in the OU-5 action memorandum. The removal actions specified in the action memorandum were taken at six sites. No action was taken at the

Table 2-3

Remedial Investigation Sites
Operable Unit 5
Williams Air Force Base, Arizona

Site Description	Site Number	E/A Report Area	Building
Airfield Underground Storage Tanks	ST-25	2	N/A[a]
Paint Shop Leach Field	WP-27	18	N/A
Sewage Sludge Trenches	DP-28	20	N/A
Prime Beef Yard	SS-29	26	N/A
Golf Course Maintenance Area	SS-31	30	N/A
Building 1070	SS-32	N/A	1070
Munitions Incinerator	SS-34	6	1119
Concrete Hardfill Drum Removal Area	LF-26	3	N/A
Sewage Sludge Stockpile Area	N/A	28	N//A

[a]N/A - Not applicable.

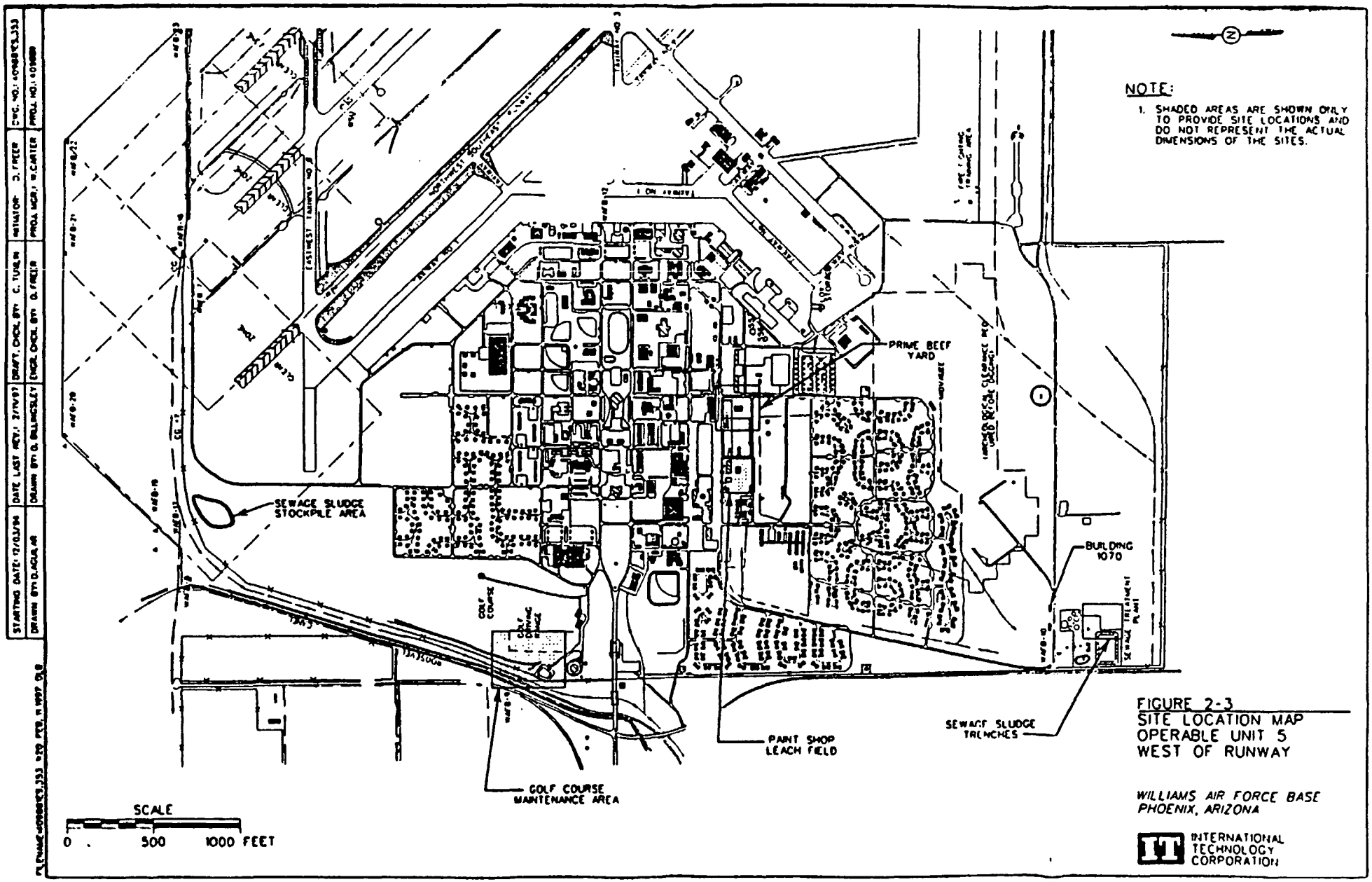

FIGURE 2-3
SITE LOCATION MAP
OPERABLE UNIT 5
WEST OF RUNWAY

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

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remaining three sites because either no action was required or action was taken under another OU.

Each of these nine sites has been investigated, removal action taken where appropriate, and postremoval samples taken. Soil removal, sampling, and analyses occurred during the July 1995 field activities. These removal actions were performed prior to promulgation of the Arizona Amended Soil Remediation Rules (April 1996). The nature, extent, and volume of contaminants are defined under investigations and removal actions, providing justification why no further action is required based on analytical sample results. Table 2-2 provides the Base-specific and regional ranges for constituents found at Williams AFB. Table 2-4 provides a summary of the detected compounds at the OU-5 RI sites. Removal action on the sites accounted for a total of nine roll-off bins containing the contaminated soil and concrete, and two drums. The roll-off bins were disposed off site by Allwaste Transportation and Remediation, Phoenix, Arizona. Chapter 4.0 provides human health risk assessment results to substantiate the no-action alternatives for those sites where analytical results were of themselves inadequate to draw this conclusion.

2.2.2.1 Airfield USTs (ST-25)

Site Description and History. The Airfield USTs area is located between the Runway 12R-30L and Runway 12C-30C, adjacent to Taxiway No. 6 (Figure 2-2). The USTs were believed to be located approximately 85 feet south of Taxiway No. 6. The area consists of an asphalt turnout from the taxiway, a concrete pad area, and suspect manway and vent or fill hole to the USTs (Figure 2-4). There are no buildings near the area.

Several reports indicate that USTs may have been located in the area of the airfield. Reportedly, at one time the Base had a rapid refueling operation for the airplanes. This would require fuel tanks to be located near the taxiways. IRP personnel inspected the airfield on April 10, 1992. Several pipes had been damaged by lawn mowers along the runways; however, only one pipe appeared to be a possible fill pipe for a UST or a sump. This pipe is located approximately 120 feet south of Taxiway No. 6. The suspected manway is located north of the concrete pad, and the vent is south of the pad.

Investigations. During the E/A investigation (IT, 1994c), a geophysical survey of the Airfield USTs area was performed. Total field magnetic and electromagnetic (EM) conductivity data

Table 2-4

Summary of Detected Compounds
OU-5 Remedial Investigation
Williams Air Force Base, Arizona

Location	Sample Number	Sample Date	Matrix	Test Group	Begin Depth ft	End Depth ft	Parameter	Result	Concentration	Qualifier	Detection Limit	Unit	Soil HBGL	Soil Resid PRG	Water HBGL µg/L	Water Resid PPG µg/L
							AIRFIELD USTs, ST-25									
ST-25	D2001	7/24/95	SOIL	VOC	3.75	4.25	METHYLENE CHLORIDE	2	2	J	11	µg/kg	180,000	11,000		
ST-25	D2002 (dup)	7/24/95	SOIL	VOC	3.75	4.25	METHYLENE CHLORIDE	3	3	J	11	µg/kg	180,000	11,000		
							PAINT SHOP LEACH FIELD, WP-27									
WP-27	D2003	7/21/95	SOIL	METAL	3	3.5	ARSENIC	7.70	7.7		0.72	mg/kg	0 91	0 32		
WP-27	D2003	7/21/95	SOIL	METAL	3	3.5	BERYLLIUM	0.49	0.49	J	0.24	mg/kg	0 32	0.14		
WP-27	D2003	7/21/95	SOIL	METAL	3	3.5	CADMIUM	1.80	1.8	J	1.2	mg/kg	58	38		
WP-27	D2003	7/21/95	SOIL	METAL	3	3.5	CHROMIUM	25.20	25.2		1.9	mg/kg	580	210		
WP-27	D2003	7/21/95	SOIL	METAL	3	3.5	COPPER	61.10	61.1		1.4	mg/kg	4,300	2,800		
WP-27	D2003	7/21/95	SOIL	METAL	3	3.5	LEAD	18.30	18.3		0.48	mg/kg	400	400		
WP-27	D2003	7/21/95	SOIL	METAL	3	3.5	NICKEL	29.50	29.5		4.5	mg/kg	2,300	1,500		
WP-27	D2003	7/21/95	SOIL	METAL	3	3.5	THALLIUM	1.00	1	J	0.72	mg/kg	8 2	NIA		
WP-27	D2003	7/21/95	SOIL	METAL	3	3.5	ZINC	149.00	149		0.95	mg/kg	35,000	23,000		
WP-27	D2004 (dup)	7/21/95	SOIL	METAL	4 5	5	ARSENIC	5.90	5.9		0.7	mg/kg	0 91	0 32		
WP-27	D2004 (dup)	7/21/95	SOIL	METAL	4 5	5	CHROMIUM	23 90	23.9		1.9	mg/kg	580	210		
WP-27	D2004 (dup)	7/21/95	SOIL	METAL	4 5	5	COPPER	32 50	32.5		1.4	mg/kg	4,300	2,800		
WP-27	D2004 (dup)	7/21/95	SOIL	METAL	4 5	5	LEAD	18 20	18 2		0 47	mg/kg	400	400		
WP-27	D2004 (dup)	7/21/95	SOIL	METAL	4 5	5	NICKEL	18.00	18		4.4	mg/kg	2,300	1,500		
WP-27	D2004 (dup)	7/21/95	SOIL	METAL	4 5	5	ZINC	86 50	86 5		0.93	mg/kg	35,000	23,000		
WP-27	D2005	7/21/95	SOIL	METAL	5	5 5	ARSENIC	9 60	9 6		0 7	mg/kg	0 91	0 32		
WP-27	D2005	7/21/95	SOIL	METAL	5	5 5	BERYLLIUM	0.43	0 43	J	0 23	mg/kg	0 32	0 14		
WP-27	D2005	7/21/95	SOIL	METAL	5	5.5	CHROMIUM	24 60	24.6		1 9	mg/kg	580	210		
WP-27	D2005	7/21/95	SOIL	METAL	5	5 5	COPPER	48 10	48.1		1 4	mg/kg	4,300	2,800		
WP-27	D2005	7/21/95	SOIL	METAL	5	5.5	LEAD	18.50	18.5		0 47	mg/kg	400	400		
WP-27	D2005	7/21/95	SOIL	METAL	5	5.5	NICKEL	21.60	21 6	J	4 4	mg/kg	2,300	1,500		
WP-27	D2005	7/21/95	SOIL	METAL	5	5 5	SELENIUM	0 86	0.86	J	0.7	mg/kg	580	380		
WP-27	D2005	7/21/95	SOIL	METAL	5	5.5	ZINC	122 00	122		0 94	mg/kg	35,000	23,000		
							PRIME BEEF YARD, SS-29									
SS-29	D2006	7/26/95	SOIL	METAL	3	3 5	ARSENIC	5 20	5 2	J	0 68	mg/kg	0 91	0 32		
SS-29	D2006	7/26/95	SOIL	METAL	3	3 5	BERYLLIUM	0 78	0.78	J	0 23	mg/kg	0 32	0 14		
SS-29	D2006	7/26/95	SOIL	METAL	3	3 5	CHROMIUM	29 60	29 6		1 8	mg/kg	580	210		
SS-29	D2006	7/26/95	SOIL	METAL	3	3 5	COPPER	155 00	155		1 4	mg/kg	4 300	2,800		
SS-29	D2006	7/26/95	SOIL	METAL	3	3 5	LEAD	21 40	21 4		0 46	mg/kg	400	400		
SS-29	D2006	7/26/95	SOIL	METAL	3	3 5	NICKEL	29 10	29 1		4 3	mg/kg	2 300	1,500		
SS-29	D2006	7/26/95	SOIL	METAL	3	3 5	SELENIUM	1 70	1 7	J	0 68	mg/kg	580	380		
SS-29	D2006	7/26/95	SOIL	METAL	3	3 5	THALLIUM	1 10	1 1	J	0 68	mg/kg	8 2	NIA		
SS-29	D2006	7/26/95	SOIL	METAL	3	3 5	ZINC	232 00	232		0 91	mg/kg	35,000	23,000		
SS-29	D2006	7/26/95	SOIL	VOC	3	3 5	METHYLENE CHLORIDE	4	4	J	11	µg/kg	180 000	11,000		
SS-29	D2008	7/26/95	SOIL	METAL	3	3 5	ARSENIC	6 30	6 3	J	0 66	mg/kg	0 91	0 32		

Table 2-4

Summary of Detected Compounds
OU-5 Remedial Investigation
Williams Air Force Base, Arizona

Location	Sample Number	Sample Date	Matrix	Test Group	Begin Depth ft	End Depth ft	Parameter	Result	Concentration	Qualifier	Detection Limit	Unit	Soil HBGL	Soil Resid PRG	Water HBGL µg/L	Water Resid PPG µg/L
SS-29	D2008	7/26/95	SOIL	METAL	3	3.5	BERYLLIUM	0.58	0.58	J	0.22	mg/kg	0.32	0.14		
SS-29	D2008	7/26/95	SOIL	METAL	3	3.5	CHROMIUM	35.20	35.2		1.8	mg/kg	580	210		
SS-29	D2008	7/26/95	SOIL	METAL	3	3.5	COPPER	79.50	79.5		1.3	mg/kg	4,300	2,800		
SS-29	D2008	7/26/95	SOIL	METAL	3	3.5	LEAD	22.60	22.6		0.44	mg/kg	400	400		
SS-29	D2008	7/26/95	SOIL	METAL	3	3.5	NICKEL	30.10	30.1	J	4.2	mg/kg	2,300	1,500		
SS-29	D2008	7/26/95	SOIL	METAL	3	3.5	SELENIUM	0.90	0.9	J	0.66	mg/kg	580	380		
SS-29	D2008	7/26/95	SOIL	METAL	3	3.5	ZINC	164.00	164		0.88	mg/kg	35,000	23,000		
SS-29	D2009	7/26/95	SOIL	METAL	3	3.5	ARSENIC	5.20	5.2	J	0.69	mg/kg	0.91	0.32		
SS-29	D2009	7/26/95	SOIL	METAL	3	3.5	BERYLLIUM	0.58	0.58	J	0.23	mg/kg	0.32	0.14		
SS-29	D2009	7/26/95	SOIL	METAL	3	3.5	CHROMIUM	28.10	28.1		1.8	mg/kg	580	210		
SS-29	D2009	7/26/95	SOIL	METAL	3	3.5	COPPER	102.00	102		1.4	mg/kg	4,300	2,800		
SS-29	D2009	7/26/95	SOIL	METAL	3	3.5	LEAD	20.80	20.8		0.46	mg/kg	400	400		
SS-29	D2009	7/26/95	SOIL	METAL	3	3.5	NICKEL	24.40	24.4	J	4.4	mg/kg	2,300	1,500		
SS-29	D2009	7/26/95	SOIL	METAL	3	3.5	THALLIUM	0.92	0.92	J	0.69	mg/kg	8.2	NIA		
SS-29	D2009	7/26/95	SOIL	METAL	3	3.5	ZINC	200.00	200		0.92	mg/kg	35,000	23,000		
MUNITIONS INCINERATOR, FACILITY 1119, SS-34																
INCI	D2014	7/20/95	SOIL	METAL	3	3.5	ARSENIC	5.80	5.8		0.63	mg/kg	0.91	0.32		
INCI	D2014	7/20/95	SOIL	METAL	3	3.5	CHROMIUM	22.10	22.1		1.7	mg/kg	580	210		
INCI	D2014	7/20/95	SOIL	METAL	3	3.5	COPPER	28.50	28.5		1.3	mg/kg	4,300	2,800		
INCI	D2014	7/20/95	SOIL	METAL	3	3.5	LEAD	16.70	16.7		0.42	mg/kg	400	400		
INCI	D2014	7/20/95	SOIL	METAL	3	3.5	NICKEL	18.80	18.8		4	mg/kg	2,300	1,500		
INCI	D2014	7/20/95	SOIL	METAL	3	3.5	SELENIUM	1.50	1.5	J	0.63	mg/kg	580	380		
INCI	D2014	7/20/95	SOIL	METAL	3	3.5	THALLIUM	1.50	1.5	J	0.63	mg/kg	8.2	NIA		
INCI	D2014	7/20/95	SOIL	METAL	3	3.5	ZINC	84.80	84.8		0.84	mg/kg	35,000	23,000		
INCI	D2015	7/20/95	SOIL	METAL	3	3.5	ARSENIC	5.30	5.3		0.64	mg/kg	0.91	0.32		
INCI	D2015	7/20/95	SOIL	METAL	3	3.5	BERYLLIUM	0.65	0.65	J	0.21	mg/kg	0.32	0.14		
INCI	D2015	7/20/95	SOIL	METAL	3	3.5	CHROMIUM	23.90	23.9		1.7	mg/kg	580	210		
INCI	D2015	7/20/95	SOIL	METAL	3	3.5	COPPER	32.40	32.4		1.3	mg/kg	4,300	2,800		
INCI	D2015	7/20/95	SOIL	METAL	3	3.5	LEAD	16.60	16.6		0.43	mg/kg	400	400		
INCI	D2015	7/20/95	SOIL	METAL	3	3.5	NICKEL	21.50	21.5	J	4	mg/kg	2,300	1,500		
INCI	D2015	7/20/95	SOIL	METAL	3	3.5	SELENIUM	0.86	0.86	J	0.64	mg/kg	580	380		
INCI	D2015	7/20/95	SOIL	METAL	3	3.5	THALLIUM	0.99	0.99	J	0.64	mg/kg	8.2	NIA		
INCI	D2015	7/20/95	SOIL	METAL	3	3.5	ZINC	78.80	78.8		0.85	mg/kg	35,000	23,000		
CONCRETE HARDFILL AREA, LF-26																
LF-26	D2016	7/20/95	SOIL	PESTPCB	3	3.5	4,4'-DDE	1.1	1.1	J	3.5	µg/kg	4,000	1,300		
LF-26	D2016	7/20/95	SOIL	PESTPCB	3	3.5	Dieldrin	12	12		3.5	µg/kg	90	28		

Table 2-4

Summary of Detected Compounds
OU-5 Remedial Investigation
Williams Air Force Base, Arizona

Location	Sample Number	Sample Date	Matrix	Test Group	Begin Depth ft	End Depth ft	Parameter	Result	Concentration	Qualifier	Detection Limit	Unit	Soil HBGL	Soil Resid PRG	Water HBGL µg/L	Water Resid PPG µg/L
AIR FIELD USTS, ST-25																
Method Blank	Q3001	7/24/95	WATER	VOC	0	0	ACETONE	6	6	JB	10	µg/L			700	610
Eqp. Blank	Q3002	7/24/95	WATER	VOC	0	0	ACETONE	6	6	JB	10	µg/L			700	610
Trip Blank	Q3003	7/24/95	WATER	VOC	0	0	ACETONE	2	2	JB	10	µg/L			700	610
PAINT SHOP LEACH FIELD, WP-27																
Method Blank	Q3004	7/21/95	WATER	METAL	0	0	ZINC	9	9	B	4	µg/L			2100	11000
Eqp. Blank	Q3005	7/21/95	WATER	METAL	0	0	ZINC	80	80		4	µg/L			2100	11000
WASTE PROFILE SAMPLE																
Trip Blank	Q3009	7/28/95	WATER	VOC	0	0	METHYLENE CHLORIDE	2.1	2.1		1	µg/L			4.7	4.3

NOTES: Golf Course Maintenance Area samples D2010 and D2011 were nondetects; Building 1070 was not sampled (see Section 3.8).

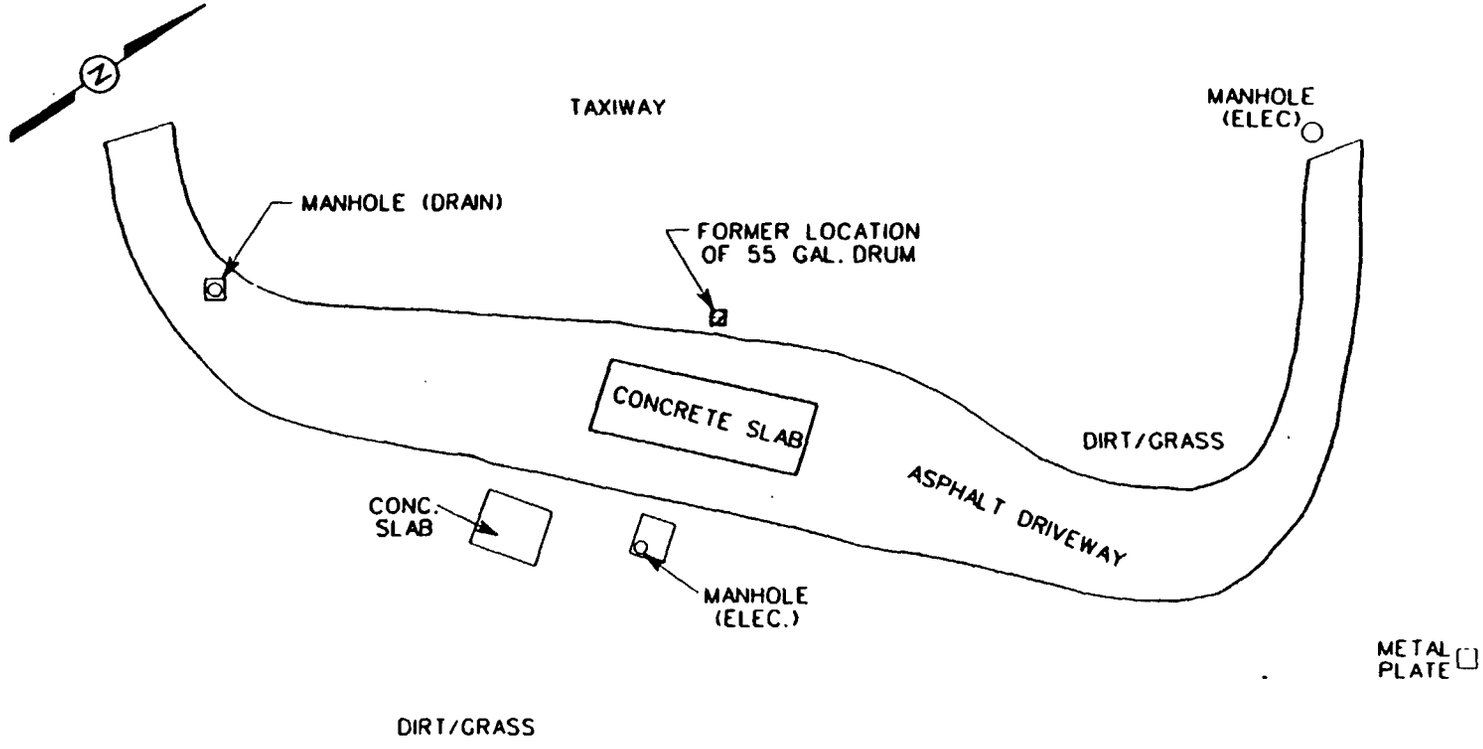
J = Value is between detection limit and reporting limit. Value is estimated.

B =

NIA = No information available.

STARTING DATE: 01/06/95	DATE LAST REV : 2/11/97	DRAFT. CHCK. BY: C TUMLIN	INITIATOR: D FREER	DWG NO : 40988IES 354
DRAWN BY D AGUILAR	DRAWN BY. D BILLINGSLEY	ENGR CHCK BY D FREER	PROJ MGR W CARTER	PROJ NO . 409881

FILENAME 40988IES-354 1:37 FEB 11, 1997 DLB



LEGEND:

DRUM EXCAVATION AREA
(3 FEET X 3 FEET). EXCAVATED TO 45" BGS.
CONFIRMATION SAMPLES D2001 & D2002
COLLECTED FROM BOTTOM OF EXCAVATION.

SCALE

0 80 160 FEET

FIGURE 2-4
SOIL REMOVAL AND SAMPLE LOCATIONS AIRFIELD USTs (ST-25)

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

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were collected at the area using an EG&G 822-L cesium vapor magnetometer and a Geonics EM-31 DL Terrain Conductivity Meter.

Analysis of the geophysical survey results indicated that no USTs were present at the Airfield USTs area. The suspected vent or fill hole was identified as a light pole that had been cut off near ground level. However, one 55-gallon drum was confirmed to have been buried upright at the location of the suspected manway, and above an underlying storm drain line. The soil inside this drum was removed and the presence of a bottom to the drum was confirmed; however, no environmental samples were collected. There was no visible indication of contamination in the soil, and the soil was returned to the drum.

The Airfield USTs location was not recommended for further investigation in the E/A. However, the drum and soil removal action was recommended to verify the removal and/or absence of contaminants.

Removal Action. The removal of the drum and contaminated soil was completed in accordance with an approved work plan. An area approximately 3 by 3 feet was excavated to a depth of 45 inches. The drum and soil was removed.

Two samples were collected from the bottom of the excavation at 45 inches below ground surface (bgs) and analyzed for total petroleum hydrocarbon (TPH) as jet petroleum grade 4 (JP-4), volatile organic compounds (VOC), and semivolatile organic compounds (SVOC). The analyses were performed to verify that no contaminants remained that would be hazardous to human health or the environment. The excavation was backfilled with clean soil.

Postremoval Analytical Samples and Results. The only constituent detected at ST-25 was methylene chloride, which was in one of the two samples taken. The maximum estimated concentration was 3 micrograms per kilogram (µg/kg). Because methylene chloride is a laboratory reagent, this can be explained as a laboratory contaminant. Even if it were not attributed to the laboratory, the concentration is below both the Arizona HBGL and Region IX residential PRG levels. The removal action was adequate. This site, therefore, requires no further action because it poses no risk to human health or the environment.

2.2.2.2 Paint Shop Leach Field (WP-27)

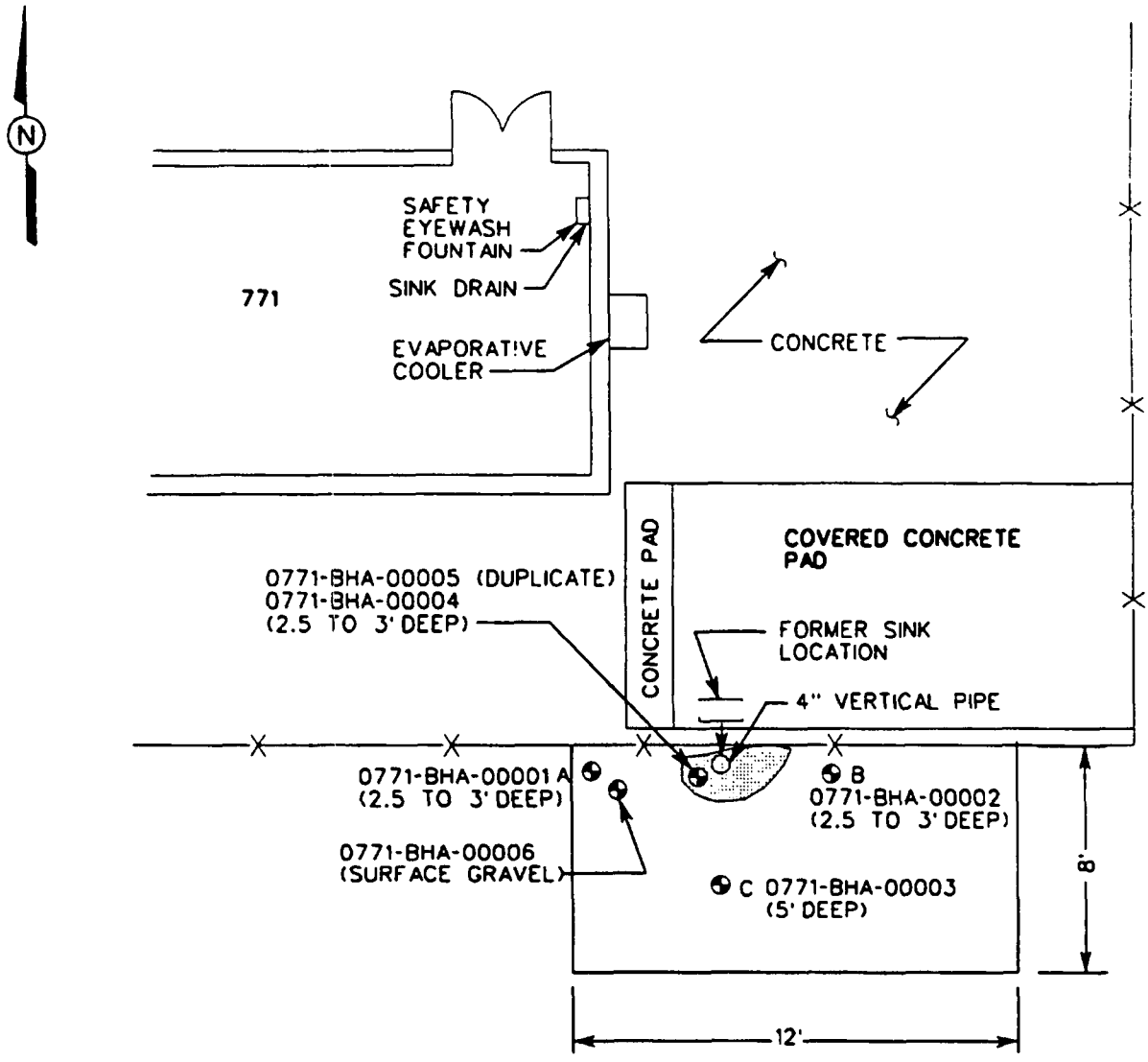
Site Description and History. The Paint Shop Leach Field area was located in the central part of the Base, south of A Street, north of Adams Street, west of 5th Street, and east of 11th Street (Figure 2-3). The paint shop (Building 771) facility was constructed in 1984 and was used for mixing and storing paints. The leach field (8 by 12 feet) shown beside Building 771 (Figure 2-5) was reportedly used to dispose of excess and waste paint. Latex paint was reportedly the primary liquid disposed of in the leach field. Base personnel reportedly would carry paint brushes and rollers to be cleaned to the sink location to be washed. The sink contents drained to the leach field through a polyvinyl chloride (PVC) pipe. The leach field was comprised of a 2- to 3-foot-thick rock bed on top of soil.

Investigations. During the investigation as part of the E/A, the rock leach bed that was overlying the area was removed, and environmental and quality assurance/quality control (QA/QC) samples of the underlying soil were collected to determine the degree of contamination (IT, 1994c). The surface gravel was also sampled. The excavated materials were properly disposed. The excavated area was then backfilled with clean soil and compacted.

Four soil samples plus one duplicate were collected and analyzed for VOCs, SVOCs, TPH, and priority pollutant metals (PPM).

Di-n-butyl phthalate was detected at a level below both the Arizona HBGL and EPA Region IX residential PRG. The level of TPH (135 milligrams per kilogram [mg/kg]) exceeded the Arizona UST regulatory guideline of 100 mg/kg at that time. Current ADEQ UST regulatory level for TPH is 7,000 mg/kg.

Analytical results for PPMs from the Paint Shop Leach Field area were also compared with the Base-specific background ranges. Arsenic exceeded its Base-specific background range at locations 01 and 06 (Figure 2-5), and was less than the Base-specific background range at locations 02, 03, 04, and 05. Beryllium exceeded the Base-specific background range at all locations except 06, where it was not detected. Chromium and nickel were detected at concentrations exceeding their respective Base-specific background ranges at locations 01, 02, 04, and 05, but were within or less than their respective Base-specific background ranges at locations 03 and 06. Lead exceeded the Base-specific background range at location 01, but was within this range at locations 02 through 06. Mercury was detected at location 05 only, where it exceeded its



NOT TO SCALE

NOTES:

1. SAMPLE LOCATIONS WERE APPROXIMATELY 4 FEET FROM THE 4" VERTICAL PIPE. FINAL LOCATIONS TO BE FIELD DETERMINED AND DOCUMENTED.
2. SAMPLE DEPTHS SHOWN ABOVE.
3. SAMPLE NUMBERS 0771-BHA-0000X.

LEGEND:

- FENCE
- SOIL SAMPLE LOCATIONS - 12/10/92
- FORMER SINK LOCATION. CONNECTED TO LEACH FIELD BY A PVC PIPE
- DRIED LATEX PAINT

FIGURE 2-5
SITE LOCATION MAP
FORMER PAINT SHOP, BLDG. 771
LEACH FIELD, (WP-27)

WILLIAMS AIR FORCE BASE
PHOENIX ARIZONA

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 12/12/94 | DATE LAST REV.: 2/11/97 | DRAFT CHCK. BY: C. TUNLIN | INITIATOR D FREER | DWG NO 409881ES 355
DRAWN BY: D AGUILAR | DRAWN BY: D. BILLINGSLEY | ENGR CHCK BY: D FREER | PROJ MGR: W CARTER | PROJ NO 409881

FILENAME 409881ES 355 1:45 FEB 11, 1997 DLB

Base-specific background range. At all six locations, zinc exceeded its Base-specific background range.

Arsenic exceeded its EPA Region IX residential PRG, as well as the Arizona HBGL, at all locations. Beryllium was consistently detected at levels exceeding both the EPA Region IX residential PRG and the Arizona HBGL. All other PPMs detected were at levels less than both the EPA Region IX residential PRG and the Arizona HBGL.

It was recommended that the leach field be excavated and samples collected from the excavated area to confirm removal of metals and organic compounds of concern.

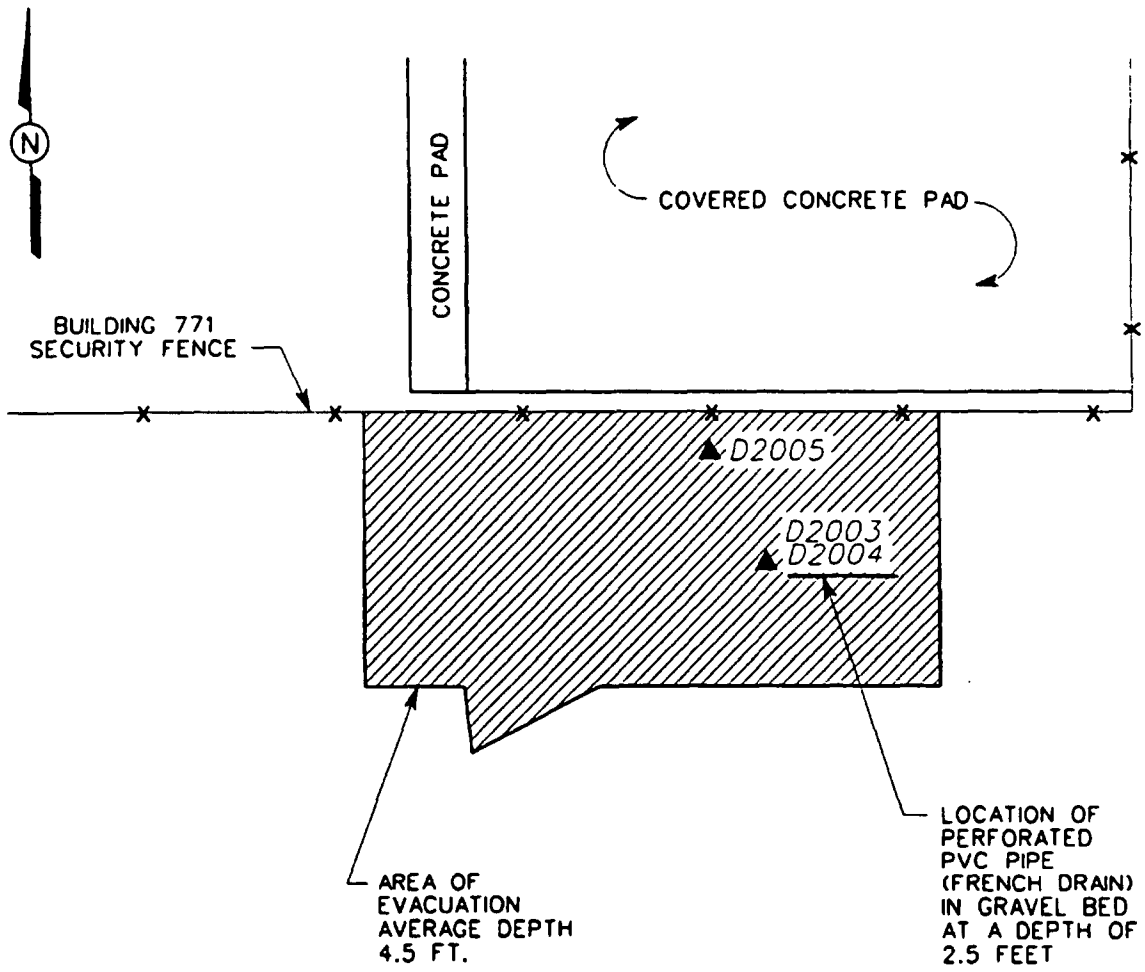
Removal Actions. The removal of the contaminated soil was completed in accordance with an approved work plan. An area 14 by 30 feet was excavated to a depth of approximately 4.5 feet. The area excavated included the removal of a remaining section of drain pipe, gravel, and plastic sheeting not removed during the previous excavation activities. Quantities of dried latex paint were observed in the vicinity of the drain pipe.

Three soil samples were collected. The samples were analyzed for SVOCs, TPH, and PPM to verify that no contamination remained that would be hazardous to human health or the environment. Subsequently, clean fill was placed in the excavation and compacted.

Postremoval Analytical Samples and Results. Nine metals were detected in each of the three samples at this site (Figure 2-6). Of these metals, however, only arsenic and beryllium exceeded the Arizona residential HBGLs and Region IX residential PRG levels. The maximum arsenic concentration was 9.6 mg/kg at a depth of 5 feet in sample D2005. This declined to 7.70 mg/kg at 3.5 feet in sample D2003. Beryllium was at 0.43 mg/kg in sample D2005 and 0.49 mg/kg in sample D2003. Each was also greater than the background level for these metals. A screening level risk assessment (SLRA) was performed to estimate health impacts of these results to determine if further action is required at this site. Chapter 4.0 describes the risk assessment, which concludes that this site poses no unacceptable risks to human health or the environment.

2.2.2.3 Sewage Sludge Trenches (DP-28)

Site Description and History. The Sewage Sludge Trenches area is located east and south of the Base wastewater treatment plant (WWTP) on the southwest corner of the Base, just south of



STARTING DATE: 01/06/95	DATE LAST REV.: 2/11/97	DRAFT CHCK. BY: D AGUILAR	INITIATOR: D FREER
DRAWN BY: D AGUILAR	DRAWN BY: D BILLINGSLEY	ENGR CHCK BY: D FREER	PROJ MGR: W CARTER
		DWG NO: 409881ES 356	PROJ NO: 409881

FILENAME 409881ES.356 2:11 FEB 11, 1997 DLB

LEGEND:

▲ SOIL SAMPLE LOCATIONS. D2005 COLLECTED AT 60" BGS; D2003 AND D2004 COLLECTED AT 55" BGS

—x— FENCE

AREA OF EXCAVATION

SCALE

0 10 20 FEET

FIGURE 2-6

SOIL REMOVAL AND SAMPLE LOCATIONS FORMER PAINT SHOP BLDG. 771 LEACH FIELD, (WP-27)

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

INTERNATIONAL TECHNOLOGY CORPORATION

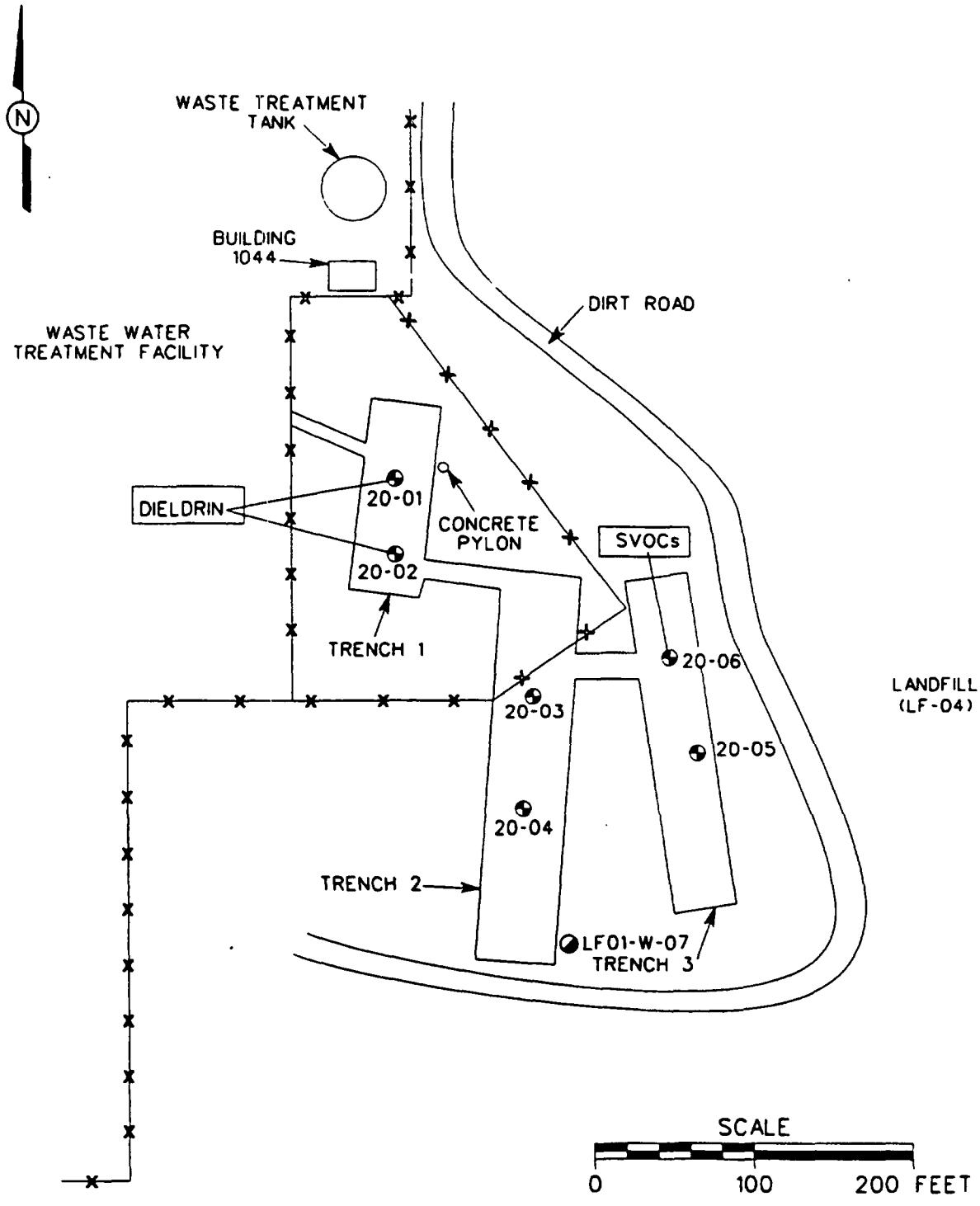
Perimeter Road (Figure 2-3). Information obtained from visual inspection and aerial photographs indicate that the trench area consists of three trenches ranging in length from approximately 140 to 350 feet, and 40 to 50 feet wide (Figure 2-7). According to the Phase I records search, the WWTP digesters were out of service from 1973 to 1979, and undigested sludge was directed to the trenches adjacent to the plant. In 1976, the Base removed sludge collected since 1973 from the trenches and disposed of it in the Landfill. In 1979, when the digesters were reactivated, the undigested sludge collected from 1976 to 1979 was also buried in the trenches.

Investigations. On September 20, 1993, soil samples were collected from a depth of 10 to 20 inches at each of the six sample locations indicated in Figure 2-5. Soil samples were analyzed for SVOCs, pesticides/polychlorinated biphenyls (PCB), and PPMs.

Analytical results for PPMs from the Sewage Sludge Trenches area were compared with the Base-specific background ranges. Arsenic was detected at locations 20-01, 20-02, and 20-05 (Figure 2-7) at levels exceeding its EPA Region IX residential PRG value; however, only one detection exceeded the Base-specific background range. Beryllium was detected at all six locations exceeding its EPA Region IX residential PRG; however, these detections occurred at levels less than Base-specific background. All other PPMs detected in the Sewage Sludge Trench samples exceeded Base-specific background, but were less than their EPA Region IX residential PRGs or HBGLs.

Dieldrin was detected exceeding both the HBGL and the EPA Region IX residential PRG at locations 20-01, 20-02, and 20-04. At locations 20-03, 20-05, and 20-06, dieldrin was detected exceeding the EPA Region IX residential PRG but less than the HBGL. All other pesticides reported were at levels less than both the HBGL and EPA Region IX residential PRG guidance levels. Six PAH SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]-fluoranthene, benzo[g,h,i]perylene, and chrysene) were detected at 20-06. Benzo(a)pyrene was detected at concentrations greater than its Region IX residential PRG, but less than its HBGL. All other PAHs detected were less than the Region IX residential PRG and HBGL levels.

Removal Actions. Because the Sewage Sludge Trenches are contiguous to and west of the landfill and the contaminant (dieldrin) was common to both the Sewage Sludge Trenches and landfill, it was determined that both sites could be remediated using the same remedy (IT, 1995c). The capping remedy had been approved in OU-1 for the landfill and was close to implementation. The Sewage Sludge Trenches therefore were capped as part of the final remedy



LEGEND:

- FENCE
- SOIL SAMPLE LOCATIONS 9/20/93
- TRENCH
- MONITORING WELL

FIGURE 2-7
SITE LOCATION MAP SEWAGE SLUDGE TRENCHES (DP-28)

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 12/02/94 | DATE LAST REV: 2/11/97 | DRAFT. CHCK. BY: C TUMLIN | INITIATOR D FREER | DWG NO 409881ES 357
DRAWN BY D AGUILAR | DRAWN BY D BILLINGSLEY | ENGR CHCK BY: D FREER | PROJ MGR W CARTER | PROJ NO 409881

FILENAME 409881ES357 2.19 FEB 11, 1997 DLB

for the Landfill (LF-04) under OU-1. No further action is required under OU-5. The capping action is further discussed in the ESD.

2.2.2.4 Prime Beef Yard (SS-29)

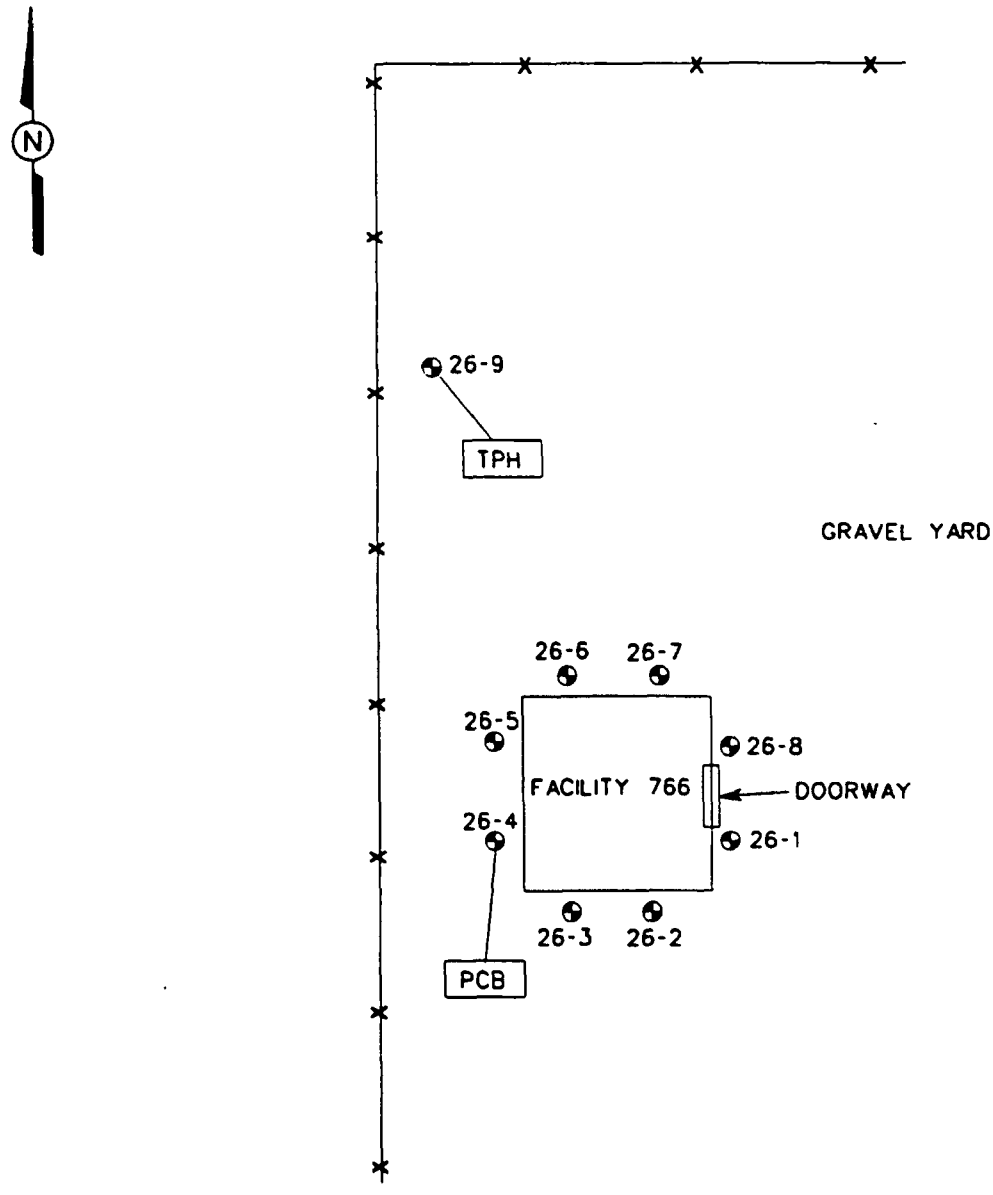
Site Description and History. The Prime Beef Yard is located in the central portion of the Base, east of 11th Street, west of 5th Street, north of Adams Street, and just south of A Street (Figure 2-3). This storage yard was used by the Base for storage of construction materials. Although listed as the storage facility in the Base's Resource Conservation and Recovery Act (RCRA) Part A Permit, it was never used for this purpose. Low levels of constituents were detected during the E/A investigation. Based on this fact, agreements were made by the EPA, ADEQ, and ADWR that the Prime Beef Yard would be investigated under OU-5, with removal actions as necessary prior to sampling to verify that there are no residual contaminants at this site that constitute a hazard to human health and the environment. The site will be formally closed, however, under a RCRA closure plan. RCRA is applicable to no other sites in OU-5.

A temporary building in the area built on a monolithic concrete pad was used for storage of PCB-contaminated transformers until they could be disposed of by the Base. No spills or releases were documented from the transformer storage building.

Because full characterization is required by ADEQ to close the area, the RCRA section of ADEQ agreed to consider the investigation completed under CERCLA and give final closure approval under RCRA. Further investigation of the temporary building for PCB contamination and one stained area in the northwest corner of the surrounding fenced yard for TPH contamination was accomplished during the E/A (IT, 1994c).

Investigations. Soil samples were collected at nine locations as indicated in Figure 2-8. Soil samples from locations 26-01 through 26-08 were analyzed for PCB/pesticides, and the soil sample from location 26-09 was analyzed for TPH.

All detections of dieldrin, dichlorodiphenyldichloroethene (DDE), dichlorodiphenyltrichloroethane (DDT), and beta-hexachlorocyclohexane (BHC) were at concentrations lower than their respective Arizona HBGL and EPA residential PRG guidelines. The PCB Aroclor-1260 was detected at sample locations 26-01 through 26-05 and 26-08 (Figure 2-6) at or greater than both the HBGL of 0.18 mg/kg and the residential PRG of 0.11 mg/kg. Concentrations of Aroclor-1260 at locations 26-06 and 26-07 were at levels between the HBGL and the residential PRG.



STARTING DATE: 12/02/94	DATE LAST REV.: 2/11/97	DRAFT. CHCK. BY: C. TUMLIN	INITIATOR: D FREER	DWG. NO 409881ES 358
DRAWN BY: D AGUILAR	DRAWN BY: D. BILLINGSLEY	ENGR CHCK BY: D FREER	PROJ MGR: W CARTER	PROJ NO 409881

FILENAME: 409881ES 358 2 27 FEB. 11, 1997 OLB

LEGEND:

- SOIL SAMPLE LOCATIONS 10/05/93
- FENCE

SCALE

0 10 20 FEET

FIGURE 2-8
SITE LOCATION MAP
FACILITY 766 PRIME BEEF
YARD (SS-29)

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PHOENIX, ARIZONA

INTERNATIONAL TECHNOLOGY CORPORATION

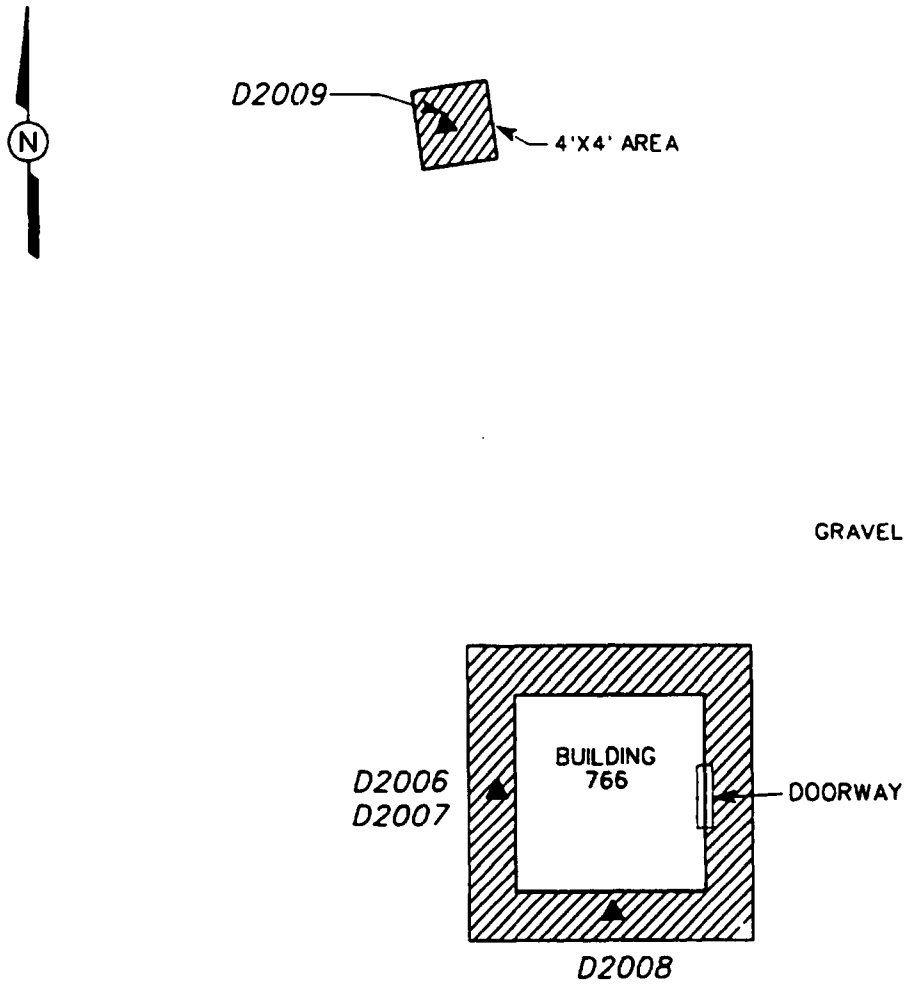
TPH as diesel was estimated at 46,000 mg/kg at sample location 26-09, greater than the Arizona UST regulatory guideline for TPH at that time (100 mg/kg). The current Arizona UST regulatory level for TPH is 7,000 mg/kg.

A removal action was recommended to excavate the soil northwest of Building 766 and the soils surrounding the concrete pad at Building 766 and sample the soil at both locations.

Removal Actions. The removal action included the excavation of the stained soil approximately 18 feet northwest of Building 766 and excavation of soils surrounding the concrete pad at Building 766. The contaminated soil was removed in accordance with an approved work plan. The first area to be excavated was northwest of the building; the area measured approximately 4 by 4 feet, and was excavated to a depth of approximately 3 feet. One confirmatory soil sample was collected from the bottom of the excavation at 3 feet bgs and analyzed for TPH, VOCs, SVOCs, and PPM to verify the absence of contamination. The second area excavated was a 30-inch-wide section of soil from all four sides of the concrete pad to a depth of 2 feet around Building 766. All excavated soil from the Prime Beef Yard removal action was placed in one roll-off bin. Three undisturbed, confirmatory soil samples were collected from the excavated area around Building 766 and analyzed for TPH, VOCs, SVOCs, PPM, and pesticides/PCBs to verify that no contamination remained that would be hazardous to human health or the environment. Also, a composite waste profile sample was collected from the excavated material in the roll-off bin. Subsequently, clean fill was placed in the excavations and compacted.

The site was to be considered for final closure under RCRA with the state of Arizona. The final RCRA closure report was issued May 15, 1996.

Postremoval Analytical Samples and Results. Nine metals were detected in the four samples (D2006, D2007, D2008, and D2009) at this site (Figure 2-9). Three of the samples were near Building 766 and the fourth was near the area of a suspected TPH spill. Of these metals, however, only arsenic and beryllium exceeded the Base background range for these metals and also exceeded the Arizona HBGL and Region IX residential PRG levels. The maximum arsenic concentration was 6.3 mg/kg at a depth of 3.5 feet in sample D2008, and 5.2 mg/kg in samples D2006 and D2009. Beryllium was detected at 0.78 mg/kg in sample D2006 and 0.58 mg/kg in samples D2008 and D2009. Methylene chloride was detected at an estimated concentration of 4 µg/kg in sample D2006. This was well below either the Arizona HBGL and Region IX residential PRG levels. An SLRA was performed to estimate health impacts of these results to determine if further action is required at this site. The actions under this closure eliminated any



STARTING DATE: 01/06/95	DATE LAST REV.: 2/11/97	DRAFT. CHCK. BY: D AGUILAR	INITIATOR: D. FREER
DRAWN BY: D AGUILAR	DRAWN BY: D BILLINGSLEY	ENGR CHCK BY: D FREER	PROJ MGR W CARTER
			PROJ NO 409881
			DWG NO: 409881ES 359

FILENAME 409881ES 359 15:41:45 Feb 11, 1997 DLB

LEGEND:

- ▲ SOIL SAMPLE LOCATIONS: D2009 COLLECTED AT 3' BGS; D2006-2008 COLLECTED AT 2' BGS
- —x— FENCE
- AREAS EXCAVATED TO 2.0 FEET

SCALE

0 10 20 FEET

FIGURE 2-9

SOIL REMOVAL AND SAMPLE LOCATIONS FACILITY 766 PRIME BEEF YARD (SS-29)

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

IT INTERNATIONAL TECHNOLOGY CORPORATION

unacceptable risks to human health and the environment. Chapter 4.0 describes the risk assessment.

2.2.2.5 Golf Course Maintenance Area (SS-31)

Site Description and History. The Golf Course Maintenance Area is located adjacent to the golf course driving range on the west side of the Base, north and west of E Street (Figure 2-3). The area is used to park, maintain, and refuel mowers, tractors, and other vehicles for the golf course.

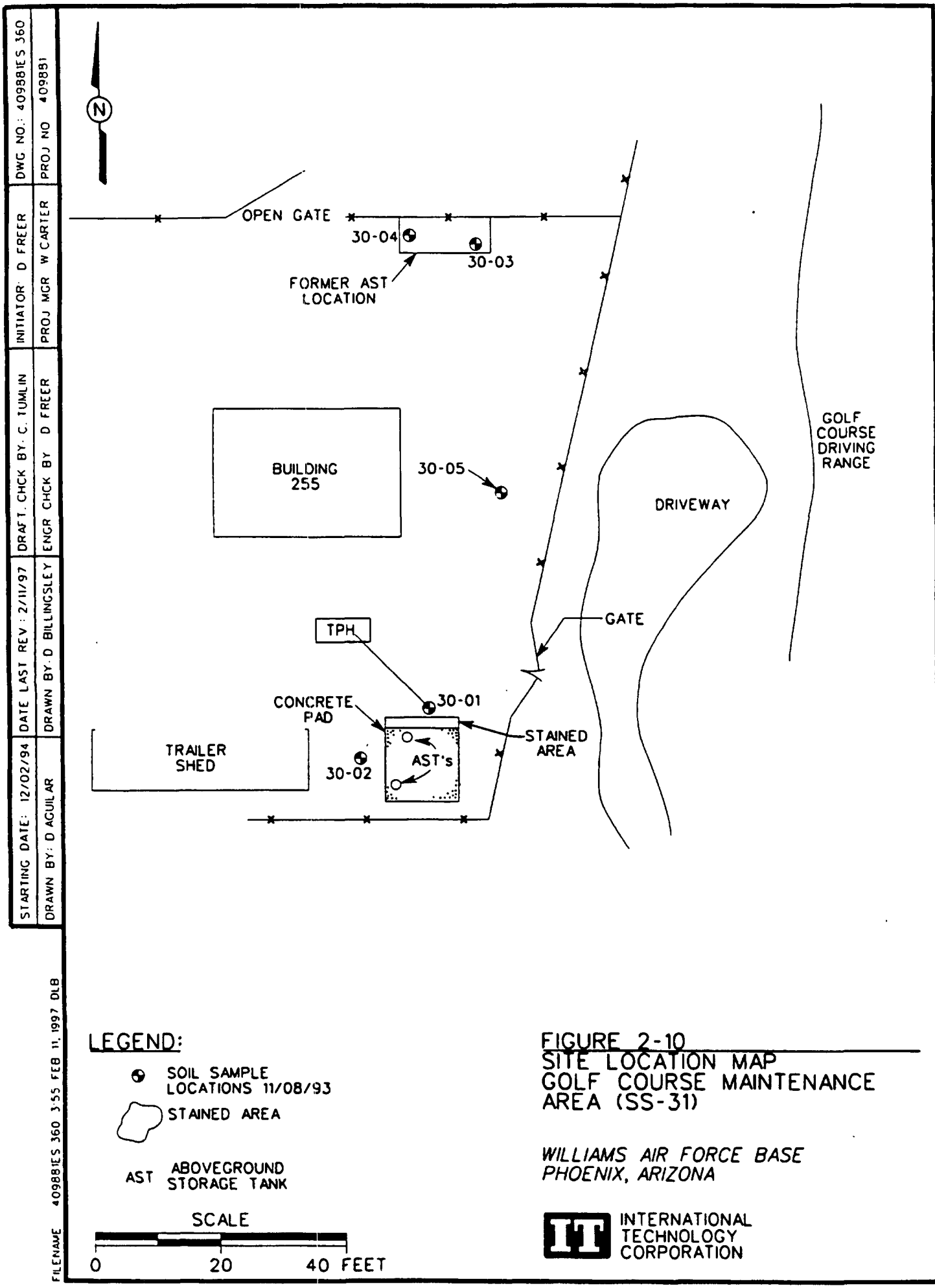
The area consists of two ASTs on a concrete pad in the southeast corner of the yard, an area of soil approximately 15 by 5 feet where the ASTs were formerly located to the north, and an area to the east of Building 255 near the entrance gate. One AST contained diesel fuel and one contained unleaded gasoline. Base personnel have verified the former AST location, and observed the relocation of the ASTs from the stained soil area at the north end of the yard to the concrete pad at the south end of the yard.

An additional area of stained soil exists adjacent to the concrete pad area near the location of one of the ASTs. No evidence of spillage exists at the former AST location; however, the surface where ASTs were located is disturbed and ADEQ personnel indicated evidence of a stained area slightly south of the disturbed soil. A potentially stained area (dark soil) to the east of Building 255 near the entrance gate was sampled at a location indicated by ADEQ personnel.

Investigations. Samples were collected from five locations indicated in Figure 2-10. Samples collected from the current and former AST locations were analyzed for TPH. Samples collected from the potentially stained soils east of Building 255 were analyzed for SVOCs.

TPH was detected at 260 mg/kg at location 30-01 (Figure 2-7), greater than the Arizona UST regulatory guideline of 100 mg/kg at that time. Current Arizona UST regulatory level for TPH is 7,000 mg/kg. All other detected analyses (TPH and SVOCs) in samples collected at the Golf Course Maintenance Area were at concentrations less than Arizona HBGL and EPA Region IX residential PRG guidelines.

A removal action was recommended to excavate soil located adjacent to the concrete pad on the north side of the current AST locations and collect confirmatory soil samples.



LEGEND:

- SOIL SAMPLE LOCATIONS 11/08/93
- STAINED AREA
- AST ABOVEGROUND STORAGE TANK

SCALE

0 20 40 FEET

FIGURE 2-10
SITE LOCATION MAP
GOLF COURSE MAINTENANCE AREA (SS-31)

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PHOENIX, ARIZONA

INTERNATIONAL TECHNOLOGY CORPORATION

Removal Actions. The removal action included the excavation of contaminated soil located adjacent to the concrete pad (Figure 2-7) on the north side of the current AST locations (the stained area) and the collection of two confirmatory soil samples from the bottom of the excavated area. Contaminated soil was removed in accordance with an approved work plan. An area approximately 2.5 by 12 feet was excavated to a depth of approximately 3 feet.

Two undisturbed, confirmatory soil samples were collected at 3.5 feet bgs and analyzed for TPH and SVOCs to verify that no contamination remained that would be hazardous to human health or the environment. Subsequently, clean fill was placed in the excavation and compacted.

Postremoval Analytical Samples and Results. Two samples were taken at this area, as shown in Figure 2-11, but no contaminants were detected. Therefore, no further action is required.

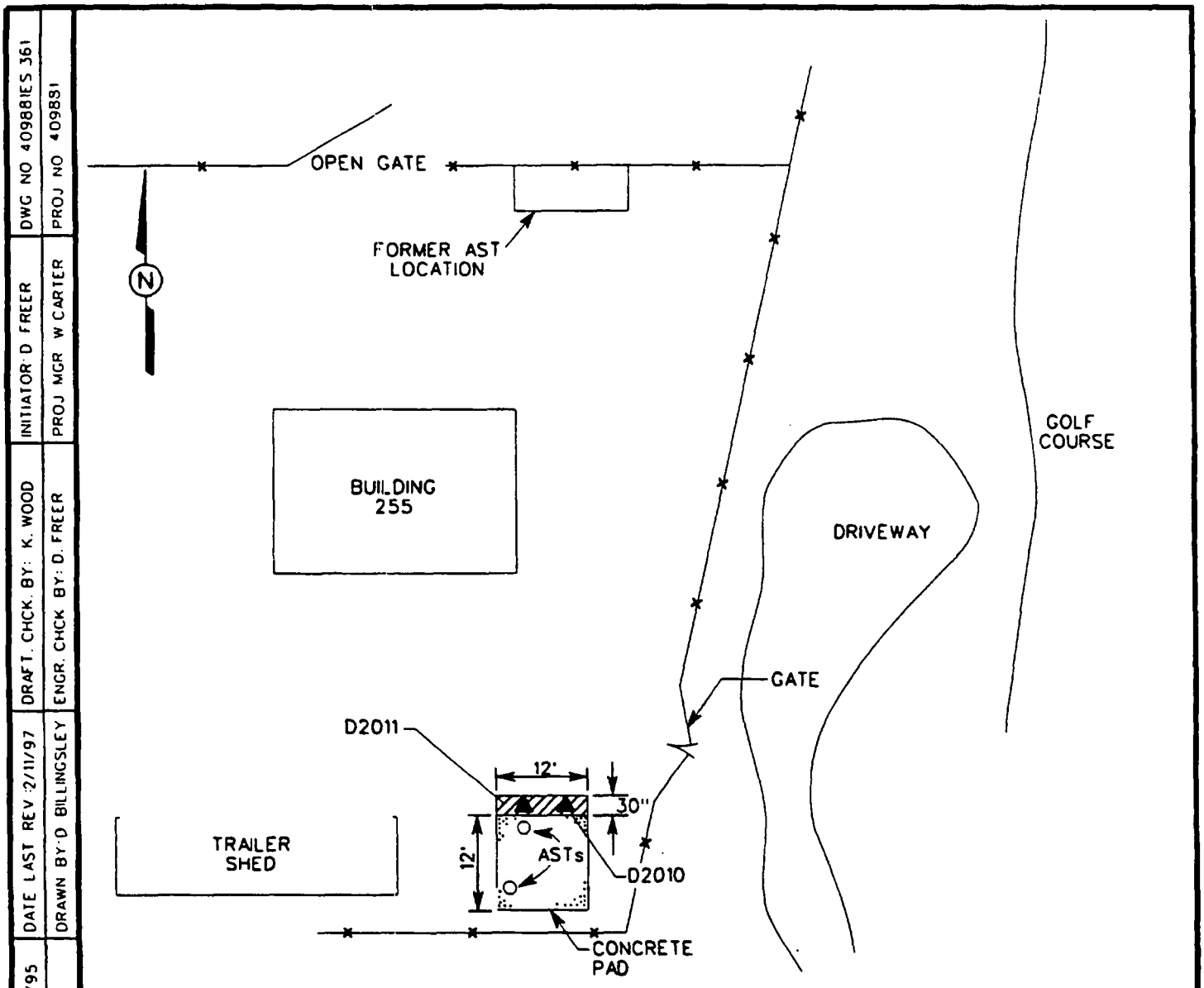
2.2.2.6 Building 1070 (SS-32)

Site Description and History. This facility, consisting of offices as well as a storage yard behind the building, was constructed in 1987 to house the contractors providing refuse service on Base. The yard is used for storage of equipment and vehicles.

Investigations. Some staining was noted in a slightly depressed area in the gravel parking area north of Building 1070. No previous sampling has been performed at this site (Figure 2-12). A removal action was recommended to excavate the gravel and underlying soil where staining was noted.

Removal Actions. The removal action in the OU-5 work plan required removing the gravel and underlying soil in an area near Building 1070 (Figure 2-12). Soil staining was previously observed in the gravel parking area. Collection of two samples was planned for this site. There were no previously reported activities involving the use, handling, or disposal at or near this facility. The stained area was presumed to be oil drippings from a vehicle or other equipment.

However, during the site inspection prior to excavation, no staining was observed. The stain was probably attributable to a rainfall event collecting at a low spot in the area prior to the site observation. Once the rain soaked into the ground or evaporated, there was no stain. On July 19, 1995, during a Technical Working Group (TWG) meeting, the TWG members inspected the site



STARTING DATE: 9/28/95 | DATE LAST REV: 2/11/97 | DRAFT. CHCK. BY: K. WOOD | INITIATOR: D FREER | DWG NO 409881ES 361
DRAWN BY: K WOOD | DRAWN BY: D BILLINGSLEY | ENGR. CHCK BY: D. FREER | PROJ MGR W CARTER | PROJ NO 409881

FILENAME: 409881ES 361 15:04:33 Feb 11, 1997 DLB

LEGEND:

▲ SOIL SAMPLES D2010 & D2011 TAKEN AT 3.5' BGS

AREA EXCAVATED TO 3' BGS

AST ABOVEGROUND STORAGE TANK

SCALE:

0 20 40 FEET

FIGURE 2-11

SOIL REMOVAL AND SAMPLING LOCATIONS GOLF COURSE MAINTENANCE AREA (SS-31)

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PHOENIX, ARIZONA

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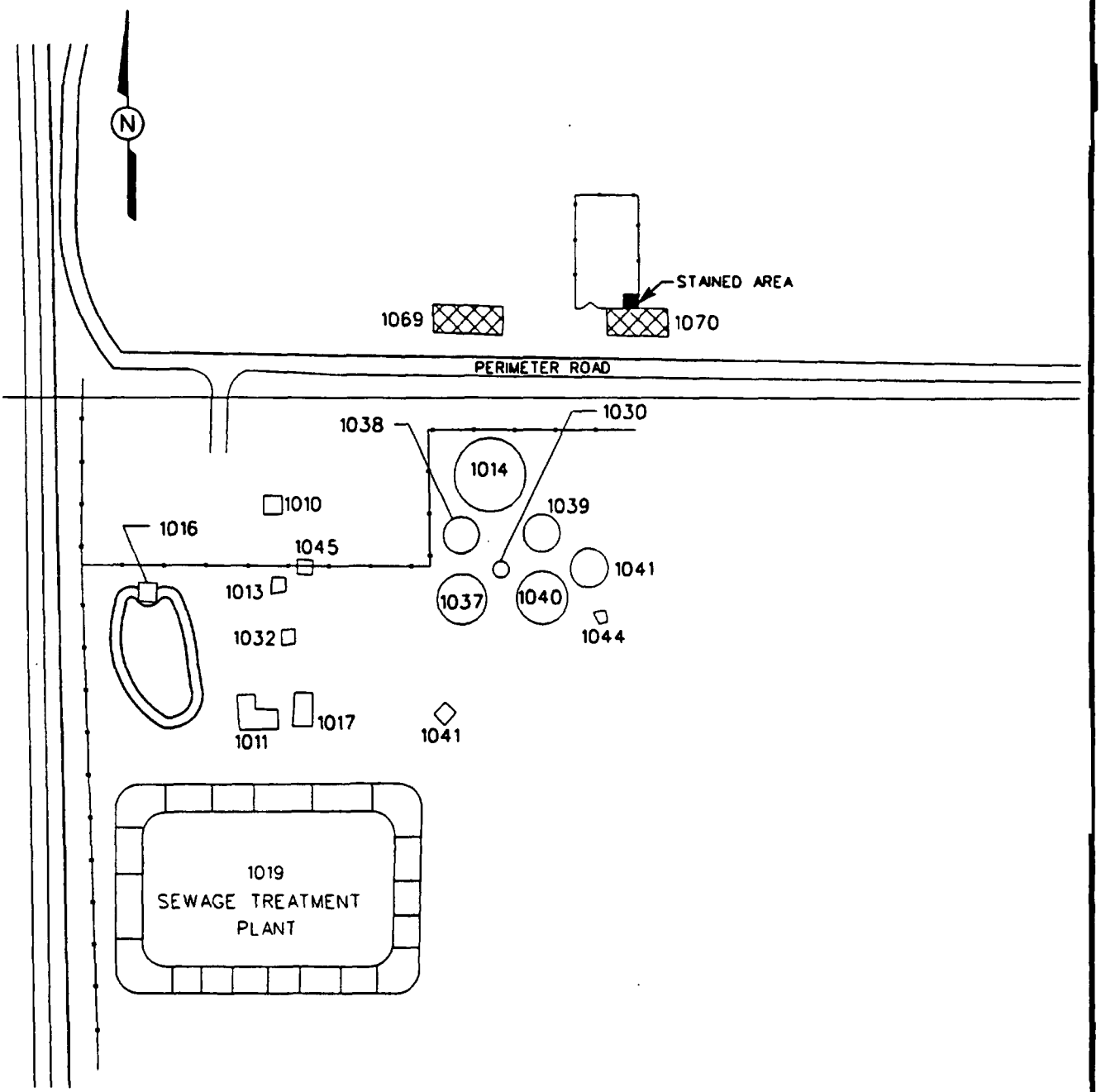

STARTING DATE: 10-13-95 | DATE LAST REV.: 2/11/97 | DRAFT. CHCK. BY: C.TUMLIN | INITIATOR: D FREER | DWG NO 409881ES 362
DRAWN BY: D.AGUILAR | DRAWN BY: D. BILLINGSLEY | ENGR CHCK BY: D. FREER | PROJ MGR: W CARTER | PROJ NO 409881

FILENAME: 409881ES 362 16:12:39 Feb 11, 1997 DLB

LEGEND:

1014 — FACILITY 1014

FENCE

STAINED AREA

SCALE

0 200 400 FEET

FIGURE 2-12
SITE LOCATION MAP
BUILDING 1070 (SS-32)

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PHOENIX, ARIZONA

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and could not detect any staining nor evidence of the cited potentially contaminated area. There was agreement of all members that no action was necessary. This agreement was formalized in a field variance. Thus, no excavation/sampling was required or done at this site.

2.2.2.7 Munitions Incinerator (Facility 1119, SS-34)

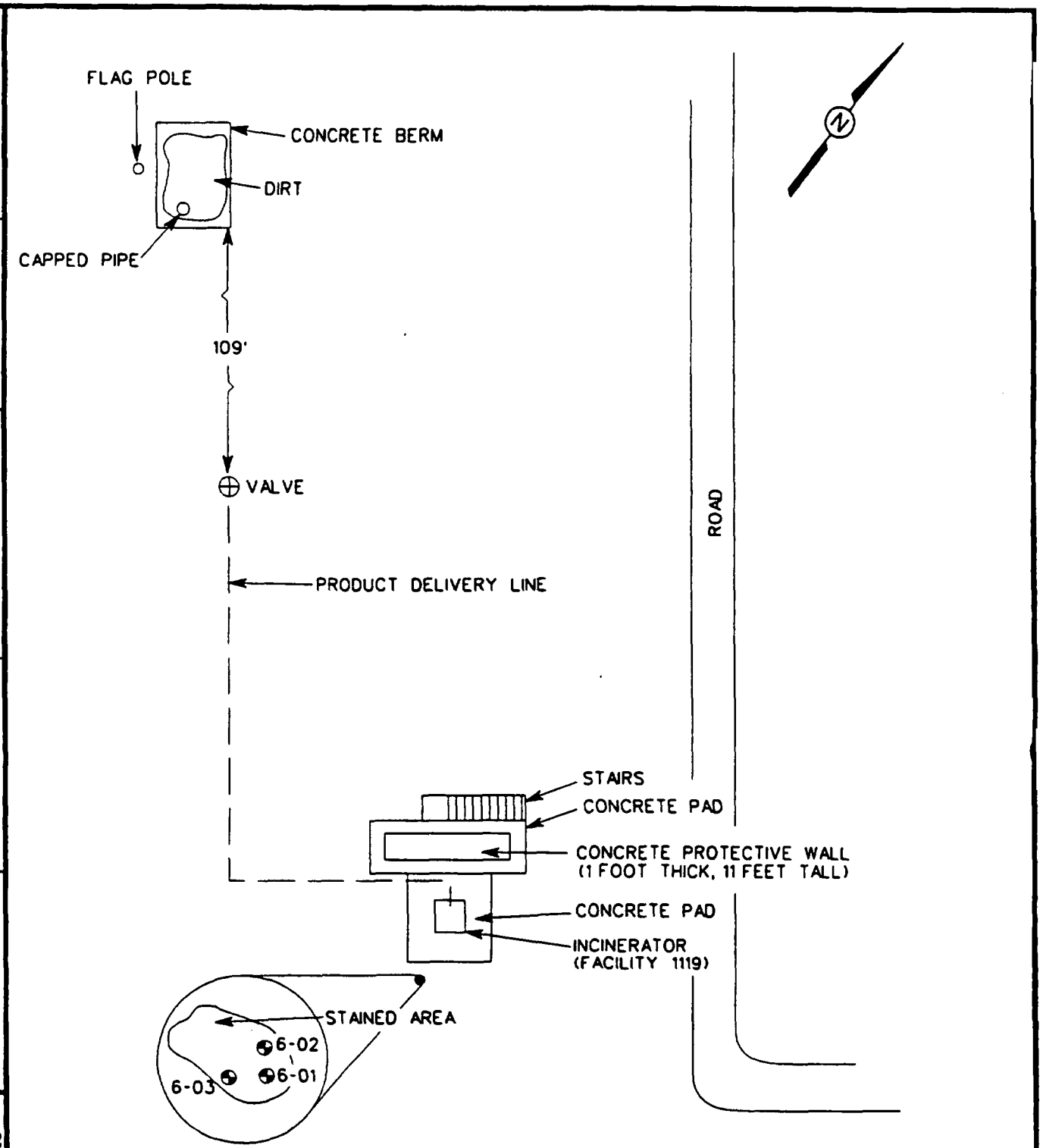
Site Description and History. The Munitions Incinerator area is located on the eastern side of the Base, west of Perimeter Road, northeast of Runway 12L-30R, and south of the Concrete Hardfill Area (Figure 2-2). The facility began operating in 1979, but is no longer in use. Visual inspection of the area revealed dark stained soil immediately to the south and east of the incinerator. In addition, an aboveground, 2-inch-diameter fuel line was observed leading from the incinerator to the north, where it disappeared into the ground. Approximately 110 feet north (adjacent to the flagpole) is a small concrete-bermed area with a pipe protruding from the ground in the south end.

Investigations. Sampling was performed during the E/A (IT, 1994c) to determine if any contamination existed in the soil around the munitions incinerator. Also, the bermed area adjacent to the flagpole was excavated to verify that a UST for fueling the incinerator was not present.

Samples were collected from three locations indicated in Figure 2-13 and were analyzed for PPMs, SVOCs, and TPH.

One SVOC, phenanthrene, was detected in soil samples from this area at an estimated concentration that was less than the contract-required detection limit. Acceptable concentrations for phenanthrene are not listed in the Arizona HBGL, and there is no established guideline in the EPA Region IX residential PRG listings.

Analytical results for PPMs from the Munitions Incinerator area were compared to Base-specific background ranges. All of the PPMs were detected at concentrations lower than respective HBGLs and EPA Region IX residential PRGs, except for arsenic and beryllium; both these PPMs were within their respective Base-specific background ranges and are not considered contaminants. Arsenic, beryllium, chromium, and nickel were detected at both locations 6-01 and 6-03 (Figure 2-13) at concentrations within or less than Base-specific background ranges for those PPMs at the Base. Lead was detected twice, with one detection at location 6-02 exceeding Base-specific background. Cadmium was detected at location 6-01 at a concentration greater than its



LEGEND:

SOIL SAMPLE LOCATIONS
09/17/93 AND 09/24/93

PRODUCT DELIVERY LINE

SCALE

0 10 20 FEET

FIGURE 2-13
SITE LOCATION MAP
FACILITY 1119 MUNITIONS
INCINERATOR (SS-34)

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

INTERNATIONAL
TECHNOLOGY
CORPORATION

STARTING DATE: 12/02/94 | DATE LAST REV.: 2/11/97 | DRAFT. CHCK BY: D AGUILAR | INITIATOR: D. FREER | DWG. NO: 409881ES 363
DRAWN BY: D AGUILAR | DRAWN BY: D BILLINGSLEY | ENGR. CHCK BY: D FREER | PROJ MGR: W CARTER | PROJ. NO 409881

FILENAME 409881ES 363 16:22:48 Feb 11, 1997 DLB

Base-specific background range. Copper and zinc were detected exceeding their Base-specific background ranges at two locations (6-02 and 6-03). It was recommended that the stained soil be removed and soil samples collected.

Removal Actions. The removal action included the excavation of soil from a dark stained area located immediately to the south of the incinerator and the collection of two undisturbed soil samples from the bottom of the excavated area.

An area of approximately 80 square feet of contaminated soil was removed to a depth of approximately 4 feet. The dark soil stain was irregular on the surface soil and was very limited in extent beneath the surface soil.

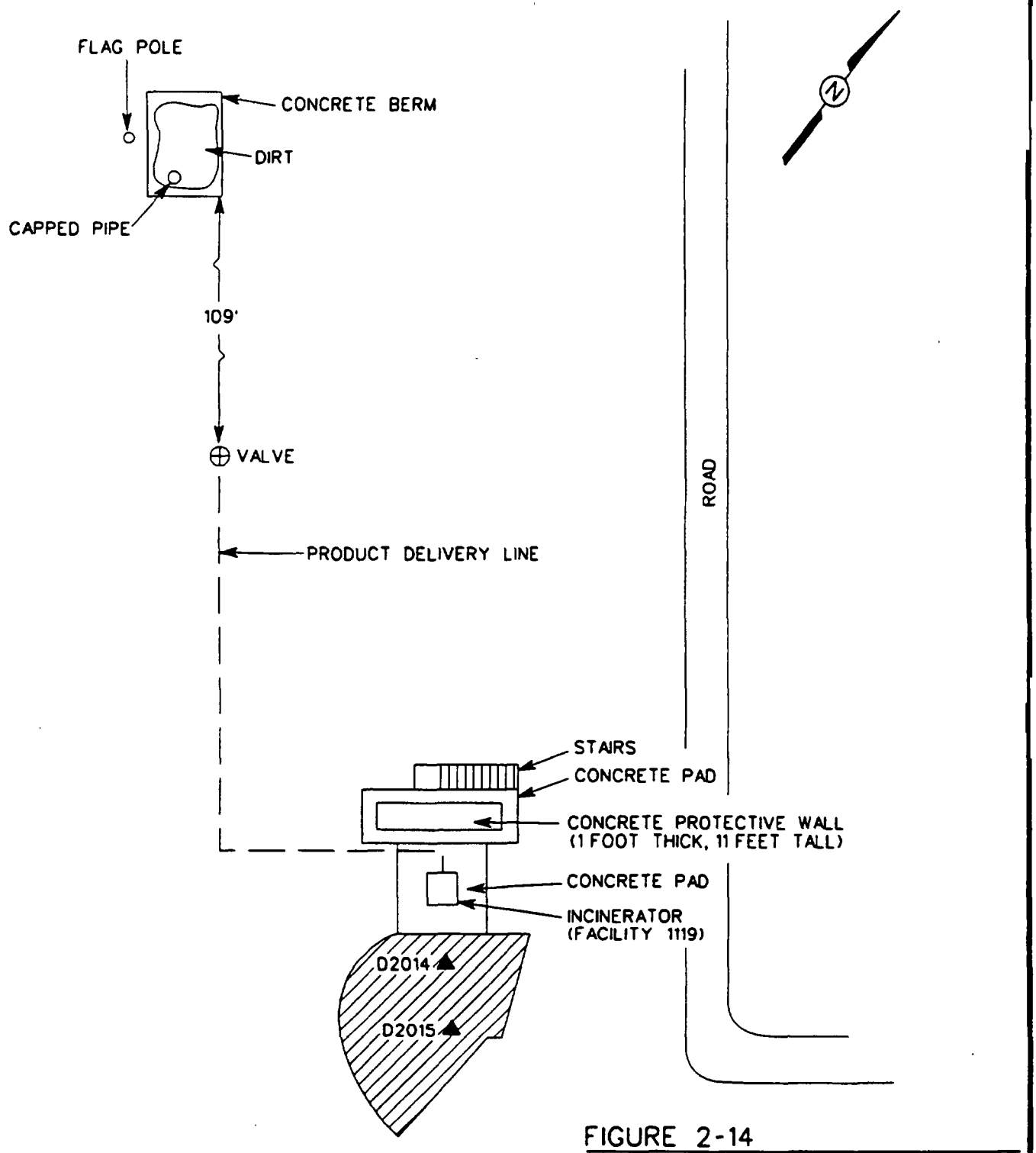
Two confirmatory soil samples were collected and analyzed for pesticides/PCBs, PPMs, SVOCs, and TPH to verify that no contamination remained that would be hazardous to human health or the environment.

Clean fill was placed in the excavation and compacted. Chapter 4.0 confirms that there is no unacceptable risk at the site.

Postremoval Analytical Samples and Results. Two samples were taken at this area, as shown in Figure 2-14. Nine metals were detected in sample D2015 and eight metals were detected in sample D2014. Of these metals, however, only arsenic and beryllium exceeded the Base background range for metals and also exceeded the Arizona HBGL and Region IX residential PRG levels. The maximum arsenic concentration was 5.8 mg/kg at a depth of 3.5 feet in sample D2014, and 5.3 mg/kg in sample D2015. Beryllium was detected in only one sample, D2015, at 0.65 mg/kg, also at 3.5 feet. An SLRA was performed to estimate health impacts of these results to determine if further action is required at this site, which concludes that this site poses no unacceptable risks to human health or the environment. Chapter 4.0 describes the risk assessment.

2.2.2.8 Concrete Hardfill Drum Removal Area (LF-26)

Site Description and History. The Concrete Hardfill Area is located on the northeast corner of the Base, northeast of Perimeter Road, and south of the Base fence (Figure 2-2, Figure 2-15). The area was designated for the disposal of concrete from the construction and destruction of



LEGEND:

▲ SOIL SAMPLES D2014 & D2015 TAKEN AT 3' BGS

— — PRODUCT DELIVERY LINE

AREA EXCAVATED TO AVERAGE DEPTH OF 4 FT.

SCALE:

0 10 20 FEET

FIGURE 2-14
SOIL REMOVAL AND SAMPLING LOCATIONS FACILITY 1119 MUNITIONS INCINERATOR (SS-34)

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

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STARTING DATE: 9/29/95 | DATE LAST REV.: 2/12/97 | DRAFT. CHCK. BY: K. WOOD | INITIATOR: D. FREER | DWG. NO.: 409881ES.364
DRAWN BY: K. WOOD | DRAWN BY: D. BILLINGSLEY | ENGR. CHCK. BY: D. FREER | PROJ. MGR: W CARTER | PROJ. NO.: 409881

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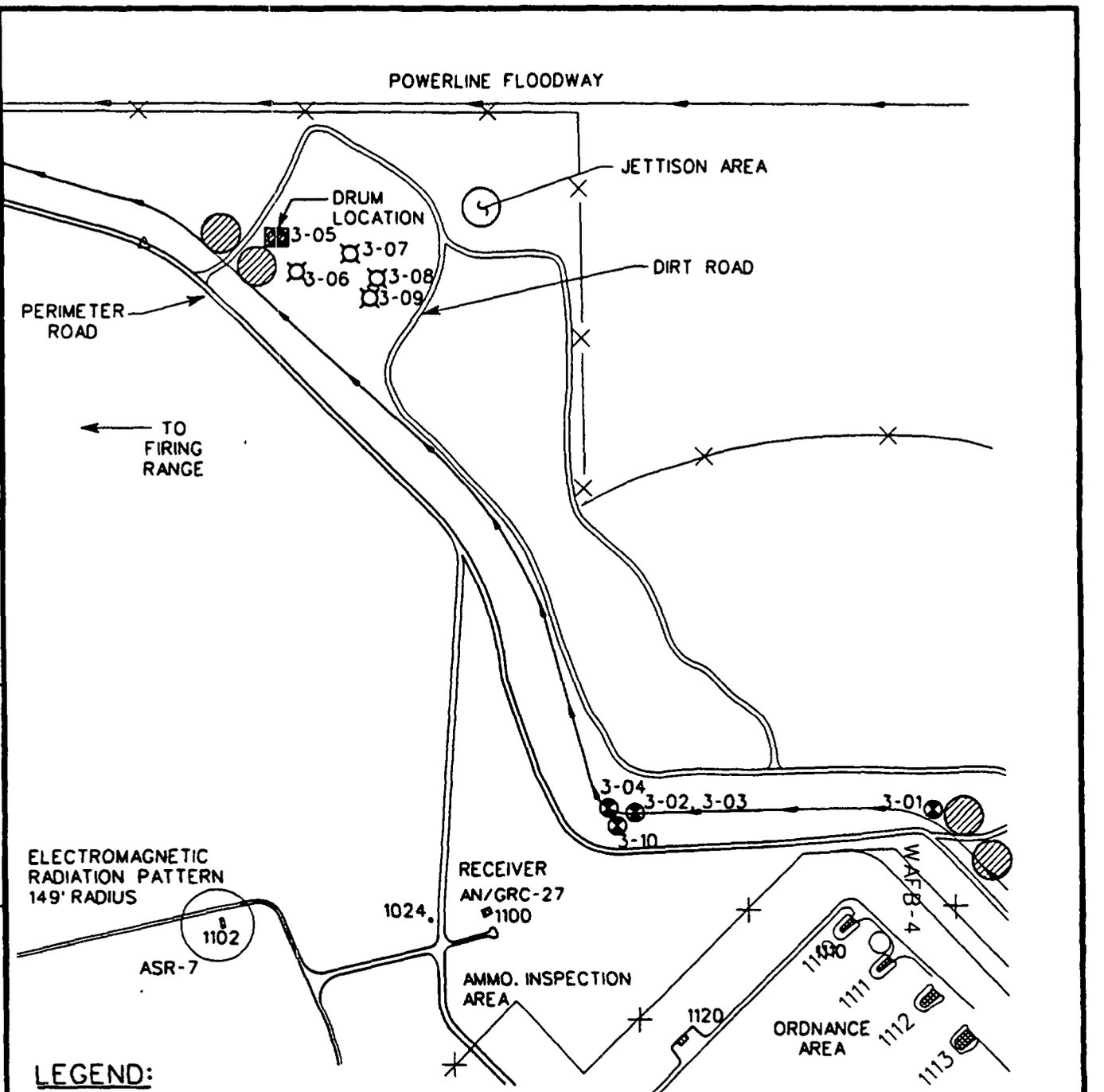

FIGURE 2-15
SAMPLE LOCATION MAP
CONCRETE HARDFILL
AREA (LF-26)

WILLIAMS AIR FORCE BASE
PHOENIX, ARIZONA

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 11/6/95 | DATE LAST REV.: 2/12/97 | DRAFT. CHCK. BY: C. TUMLIN | INITIATOR: D FREER | DWG. NO · 409881ES 365
DRAWN BY: K. WOOD | DRAWN BY: D. BILLINGSLEY | ENGR. CHCK. BY: D. FREER | PROJ. MGR.: W CARTER | PROJ NO · 409881

FILENAME: 409881ES.365 08:11:52 Feb. 12, 1997 DLB

runways for many years. Visual inspection of the area during the E/A (IT, 1994c) found debris other than concrete, including vinyl asbestos tile, asbestos concrete pipe, several drums, empty paint cans and roofing tar buckets, and other construction debris. Two soil piles wrapped in plastic consisted of material removed from golf course ponds when they were lined. Also, a former Base employee reported seeing drums of unknown content buried in this area.

Investigations. As indicated in Figure 2-15, a geophysical survey was conducted during the E/A (IT, 1994c). Total field magnetic and EM conductivity data were collected at the site.

Samples were collected from nine locations indicated in Figure 2-15. Soil samples from this area were analyzed for VOCs, SVOCs, and pesticides/PCBs. Samples of the concrete piping and vinyl tiles were collected and analyzed for asbestos fiber content.

Three SVOCs (benzo[a]pyrene, benzo[b]fluoranthene, and dibenzo[a,h]anthracene) detected at location 3-05 (Figure 2-15) exceeded the EPA Region IX residential PRG. Benzo(a)pyrene also exceeded the Arizona HBGL at location 3-05. Dieldrin at location 3-05 exceeded the HBGL and the EPA Region IX residential PRG. All other compounds detected at the Concrete Hardfill Area were less than their respective HBGLs or EPA Region IX residential PRGs.

The investigation disclosed that the asbestos-containing material in the Concrete Hardfill Area is nonfriable. Further investigation into nonfriable asbestos-laden tiles and concrete located within the Concrete Hardfill Area is not required by either federal or Arizona guidance. These materials do not appear to pose an unacceptable risk to human health or the environment, because there is no known pathway for exposure to, or risk associated with, nonfriable asbestos in limited and dispersed quantities over a large, outdoor area. However, it was recommended that the Concrete Hardfill Area be included under OU-4 for further investigation upon completion of the removal action in OU-5 to ensure there is no human health hazard.

One 55-gallon drum was observed and its contents was unknown. Therefore, it was recommended that the drum and surrounding soils and concrete be removed and soil samples collected.

This drum removal area under OU-5 has now been designated as the Concrete Hardfill Drum Removal Area to avoid confusion with the remainder of the Concrete Hardfill Area, which is being investigated under OU-4.

Removal Actions. The removal action included the 55-gallon drum, surrounding soils and concrete located in the surface drainage ditch, and the collection of confirmatory soil samples from the bottom of the excavated area in accordance with the approved work plan.

The removal of the drum, surrounding contaminated soil, and concrete was completed in an area 2.5 by 3 feet excavated to a depth of 3 feet.

Two undisturbed soil samples were collected from the bottom of the excavation and analyzed for SVOCs and pesticides/PCBs to verify that no contamination remained that would be hazardous to human health or the environment.

Clean fill was placed in the excavation and compacted. Chapter 4.0 confirms that there is no unacceptable risk at the site.

Postremoval Analytical Samples and Results. One sample was taken at this site, as shown in Figure 2-16. Low levels of the pesticides 4,4-DDE (1.1 µg/kg) and dieldrin (12 µg/kg) were detected in the sample. Both were well below the Arizona HBGL and Region IX residential PRG levels. An SLRA was performed to estimate health impacts of these results to determine if further action is required at this site. Chapter 4.0 describes the risk assessment, which concludes that this site poses no unacceptable risks to human health or the environment.

2.2.2.9 Sewage Sludge Stockpile Area (Area 28)

Site Description and History. The Sewage Sludge Stockpile area is located to the northeast of the golf course (Figure 2-3) on Perimeter Road. This area was used for stockpiling treated sludge from the WWTP from 1979 until late 1992.

Investigations. Visual inspection indicated that the sewage sludge piles have been graded level with the ground surface to an approximate thickness of 1 to 7 inches. The work was previously completed in September 1993 and reported in the final E/A report (IT, 1994c).

There were 5 SVOCs, 6 pesticides/PCBs, and 11 metals detected from samples taken from the stockpile area. Due to similarities in chemicals between Area 28 and the Landfill Area (LF-04), a comparison was made with the risk assessment results at LF-04 as reported in the OU-1 remedial investigation report addendum (IT, 1994d). This report indicated that a maximum risk

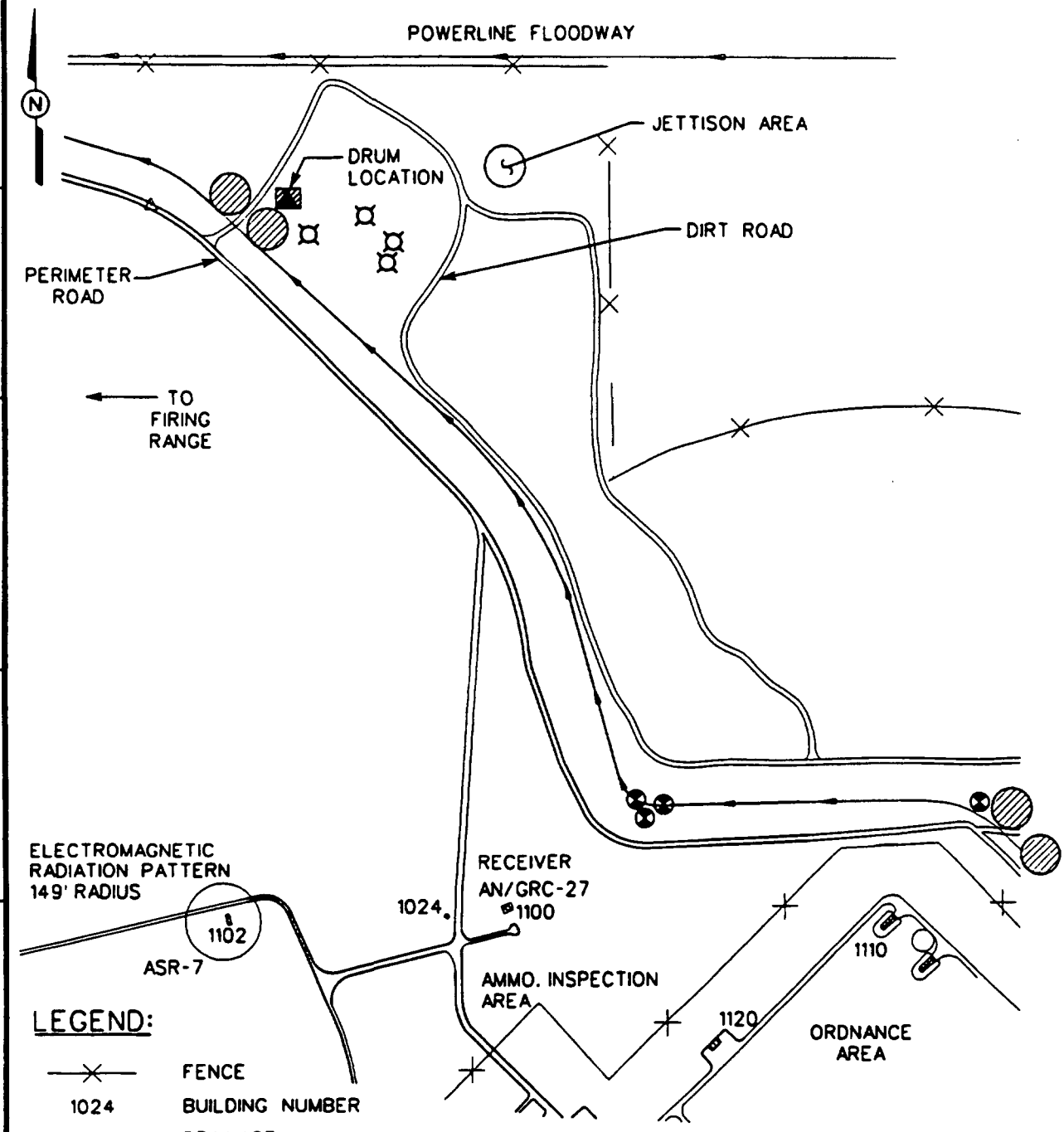

FIGURE 2-16
SOIL REMOVAL AND SAMPLING LOCATIONS CONCRETE HARDFILL DRUM REMOVAL AREA (LF-26)

WILLIAMS AIR FORCE BASE
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FILENAME: 409881ES 366 08 23:29 Feb. 12, 1997 DLB

from dieldrin in soil was 5.8 x 10^{-6}, which is within the acceptable EPA level of 10^{-6} to 10^{-4}. Thus, dieldrin did not pose an unacceptable risk to human health or the environment.

Removal Actions. Although no further action was required at Area 28, the Sewage Sludge Stockpile was removed in January 1996 to eliminate its unsightliness and the material properly disposed in an approved landfill (IT, 1996).

Because action was taken to remove the visual public nuisance, even though no further action was required, no confirmatory samples were necessary or taken. No further remedial action is required at this site because it poses no unacceptable risks to human health or the environment.

2.2.3 Demographics

Because of the Base size and close proximity of the nine OU-5 sites, the site-specific discussion on the demographics is the same as previously presented in Section 2.1.1.

2.2.4 Geology

Because of the uniform nature of the Basewide geology and the fact that the nine sites included in the OU-5 ROD are in relative close proximity, the site-specific geology is the same as the discussion previously presented in Section 2.1.3.

2.2.5 Groundwater

Because the nine sites included in the OU-5 ROD are in relatively close proximity, the site-specific groundwater is the same as the discussion previously presented in Section 2.1.4. Based on the nature and concentrations of contaminants detected at the OU-5 sites, there is no reason to suspect impact to groundwater, which is at a depth of approximately 150 feet. The actions at OU-5 were also performed prior to promulgation of the Arizona Amended Soil Remediation Rules (April 1966). No monitoring wells were required by the approved work plan to be installed at any of the OU-5 sites.

2.2.6 Surface Water

The topography of the Base is essentially flat, with the surface water draining to ditches that drain the Base. No surface water contamination was expected, so no surface water sampling was required in the approved work plan.

2.2.7 Contaminant Persistence in the Environment

Chemical persistence in environmental media is determined by the chemical's ability to move through a medium, to transfer from one medium to another, and to transform or degrade. These processes are controlled both by the chemical or element properties and the medium. Migration to groundwater can occur via water infiltration, dispersion, and diffusion. Sorption of chemicals onto soil particles or soil organic matter can reduce migration; similarly, chemically or biologically mediated transformation or degradation of chemicals can reduce migration.

Inorganics. All soils contain natural trace levels of metals so that their presence in soils is not necessarily indicative of contamination. Metals can be transformed (oxidized or reduced) so that mobility and toxicity are affected; however, metals cannot be biologically degraded. In the soil, the fate of metals can be found in one or more of the following (Shuman, 1991):

- Dissolved in the soil pore water
- Adsorbed on inorganic soil constituents
- Associated with insoluble soil organic matter
- Occupying exchange sites on inorganic constituents
- Precipitated as pure or mixture of solids.

Metals added to the soil react with the soil components in a variety of interrelated ways. These reaction mechanisms can generally be classified as inorganic and organic complexation/speciation, oxidation/reduction reactions, precipitation/dissolution reactions and adsorption/desorption reactions. The reaction mechanisms and rates both in soils and the water column depend on the type and amount of organic matter, clay, and hydrous oxides in the soil. Other factors include soil reaction potential (pH), exchangeable cations, oxidation/reduction potential (Eh), soil/water composition, infiltration rate, and chemical concentration.

Organics. The mobility of organic compounds within the soil is affected by chemical processes that are in part due to a chemical's volatility, octanol-water partition coefficient (a measure of the affinity of a chemical to partition from water to organic materials), water solubility, and concentration. In general, the more water insoluble a compound is, the more likely it is to adsorb on a sediment or organic surface. For several groups of compounds (including phenols, phthalates, and monocyclic aromatics such as benzene), volatilization, sorption, and biodegradation are all prominent processes. The behavior of a PAH was found to be a function of the number of rings present. Important processes for this class of compound are sorption and aerobic and anaerobic biodegradation. The fate of chlorinated pesticides is determined by sorption, volatilization, and/or biotransformation.

2.3 Highlights of Community Participation

Ongoing Public Involvement. A community relations plan for the Base was issued in February 1991 (IT, 1991c) and updated in March 1995. This plan listed contacts and interested parties throughout the USAF, government, and the local community. The plan also established communication channels to ensure timely dissemination of pertinent information to the surrounding community through mailings, public announcements in the local newspaper, public meetings, public comment periods, public service announcements, and the establishment of information repositories in local libraries.

Early in the IRP, the Base established a Technical Review Committee (TRC) to provide review and offer comment and recommendations on the progress of the cleanup effort. The TRC included representatives from the USAF and other governmental agencies as well as appointed representatives from the surrounding communities. Governmental agencies represented included EPA Region IX, ADEQ, ADWR, and the Maricopa County Department of Health.

With the advent of Base closure, the TRC was expanded to include additional community stakeholders and is now called the Restoration Advisory Board (RAB). Much the same as a TRC, the RAB acts as a forum for discussion and exchange of information regarding cleanup between the installation, governmental agencies and the community. However, because the RAB provides for an expanded and more diverse membership representing the community, a greater opportunity is afforded to those directly affected by the cleanup process to participate and provide input. This input will be especially valuable as decisions are made regarding transfer and end uses of Base property.

An administrative record that contains the documents relating to investigation and cleanup activities proposed for the Base has been established and is available for public inspection as part of the information repositories at the Gilbert Public Library, Gilbert, Arizona and the Base Conversion Agency (Williams AFB), Mesa, Arizona.

Public Involvement Specific To OU-5. The public has been notified of intended actions at OU-5 as part of public meetings for OU-3 and OU-2 amendment. The proposed plan for OU-5 was issued in January 1997. A public meeting was held on January 7, 1997, the details of which are provided in the responsiveness summary chapter (Chapter 7.0).

3.0 Scope and Role

As with many Superfund sites, the environmental problems at Williams AFB are complex. As a result, the USAF has organized the work into the following OUs.

- OU-1 addresses soil and groundwater contamination at the following ten sites:
  - Landfill (LF-04)
  - Fire Protection Training Area No. 1 (FT-03)
  - Northwest Drainage System (SD-10)
  - Radioactive Instrumentation Burial Area (RW-11)
  - Pesticide Burial Area (DP-13)
  - Hazardous Materials Storage Area (SS-01)
  - USTs at four area (ST-05, ST-06, ST-07, ST-08).
- OU-2 addresses soil and groundwater at the Liquid Fuels Storage Area (ST-12). Deep soil at ST-12 was added to OU-2 by an amendment.
- OU-3 addresses soil and groundwater at the following two sites:
  - Fire Protection Training Area No. 2 (FT-02)
  - Southwest Drainage System (SD-09) (soil only).
- OU-4 addresses investigations of contamination at 11 sites.
  - Electroplating/Chemical Cleaning (Facility 1085, Site SS-16)
  - Old Pesticide/Paint Shop (Facility 742, Site SS-17)
  - Oil/Water Separator - Petroleum, Oil, and Lubricant (Facility 550, Site SD-18)
  - Former Skeet Range at Former South Desert Village (Site SS-19)
  - Firing Range/Skeet Range (Facility 927, Site SS-20)
  - Facilities 1020 and 1051 (Site SS-21)
  - Aboveground Storage Tanks (AST) 556 and 557 (Site ST-22)
  - Building 1069 (Site SS-23)
  - Building 1010 (Site SS-24)
  - Concrete Hardfill Area (Site LF-26)

- Facility 1004 (Area 14).

- OU-5 addresses removal actions at the following nine sites:

  - Airfield Underground Storage Tanks (Site ST-25)
  - Paint Shop Leach Field (Site WP-27)
  - Sewage Sludge Trenches (Site DP-28) (these were included in the OU-1 remedy)
  - Prime Beef Yard (SS-29)
  - Golf Course Maintenance Area (SS-31)
  - Building 1070 (SS-32)
  - Munitions Incinerator (Facility 1119, SS-34)
  - Concrete Hard Drum Removal Area (LF-26)
  - Sewage Sludge Stockpile Area (Area 28).

As described in Section 2.2, the remedy selected in this ROD is designed to be consistent with any subsequent remedies and planned future actions at the Base proposed in all subsequent RODs.

4.0 Risk Assessment

4.1 Introduction

This section presents SLRAs on six OU-5 sites where excavation was performed to remove areas of suspected contamination. No unacceptable risks should be present at the sites where removal actions were performed. Nevertheless, the SLRAs were performed to determine if chemicals that remain require remedial action to protect human health and the environment. This risk assessment was performed as part of the RI initiated by the USAF under the IRP. The results of the assessment are used to determine the need for any remedial action and to establish a time frame to develop any required long-term alternatives. This risk assessment was conducted in accordance with the guidance documents, *Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A, Interim Final* (EPA, 1989) and *Region IX Preliminary Remediation Goals (PRG) First Half 1995* (EPA, 1995).

This section includes an SLRA on each of the following sites that are part of OU-5:

- Airfield USTs (ST-25)
- Paint Shop Leach Field (WP-27)
- Prime Beef Yard (SS-29)
- Golf Course Maintenance Area (SS-31)
- Munitions Incinerator (Facility 1119, SS-34)
- Concrete Hardfill Drum Removal Area (LF-26).

An SLRA was not performed on the Sewage Sludge Trenches Area (DP-28) because it was included in the final remedy with LF-04 in OU-1 (Section 1.2), nor on Building 1070, where evidence of the cited potentially contaminated area was not found (see Section 2.2.2.6). The Sewage Sludge Stockpile Area (Area 20) was eliminated in Chapter 2.0.

The SLRAs were conducted in two phases:

- ***Phase I:*** The environmental sampling data collected during RI activities were reviewed and evaluated, and contaminants of potential concern (COPC) were identified.

- ***Phase II:*** Risk characterization, which consists of estimating conservative screening level risks for the COPCs identified in the Phase I based on methodology suggested by EPA (1995), was performed. Sites where risks exceed the upper bound of the acceptable cancer risk range (10^{-4}) (EPA, 1990), or a noncancer hazard index (HI) of one, will be considered for further study under OU-4 (IT, 1995b).

Data validation procedures, summary statistics, and identification of COPCs are described in Section 4.2. Section 4.3 presents a brief exposure assessment section outlining the exposure scenario and exposure point concentrations. The risk characterization, Phase II of the SLRA, methodology, and results are described in Section 4.4. Overall uncertainties associated with the SLRAs are discussed, qualitatively, in Section 4.5. These SLRAs do not include a toxicity assessment section and a detailed exposure assessment found in traditional baseline type risk assessments because SLRAs use the default exposure scenario and toxicity assessments included in EPA (1995) methodology. When their default exposure scenario is used, these sections are not required.

4.2 Identification of Constituents of Potential Concern

Data collected during the RI were evaluated for use in the risk assessment in accordance with EPA guidelines. This process includes evaluating the sample collection and analytical methods used, evaluating the quality of the data, and comparing the data to EPA (1995) residential PRGs and to background. The purpose of this selection process is to first identify those constituents potentially harmful to human health if present at the site, then identify those constituents that are likely to be site-related and, finally, evaluate the acceptability of the analytical data to be used in the quantitative risk assessment (EPA, 1989).

4.2.1 Data Sources

Background. The Parties to the FFA agreed that it was necessary to establish Base-specific background levels for inorganic constituents in the surface soil as recommended in the OU-1 RI report (IT, 1992a). On this basis, background surface soil samples were collected and analyzed for inorganics. The OU-3 FSP addendum (IT, 1993b), and OU-1 RI work plan addendum (IT, 1993c) specified the exact locations and techniques that were approved by the FFA Parties. Nine surface soil samples and a duplicate were collected and the analytical results were used to determine a Base-specific background concentration for each inorganic constituent. The background metals that were analyzed included antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.

Site-Related. At the sites listed in Section 4.1 where excavations were performed, confirmatory soil samples were taken at the bottom and/or limits of an excavation. After excavation and sampling were completed, the excavated sites were backfilled with clean soil; therefore, subsurface soils were the only medium sampled. No soil samples were taken at Building 1070 or

DP-28 due to reasons noted in Section 4.1. Detailed analytical results for these sites are presented in Appendix A of the OU-5 RI report (IT, 1996).

As noted in Section 1.4, it was assumed that there was no impact on groundwater, because contamination was limited to shallow soil and confirmatory sampling has shown that there is no contaminant source. Thus, no groundwater data were acquired.

4.2.2 Data Validation

Data validation is an after-the-fact, independent, systematic process of evaluating data and comparing them to pre-established criteria to confirm that the data are of acceptable technical quality. Specific criteria are reviewed to determine whether the data meet the stipulated data quality objectives. There are five principal quality objectives:

- Precision
- Accuracy
- Completeness
- Comparability
- Representativeness.

To verify that these objectives are met, field measurements, sampling and handling procedures, laboratory analysis and reporting, and nonconformances and discrepancies in the data are examined to determine compliance with appropriate and applicable procedures. The procedures and criteria for validation are defined in the RI/FS data validation program guidelines, which are based on the EPA national functional guidelines for data review (EPA 1988a, b).

All environmental sampling data are evaluated for suitability for use in the risk assessment. Analytical results for constituents are reported using Contract Laboratory Program (CLP) data qualifiers. Constituents flagged with a "U" qualifier are considered to be not detected, or detected at a concentration below the normal, random "noise" of the analytical instrument. Estimated quantitative results such as those identified by a "J" qualifier are used in the assessment (EPA, 1989). The "J" qualifier is the most encountered data qualifier in CLP data packages. Under the CLP, the "J" qualifier describes an estimated value when a compound is present (spectral identification criteria are met), but at values less than the contract-required quantitation limit, or when QC samples suggest that the sample results may be in error (e.g., when spike samples are outside of required limits or when holding times are slightly missed). If validation of the data reveal that samples must be rejected (assigned an "R" qualifier), the rejected data are not used for the SLRA.

4.2.3 Selection of Contaminants of Potential Concern

Once the data set is complete, summary statistics on site and background analytical data sets are compiled and source-concentrations for all the chemicals are estimated. Chemicals are then eliminated from the list of COPC based on the following criteria as recommended by EPA (1989):

- ***Frequency of Detection.*** Constituents were eliminated if they were detected infrequently (5 percent or lower frequency of detection), providing there was no evidence that infrequent detection reflected a "hot spot" location.

- ***Risk-Based Screening.*** Compare source-concentrations with EPA (1995) residential PRGs for residential soil; chemicals are excluded from further consideration if their source-concentrations are equal to or less than the residential PRGs.

- ***Background.*** If the mean of the site-influenced values were less than the mean of the background values, the chemicals were excluded from further considerations. If the mean of the site-influenced values were marginally greater than the background mean, a Students t-test was performed to determine if the former is statistically greater than the latter.

- ***Chemical Specificity.*** Analytical results that were not specific for a particular compound (e.g., gross alpha, gross beta, TPH, etc.) were excluded from further consideration.

4.2.4 Data Evaluation

The statistical methods used in data evaluation are discussed in this section, and reflect EPA headquarter guidance (EPA, 1989). The summary statistic tables on site-related data for the sites evaluated in these SLRAs are presented in the OU-5 report (IT, 1996). For each set of data used to describe the concentration of contaminants in a medium, the following information was tabulated in the tables:

- Frequency of detection
- Range of detection limits
- Source-concentration
- Mean concentrations
- Background mean concentrations
- Region IX residential PRGs
- COPC selection.

Because of the uncertainty associated with characterizing contamination in environmental media, EPA (1989) recommends that the 95 percent upper confidence limit (UCL) on the mean or the

maximum detected concentration, whichever is smaller, should be adopted as the source-concentration. During the confirmatory sampling round, a maximum of three samples were taken for the compounds analyzed at all the sites. Ninety-five percent UCLs could not, therefore, be estimated, because a minimum of four samples is required to estimate UCLs. Thus, the maximum concentrations were adopted as the source-concentrations at all the sites.

Analytical results are presented as nondetects whenever constituent concentrations in samples do not exceed the detection or quantitation limits for the analytical procedures for those samples. Generally, the detection limit is the lowest concentration of a constituent that can be "seen" above the normal, random noise of an analytical instrument or method. To apply these statistical procedures to a data set with nondetects, a concentration value must be assigned to nondetects. In this assessment, one-half the detection limit was assigned to the nondetects (EPA, 1989).

4.2.5 Contaminants of Potential Concern for Subsurface Soil

The COPC selected for each site are summarized in Table 4-1. COPC were selected based on the criteria listed in Section 4.2.3. A brief description of the selection process for each site is presented in this section, while the detailed discussions of the selection process is presented in the OU-5 RI report (IT, 1996).

4.2.5.1 Airfield USTs (ST-25)

Methylene chloride was the only chemical detected, but its source-concentration was less than the residential PRG; thus, no COPC were selected at this site.

4.2.5.2 Paint Shop Leach Field (WP-27)

Organics for which analyses were performed were not detected in any of the samples. Arsenic, with a source-concentration of 9.6 mg/kg, was the only COPC selected at WP-27. Beryllium was eliminated as a COPC because the mean site concentration for beryllium was less than its background mean concentration.

4.2.5.3 Prime Beef Yard (SS-29)

Arsenic, with a source-concentration of 6.3 mg/kg, was the only COPC selected at SS-29. Beryllium was eliminated as a COPC because the mean site concentration for beryllium was less than its background mean concentration. All other inorganics were eliminated from the list of COPC because their source-concentrations were less than their respective residential PRGs.

Table 4-1

COPC Selected for Sites at OU-5
Williams Air Force Base, Arizona

Site	COPC	Soil Concentration (mg/kg)
ST-23	No COPC	NA
WP-27	Arsenic	9.6
SS-29	Arsenic	6.3
SS-31	No COPC selected	NA
SS-34	Arsenic	5.8
LF-26	No COPC selected	NA

NA - Not applicable.

Methylene chloride was the only organic compound detected, but it was excluded from the COPC list because its source-concentration was less than the residential PRG.

4.2.5.4 Golf Course Maintenance Area (SS-31)

No constituents were detected; therefore, no COPC were selected at this site.

4.2.5.5 Munitions Incinerator (Facility 1119, SS-34)

As explained in Section 4.1.5, beryllium was not selected as a COPC and arsenic, with a source-concentration of 5.8 mg/kg, was the only COPC selected at the Munitions Incinerator. Organics for which analyses were performed were not detected in any of the samples.

4.2.5.6 Concrete Hardfill Drum Removal Area (LF-26)

The only compounds detected at LF-26 were 4,4,-DDE and dieldrin, but they were excluded from the COPC list because their source-concentrations were less than the residential PRGs. Thus, no COPCs were selected at this site.

4.3 Exposure Assessment

This section presents the default exposure assessment used to estimate PRGs (EPA, 1995). The default exposure assessment provides a conservative screening level estimate of potential exposures of human receptors to constituents found at the site. Exposure is defined as the contact of a receptor with a chemical. Exposure assessment is the estimation of the magnitude, frequency, and duration of contact for each identified route of exposure. The magnitude of an exposure is determined by estimating the amount of chemical available at the receptor exchange boundaries (i.e., lungs, gastrointestinal tract, or skin) during a specified time period. The general procedure for conducting an exposure assessment is (EPA, 1989):

- Characterization of exposure setting
- Identification of potential exposure pathways
- Quantification of exposure (where possible).

4.3.1 Characterization of Exposure Setting

Section 2.1 describes the physical characteristics of the Base as well as the population, both human and environmental, living on or near the area that may be affected by the contaminants at the site.

Receptor Assessment. The conservative residential receptor outlined in EPA (1995) was used for all the sites evaluated in this SLRA.

4.3.2 Identification of Potential Exposure Pathways

The default exposure pathways for the residential land-use scenario used to calculate PRGs (EPA, 1995) are adopted for all the sites evaluated in these SLRAs. Exposure is limited to soil only and the exposure pathways include ingestion, inhalation of particulates, and inhalation of volatiles. As noted in Section 2.2.5, groundwater at this site is not expected to be impacted; therefore, exposure to groundwater was not included.

4.3.3 Estimation of Exposure

This section describes the concentration estimation of individual site-related constituents of concern that may reach human receptors. As described earlier, the exposure models and input parameters are the default values used to calculate the PRGs (EPA, 1995) for the residential soil exposure scenario. The source concentration is adopted as a screening level exposure-point concentration. Hence, it is conservatively assumed that the residents are directly exposed to the contaminated subsurface soils at all the sites.

4.4 Risk Characterization

Once COPC were identified, an evaluation was performed for each site to estimate the cancer risk or noncancer hazard quotient (HQ) associated with each chemical in soil. Cancer risks and noncancer HQs were calculated for the residential scenarios for the COPC retained.

PRGs based on carcinogenicity are concentrations that correspond to a risk of 10^{-6}. Therefore, the cancer risk associated with the source concentration was estimated as follows:

$$ILCR = \left(\frac{SC}{PRG_c} \right) 10^{-6} \qquad \text{Eq. 4.1}$$

where:

ILCR	=	incremental lifetime cancer risk (unitless probability)
SC	=	source concentration (mg/kg)
PRG_c	=	cancer-based residential PRG (mg/kg)
10^{-6}	=	cancer risk corresponding to the residential PRG.

Residential PRGs based on noncancer effects are concentrations that correspond to a HQ of 1. Therefore, the HQ associated with the source concentration was estimated as follows:

$$HQ = \left(\frac{SC}{PRG_n} \right) 1.0 \qquad \text{Eq. 4.2}$$

where:

HQ	=	hazard quotient for noncancer effects (unitless ratio)
SC	=	source concentration (mg/kg)
PRG_n	=	noncancer-based residential PRG (mg/kg)
1.0	=	HQ corresponding to the residential PRG.

The individual ILCRs are summed to estimate a total cancer risk associated with exposure to the soil at the site of interest. Similarly, the individual HQs are summed to estimate a total non-cancer HI for the site. The results of these analyses for all the sites evaluated in OU-5 are presented in Table 4-2.

Chemicals selected as COPCs would be evaluated for both cancer and noncancer effects if they are known to induce both the effects. Arsenic, which was the only compound selected as a COPC (Table 4-2), is known to induce both cancer and noncancer effects. It was selected as a COPC because its source-concentrations exceeded its cancer residential PRG of 0.32 mg/kg, and not its noncancer residential PRG of 22 mg/kg (EPA, 1995). It may be noted that a risk range of 10^{-6} to 10^{-4} and an HI less than 1 are generally considered acceptable under the EPA guidelines used to evaluate risk (EPA, 1989; 1990).

The site-specific risk results are discussed in the following paragraphs.

Airfield USTs (ST-25). No COPC were identified for this site; therefore, it can be concluded that this site poses no unacceptable risk to human health or the environment.

Paint Shop Leach Field (WP-27). Arsenic was the only COPC selected at this site. From Table 4-2, it can be seen that the screening level risk (3×10^{-5}) and HI (0.4) for arsenic are within acceptable limits (EPA, 1989; 1990). Because the conservative estimate of risk and HI are within an acceptable range, it is concluded that this site poses no unacceptable risk to human health or the environment.

Table 4-2

Summary of Risk Evaluation for Sites in OU-5
Williams Air Force Base, Arizona

Chemical (mg/kg)	Source-Term Concentration	Residential PRGs	Cancer/ Noncancer	Target Cancer Risk	Target Hazard Index
Site: Airfield USTs (ST-25)					
No COPC present					
Site: Paint Shop Leach Field (WP-27)					
Arsenic	9.6	3.20E-01	c	3.00E-05	NA
Site: Prime Beef yard (SS-29)					
Arsenic	6.3	3.20E-01	c	1.97E-05	NA
Site: Golf Course Maintenance Area (SS-31)					
No COPC present					
Site: Munitions Incinerator					
Arsenic	5.8	3.20E-01	c	1.81E-05	NA
Site: Concrete Hardfill Drum Removal Area (Portion of LF-26)					
No COPC present					

COPC - Chemical of potential concern
PRG = Preliminary remediation goals, EPA Region IX, 1995a
c = Cancer risk

Prime Beef Yard (SS-29). Arsenic was the only COPC selected at this site. From Table 4-2, it can be seen that the screening level risk (2×10^{-5}) and HI (0.3) for arsenic are within acceptable limits (EPA, 1989, 1990). Given that the conservative estimate of risk and HI are within an acceptable range, it is concluded that this site poses no unacceptable risk to human health or the environment.

Golf Course Maintenance Area (SS-31). No COPC were identified for this site; therefore, it can be concluded that this site poses no unacceptable risk to human health or the environment.

Munitions Incinerator (Facility 1119, SS-34). Arsenic was the only COPC selected at this site. From Table 4-2, it can be seen that the screening level risk (1.8×10^{-5}) and HI (0.3) for arsenic are within acceptable limits (EPA, 1989; 1990). Given that the conservative estimate of risk and HI are within an acceptable range, it is concluded that this site poses no unacceptable risk to human health or the environment.

Concrete Hardfill Drum Removal Area (LF-26). No COPC were identified for this site; therefore, it can be concluded that this site poses no unacceptable risk to human health or the environment.

4.5 Uncertainty Evaluation

4.5.1 Terminology

Generally, risk assessments carry two types of uncertainty. Measurement uncertainty refers to the usual variance that accompanies scientific measurements, e.g., instrument uncertainty (accuracy and precision) associated with constituent concentrations. The results of the risk assessment reflect the accumulated variances of the individually measured values used to develop it. A different kind of uncertainty, called informational uncertainty, stems from data gaps, i.e., the fact that additional information is needed to complete the database for the assessment. Often the data gap is significant, such as the absence of information on the effects of human exposure to a constituent or on the biological mechanism of action of an agent (EPA, 1992).

4.5.2 Sources of Uncertainty

As noted previously, uncertainties are associated with the information and data used in each phase of the baseline risk assessment. Uncertainties associated with information and data are evaluated in this section to provide a sound, balanced basis for evaluating the overall quality of

the risk assessment results. Sources of uncertainty, as well as the direction of bias that results (i.e., whether conservatism is increased or decreased) are presented in the following sections.

4.5.2.1 Selection and Quantification of COPC

Uncertainty associated with the selection process used to determine the COPC and estimation of source-concentrations arises from the following:

- Surface soils were not collected from any of the sites evaluated; however, it is believed that the nature of the contamination would be best reflected by sampling subsurface soil because these sites were backfilled and covered with clean soil.

- Estimated summary statistics are uncertain and overconservative. For statistical purposes, if a constituent is positively identified at a site and has at least a single positive hit, all the samples with nondetects are assumed to have a value equal to half the minimum detectable activity and are included in the data set. These procedures introduce a conservative bias into the risk assessment.

- Limited numbers of samples result in the calculation of wide confidence intervals on the mean concentration and high source-concentrations. Ninety-five percent UCLs on the mean could not be estimated at several sites due to too few samples. Thus, the maximum concentrations were adopted as the source, introducing a conservative bias into the risk assessment.

- Laboratory analytical techniques have a degree of uncertainty associated with them. These uncertainties are documented by using data qualifiers to reflect the degree of certainty of measurement. The direction of bias is unclear.

- The COPC selection was based on residential PRGs that may not reflect plausible site-specific land use scenarios.

4.5.2.2 Exposure Point Concentrations

It was assumed that the source concentrations were also the exposure-point concentrations for the purposes of the SLRA. However, it is unlikely that a residential receptor would be exposed to subsurface soil. Hence, this assumption introduces a highly conservative bias into the risk assessment.

4.5.2.3 Selection of Hypothetical Receptors and Potential Exposure Pathways

As previously noted, the selection of a residential receptor being exposed to subsurface soil introduces a highly conservative bias into the risk assessment.

4.5.2.4 Risk Characterization

The primary goal of this assessment was to conduct a screening level assessment. Therefore, conservative biases exist at every phase of this assessment. These biases are additive, resulting in overly conservative risk, or HQ, estimates.

This effort to identify potential uncertainties associated with each step of the risk assessment is not intended to discredit the calculated results, but to point out that risks are calculated for hypothetical receptors under a definite, strict method. Refinements of sampling plans, analytical techniques, data statistical evaluation, exposure assessment models and parameters, hazard evaluation, dose-response assessment, and risk characterization could reduce these uncertainties.

4.6 Risk Conclusions

No COPC were selected at LF-26, SS-31, and ST-25; the screening level target cancer risks at WP-27, SS-29, and the munitions incinerator are within the acceptable risk range (10^{-6} to 10^{-4}). In addition, no COPC were selected based on noncancer residential PRGs. Thus, it can be concluded that the sites at OU-5 pose no unacceptable risk or hazard to human health or the environment.

5.0 Description of No-Action Alternative

The no-action alternative requires no further action at any of the OU-5 sites. With the implementation of the OU-5 action memorandum, the soil with COPC identified at the sites included in OU-5 were excavated and removed from the sites. Postremoval sampling results confirmed that all constituents in soils at OU-5 sites are at levels that do not pose any unacceptable risk or hazard to human health or the environment, as substantiated in Section 2.2.2 and Chapter 4.0. Therefore, no action is the only reasonable alternative.

6.0 Documentation of Significant Changes

This section documents the reasons for any significant changes to the selected remedy after receiving public comments on this document.

The public comment period for cleanup of soils at OU-5 was held from December 20, 1996 to January 20, 1997. No written comments were received and there were no changes resulting from the public comment period.

7.0 Responsiveness Summary

7.1 Overview

The USAF published the proposed plan for a no-action alternative for OU-5, Williams AFB in December 1996; the public comment period began December 20, 1996 and extended through January 20, 1997. A public meeting was held at the Williams Gateway Airport, Building 1, 601 South Power Road in Mesa, Arizona to present the plan to the public on January 7, 1997. The ROD recommends a no-action alternative for all OU-5 sites because there is no contaminant at the sites that poses a unacceptable risk to human health and the environment.

The public meeting held on January 7, 1997 was attended by all members of the RAB and two members of the public. There were few comments and no written questions received.

7.2 Background on Community Involvement

To date, the level of community interest and concern regarding the groundwater and soil contamination at OU-5 in particular and environmental cleanup in general at Williams AFB can be characterized as extremely low. In contrast, Base reuse issues have sparked great interest, which in turn have created an indirect interest on what effect, if any, the environmental contamination at the Base will have on future use or transfer of Base property.

The RAB has been briefed on the progress of environmental investigation all OUs and the selected remedy identified in the ROD for OU-5. A notice was placed in the *Tribune* announcing to the public that the proposed plan had been placed in the information repository at the Gilbert Public Library and that there was an opportunity to offer input during the 30-day comment period. A fact sheet describing the no-action remedy for cleanup of OU-5 was also placed in the information repository and distributed at the public meeting. The notice announcing the public comment period and the availability of the proposed plan for review contained the time, location, and subject matter of the public meeting.

7.3 Summary of Comments Received During the Public Comment Period and Air Force Responses

The public comment period on the proposed plan for cleanup of soils at OU-5 was held from December 20, 1996 through January 20, 1997. No written comments were received.

7.4 Community Relations Activities at Williams Air Force Base

Community relations activities at Williams AFB have been guided by a written community relations plan. Design of the site-specific community relations plan was guided by the level and types of concern expressed by local community members in one-on-one interviews conducted in November 1989.

An information repository containing correspondence, fact sheets, and other pertinent documents, such as the community relations plan, has been established and is currently maintained at the Gilbert Public Library, 665 North Gilbert Road, No. 152, Gilbert, Arizona 85234, (602) 892-3141.

A Technical Review Committee (TRC) provided review and comment on actions and proposed actions with respect to releases and threatened releases of hazardous substances at Williams AFB until it was replaced by the RAB in February, 1994. The purpose of the RAB (and the TRC before it) is to serve as an advisory committee to the USAF on the IRP at Williams AFB. The RAB, whose expanded membership includes representatives of the USAF, State of Arizona and federal regulatory agencies, and community stakeholders, meets quarterly to discuss the results of the field investigations and to discuss proposals for interim or final cleanup actions. In addition to IRP issues, the RAB covers Base reuse topics.

Ten fact sheets have been written and distributed that describe planned, ongoing, and completed activities under the IRP at Williams AFB. Six were information updates on progress of environmental investigation. Four others described the proposed plans for cleanup of OU-1, OU-2, OU-3, and OU-5.

A 35-millimeter slide presentation describing the IRP was developed for the Base Commander's use with community and civic groups. Before the training wing was de-activated, the Commander or his designee briefed numerous groups about environmental activities at Williams AFB.

News releases and public notices have been submitted to the local papers announcing milestones in the IRP. Topics include:

- Signing of the FFA

- Availability for comment on engineering evaluation/cost analyses for the Radioactive Instrumentation Burial Area, the Fire Protection Training Area No. 1, and the Pesticide Burial Area

- Availability of the OU-1, OU-2, OU-3, and OU-5 RI reports for review

- Availability of the OU-1, OU-2, OU-3, and OU-5 proposed plans for public comment

- Announcement of public meeting to present the proposed plans for OU-1, OU-2, OU-3, and OU-5.

Fact sheets describing the proposed plans to clean up OU-1 and OU-2 were mailed to the mailing list contained in the community relations plan, along with the announcement of the public comment period and the public meeting. The broadcast media also received a public service announcement giving the time and location of the public meeting. Notices in the *Arizona Republic/Phoenix Gazette* announced the public comment periods for OU-1 and OU-2. The *Tribune* carried notices for the public comment period for the OU-3 and OU-5 proposed plans.

Four public meetings have been held at the Mesa Conference Center Complex as part of the community relations program at Williams AFB. Fifty to 75 citizens attended the first meeting held on June 16, 1992 to present the proposed plan for cleanup of OU-2, and less than 20 citizens attended the second and third public meetings held October 14, 1993 and February 10, 1994 to present the proposed plan for cleanup of OU-1. Less than a half dozen bona fide community members attended the public meeting held on July 18, 1995 to present the proposed plan for OU-3. RAB members and two persons, one representing the State of Arizona and one representing the Gila River Indian Community, attended the OU-5 public meeting.

At each public meeting, attendees were given an agenda, a fact sheet, and graphic representations of cleanup alternatives as handouts. Copies of the FSs and proposed plans were available at each public meeting for review. Press packets, including the handouts, hard copies of slides, and the news releases, were available for media representatives who attended the first four meetings. The presentation materials were provided all attendees of the OU-5 meeting.

8.0 References

AeroVironment, Inc. (AV), 1986, ***Installation Restoration Program, Phase II Confirmation/Quantification, Stage 1 Report***, Williams AFB, AeroVironment Report AF-FR-84/593, January 1986.

AeroVironment, Inc. (AV), 1987, ***Installation Restoration Program, Phase II Confirmation/Quantification, Stage 2 Report***, Williams AFB, AeroVironment Report AV-FR-87/536.

Alloway, B. J., 1990, ***Heavy Metals in Soils***, John Wiley & Sons, New Jersey, 339 pp.

Cost Branch Controller Division, 1987, ***Community Economic Impact Statement***, 82nd Flying Training Wing.

Engineering-Science, Inc. (ES), 1984, ***Installation Restoration Program, Phase I - Records Search, Williams AFB, Arizona***, February 1984.

Gschwend, P. M. and R. A. Hites, 1981, "Fluxes of Polycyclic Aromatic Hydrocarbons to Marine and Lacustrine Sediments in the Northeastern United States," ***Geochim. Cosmochim. Acta***, 45:2359-67.

IT Corporation (IT), 1996, ***Final Remedial Investigation Report, Operable Unit 5 (OU-5), Williams Air Force Base***, prepared for Air Force Center for Environmental Excellence, HSC/PKCVCB Headquarters Human Systems Center (AFMC), Brooks Air Force Base, Texas, May 1996.

IT Corporation (IT), 1995a, ***Final Action Memorandum, Operable Unit 5 (OU-5), Williams Air Force Base, Arizona***, prepared for AFBCA, Williams Air Force Base, June 1995.

IT Corporation (IT), 1995b, ***Final Field Sampling Plan, Operable Unit 5 (OU-5), Williams Air Force Base, Arizona***, prepared for Air Force Center for Environmental Excellence, HSC/PKCVCB Headquarters Human Systems Center (AFMC), Brooks Air Force Base, Texas, June 1995.

IT Corporation (IT), 1995c, ***Final Report, Installation of Permeable Cap, Landfill LF-04, Williams Air Force Base, Arizona***, prepared for Air Force Center for Environmental Excellence, HSC/PKCVCB Headquarters Human Systems Center (AFMC), Brooks Air Force Base, Texas, October 1995.

IT Corporation (IT), 1994a, ***Final Remedial Investigation Report, Operable Unit 3, Williams Air Force Base, Arizona***, prepared for Air Force Base Conversion Agency, Williams Air Force Base, Arizona, by IT Corporation, September 1994.

IT Corporation (IT), 1994b, ***Final Remedial Investigation Report Addendum, Operable Unit 1, Williams Air Force Base, Arizona***, prepared for Air Force Base Conversion Agency, Williams Air Force Base, Arizona, January 1994.

IT Corporation (IT), 1994c, ***Final Evaluation/Assessment Report, Williams Air Force Base, Arizona***, prepared for Air Force Base Conversion Agency, September 1994.

IT Corporation (IT), 1994d, ***Final Remedial Investigation Report Addendum, Operable Unit 1, Williams Air Force Base, Arizona***, prepared for Air Force Base Conversion Agency, Williams Air Force Base, Arizona, January 1994.

IT Corporation (IT), 1993a, ***Final Facilities Assessment Report, Williams Air Force Base, Arizona***, prepared for USAF Air Training Command, Randolph Air Force Base, Texas, March 1993.

IT Corporation (IT), 1993b, ***Final Field Sampling Plan Addendum, Operable Unit 3, Williams AFB, Arizona***, prepared for the USAF Air Training Command, Randolph Air Force Base, Texas, August 1993.

IT Corporation (IT), 1993c, ***Final Work Plan Addendum, Operable Unit 1, Williams AFB, Arizona***, prepared for the USAF Air Training Command, Randolph Air Force Base, Texas, August 1993.

IT Corporation (IT), 1992a, ***Final Remedial Investigation Report, Operable Unit 1, Williams AFB, Arizona***, prepared for the USAF Air Training Command, Randolph Air Force Base, Texas, October 1992.

IT Corporation (IT), 1992b, ***Final Remedial Investigation Report, Liquid Fuels Storage Area - Operable Unit 2, Williams Air Force Base, Arizona***, prepared for the USAF Air Training Command, Randolph Air Force Base, Texas, January 1992.

IT Corporation (IT), 1992c, ***Final Feasibility Study Report, Operable Unit 2, Williams AFB, Arizona***, prepared for the USAF Air Training Command, Randolph Air Force Base, Texas, April 1992.

IT Corporation (IT), 1992d, ***Final Record of Decision Report, Operable Unit 2, Williams AFB, Arizona***, prepared for the USAF Air Training Command, Randolph Air Force Base, Texas, December 1992.

IT Corporation (IT), 1991a, ***Williams Air Force Base Final Work Plan and Quality Assurance Project Plan***, prepared for the USAF Air Training Command, Randolph Air Force Base, Texas, February 1991.

IT Corporation (IT), 1991b, ***Williams Air Force Base Final Field Sampling Plan***, prepared for the USAF Air Training Command, Randolph Air Force Base, Texas, April 1991.

IT Corporation (IT), 1991c, ***Williams Air Force Base Final Community Relations Plan***, prepared for the USAF Air Training Command, Randolph AFB, Texas, by IT Corporation.

IT Corporation (IT), 1987a, ***Task Report No. 4, Remedial Action Report for the Southwest Drainage System, Williams AFB, Arizona***, prepared for the USAF Air Training Command, Randolph Air Force Base, Texas, June 10, 1987.

IT Corporation (IT), 1987b, ***Plans and Specifications for Remediation of the Southwest Drainage System Ditch, Williams AFB, Arizona***, prepared for the USAF Air Training Command, Randolph Air Force Base, Texas, September 18, 1987.

Kawamura, K. and I. R. Kaplan, 1983, "Organic Compounds in the Rainwater of Los Angeles," ***Environ. Sci. Technol.***, 17:497-501.

LaFlamme, R. E. and R. A. Hites, 1978, "The Global Distribution of Polycyclic Aromatic Hydrocarbons in Recent Sediments," ***Geochimica et Cosmochimica Acta***, 42:289-303.

Laney, R. L. and M. E. Hahn, 1986, "Hydrogeology of the Eastern Part of the Salt River Valley Area, Maricopa and Pinard Counties, Arizona," ***U.S. Geological Survey, Water Resources Investigations Report***, pp. 86-4147.

National Oceanic and Atmospheric Administration, 1977, ***Climatic Atlas of the United States***, National Climatic Center, Asheville, North Carolina.

Shuman, L. M., 1991, "Chemical Forms of Micronutrients in Soils," J. J. Montvedt (ed.). ***Micronutrients in Agriculture***, Soil Sci. Soc. Amer. Book Series No. 4, Soil Sci. Soc. Amer., Inc., Madison, Wisconsin.

Sunregion Associates, 1987, ***Maricopa Land Use Plan, Ocean Creek and East Mesa, Subarea A2.***

Thomas, W., 1986, Accumulation of Airborne Trace Pollutants by Arctic Plants and Soil, ***Water Sci. Technol.***, 18:47-57.

U.S. Department of Housing and Urban Development, 1979, ***Firm Flood Insurance Rate Map, Maricopa County, Arizona, Unincorporated Areas: Community, Panel No. 040037 1600A.***

U.S. Environmental Protection Agency (EPA), 1995, ***Region IX Preliminary Remediation Goals (PRGs) First Half 1995***, EPA Region IX, San Francisco, California, February 1, 1995.

U.S. Environmental Protection Agency (EPA), 1992, "Guidance on Risk Characterization for Risk Managers and Risk Assessors," Memorandum from F. Henry Habicht II, Deputy Administrator, to Assistant Administrators, Regional Administrators, February 26.

U.S. Environmental Protection Agency (EPA), 1990, ***National Oil and Hazardous Substances Pollution Contingency Plan***, Final Rule, FR Vol. 55, No. 46, March 8, 1990, available from U.S. Government Printing Office, Washington, DC.

U.S. Environmental Protection Agency (EPA), 1989, ***Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A, Interim Final***, EPA/540/1-89/002, EPA, Office of Emergency and Remedial Response, Washington, DC.

U.S. Environmental Protection Agency (EPA), 1988a, ***Laboratory Data Validation: Functional Guidelines for Evaluating Inorganics Analysis***, Office of Emergency and Remedial Response, Washington, DC.

U.S. Environmental Protection Agency (EPA), 1988b, ***Laboratory Data Validation: Functional Guidelines for Evaluating Organics Analysis***, Office of Emergency and Remedial Response, Washington, DC.