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FINAL SUMMARY OF REMEDIATION PROJECTS AT AIR FORCE PLANT 4 VOLUME 2 OF 2
NAS FORT WORTH TX
7/1/1994
ENVIRONMENTAL SCIENCE AND ENGINEERING



**NAVAL AIR STATION
FORT WORTH JRB
CARSWELL FIELD
TEXAS**

**ADMINISTRATIVE RECORD
COVER SHEET**

AR File Number 235

FINAL REPORT

Summary of Remediation Projects at Air Force Plant 4 and Carswell Air Force Base

Volume II

Prepared for:

U.S. Army Engineer District
Ft. Worth, Texas

July 1994

Prepared by:



Environmental
Science &
Engineering, Inc.

TABLE OF CONTENTS

VOLUME II

<u>Title</u>	<u>Page</u>
<u>APPENDIX A--REPORT SUMMARIES, AFP4</u>	
Specifications for Waste Disposal Project-West Parking Lot	A.1-1
Assessment of French Drain Pumpage	A.2-1
Three-Site RAP Review Action Items, Attachments A, B, and C	A.3-1
Draft Remedial Action Plan and Conceptual Documents for Fuel Saturation Areas No. 1 and 3	A.4-1
Draft Construction Site Assessment Report for the Die Yard Zone	A.5-1
Evaluation of Condenser Water Pipeline and Interim Remedial Measures, Fuel Saturation Area No. 3	A.6-1
Engineering Report, Remedial Action for Fuel Saturation Areas No. 1 and 3 and Treating Leachate of French Drain No. 1	A.7-1
Preliminary Assessment/Site Inspection and RI/FS Waste Management Plan	A.8-1
Alternatives for East Plume Groundwater Remediation	A.9-1
Draft Contract Quality Control Plan Addendum, Groundwater Remediation of Window Area	A.10-1
Groundwater Remediation of Window Area--50 Percent Design Package	A.11-1
Design Plan for Subsurface Barrier Wall at Landfill No. 3	A.12-1
Final Feasibility Study	A.13-1
East Parking Lot, Installation of Groundwater System	A.14-1
Groundwater Remediation of Window Area - 100% Design Package	A.15-1
Pre-Construction Field Test Results VEP Well Field, Landfill 3	A.16-1
Draft Soil Vapor Extraction Pilot Plant Study, Building 181	A.17-1

TABLE OF CONTENTS
(Continued, Page 2 of 2)

VOLUME II

<u>Title</u>	<u>Page</u>
<u>APPENDIX B--REPORT SUMMARIES, CAFB</u>	
Decision Paper - Site 12	B.1-1
Decision Paper - Weapons Storage Area	B.2-1
Draft Interim Investigation/Remediation Plan - Waste Burial Area	B.3-1
Draft Feasibility Study for the East Area	B.4-1
Summary of Permit Sites	B.5-1
90% Plans and Specifications - Site 12	B.6-1
90% Design Cost Estimate - Site 12	B.7-1
90% Plans and Specifications - Site SD10	B.8-1
90% Design Cost Estimates - Site SD10	B.9-1
Preliminary Remedial Action Plans - SWMUs 16, 22, 23, 24, 32, 35, 36, 61, and 68	B.10-1
Final Feasibility Study for the Flightline Area	B.11-1
Investigation/Remediation Plans - SWMUs 16, 32, 35, 36, and 61	B.12-1
Management Action Plan	B.13-1
POTW Discharge Permit	B.14-1

APPENDIX A--REPORT SUMMARIES, AFP4

TITLE: Specifications for Waste Disposal Project-West Parking Lot
AUTHOR: General Dynamics
DOCUMENT NUMBER: 01006
CATEGORY: 01.04
SUBMITTED: June 1983

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this report was to inform potential contractors of a formal bid invitation for excavation and disposal of approximately 10,700 cubic yards (yd³) of Class I Hazardous Industrial Waste from the West Parking Lot (Figure A.1-1) of U.S. Air Force (USAF) Plant No. 4 (Plant 4).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

Plant 4 is an aircraft manufacturing facility located in Tarrant County, Texas, 7 miles northwest of the city of Fort Worth. The facility has been in operation since 1942 and currently produces F-16 aircraft, radar units, and various aircraft and missile components.

Historically, the manufacturing processes at Plant 4 have generated an estimated 5,500 to 6,000 tons of waste oils, solvents, paint residues, and spent process chemicals per year. These wastes were disposed onsite by burial in landfills, burning, or discharge into pits or the sanitary sewer system. A waste treatment plant was constructed in the early 1970s to treat the process chemical solutions, rinse waters, and other waste waters, and solvents. Some wastes, such as paint residues and process cyanide solutions, were later disposed of offsite by a contractor, while waste oils and fuels continued to be disposed in onsite landfills or burned in fire training exercises. During the late 1970s, the burning of fuels for fire training was phased out and all waste oils and recoverable solvents have since been disposed offsite by a contractor. Currently, through waste

minimization techniques, the offsite disposal of wastes is less than 2,500 tons per year.

2.2 PREVIOUS INVESTIGATION RESULTS

Potential contamination at Plant 4 was first noticed by a private citizen in September 1982. General Dynamics (GD) was notified and took immediate action. The source of the observed contamination was thought to be leachate from a landfill. In October 1982, GD began construction of French Drain Number 1 to prevent migration of contaminated groundwater toward Meandering Road Creek and divert the flow of surface water from the outfall where the contamination was first noticed.

In November 1982, Hargis & Associates, Inc. drilled approximately 260 soil borings, of which approximately 160 were constructed as monitor wells. Results of these investigations are contained within several reports (Hargis & Montgomery 1983; Hargis & Associates 1985a, 1985b, 1985c, 1987a, 1987b, 1988a, 1988b).

A Technical Review Committee (TRC) for Plant 4 was established in 1983. The TRC consists of representatives from the U.S. Environmental Protection Agency (EPA) Region VI, the Texas Natural Resource Conservation Commission (TNRCC), formerly the Texas Water Commission (TWC); the city of Fort Worth; the city of White Settlement; USAF; the U.S. Army Corps of Engineers (USACE); and GD. Periodic TRC meetings have been held since 1983 to keep the local authorities and the community informed of remedial investigations (RIs) at Plant 4.

2.3 PROJECT ACCOMPLISHMENTS

Based on the previous investigations results, approximately 10,700 (yd³) of soil was contaminated at the West Parking Lot. This report did not present any prior

investigation results of the contaminated soils or the extent of contamination at the West Parking Lot.

The detailed the formal bid process pertaining to the excavation and offsite disposal of the contaminated soil from the West Parking Lot was presented in this report; specifically, the job description, quality assurance, job conditions, and earthwork, etc.

The report also specifies the following qualifications for the contractors: the contractor shall be a specialist in the field of contaminated waste handling and disposal and shall have the personnel, skill, and organization to provide efficient and effective completion of the work. Also, the contractor's responsibility shall include scheduling and coordinating all work with a minimum of delay. The work to be done consists of furnishing all labor, supervision, materials (unless specified as owner-furnished), equipment, tools, appliances, and services necessary for the work.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

Detailed information on the bid qualifications for the excavation and offsite disposal of the contaminated soil from the West Parking Lot was developed as a result of this project.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional studies at the site.

5.0 PROJECTS RESULTING FROM THE PROJECT

A remedial project was implemented at the West Parking Lot in 1983.

6.0 STATUS OF THE PROJECT

In 1983, remedial actions were conducted at the West Parking Lot and approximately 10,700 yd³ of contaminated soil was excavated and disposed offsite. (Hargis, 1985).

7.0 SCHEDULE

The project was completed in 1983.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No data from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

No discrepancies between project reports were observed.

TITLE: Assessment of French Drain Pumpage
AUTHOR: Hargis & Associates, Inc.
DOCUMENT NUMBER: 01021
CATEGORY: 01.04
SUBMITTED: December 1985

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to assess the changes in groundwater chemical quality in the vicinity of the West Parking Lot to groundwater pumpage from the French drains.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

Historical waste disposal practices at U.S. Air Force (USAF) Plant No. 4 (Plant 4) have included the disposal of a variety of chemical wastes in pits and landfills beneath the West Parking Lot (Figure A.2-1). Landfill No. 1 was used to for disposal of much of the facility's wastes from 1942 until about 1966. Solvents, thinners, paints, waste fuel, and oil were disposed of at this site. The primary site in this area is referred to as the waste oil pits. Additional landfills are present west of Bomber Road (CH₂M Hill, 1984, Hargis & Associates, Inc., 1985).

In September 1982, the Fort Worth Water Department was anonymously notified of odors coming from a stormwater outfall adjacent to the west property boundary of Plant 4. Groundwater was apparently seeping into the joints of a buried 36-inch stormwater drainage pipe that connected two stormwater inlets and ultimately discharged into Meandering Road Creek. This buried pipe has been referred to as the Stormwater No. 5 outfall (St. 5 outfall) and runs parallel to the western boundary of the parking lot, between the lot and Meandering Road (CH₂M Hill, 1984). Analyses of water samples subsequently collected from the outfall identified several contaminants, the most prevalent of which was

trichloroethene (TCE). General Dynamics (GD) personnel concluded that the immediate suspected source of contamination was infiltration from beneath the West Parking Lot.

2.2 PREVIOUS INVESTIGATION RESULTS

To prevent further infiltration into the St. 5 outfall system, GD installed a French drain system in November 1982. The system consists of a 90-foot (ft) length of perforated 4-inch drain pipe placed on bedrock east of the St. 5 outfall. During excavation, two 6-inch perforated pipes were also uncovered. These pipes were apparently installed in 1967 before the parking lot was graded for paving. The 6-inch pipes were also connected to the French Drain No. 1 system.

In 1983, additional remedial actions were conducted near the site of French Drain No. 1, within the area of Landfill No. 1. Because the main source of residual contamination was suspected to be the former waste oil pits, an area beneath the West Parking Lot was excavated to bedrock. Six 24-inch drainlines were placed in the bottom of this pit and connected to a collector box (CH₂M Hill, 1984). Prior to December 1984, French Drain No. 1 was excavated daily using a vacuum truck to reduce the amount of groundwater infiltration into the St. 5 outfall. A submersible electric pump in French Drain No. 2 was activated on December 20, 1984. Diversion of water to the cooling tower and sanitary sewer also began at this time.

2.3 PROJECT ACCOMPLISHMENTS

In this report, the changes in the groundwater chemical quality were assessed in the vicinity of West Parking Lot to groundwater pumpage from the French drains. Changes in groundwater chemical quality were detected as a result of groundwater pumpage from the French drains. In general, the concentrations of TCE and 1,2-dichloroethene have decreased due to groundwater pumpage. However, no clear relationship was established between the groundwater pumpage and the groundwater chemical quality.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

The estimated monthly pumpage from FD-2 (Figure A.2-2) and the resulting changes in groundwater quality as a result of pumpage (Figure A.2-3) were developed as a result of this project.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

Recommendations were made for the following additional studies at this site:

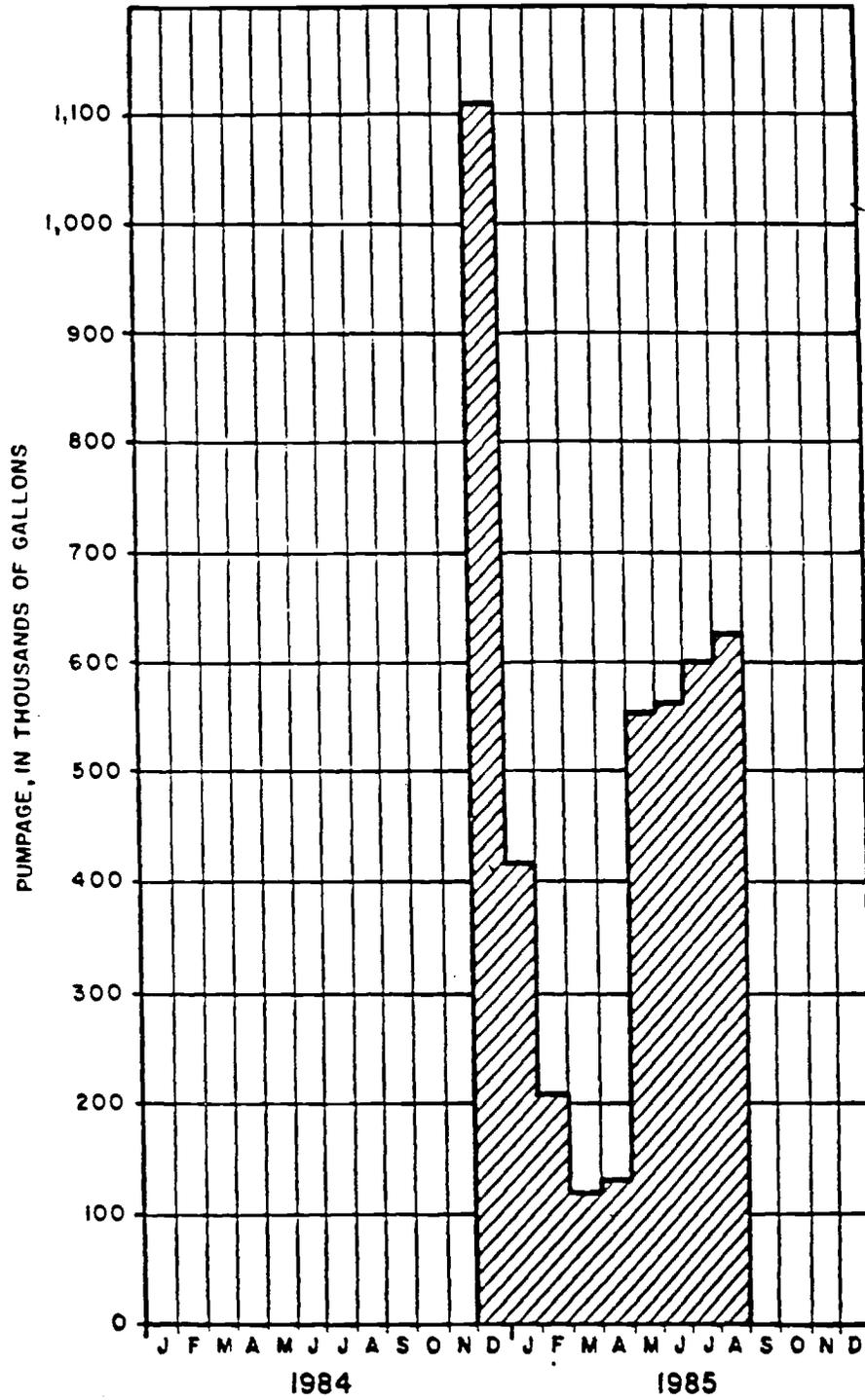
1. Measure the depth to water in all upper zone monitor wells in the vicinity of the French drains on a monthly basis and measure the VOCs,
2. Install continuous water level recorders to monitor water level fluctuations in the vicinity of French Drain No. 2,
3. Install a fourth water level recorder to monitor background water level fluctuations.
4. Analyze water samples collected directly from French Drain No. 1 to determine the feasibility of air stripping any detected contaminants. If air stripping is feasible, a submersible electric pump should be installed in French Drain No. 1, and the effluent should be routed into the existing treatment system.
5. Measure the pumpage from French Drain No. 1 and French Drain No. 2 separately with cumulating flow meters.

5.0 PROJECTS RESULTING FROM THE PROJECT

An engineering report was prepared for the treatment of leachate from FD-1 (HDR, 1989).

6.0 STATUS OF THE PROJECT

The project was not implemented.



Data provided by General Dynamics Corporation

Figure A.2-2 ESTIMATED MONTHLY PUMPAGE FROM FRENCH DRAIN NO. 2
SOURCES: HARGIS & ASSOCIATES, INC., 1985; ESE.

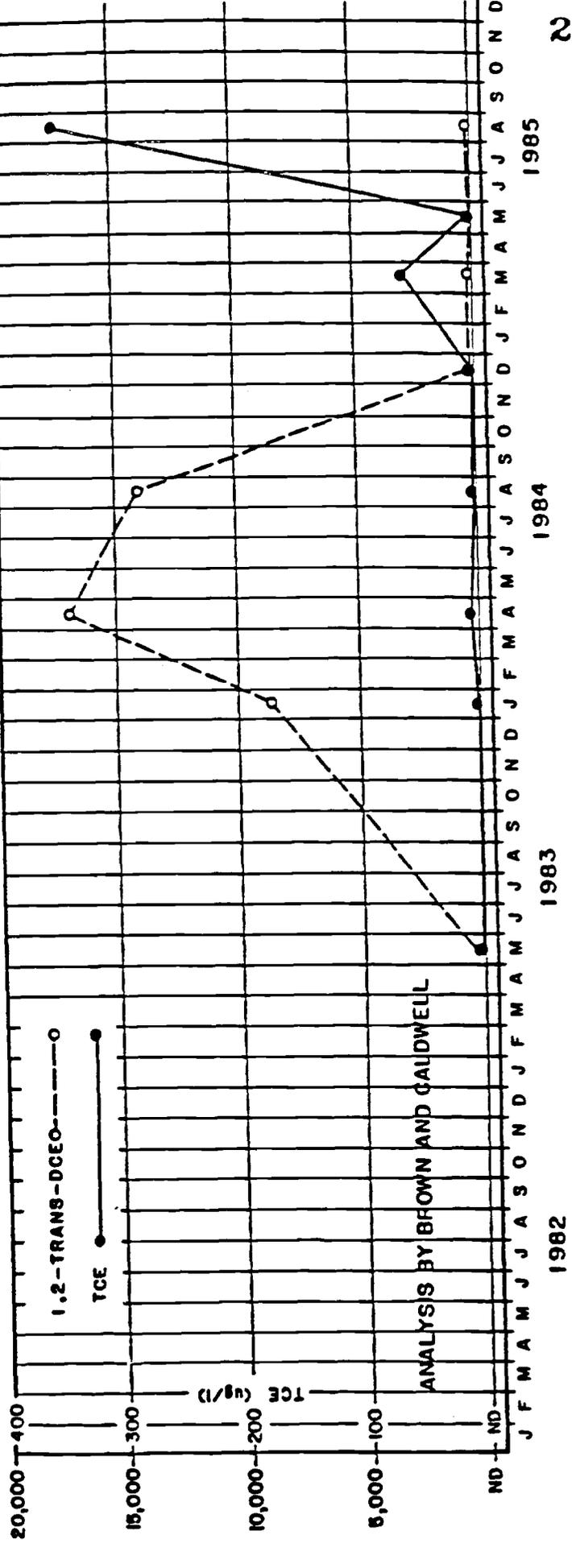
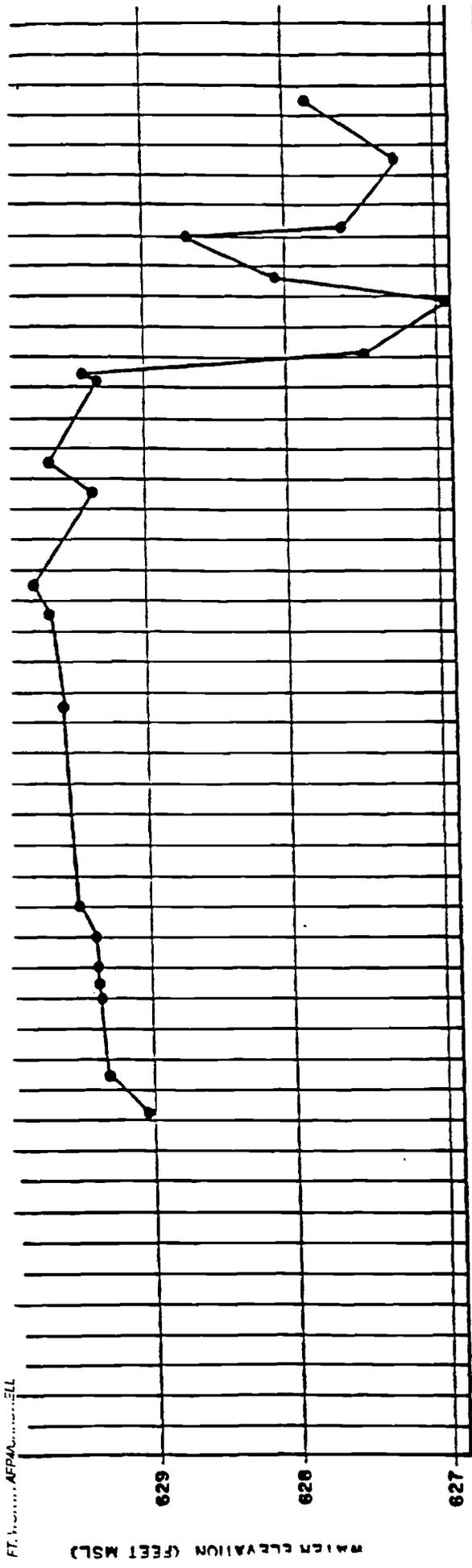


Figure A.2-3 WATER LEVEL AND WATER QUALITY HYDROGRAPH FOR MONITOR WELL HM-7

SOURCES: HARGIS & ASSOCIATES, INC., 1985; ESE.

7.0 SCHEDULE

Not available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No data from this project are in IRPIMS

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Three-Site RAP Review Action Items, Attachments A, B, and C
AUTHOR: Intellus Corporation
DOCUMENT NUMBER: 01024
CATEGORY: 01.03
SUBMITTED: July, 1986

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to present responses to the comments on the Three-Site Remedial Action Plan (RAP) document. The Three-Site RAP document is also referred as the Draft RAP and Conceptual Documents for Fuel Saturation Areas (FSAs) Nos. 1 and 3.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

Air Force Plant 4 (AFP4) has engaged in operations that may have resulted in potential releases of toxic or hazardous materials to the environment. This problem was recognized by the Department of Defense (DOD), and actions were taken to locate and identify past disposal sites and to eliminate the resultant potential contaminant hazards to public health in an environmentally responsible manner via the Installation Restoration Program (IRP). The IRP is a four-phase program that includes: Phase I - Problem Identification, Phase II - Confirmation, Phase III - Technology Development, and Phase IV - Planning and Implementation of Appropriate Control Measures.

2.2 PREVIOUS INVESTIGATION RESULTS

The IRP for AFP4 was initiated in March 1984 when CH2M Hill, Inc. conducted a Phase I Records Search. During the Phase I investigation, 21 sites were identified as requiring for further investigation. The 21 sites include industrial processing areas, fuel storage area, landfills, known chemical and fuel spills, chemical disposal pits, fire training areas, and the Assembly Building/Parts Plant.

In June 1985, the U.S. Army Corps of Engineers (USACE) worked to further delineate groundwater conditions along the southern base boundary and the East Parking Lot area of AFP4. USACE drilled 28 soil borings and constructed six monitor wells.

In September 1985, Radian Corporation (Radian) performed the Phase II, Stage I, Confirmation/Quantification of the IRP. Radian drilled 26 soil borings and constructed 14 groundwater monitor wells. A summary report of field investigations performed during the IRP Phase II, Stage 1 was prepared (Radian Corporation, 1987).

During Phase II investigations, 8 of the 21 sites [Former Fuel Storage Site, Landfill No. 2 (LF02), Landfill No. 4 (LF04), Fire Department Training Area 3 (FDTA 3), FDTA 4, Solvent Lines, Nuclear Aerospace Research Facility (NARF) Area, and Jet Engine Test Stand) were recommended for no further action. One site (FSA-2) has been recommended for further investigation, and the remaining 12 sites have been recommended for remediation. FSA-1 and FSA-3 are depicted in Figure A.3-1.

The results of the Phase II field investigations at FSA-1 and FSA-3 revealed the presence of trichloroethene (TCE) and benzene, toluene, ethyl benzene, and xylene (BTEX) compounds in the groundwater. The maximum concentrations detected for TCE and BTEX were 1,200; 27,000; 44,000; 42,000; and 29,500 micrograms per liter ($\mu\text{g/L}$), respectively (Table A.3-1). No information is available on the Phase III, the Technology Base Development work effort.

During the Phase IV-A investigation, a RAP was developed for the remediation of sites at FSA-1 and FSA-3 (Intellus, 1986). Air stripping followed by activated carbon adsorption was selected as the preferred treatment alternative at both FSA-1 and FSA-3.

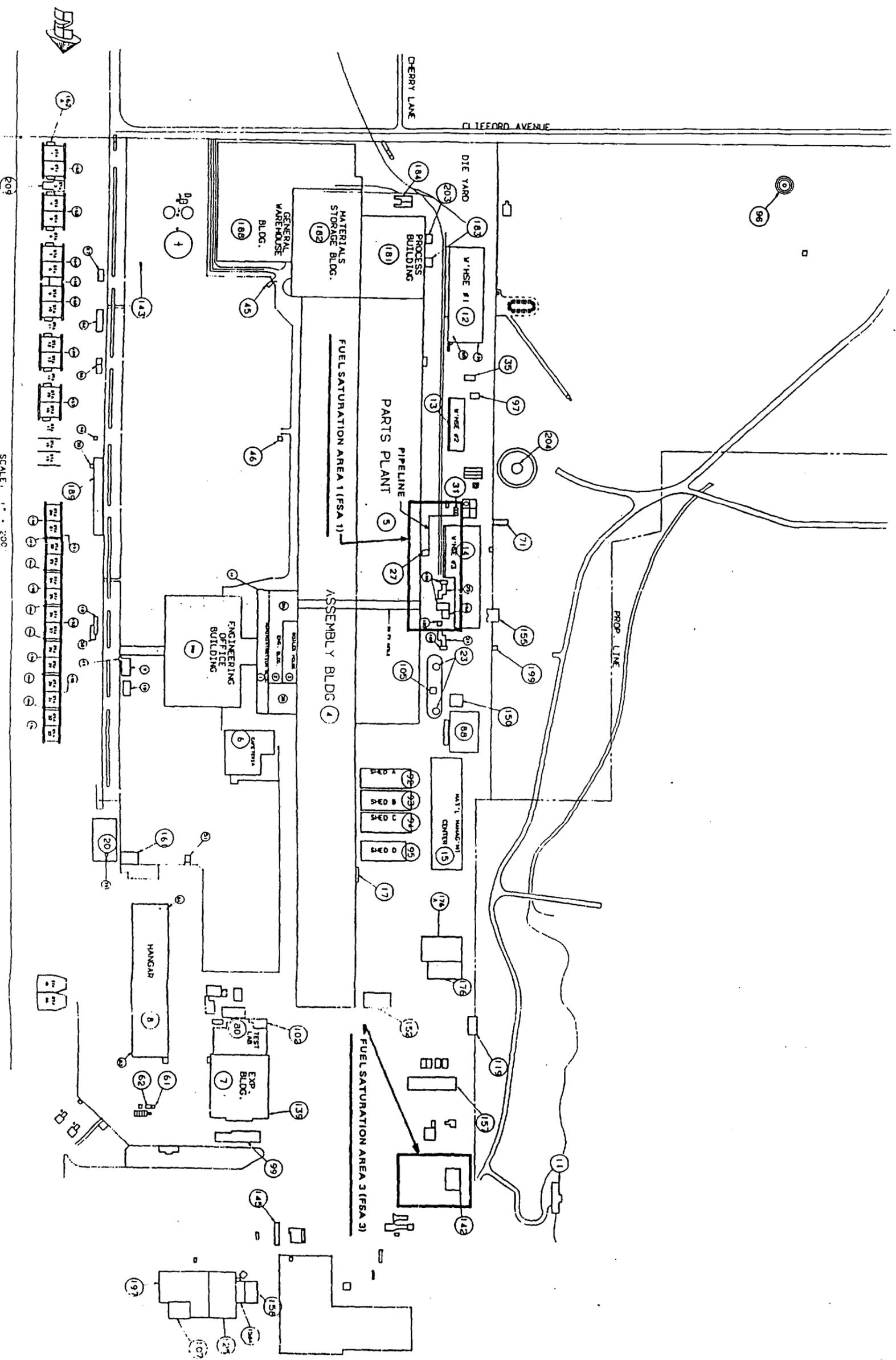


Figure A.3-1 FSA 1 AND FSA 3 LOCATION PLAN

SCALE: 1" = 200'

Table A.3-1. Summary of Contaminants Detected in HM and Intellus Wells at FSA 1 and FSA 3⁽¹⁾

Well No.	Date Sampled	Benzene	Toluene	Ethylbenzene	TCE	Tr DCE	VC	CHCl ₃	1,1 DCE	Chlorobenzene	1,1,1 TCA	Xylene	TOC	TPH
FSA 1 Wells														
HM-53	04/19/84	240	N.D.	48	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	08/04/84	25	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	12/12/84	160	12	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	03/23/85	160	N.D.	N.D.	15	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	03/27/85	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	10/10/85	220	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	01/10/86	77	N.D.	8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-55	03/07/84	N.D.	N.D.	N.D.	8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-55	12/11/85	N.D.	N.D.	N.D.	13	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-55	03/21/85	N.D.	N.D.	N.D.	14	2	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-55	08/26/86	N.D.	N.D.	N.D.	4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-55	01/10/86	N.D.	N.D.	N.D.	2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-62	08/07/84	N.D.	N.D.	N.D.	1200	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-62	12/10/84	N.D.	N.D.	N.D.	420	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-62	03/23/85	N.D.	N.D.	N.D.	170	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-62	06/30/85	N.D.	N.D.	N.D.	35	N.D.	N.D.	N.D.	N.D.	N.D.	5	N.A.	N.A.	N.A.
HM-62	10/10/85	N.D.	2	N.D.	14	N.D.	N.D.	N.D.	1	N.D.	11	N.A.	N.A.	N.A.
HM-62	01/09/86	N.D.	N.D.	N.D.	9	N.D.	N.D.	N.D.	N.D.	N.D.	4	N.A.	N.A.	N.A.
F-203	3/14/86	N.D.	5.1	N.D.	506	199	455	N.D.	14	N.A.	N.A.	64	4	N.D.
F-204	3/14/86	1650	650	1940	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	2920	28	2180
F-205	3/14/86	4310	7500	8800	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	20600	48.5	469
F-206	3/14/86	6050	7700	11700	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	29500	182	130
F-207	3/14/86	N.D.	N.D.	4.1	77	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	12	<1	23
F-211	3/14/86	N.D.	3.5	7.6	579	N.D.	N.D.	18	3.3	N.A.	N.A.	22	<1	237
FSA 3 Wells														
HM-78	02/15/85	27000	44000	42000	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-78	03/20/85	8100	1400	1200	500	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-78	07/01/85	5200	1200	1100	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-78	10/12/85	3800	380	650	120	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-78	01/10/86	2100	230	250	N.D.	N.D.	N.D.	N.D.	N.D.	390	N.D.	N.A.	N.A.	N.A.
F-200	3/14/86	N.D.	39	42	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	118	<1	N.D.
F-201	3/14/86	10500	3020	7700	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	17600	510	510
F-202	3/14/86	N.D.	13	494	11	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	96	11	34
F-208	3/14/86	N.D.	35	35	27	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	101	11.5	18
F-209	3/14/86	54	10	24	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	25	18	45
F-210	3/14/86	15	14	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	83	17	4

A.3-1
Notes:

- (1) Data assimilated from Hargis and Associates, Inc., and Intellus Site Investigation (Appendix I).
- (2) All units are in µg/l.
- (3) N.D. indicates that contaminant was not detected.
- (4) N.A. indicates that analysis did not include testing for the contaminant.
- (5) Refer to Appendix B for definition of other abbreviations.

Sources: Intellus, 1986; ESE.

2.3 PROJECT ACCOMPLISHMENTS

In this report, responses to the comments were presented on the draft RAP completed under the Phase IV-A investigation. The report included a cover letter and the following four attachments (Attachments A, B, C, and D):

- Calculations and design basis for selected conceptual design (Attachment A),
- Capital cost estimates for Alternatives 2, 3, and 4 (Attachment B),
- Present-worth analysis for Alternatives 1, 2, 3, and 4 (Attachment C), and
- Response to unresolved comments on the draft RAP (Attachment D).

The cost estimates for the remedial alternatives are presented in Table A.3-2.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

As a result of this project, design calculations and cost estimates were developed for the treatment alternatives at FSA-1 and FSA-3.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made in this report for additional site investigations at FSA-1 and FSA-3.

5.0 PROJECTS RESULTING FROM THE PROJECT

Based on the results of the Phase IV-A investigation and the selected alternative at FSA-1 and FSA-3, an intermediate remedial action was developed for the removal of free-product and the treatment of groundwater as part of Phase IV-B. This phase of work included preparation of an engineering report and design of a remedial action facility (HDR, 1989). In 1993, a draft-final Feasibility Study (FS) was prepared for the remediation of sites at AFP4, including FSA-1 and FSA-3 (RUST Geotech, Inc., 1993).

GENERAL DYNAMICS CORP.
FT. WORTH, TEXAS

INTELLUS CORPORATION
ENVIRONMENTAL SCI., ENGR. & CONSTR.
IRVINE, CALIFORNIA

Table A.3-2. Cost Estimates for the Remedial Alternatives

EFFECTIVE DATE OF RETURN 7.001 10.001 11.001
NUMBER OF PERIODS PER YEAR 2 2 2
ROUTINE DATE OF RETURN 6.00102 9.70102 12.00702

Jan-86 LHM

ALT. 1 - SITE MONITORING ONLY
NO CAPITAL INVESTMENT

DESCRIPTION	PROJECTED LIFE FOR ECONOMIC ANALYSIS - PERIODS GIVEN IN YEARS															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CAPITAL COSTS																
F.S.A. 1 AREA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F.S.A. 3 AREA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROCESS AREA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INTERCONNECTING FACILITIES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INDIRECTS/CONSTR. SUPP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INDICES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONTINGENCY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATING COSTS																
LABORATORY SAMPLING	10,091	11,312	0,993	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
REPORTING	69,636	37,700	20,903	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
LABOR TO COLLECT SAMPLES	24,810	10,054	16,911	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
TOTALS	89,305	67,874	51,905	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200

Table A.3-2. Cost Estimates for the Remedial Alternatives (Continued, Page 2 of 7)

DESCRIPTION	PROJECTED LIFE FOR ECONOMIC ANALYSIS - PERIODS SHOWN IN YEARS													
	17	18	19	20	21	22	23	24	25	26	27	28	29	30
CAPITAL COSTS														
P.S.A. 1 AREA	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
P.S.A. 3 AREA	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
PROJECTS AREA	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
INTERCONNECTING FACILITIES														
INSTRUMENTS/CONSTR. SUPT.														
TRUCKS														
CONTINGENCY														
FEES														
OPERATING COSTS														
LABORATORY SUPPLIES														
REPORTING														
LAND TO COLLECT SAMPLES														
TOTALS	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200

GENERAL DYNAMICS CORP.
P.O. BOX 100, TEXAS

INTELLING CORPORATION
ENVIRONMENTAL SCI., ENGR. & CONSTR.
IRVINE, CALIFORNIA

EFFECTIVE DATE OF RETURN
NUMBER OF PERIODS PER YEAR
MINIMAL RATE OF RETURN

Jan-86 LRM
ALT. 1 - SITE MONITORING ONLY
NO CAPITAL INVESTMENT

Table A.3-2. Cost Estimates for the Remedial Alternatives (Continued, Page 3 of 7)

GENERAL DYNAMICS CORP.
 FT. WORTH, TEXAS

INTELLIG CORPORATION
 ENVIRONMENTAL SCI., ENGR. & CONSTR.
 IRVINE, CALIFORNIA

Jan-86 LHM
 ALT. 2 - BIO-REMEDIATION PROCESS

EFFECTIVE DATE OF RETURN 7.001 10.001 13.001
 NUMBER OF PERIODS PER YEAR 2 2 2
 NOMINAL RATE OF RETURN 6.00148 9.75102 12.62772

DESCRIPTION	PROJECTED LIFE FOR ECONOMIC ANALYSIS - PERIODS SHOWN IN YEARS															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CAPITAL COSTS																
F.S.A. 1 AREA	111,482	100,636	105,732	119,340												
F.S.A. 3 AREA	228,131	221,909	216,010	244,100												
PROCESS AREA	90,541	88,091	85,732	96,990												
INTERCONNECTING FACILITIES	177,009	173,182	167,411	189,400												
INDIRECT/CONSTR. COSTS	239,241	229,273	218,319	246,700												
TOTALS	15,421	15,000	14,667	16,300												
CONTINGENCY	83,377	81,000	80,796	91,340												
FEES	44,914	43,434	44,423	50,200												
	0	0	0	0												
	0	0	0	0												
	0	0	0	0												
OPERATING COSTS																
SAMPLING & ANALYSIS	125,983	117,410	109,470													
NUTRIENTS & CHEMICALS	303,829	320,110	333,229													
INSTRUMENTAL ON-SITE ASSISTANCE	215,243	226,077	206,523													
BIOMONITORING	92,819	76,872	71,529													
OPERATIONS AND MAINT. LABOR	102,029	91,048	86,920													
OPERATIONS UTILITIES	3,006	3,426	3,013													
	0	0	0													
TOTALS	11,931,415	11,834,478	11,748,537	11,954,400	315,000	316,000	316,000	316,000	316,000	316,000	316,000	316,000	316,000	316,000	316,000	316,000

Table A.3-2. Cost Estimates for the Remedial Alternatives (Continued, Page 4 of 7)

DESCRIPTION	PROJECTED LIFE FOR ECONOMIC ANALYSIS - PERIODS SHOWN IN YEARS													
	17	18	19	20	21	22	23	24	25	26	27	28	29	30
CAPITAL COSTS														
F.O.A. 1 AREA														
F.O.A. 3 AREA														
PROCESS AREA														
INTERCONNECTING FACILITIES														
INDUSTRIAL/CONSTR. SPT.														
TARES														
CONTINGENCY														
FEE														
OPERATING COSTS														
SAMPLING & ANALYSIS														
REAGENTS & CHEMICALS														
BIOLOGICAL ON-SITE ASSISTANCE														
BIOMONITORING														
OPERATIONS AND MAINT. LABOR														
UTILITIES														
TOTALS														

INTELLUS CORPORATION
 ENVIRONMENTAL SCI., ENGR. & CONSTR.
 IOWA, CALIFORNIA

Jan-86 LON
 ALT. 2 - BIO-REMEDIATION PROCESS

GENERAL DYNAMICS CORP.
 FT. WORTH, TEXAS

EFFECTIVE DATE OF RETURN
 NUMBER OF PERIODS PER YEAR
 NOMINAL DATE OF RETURN

Table A.3-2. Cost Estimates for the Remedial Alternatives (Continued, Page 5 of 7)

DESCRIPTION	PRESENT WORTH VALUE		PROJECTED LIFE FOR ECONOMIC ANALYSIS - PERIODS BEGINNING IN YEARS															
	7,000 EFF. PER	10,000 EFF. PER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CAPITAL COSTS																		
F.S.A. 1 AREA	104,075	103,182	100,442	113,300														
F.S.A. 2 AREA	125,327	121,909	118,473	134,100														
PROCESS AREA	72,817	70,436	68,761	77,700														
INTERCONNECTING FACILITIES	100,765	105,818	103,009	116,400														
LABORATORY/ADMIN. SUPT.	140,972	140,909	141,042	159,400														
TRUCKS	11,213	10,909	10,619	12,000														
CONTINGENCY	57,790	50,777	54,248	61,300														
FEES	31,495	30,636	29,823	33,700														
OPERATING COSTS																		
MATERIALS	0	0	0	0														
CARBON	177	143	150		72	72	72											
L.I.R. PHASE CARBON BED DRUMS WITH ACTIVATED CARBON	32,843	30,290	28,000		13,400	13,400	13,400											
CARBON BED MAT'L DISPOSAL	2,943	2,713	2,507		1,200	1,200	1,200											
GEN. OPERATIONS MATERIAL	2,451	2,241	2,090		1,000	1,000	1,000											
LABORATORY SUPPLIES	11,773	10,832	10,030		4,000	4,000	4,000											
OPERATIONS AND MAINT. LABOR	102,029	94,000	86,924		41,400	41,400	41,400											
OPERATIONS UTILITIES	5,006	5,026	5,015		2,000	2,000	2,000											
TOTALS	819,902	789,400	761,352	700,100	64,472	64,472	64,472	84,472										

GENERAL DYNAMICS CORP.
P.O. BOX 100, TEXAS

EFFECTIVE DATE OF RETURN: 7,000 10,000 13,000
NUMBER OF PERIODS PER YEAR: 2 2 2
INITIAL RATE OF RETURN: 6.80142 9.74102 12.46771

INTELLIGENT CORPORATION
ENVIRONMENTAL SCI., ENGR. & CONSTR.
IRVINE, CALIFORNIA
JAN-86 CDM
ALF. 3 - CHAMBERLAIN CLEANUP AND
RECONSTRUCTION

INTELLIG CORPORATION
 ENVIRONMENTAL SCI., CORP. & CONSTR.
 Irvine, California

Jan-84 LCM
 ALT. 4 - COMMUNITED CLEANUP FOR
 PROCESS USE

Table A.3-2. Cost Estimates for the Remedial Alternatives (Continued, Page 6 of 7)

7.002 10.002 13.002
 2 2 2
 0.00103 9.76192 12.40775

DESCRIPTION	PROJECTED LIFE CYCLE ECONOMIC ANALYSIS - PERIODS GIVEN IN YEARS																
	PRESENT WORTH VALUE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CAPITAL COSTS																	
F.S.A. 1 AREA	79,346	77,182	75,133	84,949													
F.S.A. 2 AREA	172,430	163,727	153,274	186,200													
PROCESS AREA	70,740	68,818	64,971	75,700													
INTERCONNECTING FACILITIES	56,822	53,273	51,805	66,000													
INDIRECTS/CONTR. IMP1.	99,873	92,091	89,446	101,200													
TAXES	10,200	10,000	9,735	11,000													
CONTINGENCY	68,411	67,091	65,841	51,000													
FEE	26,436	25,999	25,221	28,200													
OPERATING COSTS																	
MATERIALS	0	0	0														
CARTRIDGES	177	143	159														
LIN. PHASE CARBON BED DRINKS WITH ACTIVATED CARBON	32,843	30,295	29,000														
CARBON BED MTL'L DISPOSAL	2,943	2,713	2,297														
REC. OPERATIONS MATERIAL	2,453	2,261	2,090														
LABORATORY SUPPLIES	11,775	10,832	10,030														
OPERATIONS AND MAINT. LABOR	167,079	161,940	164,270														
OPERATIONS UTILITIES	5,006	5,026	5,015														
TOTALS	717,472	689,648	644,361	596,200	64,472	64,472	64,472	64,472	64,472	64,472	64,472	64,472	64,472	64,472	64,472	64,472	64,472

Table A.3-2. Cost Estimates for the Remedial Alternatives (Continued, Page 7 of 7)

GENERAL DYNAMICS CORP.
 P.O. BOX 100
 WORTH, TEXAS

EFFECTIVE DATE OF RETURN
 NUMBER OF PERIODS PER YEAR
 INITIAL DATE OF RETURN

DESCRIPTION	PROJECTED LIFE FOR ECONOMIC ANALYSIS - PERIODS SHOWN IN YEARS													
	17	18	19	20	21	22	23	24	25	26	27	28	29	30
CAPITAL COSTS														
F.A.A. 1 AREA														
F.A.A. 2 AREA														
PROCESS AREA														
INTERCONNECTING FACILITIES														
INDUSTRIAL/COMSTR. BLDG.														
PAVES														
CURTAINING														
FEE														
OPERATING COSTS														
MATERIALS														
CARBONICES														
L.I.G. PINK CARBON BED DRUMS WITH ACTIVATED CARBON CARBON BED MAT'L DISPOSAL														
DISC. OPERATIONS MATERIAL														
LABORATORY SAMPLING														
OPERATIONS AND MAINT. LABOR														
OPERATIONS UTILITIES														
TOTALS														

Jan-86 LBN
 ALT. 4 - ON-GOING WATER CLEANUP FOR
 PROCESS USE

ATTACH. C, SH. 1

Sources: Intellus, 1986; ESE. 8

6.0 PROJECT STATUS

No information is available on the implementation of the RAP at FSA-1 and FSA-3.

7.0 SCHEDULE

No schedule is available on implementation of this project.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN INSTALLATION RESTORATION PROGRAM INFORMATION MANAGEMENT SYSTEM (IRPIMS)

No data from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Draft Remedial Action Plan and Conceptual Documents
for Fuel Saturation Areas No. 1 and 3

AUTHOR: Intellus Corporation

DOCUMENT NUMBER: 01025

CATEGORY: 01.04

SUBMITTED: July 1986

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of the project was to prepare a remedial action plan (RAP) for Fuel Saturation Areas Nos. 1 and 3 (FSA-1 and FSA-3) at Air Force Plant 4 (AFP4). The plan includes selection of remedial actions that will minimize hazards to public health and the environment in a timely, cost effective, and environmentally responsive manner.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

AFP4 has engaged in operations that may have resulted in potential releases of toxic or hazardous materials to the environment. This problem was recognized by the U.S. Department of Defense (DOD), and actions were taken to locate and identify past disposal sites and to eliminate the resultant potential contaminant hazards to public health in an environmentally responsible manner via the Installation Restoration Program (IRP). The IRP is a four-phase program comprised of Phase I - Problem Identification, Phase II - Confirmation, Phase III - Technology Development, and Phase IV - Planning and Implementation of Appropriate Control Measures.

2.2 PREVIOUS INVESTIGATION RESULTS

The IRP for AFP4 was initiated in March 1984 when CH2M Hill, Inc. conducted a Phase I Records Search. During the Phase I investigation, 21 sites were identified to require for further investigation. The 21 sites include industrial

processing areas, fuel storage areas, landfills, known chemical and fuel spills, chemical disposal pits, fire training areas, and the Assembly Building/Parts Plant.

In June 1985, the U.S. Army Corps of Engineers (USACE) worked to further delineate groundwater conditions along the southern base boundary and the East Parking Lot area of AFP4. USACE drilled 28 soil borings and constructed 6 monitor wells.

In September 1985, Radian Corporation (Radian) performed the Phase II, Stage I, Confirmation/Quantification of the IRP. Radian drilled 26 soil borings and constructed 14 groundwater monitor wells. A summary report of field investigations performed during the IRP Phase II, Stage 1 was prepared by Radian (1987).

During Phase II investigations, 8 of the 21 sites [Former Fuel Storage Site, Landfill No. 2 (LF02), Landfill No. 4 (LF04), Fire Department Training Area 3 (FDTA 3), FDTA 4, Solvent Lines, Nuclear Aerospace Research Facility (NARF) Area, and Jet Engine Test Stand] were recommended for no further action. One site (FSA-2) has been recommended for further investigation, and the remaining 12 sites have been recommended for remediation. FSA-1 and FSA-3 are depicted in Figure 3.0-1.

The results of the Phase II field investigations at FSA-1 and FSA-3 revealed the presence of trichloroethene (TCE) and benzene, toluene, ethyl benzene, and xylene (BTEX) compounds in the groundwater. The maximum concentrations detected for TCE and BTEX were 1,200; 27,000; 44,000; 42,000; and 29,500 micrograms per liter ($\mu\text{g/L}$), respectively (Table A.4-1).

No information is available for Phase III (Technology Development) for FSA-1 and FSA-3.

Table A.4-1. Summary of Contaminants Detected in HM and Intellus Wells at FSA 1 and FSA 3⁽¹⁾

Well No.	Date Sampled	Benzene	Toluene	Ethylbenzene	TCE	Tr DCE	VC	CHCl ₃	1,1 DCE	Chlorobenzene	1,1,1 TCA	Xylene	TOC	TPH
FSA 1 Wells														
HM-53	04/19/84	240	N.D.	48	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	08/04/84	25	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	12/12/84	160	12	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	03/23/85	160	N.D.	N.D.	15	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	03/27/85	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	10/10/85	220	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-53	01/10/86	77	N.D.	8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-55	03/07/84	N.D.	N.D.	N.D.	8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-55	12/11/85	N.D.	N.D.	N.D.	13	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-55	03/21/85	N.D.	N.D.	N.D.	14	2	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-55	08/26/86	N.D.	N.D.	N.D.	4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-55	01/10/86	N.D.	N.D.	N.D.	2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-62	08/07/84	N.D.	N.D.	N.D.	1200	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-62	12/10/84	N.D.	N.D.	N.D.	420	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-62	03/23/85	N.D.	N.D.	N.D.	170	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-62	06/30/85	N.D.	N.D.	N.D.	35	N.D.	N.D.	N.D.	N.D.	N.D.	5	N.A.	N.A.	N.A.
HM-62	10/10/85	N.D.	2	N.D.	14	N.D.	N.D.	N.D.	1	N.D.	11	N.A.	N.A.	N.A.
HM-62	01/09/86	N.D.	N.D.	N.D.	9	N.D.	N.D.	N.D.	N.D.	N.D.	4	N.A.	N.A.	N.A.
F-203	3/14/86	N.D.	5.1	N.D.	506	199	455	N.D.	14	N.A.	N.A.	64	4	N.D.
F-204	3/14/86	1650	650	1940	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	2920	28	2180
F-205	3/14/86	4310	7500	8800	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	20600	48.5	469
F-206	3/14/86	6050	7700	11700	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	29500	182	130
F-207	3/14/86	N.D.	N.D.	4.1	77	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	12	<1	23
F-211	3/14/86	N.D.	3.5	7.6	579	N.D.	N.D.	18	3.3	N.A.	N.A.	22	<1	237
FSA 3 Wells														
HM-78	02/15/85	27000	44000	42000	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-78	03/20/85	8100	1400	1200	500	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-78	07/01/85	5200	1200	1100	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-78	10/12/85	3800	380	650	120	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.
HM-78	01/10/86	2100	230	250	N.D.	N.D.	N.D.	N.D.	N.D.	390	N.D.	N.A.	N.A.	N.A.
F-200	3/14/86	N.D.	39	42	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	118	<1	N.D.
F-201	3/14/86	10500	3020	7700	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	17600	510	510
F-202	3/14/86	N.D.	13	494	11	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	96	11	34
F-208	3/14/86	N.D.	35	35	27	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	101	11.5	18
F-209	3/14/86	54	10	24	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	25	18	45
F-210	3/14/86	15	14	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	83	17	4

Notes:

- (1) Data assimilated from Hargis and Associates, Inc., and Intellus Site Investigation (Appendix I).
- (2) All units are in µg/l.
- (3) N.D. indicates that contaminant was not detected.
- (4) N.A. indicates that analysis did not include testing for the contaminant.
- (5) Refer to Appendix B for definition of other abbreviations.

Sources: Intellus, 1986; ESE.

2.3 PROJECT ACCOMPLISHMENTS

The Phase IV work effort was divided into two stages, Phase IV-A and IV-B. This report was limited to the Phase IV-A work effort at FSA-1 and FSA-3.

Phase IV-A work was conducted in four stages: (1) screen control measures, (2) develop and evaluate detailed alternatives, (3) select preferred alternatives, and (4) describe preferred alternative. Figure A.4-3 portrays the methodology used to select the remedial alternatives.

In the first stage, the control measures were screened to address the fuel floating on the shallow groundwater and the dissolved organic constituents in the upper zone aquifer. The primary criteria used to evaluate the control measures were technical feasibility, cost, environmental impact, public health risk, and regulatory compliance. The screening matrix is shown in Table A.4-2.

The second stage work was conducted to develop and evaluate the alternatives that passed the initial level of screening. The four alternatives retained from preliminary screening were evaluated in detail for engineering feasibility, cost analysis, public health analysis, and environmental assessment and regulatory requirements. A narrative matrix for the alternatives is presented in Table A.4-3.

A preferred alternative was selected in Stage 3 for the remediation of groundwater at FSA-1 and FSA-3. The recovery system for FSA-1 groundwater consists of two extraction wells with submersible pumps, and the recovery system for FSA-3 consists of two French drains (interceptor trenches), sumps, and submersible pumps. The major components of the centralized treatment system in the selected alternative for FSA-1 consists of an oil/water separator and an air stripping followed by a liquid-phase granular activated carbon (GAC) unit. The effluent from the treatment system will be discharged to the AFP4 process makeup water. The treatment alternative was selected based on the following criteria:

FT. WORTH AFP/CARSWELL

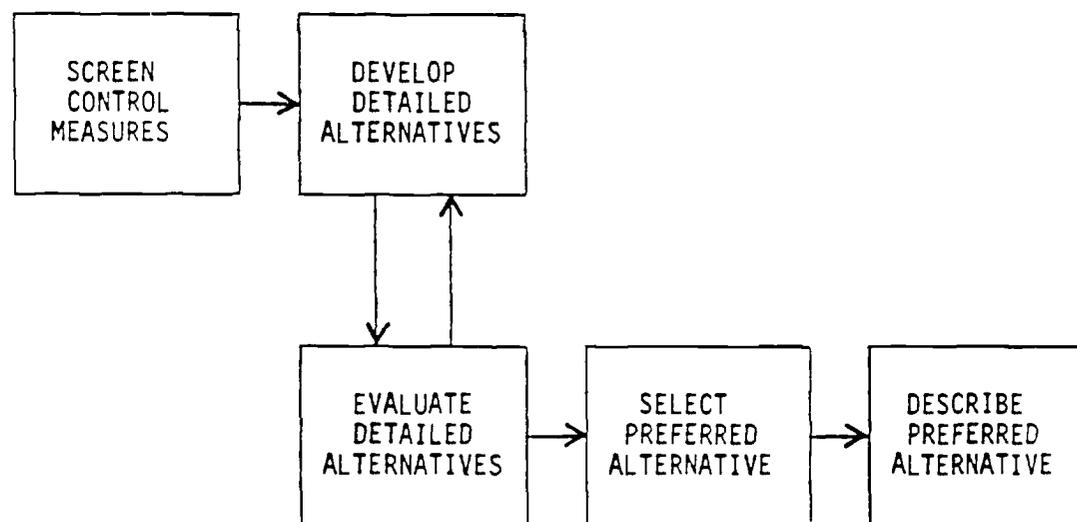


Figure A.4-3 PREPARATION OF REMEDIAL ACTION PLAN
SOURCES: INTELLUS, 1986; ESE.

Table A.4-2. Evaluation of Potential Remedial Action Alternatives at FSA 1 and FSA 3

Alternative	Cost	Technical Feasibility	Environmental Impact	Public Health Risk	Regulatory Compliance	Engineering Judgement	Retain Option
1. No Action - Monitoring and Site Maintenance	1	1	5	5	5	17 ⁽¹⁾	Yes
2. In-situ bioreclamation of soil and water	3	4	2	2	2	13	Yes
A. French drain/wells for contaminated groundwater collection							
B. Gravity separation of fuel and water							
C. Reinject water with microbes and nutrients, etc.							
D. Dispose of or reclaim fuel							
3. Onsite contaminated groundwater treatment/soil leaching	2	2	3	3	2	12	Yes
A. Use French drains/well for contaminated groundwater collection							
B. Gravity separation of fuel and water							
C. Treat water using air stripping and/or activated carbon							
D. Dispose of or reclaim fuel							
4. Offsite treatment of contaminated groundwater and no action on soil	4	1	4	4	3	16	No
A. Use French drains/wells for contaminated groundwater collection							
B. Transport contaminated water offsite to a commercial treatment and disposal facility							
5. In-situ soil bioreclamation and onsite contaminated groundwater treatment	4	3	2	2	2	13	Yes
A. Use French drains/wells for contaminated groundwater collection							
B. In-situ soil bioreclamation							
C. Physical treatment of water using:							
1. Gravity separation							
2. Air stripping and/or activated carbon							
D. Reuse of treated water by AFP No. 4							
E. Dispose of or reclaim fuel							
6. Onsite soil and groundwater incineration	5	4	2	2	2	15 ⁽²⁾	No
A. Excavate soil and incinerate							
B. Collect contaminated groundwater with French drains/wells and incinerate							

Notes:

- (1) Questionable regulatory approval for contaminant migration. Lowest cost option.
(2) Difficult and costly to excavate soil from under buildings. Incineration is costly and permitting will take a great deal of time.

Sources: Intellus, 1986; ESE.

Table A.4-3. Narrative Matrix for FSA 1 and FSA 3 Technical Evaluation of Alternatives

						PUBLIC
<u>ALTERNATIVE</u>	<u>CAPITAL COST</u>	<u>PRESENT WORTH</u>	<u>ENGINEERING FEASIBILITY</u>	<u>ENVIRONMENTAL IMPACT</u>	<u>HEALTH ANALYSIS</u>	<u>REGULATORY COMPLIANCE</u>
1. No Action - Site Monitoring/Maintenance	nil	\$ 68,000	Technically feasible; however, contaminant plume migration is not addressed.	Continued migration of contaminants; potential for plume to migrate offsite.	Does not provide short or long term Public Health Protection.	No new permits required. Potential Regulatory Enforcement Action, penalties and citizen suits.
2. In-Situ Bioreclamation of Soil and Groundwater	\$1,055,000	\$1,837,000	Bench-scale and onsite pilot-scale studies will be required to determine effectiveness. Geohydrological conditions will determine its effectiveness. Low permeability is the limiting factor for the rates of liquid extraction and reinjection at FSA 3.	Adverse impact may include: a. Vehicular and heavy equipment noise b. Volatilization of organic compounds c. Dust d. Spills onsite from tanks, pipes and related equipment e. Offsite transportation spills f. Reinjection may cause contaminant migration to undesired area.	Provides short and long term Public Health Protection by: intercepting and removing the contaminant plume; and if successful, biodegrading the residual contaminants.	The following permits may be required: a. TWC Class V Injection Well Permit. b. Texas Air Control Board Special Permit. Offsite disposition of fuel and water treatment by-products is required. Technology has not been proven to regulatory authorities.
3. Onsite Contaminated Groundwater Treatment and Reinjection for Water Leaching of Soil	\$708,000	\$789,000	Water treatment technology is proven. However, bench-scale study may be necessary to determine soluble organic removal efficiency. Low permeability is the limiting factor for rates of liquid extraction and reinjection at FSA 3.	Adverse impact may include: a. Vehicular and heavy equipment noise b. Volatilization of organic compounds c. Dust d. Spills onsite from tanks, pipes and related equipment e. Offsite transportation spills f. Reinjection may cause contaminant migration to undesired area.	Provides short and long term Public Health Protection by: intercepting and removing the contaminant plume; and leaching of the water soluble organics from the soil.	The following permits may be required: a. TWC Class V Injection Well Permit. b. Texas Air Control Board Special Permit. Offsite disposition of fuel and water treatment byproducts is required.
4. Onsite Contaminated Groundwater Treatment and Discharge to AFP No. 4 Process Water Makeup System	\$599,000	\$690,000	Water treatment technology is proven. Utilization of treated water will offset a portion of the demand for process makeup water from the city. Low permeability is the limiting factor for the rates of extraction at FSA 3.	Adverse impacts may include: a. Vehicular and heavy equipment noise b. Volatilization of organic compounds. c. Dust d. Spills onsite from tanks, pipes and related equipment e. Offsite transportation spills	Provides short and long term Public Health Protection by: intercepting and removing the contaminant plume.	The following permit may be required: a. Texas Air Control Board Special Permit. Offsite disposition of fuel and water treatment by-products is required. The process makeup water can be discharged through GD Treatment Plant using their current Industrial Waste Discharge Permit.

Sources: Intellus, 1986; ESE.

1. The efficiency is extremely high in a variety of influent conditions and is not susceptible to toxics,
2. Various units can be added to the treatment system as needed,
3. The alternative will allow AFP4 to reduce its demand for city-supplied water,
4. The reclaimed jet fuel may be used onsite as a supplemental energy source.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

As a result of this project, a recovery and treatment alternative was selected for FSA-1 and FSA-3. The recovery system for FSA-1 groundwater consists of two extraction wells with submersible pumps and the recovery system for FSA-3 consists of two French drains (interceptor trenches), sumps, and submersible pumps. The major components of the centralized treatment system in the selected alternative for FSA-1 consists of an oil/water separator and an air stripping followed by a liquid-phase GAC unit. The effluent from the treatment system will be discharged to the AFP4 process makeup water.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made in this report for additional site investigations at FSA-1 and FSA-3 (see Section 3.0 for discussion pertaining to remediation).

5.0 PROJECTS RESULTING FROM THE PROJECT

A report was prepared responding to the comments on this project (Intellus, 1986). Based on the results of the Phase IV-A investigation and the selected alternative at FSA-1 and FSA-3, an intermediate remedial action was developed for the removal of free-product and the treatment of groundwater as part of Phase IV-B. This phase of work included preparation of an engineering report and design of a remedial action facility (HDR, 1989). In 1993, a draft-final

feasibility study (FS) was prepared for the remediation of sites at AFP4 including FSA-1 and FSA-3 (RUST Geotech, Inc., 1993).

6.0 PROJECT STATUS

No information is available on the implementation of the RAP at FSA-1 and FSA-3.

7.0 SCHEDULE

No schedule is available on implementation of this project.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN THE INSTALLATION RESTORATION PROGRAM INFORMATION MANAGEMENT SYSTEM (IRPIMS)

No data from this project are in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Draft Construction Site Assessment Report for the Die Yard Zone
AUTHOR: Intellus Corporation
DOCUMENT NUMBER: 01027
CATEGORY: 01.04
SUBMITTED: January 1987

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this report was to propose a comprehensive solution for groundwater and soil management during construction of the Waste Treatment Facility and Hazardous Material Storage Building Air Force Plant 4 (AFP4). Soil and groundwater alternatives were defined and evaluated for the purpose of relating the respective solutions for soil and groundwater management.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

The Die Yard Zone is the concrete paved area located south of Warehouse No. 1 and north of Clifford Avenue. The area has most recently been used for storage of casting molds. Two specific sources of contamination, the Die Yard Chemical Pits (DP13), and Fire Department Training Area No. 5 (FDTA 5) are located in the Die Yard Zone. Figure A.5-1 shows the Die Yard Zone Location plan.

2.2 PROJECT ACCOMPLISHMENTS

This report addressed the following project objectives:

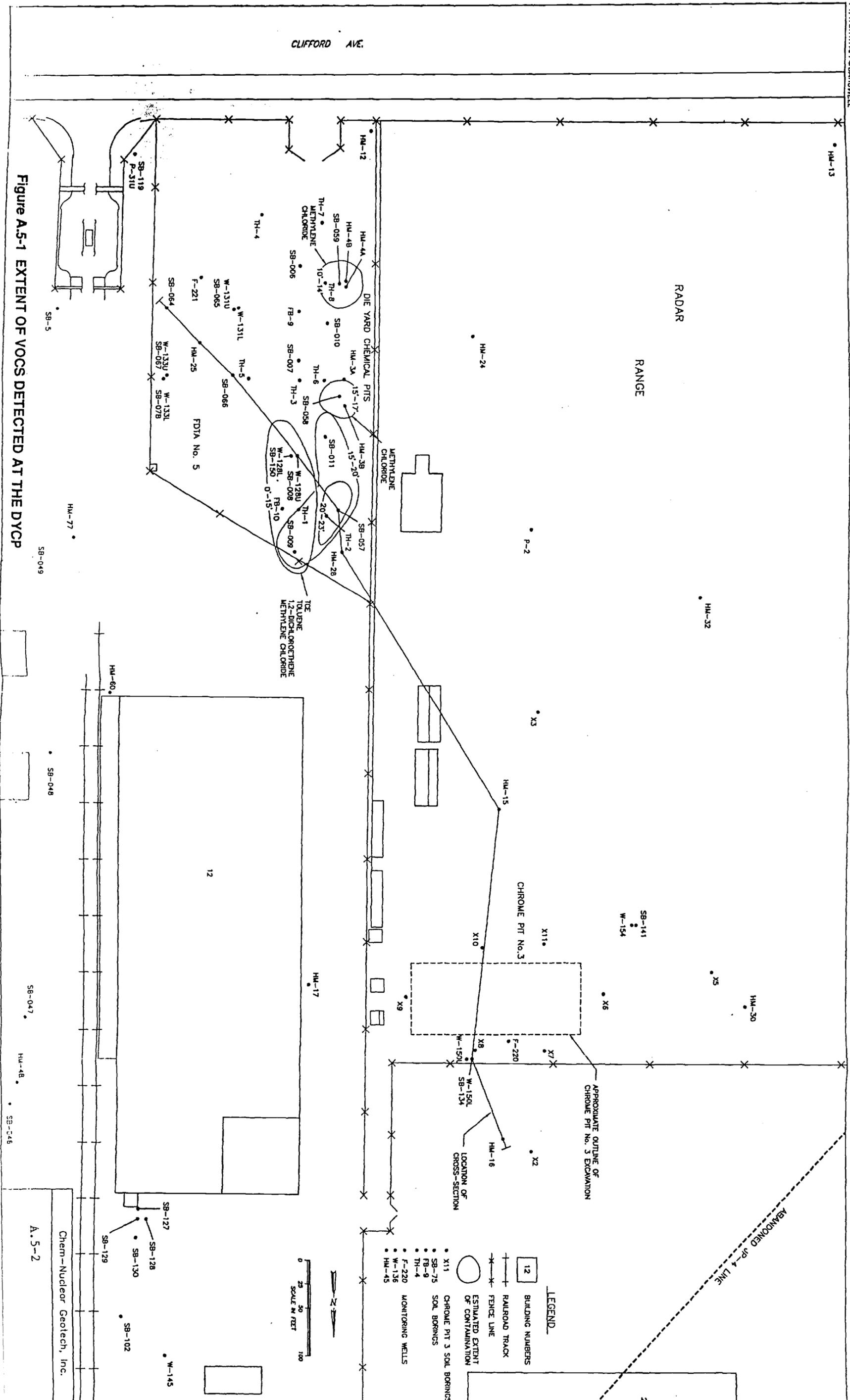
1. Evaluate the potential impact of construction on the Die Yard Zone Upper Zone groundwater movement and propose control measures, as necessary, to mediate potential undesirable impacts.
2. Evaluate the potential need for construction dewatering and propose control measures, as necessary, to accomplish this task. Determine methods, as necessary, to treat the potentially contaminated groundwater.

CLIFFORD AVE.

RADAR

RANGE

Figure A.5-1 EXTENT OF VOCS DETECTED AT THE DYCP



0 25 50 100
SCALE IN FEET

- X11 CHROME PIT 3 SOL BORINGS
- SB-75 SOL BORINGS
- FB-9
- TH-4
- F-220 MONITORING WELLS
- W-136
- HM-45

LEGEND

- 12 BUILDING NUMBERS
- RAILROAD TRACK
- FENCE LINE
- ESTIMATED EXTENT OF CONTAMINATION

Chem-Nuclear Geotech, Inc.

A.5-2

3. Evaluate the potential impacts associated with the excavation and handling of potentially contaminated soil and propose control measures, as necessary, to mediate potential undesirable impacts.
4. Assess the potential impact construction may have on future remediation activities.

The report identified investigations performed at the Die Yard Zone. It was determined that groundwater management was necessary to construct the equalization basins in the dry zone, therefore necessitating a dewatering construction area). Tables A.5-1 and A.5-2 show the contaminants present in soils and groundwater, respectively, at the Die Yard Zone.

Several alternatives were evaluated for groundwater and soils management at the Die Yard Zone based on cost and efficiency. Alternative W-1 was selected from the following:

1. Alternative W-1, Groundwater Collection and Treatment--Eight dewatering wells will be installed outside and surrounding the proposed excavation (Figure A.5-2). The collected groundwater will be filtered using a dual bag-type filter to remove the suspended solids. Effluent from the filter will be treated using granular activated carbon (GAC) to remove the organic contaminants. The treated effluent from the activated carbon will be discharged to the AFP4 Industrial Wastewater Treatment Facility. The proposed Equalization Basin excavation can be constructed in-the-dry using the dewatering and water treatment alternative. In the dewatering and water treatment alternative, eight dewatering wells will be installed outside the proposed excavation area. The collected water will then be treated using granular activated carbon.
2. Alternative W-2, Groundwater Diversion Utilizing Slurry Walls--The upper zone groundwater flow will be diverted around the proposed Equalization Basins excavation via a slurry wall. The slurry wall

Table A.5-1. Summary Chemical Analysis of Soil Samples for Metals

Metal Constituents (ppb)	DIE YARD PITS			DIE YARD PITS			FDTA 5			BACKGROUND LEVELS (ppm)
	Sample Number: FB-9 7-7.5'	Sample Number: FB-9 13-13.5'	Sample Number: FB-10 8-8.5'	Sample Number: FB-10 11-11.5'	Sample Number: FB-10 3-3.5'	Sample Number: F-221 7-7.5'	Sample Number: F-221 3-3.5'	Sample Number: F-221 7-7.5'		
Aluminum	8000	11000	13000	15000	13000	14000	14000	14000	Common	
Antimony	ND	ND	ND	ND	ND	ND	ND	ND	0.25-0.6 ppm	
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND	0.1-69 ppm	
Barium	48	49	39	47	58	46	46	46	20-3,000 ppm	
Beryllium	ND	ND	ND	ND	ND	ND	ND	ND	.1-15 ppm	
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	0.0-3.0 ppm	
Calcium	260000	140000	240000	200000	180000	190000	190000	190000	Common	
Chromium	8.0	8.5	11	12	10	9.9	9.9	9.9	5-1,000 ppm	
Cobalt	ND	ND	ND	ND	ND	ND	ND	ND	1-40 ppm	
Copper	ND	ND	ND	ND	ND	ND	ND	ND	1-1,000 ppm	
Iron	9700	9500	11000	13000	10000	10000	10000	10000	.5-5%	
Lead	ND	ND	ND	ND	ND	ND	ND	ND	2-200 ppm	
Magnesium	2500	2400	3500	3300	2800	2600	2600	2600	Common	
Manganese	290	240	210	290	210	190	190	190	7-3,000 ppm	
Molybdenum	14	22	25	29	23	28	28	28	0.8-30 ppm	
Nickel	7.4	8.0	9.7	11	8.6	9.0	9.0	9.0	5-200 ppm	
Potassium	880	1300	1800	1800	1400	1500	1500	1500	Common	
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	0.0005-4 ppm	
Silica	180	2600	370	520	470	370	370	370	Common	
Silver	ND	ND	ND	ND	ND	ND	ND	ND	0.9-0.09 ppm	
Sodium	290	210	290	330	510	260	260	260	Common	
Strontium	160	77	170	130	96	88	88	88	1-3,500 ppm	
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	2-200 ppm	
Vanadium	22	16	22	23	22	21	21	21	5-460 ppm	
Zinc	15	18	21	29	20	21	21	21	less than 5-300 ppm	

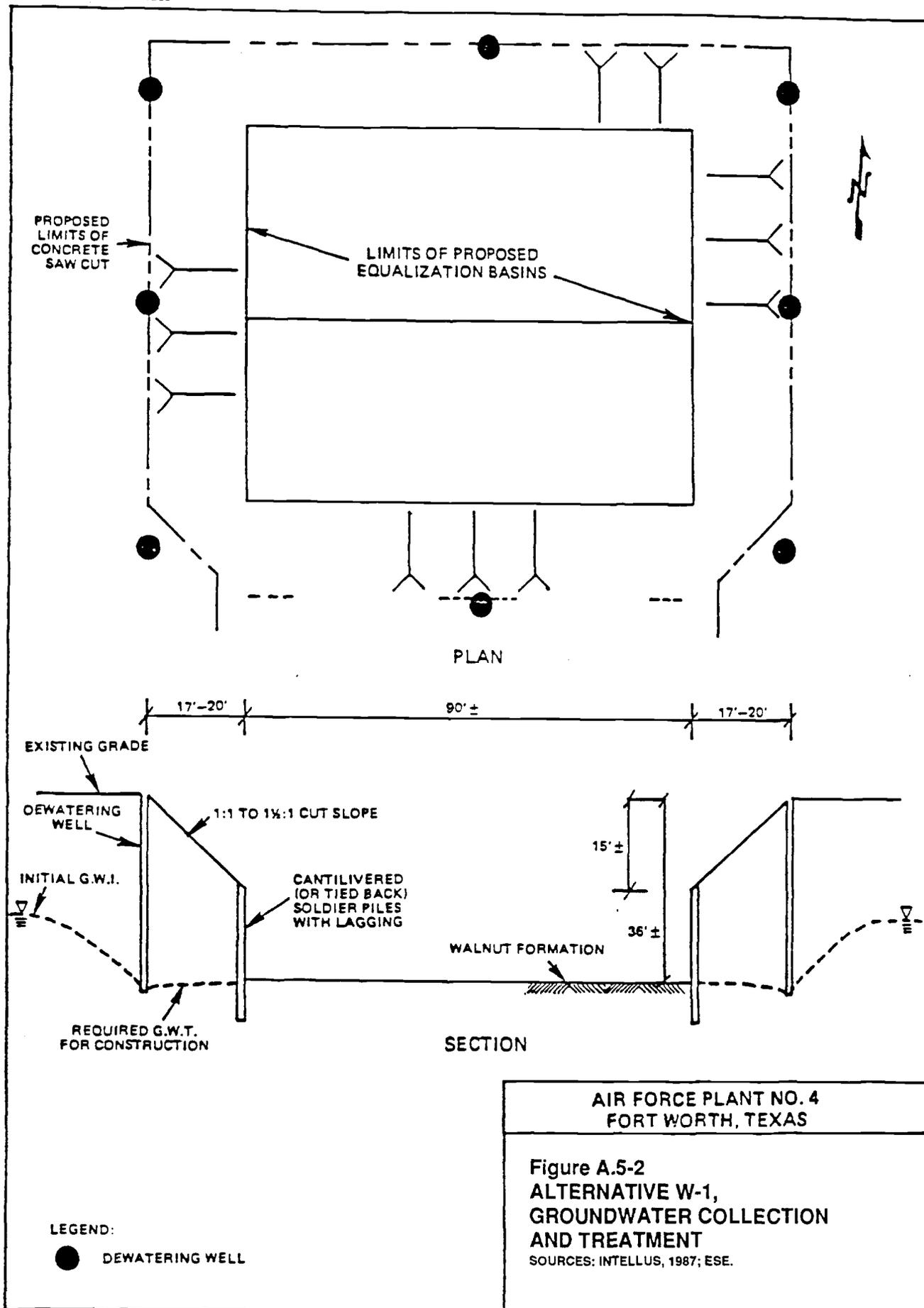
ND = Not Detected

Sources: Intellus 1087. ECF

Table A.5-2. Variation of Volatile Organic Compound Concentrations in Groundwater Over Time at Monitor Wells HM-24, HM-25, and HM-28

<u>Figure No.</u>	<u>Compound</u>	<u>Monitoring Well No.</u>
A.1	Chloroform	HM-24
A.2	Dichloropropane	HM-24
A.3	Methylene Chloride	HM-24
A.4	Trichloroethylene	HM-24
A.5	Benzene	HM-25
A.6	Chlorobenzene	HM-25
A.7	Ethyl-Benzene	HM-25
A.8	Toulene	HM-25
A.9	1,2-Trans-Dichloroethylene	HM-25
A.10	Chloroform	HM-28
A.11	1,2-Trans-Dichloroethylene	HM-28
A.12	Trichloroethylene	HM-28

Sources: Intellus, 1987; ESE.



- would be constructed exterior to the proposed excavation area perimeter. The wall will be approximately 24 inches wide.
3. Alternative W-3, Groundwater Diversion Utilizing Concrete Diaphragm Walls--A concrete diaphragm wall system will be designed and used as the permanent perimeter retaining wall for the proposed Equalization Basins. The diaphragm walls, keyed into the bedrock, will divert the Upper Zone groundwater around the Equalization Basins excavation.
 4. Alternative W-4, No Action.

The following two alternatives were developed for soils at the Die Yard Zone. In Alternative S-1 (Soil Segregation and Onsite Aeration) soils above the capillary zone will be sampled and segregated, as necessary, into uncontaminated and contaminated waste piles using an organic vapor analyzer (OVA). Soils containing the organic contaminants will be aerated and the remaining clean soils will be used as fill or disposed of.

Alternative S-2, (Disposal of Soils in a Hazardous Waste Landfill), will include segregation of soils as previously described in Alternative S-1. All soils having a trichloroethene (TCE) concentration greater than a previously negotiated limit (not defined in the report) will be disposed of in a hazardous waste landfill.

Soil Management Alternative S-1 was selected for the following reasons:

1. The cost to manage all the soil in the capillary and saturated zones as a hazardous waste is extremely high,
2. The contaminants concentration in the soil are extremely low,
3. The finite space available in hazardous waste landfills should not be consumed when alternate appropriate methods of disposal are available, and
4. Soil aeration is an accepted method of treatment for low concentration volatile contaminants.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

Alternatives were selected for the management of contaminated soil and groundwater affected by the construction of the Waste Treatment Facility and Hazardous Materials Storage Building.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional studies at the site.

5.0 PROJECTS RESULTING FROM THE PROJECT

Conceptual design for the recommended alternatives was proposed as a separate project.

6.0 PROJECT STATUS

The project was not implemented as of 1993.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN THE INSTALLATION RESTORATION PROGRAM INFORMATION MANAGEMENT SYSTEM (IRPIMS)

No data from this project are in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Evaluation of Condenser Water Pipeline and Interim Remedial Measures, Fuel Saturation Area No. 3.
AUTHOR: Hargis and Associates, Inc.
DOCUMENT NUMBER: 01043
CATEGORY: 01.04
SUBMITTED: July 1988

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this report is to evaluate the feasibility of coordinating the installation of a 48-inch condenser water pipeline (the Pipeline) with the interim remedial measures to recover the free-product from Fuel Saturation Area No. 3 (FSA-3).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

FSA-3 is located in the northwest quadrant of Air Force Plant 4 (AFP4) and is shown in Figure A.6-1. The area has reportedly been saturated with fuel from the mid-1970s until the early 1980s due to leaks in buried jet fuel pipelines. The remedial action plan (RAP) and conceptual design report for FSA-1 and FSA-3, completed as part of Phase IV-A of the Installation Restoration Program (IRP), recommended a combination of extraction wells and interceptor trench to recover the free-product.

The proposed location of the pipeline and the interceptor trench is on the northern edge of the free-product. The proposed interceptor trench (Figure A.6-2) would reclaim groundwater and the free-product from the south. A hydrogeologic cross section prepared along the alignment of the Pipeline identifies the approximate area where the Pipeline excavation will encounter groundwater and the free-product. Since the available data indicate that the pipelines are located below the water table, they are potential conduits for groundwater and contaminant migration.

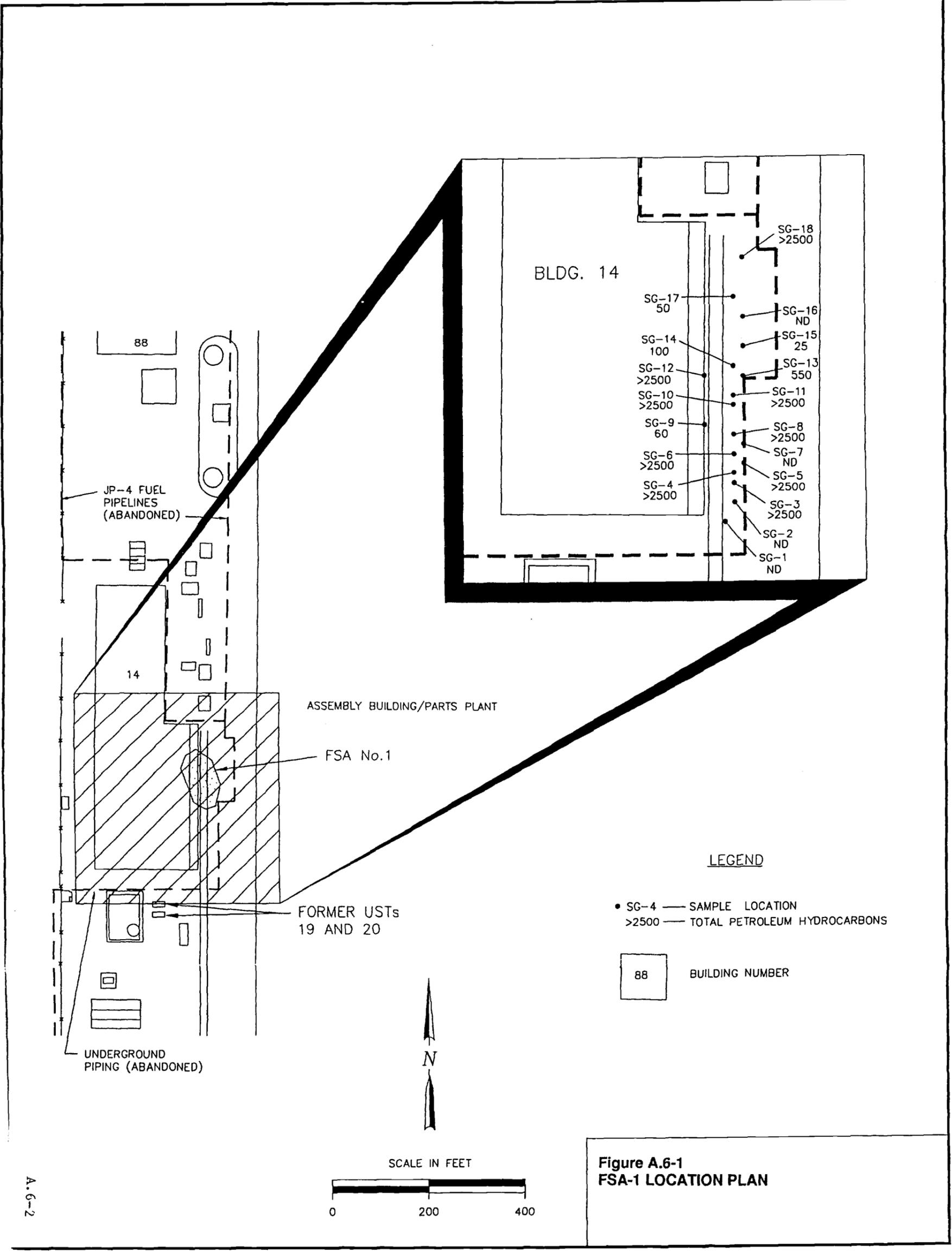


Figure A.6-1
FSA-1 LOCATION PLAN

2.2 PREVIOUS INVESTIGATION RESULTS

The IRP for AFP4 was initiated in March 1984 when CH2M Hill, Inc. conducted a Phase I records search. During the Phase I investigation, 21 sites were identified as requiring further investigation (Figure A.6-1). The 21 sites include industrial processing areas, fuel storage areas, landfills, known chemical and fuel spills, chemical disposal pits, fire training areas, and the Assembly Building/Parts Plant.

In June 1985, the U.S. Army Corps of Engineers (USACE) worked to further delineate groundwater conditions along the southern base boundary and the East Parking Lot area of AFP4. The USACE drilled 28 soil borings and constructed 6 monitor wells.

In September 1985, Radian Corporation (Radian) performed the Phase II, Stage I, Confirmation/Quantification of the IRP. Radian drilled 26 soil borings and constructed 14 groundwater monitor wells. A summary report of field investigations performed during the IRP Phase II, Stage 1 was prepared (Radian, 1987).

During Phase II investigations, 8 of the 21 sites [former fuel storage site, Landfill No. 2 (LF02), Landfill No. 4 (LF04), Fire Department Training Area 3 (FDTA 3), FDTA 4, Solvent Lines, Nuclear Aerospace Research Facility (NARF) Area, and Jet Engine Test Stand] were recommended for no further action. One site (FSA-2) has been recommended for further investigation and the remaining 12 sites have been recommended for remediation. FSA-1 and FSA-3 are among these 12 sites and are illustrated in Figure A.6-2.

The results of the Phase II field investigations at FSA-1 and FSA-3 revealed the presence of trichloroethene (TCE) and benzene, toluene, ethyl benzene, and xylene (BTEX) compounds in the groundwater. The maximum concentrations detected for TCE and BTEX were 1,200; 27,000; 44,000; 42,000; and 29,500

micrograms per liter ($\mu\text{g/L}$), respectively (Table A.6-1). No information is available on Phase III, the Technology Base Development work effort.

During the Phase IV-A investigation, a RAP was developed for the remediation of sites at FSA-1 and FSA-3 (Intellus, 1986). Air stripping followed by activated carbon adsorption was selected as the preferred treatment alternative at both FSA-1 and FSA-3. A second report was prepared addressing the comments on the draft RAP (Intellus, 1986).

2.3 PROJECT ACCOMPLISHMENTS

A summary of the previous investigations at FSA-3 was presented in this report (Hargis and Associates, Inc., 1985; Intellus, 1986; and Radian, 1987). Due to insufficient data from the previous studies, further investigation was conducted to define the hydrological conditions at FSA-3. It involved drilling of 2 soil borings (FSA3-5 and FSA3-9) and 10 monitor wells (FSA3-1, FSA3-2, FSA3-3, FSA3-4, FSA3-6, FSA3-7, FSA3-8, FSA3-10, FSA3-10, FSA3-11, and FSA3-12) at FSA-3. The areal extent of contamination at FSA-3 is shown in Figure A.6-2.

The following conclusions were made based on the investigation results:

1. Existing buried pipelines below the groundwater table are potential conduits for the migration of contaminated groundwater in the vicinity of FSA-3.
2. The proposed pipeline excavation will encounter groundwater and free-product from approximately 60 feet (ft) west of soil boring FSB-1 to 50 ft east of monitor well FSA3-1 (Figure A.6-3).
3. An interceptor trench could be installed in the same trench as the Pipeline, but the location of the proposed Pipeline is not the optimum location for recovery of free-product and contaminated groundwater.

It was recommended that the interceptor trench not be installed in the same trench as the Pipeline and additional data be collected to delineate the

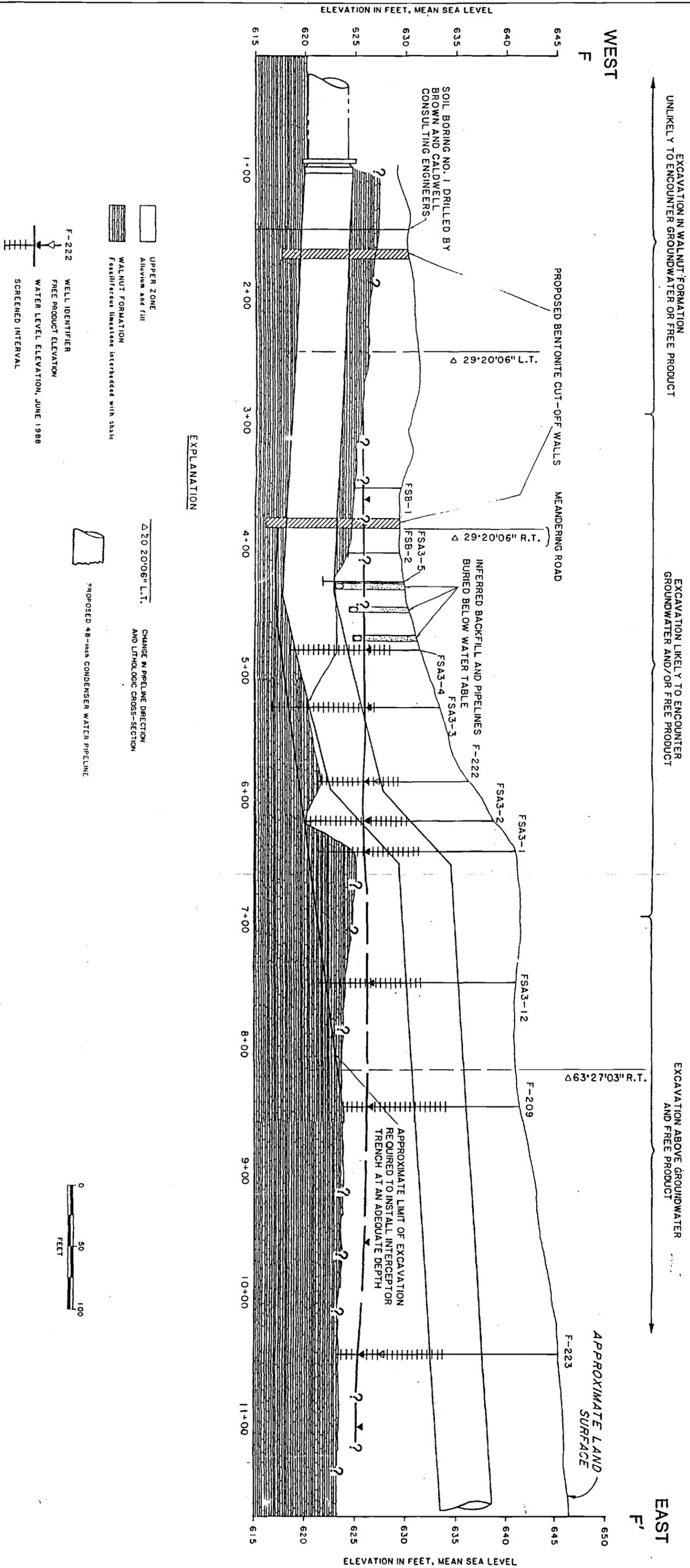


Figure A.6-3 HYDROGEOLOGIC CROSS SECTION F-F'

SOURCES: HARGIS & ASSOCIATES, INC., 1988; ESE

ENVIRONMENTAL SCIENCE & ENGINEERING, INC.

distribution of free-product so that an optimum location for an interceptor trench can be determined.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

As a result of this project, a recommendation was made at FSA-3 that the interceptor trench not be installed in the same trench where the pipeline was located.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

Recommendations were made for additional site investigations at FSA-3 to delineate the distribution of free-product so that an optimum location for an interceptor trench can be determined.

5.0 PROJECTS RESULTING FROM THE PROJECT

An engineering report for the treatment of groundwater at FSA-1 and FSA-3 (HDR, 1988) and a draft-final feasibility study (FS) for sites at AFP4 were prepared (Chem Nuclear Geotech, Inc., 1993).

6.0 PROJECT STATUS

The remediation project was not implemented as of 1993.

7.0 SCHEDULE

Schedule is not available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN THE INSTALLATION RESTORATION PROGRAM INFORMATION MANAGEMENT SYSTEM (IRPIMS)

No data from this project are in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Engineering Report, Remedial Action for Fuel Saturation Areas No. 1 and 3 and Treating Leachate of French Drain No. 1

AUTHOR: HDR

DOCUMENT NUMBER: 01044

CATEGORY: 01.04

SUBMITTED: July 1988

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to develop an intermediate remedial action plan (RAP) for the recovery of free-product at Fuel Saturation Area 1 (FSA-1) and FSA-3 and treatment of groundwater at FSA-1, FSA-3, and French Drain No. 1.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

FSA-1, FSA-3, and French Drain No. 1 are located in the west and the northwest quadrants of Air Force Plant 4 (AFP4) as depicted in Figure A.7-1. Both FSA areas have reportedly been saturated with fuels from the mid-1970s until the early 1980s due to leaks in buried jet fuel pipelines. The RAP and conceptual design report for FSA-1 and FSA-3, completed as part of Phase IV-A of the Installation Restoration Program (IRP), recommended a combination of extraction wells and French drains to recover the free-product at the two sites. French Drain No. 1 area groundwater was also reportedly contaminated with chlorinated solvents. The reported contaminant concentrations are presented in Table A.7-1.

2.2 PREVIOUS INVESTIGATION RESULTS

The IRP for AFP4 was initiated in March 1984 when CH2M Hill, Inc. conducted a Phase I records search. During the Phase I investigation, 21 sites were identified to require for further investigation (Figure A.7-1). The 21 sites include industrial processing areas, fuel storage areas, landfills, known chemical and fuel



North
APPROX. SCALE: 1" = 200'

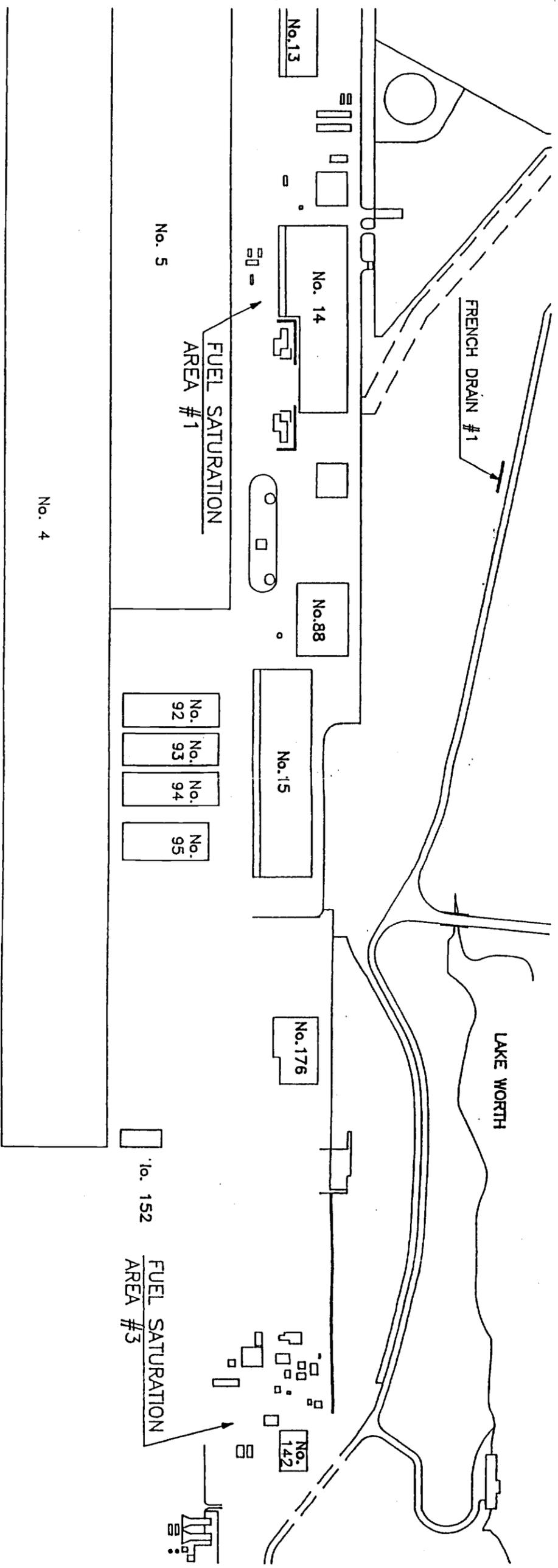


Figure A.7-1
FSA-1, FSA-3, AND FRENCH DRAIN NO. 1 SITE LOCATION MAP

Table A.7-1. Comparison of Pretreatment Standards to Combined Untreated Groundwater Quality

<u>POLLUTANT</u>	<u>UNTREATED GROUNDWATER (mg/l)</u>	<u>PRETREATMENT STANDARDS MONTHLY AVERAGE (mg/l)</u>
Cadmium	<0.0005	0.26
Chromium (Total)	<0.030	1.71
Copper	<0.030	2.07
Lead	<0.004	0.43
Nickel	<0.050	2.38
Silver	<0.010	0.24
Zinc	<0.010	1.48
Total Toxic Organics:		
Benzene	4.85	---
Toluene	6.35	---
Ethyl Benzene	8.71	---
Trans -1, 2-Dichlorethylene	4.76	---
Tetrachloroethylene	0.09	---
Trichloroethylene	0.34	---
Vinyl Chloride	<u>0.30</u>	<u>---</u>
Total =	25.40	2.13 ⁽¹⁾

⁽¹⁾ Maximum one day concentration allowable for all
Total Toxic Organics. (TTO)

Sources: General Dynamics, 1989; ESE.

spills, chemical disposal pits, fire training areas, and the Assembly Building/Parts Plant.

In June 1985, the U.S. Army Corps of Engineers (USACE) worked to further delineate groundwater conditions along the southern base boundary and the East Parking Lot area of AFP4. USACE drilled 28 soil borings and constructed six monitor wells.

In September 1985, Radian Corporation (Radian) performed the Phase II, Stage I, Confirmation/Quantification of the IRP. Radian drilled 26 soil borings and constructed 14 groundwater monitor wells. A summary report of field investigations performed during the IRP Phase II, Stage 1 was prepared (Radian, 1987).

During Phase II investigations, eight of the 21 sites [Former Fuel Storage Site, Landfill No. 2 (LF02), Landfill No. 4 (LF04), Fire Department Training Area 3 (FDTA 3), FDTA-4, Solvent Lines, Nuclear Aerospace Research Facility (NARF) Area, Jet Engine Test Stand) were recommended for no further action. One site (FSA-2) has been recommended for further investigation, and the remaining 12 sites have been recommended for remediation. FSA-1 and FSA-3 are among these 12 sites and are illustrated in Figure A.7-1.

The results of the Phase II field investigations at FSA-1 and FSA-3 revealed the presence of trichloroethene (TCE) and benzene, toluene, ethyl benzene, and xylene (BTEX) compounds in the groundwater. The maximum concentrations detected for TCE and BTEX were 1,200; 27,000; 44,000; 42,000; and 29,500 micrograms per liter ($\mu\text{g/L}$), respectively (Table A.7-1). No information is available on the Phase III, the Technology Base Development work effort.

During Phase IV-A investigation, a RAP was developed for the remediation of sites at FSA-1 and FSA-3 (Intellus, 1986). Air stripping followed by activated

carbon adsorption was selected as the preferred treatment alternative at both FSA-1 and FSA-3. A second report was prepared addressing the comments on the draft RAP (Intellus, 1986). In 1988, a report was prepared at FSA-3 to evaluate the feasibility of coordinating the installation of a condenser water pipeline with the interim remedial measures to recover the groundwater (Hargis and Associates, Inc., 1988).

2.3 PROJECT ACCOMPLISHMENTS

An engineering report was prepared and intermediate remedial actions were developed at FSA-1, FSA-3, and French Drain No. 1. The remedial actions were divided into recovery system and treatment system. Five alternatives were evaluated for technical feasibility and cost effectiveness under the recovery system and five alternatives were evaluated under the treatment system.

The alternatives evaluated under the recovery system include the following:

1. Alternative 1--extraction of groundwater using the existing two wells at FSA-1,
2. Alternative 2--extraction of groundwater using eight new wells at FSA-3,
3. Alternative 3--extraction of groundwater using the existing eight wells at FSA-3,
4. Alternative 4--extraction of groundwater using the existing seven wells and one new well at FSA-3, and
5. Alternative 5--extraction of groundwater using the existing seven wells and two new wells at FSA-3.

The alternatives evaluated under the treatment system include the following:

1. Alternative 1A--centralized treatment system using air stripping followed by liquid and vapor-phase granular activated carbon (GAC),
2. Alternative 1B--centralized treatment system using liquid-phase carbon,
3. Alternative 2--trucking versus pumping of groundwater to the centralized treatment system,

4. Alternative 3--localized treatment systems at FSA-1 (for groundwater from FSA-1 and French Drain No. 1) and FSA-3, and
5. Alternative 4--consisting of Alternative 1B and onsite regeneration of activated carbon.

Extraction of groundwater using the seven existing wells and one new well was selected under the recovery system evaluation of alternatives. Alternative 1B was selected for the treatment system alternative evaluation. Alternative 1B consists of the following treatment components:

1. Gravity separators to separate the recovered free-product from groundwater at FSA-1, FSA-3, and French Drain No. 1;
2. Equalization tanks to store the recovered free-product and the separated groundwater; and
3. Two 10,000-pound (lb) granular activated carbon (GAC) units to treat the separated groundwater.

The treatment system was designed based on 20 gallons per minute (gpm) influent rate at a cost of \$1,360,000 for a total of 3 years. The process and instrumentation diagram for the treatment system is presented in Figure A.7-2.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

As a result of this project, an intermediate remedial alternative was selected for the extraction of free-product and treatment of groundwater at FSA-1 and FSA-3 and also treatment of leachate at French Drain No. 1.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made in this report for additional site investigations at FSA-1, FSA-3, and French Drain No. 1.

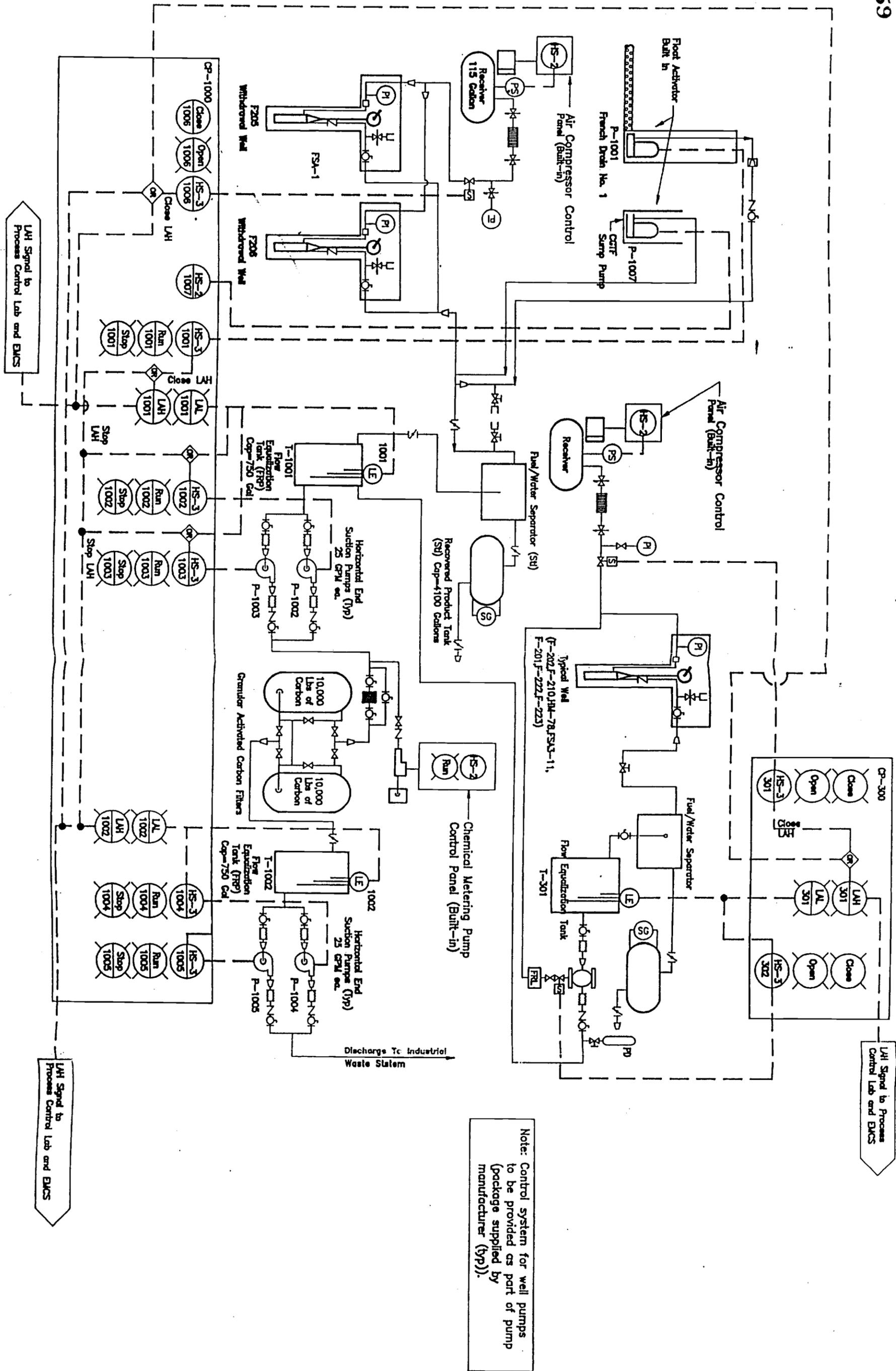


Figure A.7-2 PROCESS AND INSTRUMENTATION DIAGRAM PROJECT NO. G-0601
 SOURCES: GENERAL DYNAMICS, 1989; ESE.

5.0 PROJECTS RESULTING FROM THE PROJECT

In 1993, a draft-final feasibility study (FS) was prepared for the remediation of sites at AFP4, including FSA-1 and FSA-3 (Geotech, Inc., 1993).

6.0 PROJECT STATUS

No information is available on the implementation of the RAP at FSA-1, FSA-3, and French Drain No. 1.

7.0 SCHEDULE

No schedule is available on implementation of this project.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN THE INSTALLATION RESTORATION PROGRAM INFORMATION MANAGEMENT SYSTEM (IRPIMS)

No data from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Preliminary Assessment/Site Inspection and RI/FS,
Waste Management Plan

AUTHOR: U.S. Department of Energy

DOCUMENT NUMBER: 01056

CATEGORY: 01.09

SUBMITTED: December 1990

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project report was to present an overall management plan in support of RI/FS field investigations for wastes generated at Air Force Plant 4 (AFP4).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 PREVIOUS INVESTIGATION RESULTS

Since 1942, manufacturing activities at AFP4 have resulted in the generation of wastes, including waste oils, fuels, spent solvents, paint residues, and spent process chemicals. Many of these wastes were previously disposed of onsite in landfills and pits. Several investigations (Radian, 1987; Intellus, 1986; and Hargis and Associates, Inc., 1989) were conducted to characterize the extent of contamination at AFP4 under the Installation Restoration Program (IRP). The most significant contaminants identified at AFP4 during these investigations include the following organics and metals: trans 1,2- dichloroethene; methylene chloride; tetrachloroethene; trichloroethene; vinyl chloride; benzene; ethylbenzene; toluene; naphthalene; mercury; and arsenic.

Since the facility was placed on the federal superfund National Priorities List (NPL), current investigations are designed to satisfy the requirements of the remedial investigation/feasibility study (RI/FS) promulgated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

2.2 PROJECT ACCOMPLISHMENTS

This document presents the appropriate methods to handle, store, and dispose of in wastes at AFP4 in accordance with all applicable federal, state, and local laws and regulations governing waste disposal. Only those wastes generated as part of the RI/FS for AFP4 were covered under this plan.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

Appropriate handling methods were identified for the following types of wastes identified at AFP4:

1. Noncontaminated general refuse (i.e., paper towels and clothing),
2. Contaminated general refuse (i.e., contaminated clothing),
3. Noncontaminated soil from soil borings (cuttings and core),
4. Contaminated soil from soil borings (cuttings and core),
5. Noncontaminated purge water,
6. Contaminated purge water,
7. Decontamination fluids, and
8. Waste-activated carbon adsorption materials.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional studies at the site.

5.0 PROJECTS RESULTING FROM THE PROJECT

A preliminary assessment/site inspection/remedial investigation (PA/SI/RI) activities have resulted from this waste management plan.

6.0 PROJECT STATUS

The waste management plan was approved by U.S. Environmental Protection Agency (EPA) Region VI and preliminary RI/FS activities have begun.

7.0 SCHEDULE

No schedule is available.

**8.0 WHETHER OR NOT INFORMATION DERIVED
IS IN THE INSTALLATION RESTORATION PROGRAM
INFORMATION MANAGEMENT SYSTEM (IRPIMS)**

No data from this project are in IRPIMS

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Alternatives for East Plume Groundwater Remediation
AUTHOR: Tyndall AFB
DOCUMENT NUMBER: Not Available
CATEGORY: Not Available
SUBMITTED: December 1991

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to propose alternatives for the remediation of groundwater at the East Parking Lot of Air Force Plant 4 (AFP4), considering such tasks as cost reduction, plume management, health risks, appropriate technologies, and pollution prevention.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 PREVIOUS INVESTIGATION RESULTS

AFP4 is an aircraft manufacturing facility located in Tarrant County, Texas, 7 miles northwest of the City of Fort Worth. The facility has been in operation since 1942 and currently produces F-16 aircraft, radar units, and various aircraft and missile components.

The records search to locate the potential environmental problems associated with waste disposal practices during the Phase I investigation was completed in 1984 (CH2M Hill, 1984). The results of the Phase I investigation identified 21 sites as the sources of contamination due to past waste disposal practices. The East Parking Lot is one of the 21 sites identified for remediation under the Installation Restoration Program (IRP). Figure A.9-1 shows the location of the East Parking Lot at AFP4.

During Phase II investigation, the extent and degree of contamination at the identified sites was completed (Radian, 1987). Groundwater samples were collected and analyzed from the shallow aquifer and the Paluxy aquifer. A total

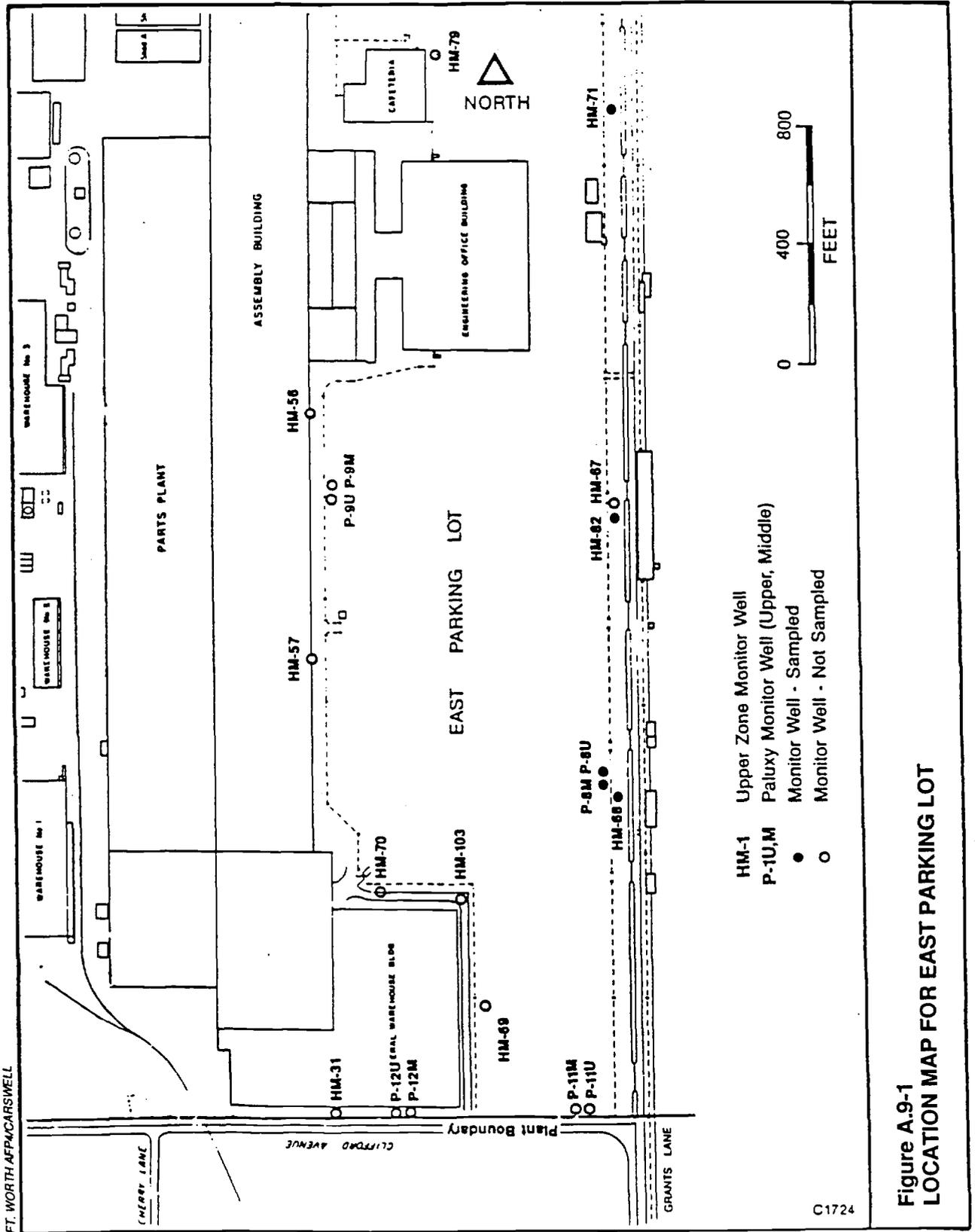


Figure A.9-1
LOCATION MAP FOR EAST PARKING LOT

C1724

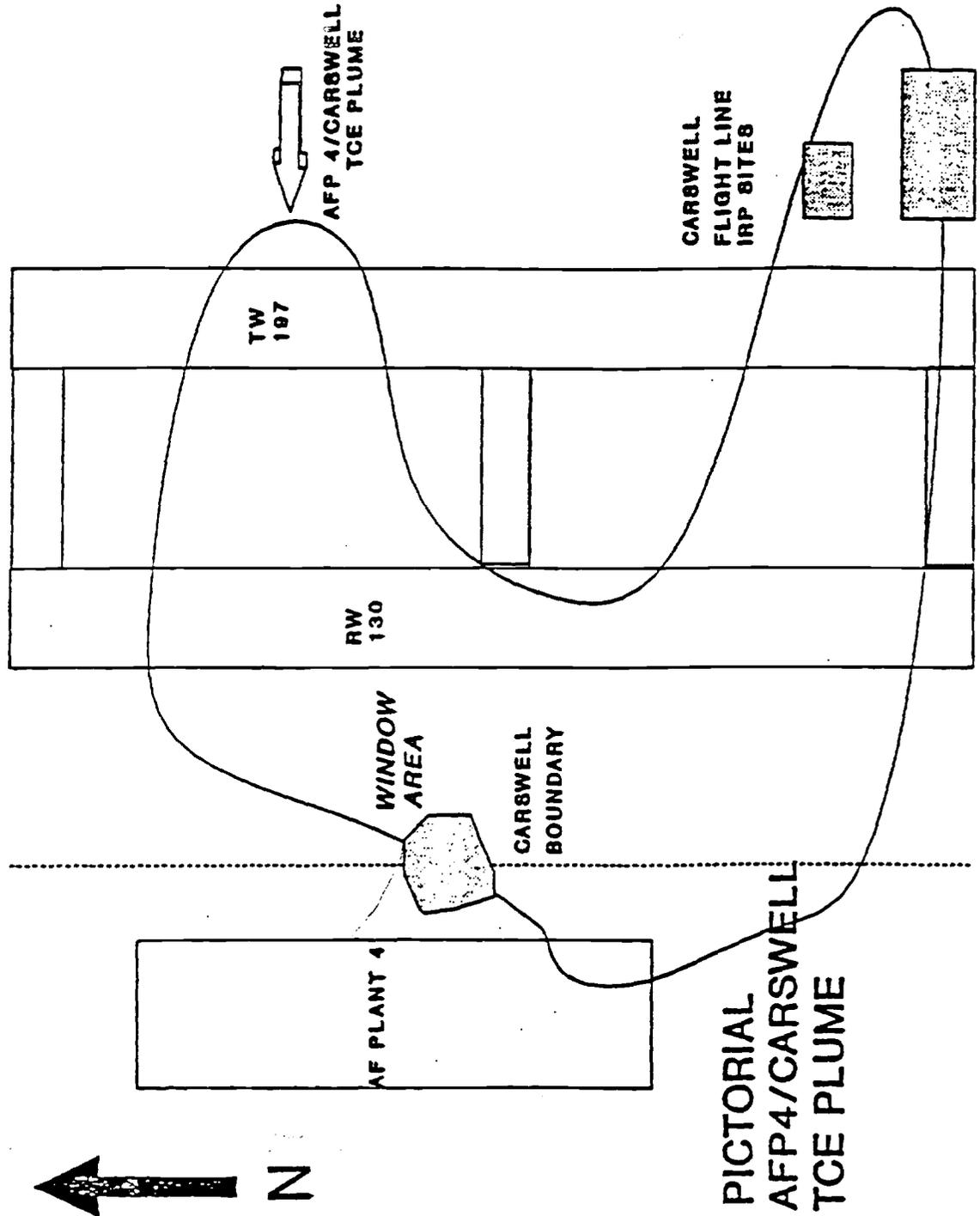


Figure A.9-2 THE EXTENT OF TCE CONTAMINATION
SOURCES: TYNDALL AFB, 1991; ESE.

of forty-seven groundwater monitor wells was sampled and analyzed for the following constituents:

1. Volatile organic compounds (VOCs),
2. Base/neutral organic compounds (BNAs),
3. Organic compounds,
4. Trace metals,
5. Oil/grease and total fuel hydrocarbons, and
6. Common ion constituents.

Results of the groundwater investigation have confirmed the presence of trichloroethene (TCE), dichloroethene and chromium at the East Parking Lot. Tables A.9-1 and A.9-2 presents the chemical analyses of the contaminants present in the plumes at the East Parking Lot and the Paluxy aquifer. The extent of TCE contamination at the East Parking Lot is shown in Figure A.9-2.

2.2 PROJECT ACCOMPLISHMENTS

This report was prepared for Headquarters, United States Air Force (USAF) by the Air Force Civil Engineering Support Agency, Research Development and Acquisition Directorates. A pump-and-treat alternative was recommended earlier but it was not advocated as a final remediation technology but rather as an interim measure to control the further spread of the plume. In this report, applicable and emerging technologies are evaluated for the groundwater remediation at the East Parking Lot and consists of the following:

1. Containment technologies,
2. Source removal technologies, and
3. In situ plume management technologies.

Hydraulic and physical containment technologies were considered in this report. The hydraulic containment technology consists of pumping and treating the highly contaminated groundwater immediately downgradient of the source areas. This technology was considered applicable for the remediation of the

Table A.9-1. Upper-Zone Monitoring Wells Within the East Parking Lot Plume at Which TCE Concentrations Exceeded the Contract Required Quantitation Limit (CRQL)

Site ID	Sample ID	Sample Date	Result ($\mu\text{g/L}$)
F-218	NAA157	27-Apr-90	3,000
F-219	NAA158	26-Apr-90	67
F-219	NAA260	26-Apr-90	71
HM-029	NAA162	27-Apr-90	1,400
HM-031	NAA163	27-Apr-90	920
HM-047	NAA164	27-Apr-90	4,400
HM-047	NAA269	27-Apr-90	7,100
HM-056	NAA168	28-Apr-90	150
HM-060	NAA169	27-Apr-90	170
HM-071	NAA172	28-Apr-90	420
HM-086	NAA173	28-Apr-90	250
HM-087	NAA174	29-Apr-90	350
HM-088	NAA175	01-May-90	6,700
HM-088	NAA271	01-May-90	6,000
HM-089	NAA176	01-May-90	4,500
HM-089	NAA261	01-May-90	4,800
HM-089	NAA272	01-May-90	3,600
HM-094	NAA180	29-Apr-90	19,000
HM-095	NAA181	25-Apr-90	1,900
HM-096	NAA182	25-Apr-90	1,200
HM-097	NAA183	25-Apr-90	440
HM-099	HM-99	25-Oct-91	720
HM-099	NAA185	25-Apr-90	2,100
HM-099	QM-006	14-Mar-91	1,200
HM-099	WQM004	05-Dec-90	2,300
HM-103	NAA186	01-May-90	1,900
HM-110	NAA188	01-May-90	23
HM-111	NAA189	30-Apr-90	410
HM-111	NAA273	30-Apr-90	420
HM-112	NAA190	30-Apr-90	3,700
HM-112	NAA274	30-Apr-90	3,400
HM-113	NAA191	30-Apr-90	380
HM-115	NAA192	01-May-90	110
HM-115	QM-008DL	18-Mar-91	240
HM-115	WQM010	07-Dec-90	320
HM-116	NAA193	01-May-90	860
HM-117	NAA194	01-May-90	640
HM-118	NAA195	01-May-90	180
HM-119	NAA196	01-May-90	25
HM-119	QM-009	18-Mar-91	62
HM-119	WQM007	06-Dec-90	66
HM-121	QM-010DL	19-Mar-91	450
HM-121	WQM009	06-Dec-90	500
HM-122	QM-011DL	19-Mar-91	870

Table A.9-1. Upper-Zone Monitoring Wells Within the East Parking Lot Plume at Which TCE Concentrations Exceeded the Contract Required Quantitation Limit (CRQL) (Continued, Page 2 of 2)

Site ID	Sample ID	Sample Date	Result (µg/L)
HM-122	WQM022	10-Dec-90	890
HM-123	HM-123	25-Oct-91	2,000
HM-123	QM-012	19-Mar-91	120
HM-123	QM-012DL	19-Mar-91	1,900
HM-123	WQM011	07-Dec-90	2,100
HM-125	QM-013	18-Mar-91	66
HM-125	WQM024	10-Dec-90	36
HM-126	NAA203	01-May-90	2,600
HM-127	NAA204	01-May-90	55
LF04-02	LF04-02	27-Oct-91	3,800
LF04-04	LF04-04	27-Oct-91	1,800
LF05-01	LF05-01	28-Oct-91	880
LF05-5A	LF05-5A	27-Oct-91	1,600
W-128L	W-128L-01	12-Sep-91	19
W-128L	W-128L-11	19-Oct-91	19
W-131L	W-131L-01	11-Sep-91	6
W-131U	W-131U-11	24-Oct-91	21
W-131U	W-131U-11EB	24-Oct-91	11
W-131U	W-131U-12	24-Oct-91	20
W-137	W-137-01	16-Sep-91	76
W-137	W-137-11	24-Oct-91	56
W-145	W-145-01	15-Sep-91	8
W-149	W-149-01	18-Sep-91	20,000
W-149	W-149-11	17-Oct-91	21,000
W-150L	W-150-11D	20-Oct-91	4,100
W-150L	W-150L-01DL	14-Sep-91	4,900
W-151	W-151-01DL	13-Sep-91	510
W-151	W-151-11D	21-Oct-91	520
W-153	W-153-01	18-Sep-91	1,500
W-153	W-153-02	18-Sep-91	1,300
W-153	W-153-11D	23-Oct-91	1,000
W-153	W-153-12D	23-Oct-91	1,000
W-154	W-154-01DL	14-Sep-91	2,800
W-154	W-154-02DL	14-Sep-91	2,700
W-154	W-154-11D	21-Oct-91	2,500
W-156	W-156-01DL	17-Sep-91	3,900
W-156	W-156-11D	22-Oct-91	3,600
W-158	W-158-01DL	14-Sep-91	15,000
W-158	W-158-11D	20-Oct-91	13,000
W-159	W-159-01DL	14-Sep-91	15,000
W-159	W-159-11D	20-Oct-91	31,000
W-160	W-160-01DL	14-Sep-91	480
W-160	W-160-11D	23-Oct-91	400
WP-07-10A	WP07-10A	27-Oct-91	1,300

Table A.9-2. Upper-Zone Monitor Wells Within the East Parking Lot Plume at Which TCE Degradation Product Concentrations Exceeded the Contract Required Quantitation Limit (CRQL)

Chemical Name	Site ID	Sample ID	Sample Date	Result ($\mu\text{g/L}$)
1,1-Dichloroethene	LF04-02	LF04-02	27-Oct-91	2
1,1-Dichloroethene	LF04-04	LF04-04	27-Oct-91	2
1,1-Dichloroethene	LF05-01	LF05-01	28-Oct-91	2
1,1-Dichloroethene	LF05-5A	LF05-5A	27-Oct-91	3
1,1-Dichloroethene	WP07-10A	WP07-10A	27-Oct-91	2
1,2-Dichloroethene	HM-099	QM-006	14-Mar-91	250
1,2-Dichloroethene	HM-099	WQM004	05-Dec-90	1,100
1,2-Dichloroethene	HM-115	QM-008	18-Mar-91	28
1,2-Dichloroethene	HM-115	WQM010	07-Dec-90	9
1,2-Dichloroethene	HM-121	QM-010	19-Mar-91	13
1,2-Dichloroethene	HM-121	WQM009	06-Dec-90	9
1,2-Dichloroethene	HM-122	QM-011DL	19-Mar-91	3800
1,2-Dichloroethene	HM-122	WQM022	10-Dec-90	290
1,2-Dichloroethene	HM-123	QM-012DL	19-Mar-91	1000
1,2-Dichloroethene	HM-123	WQM011	07-Dec-90	670
cis-1,2-Dichloroethene	HM-099	HM-99	25-Oct-91	440
cis-1,2-Dichloroethene	HM-123	HM-123	25-Oct-91	230
cis-1,2-Dichloroethene	LF04-02	LF04-02	27-Oct-91	390
cis-1,2-Dichloroethene	LF04-04	LF04-04	27-Oct-91	350
cis-1,2-Dichloroethene	LF05-01	LF05-01	28-Oct-91	110
cis-1,2-Dichloroethene	LF05-5A	LF05-5A	27-Oct-91	600
cis-1,2-Dichloroethene	W-131L	W-131L-01	11-Sep-91	7
cis-1,2-Dichloroethene	W-137	W-137-01	16-Sep-91	16
cis-1,2-Dichloroethene	W-137	W-137-11	24-Oct-91	29
cis-1,2-Dichloroethene	W-139L	W-139L-01	16-Sep-91	11
cis-1,2-Dichloroethene	W-139L	W-139L-11	19-Oct-91	9
cis-1,2-Dichloroethene	W-149	W-149-01	18-Sep-91	1,500
cis-1,2-Dichloroethene	W-149	W-149-11	17-Oct-91	1,500
cis-1,2-Dichloroethene	W-150L	W-150-11	20-Oct-91	19
cis-1,2-Dichloroethene	W-150L	W-150L-01	14-Sep-91	34
cis-1,2-Dichloroethene	W-151	W-151-01	13-Sep-91	28
cis-1,2-Dichloroethene	W-151	W-151-01DL	13-Sep-91	25
cis-1,2-Dichloroethene	W-151	W-151-11	21-Oct-91	23
cis-1,2-Dichloroethene	W-151	W-151-11D	21-Oct-91	37
cis-1,2-Dichloroethene	W-153	W-153-01	18-Sep-91	130
cis-1,2-Dichloroethene	W-153	W-153-02	18-Sep-91	120
cis-1,2-Dichloroethene	W-153	W-153-11	23-Oct-91	110
cis-1,2-Dichloroethene	W-153	W-153-11D	23-Oct-91	87
cis-1,2-Dichloroethene	W-153	W-153-12	23-Oct-91	110
cis-1,2-Dichloroethene	W-153	W-153-12D	23-Oct-91	100
cis-1,2-Dichloroethene	W-156	W-156-01	17-Sep-91	170
cis-1,2-Dichloroethene	W-156	W-156-01DL	17-Sep-91	170
cis-1,2-Dichloroethene	W-156	W-156-11	22-Oct-91	170

Table A.9-2. Upper-Zone Monitor Wells Within the East Parking Lot Plume at Which TCE Degradation Product Concentrations Exceeded the Contract Required Quantitation Limit (CRQL) (Continued, Page 2 of 2)

Chemical Name	Site ID	Sample ID	Sample Date	Result ($\mu\text{g/L}$)
<i>cis</i> -1,2-Dichloroethene	W-158	W-158-01	14-Sep-91	18
<i>cis</i> -1,2-Dichloroethene	W-158	W-158-11	20-Oct-91	19
<i>cis</i> -1,2-Dichloroethene	W-159	W-159-01	14-Sep-91	20
<i>cis</i> -1,2-Dichloroethene	W-159	W-159-11	20-Oct-91	20
<i>cis</i> -1,2-Dichloroethene	W-160	W-160-01	14-Sep-91	170
<i>cis</i> -1,2-Dichloroethene	W-160	W-160-01DL	14-Sep-91	180
<i>cis</i> -1,2-Dichloroethene	W-160	W-160-11	23-Oct-91	120
<i>cis</i> -1,2-Dichloroethene	W-160	W-160-11D	23-Oct-91	110
<i>cis</i> -1,2-Dichloroethene	WP07-10A	WP07-10A	27-Oct-91	440
<i>trans</i> -1,2-Dichloroethene	HM-099	HM-99	25-Oct-91	2
<i>trans</i> -1,2-Dichloroethene	HM-123	HM-123	25-Oct-91	13
<i>trans</i> -1,2-Dichloroethene	LP04-02	LP04-02	27-Oct-91	15
<i>trans</i> -1,2-Dichloroethene	LP04-04	LP04-04	27-Oct-91	11
<i>trans</i> -1,2-Dichloroethene	LP05-01	LP05-01	28-Oct-91	10
<i>trans</i> -1,2-Dichloroethene	LP05-5A	LP05-5A	27-Oct-91	16
<i>trans</i> -1,2-Dichloroethene	W-150L	W-150L-01	14-Sep-91	22
<i>trans</i> -1,2-Dichloroethene	W-160	W-160-01	14-Sep-91	5
<i>trans</i> -1,2-Dichloroethene	WP07-10A	WP07-10A	27-Oct-91	13
Vinyl Chloride	HM-122	QM-011	19-Mar-91	14
Vinyl Chloride	HM-123	HM-123	25-Oct-91	7
Vinyl Chloride	HM-123	QM-012	19-Mar-91	27
Vinyl Chloride	LP04-02	LP04-02	27-Oct-91	3
Vinyl Chloride	LP04-04	LP04-04	27-Oct-91	3
Vinyl Chloride	LP05-01	LP05-01	28-Oct-91	15
Vinyl Chloride	LP05-5A	LP05-5A	27-Oct-91	7
Vinyl Chloride	W-160	W-160-01	14-Sep-91	98
Vinyl Chloride	W-160	W-160-01DL	14-Sep-91	91
Vinyl Chloride	W-160	W-160-11	23-Oct-91	86
Vinyl Chloride	W-160	W-160-11D	23-Oct-91	78
Vinyl Chloride	WP07-10A	WP07-10A	27-Oct-91	4

contaminated plumes at AFP4. The physical containment technology consists of using a sealable joint sheet piling to isolate the source areas. This technology was not considered practical at the site due to the presence of underground utilities and the permeable gravel above the Walnut Formation aquifer.

Soil venting and soil washing are the two source removal technologies considered in this report. The soil venting technology was considered applicable at the site. However, the soil washing technology is viewed as too exploratory and risky. It was considered risky because the surface tension reduction of TCE by the surfactants can cause pure TCE phase to migrate further downward.

The in situ plume management technologies are for the most part are still emerging technologies. These include methanotrophic microbial degradation (MMD), constitutive aerobic microbial degradation (CAMD) and the permeable dehalogenation wall (PDW). With the MMD technology, methane and oxygen are dissolved in water and introduced into the aquifer. The microbes co-metabolize the TCE with the methane. The MMD technology was considered innovative and holds promise for application at the site.

This technology is in the field demonstration stage and has met with limited success. In the CAMD technology, specific microbes containing enzyme systems, activated by a nontoxic substrate, are added to the groundwater for the destruction of TCE. Field studies are yet to be conducted on this technology.

The PDW technology is applied by emplacing a permeable reaction zone containing iron grindings into the aquifer. This technology is in the field demonstration stage and considered applicable for the upper zone aquifer at the East Parking Lot.

Based on the technology review, both interim and long-term recommendations were made for the remediation of contaminated plume at the East Parking Lot.

Also, a cost analysis system, Remedial Action Cost Estimating and Requirements (RACER) system, is proposed for use in the technology evaluation at AFP4.

The following interim and long-term recommendations were made to achieve a limitation in further escalation of the plume:

1. Interim Measures:
 - a. Data collection (e.g., concentrations, hydraulic heads, and conductivity) using the existing wells to define the hot-spot dimensions and hydraulic characteristics. Also, additional characterization of the downgradient plume would be needed.
 - b. Installation of an extraction well for pilot-scale pumping test to determine the time series concentration data and the radius of influence.
 - c. Completion of design and installation of remedial well fields downgradient of the hot spots. This would include customization of numerical or analytical model of the pumping situation. Also, an aboveground treatment system would be required to treat the contaminated water.
 - d. Installation of soil vapor extraction system on west side of the Assembly Building and conduct soil sampling in other suspected hot spots.
 - e. Installation of free-product recovery systems.

Other interim measures suggested to further limit the plume spread include the following:

- f. Installation of soil vapor extraction system near the new spill on west side of the Assembly Building.
2. Long-term measures:
 - a. Pump-and-treat for the dilute and predominate portion of the plume using state-of-the-art pump and treat optimization processes. Obtain regulatory approval for placement of

extraction wells at an isoconcentration contour commensurate with a level of risk un the Upper Zone Aquifer.

- b. Significant vadose zone contamination would warrant soil venting operations for long-term remediation. Using cometabolism bioventing should be also be considered.
- c. Other area of plume management, i.e., application of in situ technologies (i.e., soil venting, MMD, and PMW) for the concentrated portion of the plume.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

Recommendations were made for interim and long-term measures for the remediation of groundwater at the East Parking Lot.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

Additional characterization and sampling was proposed for the downgradient plume at the East Parking Lot.

5.0 PROJECTS RESULTING FROM THE PROJECT

The following project reports were prepared as a result of this project on the Window Area at the East Parking Lot and the East Parking Lot Plume:

1. A Quality Assurance Management Plan (QAMP) [International Technologies, Inc. (IT), 1992],
2. A 50-percent design package (IT, 1993),
3. A draft-final feasibility study (FS) (RUST Geotech, Inc., 1993),
4. Construction plans (IT, 1993), and
5. A 100 percent design package (IT, 1993).

6.0 PROJECT STATUS

The project was not implemented.

7.0 SCHEDULE

Schedule is not available.

**8.0 WHETHER OR NOT INFORMATION DERIVED
IS IN THE INSTALLATION RESTORATION PROGRAM
INFORMATION MANAGEMENT SYSTEM (IRPIMS)**

No data from this project are in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Draft Contract Quality Control Plan Addendum,
Groundwater Remediation of Window Area

AUTHOR: International Technology Corporation

DOCUMENT NUMBER: Not Available

CATEGORY: Not Available

SUBMITTED: October 1992

1.0 REMEDIATION PROJECT OBJECTIVES

The purpose of this document was to present the Contract Quality Control Plan (CQCP) for the Window Area groundwater remediation project at Air Force Plant 4 (AFP4).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 PREVIOUS INVESTIGATION RESULTS

Previous investigations have identified an upper zone aquifer containing trichloroethene (TCE) at AFP4. The TCE concentrations form a relatively narrow highly concentrated central plume paralleling the bedrock topography. TCE was also identified in a broader lower zone aquifer (Paluxy aquifer) plume that flows in the same direction as the upper zone aquifer.

The Window Area was defined as the location where the overburden alluvium (upper zone aquifer) is in contact with the lower Paluxy aquifer. It is located on the eastern side of the assembly building within the area occupied by the East Parking Lot. The location of the Window Area is shown in Figure A.10-1.

2.2 PROJECT ACCOMPLISHMENTS

The CQCP was prepared as an addendum to the Quality Assurance Management Plan (QAMP). It focused on specific procedures, data quality objectives, and verification activities for the groundwater remediation project at the Window Area. The specific operations addressed in this CQCP include the following:

1. Chemical testing and quality control,

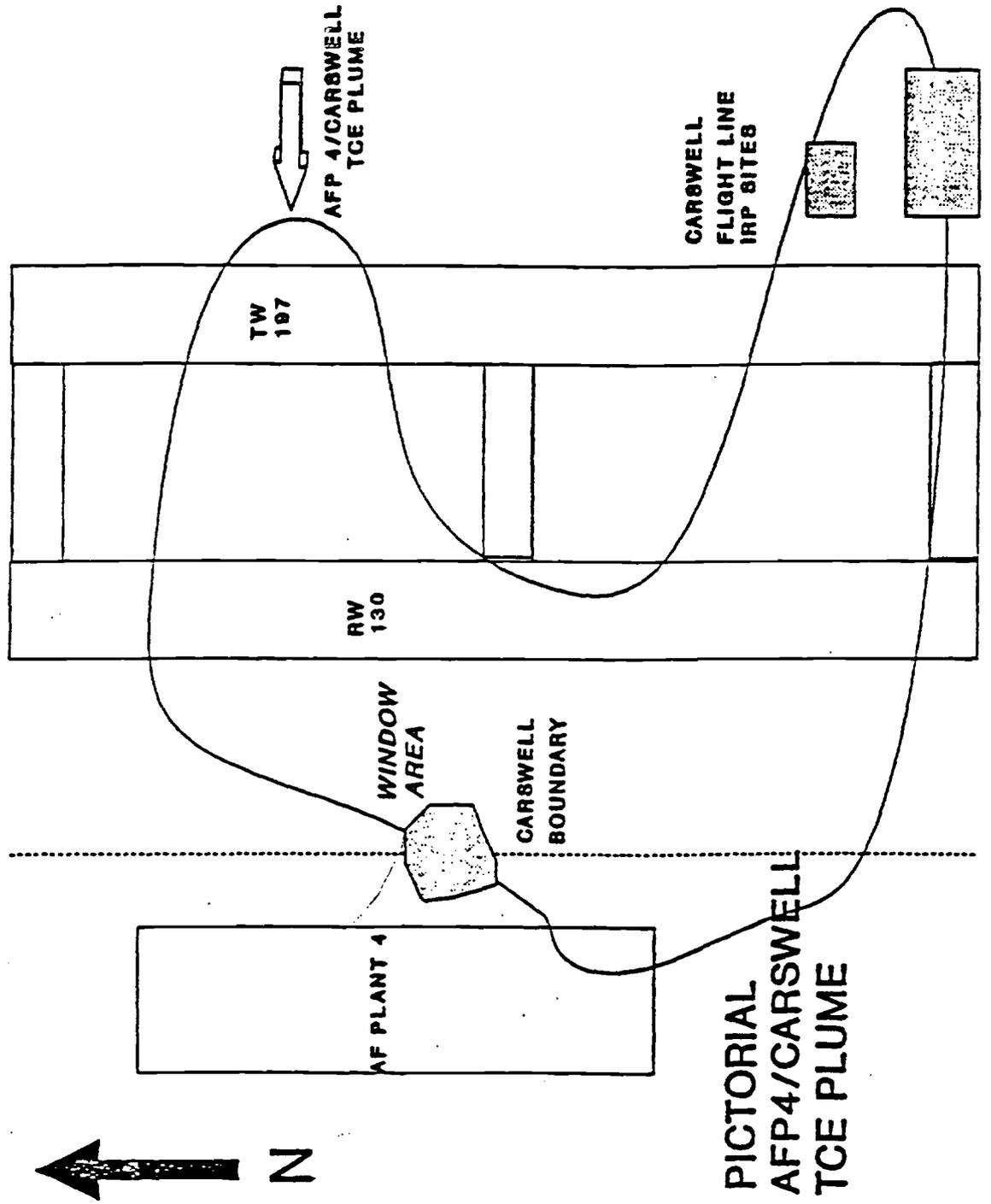


Figure A.10-1
LOCATION PLAN OF THE WINDOW AREA

2. Verification of chemical data,
3. Preventive maintenance, and
4. Construction verification and quality control.

2.2.1 CHEMICAL TESTING AND QUALITY CONTROL (QC)

The specific QC requirements for the groundwater chemical analysis samples collected during the aquifer pumping tests are presented in this section. It also specified the requirements for onsite field testing and offsite analytical laboratory quality control. The information on the chemical data quality objectives summary; the precision, accuracy, completeness; and sensitivity summary are presented in Tables A.10-1 and A.10-2, respectively. The internal QC summary and sample containers, preservatives, and holding times summary are presented in Tables A.10-3 and A.10-4, respectively.

2.2.2 VERIFICATION OF CHEMICAL DATA

A summary of the groundwater chemical data verification requirements is presented in Table A.10-5. The required level of review for each activity was also presented in this section.

2.2.3 PREVENTIVE MAINTENANCE

The information on the preventive maintenance requirements for the field equipment and the laboratory instruments was discussed. The degree and frequency of maintenance was established according to the frequency of use and the sensitivity of the equipment to environmental conditions.

The schedule of preventive maintenance was presented in the field sampling, analysis, and testing plan (FSATP). A routine preventive maintenance program was conducted by an offsite laboratory team from International Technology (IT) Corporation to minimize the occurrence of instrument and system malfunctions.

Table A.10-1. Chemical Data Quality Objectives Summary

Test	Method	Field Samples	Field QC Samples	Lab QC Samples	Quality Level
VOA	CLP ¹	9	1	4	Level 4
Semi-VOA	CLP ¹	9	1	3	Level 4
Metals	CLP ²	9	1	3	Level 4
Cr+6	LACHAT ³ 10-124-13-1A	9	1	3	Level 3
Nitrate/ Nitrite	LACHAT ³ 10-107-04-1A	9	1	3	Level 3
Sulfate	MCAWW ⁴ 375.2	9	1	F 3	Level 3
Chloride	MCAWW ⁴ 325.3	9	A 1	3	Level 3
Alkalinity	MCAWW ⁴ 310.1	9	1	3	Level 3
BOD	SM ⁵ 507	R 9	1	2	Level 2
COD	MCAWW ⁴ 410.1	9	1	2	Level 3
Settleable Solids	SM ⁵ 209E	9	1	0	Level 2
TSS	MCAWW ⁴ 160.1	9	1	1	Level 3
TDS	MCAWW ⁴ 160.2	9	1	1	Level 3
pH	MCAWW ⁴ 150.1	9	1	1	Level 2

¹EPA Contract Laboratory Program Statement of Work for Organic Analysis, Document No. OLM01.1.

²EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Document No. ILM02.0.

³Quick Chem Method, LACHAT Instruments, 1987.

⁴Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.

⁵Standard Methods for the Examination of water and Wastewater, 17th ed., 1989.

Sources: IT Corp., 1992; ESE.

PTJ0-92AWP305849:QCFAAddn(AFP4 GW Remediation Window Area)

Table A.10-2. Precision, Accuracy, Completeness, and Sensitivity Summary

Test	Method	Spike Limits Precision	Accuracy	Completeness ¹	Sensitivity
VOA	CLP ²	CLP Matrix	CLP Matrix	85%	10 µg/l
Semi-VOA	CLP ²	CLP Matrix	CLP Matrix	85%	10 to 25 µg/L
Metals	CLP ³	± 25% RPD	75 to 125% Recovery	85%	0.2 to 5,000 µg/L
Cr+6	LACHAT ⁴ 10-124-13-1A	± 25% RPD	75 to 125% Recovery	90%	0.02 mg/L
Nitrate/ Nitrite	LACHAT ⁴ 10-107-04-1a	± 25% RPD	75 to 125% Recovery	90%	0.2 mg/L
Sulfate	MCAWW ⁵ 375.2	± 25% RPD	75 to 125% Recovery	90%	10 mg/l
Chloride	MCAWW ⁵ 325.3	± 25% RPD	75 to 125% Recovery	90%	1 mg/l
Alkalinity	MCAWW ⁵ 310.1	± 25% RPD	75 to 125% Recovery	90%	1.0 mg/l
BOD	SM ⁶ 507	± 35% RPD	N/A	90%	2 mg/l
COD	MCAWW ⁵ 410.1	± 25% RPD	N/A	90%	50 to 250 mg/l
Settleable Solids	SM ⁶ 209E	N/A	N/A	90%	N/A
TSS	MCAWW ⁵ 160.1	± 15% RPD	N/A	90%	4 mg/l
TDS	MCAWW ⁵ 160.2	± 15% RPD	N/A	90%	10 mg/l
pH	MCAWW ⁵ 150.1	N/A	N/A	90%	± 0.05 pH units

¹Matrix or Surrogate Spike Interferences will not be included in Percent completeness.

²EPA Contract Laboratory Program Statement of Work for Organic Analysis, Document No. OLM01.1.

³EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Document No. ILM02.0.

⁴Quick Chem Method, LACHAT Instruments, 1987.

⁵Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.

⁶Standard Methods for the Examination of Water and Wastewater, 17th ed., 1989.

Sources: IT Corp., 1992; ESE.

Table A.10-3. Internal Quality Control Summary

Test	Method	Matrix Spike	Matrix Spike Duplicate	Duplicate	Spike	Method Blank	Trip Blank
VOA	CLP ¹	✓	✓			✓	✓
Semi-VOA	CLP ¹	✓	✓			✓	
Metals	CLP ²			✓	✓	✓	
Cr+6	LACHAT ³ 10-124-13-1A			✓	✓	✓ T	
Nitrate/ Nitrite	LACHAT ³ 10-107-04-1A			✓	✓	✓	
Sulfate	MCAWW ⁴ 375.2			✓	F✓	✓	
Chloride	MCAWW ⁴ 325.3			A✓	✓	✓	
Alkalinity	MCAWW ⁴ 310.1			✓	✓	✓	
BOD	SM ⁵ 507	R		✓		✓	
COD	MCAWW ⁴ 410.1			✓		✓	
Settleable Solids	SM ⁵ 209E						
TSS	MCAWW ⁴ 160.1			✓			
TDS	MCAWW ⁴ 160.2			✓			
pH	MCAWW ⁴ 150.1			✓			

¹EPA Contract Laboratory Program Statement of Work for Organic Analysis, Document No. OLM01.1.

²EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Document No. ILM02.0.

³Quick Chem Method, LACHAT Instruments, 1987.

⁴Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.

⁵Standard Methods for the Examination of Water and Wastewater, 17th ed., 1989.

Sources: IT Corp., 1992; ESE.

Table A.10-4. Samples Containers, Preservatives, and Holding Times Summary

Test	Method	Media	Sample Container	Preservative	Holding Time
VOA	CLP ¹	Groundwater	40 ml amber	HCl	10 days VTSR
Semi-VOA	CLP ¹	Groundwater	80 oz amber	None	5 days VTSR
Metals	CLP ²	Groundwater	1 liter plastic	HNO ₃	26 days Hg others 180 days
Cr+6	LACHAT ³ 10-124-13-1A	Groundwater	1 liter plastic	HNO ₃	24 hours
Nitrate/ Nitrite	LACHAT ³ 10-107-04-1A	Groundwater	1 liter plastic	F H ₂ SO ₄	28 days
Sulfate	MCAWW ⁴ 375.2	Groundwater	1 liter plastic	None	28 days
Chloride	MCAWW ⁴ 325.3	Groundwater	1 liter plastic	None	28 days
Alkalinity	MCAWW ⁴ 310.1	R Groundwater	1 liter plastic	None	14 days
BOD	SM ⁵ 507	Groundwater	1 liter plastic	None	48 hours
COD	MCAWW ⁴ 410.1	Groundwater	1 liter plastic	H ₂ SO ₄	28 days
Settleable Solids	SM ⁵ 209E	Groundwater	1 liter plastic	None	24 hours
TSS	MCAWW ⁴ 160.1	Groundwater	1 liter plastic	None	7 days
TDS	MCAWW ⁴ 160.2	Groundwater	1 liter plastic	None	7 days
pH	MCAWW ⁴ 150.1	Groundwater	1 liter plastic	None	immediate

¹EPA Contract Laboratory Program Statement of Work for Organic Analysis, Document No. OLM01.1.

²EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Document No. ILM02.0.

³Quick Chem Method, LACHAT Instruments, 1987.

⁴Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.

⁵Standard Methods for the Examination of Water and Wastewater, 17th ed., 1989.

Sources: IT Corp., 1992; ESE.

Table A.10-5. Chemical Data Verification Summary

Data Use	Verify Chain-of Custody	Verify Holding Time	Verify Calibration	Calibration Check Performed	Review of Internal OC Samples	Review of Nonconformance Reports	CLP Data Package Required	Certificate of Analysis Required	Numerical Listing of Data Only
Field GW Measurements			✓	✓		✓			✓
Lab GW Analytical Data (CLP)	✓	✓	✓	✓	✓	✓	✓	✓	
Lab GW Analytical Data (pH, settleable solids, BOD)	✓	✓	✓	✓		✓			✓
Lab GW Analytical Data (All remaining)	✓	✓	✓	✓	✓	✓		✓	

✓

✓

Sources: IT Corp., 1992; ESE.

2.2.4 CONSTRUCTION VERIFICATION AND QC

The verification inspections and testing activities required for the aquifer pumping test system installation and start-up were discussed. They included the inspection requirements upon receiving the field equipment, inspection of the system installation on a continual basis during construction, and the requirements for the pumping test.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

This document developed the quality control plans for the remediation of groundwater at the Window Area.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional studies.

5.0 PROJECTS RESULTING FROM THE PROJECT

The following project reports were prepared as a result of this project on the Window Area at the East Parking Lot and the East Parking Lot Plume:

1. A 50 percent design package (IT, 1993),
2. A draft-final feasibility study (FS) (Geotech, Inc., 1993),
3. Construction plans (IT, 1993), and
4. A 100 percent design package (IT, 1993).

6.0 PROJECT STATUS

The project was not implemented.

7.0 SCHEDULE

No schedule is available.

**8.0 WHETHER OR NOT INFORMATION DERIVED
IS IN THE INSTALLATION RESTORATION PROGRAM
INFORMATION MANAGEMENT SYSTEM (IRPIMS)**

No data from this project are in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Groundwater Remediation of Window Area--50
Percent Design Package

AUTHOR: International Technology Corporation

DOCUMENT NUMBER: Not Available

CATEGORY: Not Available

SUBMITTED: March 1993

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to develop a 50 percent design package for the groundwater treatment facility at the Window Area of Air Force Plant 4 (AFP4).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 PREVIOUS INVESTIGATION RESULTS

Site characterization performed at AFP4 indicated that groundwater at this site was contaminated with volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and inorganic compounds. The most prevalent VOC was trichloroethene (TCE) and, to a lesser extent 1,1,1-trichloroethane (TCA). The highest concentrations of TCE was present in the upper-zone groundwater plumes. Plumes of decreasing concentrations of TCE, TCA, and their degradation products extend along the groundwater flow direction in the upper zone.

Contamination was introduced into the Paluxy Formation primarily through vertical leakage from the upper-zone flow system in the vicinity of the East Parking Lot. This vertical leakage area at the East Parking Lot was named the Window Area (Figure A.11-1). Samples from monitor wells completed in the upper portion of the Paluxy Formation in the vicinity of the Window Area contain relatively high concentrations of TCE (Table A.11-1).

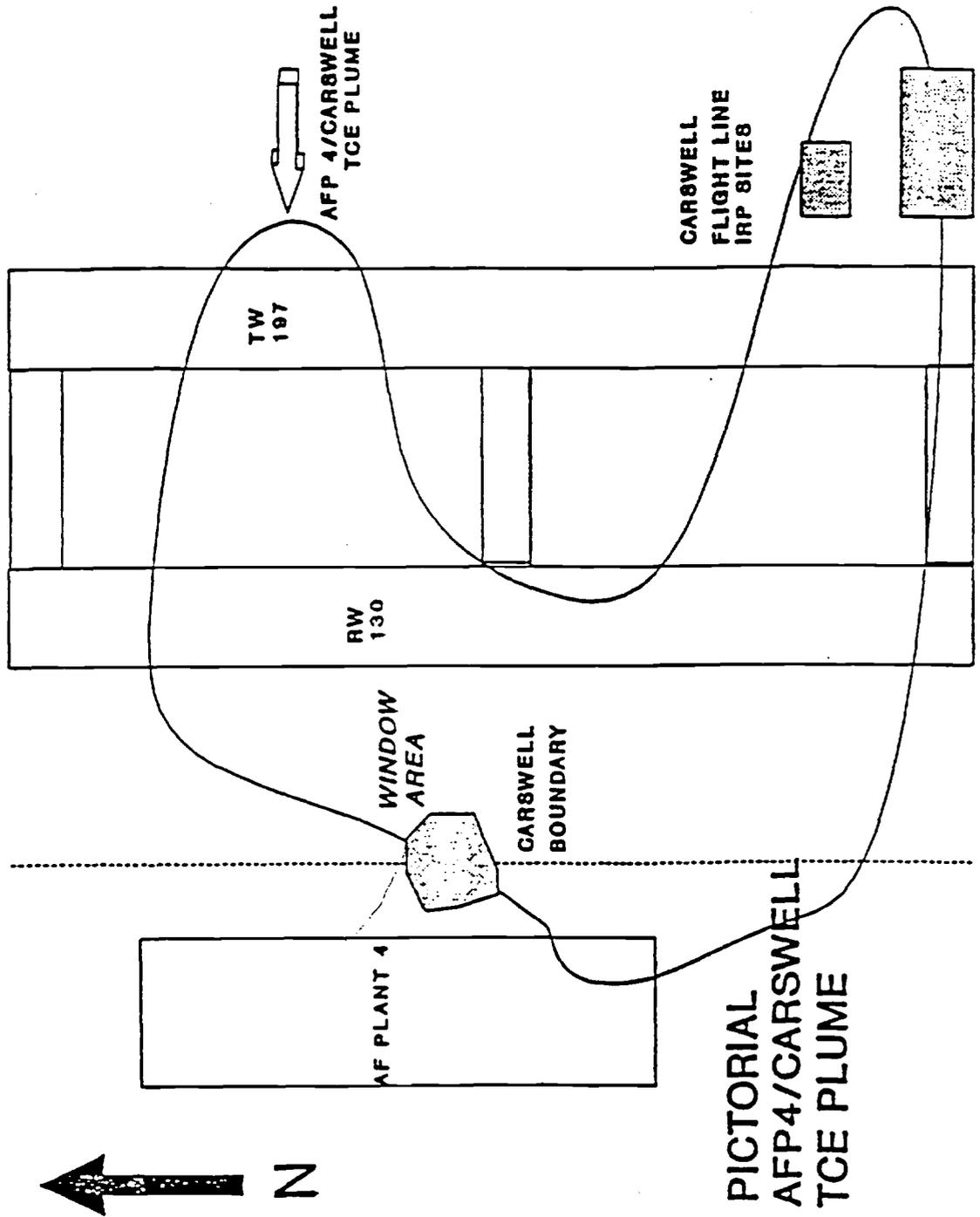


Figure A.11-1 WINDOW AREA AT AIR FORCE PLANT 4
SOURCES: IT CORP., 1993; ESE.

Table A.11-1. Paluxy Formation Monitoring Wells at Which TCE Was Detected Above CRQL

Well ID	Sample ID	Sample Date	TCE ($\mu\text{g/L}$)
P-05M	NAA206	28-Apr-90	14
P-08UN	NAA266	28-Apr-90	22
P-08UN	P-8UN	19-Oct-91	30
P-08US	NAA213	29-Apr-90	550
P-09US	NAA215	29-Apr-90	4,300
P-09US	QM-014	13-Mar-91	980
P-09US	WQM005	05-Dec-90	1,900
P-10M	NAA217	30-Apr-90	13
P-12M	AFR-005	12-Jun-91	3
P-12M	NAA221	29-Apr-90	7
P-14US	NAA225	02-May-90	320
P-15US	NAA226	02-May-90	40
P-16US	NAA228	02-May-90	860
P-16US	P-16US	26-Oct-91	510
P-16US	QM-016	13-Mar-91	780
P-16US	WQM021	09-Dec-90	900
P-22M	NAA275	01-May-90	10
P-22M	P-22M	22-Oct-91	2
P-22M	WQM015	08-Dec-90	7
P-22U	NAA230	01-May-90	90
P-22U	NAA264	01-May-90	69
P-22U	P-22UPPER	27-Jan-90	100
P-22U	WQM017	08-Dec-90	48
P-24M	NAA233	30-Apr-90	8
P-27U	P27U-11	18-Oct-91	69
P-27U	P27U-11D	18-Oct-91	74

2.2 PROJECT ACCOMPLISHMENTS

This report developed a design package (50 percent) for the remediation of groundwater at the Window Area. It consisted of the specifications and drawings for the air stripping treatment system and the associated equipment.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

The information developed as a result of this project includes the following:

1. Specifications for the air stripping system and the associated equipment,
2. Piping layout, and
3. Drawings (process flow diagram, P&ID legend, recovery wells and equalization tank, air stripping tower, liquid and vapor-phase carbon, plan and elevation of the treatment facility, and plan and sections of the valve box).

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional studies at the site.

5.0 PROJECTS RESULTING FROM THE PROJECT

The following project reports were prepared as a result of this project:

1. Draft-final feasibility study (FS) (RUST Geotech, Inc., 1993),
2. Construction plans (IT, 1993), and
3. A 100-percent design package (IT, 1993).

6.0 PROJECT STATUS

The project was not implemented.

7.0 SCHEDULE

No schedule is available.

**8.0 WHETHER OR NOT INFORMATION DERIVED
IS IN THE INSTALLATION RESTORATION PROGRAM
INFORMATION MANAGEMENT SYSTEM (IRPIMS)**

No data from this project are in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Design Plan for Subsurface Barrier Wall at Landfill No. 3

AUTHOR: International Technology Corporation

DOCUMENT NUMBER: Not Available

CATEGORY: Not Available

SUBMITTED: March 1993

1.0 REMEDIATION PROJECT OBJECTIVES

The purpose of the project was to develop a preliminary design strategy plan to control the offsite migration of groundwater from Landfill No. 3 (LF03) into Meandering Road Creek.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

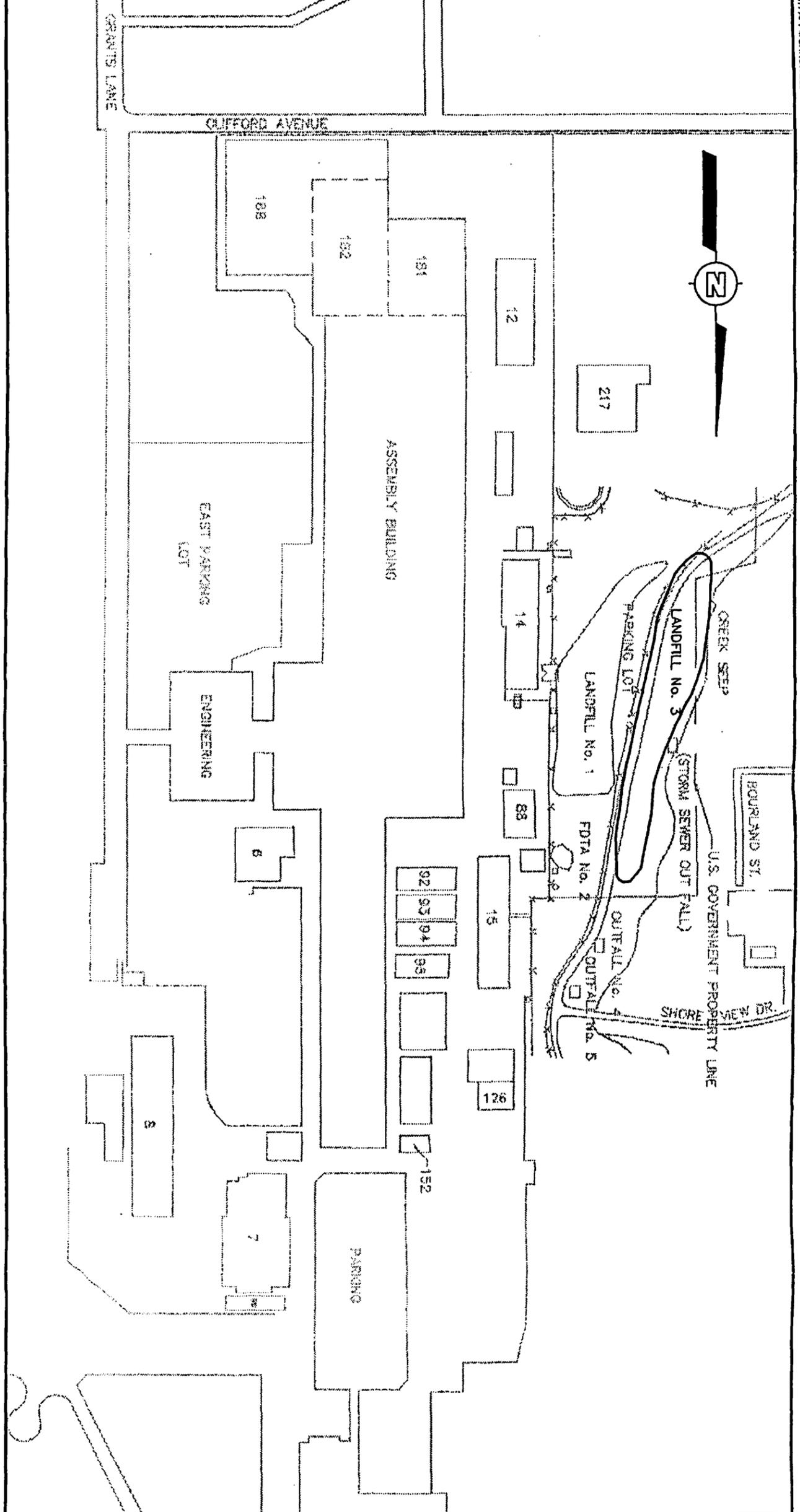
2.1 PREVIOUS INVESTIGATION RESULTS

LF03 was used to discard a variety of waste, including hazardous waste, consisting of mixed oils and solvents from 1942 to 1945. The location of LF03 is shown in Figure A.12-1. The report presents the references for previous investigations conducted at the site [U.S. Army Corps of Engineers (USACE), 1986; Hargis & Associates, Inc., 1989; Jacobs Engineering Group, 1992; Chem Nuclear Geotech, 1992a, 1992b]. The report cites that soil and groundwater media are contaminated with fuels, solvent-related compounds, and traces of metals. Analytical results for groundwater and soils at LF03 are presented in this report. Based on the available information at the site, Air Force Center for Environmental Excellence (AFCEE) envisioned an impermeable subsurface barrier system with a groundwater extraction system as the conceptual solution for the remediation of groundwater at LF03.

2.2 PROJECT ACCOMPLISHMENTS

A preliminary design strategy for groundwater remediation at LF03 was presented in this report. Under this strategy, the following alternatives were considered for the control of offsite migration of groundwater at LF03:

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		APPROVED BY			



LEGEND:

———— BOUNDARY OF LANDFILL NO. 3



Figure A.12-1 LOCATION PLAN FOR LF03

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1. Slurry wall (Figure A.12-2),
2. High-density polyethylene (HDPE) wall (Figure A.12-3),
3. Groundwater extraction system (Figure A.12-4), and
4. Leachate collection trench (Figure A.12-5).

These alternatives were evaluated based on the following seven criteria:

1. Overall protection of human health and the environment;
2. Compliance with applicable or relevant and appropriate requirements (ARARs);
3. Long-term effectiveness and permanence;
4. Reduction of toxicity, mobility, and volume (TMV); and
5. Short-term effectiveness;
6. Implementability; and
7. Cost.

No recommendations were made for the selected alternative in this report.

However, it was stated that a recommendation will be submitted to AFCEE in the form of a report entitled Confirmation of Design Strategy. The implementation of the conceptual design (Phase 1-B) would then be undertaken, following the approval of the design by AFCEE.

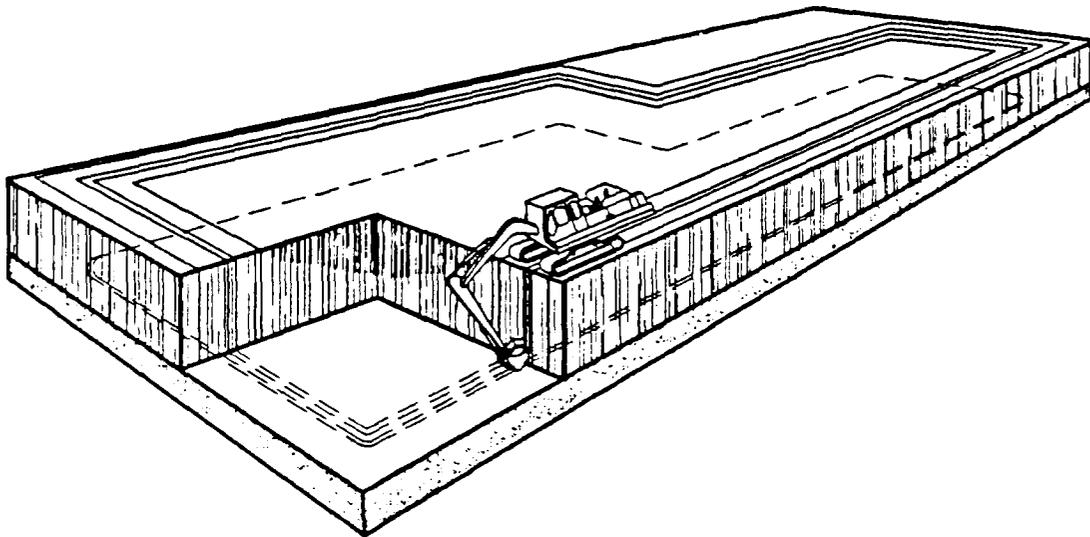
3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

Several alternatives were evaluated to control the offsite migration of groundwater at LF03 (see Section 2.0 for details of the alternatives). This report addressed only the groundwater contamination at LF03.

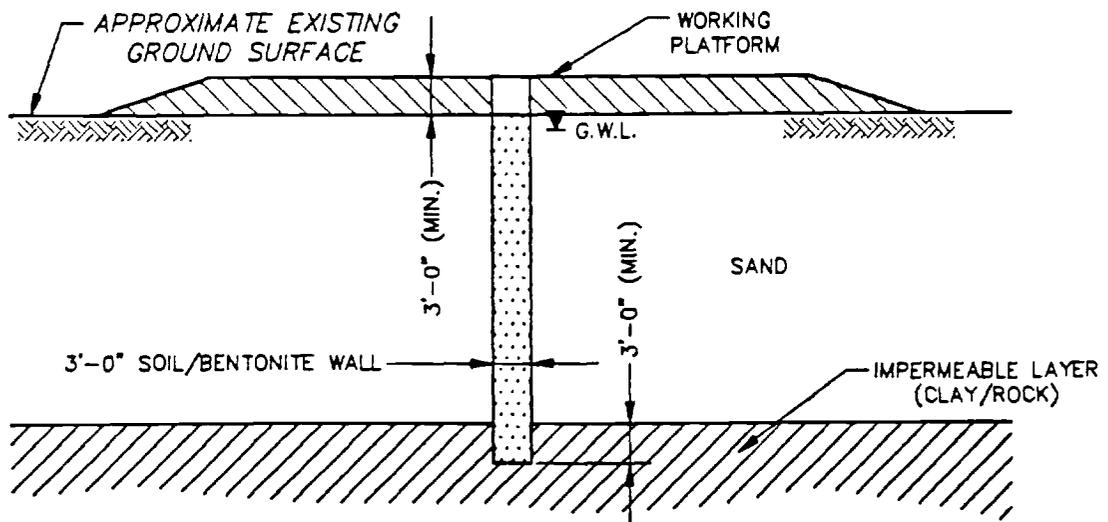
4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional studies at LF03.

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SLURRY WALL SCHEMATIC
NOT TO SCALE



CROSS-SECTION
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Figure A.12-2
**SLURRY WALL
SCHEMATIC AND CROSS-SECTION
LANDFILL #3**
SOURCES: IT CORP., 1993; ESE.

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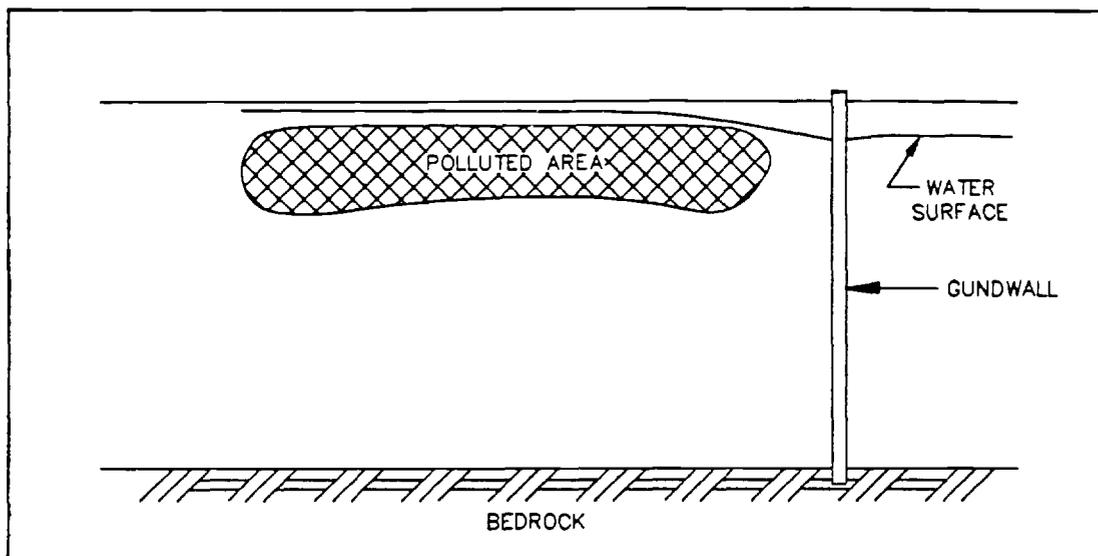
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FT. WORTH AFP/CARSWELL

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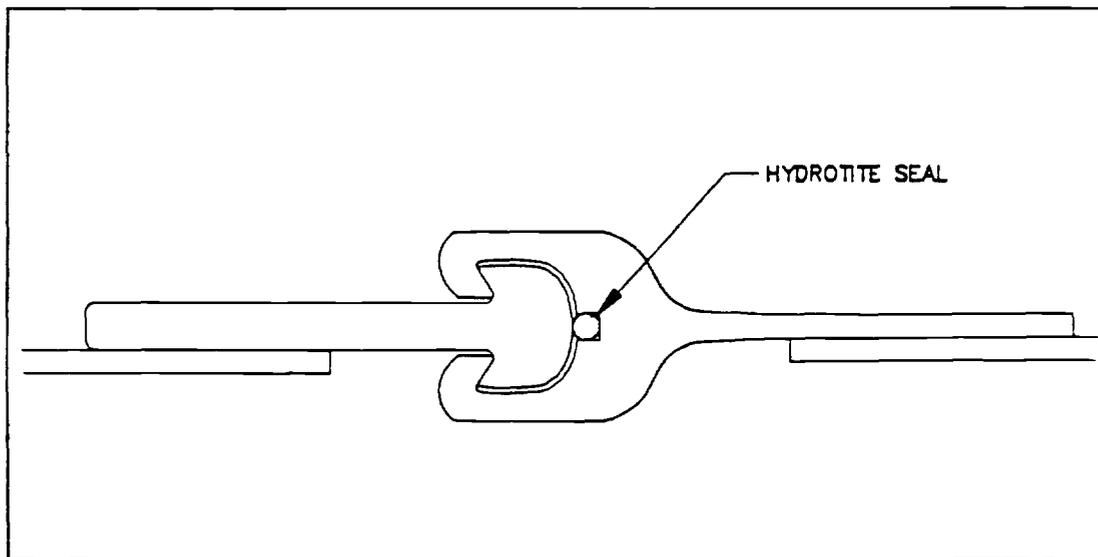
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APPROVED BY 11-13-92

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GUNDWALL CROSS-SECTION

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GUNDWALL INTERLOCK

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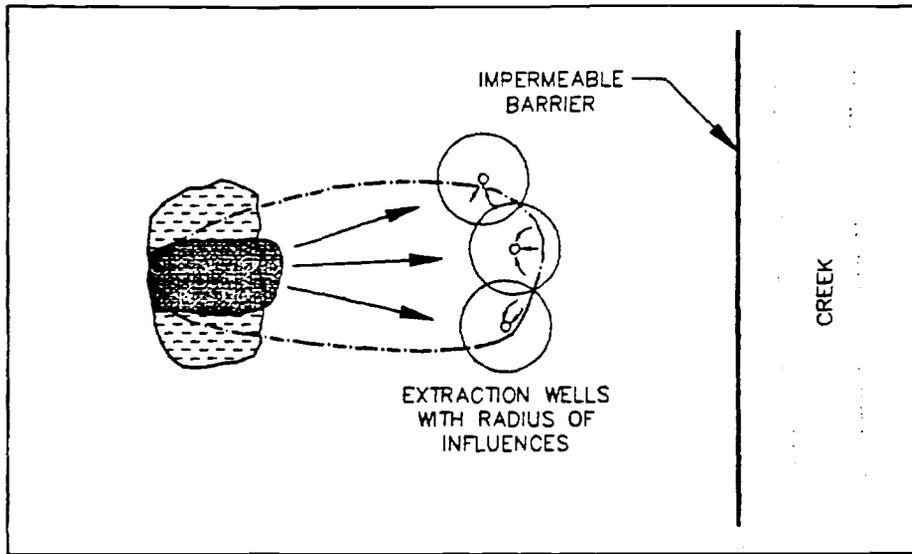
Figure A.12-3
GUNDWALL CROSS-SECTION
& INTERLOCK
LANDFILL #3
SOURCES: IT CORP., 1993; ESE.

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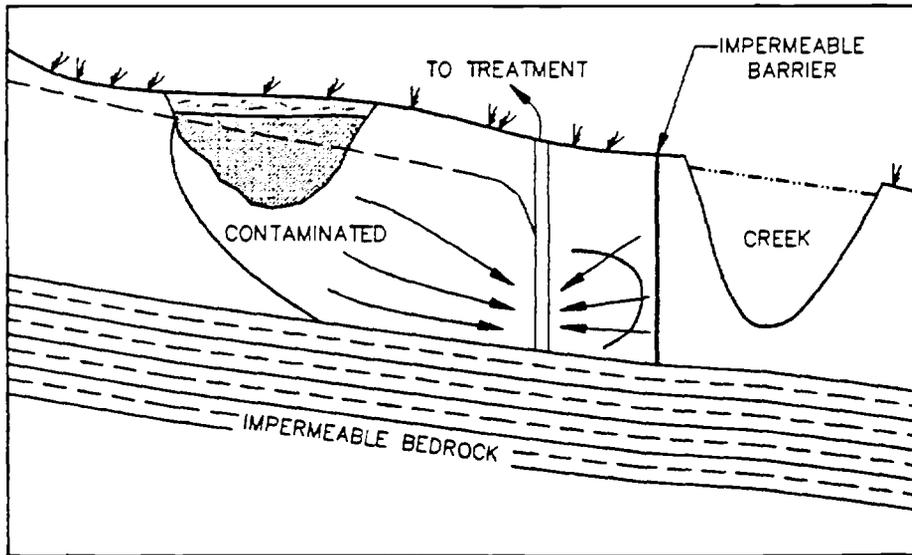
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PLAN VIEW
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CROSS-SECTION
NOT TO SCALE

Figure A.12-4
 EXTRACTION WELLS
 AND IMPERMEABLE BARRIER
 PLAN VIEW AND CROSS-SECTION
 LANDFILL #3
 SOURCES: IT CORP., 1993; ESE.

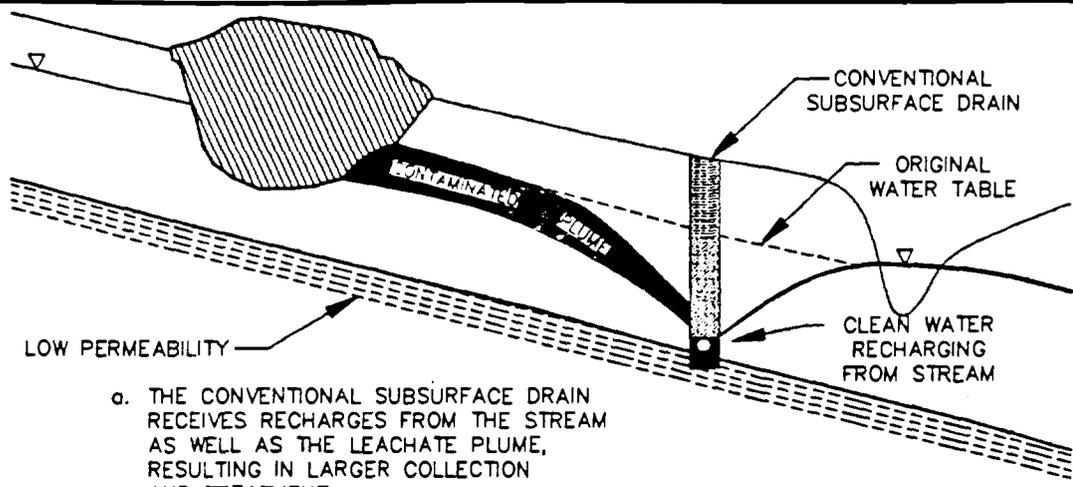
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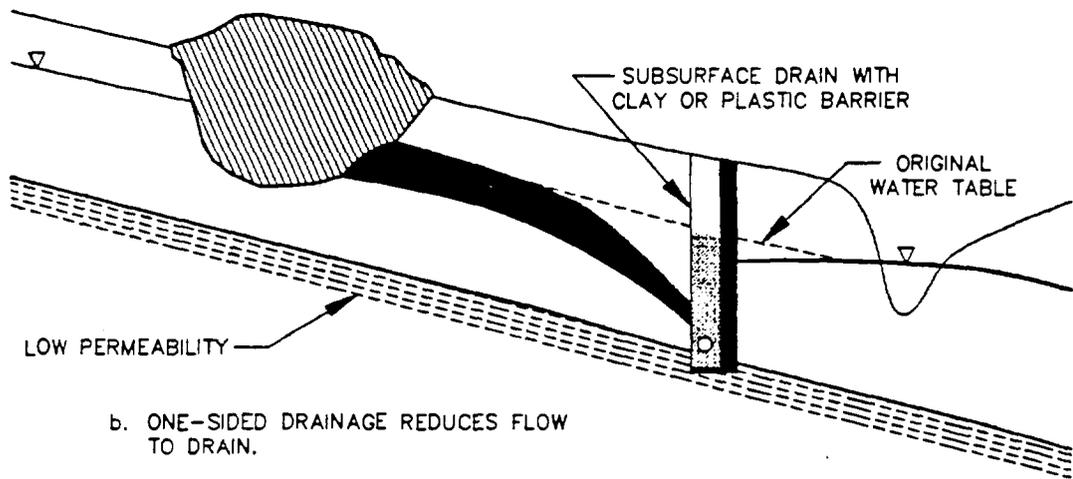
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FT. WORTH AFP4/CARSWELL

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a. THE CONVENTIONAL SUBSURFACE DRAIN RECEIVES RECHARGES FROM THE STREAM AS WELL AS THE LEACHATE PLUME, RESULTING IN LARGER COLLECTION AND TREATMENT.



b. ONE-SIDED DRAINAGE REDUCES FLOW TO DRAIN.

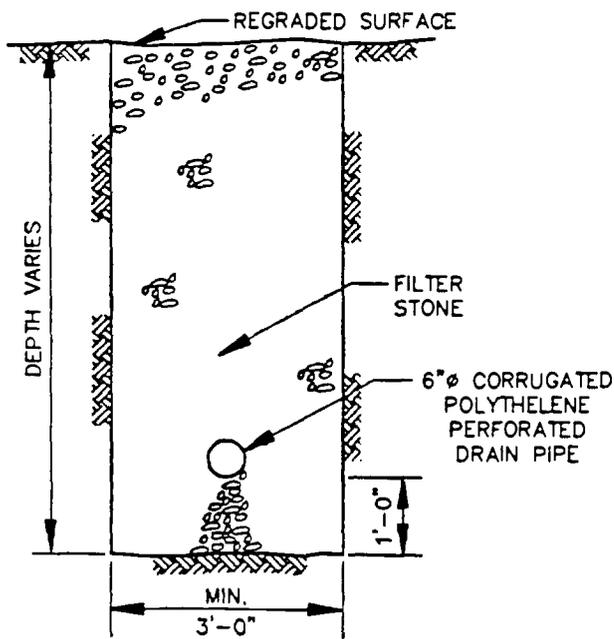


Figure A.12-5
LEACHATE COLLECTION
TRENCH SECTIONS
LANDFILL #3
SOURCES: IT CORP., 1993; ESE.

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"Do Not Scale This Drawing"

5.0 PROJECTS RESULTING FROM THE PROJECT

This report addressed only the groundwater contamination at LF03. In 1993, a draft final feasibility study (FS) report was prepared, and the analytical results of soil contamination at LF03 were discussed in the FS (Chem Nuclear Geotech, 1993).

6.0 PROJECT STATUS

The project was not implemented.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN THE INSTALLATION RESTORATION PROGRAM INFORMATION MANAGEMENT SYSTEM (IRPIMS)

No data from this project are in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Final Feasibility Study
AUTHOR: Chem Nuclear Geotech, Inc.
DOCUMENT NUMBER: Not Available
CATEGORY: Not Available
SUBMITTED: October 1993

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to prepare a draft-final feasibility study (FS) for the remediation of uncontrolled releases of hazardous substances at Air Force Plant 4 (AFP4).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

AFP4 is an aircraft manufacturing facility located in Tarrant County, Texas, 7 miles northwest of the City of Fort Worth. The facility has been in operation since 1942 and currently produces F-16 aircraft, radar units, and various aircraft and missile components.

Historically, the manufacturing processes at AFP4 have generated an estimated 5,500 to 6,000 tons of waste oils, solvents, paint residues, and spent process chemicals per year. These wastes were disposed onsite by burial in landfills, burning, or discharge into pits or the sanitary sewer system. A waste treatment plant was constructed in the early 1970s to treat the process chemical solutions, rinse waters, and other waste waters, and solvents. Some wastes, such as paint residues and process cyanide solutions, were later disposed of offsite by a contractor, and waste oils and fuels continued to be disposed of in onsite landfills or burned in fire training exercises. During the late 1970s, the burning of fuels for fire training was phased out and all waste oils and recoverable solvents have since been disposed of offsite by a contractor. Currently, through waste minimization techniques, the offsite disposal of wastes is less than 2,500 tons per year.

2.2 PREVIOUS INVESTIGATION RESULTS

Potential contamination at AFP4 was first noticed by a private citizen in September 1982. General Dynamics (GD) was notified and took immediate action. The source of the observed contamination was thought to be leachate from a landfill. In October 1982, GD began construction of French Drain No. 1 to prevent migration of contaminated groundwater toward Meandering Road Creek and divert the flow of surface water from the outfall where the contamination was first noticed.

In November 1982, Hargis & Associates, Inc. drilled approximately 260 soil borings, of which approximately 160 were constructed as monitor wells. Results of these investigations are contained within several reports (Hargis & Montgomery, 1983; Hargis & Associates, Inc., 1985a, 1985b, 1985c, 1987a, 1987b, 1988a, 1988b).

A Technical Review Committee (TRC) for AFP4 was established in 1983. The TRC consists of representatives from U.S. Environmental Protection Agency (EPA) Region VI, the Texas Water Commission (TWC), the City of Fort Worth, the City of White Settlement, the U.S. Air Force (USAF), the U.S. Army Corps of Engineers (USACE), and GD. Periodic TRC meetings have been held since 1983 to keep the local authorities and the community informed of remedial investigations at AFP4.

The Installation Restoration Program (IRP) for AFP4 was initiated in March 1984 when CH2MHill, Inc. conducted a Phase I Records Search. CH2MHill ranked 21 identified disposal sites in August 1984 according to the USAF Hazard Assessment Rating Methodology (HARM). The 21 sites include industrial processing areas, fuel storage areas, landfills, known chemical and fuel spills, chemical disposal pits, fire training areas, and the Assembly Building/Parts Plant.

USACE was retained in June 1985 to further delineate groundwater conditions along the southern base boundary and the East Parking Lot area of AFP4. USACE drilled 28 soil borings and constructed 6 monitor wells.

Radian Corporation (Radian) was retained in September 1985 to perform the Phase II, Stage I, Confirmation/Quantification of the IRP. Radian drilled 26 soil borings and constructed 14 monitor wells. A summary report of field investigations performed during the IRP Phase II, Stage 1 was prepared (Radian, 1987).

In December 1985, Intellus Corporation was contracted to conduct an IRP Phase IV remedial action plan (RAP) for 10 potential disposal sites and a Phase IV-A RAP and Phase IV-B design and construction for Fuel Saturation Areas Nos. 1 and 3 (FSA-1 and FSA-3). In support of the tasks, Intellus Corporation drilled 36 soil borings and constructed 24 groundwater monitor wells (Intellus, 1986a, 1986b, 1987).

Although previous studies have identified contaminants at each of the sites, the extent and nature of the contamination has not been fully addressed. Remedial actions were implemented at some sites; however, no investigations were previously performed to assess the success of these actions. It was also recognized that additional information was needed to assess potential pathways of contamination migration from the identified sites.

AFP4 was placed on the EPA National Priorities List (NPL) in August 1990. Pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), USAF, EPA Region VI, and TWC entered into a Federal Facility Agreement (FFA) in November 1990, to address environmental impacts from past practices at AFP4. Chem-Nuclear Geotech, Inc. (Geotech), operating contractor for the U.S. Department of Energy Grand

Junction Projects Office, through a Memorandum of Agreement between USAF and the U.S. Department of Energy, prepared a PA/SI and remedial investigation/feasibility study (RI/FS) work plan that was approved in October 1990.

Data collection requirements for characterizing AFP4 are identified in the work plan (Geotech, 1990). Site characterization activities were implemented in three phases. Phase I included a review of the existing data and preparation of planning documents in support of PA/SI and RI/FS activities at AFP4. The planning documents prepared by Geotech included the work plan, sampling and analysis plan, quality assurance project plan, and health and safety plan. These documents were reviewed by the Aeronautical Systems Center (ASC), EPA Region VI, and TWC and approved in October 1990.

During Phase II, soil-gas surveys were conducted in 1990 to provide initial screening of sites and to guide subsequent surface and subsurface investigations. The surveys were conducted around the perimeter of the Assembly Building/Parts Plant and FSA-1, FSA-2, and FSA-3.

Phase III field investigations began in early February 1991 and continued through mid-May 1992. The effort included drilling soil borings; installing monitor wells; and collecting soil, water, stream sediments, lake sediment, air, and ecological samples for chemical analyses. A total of 168 soil borings were drilled and 43 monitor wells were installed. Approximately 2,500 soil samples were collected for chemical analysis from the new soil borings. During the field investigations, surface water samples, Meandering Road Creek site samples, Lake Worth water and sediment samples, and air samples were also collected and analyzed.

Trichloroethene (TCE) is the most prevalent volatile organic compound (VOC) in soils. Widespread occurrence of this compound, at relatively high concentrations,

is associated with saturated soils under the south end of the Assembly Building, the East Parking Lot area, and at least as far as Runway Number 130 North. Relatively low concentrations of TCE were detected in vadose-zone soil samples from the Dye Yard Chemical Pits (DP13), Fire Department Training Area 2 (FDTA 2), and Landfill No. 4 (LF04). Relatively high concentrations of TCE occurred at Chrome Pit No. 3 (DP12) and Landfill No. 3 (LF03). Other VOCs detected less frequently but at relatively high concentrations in soil include toluene; 2-butanone; methylene chloride; and 1,2-dichloroethene (DCE). Some or all of these compounds were detected at LF01 and LF03, the former Underground Storage Tanks (USTs) No. 19 and No. 20, and the DP13.

VOCs and total petroleum hydrocarbons (TPH) contamination was detected in soil samples obtained from the Jet Engine Test Stand (JETS), FSA-1, and FSA-3, reflecting JP-4 leaks in underground fuel lines. Semivolatile organic compounds (SVOCs), typically associated with petroleum products, are characteristic of the contamination at these sites. Another group of SVOCs that were detected are those typically associated with asphalt. The highest concentrations of these SVOC contaminants were detected at LF01 and LF04.

Elevated concentrations of inorganics (antimony, cadmium, chromium, copper, lead, nickel, silver, and zinc) were detected at LF04 and FDTA-2 (Tables A.13-1 and A.13-2). Minimal soil contamination was detected at FSA-2 and FDTA 6, and no soil contamination was detected at the Wastewater Collection Basin (WWCB) and Former Fuel Storage Area.

Site characterization performed at AFP4 indicated that groundwater contamination consists of VOCs (TCE is the most prevalent), SVOCs, and inorganic compounds. The highest concentrations of groundwater contamination occur near source areas. TCE concentrations approaching saturation were detected in the groundwater samples from wells in the south central part of AFP4, where numerous potential sources exist, and near FDTA 2. The highest

Table A.13-1. Summary of Inorganic Sample Analysis for Soil Samples Obtained From Landfill No. 4

Analyte	Minimum mg/kg	Maximum mg/kg	Upper Background ⁴ Limit mg/kg	No. of Samples Analyzed	No. Above Natural Background for the Western USA ⁴
Antimony	(8)	(11)	2	32	1
Arsenic	2.4	12.4	21.8	32	0
Beryllium	(0.23)	1.1	3.1	32	0
Cadmium	(0.8)	87.3	2.8	32	8
Chromium	5.5	3,170	180	32	4
Copper	3.2B	1,690	87	32	5
Lead	4.3	1,560	61	32	8
Nickel	5.5B	202	63	32	4
Selenium	(0.4)	(4.8)	1.12	32	0
Silver	(0.8)	21.4	1.4	32	6
Thallium	(0.4)	(0.55)	27.1	32	0
Zinc	10	12,200	197	32	6

- Notes:
- 1) Concentration in parentheses indicates the compound was not detected at the reported value.
 - 2) B qualifier indicates the analyte was detected above the IDL but less than the CRDL.
 - 3) Cadmium, chromium, copper, nickel, and zinc were identified in the Baseline Risk Assessment as chemicals of concern.
 - 4) Upper background from range in Soils of Western USA, Shackleton and Borenson, 1984.

Sources: RUST Geotech, 1993; ESE.

Table A.13-2. Summary of Inorganic Sample Analysis for Soil Samples Obtained From FDTA-2

Analyte	Minimum mg/kg	Maximum mg/kg	Upper Background ⁴ mg/kg	No. of Samples Analyzed	No. Above Natural Background ⁴
Antimony	(9.1)	14.8	2	23	1
Arsenic	1.6B	13.3	21.8	23	0
Beryllium	0.3B	1.5	3.1	23	0
Cadmium	(0.92)	69.8	2.8	23	4
Chromium	8.8	549	180	23	1
Copper	(1.8)	8060	87	23	1
Lead	3.2	84.6	61	23	2
Nickel	(5.7)	413	63	23	1
Selenium	(0.46)	(2.3)	1.12	23	0
Silver	(0.91)	8.7	1.4	23	1
Thallium	(0.46)	0.6B	27.1	23	0
Zinc	5.4	2060	197	23	1

- Notes:
- 1) Concentration in parentheses indicates the compound was not detected at the reported value.
 - 2) B qualifier indicates the analyte was detected above the IDL but less than the CRDL.
 - 3) Cadmium, chromium, copper, nickel, and zinc were identified in the Base Risk Assessment as chemicals of concern.
 - 4) Upper background from range in Soils of Western USA, Shacklett and Boerger, 1984.

Sources: RUST Geotech, 1993; ESE.

concentrations of TCE are present in the upper-zone groundwater plumes (Tables A.13-3 and A.13-4). Plumes of decreasing concentrations of TCE, TCA, and their degradation products extend along the groundwater flow direction in the upper zone. The East Parking Lot Plume originates at the south-central and west-central parts of AFP4 and extends in an easterly direction beyond the property line, onto Carswell Air Force Base (CAFB). Potential sources for the East Parking Lot Plume include Chrome Pits No. 1, No. 2, and No. 3; DP13; FDTA 5; degreaser tanks T-534 and T-544 located within Building 181; the eastern part of FSA-1; and dense nonaqueous phase liquid (DNAPL) from FDTA 2. The West Plume originates near LF01 and the west part of FSA-1 and extends in a westerly direction toward Meandering Road Creek. The North Plume consists of moderately elevated concentrations of solvent compounds adjacent to the JETS.

Contamination is introduced into the Paluxy Formation primarily through vertical leakage from the upper-zone flow system in the vicinity of the East Parking Lot window area. Samples from monitor wells completed in the upper portion of the Paluxy Formation in the vicinity of the window area contain relatively high concentrations of TCE (Table A.13-5). Chromium is the most prevalent inorganic priority pollutant detected above the maximum contaminant level (MCL) in samples from upper-zone groundwater.

Surface water contamination in the vicinity of AFP4 is primarily associated with Meandering Road Creek. The most significant contamination identified in the creek results from elevated concentrations of VOCs. The primary VOCs of concern included TCE; CIS-1,2-DCE; 1,2-DCE; and vinyl chloride. The results of an air-monitoring program indicated that the activities at AFP4 do not contribute significant quantities of particulates to the air.

A baseline risk assessment was conducted to assess the potential risks associated with possible exposure to contaminants from AFP4. The risk assessment

Table A.13-3. Upper-Zone Monitoring Wells Within the East Parking Lot Plume at Which TCE Concentrations Exceeded the CRQL

Site ID	Sample ID	Sample Date	Result (µg/L)
F-218	NAA157	27-Apr-90	3,000
F-219	NAA158	26-Apr-90	67
F-219	NAA260	26-Apr-90	71
HM-029	NAA162	27-Apr-90	1,400
HM-031	NAA163	27-Apr-90	920
HM-047	NAA164	27-Apr-90	4,400
HM-047	NAA269	27-Apr-90	7,100
HM-056	NAA168	28-Apr-90	150
HM-060	NAA169	27-Apr-90	170
HM-071	NAA172	28-Apr-90	420
HM-086	NAA173	28-Apr-90	250
HM-087	NAA174	29-Apr-90	350
HM-088	NAA175	01-May-90	6,700
HM-088	NAA271	01-May-90	6,000
HM-089	NAA176	01-May-90	4,500
HM-089	NAA261	01-May-90	4,800
HM-089	NAA272	01-May-90	3,600
HM-094	NAA180	29-Apr-90	19,000
HM-095	NAA181	25-Apr-90	1,900
HM-096	NAA182	25-Apr-90	1,200
HM-097	NAA183	25-Apr-90	440
HM-099	HM-99	25-Oct-91	720
HM-099	NAA185	25-Apr-90	2,100
HM-099	QM-006	14-Mar-91	1,200
HM-099	WQM004	05-Dec-90	2,300
HM-103	NAA186	01-May-90	1,900
HM-110	NAA188	01-May-90	23
HM-111	NAA189	30-Apr-90	410
HM-111	NAA273	30-Apr-90	420
HM-112	NAA190	30-Apr-90	3,700
HM-112	NAA274	30-Apr-90	3,400
HM-113	NAA191	30-Apr-90	380
HM-115	NAA192	01-May-90	110
HM-115	QM-008DL	18-Mar-91	240
HM-115	WQM010	07-Dec-90	320
HM-116	NAA193	01-May-90	860
HM-117	NAA194	01-May-90	640
HM-118	NAA195	01-May-90	180
HM-119	NAA196	01-May-90	25
HM-119	QM-009	18-Mar-91	62
HM-119	WQM007	06-Dec-90	66
HM-121	QM-010DL	19-Mar-91	450
HM-121	WQM009	06-Dec-90	500
HM-122	QM-011DL	19-Mar-91	870

Sources: RUST Geotech, 1993; ESE.

Table A.13-4. Upper-Zone Monitoring Wells Within the West Plume Area at Which TCE Concentrations Exceeded the CRQL

Site ID	Sample ID	Sample Date	Result ($\mu\text{g/L}$)
F-207	QM-001	19-Mar-91	9
F-207	QM-017	19-Mar-91	8
F-207	WQM001	05-Dec-90	13
F-215	QM-002DL	14-Mar-91	780
F-215	WQM002DL	05-Dec-90	970
F-216	NAA268	28-Apr-90	13
F-217	NAA156	02-May-90	10
F-217	NAA267	02-May-90	33
HM-010	NAA160	27-Apr-90	9
HM-010	QM-003	14-Mar-91	6
HM-010	WQM006	06-Dec-90	9
HM-020	NAA161	27-Apr-90	240
HM-020	NAA256	27-Apr-90	230
HM-021	QM-004	20-Mar-91	130
HM-029	NAA162	27-Apr-90	1,400
HM-050	NAA165	27-Apr-90	35
HM-051	NAA166	28-Apr-90	87,000
HM-051	NAA257	28-Apr-90	78,000
HM-063	NAA170	29-Apr-90	15
HM-066	NAA171	28-Apr-90	48
W-129	W-129-01	10-Sep-91	90
W-144	W-144-01	17-Sep-91	45
W-144	W-144-11D	17-Oct-91	150

Table A.13-5. Paluxy Formation Monitoring Wells at Which TCE Was Detected Above the CRQL

Well ID	Sample ID	Sample Date	TCE ($\mu\text{g/L}$)
P-05M	NAA206	28-Apr-90	14
P-08UN	NAA266	28-Apr-90	22
P-08UN	P-8UN	19-Oct-91	30
P-08US	NAA213	29-Apr-90	550
P-09US	NAA215	29-Apr-90	4,300
P-09US	QM-014	13-Mar-91	980
P-09US	WQM005	05-Dec-90	1,900
P-10M	NAA217	30-Apr-90	13
P-12M	AFR-005	12-Jun-91	3
P-12M	NAA221	29-Apr-90	7
P-14US	NAA225	02-May-90	320
P-15US	NAA226	02-May-90	40
P-16US	NAA228	02-May-90	860
P-16US	P-16US	26-Oct-91	510
P-16US	QM-016	13-Mar-91	780
P-16US	WQM021	09-Dec-90	900
P-22M	NAA275	01-May-90	10
P-22M	P-22M	22-Oct-91	2
P-22M	WQM015	08-Dec-90	7
P-22U	NAA230	01-May-90	90
P-22U	NAA264	01-May-90	69
P-22U	P-22UPPER	27-Jan-90	100
P-22U	WQM017	08-Dec-90	48
P-24M	NAA233	30-Apr-90	8
P-27U	P27U-11	18-Oct-91	69
P-27U	P27U-11D	18-Oct-91	74

examined 15 current and future exposure pathways; however, only six were found to be complete (i.e., contains a contaminant release to the environment, an environmental transport mechanism, a point of exposure by a receptor, and a route of exposure).

Carcinogenic risks exceeded a 1×10^{-6} level for two exposure pathways involving current land use; none of these exposures exceeded 1×10^{-4} . Carcinogenic risks exceeded a 1×10^{-6} level in the three exposure pathways involving future land use, with two of these three exceeding 1×10^{-4} . TCE is the only chemical that contributes to the risk for carcinogens.

For noncarcinogens, the Hazard Indices (HIs) were 2.6 for current residential exposure and 1.1 for future residential exposure. Chromium contributes approximately 80 percent of the total risk under the current scenario and 1,2-DCE contributes approximately 90 percent of the total risk under the future scenario.

In summary, the three areas of soil contamination identified in the RI are LF01, LF04, and FDTA 2. The primary contaminants of concern (COC) in the soil are chromium and benzo(a)pyrene. The four different contaminant plumes identified in groundwater are (1) East Parking Lot Plume, (2) West Plume, (3) Paluxy East, and (4) Paluxy West. The primary COCs in the groundwater are TCE and 1,2-DCE. It is suspected that a significant amount of TCE exists as a DNAPL.

2.3 PROJECT ACCOMPLISHMENTS

The FS was divided into the following three sections: (1) development and screening of technologies, (2) assembly of screened technologies into alternatives, and (3) evaluation of alternatives.

The applicable remedial technologies for soil and groundwater are identified and screened based on technical implementability and effectiveness. The

effectiveness was based on (1) the potential effectiveness of process options in handling the estimated volumes of media and satisfying the identified remedial action objectives, and (2) the proven reliability of the process with respect to the contaminants at AFP4. Tables A.13-6 and A.13-7 present the remediation technologies screened for effectiveness, implementability, and cost for groundwater and soils at AFP4.

The screened technologies are then assembled into alternatives. The following four alternatives have been developed for soils at LF01, LF04, and FDTA 2:

1. No action,
2. Containment (capping),
3. Chemical treatment (in situ stabilization), and
4. Removal/disposal.

The following four alternatives have been developed for groundwater:

1. No action,
2. Physical treatment (air stripping),
3. Chemical treatment [ultraviolet (UV) light and oxidation}; and
4. Biological treatment (aboveground bioreactors).

The assembled alternatives were then evaluated in detail for the following criteria: (1) overall protection of human health and the environment; (2) compliance with ARARs; (3) long-term effectiveness; (4) reduction of toxicity, mobility, and volume (TMV); (5) implementability; (6) short-term effectiveness; (7) cost; (8) state acceptance; and (9) community acceptance. Tables A.13-8 and A.13-9 present the comparison of detailed analysis for remediation of groundwater and soils. No final recommendations were made in the FS for the selected alternative.

Table A.13-6. Evaluation of Process Options for Groundwater Remediation

<u>General Response Action</u>	<u>Technology Type</u>	<u>Process Options</u>	<u>Effectiveness</u>	<u>Implementability</u>	<u>Cost</u>
No-Action	None	Not Applicable	Relies on natural degradation	Easy to implement	None
Institutional Controls	Monitoring	Monitoring	Effective in determining plume movement and remediation effectiveness	Easy to implement	Moderate Cost
	Alternative Water Supply	Development of New Private System	Will not achieve RAOs but will provide safe, potable water source	Easy to implement	Moderate cost, Moderate O&M
Extraction/Discharge	Extraction	Extraction	Must be coupled with treatment to achieve RAOs	Moderate to implement	Moderate capital, Low O&M
		Interceptor trench	Must be coupled with treatment to achieve RAOs	Moderate to implement	Moderate capital, Low O&M
	Discharge	Discharge to receiving waters	Must be coupled with treatment to achieve RAOs	Easy to implement	Moderate capital, Low O&M
Treatment	Physical Treatment	Air Stripping	Effective in removing volatile organics from groundwater	Moderate to implement	Moderate capital, Low O&M
		Carbon Adsorption	Effective in removing organic compounds, but not efficient	Easy to implement	Moderate capital, Moderate O&M
		Oil/Water Separation	Separating emulsified, floating, or sinking oils from water	Easy to implement	Low capital, Low O&M
	Chemical Treatment	UV/Oxidation	Effective in destroying organic compounds	Moderate to implement	Low capital, Low O&M
	Biological Treatment	Above-Ground Bioremediation	Effective in destroying or altering organic contaminants	Moderate to implement	Moderate capital, Moderate O&M
	Innovative Technologies	Enhanced DNAPL Recovery	Must be coupled with treatment to achieve RAOs	Moderate to implement	Moderate cost, Moderate O&M

Table A.13-7. Evaluation of Process Options for Soil Remediation

<u>General Response Action</u>	<u>Technology Type</u>	<u>Process Options</u>	<u>Effectiveness</u>	<u>Implementability</u>	<u>Cost</u>
No-Action	None	Not Applicable	Relies on natural degradation	Easy to implement	None
Containment	Capping	Asphalt, clay, concrete, synthetic	Will limit human contact and should achieve RAOs	Moderately easy to implement	Low capital, Low O&M
Treatment	Chemical	Soil Mixing	Effective for metals, more difficult for organics	Moderately difficult	Moderate capital, Low O&M
		Soil Washing	Effective for soil containing metals and organics	Moderate to difficult	High cost, No O&M
Removal/Disposal	Excavation	Excavation	Not a remediation by itself, must be coupled with other technologies to achieve RAOs	Easy to implement	Moderate capital, No O&M
	Disposal	Off-site Disposal	Will achieve RAOs, but must meet BDAT regulations	Easy to implement	High capital, No O&M

Table A.13-8. Comparative Analysis of Groundwater Alternatives

Criteria	Alternative 1 No Action	Alternative 2 Physical Treatment	Alternative 3 Chemical Treatment	Alternative 4 Biological Treatment
Overall Protectiveness	Contaminants unmitigated, may impact White Settlement production wells in time	Protection of human health and environment through removing metals and dissolved organic contaminants through air stripping	Protection of human health and the environment through removing metals and destroying dissolved organic contaminants through UV/oxidation, respectively	Protection of human health and the environment through destroying dissolved organic contaminants above ground bioreactors
Compliance with ARARs	Would not comply with ARARs	Would comply with ARARs	Would comply with ARARs	Would comply with ARARs
Long-Term Effectiveness and Permanence	No long term effectiveness or permanence	Effective in removing volatiles from the ground water, a permanent solution	Effective in destroying volatiles in the ground water, a permanent solution	Effective in destroying volatiles in the ground water, a permanent solution
Reduction of Toxicity, Mobility, or Volume Through Treatment	Reduction in toxicity and volume over time, no change to mobility	Reduces mobility and volume through ground water well pumping, reduces toxicity through treatment with air stripping	Reduces mobility and volume through ground water well pumping, reduces toxicity by destroying dissolved organic contamination through UV/oxidation.	Reduces mobility and volume through ground water well pumping and destroying dissolved organic contamination through above ground reactors.
Short-Term Effectiveness	Not applicable	Safety requirements for system installation. No expected impacts to workers or nearby communities. Expected project life is 12 years.	Safety requirements for system installation. No expected impacts to workers or nearby communities. Expected project life is 12 years.	Safety requirements for system installation. No expected impacts to workers or nearby communities. Expected project life is 12 years.
Implementability	No action to implement	Straight forward construction and operation. Services, vendors, and technology are readily available. Water quality parameters and updated dissolved contaminant concentrations needed.	Straight forward construction and operation. Services, vendors, and technology available. Water quality parameters and updated dissolved contaminant concentrations required. Pre-treatment of water may be required depending upon water quality. Treatability testing may be required.	Straight forward construction and operation. Services, vendors, and technology available. Water quality parameters and updated dissolved contaminant concentrations required. Pre-treatment of water may be required depending upon water quality. Treatability testing required.
Cost	No cost	\$18,250,000	\$22,825,000	\$23,303,000

Table A.13-9. Comparative Analysis of Soil Alternatives

Criteria	Alternative 1 No Action	Alternative 2 Containment (Capping)	Alternative 3 Chemical Treatment (Stabilization)	Alternative 4 Removal/Disposal
Overall Protection of Human Health and the Environment	May be protective of Human Health; Protective of Environment	Protective of Human Health; Protective of Environment	Protective of Human Health; Protective of Environment	Protective of Human Health; Protective of Environment
Compliance with ARARs	Would Comply with ARARs	Would Comply with ARARs	Would Comply with ARARs	Would Comply with ARARs
Long-Term Effectiveness and Permanence	No changes in BRA condition expected	Long-term risks reduced, periodic maintenance required.	Long-term risk reduced. No maintenance required.	Long-term, risks reduced at Plant 4. No maintenance necessary. Long-term liabilities at final disposal site may exist.
Reduction of Toxicity, Mobility, or Volume Through Treatment	No reductions in toxicity, mobility, or volume	Mobility reduced. No change in toxicity or volume.	Mobility reduced. Toxicity probably not reduced. Slight increase in volume.	Mobility reduced. Toxicity and volume removed from Plant 4 but still exists at disposal site.
Short-Term Effectiveness	No short-term risks	Small risk expected during construction activities. Small risk of wetlands impact.	Some risks during construction, probably greater risk than Alternatives 2 and 4 due to types of equipment utilized. Small risk of wetlands impact.	Small risk expected during construction activities. Small risk of wetlands impact. Transportation related risks.
Implementability	May be difficult to obtain acceptance of no-action	Easy to implement	Treatability testing required. Administrative issues to be resolved. Services available, although not as available as those for Alternative 2.	Transportation issues to be resolved. Services available, although not as available as those for Alternative 2.
Cost	No Cost	\$266,000	\$15,000,000	\$40,000,000

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

As a result of this project, remedial alternatives were developed at LF01, LF04, and FDTA 2 for soils and at East Plume and West Plume for groundwater. Although soil contamination was identified at LF03, no alternatives were evaluated for the remediation of soils at this site.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made in this report for additional site investigations at AFP4.

5.0 PROJECTS RESULTING FROM THE PROJECT

No remediation projects were implemented at any of the AFP4 sites as a result of this project.

6.0 PROJECT STATUS

The project status is unknown.

7.0 SCHEDULE

No schedule is available on implementation of this project.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN THE INSTALLATION RESTORATION PROGRAM INFORMATION MANAGEMENT SYSTEM (IRPIMS)

No data from this project are in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: East Parking Lot, Installation of Groundwater System
AUTHOR: International Technology Corporation
DOCUMENT NUMBER: Not Available
CATEGORY: Not Available
SUBMITTED: August 1993

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project report was to inform Lockheed of the construction plans for the groundwater treatment system at the East Parking Lot of Air Force Plant 4 (AFP4).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

AFP4 is an aircraft manufacturing facility located in Tarrant County, Texas, 7 miles northwest of the City of Fort Worth. The facility has been in operation since 1942 and currently produces F-16 aircraft, radar units, and various aircraft and missile components.

The U.S. Department of Defense's Installation Restoration Program (IRP) is a four-phase program to perform the following: (1) identify past waste disposal practices, (2) evaluate the environmental impacts, (3) propose mitigation measures, and (4) remediate environmental problems.

The records search to locate the potential environmental problems associated with waste disposal practices during Phase I investigation was completed in 1984 (CH2MHill, Inc.). The results of the Phase I investigation identified 21 sites as the sources of contamination due to past waste disposal practices. The East Parking Lot is one of the 21 sites identified for remediation under the IRP. Figure A.14-1 shows the location of the East Parking Lot at AFP4.

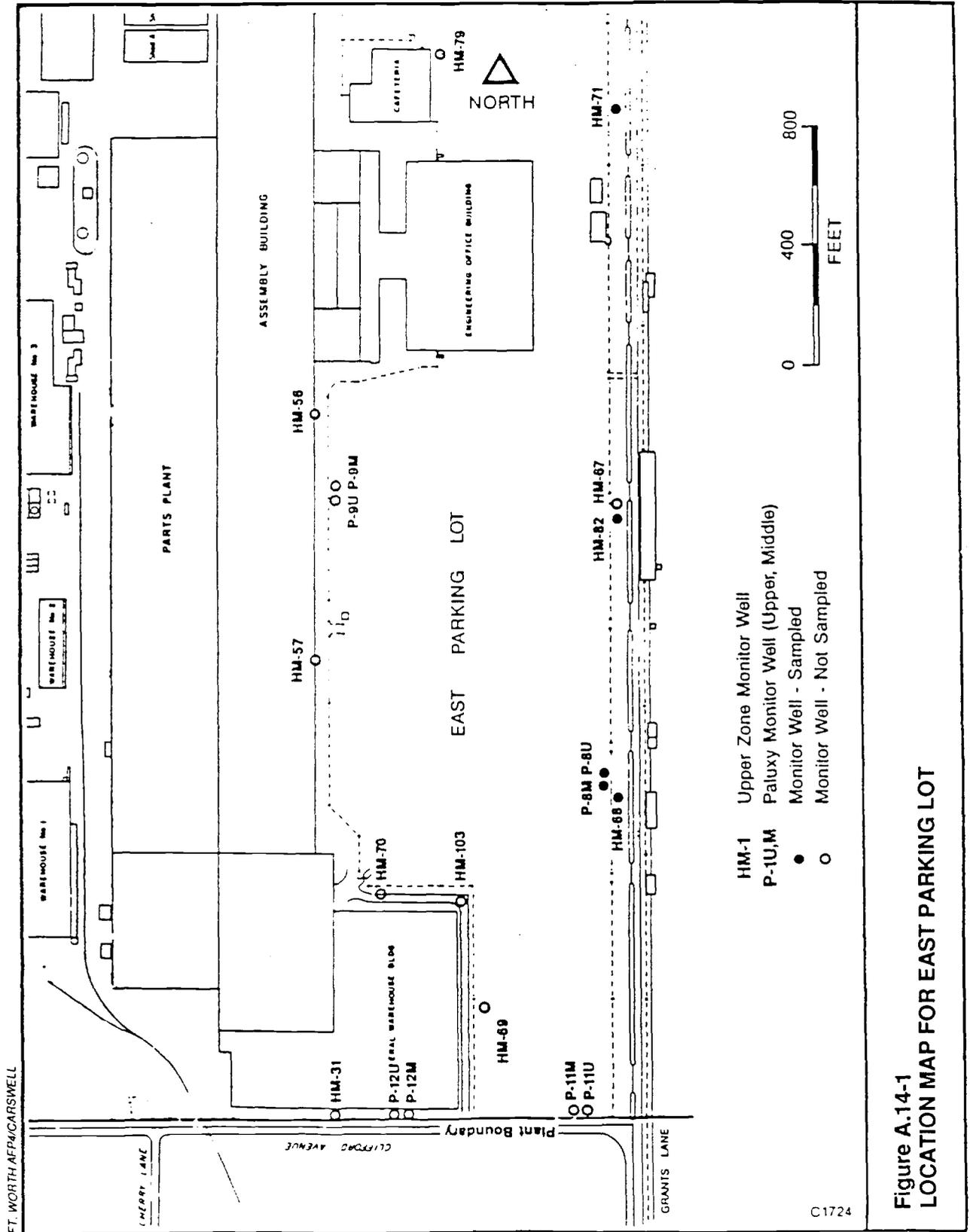


Figure A.14-1
LOCATION MAP FOR EAST PARKING LOT

During Phase II investigation, the extent and degree of contamination at the identified sites was completed [Radian Corporation (Radian), 1987].

Groundwater samples were collected and analyzed from both the shallow aquifer and the Paluxy aquifer. A total of 47 groundwater monitor wells were sampled and analyzed.

Results of the groundwater investigation have confirmed the presence of trichloroethene (TCE), dichloroethene, and chromium at the East Parking Lot. Table A.14-1 presents the chemical analysis of TCE present in the plume at the East Parking Lot. The spread of TCE contamination at the East Parking Lot is shown in Figure A.14-2.

Applicable and emerging technologies are evaluated for groundwater remediation at the East Parking Lot and consist of the following:

1. Containment technologies,
2. Source removal technologies, and
3. In situ plume management technologies.

The containment technologies considered in this report are primarily of two types: hydraulic and physical. The hydraulic containment technology consists of pumping and treating the highly contaminated groundwater immediately downgradient of the source areas. This technology is considered applicable for the remediation of the contaminated plumes at AFP4. The physical containment technology consists of using a sealable joint sheet piling to isolate the source areas. This technology is not considered practical at the site due the presence of underground utilities and the permeable gravel above the Walnut Formation aquitar.

Two source removal technologies are considered: soil venting and soil washing. The soil venting technology is considered applicable at the site. However, the soil washing technology is viewed as too exploratory and risky. It is considered

Table A.14-1. Upper-Zone Monitoring Wells Within the East Parking Lot Plume at Which TCE Concentrations Exceeded the CRQL

Site ID	Sample ID	Sample Date	Result (µg/L)
F-218	NAA157	27-Apr-90	3,000
F-219	NAA158	26-Apr-90	67
F-219	NAA260	26-Apr-90	71
HM-029	NAA162	27-Apr-90	1,400
HM-031	NAA163	27-Apr-90	920
HM-047	NAA164	27-Apr-90	4,400
HM-047	NAA269	27-Apr-90	7,100
HM-056	NAA168	28-Apr-90	150
HM-060	NAA169	27-Apr-90	170
HM-071	NAA172	28-Apr-90	420
HM-086	NAA173	28-Apr-90	250
HM-087	NAA174	29-Apr-90	350
HM-088	NAA175	01-May-90	6,700
HM-088	NAA271	01-May-90	6,000
HM-089	NAA176	01-May-90	4,500
HM-089	NAA261	01-May-90	4,800
HM-089	NAA272	01-May-90	3,600
HM-094	NAA180	29-Apr-90	19,000
HM-095	NAA181	25-Apr-90	1,900
HM-096	NAA182	25-Apr-90	1,200
HM-097	NAA183	25-Apr-90	440
HM-099	HM-99	25-Oct-91	720
HM-099	NAA185	25-Apr-90	2,100
HM-099	QM-006	14-Mar-91	1,200
HM-099	WQM004	05-Dec-90	2,300
HM-103	NAA186	01-May-90	1,900
HM-110	NAA188	01-May-90	23
HM-111	NAA189	30-Apr-90	410
HM-111	NAA273	30-Apr-90	420
HM-112	NAA190	30-Apr-90	3,700
HM-112	NAA274	30-Apr-90	3,400
HM-113	NAA191	30-Apr-90	380
HM-115	NAA192	01-May-90	110
HM-115	QM-008DL	18-Mar-91	240
HM-115	WQM010	07-Dec-90	320
HM-116	NAA193	01-May-90	860
HM-117	NAA194	01-May-90	640
HM-118	NAA195	01-May-90	180
HM-119	NAA196	01-May-90	25
HM-119	QM-009	18-Mar-91	62
HM-119	WQM007	06-Dec-90	66
HM-121	QM-010DL	19-Mar-91	450
HM-121	WQM009	06-Dec-90	500
HM-122	QM-011DL	19-Mar-91	870

risky because the surface tension reduction of TCE by the surfactants can cause pure TCE phase to migrate further downward.

The in situ plume management technologies are for the most part emerging in nature. These include methanotrophic microbial degradation (MMD), constitutive aerobic microbia degradation (CAMD) and the permeable dehalogenation wall (PDW). In MMD technology, methane and oxygen are dissolved in water and introduced into the aquifer. The microbes co-metabolize the TCE with the methane. The MMD technology was considered innovative and holds promise for application at the site. This technology is in the field demonstration stage and has met with limited success. In the CAMD technology, specific microbes containing enzyme systems activated by a nontoxic substrate are added to the groundwater for the destruction of TCE. Field studies are yet to be conducted on this technology. The PDW technology is applied by emplacing a permeable reaction zone containing iron grindings into the aquifer. This technology is in the field demonstration stage and considered applicable for the upper zone aquifer at the East Parking Lot.

Based on the technology review, both interim and long-term recommendations are made for the remediation of contaminated plume at the East Parking Lot. Also, a cost analysis system [Remedial Action Cost Estimating and Requirements (RACER)] is proposed for use in the technology evaluation at AFP4.

A preliminary assessment/site inspection (PA/SI) and remedial investigation (RI) report was prepared (Geotech, 1992) for the contaminated sites at AFP4. The primary COCs in the groundwater at the East Parking Lot are TCE and 1,2-DCE. It is suspected that a significant amount of TCE exists as a dense nonaqueous phase liquid (DNAPL). A feasibility study (FS) was prepared (Geotech, 1993) to address the remediation of contamination at AFP4.

2.2 PROJECT ACCOMPLISHMENTS

Lockheed was informed of the construction plans of the groundwater treatment system. This report includes a cover letter and the following schematics of the treatment system: (1) groundwater recovery system details, (2) groundwater recovery system plan, and (3) concrete containment plan and details.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

Lockheed was informed of the construction plans of the groundwater treatment system.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations are made for additional studies at the site.

5.0 PROJECTS RESULTING FROM THE PROJECT

As a result of this project, a 100-percent design package for the remediation of groundwater at the East Parking Lot was completed (IT, 1993).

6.0 PROJECT STATUS

The project was not implemented.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN THE INSTALLATION RESTORATION PROGRAM INFORMATION MANAGEMENT SYSTEM (IRPIMS)

No data from this project are in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Groundwater Remediation of Window Area - 100%
Design Package

AUTHOR: International Technology Corporation

DOCUMENT NUMBER: Not Available

CATEGORY: Not Available

SUBMITTED: September 1993

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to develop a 100-percent design package for the groundwater treatment facility at the Window Area of Air Force Plant 4 (AFP4).

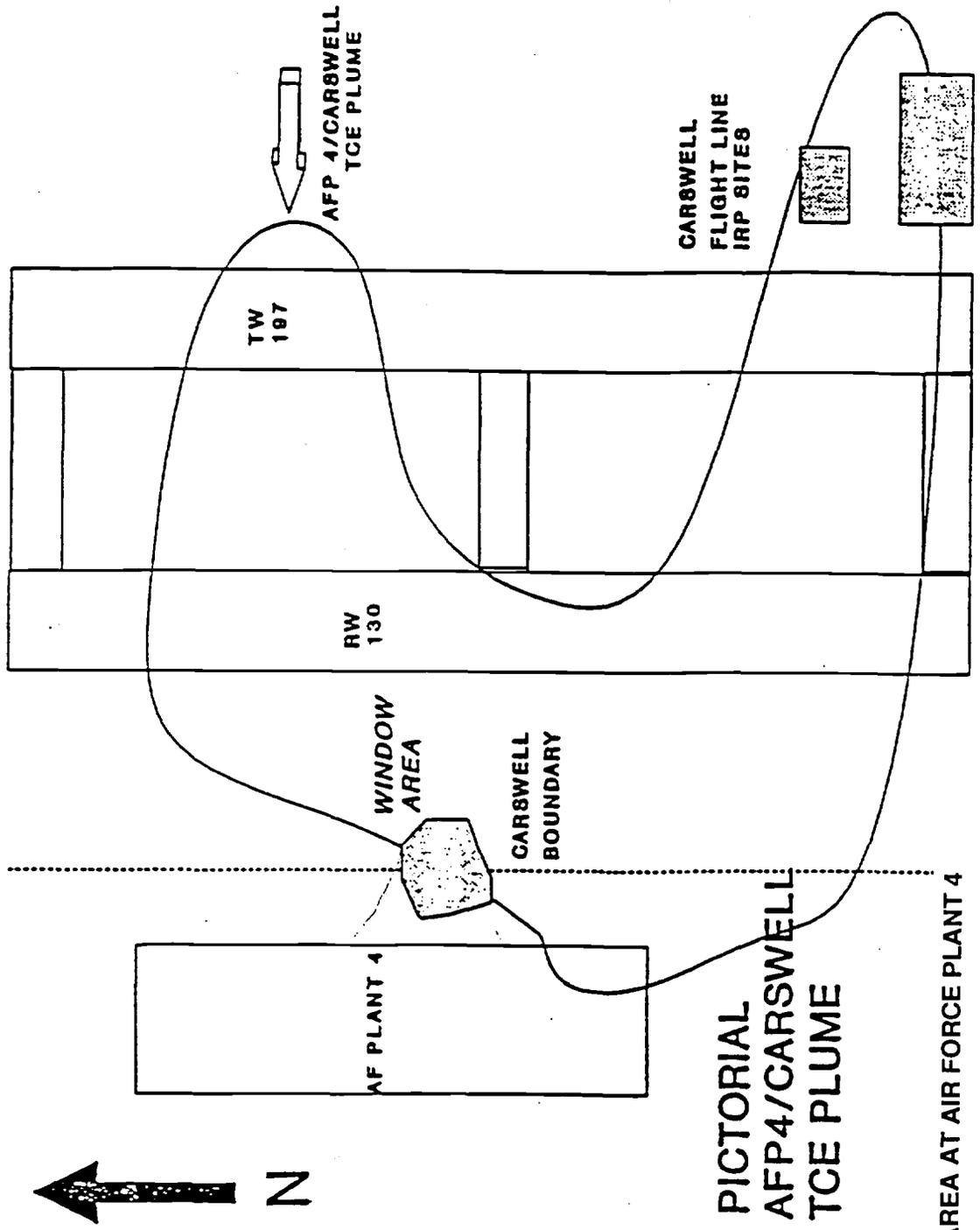
2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 PREVIOUS INVESTIGATIONS

Site characterization performed at AFP4 indicated that groundwater at this site was contaminated with volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and inorganic compounds. The most prevalent VOC was trichloroethene (TCE) and, to a lesser extent, 1,1,1-trichloroethane (TCA). The highest concentrations of TCE were present in the upper-zone groundwater plumes. Plumes of decreasing concentrations of TCE, TCA, and their degradation products extend along the groundwater flow direction in the upper zone.

Contamination was introduced into the Paluxy Formation primarily through vertical leakage from the upper-zone flow system in the vicinity of the East Parking Lot. This vertical leakage area at the East Parking Lot was termed as Window Area (Figure A.15-1). Samples from monitor wells completed in the upper portion of the Paluxy Formation in the vicinity of the Window Area contain relatively high concentrations of TCE (Table A.15-1).

In 1993, a 50-percent design package for groundwater remediation at the Window Area was completed (IT, 1993). It consisted of the specifications and drawings for the air stripping treatment system and the associated equipment.



**PICTORIAL
AFP4/CARSWELL
TCE PLUME**

Figure A.15-1 WINDOW AREA AT AIR FORCE PLANT 4
SOURCES: IT CORP., 1993; ESE.

Table A.15-1. Paluxy Formation Monitoring Wells at Which TCE Was Detected Above CRQL

Well ID	Sample ID	Sample Date	TCE (ug/L)
P-05M	NAA206	28-Apr-90	14
P-08UN	NAA266	28-Apr-90	22
P-08UN	P-8UN	19-Oct-91	30
P-08US	NAA213	29-Apr-90	550
P-09US	NAA215	29-Apr-90	4,300
P-09US	QM-014	13-Mar-91	980
P-09US	WQM005	05-Dec-90	1,900
P-10M	NAA217	30-Apr-90	13
P-12M	AFR-005	12-Jun-91	3
P-12M	NAA221	29-Apr-90	7
P-14US	NAA225	02-May-90	320
P-15US	NAA226	02-May-90	40
P-16US	NAA228	02-May-90	860
P-16US	P-16US	26-Oct-91	510
P-16US	QM-016	13-Mar-91	780
P-16US	WQM021	09-Dec-90	900
P-22M	NAA275	01-May-90	10
P-22M	P-22M	22-Oct-91	2
P-22M	WQM015	08-Dec-90	7
P-22U	NAA230	01-May-90	90
P-22U	NAA264	01-May-90	69
P-22U	P-22UPPER	27-Jan-90	100
P-22U	WQM017	08-Dec-90	48
P-24M	NAA233	30-Apr-90	8
P-27U	P27U-11	18-Oct-91	69
P-27U	P27U-11D	18-Oct-91	74

2.2 PROJECT ACCOMPLISHMENTS

As a result of this project, a 100-percent draft design package was developed for the groundwater treatment facility at the Window Area. The package includes the following:

1. Equipment sizing calculations,
2. Trenching specifications,
3. Concrete specifications,
4. Equipment specifications,
5. Mechanical specifications,
6. Electrical specifications,
7. Equipment shop drawings, and
8. Construction drawings.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

A 100-percent design package for groundwater remediation at the East Parking Lot was developed (see Section 2.0 for details of the design package).

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional studies at the site.

5.0 PROJECTS RESULTING FROM THE PROJECT

No new projects have resulted from this project.

6.0 PROJECT STATUS

The project was not implemented.

7.0 SCHEDULE

Not available.

**8.0 WHETHER OR NOT INFORMATION DERIVED IS IN THE
INSTALLATION RESTORATION PROGRAM INFORMATION
MANAGEMENT SYSTEM (IRPIMS)**

No data from this project are in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Pre-Construction Field Test Results VEP Well Field,
Landfill 3

AUTHOR: IT Corporation

DOCUMENT NUMBER: NA

CATEGORY: NA

SUBMITTED: June 1994

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this report was to present the results of a pre-construction field test of a vacuum enhanced pumping (VEP) system for the remediation of groundwater at Landfill 3 and to implement early remedial action plan to control the off-site migration of groundwater from Landfill 3 into Meandering Road Creek.

2.0 REMEDIATION ACCOMPLISHMENTS AND RESULTS

2.1 SITE HISTORY

Landfill 3 encompasses approximately three acres of land and was used to discard a variety of wastes including hazardous wastes consisting of mixed oils and solvents during the period of 1942-1945. Small pits within the landfill were used to hold and burn some of these wastes. Landfill use was discontinued, and fill dirt and rubble were used to fill and grade the wastes.

The use of VEP wells as an early action was proposed in the Confirmation of Design Strategy Report prepared by IT in August 1993. The report analyzed various alternatives for an emergency remedial action at the site. The results of the analysis indicate that a line of VEP wells along the western boundary of the landfill provides a cost-effective alternative to other, more traditional remedial schemes, such as slurry walls or leachate collection trenches.

2.2 PROJECT ACCOMPLISHMENTS

The VEP pre-construction field (PCF) tests were performed at Landfill 3 from February 28 through April 17, 1994. The location of VEP wells is shown in Figure A.16-1 and a typical VEP well design is shown in Figure A.16-2. The PCF test utilized a skid-mounted extraction and air treatment system which was mobilized on site prior to the test. A schematic of the treatment system is shown in Figure A.16-3.

Air samples taken from the VEP wells were analyzed for major air constituents and for volatile organic compounds (VOCs). Table A.16-1 lists the detected compounds and their values for each sample. Groundwater samples taken from the VEP wells were also analyzed for VOCs and semi-VOCs. Table A-16-2 shows the detected compounds and their concentrations.

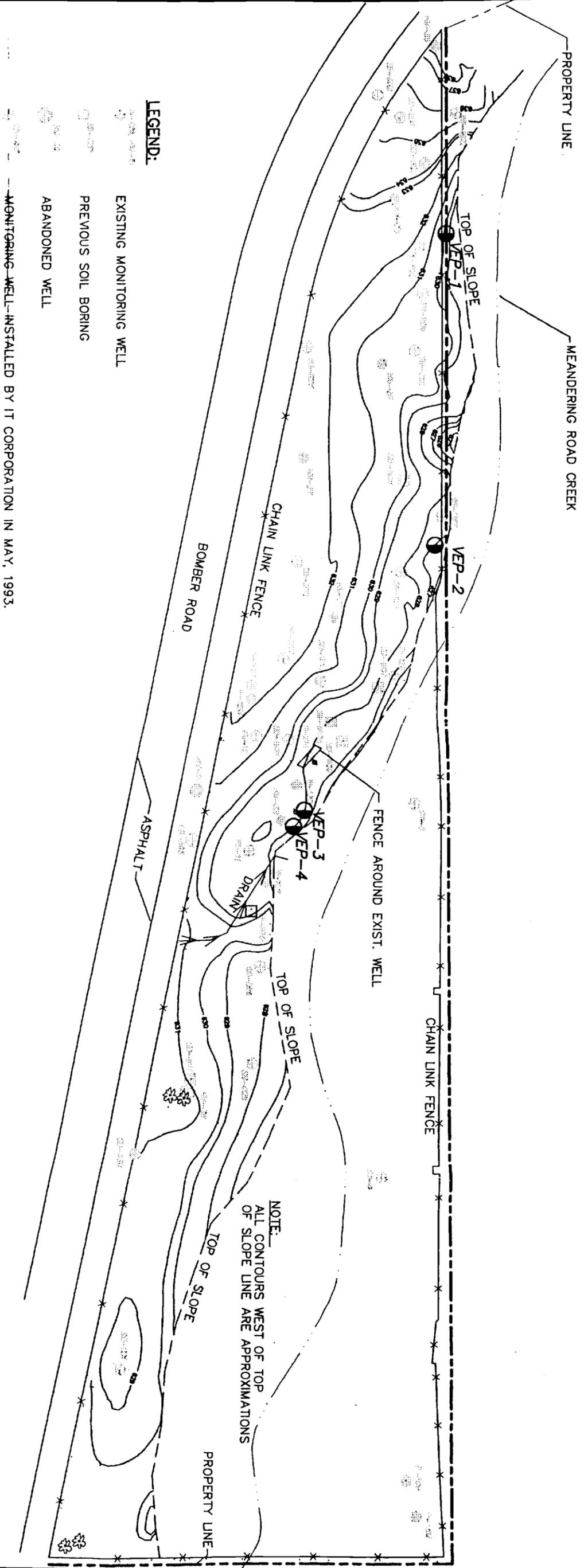
The PCF testing performed at Landfill 3 demonstrated that VEP wells were able to capture trichloroethylene and cis-1,2-dichloroethene. In addition to the groundwater removal from the VEP wells, DNAPL movement and volatilization was observed during the PCF tests. The following observations were made during the VEP testing:

1. Tests in the northern and southern portions of the landfill were able to maintain influence zones of 30 and 60 feet from the wells respectively during the tests and
2. The central portion of the landfill was unable to maintain a constant influence zone due to the presence of a bedrock knob, in which the well was screened.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

The PCF test demonstrated that the VEP wells were able to capture and contain groundwater at the landfill. Aquifer properties and mass removal rates of the

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27 APR 94		APPROVED BY			



- LEGEND:**
- EXISTING MONITORING WELL
 - PREVIOUS SOIL BORING
 - ABANDONED WELL
 - MONITORING WELL-INSTALLED BY IT CORPORATION IN MAY, 1993.
 - SOIL BORING DRILLED BY IT CORPORATION IN MAY, 1993.
 - VEP-1 VEP PILOT WELL CLUSTER
 - ELECTRICAL POLE
 - TREES
 - FACILITY BOUNDARY (APPROXIMATE LOCATION)
 - CHAIN LINK FENCE

NOTE:
ALL CONTOURS WEST OF TOP OF SLOPE LINE ARE APPROXIMATIONS



Figure A.16-1

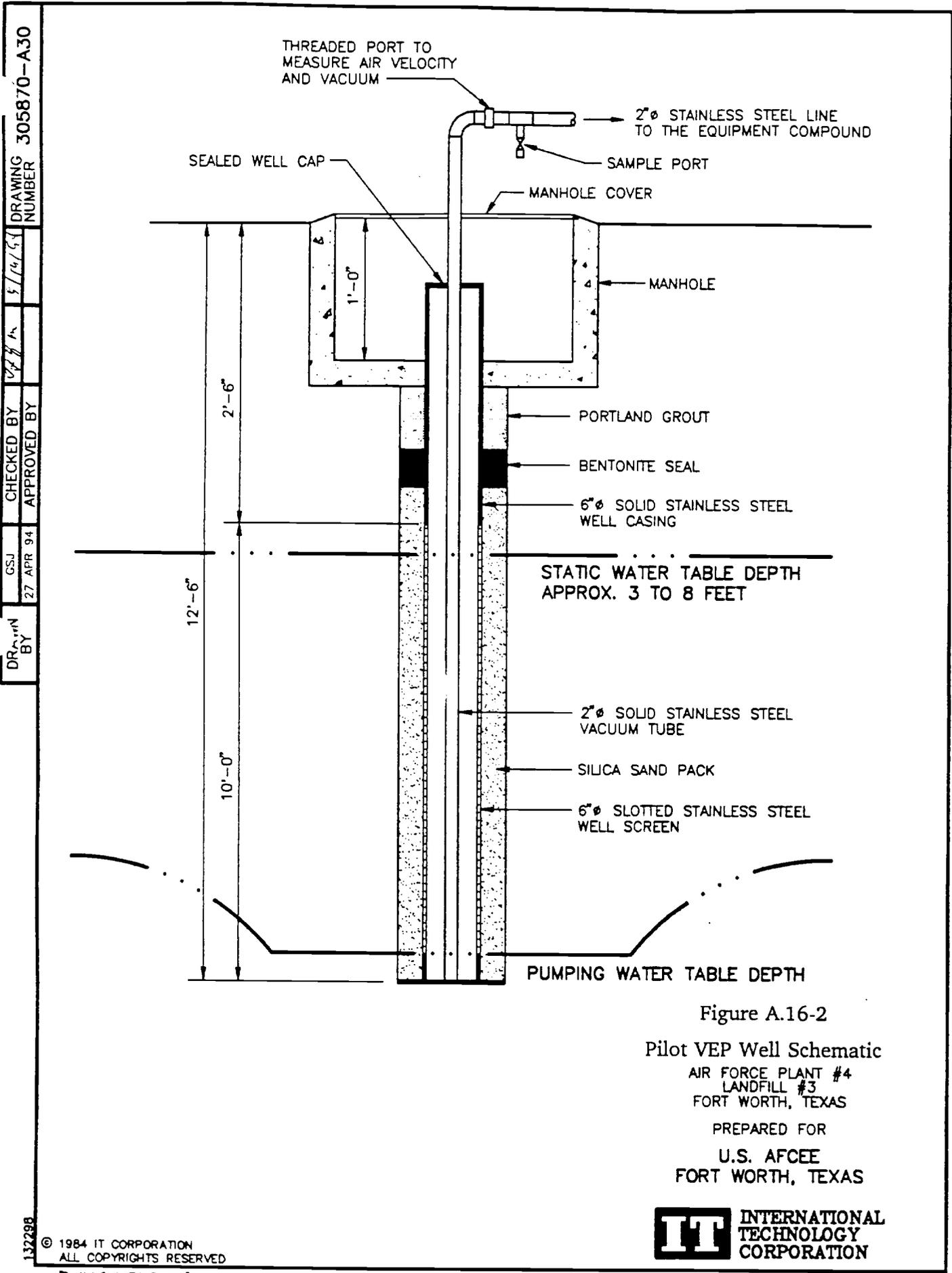
Location of VEP Test Wells

PREPARED FOR

U.S. AFCEE
AIR FORCE PLANT #4
LANDFILL #3
FORT WORTH, TEXAS



REFERENCE:
THIS SURVEY CORRECT AS SURVEYED ON THE GROUND, APRIL 28, 1993,
BY JACOB & MARTIN INC. ABILENE, TEXAS.



DRAWING NUMBER 305870-A30

CHECKED BY [Signature] 5/14/95

APPROVED BY [Signature]

GSJ 27 APR 94

DR. [Signature] BY

Figure A.16-2

Pilot VEP Well Schematic
 AIR FORCE PLANT #4
 LANDFILL #3
 FORT WORTH, TEXAS
 PREPARED FOR
 U.S. AFCEE
 FORT WORTH, TEXAS



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"Do Not Scale This Drawing"

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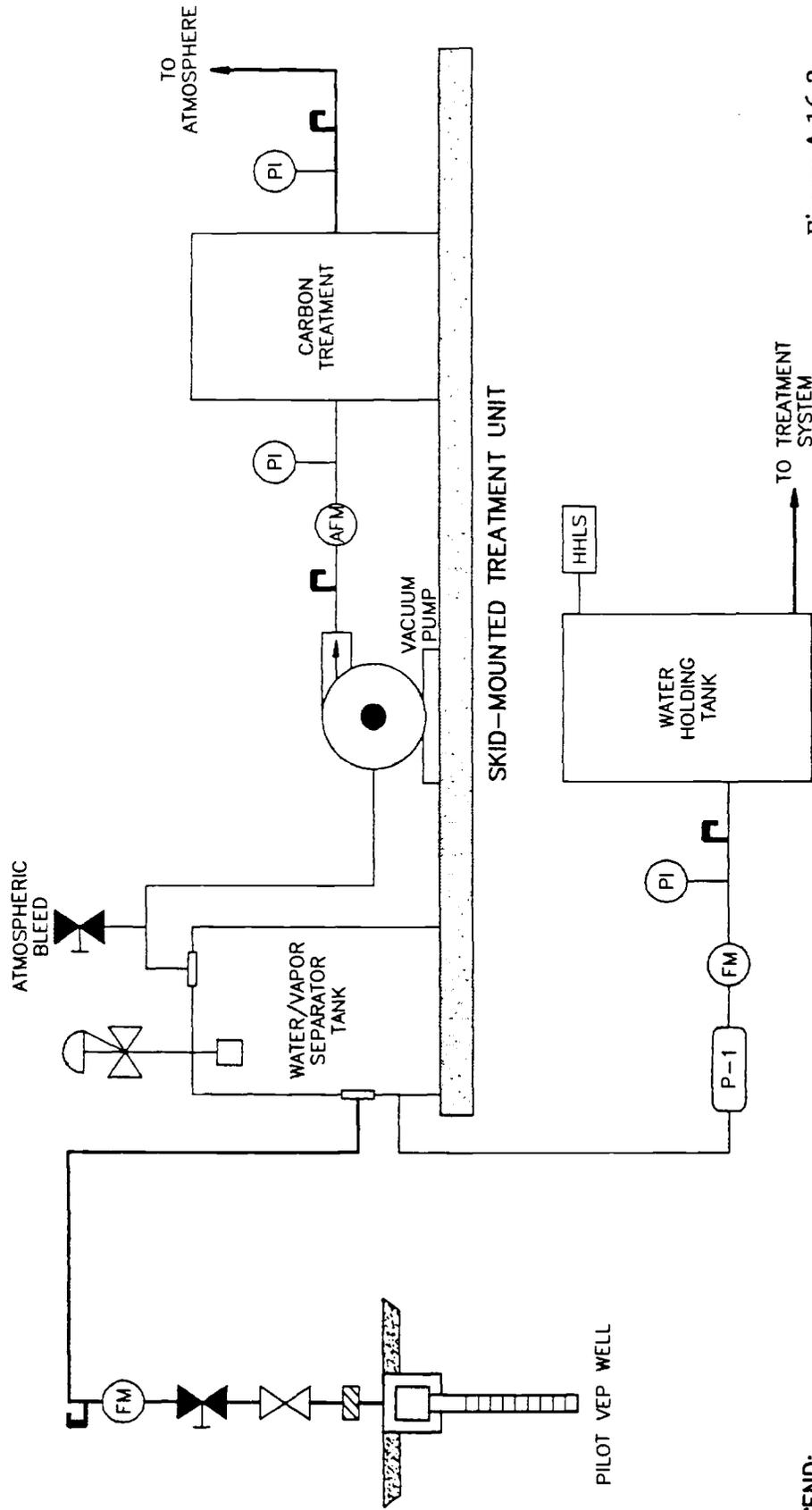


Figure A.16-3

Process Flow Diagram
Pilot VEP Well Unit

PREPARED FOR

U.S. AFCEE

AIR FORCE PLANT #4

LANDFILL #3

FORT WORTH, TEXAS

INTERNATIONAL
TECHNOLOGY
CORPORATION



LEGEND:

- PRESSURE RELIEF VALVE
- SAMPLING PORT
- FLOWMETER
- AIR FLOW METER
- PRESSURE GAGE
- CHECK VALVE
- GATE VALVE
- TRANSFER PUMP
- THREADED PORT TO MEASURE VACUUM PRESSURE
- HIGH-HIGH LEVEL SWITCH

132298

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Table A.16-1
Landfill 3 PCF Tests
Results of Air Sampling^a

Sample I.D./Compound	VEP 1-1	VEP 1-2	VEP 1-3	VEP 1-4	VEP 2-1	VEP 2-2	VEP 2-3	VEP 2-4	VEP 2-A	VEP 3 & 4-1	VEP 3 & 4-2	VEP 3 & 4-3	VEP 3 & 4-4
Oxygen (% Vol.)	13	19	19	19	17	20	20	20	20	12	18	19	20
Nitrogen (% Vol.)	72	72	72	72	78	74	74	75	73	78	72	72	72
Methane (% Vol.)	0.4	nd ^b	nd	nd	nd	nd							
Carbon dioxide (% Vol.)	7.6	2.7	2.0	2.6	1.1	nd	0.3	0.5	nd	5.1	2.1	1.3	0.8
Vinyl chloride	30,000	nd	nd	nd	180	nd	72	490	nd	nd	430	170	140
1,1-Dichloroethene	28,000	nd	nd	nd	240	nd	55	500	nd	nd	17	7.1	nd
Methylene chloride	nd	nd	nd	nd	33	nd	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	nd	nd	nd	nd	19	nd	9.6	28	nd	nd	nd	nd	nd
cis-1,2-Dichloroethene	58,000	11,000	7,500	17,000	900	nd	900	2,100	12	6,200	1,500	1,200	970
1,1,1-Trichloroethane	nd	nd	nd	nd	19	nd	nd	7.7	nd	nd	nd	nd	nd
Benzene	nd	nd	nd	nd	32	nd	18	19	nd	nd	nd	nd	nd
Trichloroethene	79,000	25,000	19,000	35,000	620	nd	160	460	nd	nd	1,400	1,100	830
Toluene	nd	nd	nd	nd	2,500	nd	10	8.8	10	nd	45	15	8.3
Tetrachloroethene	nd	nd	nd	nd	240	nd	18	21	nd	nd	130	110	88
Chlorobenzene	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	27	13	7.0
Ethylbenzene	nd	nd	nd	nd	11	nd	nd	nd	nd	nd	nd	nd	nd
m/p-Xylene	nd	nd	nd	nd	24	nd	nd	nd	nd	nd	nd	nd	nd
o-Xylene	nd	nd	nd	nd	8.9	nd	nd	nd	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	33	11	nd
1,4-Dichlorobenzene	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	33	11	nd
1,2-Dichlorobenzene	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	170	56	22

^aResults presented in ppb (V/V).
^b"nd" = not detected.

Table A.16-2
Landfill 3 PCF Tests
Results of Groundwater Sampling^a

Sample I.D./Compound	VEP 1-1	VEP 1-2	VEP 1-3	VEP 1-4	VEP 2-1	VEP 3 & 4-1	VEP 3 & 4-2	VEP 3 & 4-3	VEP 3 & 4-4
Vinyl chloride	14	nd ^b	nd	nd	nd	nd	nd	nd	nd
Acetone	nd	nd	nd	nd	nd	230	nd	nd	nd
1,1-Dichloroethylene	16	nd	nd	nd	nd	nd	nd	nd	nd
cis-1,2-Dichloroethylene	140	26	22	31	9.1	71	nd	nd	nd
Chloroform	7.8	nd	nd	nd	nd	nd	nd	nd	nd
2-Butanone	95	nd	nd	nd	520 ^c	21,000	nd	100	nd
Trichloroethylene	130	23	23	29	9.7	8.8	nd	nd	nd
Tetrahydrofuran	nd	nd	nd	nd	1,200 ^d	11,000 ^d	49 ^d	nd	nd
bis(2-Ethylhexyl)phthalate	nd	nd	nd	nd	nd	nd	nd	41	55

^aResults presented in ug/L.

^b"nd" = not detected.

^c2-Butanone result reported from a 5X dilution.

^dTetrahydrofuran was quantitated using historical RF and the result should be regarded as estimated.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Draft Soil Vapor Extraction Pilot Plant Study,
Building 181

AUTHOR: ESE, Inc.

DOCUMENT NUMBER: NA

CATEGORY: NA

SUBMITTED: April 1994

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this report was to present the results of the soil vapor extraction pilot plant (SVEPP) testing conducted at Building 181 for the removal of trichloroethylene from contaminated soils.

2.0 REMEDIATION ACCOMPLISHMENTS AND RESULTS

2.1 SITE HISTORY

In 1991, operators of the chemical process area in Building 181 noted that unusually large quantities of TCE were required to refill one of two degreaser tanks located within the building. Later TCE was observed leaking from the tank. In 1991, both degreaser tanks were removed from the building. Past spills of TCE have reportedly occurred within the Chemical Process Facility of the building.

2.2 PROJECT ACCOMPLISHMENTS

Two tests were conducted on the TCE-contaminated perched and upper zone soils. The first test was the step test to determine the parameters necessary to evaluate the applicability of vapor extraction and allow for design of a full-scale soil vapor extraction remedial system. The second test was the 90-day test which provided continuous operation of the SVEPP. The first test was conducted between November 4 and 9, 1993. The second test started on December 2, 1993, but was interrupted on December 16, 1993 due to operational difficulties.

Following the winterization of the SVEPP system, operation was resumed on January 7 and continued through March 24, 1994.

Extraction well performance and the permeability of the soil to airflow were developed from the step test. Radius of influence of each extraction well under different vacuum conditions is presented in Table A.17-1 and the soil permeability to air flow rates is presented in Table A.17-2.

TCE was removed from both perched zone, the upper zone, and carbon vessels at Building 181 during the 90-day pilot test. Approximately 2,700 lbs of TCE was removed from the perched zone and approximately 475 lbs of TCE was removed from the upper zone. The removal rates from the perched zone and the upper zone are presented in Figures A.17-1 and A.17-2.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

Removal rates of TCE from the perched zone, upper zone, and the carbon vessels were developed as a result of the pilot study.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

Expanded operation of the SVEEP system was recommended.

5.0 PROJECTS RESULTING FROM THE PROJECT

No projects resulted from this project.

6.0 PROJECT STATUS

The status on the expanded operation of the SVEEP system is not available.

7.0 SCHEDULE

No schedule is available.

Table A.17-1. R_i for Each Extraction Well

<u>Extraction Well</u>	<u>Radius of Influence (R_i) (ft)</u>		
	<u>2 inches Hg</u>	<u>5 inches Hg</u>	<u>8 inches Hg</u>
PZ-1	79	85	90
PZ-2	105	118	122
PZ-3	NA	NA	NA
PZ-4	65	68	77
PZ-5	95	102	NA
PZ-6	105	130	150
PZ-7	NA	NA	NA
UZ-1	32	48	45

- Note:
1. R_i was determined from the figures included in Appendix B. R_i represents the distance from the extraction well to a minimum effective vacuum pressure response of 0.01 inches of water.
 2. Field measurements were not representative to support the determination of R_i .
- NA = measurements not taken at these locations.

Source: ESE.

Table A.17-2. Soil Permeability to Air Flow Rate (k)

Well Identification	Empirical k		Theoretical k	
	$\times 10^{-6} \text{ cm}^2$	Darcy	$\times 10^{-6} \text{ cm}^2$	Darcy
PZ-1	1.7	170	0.32	32
PZ-2	2.4	240	0.85	85
PZ-3	4.5	45	0.25	25
PZ-4	5.3	530	0.62	62
PZ-5	410	41,000	0.87	87
PZ-6	1,500	150,000	0.44	44
PZ-7	NA	NA	0.40	40
UZ-1	0.00035	0.035	0.061	6.1

Note: 1. Field measurements were inadequate to support the determination of k.
 2. Three k values were calculated for each well at the different test pressures. The theoretical k is the average of the three values.

Source: ESE.

FT. WORTH AFF4/CARSWELL 794 BL

Removal Rate (lbs/d) versus Time Perched Zone

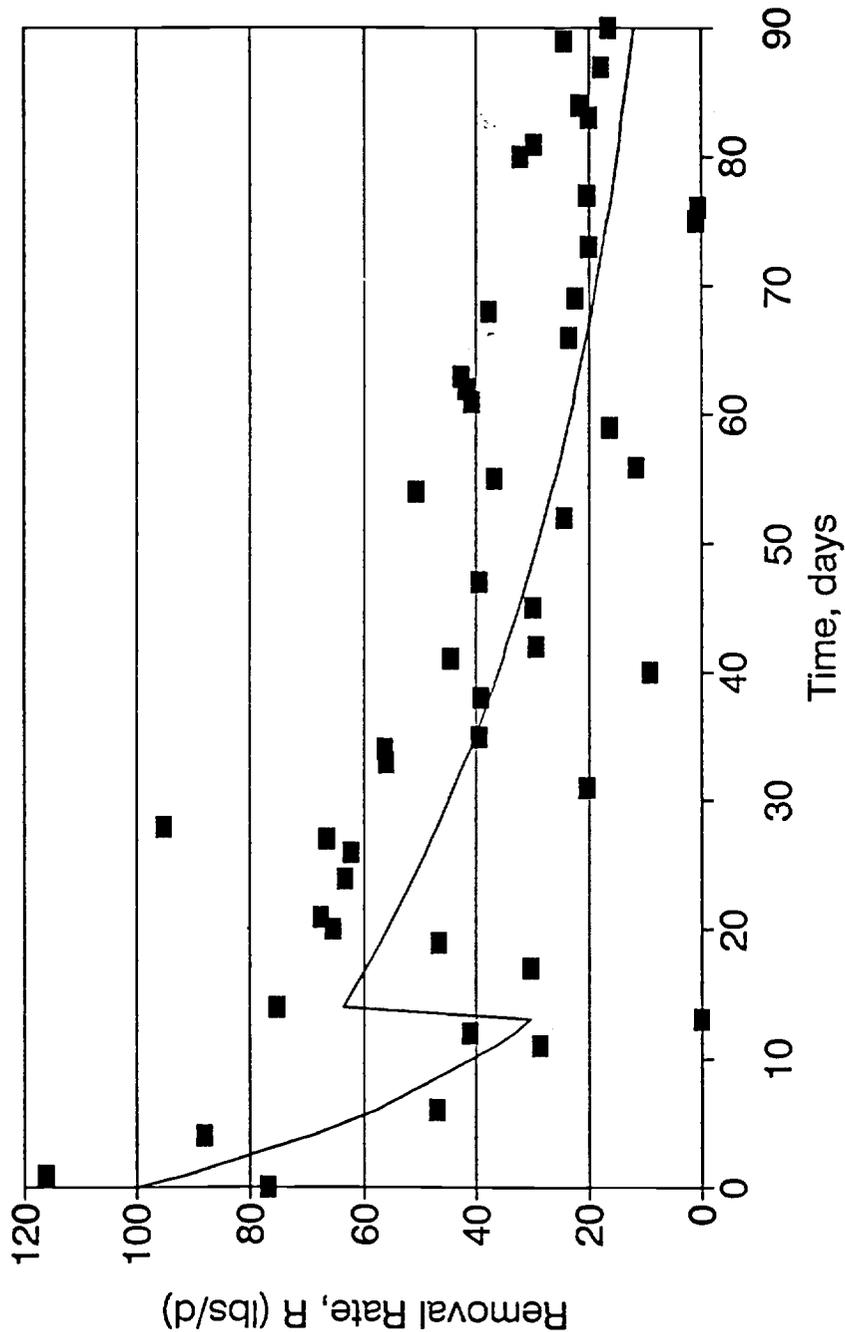


Figure A.17-1
PERCHED ZONE CONTAMINANT
REMOVAL RATE

SOURCE: ESE.

ENVIRONMENTAL SCIENCE
& ENGINEERING, INC.

Removal Rate (lbs/d) versus Time

Terrace Deposits

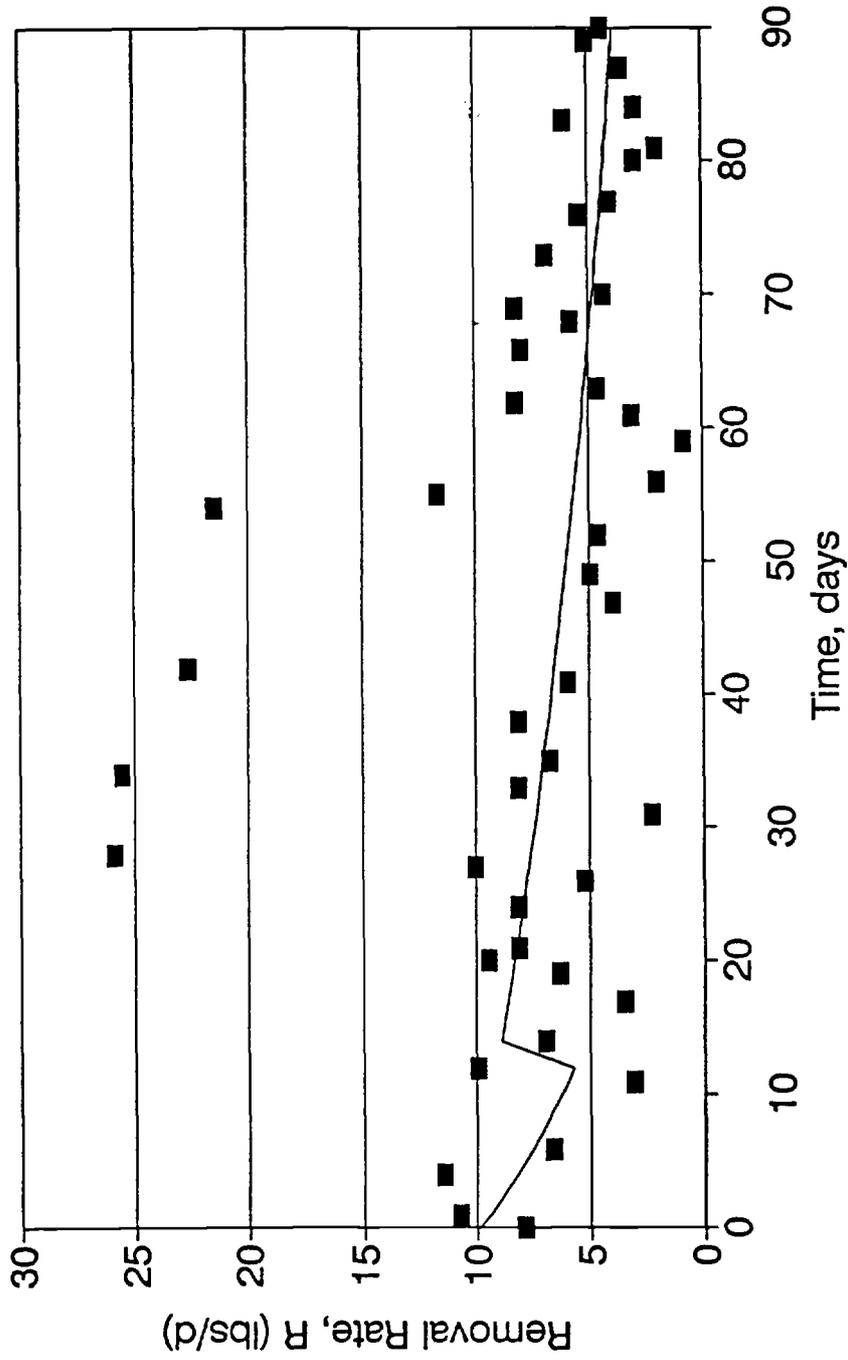


Figure A.17-2
TERRACE DEPOSITS CONTAMINANT
REMOVAL RATE

SOURCE: ESE.

ENVIRONMENTAL SCIENCE
& ENGINEERING, INC.

**8.0 WHETHER OR NOT INFORMATION DERIVED IS IN THE
INSTALLATION RESTORATION PROGRAM INFORMATION
MANAGEMENT SYSTEM (IRPIMS)**

No data from the project are in IPRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

contaminants from the VEP wells were developed. Based on the results of the PCF tests, the following recommendations and observations were made:

1. Use of VEP wells as a substitute for a slurry wall,
2. Use of the french drain system at the parking lot to reduce the upgradient groundwater flow entering Landfill 3,
3. VEP well spacing for northern portion of Landfill 3 should be approximately 25 ft and the VEP well spacing for the southern portion of the landfill should be approximately 20 ft, and
4. The central portion of the landfill is best suited for the installation of a leachate collection trench augmented with a horizontal VEP well.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional studies at the site.

5.0 PROJECTS RESULTING FROM THE PROJECT

A full-scale treatment system will be installed for the remediation of groundwater at Landfill 3.

6.0 PROJECT STATUS

The pre-field test was completed at Landfill 3 and a report was prepared in June 1994.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN THE INSTALLATION RESTORATION PROGRAM INFORMATION MANAGEMENT SYSTEM (IRPIMS)

No data from the project are in IPRPIMS.

APPENDIX B--REPORT SUMMARIES, CAFB

TITLE: Decision Paper - Site 12
AUTHOR: Radian Corporation
DOCUMENT NUMBER: 96
CATEGORY: NA
SUBMITTED: April 1990

1.0 REMEDIATION PROJECT OBJECTIVES

The purpose of this project was to propose a remedial action alternative for Site 12 located at Carswell Air Force Base (CAFB).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

Site 12 (SWMUs 19, 20, and 21) is located between the north-south taxiway and the radar facility (Figure B.1-1). It consists of a fire ring that is gravel-lined with a low earthen berm around its perimeter, was reportedly used for fire burn training exercises in the early 1960s. Two tanks at the site were used for storage of flammable liquids prior to training exercises. An underground tank of approximately 9,500 gallons was used for storage of waste oils and solvents from the Flightline shops.

2.2 PREVIOUS INVESTIGATION RESULTS

The evaluation was conducted as part of the IRP Remedial Investigation/Feasibility Study (RI/FS) Stage 2 investigation at CAFB. Results of soil sampling and analysis during the RI/FS studies indicated that several organic constituents, including benzene, ethylbenzene, xylenes, 2-methylnaphthalene, 4-methylphenol, phenol, and naphthalene occurred in the soil beneath Site 12.

The highest contaminant concentrations occur at the surface, decreasing with depth. However, in boreholes that encountered a sand zone at approximately 24 ft below land surface, the maximum values of contaminants were found in the sand strata above the water table. Petroleum hydrocarbon constituents were also

FT. WORTH AFP4/CARSWELL

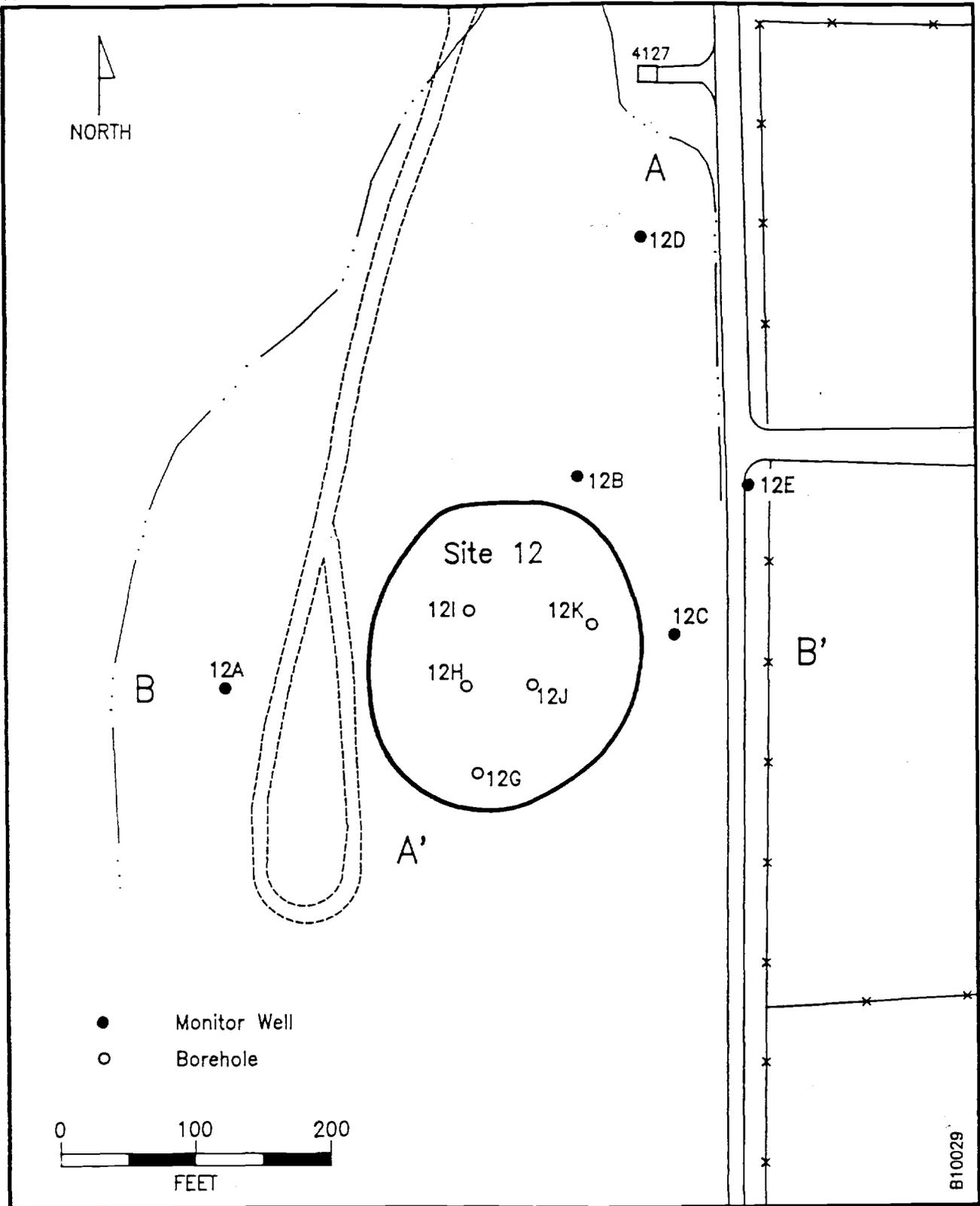


Figure B.1-1 LOCATION MAP FOR FDTA-2 (SITE 12, FT09)

SOURCES: Radian, 1990; ESE.

detected in the groundwater (Table B.1-1). The highest concentration of contaminants were detected at monitor well 12H, in the 19-25 ft soil depth range, which lies directly above the groundwater zone. Table B.1-2 shows the concentration of petroleum hydrocarbons, ethylbenzene, toluene, 1,1,2,2,-tetrachloroethane, and acetone at 12H.

2.3 PROJECT ACCOMPLISHMENTS

This report analyzed the previous studies conducted at Site 12 for selection of a remediation alternative. Based on the previous investigation results, the following seven alternatives were evaluated:

1. No Further Action,
2. Onsite aeration of the top 2 ft of contaminated soils located within the outer 200 ft earthen berm,
3. Removal and off-site disposal of the top 2 ft of contaminated soils within the 200 ft earthen berm in a landfill,
4. Removal and off-site incineration of the top 2 ft of contaminated soils within the 200 ft earthen berm,
5. Excavate contaminated soil located within the 200 ft earthen berm to bedrock, then dispose of the contaminated soil in an approved landfill. The excavated area will then be filled with borrow material,
6. Excavate (and aerate) the top 2 ft of soil, vacuum extract and aerate deep soils in-situ within the 200 ft earthen berm, and
7. Excavate and landfill the top 2 ft of soil, vacuum extract and aerate deep soils in-situ within the 200 ft earthen berm.

Alternative 2 was selected based on the following criteria:

- site characteristics,
- cost,
- Technical feasibility and effectiveness, and
- Hazards to humans and the environment.

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS

PARAMETER	EPA Standards,			Monitor Well		
	Criteria			Sample ID	Date Sampled	
	12A	12A	12B	12A	12B	12B
Petroleum Hydrocarbons UG/L	200.0(M)	200.0(G)	200.0(G)	02-154	04-04	03-25
Petroleum Hydrocarbons				25-Feb-88	06-Apr-88	03-Mar-88
Purgeable Halocarbons UG/L						
1,1,1-Trichloroethane	200.0(M)	200.0(G)	ND (0.090)	ND	ND (200.0)	ND (200.0)
1,1,2,2-Tetrachloroethane			ND (0.12)	ND	ND (2.3)	ND (2.3)
1,1,2-Trichloroethane			ND (0.070)	ND	ND (3.0)	ND (3.0)
1,1-Dichloroethane			ND (0.090)	ND	ND (1.8)	ND (1.8)
1,1-Dichloroethene	7.0(M)	7.0(G)	ND (0.10)	ND	ND (2.3)	ND (2.3)
1,2-Dichlorobenzene	620.0(G)		ND (0.50)	ND	ND (2.5)	ND (2.5)
1,2-Dichloroethane	5.0(M)	0.0(G)	ND (0.030)	ND	ND (13.0)	ND (13.0)
1,2-Dichloropropane			ND (0.10)	ND	ND (0.75)	ND (0.75)
1,3-Dichlorobenzene	400.0(G)		ND (0.30)	ND	ND (2.5)	ND (2.5)
1,4-Dichlorobenzene	750.0(M)	750.0(G)	ND (0.40)	ND	ND (7.5)	ND (7.5)
2-Chloroethylvinyl ether			ND (0.20)	ND	ND (10.0)	ND (10.0)
Bromodichloromethane			ND (0.10)	ND	ND (5.0)	ND (5.0)
Bromoform			ND (0.30)	ND	ND (2.5)	ND (2.5)
Bromomethane			ND (1.2)	ND	ND (7.5)	ND (7.5)
Carbon tetrachloride	3.0(M)	0.0(G)	ND (0.10)	ND	ND (30.0)	ND (30.0)
Chlorobenzene	60.0(G)		ND (0.30)	ND	ND (2.5)	ND (2.5)
Chloroethane			ND (0.50)	ND	ND (7.5)	ND (7.5)
Chloroform			ND (0.050)	0.20	ND (13.0)	ND (13.0)
Chloromethane			ND (0.30)	ND	ND (1.3)	ND (1.3)
Dibromochloromethane			ND (0.20)	ND	ND (7.5)	ND (7.5)
Methylene chloride			ND (0.30)	ND	ND (5.0)	ND (5.0)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

t: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

B: Detected in Reagent Blank; background subtraction not performed

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

() : Detection limit

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS

PARAMETER	EPA Standards,		Criteria		12A		12B		12B		
	200.0(M)		200.0(G)		02-154		04-04		03-25		
	25-Feb-88		06-Apr-88		03-Mar-88		03-Mar-88		03-Mar-88		
	UC/L										
Petroleum Hydrocarbons	UC/L										
Petroleum Hydrocarbons											
Purgeable Halocarbons	UC/L										
1,1,1-Trichloroethane		200.0(M)	200.0(G)	ND	(0.090)	ND	(0.090)	ND	(2.3)	ND	(2.3)
1,1,2,2-Tetrachloroethane				ND	(0.12)	ND	(0.12)	ND	(3.0)	ND	(3.0)
1,1,2-Trichloroethane				ND	(0.070)	ND	(0.070)	ND	(1.8)	ND	(1.8)
1,1-Dichloroethane				ND	(0.090)	ND	(0.090)	ND	(2.3)	ND	(2.3)
1,1-Dichloroethene		7.0(M)	7.0(G)	ND	(0.10)	ND	(0.10)	ND	(2.5)	ND	(2.5)
1,2-Dichlorobenzene		620.0(G)		ND	(0.50)	ND	(0.50)	ND	(13.0)	ND	(13.0)
1,2-Dichloroethane		5.0(M)	0.0(G)	ND	(0.030)	ND	(0.030)	ND	(0.75)	ND	(0.75)
1,2-Dichloropropane				ND	(0.10)	ND	(0.10)	ND	(2.5)	ND	(2.5)
1,3-Dichlorobenzene		400.0(G)		ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)
1,4-Dichlorobenzene		750.0(M)	750.0(G)	ND	(0.40)	ND	(0.40)	ND	(10.0)	ND	(10.0)
2-Chloroethylvinyl ether				ND	(0.20)	ND	(0.20)	ND	(5.0)	ND	(5.0)
Bromodichloromethane				ND	(0.10)	ND	(0.10)	ND	(2.5)	ND	(2.5)
Bromoform				ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)
Bromomethane				ND	(1.2)	ND	(1.2)	ND	(30.0)	ND	(30.0)
Carbon tetrachloride		5.0(M)	0.0(G)	ND	(0.10)	ND	(0.10)	ND	(2.5)	ND	(2.5)
Chlorobenzene		60.0(G)		ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)
Chloroethane				ND	(0.50)	ND	(0.50)	ND	(13.0)	ND	(13.0)
Chloroform				ND	(0.050)	0.20	(0.050)	ND	(1.3)	ND	(1.3)
Chloromethane				ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)
Dibromochloromethane				ND	(0.20)	ND	(0.20)	ND	(5.0)	ND	(5.0)
Methylene chloride				ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

A: cis-1,3-Dichloropropene cannot be quantitated due to coelution.
 B: Detected in Reagent Blank; background subtraction not performed
 Q: Daily EPA QC recovery outside 95% confidence limit.
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	EPA Standards, Criteria				12A		12B		
	8.0(G)	5.0(M)	2.0(M)	70.0(G)	02-154	04-04	03-24	03-25	
					25-Feb-88	06-Apr-88	03-Mar-88	03-Mar-88	
				0.030	(0.030)	42.0	(0.75)	43.0	(0.75)
Tetrachloroethene					ND	(0.030)			
Trichloroethene		0.0(G)			ND	(0.20)	110.0	110.0	(5.0)
Trichlorofluoromethane					ND	(0.10)	ND	ND	(2.5)
Vinyl chloride			0.0(G)		ND	(0.20)	ND	ND	(5.0)
cis-1,3-Dichloropropene					ND&		ND&	ND&	
trans-1,2-Dichloroethene				70.0(G)	ND	(0.20)	ND	ND	(5.0)
trans-1,3-Dichloropropene					ND	(0.30)	ND	ND	(7.5)
Purgeable Aromatics UC/L									
1,2-Dichlorobenzene	620.0(G)				ND	(0.40)	ND	ND	(10.0)
1,3-Dichlorobenzene	400.0(G)				ND	(0.40)	ND	ND	(10.0)
1,4-Dichlorobenzene	750.0(M)	750.0(G)			ND	(0.30)	ND	ND	(8.0)
Benzene	5.0(M)	0.0(G)			ND	(0.20)	ND	ND	(5.0)
Chlorobenzene	60.0(G)				ND	(0.30)	ND	ND	(8.0)
Ethylbenzene	680.0(G)				ND	(0.30)	ND	ND	(8.0)
Toluene	2000.0(G)				1.1	(0.20)	9.0	9.0	(5.0)
m-Xylene					ND	(0.20)	ND	ND	(5.0)
o-Xylene					ND	(0.10)	ND	ND	(3.0)
p-Xylene					NDQ	(0.20)	ND	ND	(5.0)
Extractable Priority Pollutants UC/L									
1,2,4-trichlorobenzene					ND	(2.0)			
1,2-dichlorobenzene					ND	(2.0)			
1,3-dichlorobenzene					ND	(2.0)			
1,4-dichlorobenzene	750.0(G)				ND	(4.5)			

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

&: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

B: Detected in Reagent Blank; background subtraction not performed

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDIA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	EPA Standards, Criteria	Monitor Well	
		Sample ID	Date Sampled
		12A	12B
		02-154	03-24
		06-Apr-88	03-Mar-88
		25-Feb-88	
2,4,5-trichlorophenol	ND	(10.0)	
2,4,6-trichlorophenol	ND	(2.8)	
2,4-dichlorophenol	3090.0(G)	(2.8)	
2,4-dimethylphenol	400.0(G)	(2.8)	
2,4-dinitrophenol	ND	(43.0)	
2,4-dinitrotoluene	ND	(5.9)	
2,6-dinitrotoluene	ND	(2.0)	
2-chloronaphthalene	ND	(2.0)	
2-chlorophenol	ND	(3.4)	
2-methylnaphthalene	ND	(10.0)	
2-methylphenol	ND	(10.0)	
2-nitroaniline	ND	(52.0)	
2-nitrophenol	ND	(3.7)	
3,3'-dichlorobenzidine	ND	(17.0)	
4,6-dinitro-2-methylphenol	ND	(25.0)	
4-bromophenyl-phenylether	ND	(2.0)	
4-chloro-3-methylphenol	ND	(3.1)	
4-chloroaniline	ND	(10.0)	
4-chlorophenyl-phenylether	ND	(4.3)	
4-methylphenol	ND	(10.0)	
4-nitroaniline	ND	(52.0)	
4-nitrophenol	ND	(2.5)	
acenaphthene	ND	(2.0)	
acenaphthylene	ND	(3.6)	
aniline	ND	(10.0)	

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

A: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

B: Detected in Reagent Blank; background subtraction not performed

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

() : Detection limit

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	EPA Standards, Criteria		Monitor Well	
	12A	02-154	12A	12B
anthracene	ND	(2.0)		
benzidine	ND	(45.0)		
benzo(a)anthracene	ND	(8.0)		
benzo(a)pyrene	ND	(2.6)		
benzo(b)fluoranthene	ND	(4.9)		
benzo(g,h,i)perylene	ND	(4.2)		
benzo(k)fluoranthene	ND	(2.6)		
benzoic acid	ND	(52.0)		
benzyl alcohol	ND	(52.0)		
bis(2-chloroethoxy)methane	ND	(5.5)		
bis(2-chloroethyl) ether	ND	(5.9)		
bis(2-chloroisopropyl) ether	ND	(5.9)		
bis(2-ethylhexyl)phthalate	17.0	(2.6)		
butylbenzylphthalate	ND	(2.6)		
chrysene	ND	(2.6)		
di-n-butylphthalate	35000.0(G)			
di-n-octyl phthalate	940.0(G)			
dibenzo(a,h)anthracene	4.28	(2.6)		
dibenzofuran	ND	(2.6)		
diethylphthalate	ND	(10.0)		
dimethyl phthalate	ND	(2.0)		
fluoranthene	0.030(G)	(1.6)		
fluorene	0.030(G)	(2.3)		
hexachlorobenzene	ND	(2.0)		
hexachlorobutadiene	ND	(2.0)		
		(0.93)		

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

L: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

B: Detected in Reagent Blank; background subtraction not performed

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

(): Detection limit

B. 1-8

235153

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	EPA Standards, Criteria	Monitor Well	
		Sample ID	Date Sampled
hexachlorocyclopentadiene		12A	12B
hexachloroethane		02-154	03-25
Indeno(1,2,3-cd)pyrene		25-Feb-88	03-Mar-88
Isophorone	5200.0(G)	ND (6.2)	
n-nitroso-di-n-propylamine		ND (1.6)	
n-nitrosodimethylamine		ND (3.8)	
n-nitrosodiphenylamine		ND (2.3)	
naphthalene	620.0(G)	ND (12.0)	
nitrobenzene		ND (10.0)	
pentachlorophenol	200.0(G)	ND (2.0)	
phenanthrene	0.030(G)	ND (1.6)	
phenol	3500.0(G)	ND (2.0)	
pyrene	0.030(G)	ND (3.7)	
		ND (5.6)	
		ND (1.5)	
		ND (2.0)	

B.1-9

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

L: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

B: Detected In Reagent Blank; background subtraction not performed

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

(): Detection limit

235154

SOURCES: Radian, 1990; ESE.

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDIA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well			
	Sample ID			
	128	12C	12D	
EPA Standards, Criteria	04-57 13-Apr-88	03-26 03-Mar-88	04-59 11-Apr-88	03-23 03-Mar-88
Petroleum Hydrocarbons UG/L	ND	600.0	ND	ND
Petroleum Hydrocarbons	(200.0)	(200.0)	(200.0)	(200.0)
Purgeable Halocarbons UG/L				
1,1,1-Trichloroethane	ND	0.30	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
1,1-Dichloroethane	ND	3.2	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND
2-Chloroethylvinyl ether	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

S: cis-1,3-Dichloropropene cannot be quantitated due to coelution.
 J: Estimated value (GC test codes)
 Q: Daily EPA QC recovery outside 95% confidence limit.
 ND: Not detected at specified detection limit
 (): Detection limit

235155

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well							
	Sample ID							
	12B		12C		12D			
EPA Standards, Criteria	04-57	03-26	04-59	03-23				
	13-Apr-88	03-Mar-88	11-Apr-88	03-Mar-88				
Tetrachloroethene	8.0(G)	49.0	2.5	2.7	ND	(0.75)	ND	(0.75)
Trichloroethene	5.0(M)	100.0	3.0	ND	48.0	(5.0)	ND	(5.0)
Trichlorofluoromethane		ND	ND	ND	ND	(2.5)	ND	(2.5)
Vinyl chloride	2.0(M)	ND	18.0	15.0	ND	(5.0)	ND	(5.0)
cis-1,3-Dichloropropene		ND	ND	ND	ND	(0.20)	ND	(0.20)
trans-1,2-Dichloroethene	70.0(G)	ND	ND	ND	ND	(5.0)	ND	(5.0)
trans-1,3-Dichloropropene		ND	ND	ND	ND	(7.5)	ND	(7.5)
Purgeable Aromatics UG/L								
1,2-Dichlorobenzene	620.0(G)	ND	ND	2.3	ND	(2.0)	ND	(0.40)
1,3-Dichlorobenzene	400.0(G)	ND	ND	ND	ND	(2.0)	ND	(0.40)
1,4-Dichlorobenzene	750.0(M)	ND	ND	1.4	ND	(2.0)	ND	(0.30)
Benzene	5.0(M)	ND	ND	ND	ND	(1.0)	ND	(0.20)
Chlorobenzene	60.0(G)	ND	ND	ND	ND	(2.0)	ND	(0.30)
Ethylbenzene	680.0(G)	ND	ND	ND	ND	(2.0)	ND	(0.30)
Toluene	2000.0(G)	ND	17.0	1.0	7.6	(1.0)	ND	(0.20)
m-Xylene		ND	ND	ND	ND	(1.0)	ND	(0.20)
o-Xylene		ND	ND	ND	ND	(0.50)	ND	(0.10)
p-Xylene		ND	ND	ND	ND	(1.0)	ND	(0.10)
Extractable Priority Pollutants UG/L								
1,2,4-trichlorobenzene								
1,2-dichlorobenzene								
1,3-dichlorobenzene								
1,4-dichlorobenzene	750.0(G)							

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

Q: cis-1,3-Dichloropropene cannot be quantitated due to coelution.
 J: Estimated value (GC test codes)
 Q: Daily EPA QC recovery outside 95% confidence limit.
 ND: Not detected at specified detection limit
 (): Detection limit

235156

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE I2 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	EPA Standards, Criteria	12B		12C		12D	
		04-57	03-26	04-59	03-23		
		13-Apr-88	03-Mar-88	11-Apr-88	03-Mar-88	Monitor Well Sample ID	Date Sampled
2,4,5-trichlorophenol				ND	(13.0)		
2,4,6-trichlorophenol				ND	(3.6)		
2,4-dichlorophenol	3090.0(G)			ND	(3.6)		
2,4-dimethylphenol	400.0(G)			ND	(3.6)		
2,4-dinitrophenol				ND	(55.0)		
2,4-dinitrotoluene				ND	(7.5)		
2,6-dinitrotoluene				ND	(2.5)		
2-chloronaphthalene				ND	(2.5)		
2-chlorophenol				ND	(4.4)		
2-methylnaphthalene				ND	(13.0)		
2-methylphenol				ND	(13.0)		
2-nitroaniline				ND	(66.0)		
2-nitrophenol				ND	(4.8)		
2,3,3'-dichlorobenzidine				ND	(22.0)		
1,4,6-dinitro-2-methylphenol				ND	(32.0)		
1,4-bromophenyl-phenylether				ND	(2.5)		
4-chloro-3-methylphenol				ND	(4.0)		
4-chloroaniline				ND	(13.0)		
4-chlorophenyl-phenylether				ND	(5.5)		
4-methylphenol				ND	(13.0)		
4-nitroaniline				ND	(66.0)		
4-nitrophenol				ND	(3.2)		
acenaphthene				ND	(2.5)		
acenaphthylene	0.030(G)			ND	(4.6)		
anthracene				ND	(2.5)		

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

b: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

J: Estimated value (GC test codes)

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

(): Detection limit

235157

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	EPA Standards,		Criteria		Monitor Well	
	12B	12C	12B	12C	Sample ID	Date Sampled
benzo(a)anthracene	04-57	03-26	13-Apr-88	11-Apr-88	12D	03-Mar-88
benzo(a)pyrene					ND	(10.0)
benzo(b)fluoranthene					ND	(3.3)
benzo(g,h,i)perylene					ND	(6.3)
benzo(k)fluoranthene					ND	(5.4)
benzoic acid					ND	(3.3)
benzyl alcohol					ND	(66.0)
bis(2-chloroethoxy)methane					ND	(66.0)
bis(2-chloroethyl) ether					ND	(7.0)
bis(2-chloroisopropyl)ether					ND	(7.5)
bis(2-ethylhexyl)phthalate					ND	(7.5)
butylbenzylphthalate		15000.0(G)			2.3J	(3.3)
chrysene		940.0(G)			8.9	(3.3)
di-n-butylphthalate		35000.0(G)			ND	(3.3)
di-n-octyl phthalate					1.4J	(3.3)
di benzo(a,h)anthracene					ND	(3.3)
dibenzofuran					ND	(3.3)
diethylphthalate					ND	(13.0)
dimethyl phthalate					ND	(2.5)
fluoranthene		0.030(G)			ND	(2.1)
fluorene		0.030(G)			ND	(2.9)
hexachlorobenzene					ND	(2.5)
hexachlorobutadiene					ND	(2.5)
hexachlorocyclopentadiene					ND	(1.2)
hexachloroethane					ND	(7.9)
					ND	(2.1)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard

(Refer to Tables 4.1-1 and 4.1-2).

S: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

J: Estimated value (GC test codes)

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

(): Detection limit

235153

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDIA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	EPA Standards		Criteria		Monitor Well	
	12D	12E	12D	12E	Sample ID	Date Sampled
Petroleum Hydrocarbons UC/L	ND	(200.0)	ND	(200.0)	03-27	04-56
Petroleum Hydrocarbons	ND	(200.0)	ND	(200.0)	03-Mar-88	13-Apr-88
Purgeable Halocarbons UC/L	200.0(M)	200.0(G)	200.0(M)	200.0(G)		
1,1,1-Trichloroethane	ND	(2.3)	ND	(0.090)	ND	0.40 (0.090)
1,1,2,2-Tetrachloroethane	ND	(3.0)	ND	(0.12)	ND	ND (0.12)
1,1,2-Trichloroethane	ND	(1.8)	ND	(0.070)	ND	ND (0.070)
1,1-Dichloroethane	ND	(2.3)	0.80	(0.090)	0.80	0.40 (0.090)
1,1-Dichloroethene	7.0(M)	7.0(G)	7.0(M)	7.0(G)	ND	ND (0.10)
1,2-Dichlorobenzene	620.0(G)		620.0(G)		ND	ND (0.50)
1,2-Dichloroethane	5.0(M)	0.0(G)	5.0(M)	0.0(G)	ND	ND (0.030)
1,2-Dichloropropane	ND	(2.5)	ND	(0.10)	ND	ND (0.10)
1,3-Dichlorobenzene	400.0(G)		400.0(G)		ND	ND (0.30)
1,4-Dichlorobenzene	750.0(M)	750.0(G)	750.0(M)	750.0(G)	2.6	1.6 (0.40)
2-Chloroethylvinyl ether	ND	(5.0)	ND	(0.20)	ND	ND (0.20)
Bromodichloromethane	ND	(2.5)	ND	(0.10)	ND	ND (0.10)
Bromoform	ND	(7.5)	ND	(0.30)	ND	ND (0.30)
Bromomethane	ND	(30.0)	ND	(1.2)	ND	ND (1.2)
Carbon tetrachloride	5.0(M)	0.0(G)	5.0(M)	0.0(G)	ND	ND (0.10)
Chlorobenzene	60.0(G)		60.0(G)		ND	ND (0.30)
Chloroethane	ND	(13.0)	ND	(0.50)	1.5	0.60 (0.50)
Chloroform	ND	(1.3)	ND	(0.050)	ND	ND (0.050)
Chloromethane	ND	(7.5)	ND	(0.30)	ND	ND (0.30)
Dibromochloromethane	ND	(5.0)	ND	(0.20)	ND	ND (0.20)
Methylene chloride	ND	(7.5)	ND	(0.30)	ND	ND (0.30)
Tetrachloroethane	8.0(G)		8.0(G)		ND	0.30 (0.030)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

±: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-1 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	EPA Standards, Criteria		Monitor Well	
			Sample ID	Date Sampled
	12D 04-53 13-Apr-88	12E 03-27 03-Mar-88	12E 04-56 13-Apr-88	
Trichloroethene	5.0(M) 0.0(G)	55.0 (5.0)	0.80 (0.20)	1.1 (0.20)
Trichlorofluoromethane		ND (2.5)	ND (0.10)	ND (0.10)
Vinyl chloride	2.0(M) 0.0(G)	ND (5.0)	3.4 (0.20)	1.8 (0.20)
cis-1,3-Dichloropropene		ND&	ND&	ND&
trans-1,2-Dichloroethene	70.0(G)	ND (5.0)	ND (0.20)	ND (0.20)
trans-1,3-Dichloropropene		ND (7.5)	ND (0.30)	ND (0.30)
Purgeable Aromatics UG/L				
1,2-Dichlorobenzene	620.0(G)	ND (0.40)	ND (0.40)	ND (0.40)
1,3-Dichlorobenzene	400.0(G)	ND (0.40)	ND (0.40)	ND (0.40)
1,4-Dichlorobenzene	750.0(M) 750.0(G)	ND (0.30)	5.2 (0.30)	5.1 (0.30)
Benzene	5.0(M) 0.0(G)	ND (0.20)	ND (0.20)	0.30 (0.20)
Chlorobenzene	60.0(G)	ND (0.30)	ND (0.30)	ND (0.30)
Ethylbenzene	680.0(G)	ND (0.30)	ND (0.30)	ND (0.30)
Toluene	2000.0(G)	1.8 (0.20)	47.0 (0.20)	1.0 (0.20)
m-Xylene		ND (0.20)	ND (0.20)	ND (0.20)
o-Xylene		ND (0.10)	ND (0.10)	ND (0.10)
p-Xylene		ND (0.20)	ND (0.20)	NDQ (0.20)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

&: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS

PARAMETER	Monitor Well		Date Sampled		Beg. Depth - End Depth	
	Sample ID	Sample ID	Date	Date	Depth	Depth
	12D	12E	12D-6	12E-2	12E	12E-4
Petroleum Hydrocarbons	ND	ND	19-Feb-88	23-Feb-88	23-Feb-88	23-Feb-88
Petroleum Hydrocarbons	15 - 20	25 - 30	4 - 6	14 - 19		
Petroleum Hydrocarbons	ND	ND	(2.0)	ND	(5.0)	14.0
Volatiles Organic Compounds	MG/KG					
1,1,1-trichloroethane	ND (0.0040)	ND (0.0045)	ND	ND	(0.0044)	ND (0.0039)
1,1,2,2-tetrachloroethane	ND (0.0073)	ND (0.0081)	ND	ND	(0.0080)	ND (0.0071)
1,1,2-trichloroethane	ND (0.0053)	ND (0.0059)	ND	ND	(0.0058)	ND (0.0052)
1,2-dichloroethane	ND (0.0030)	ND (0.0033)	ND	ND	(0.0032)	ND (0.0029)
1,2-dichloropropane	ND (0.0064)	ND (0.0071)	ND	ND	(0.0070)	ND (0.0062)
2-butanone	ND (0.027)	ND (0.030)	ND	ND	(0.029)	ND (0.026)
2-chloroethylvinyl ether	ND (0.0053)	ND (0.0059)	ND	ND	(0.0058)	ND (0.0052)
2-hexanone	ND (0.038)	ND (0.042)	ND	ND	(0.042)	ND (0.037)
4-methyl-2-pentanone	ND (0.049)	ND (0.054)	ND	ND	(0.053)	ND (0.047)
Benzene	ND (0.0047)	ND (0.0052)	ND	ND	(0.0051)	ND (0.0045)
Ethylbenzene	ND (0.0076)	ND (0.0085)	ND	ND	(0.0084)	ND (0.0074)
Toluene	ND (0.0064)	0.029	(0.0071)	0.018	(0.0070)	(0.0062)
Trichloroethene	ND (0.0020)	ND (0.0022)	ND	ND	(0.0022)	ND (0.0020)
acetone	0.011B	0.014B	(0.0089)	0.012B	(0.0087)	0.015B
bromodichloromethane	ND (0.0023)	ND (0.0026)	ND	ND	(0.0026)	ND (0.0023)
bromoform	ND (0.0050)	ND (0.0055)	ND	ND	(0.0055)	ND (0.0048)
bromomethane	ND (0.0053)	ND (0.0059)	ND	ND	(0.0058)	ND (0.0052)
carbon disulfide	ND (0.0018)	ND (0.0020)	ND	ND	(0.0020)	ND (0.0018)
carbon tetrachloride	ND (0.0030)	ND (0.0033)	ND	ND	(0.0032)	ND (0.0029)
chlorobenzene	ND (0.0064)	ND (0.0071)	ND	ND	(0.0070)	ND (0.0062)
chloroethane	ND (0.0053)	ND (0.0059)	ND	ND	(0.0058)	ND (0.0052)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-2 . RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well					
	Sample ID					
	Date Sampled					
	12D	12D-4	12D-6	12E	12E-2	12E-4
	19-Feb-88	19-Feb-88	19-Feb-88	23-Feb-88	23-Feb-88	23-Feb-88
	15 - 20	25 - 30	4 - 6	14 - 19		
chloroform	ND (0.0017)	ND (0.0019)	ND (0.0019)	ND (0.0016)	ND (0.0019)	ND (0.0016)
chloromethane	ND (0.0053)	ND (0.0059)	ND (0.0059)	ND (0.0058)	ND (0.0058)	ND (0.0052)
cis-1,3-Dichloropropene	ND (0.0053)	ND (0.0059)	ND (0.0059)	ND (0.0058)	ND (0.0058)	ND (0.0052)
dibromochloromethane	ND (0.0033)	ND (0.0037)	ND (0.0036)	ND (0.0032)	ND (0.0036)	ND (0.0032)
methylene chloride	ND (0.0030)	ND (0.0033)	ND (0.0032)	ND (0.0032)	ND (0.0032)	ND (0.0029)
styrene	ND (0.0032)	ND (0.0035)	ND (0.0035)	ND (0.0031)	ND (0.0035)	ND (0.0031)
tetrachloroethene	ND (0.0043)	ND (0.0048)	ND (0.0048)	ND (0.0042)	ND (0.0048)	ND (0.0042)
total xylenes	ND (0.0049)	ND (0.0054)	ND (0.0054)	ND (0.0053)	ND (0.0053)	ND (0.0047)
trans-1,2-Dichloroethene	ND (0.0017)	ND (0.0019)	ND (0.0019)	ND (0.0019)	ND (0.0019)	ND (0.0016)
trans-1,3-Dichloropropene	ND (0.0053)	ND (0.0059)	ND (0.0059)	ND (0.0058)	ND (0.0058)	ND (0.0052)
trichlorofluoromethane	ND (0.0053)	ND (0.0059)	ND (0.0059)	ND (0.0058)	ND (0.0058)	ND (0.0052)
vinyl acetate	ND (0.0073)	ND (0.0081)	ND (0.0081)	ND (0.0080)	ND (0.0080)	ND (0.0071)
vinyl chloride	ND (0.0053)	ND (0.0059)	ND (0.0059)	ND (0.0058)	ND (0.0058)	ND (0.0052)
∞						
Semivolatile Organic Compounds MG/KG						
1,2,4-trichlorobenzene	ND (0.13)	ND (0.15)	ND (0.15)	ND (0.17)	ND (0.17)	ND (0.15)
1,2-dichlorobenzene	ND (0.13)	ND (0.15)	ND (0.15)	ND (0.17)	ND (0.17)	ND (0.15)
1,3-dichlorobenzene	ND (0.13)	ND (0.15)	ND (0.15)	ND (0.17)	ND (0.17)	ND (0.15)
1,4-dichlorobenzene	ND (0.30)	ND (0.34)	ND (0.34)	ND (0.40)	ND (0.40)	ND (0.35)
2,4,5-trichlorophenol	ND (0.68)	ND (0.77)	ND (0.77)	ND (0.91)	ND (0.91)	ND (0.79)
2,4,6-trichlorophenol	ND (0.18)	ND (0.21)	ND (0.21)	ND (0.25)	ND (0.25)	ND (0.21)
2,4-dichlorophenol	ND (0.18)	ND (0.21)	ND (0.21)	ND (0.25)	ND (0.25)	ND (0.21)
2,4-dimethylphenol	ND (0.18)	ND (0.21)	ND (0.21)	ND (0.25)	ND (0.25)	ND (0.21)
2,4-dinitrophenol	ND (2.9)	ND (3.2)	ND (3.2)	ND (3.8)	ND (3.8)	ND (3.3)
2,4-dinitrotoluene	ND (0.39)	ND (0.44)	ND (0.44)	ND (0.52)	ND (0.52)	ND (0.45)

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

SOURCES: Radian, 1990; ESE.

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

Primary Results	Monitor Well		
	Sample ID		
	Date Sampled	Beg. Depth - End Depth	
	120	12E	
	120-4	12E-4	
	19-Feb-88	23-Feb-88	
	15 - 20	4 - 6	
PARAMETER	120	12E	
	120-6	12E-2	
	19-Feb-88	23-Feb-88	
	25 - 30	14 - 19	
2,6-dinitrotoluene	ND (0.13)	ND (0.17)	ND (0.15)
2-chloronaphthalene	ND (0.13)	ND (0.17)	ND (0.15)
2-chlorophenol	ND (0.23)	ND (0.30)	ND (0.26)
2-methylnaphthalene	ND (0.68)	ND (0.91)	ND (0.79)
2-methylphenol	ND (0.68)	ND (0.91)	ND (0.79)
2-nitroaniline	ND (3.4)	ND (4.6)	ND (4.0)
2-nitrophenol	ND (0.25)	ND (0.33)	ND (0.29)
3,3'-dichlorobenzidine	ND (1.1)	ND (1.5)	ND (1.3)
3-nitroaniline	ND (3.4)	ND (4.6)	ND (4.0)
4,6-dinitro-2-methylphenol	ND (1.6)	ND (2.2)	ND (1.9)
4-bromophenyl-phenylether	ND (0.13)	ND (0.17)	ND (0.15)
4-chloro-3-methylphenol	ND (0.21)	ND (0.27)	ND (0.24)
4-chloroaniline	ND (0.68)	ND (0.91)	ND (0.79)
4-chlorophenyl-phenylether	ND (0.29)	ND (0.38)	ND (0.33)
4-methylphenol	ND (0.68)	ND (0.91)	ND (0.79)
4-nitroaniline	ND (3.4)	ND (4.6)	ND (4.0)
4-nitrophenol	ND (0.16)	ND (0.22)	ND (0.19)
acenaphthene	ND (0.13)	ND (0.17)	ND (0.15)
acenaphthylene	ND (0.24)	ND (0.32)	ND (0.28)
aniline	ND (0.68)	ND (0.91)	ND (0.79)
anthracene	ND (0.13)	ND (0.17)	ND (0.15)
benzidine	ND (3.0)	ND (4.0)	ND (3.5)
benzo(a)anthracene	ND (0.53)	ND (0.71)	ND (0.62)
benzo(a)pyrene	ND (0.17)	ND (0.23)	ND (0.20)
benzo(b)fluoranthene	ND (0.33)	ND (0.44)	ND (0.38)

SOURCES: Radian, 1990
 2) 14 6

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well					
	Sample ID					
	Date Sampled					
	12D		12E		12F	
	120-4	120-6	12E-2	12E-4	12E-4	12E-4
	19-Feb-88	19-Feb-88	23-Feb-88	23-Feb-88	23-Feb-88	23-Feb-88
	15 - 20	25 - 30	4 - 6	14 - 19		
	Reg.	Depth	End Depth			
benzo(k)fluoranthene	ND (0.17)	ND (0.19)	ND (0.23)	ND (0.20)	ND (0.20)	ND (0.20)
benzoic acid	ND (3.4)	ND (3.9)	ND (4.6)	ND (4.0)	ND (4.0)	ND (4.0)
benzyl alcohol	ND (3.4)	ND (3.9)	ND (4.6)	ND (4.0)	ND (4.0)	ND (4.0)
bis(2-chloroethoxy)methane	ND (0.36)	ND (0.41)	ND (0.48)	ND (0.42)	ND (0.42)	ND (0.42)
bis(2-chloroethyl) ether	ND (0.39)	ND (0.44)	ND (0.52)	ND (0.45)	ND (0.45)	ND (0.45)
bis(2-chloroisopropyl) ether	ND (0.39)	ND (0.44)	ND (0.52)	ND (0.45)	ND (0.45)	ND (0.45)
bis(2-ethylhexyl)phthalate	ND (0.17)	0.15BJ (0.19)	0.11J (0.23)	0.16J (0.20)	0.16J (0.20)	0.16J (0.20)
butylbenzylphthalate	ND (0.17)	ND (0.19)	ND (0.23)	ND (0.20)	ND (0.20)	ND (0.20)
chrysene	ND (0.17)	ND (0.19)	ND (0.23)	ND (0.20)	ND (0.20)	ND (0.20)
di-n-butylphthalate	0.21 (0.17)	0.096J (0.19)	0.15BJ (0.23)	0.25B (0.20)	0.25B (0.20)	0.25B (0.20)
di-n-octyl phthalate	ND (0.17)	ND (0.19)	0.10J (0.23)	ND (0.20)	ND (0.20)	ND (0.20)
dibenzo(a,h)anthracene	ND (0.17)	ND (0.19)	ND (0.23)	ND (0.20)	ND (0.20)	ND (0.20)
1-dibenzofuran	ND (0.68)	ND (0.77)	ND (0.91)	ND (0.79)	ND (0.79)	ND (0.79)
diethylphthalate	ND (0.13)	ND (0.15)	ND (0.17)	ND (0.15)	ND (0.15)	ND (0.15)
dimethyl phthalate	ND (0.11)	ND (0.12)	ND (0.15)	ND (0.13)	ND (0.13)	ND (0.13)
fluoranthene	ND (0.15)	ND (0.17)	ND (0.20)	ND (0.17)	ND (0.17)	ND (0.17)
fluorene	ND (0.13)	ND (0.15)	ND (0.17)	ND (0.15)	ND (0.15)	ND (0.15)
hexachlorobenzene	ND (0.13)	ND (0.15)	ND (0.17)	ND (0.15)	ND (0.15)	ND (0.15)
hexachlorobutadiene	ND (0.062)	ND (0.069)	ND (0.082)	ND (0.071)	ND (0.071)	ND (0.071)
hexachlorocyclopentadiene	ND (0.41)	ND (0.46)	ND (0.55)	ND (0.48)	ND (0.48)	ND (0.48)
hexachloroethane	ND (0.11)	ND (0.12)	ND (0.15)	ND (0.13)	ND (0.13)	ND (0.13)
indeno(1,2,3-cd)pyrene	ND (0.25)	ND (0.29)	ND (0.34)	ND (0.29)	ND (0.29)	ND (0.29)
isophorone	ND (0.15)	ND (0.17)	ND (0.20)	ND (0.17)	ND (0.17)	ND (0.17)
n-nitroso-di-n-propylamine	ND (0.82)	ND (0.93)	ND (1.1)	ND (0.95)	ND (0.95)	ND (0.95)
n-nitrosodimethylamine	ND (0.68)	ND (0.77)	ND (0.91)	ND (0.79)	ND (0.79)	ND (0.79)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

(): Detection limit

SOURCES: Radian, 1990; ESE.

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

Primary Results

PARAMETER	Monitor Well		Date Sampled		Beg. Depth - End Depth	
	Sample ID	Sample ID	Date Sampled	Date Sampled	Beg. Depth - End Depth	Beg. Depth - End Depth
n-nitrosodiphenylamine	12D	12E	19-Feb-88	23-Feb-88	15 - 20	14 - 19
naphthalene	ND	ND	(0.13)	(0.15)	ND	ND
nitrobenzene	ND	ND	(0.11)	(0.12)	ND	(0.15)
pentachlorophenol	ND	ND	(0.13)	(0.15)	ND	ND
phenanthrene	ND	ND	(0.25)	(0.28)	ND	ND
phenol	ND	ND	(0.37)	(0.42)	ND	ND
pyrene	ND	ND	(0.10)	(0.12)	ND	ND
	ND	ND	(0.13)	(0.15)	ND	ND

B.1-21

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

SOURCES: Radian, 1990; ES
 235166

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well		Beg. Depth - End Depth	Date Sampled	Sample ID
	12E	12H			
Petroleum Hydrocarbons	12E-6	12G-4	20-Feb-88	23-Feb-88	12H-1
Petroleum Hydrocarbons	24 - 29	14 - 17	0 - 4		
Volatile Organic Compounds	ND (5.0)	ND (5.0)			3230.0
1,1,1-trichloroethane	ND (0.0040)	ND (0.0044)			ND (0.95)
1,1,2,2-tetrachloroethane	ND (0.0072)	ND (0.0079)			ND (1.7)
1,1,2-trichloroethane	ND (0.0053)	ND (0.0058)			ND (1.3)
1,2-dichloroethane	ND (0.0029)	ND (0.0032)			ND (0.70)
1,2-dichloropropane	ND (0.0063)	ND (0.0069)			ND (1.5)
2-butanone	ND (0.026)	ND (0.029)			3.68J (6.3)
2-chloroethylvinyl ether	ND (0.0053)	ND (0.0058)			ND (1.3)
2-hexanone	ND (0.038)	ND (0.041)			ND (9.0)
4-methyl-2-pentanone	ND (0.048)	ND (0.053)			ND (12.0)
Benzene	ND (0.0046)	ND (0.0051)			0.37J (1.1)
Ethylbenzene	ND (0.0076)	ND (0.0083)			4.1 (1.8)
Toluene	0.0042J (0.0063)	0.019 (0.0069)			11.0 (1.5)
Trichloroethene	ND (0.0020)	ND (0.0022)			ND (0.48)
acetone	0.029B (0.0079)	0.015B (0.0086)			0.748J (1.9)
bromodichloromethane	ND (0.0023)	ND (0.0025)			ND (0.55)
bromoform	ND (0.0049)	ND (0.0054)			ND (1.2)
bromomethane	ND (0.0053)	ND (0.0058)			ND (1.3)
carbon disulfide	ND (0.0018)	ND (0.0020)			ND (0.43)
carbon tetrachloride	ND (0.0029)	ND (0.0032)			ND (0.70)
chlorobenzene	ND (0.0063)	ND (0.0069)			ND (1.5)
chloroethane	ND (0.0053)	ND (0.0058)			ND (1.3)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (CC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well		Beg. Depth - End Depth	12H
	Sample ID	Date Sampled		
	12E	12G		12H
	12E-6	12G-4		12H-1
	23-Feb-88	20-Feb-88	23-Feb-88	23-Feb-88
	24 - 29	14 - 17	0 - 4	
chloroform	ND (0.0017)	ND (0.0018)	ND (0.40)	
chloromethane	ND (0.0053)	ND (0.0058)	ND (1.3)	
cis-1,3-Dichloropropene	ND (0.0053)	ND (0.0058)	ND (1.3)	
dibromochloromethane	ND (0.0033)	ND (0.0036)	ND (0.78)	
methylene chloride	ND (0.0029)	ND (0.0032)	ND (0.70)	
styrene	ND (0.0032)	ND (0.0035)	ND (0.75)	
tetrachloroethane	ND (0.0043)	ND (0.0047)	ND (1.0)	
total xylenes	ND (0.0048)	ND (0.0053)	32.0 (1.2)	
trans-1,2-Dichloroethene	ND (0.0017)	ND (0.0018)	ND (0.40)	
trans-1,3-Dichloropropene	ND (0.0053)	ND (0.0058)	ND (1.3)	
trichlorofluoromethane	ND (0.0053)	ND (0.0058)	ND (1.3)	
vinyl acetate	ND (0.0072)	ND (0.0079)	ND (1.7)	
vinyl chloride	ND (0.0053)	ND (0.0058)	ND (1.3)	
Semivolatile Organic Compounds MG/KG				
1,2,4-trichlorobenzene	ND (0.17)	ND (0.18)	ND (0.22)	
1,2-dichlorobenzene	ND (0.17)	ND (0.18)	ND (0.22)	
1,3-dichlorobenzene	ND (0.17)	ND (0.18)	ND (0.22)	
1,4-dichlorobenzene	ND (0.39)	ND (0.41)	ND (0.51)	
2,4,5-trichlorophenol	ND (0.89)	ND (0.92)	ND (1.2)	
2,4,6-trichlorophenol	ND (0.24)	ND (0.25)	ND (0.32)	
2,4-dichlorophenol	ND (0.24)	ND (0.25)	ND (0.32)	
2,4-dimethylphenol	ND (0.24)	ND (0.25)	ND (0.32)	
2,4-dinitrophenol	ND (3.8)	ND (3.9)	ND (4.9)	
2,4-dinitrotoluene	ND (0.51)	ND (0.53)	ND (0.67)	

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-2 . RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	12E		12G		12H	
	24 - 29		14 - 17		0 - 4	
	23-Feb-88	20-Feb-88	23-Feb-88	20-Feb-88	23-Feb-88	20-Feb-88
2,6-dinitrotoluene	ND (0.17)	ND (0.18)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)
2-chloronaphthalene	ND (0.17)	ND (0.18)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)
2-chlorophenol	ND (0.30)	ND (0.30)	ND (0.39)	ND (0.39)	ND (0.39)	ND (0.39)
2-methylnaphthalene	ND (0.89)	ND (0.92)	8.7 (1.2)	8.7 (1.2)	8.7 (1.2)	8.7 (1.2)
2-methylphenol	ND (0.89)	ND (0.92)	ND (1.2)	ND (1.2)	ND (1.2)	ND (1.2)
2-nitroaniline	ND (4.5)	ND (4.6)	ND (5.8)	ND (5.8)	ND (5.8)	ND (5.8)
2-nitrophenol	ND (0.32)	ND (0.33)	ND (0.42)	ND (0.42)	ND (0.42)	ND (0.42)
3,3'-dichlorobenzidine	ND (1.5)	ND (1.5)	ND (1.9)	ND (1.9)	ND (1.9)	ND (1.9)
3-nitroaniline	ND (4.5)	ND (4.6)	ND (5.8)	ND (5.8)	ND (5.8)	ND (5.8)
4,6-dinitro-2-methylphenol	ND (2.1)	ND (2.2)	ND (2.8)	ND (2.8)	ND (2.8)	ND (2.8)
4-bromophenyl-phenylether	ND (0.17)	ND (0.18)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)
4-chloro-3-methylphenol	ND (0.27)	ND (0.28)	ND (0.35)	ND (0.35)	ND (0.35)	ND (0.35)
1,4-chloroaniline	ND (0.89)	ND (0.92)	ND (1.2)	ND (1.2)	ND (1.2)	ND (1.2)
4-chlorophenyl-phenylether	ND (0.38)	ND (0.39)	ND (0.49)	ND (0.49)	ND (0.49)	ND (0.49)
4-methylphenol	ND (0.89)	ND (0.92)	4.2 (1.2)	4.2 (1.2)	4.2 (1.2)	4.2 (1.2)
4-nitroaniline	ND (4.5)	ND (4.6)	ND (5.8)	ND (5.8)	ND (5.8)	ND (5.8)
4-nitrophenol	ND (0.21)	ND (0.22)	ND (0.28)	ND (0.28)	ND (0.28)	ND (0.28)
acenaphthene	ND (0.17)	ND (0.18)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)
acenaphthylene	ND (0.31)	ND (0.32)	ND (0.41)	ND (0.41)	ND (0.41)	ND (0.41)
aniline	ND (0.89)	ND (0.92)	ND (1.2)	ND (1.2)	ND (1.2)	ND (1.2)
anthracene	ND (0.17)	ND (0.18)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)
benzidine	ND (3.9)	ND (4.1)	ND (5.1)	ND (5.1)	ND (5.1)	ND (5.1)
benzo(a)anthracene	ND (0.70)	ND (0.72)	ND (0.91)	ND (0.91)	ND (0.91)	ND (0.91)
benzo(a)pyrene	ND (0.22)	ND (0.23)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)
benzo(b)fluoranthene	ND (0.43)	ND (0.44)	ND (0.56)	ND (0.56)	ND (0.56)	ND (0.56)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed
 RJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (CC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well			
	Sample ID			
	Date Sampled			
	Beg. Depth - End Depth	End Depth	Beg. Depth - End Depth	End Depth
	12E	12G	12H	
	12E-6	12G-4	12H-1	
	23-Feb-88	20-Feb-88	23-Feb-88	
	24 - 29	14 - 17	0 - 4	
benzo(k)fluoranthene	ND (0.22)	ND (0.23)	ND (0.29)	ND (0.29)
benzoic acid	ND (4.5)	ND (4.6)	ND (5.8)	ND (5.8)
benzyl alcohol	ND (4.5)	ND (4.6)	ND (5.8)	ND (5.8)
bis(2-chloroethoxy)methane	ND (0.47)	ND (0.49)	ND (0.62)	ND (0.62)
bis(2-chloroethyl) ether	ND (0.51)	ND (0.53)	ND (0.67)	ND (0.67)
bis(2-chloroisopropyl) ether	ND (0.51)	ND (0.53)	ND (0.67)	ND (0.67)
bis(2-ethylhexyl)phthalate	0.094J (0.22)	0.19J (0.23)	0.53 (0.29)	0.53 (0.29)
butylbenzylphthalate	ND (0.22)	ND (0.23)	ND (0.29)	ND (0.29)
chrysene	ND (0.22)	ND (0.23)	ND (0.29)	ND (0.29)
di-n-butylphthalate	0.24B (0.22)	0.31B (0.23)	0.62B (0.29)	0.62B (0.29)
di-n-octyl phthalate	0.092J (0.22)	0.18J (0.23)	0.15J (0.29)	0.15J (0.29)
1,2-dibenzo(a,h)anthracene	ND (0.22)	ND (0.23)	ND (0.29)	ND (0.29)
1,4-dibenzofuran	ND (0.89)	ND (0.92)	0.17J (1.2)	0.17J (1.2)
1,2-diethylphthalate	ND (0.17)	ND (0.18)	ND (0.22)	ND (0.22)
dimethyl phthalate	ND (0.14)	ND (0.15)	ND (0.19)	ND (0.19)
fluoranthene	ND (0.20)	ND (0.20)	ND (0.26)	ND (0.26)
fluorene	ND (0.17)	ND (0.18)	ND (0.22)	ND (0.22)
hexachlorobenzene	ND (0.17)	ND (0.18)	ND (0.22)	ND (0.22)
hexachlorobutadiene	ND (0.080)	ND (0.083)	ND (0.11)	ND (0.11)
hexachlorocyclopentadiene	ND (0.54)	ND (0.55)	ND (0.70)	ND (0.70)
hexachloroethane	ND (0.14)	ND (0.15)	ND (0.19)	ND (0.19)
indeno(1,2,3-cd)pyrene	ND (0.33)	ND (0.34)	ND (0.43)	ND (0.43)
isophorone	ND (0.20)	ND (0.20)	ND (0.26)	ND (0.26)
n-nitroso-di-n-propylamine	ND (1.1)	ND (1.1)	ND (1.4)	ND (1.4)
n-nitrosodimethylamine	ND (0.89)	ND (0.92)	ND (1.2)	ND (1.2)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDA 2), CARSWELL AFB, TEXAS (Cont.)

Primary Results

PARAMETER	Monitor Well	
	Sample ID	Date Sampled
	12E	12H
	12E-6	12H-1
	23-Feb-88	23-Feb-88
	24 - 29	0 - 4
	14 - 17	
n-nitrosodiphenylamine	ND (0.17)	ND (0.18)
naphthalene	ND (0.14)	3.9 (0.19)
nitrobenzene	ND (0.17)	ND (0.22)
pentachlorophenol	ND (0.32)	ND (0.42)
phenanthrene	ND (0.48)	ND (0.63)
phenol	ND (0.13)	0.50 (0.18)
pyrene	ND (0.17)	ND (0.22)

SOURCES: Radian, 1990; ESE

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well			
	Sample ID			
	Date Sampled			
	Beg. Depth	End Depth		
	12H	12H-2	12H	12H
	12H-2	12H-3	12H-3	12H-4
	23-Feb-88	23-Feb-88	23-Feb-88	23-Feb-88
	4 - 9	4 - 9	9 - 14	14 - 19
	2110.0	1200.0	450.0	340.0
Petroleum Hydrocarbons MC/KG				
Petroleum Hydrocarbons				
Volatile Organic Compounds MC/KG				
1,1,1-trichloroethane	ND (0.95)	ND (0.55)	ND (0.56)	ND (0.56)
1,1,2,2-tetrachloroethane	ND (1.7)	ND (1.0)	ND (1.0)	ND (1.0)
1,1,2-trichloroethane	ND (1.3)	ND (0.73)	ND (0.74)	ND (0.74)
1,2-dichloroethane	ND (0.70)	ND (0.41)	ND (0.41)	ND (0.41)
1,2-dichloropropane	ND (1.5)	ND (0.87)	ND (0.88)	ND (0.88)
2-butanone	4.3BJ (6.3)	5.1B (3.6)	8.0B (3.7)	5.7B (3.7)
2-chloroethylvinyl ether	ND (1.3)	ND (0.73)	ND (0.74)	ND (0.74)
2-hexanone	ND (9.0)	ND (5.2)	ND (5.3)	ND (5.3)
4-methyl-2-pentanone	ND (12.0)	ND (6.7)	ND (6.8)	ND (6.8)
Benzene	ND (1.1)	ND (0.64)	ND (0.65)	ND (0.65)
Ethylbenzene	4.8 (1.8)	3.6 (1.0)	1.1J (1.1)	0.89J (1.1)
Toluene	8.8 (1.5)	7.5 (0.87)	1.9 (0.88)	0.24J (0.88)
Trichloroethene	ND (0.48)	ND (0.28)	ND (0.28)	ND (0.28)
acetone	4.0B (1.9)	2.6B (1.1)	2.5B (1.1)	11.0B (1.1)
bromodichloromethane	ND (0.55)	ND (0.32)	ND (0.32)	ND (0.32)
bromoform	ND (1.2)	ND (0.68)	ND (0.69)	ND (0.69)
bromomethane	ND (1.3)	ND (0.73)	ND (0.74)	ND (0.74)
carbon disulfide	ND (0.43)	ND (0.25)	ND (0.25)	ND (0.25)
carbon tetrachloride	ND (0.70)	ND (0.41)	ND (0.41)	ND (0.41)
chlorobenzene	ND (1.5)	ND (0.87)	ND (0.88)	ND (0.88)
chloroethane	ND (1.3)	ND (0.73)	ND (0.74)	ND (0.74)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well											
	Sample ID											
	Date Sampled											
	12H		12H-2		12H		12H-3		12H-4		12H	
	23-Feb-88		23-Feb-88		23-Feb-88		23-Feb-88		23-Feb-88		23-Feb-88	
	4 - 9		4 - 9		9 - 14		9 - 14		14 - 19		14 - 19	
	ND	(0.40)	ND	(0.23)	ND	(0.24)	ND	(0.24)	ND	(0.24)	ND	(0.24)
chloroform	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)	ND	(0.74)	ND	(0.74)
chloromethane	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)	ND	(0.74)	ND	(0.74)
cis-1,3-Dichloropropene	ND	(0.78)	ND	(0.45)	ND	(0.46)	ND	(0.46)	ND	(0.46)	ND	(0.46)
dibromochloromethane	ND	(0.70)	ND	(0.41)								
methylene chloride	ND	(0.75)	ND	(0.44)								
styrene	ND	(1.0)	ND	(0.59)	ND	(0.60)	ND	(0.60)	ND	(0.60)	ND	(0.60)
tetrachloroethene	31.0	(1.2)	23.0	(0.67)	6.4	(0.68)	4.0	(0.68)	4.0	(0.68)	4.0	(0.68)
total xylenes	ND	(0.40)	ND	(0.23)	ND	(0.24)	ND	(0.24)	ND	(0.24)	ND	(0.24)
trans-1,2-Dichloroethene	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)	ND	(0.74)	ND	(0.74)
trans-1,3-Dichloropropene	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)	ND	(0.74)	ND	(0.74)
trichlorofluoromethane	ND	(1.7)	ND	(1.0)								
vinyl acetate	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)	ND	(0.74)	ND	(0.74)
vinyl chloride	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
1,2,4-trichlorobenzene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
1,2-dichlorobenzene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
1,3-dichlorobenzene	ND	(0.40)	ND	(0.40)	ND	(0.39)	ND	(0.39)	ND	(0.40)	ND	(0.40)
1,4-dichlorobenzene	ND	(0.92)	ND	(0.91)	ND	(0.89)	ND	(0.89)	ND	(0.92)	ND	(0.92)
2,4,5-trichlorophenol	ND	(0.25)	ND	(0.25)	ND	(0.24)	ND	(0.24)	ND	(0.25)	ND	(0.25)
2,4,6-trichlorophenol	ND	(0.25)	ND	(0.25)	ND	(0.24)	ND	(0.24)	ND	(0.25)	ND	(0.25)
2,4-dichlorophenol	ND	(0.25)	ND	(0.25)	ND	(0.24)	ND	(0.24)	ND	(0.25)	ND	(0.25)
2,4-dimethylphenol	ND	(3.8)	ND	(3.8)	ND	(3.7)	ND	(3.7)	ND	(3.9)	ND	(3.9)
2,4-dinitrophenol	ND	(0.52)	ND	(0.52)	ND	(0.51)	ND	(0.51)	ND	(0.52)	ND	(0.52)
2,4-dinitrotoluene												

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

SOURCES: Radian, 1990; ESE.

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well					
	Sample ID					
	Date Sampled					
	12H		12H		12H	
	12H-2	12H-2	12H-2	12H-3	12H-4	12H-4
	23-Feb-88	23-Feb-88	23-Feb-88	23-Feb-88	23-Feb-88	23-Feb-88
	4 - 9	4 - 9	9 - 14	9 - 14	14 - 19	14 - 19
Beg. Depth - End Depth						
2,6-dinitrotoluene	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)
2-chloronaphthalene	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)
2-chlorophenol	ND (0.30)	ND (0.30)	ND (0.29)	ND (0.29)	ND (0.30)	ND (0.30)
2-methylnaphthalene	4.0 (0.92)	4.8 (0.91)	0.66J (0.89)	0.66J (0.89)	0.95 (0.92)	0.95 (0.92)
2-methylphenol	ND (0.92)	ND (0.91)	ND (0.89)	ND (0.89)	ND (0.92)	ND (0.92)
2-nitroaniline	ND (4.6)	ND (4.6)	ND (4.4)	ND (4.4)	ND (4.6)	ND (4.6)
2-nitrophenol	ND (0.33)	ND (0.33)	ND (0.32)	ND (0.32)	ND (0.33)	ND (0.33)
3,3'-dichlorobenzidine	ND (1.5)	ND (1.5)	ND (1.5)	ND (1.5)	ND (1.5)	ND (1.5)
3-nitroaniline	ND (4.6)	ND (4.6)	ND (4.4)	ND (4.4)	ND (4.6)	ND (4.6)
4,6-dinitro-2-methylphenol	ND (2.2)	ND (2.2)	ND (2.1)	ND (2.1)	ND (2.2)	ND (2.2)
4-bromophenyl-phenylether	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)
4-chloro-3-methylphenol	ND (0.27)	ND (0.27)	ND (0.27)	ND (0.27)	ND (0.28)	ND (0.28)
4-chloroaniline	ND (0.92)	ND (0.91)	ND (0.89)	ND (0.89)	ND (0.92)	ND (0.92)
4-chlorophenyl-phenylether	ND (0.38)	ND (0.38)	ND (0.37)	ND (0.37)	ND (0.39)	ND (0.39)
4-methylphenol	0.54J (0.92)	0.76J (0.91)	ND (0.89)	ND (0.89)	ND (0.92)	ND (0.92)
4-nitroaniline	ND (4.6)	ND (4.6)	ND (4.4)	ND (4.4)	ND (4.6)	ND (4.6)
4-nitrophenol	ND (0.22)	ND (0.22)	ND (0.21)	ND (0.21)	ND (0.22)	ND (0.22)
acenaphthene	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)
acenaphthylene	ND (0.32)	ND (0.32)	ND (0.31)	ND (0.31)	ND (0.32)	ND (0.32)
aniline	ND (0.92)	ND (0.91)	ND (0.89)	ND (0.89)	ND (0.92)	ND (0.92)
anthracene	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)
benzidine	ND (4.0)	ND (4.0)	ND (3.9)	ND (3.9)	ND (4.0)	ND (4.0)
benzo(a)anthracene	ND (0.71)	ND (0.71)	ND (0.69)	ND (0.69)	ND (0.72)	ND (0.72)
benzo(a)pyrene	ND (0.23)	ND (0.23)	ND (0.22)	ND (0.22)	ND (0.23)	ND (0.23)
benzo(b)fluoranthene	ND (0.44)	ND (0.44)	ND (0.43)	ND (0.43)	ND (0.44)	ND (0.44)

235174

SOURCES: Radian, 1990;

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well			
	Sample ID			
	Date Sampled			
	Beg. Depth - End Depth			
	12H	12H	12H	12H
	12H-2	12H-2	12H-3	12H-4
	23-Feb-88	23-Feb-88	23-Feb-88	23-Feb-88
	4 - 9	4 - 9	9 - 14	14 - 19
benzo(k)fluoranthene	ND (0.23)	ND (0.23)	ND (0.22)	ND (0.23)
benzoic acid	ND (4.6)	ND (4.6)	ND (4.4)	ND (4.6)
benzyl alcohol	ND (4.6)	ND (4.6)	ND (4.4)	ND (4.6)
bis(2-chloroethoxy)methane	ND (0.48)	ND (0.48)	ND (0.47)	ND (0.49)
bis(2-chloroethyl) ether	ND (0.52)	ND (0.52)	ND (0.51)	ND (0.52)
bis(2-chloroisopropyl)ether	ND (0.52)	ND (0.52)	ND (0.51)	ND (0.52)
bis(2-ethylhexyl)phthalate	0.28 (0.23)	0.33 (0.23)	1.1B (0.22)	1.4B (0.23)
butylbenzylphthalate	ND (0.23)	ND (0.23)	ND (0.22)	ND (0.23)
chrysene	ND (0.23)	ND (0.23)	ND (0.22)	ND (0.23)
di-n-butylphthalate	0.28B (0.23)	0.61B (0.23)	ND (0.22)	ND (0.23)
di-n-octyl phthalate	0.10J (0.23)	0.22J (0.23)	0.14RJ (0.22)	ND (0.23)
dibenzo(a,h)anthracene	ND (0.23)	ND (0.23)	ND (0.22)	ND (0.23)
dibenzofuran	ND (0.92)	ND (0.91)	ND (0.89)	ND (0.92)
diethylphthalate	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)
dimethyl phthalate	ND (0.15)	ND (0.15)	ND (0.14)	ND (0.15)
fluoranthene	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)
fluorene	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)
hexachlorobenzene	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)
hexachlorobutadiene	ND (0.082)	ND (0.082)	ND (0.080)	ND (0.083)
hexachlorocyclopentadiene	ND (0.55)	ND (0.55)	ND (0.53)	ND (0.55)
hexachloroethane	ND (0.15)	ND (0.15)	ND (0.14)	ND (0.15)
indeno(1,2,3-cd)pyrene	ND (0.34)	ND (0.34)	ND (0.33)	ND (0.34)
isophorone	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)
n-nitroso-di-n-propylamine	ND (1.1)	ND (1.1)	ND (1.1)	ND (1.1)
n-nitrosodimethylamine	ND (0.92)	ND (0.91)	ND (0.89)	ND (0.92)

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-2 . RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

Primary Results

PARAMETER	Monitor Well		Date Sampled		Beg. Depth - End Depth	
	Sample ID	Sample ID	Date Sampled	Date Sampled	Beg. Depth	End Depth
n-nitrosodiphenylamine	12H	12H	23-Feb-88	23-Feb-88	4 - 9	9 - 14
naphthalene	12H-2	12H-2	4 - 9	4 - 9	ND	ND
nitrobenzene	12H-2	12H-2	23-Feb-88	23-Feb-88	2.7	0.31
pentachlorophenol	12H-2	12H-2	4 - 9	4 - 9	ND	ND
phenanthrene	12H-2	12H-2	23-Feb-88	23-Feb-88	ND	ND
phenol	12H-2	12H-2	4 - 9	4 - 9	0.36	ND
pyrene	12H-2	12H-2	23-Feb-88	23-Feb-88	ND	ND
	12H	12H	23-Feb-88	23-Feb-88	ND	ND
	12H-4	12H-4	14 - 19	14 - 19	0.37	ND

SOURCES: Radian, 1990; ESE.

235176

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank; Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-2: RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well		Reg. Depth - End Depth	Date Sampled	Sample ID	
	12H	12I				
Petroleum Hydrocarbons	5760.0	670.0*	450.0			
Petroleum Hydrocarbons				12I-5	12I-3	
				23-Feb-88	24-Feb-88	
				19 - 25	9 - 14	
Volatlie Organic Compounds						
1,1,1-trichloroethane	ND	(2.4)	ND	(0.55)	ND	(0.55)
1,1,2,2-tetrachloroethane	1.3J	(4.3)	ND	(1.0)	ND	(0.99)
1,1,2-trichloroethane	ND	(3.1)	ND	(0.73)	ND	(0.72)
1,2-dichloroethane	ND	(1.8)	ND	(0.41)	ND	(0.40)
1,2-dichloropropane	ND	(3.8)	ND	(0.87)	ND	(0.86)
2-butanone	ND	(16.0)	5.0B	(3.6)	6.0B	(3.6)
2-chloroethylvinyl ether	ND	(3.1)	ND	(0.73)	ND	(0.72)
2-hexanone	ND	(23.0)	ND	(5.2)	ND	(5.2)
4-methyl-2-pentanone	ND	(29.0)	ND	(6.7)	ND	(6.6)
Benzene	ND	(2.8)	ND	(0.64)	0.54J	(0.63)
Ethylbenzene	5.0	(4.5)	1.3	(1.0)	5.6	(1.0)
Toluene	3.7J	(3.8)	1.7	(0.87)	2.2	(0.86)
Trichloroethene	ND	(1.2)	ND	(0.28)	ND	(0.27)
acetone	0.87BJ	(4.7)	8.2B	(1.1)	5.4B	(1.1)
bromodichloromethane	ND	(1.4)	ND	(0.32)	ND	(0.32)
bromoform	ND	(2.9)	ND	(0.68)	ND	(0.68)
bromomethane	ND	(3.1)	ND	(0.73)	ND	(0.72)
carbon disulfide	ND	(1.1)	ND	(0.25)	ND	(0.24)
carbon tetrachloride	ND	(1.8)	ND	(0.41)	ND	(0.40)
chlorobenzene	ND	(3.8)	ND	(0.87)	ND	(0.86)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test code)

*: Indicates duplicate analysis is not within control limits.

ND: Not detected at specified detection limit

(): Detection Limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well		Beg. Depth - End Depth	Date Sampled	Sample ID
	12H	12I			
	12H-5	12I-3			
	23-Feb-88	23-Feb-88	19 - 25	4 - 9	24-Feb-88
	19 - 25	4 - 9	19 - 14		
chloroethane	ND (3.1)	ND (0.73)	ND (0.72)		ND (0.72)
chloroform	ND (1.0)	ND (0.23)	ND (0.23)		ND (0.23)
chloromethane	ND (3.1)	ND (0.73)	ND (0.72)		ND (0.72)
cis-1,3-Dichloropropene	ND (3.1)	ND (0.73)	ND (0.72)		ND (0.72)
dibromochloromethane	ND (1.9)	ND (0.45)	ND (0.45)		ND (0.45)
methylene chloride	ND (1.8)	ND (0.41)	ND (0.40)		ND (0.40)
styrene	ND (1.9)	ND (0.44)	ND (0.43)		ND (0.43)
tetrachloroethene	ND (2.6)	ND (0.59)	ND (0.59)		ND (0.59)
total xylenes	32.0 (2.9)	8.6 (0.67)	35.0 (0.66)		35.0 (0.66)
trans-1,2-Dichloroethene	ND (1.0)	ND (0.23)	ND (0.23)		ND (0.23)
trans-1,3-Dichloropropene	ND (3.1)	ND (0.73)	ND (0.72)		ND (0.72)
trichlorofluoromethane	ND (3.1)	ND (0.73)	ND (0.72)		ND (0.72)
vinyl acetate	ND (4.3)	ND (1.0)	ND (0.99)		ND (0.99)
vinyl chloride	ND (3.1)	ND (0.73)	ND (0.72)		ND (0.72)
Semivolatile Organic Compounds MG/KG					
1,2,4-trichlorobenzene	ND (1.4)	ND (0.15)	ND (0.15)		ND (0.15)
1,2-dichlorobenzene	ND (1.4)	ND (0.15)	ND (0.15)		ND (0.15)
1,3-dichlorobenzene	ND (1.4)	ND (0.15)	ND (0.15)		ND (0.15)
1,4-dichlorobenzene	ND (3.3)	ND (0.35)	ND (0.35)		ND (0.35)
2,4,5-trichlorophenol	ND (7.6)	ND (0.80)	ND (0.79)		ND (0.79)
2,4,6-trichlorophenol	ND (2.0)	ND (0.22)	ND (0.21)		ND (0.21)
2,4-dichlorophenol	ND (2.0)	ND (0.22)	ND (0.21)		ND (0.21)
2,4-dimethylphenol	ND (2.0)	ND (0.22)	ND (0.21)		ND (0.21)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ^: Indicates duplicate analysis is not within control limits.
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	12H		12I	
	12H-5		12I-2	
	19 - 25	23-Feb-88	4 - 9	23-Feb-88
2,4-dinitrophenol	ND	(32.0)	ND	(3.4)
2,4-dinitrotoluene	ND	(4.3)	ND	(0.45)
2,6-dinitrotoluene	ND	(1.4)	ND	(0.15)
2-chloronaphthalene	ND	(1.4)	ND	(0.15)
2-chlorophenol	ND	(2.5)	ND	(0.26)
2-methylnaphthalene	11.0	(7.6)	2.0	(0.80)
2-methylphenol	ND	(7.6)	ND	(0.80)
2-nitroaniline	ND	(38.0)	ND	(4.0)
2-nitrophenol	ND	(2.7)	ND	(0.29)
3,3'-dichlorobenzidine	ND	(12.0)	ND	(1.3)
3-nitroaniline	ND	(38.0)	ND	(4.0)
4,6-dinitro-2-methylphenol	ND	(18.0)	ND	(1.9)
4-bromophenyl-phenylether	ND	(1.4)	ND	(0.15)
4-chloro-3-methylphenol	ND	(2.3)	ND	(0.24)
4-chloroaniline	ND	(7.6)	ND	(0.80)
4-chlorophenyl-phenylether	ND	(3.2)	ND	(0.34)
4-methylphenol	ND	(7.6)	1.4	(0.80)
4-nitroaniline	ND	(38.0)	ND	(4.0)
4-nitrophenol	ND	(1.8)	ND	(0.19)
acenaphthene	ND	(1.4)	ND	(0.15)
acenaphthylene	ND	(2.6)	ND	(0.28)
aniline	ND	(7.6)	ND	(0.80)
anthracene	ND	(1.4)	ND	(0.15)
benzidine	ND	(33.0)	ND	(3.5)

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ^: Indicates duplicate analysis is not within control limits.
 ND: Not detected at specified detection limit
 (): Detection limit

SOURCES: Radian, 1990; ESE.

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	12H		12I		12I-3	
	23-Feb-88	19 - 25	23-Feb-88	4 - 9	24-Feb-88	9 - 14
	12H		12I		12I-3	
	23-Feb-88		23-Feb-88		24-Feb-88	
	19 - 25		4 - 9		9 - 14	
	12H	12I	12I-2	12I-3	24-Feb-88	9 - 14
	23-Feb-88	19 - 25	23-Feb-88	4 - 9	24-Feb-88	9 - 14
benzo(a)anthracene	ND	(5.9)	ND	(0.62)	ND	(0.61)
benzo(a)pyrene	ND	(1.9)	ND	(0.20)	ND	(0.20)
benzo(b)fluoranthene	ND	(3.6)	ND	(0.38)	ND	(0.38)
benzo(k)fluoranthene	ND	(1.9)	ND	(0.20)	ND	(0.20)
benzoic acid	ND	(38.0)	ND	(4.0)	ND	(3.9)
benzyl alcohol	ND	(38.0)	ND	(4.0)	ND	(3.9)
bis(2-chloroethoxy)methane	ND	(4.0)	ND	(0.42)	ND	(0.42)
bis(2-chloroethyl) ether	ND	(4.3)	ND	(0.45)	ND	(0.45)
bis(2-chloroisopropyl)ether	ND	(4.3)	ND	(0.45)	ND	(0.45)
bis(2-ethylhexyl)phthalate	12.08	(1.9)	1.48	(0.20)	0.588	(0.20)
butylbenzylphthalate	ND	(1.9)	ND	(0.20)	ND	(0.20)
chrysene	ND	(1.9)	ND	(0.20)	ND	(0.20)
di-n-butylphthalate	ND	(1.9)	ND	(0.20)	ND	(0.20)
di-n-octyl phthalate	ND	(1.9)	ND	(0.20)	ND	(0.20)
dibenzo(a,h)anthracene	ND	(1.9)	0.21	(0.20)	0.47	(0.20)
dibenzofuran	ND	(7.6)	ND	(0.20)	ND	(0.20)
diethylphthalate	ND	(1.4)	ND	(0.80)	ND	(0.79)
dimethyl phthalate	ND	(1.2)	ND	(0.15)	ND	(0.15)
fluoranthene	ND	(1.7)	ND	(0.13)	ND	(0.13)
fluorene	ND	(1.4)	ND	(0.18)	ND	(0.17)
hexachlorobenzene	ND	(1.4)	ND	(0.15)	ND	(0.15)
hexachlorobutadiene	ND	(1.4)	ND	(0.15)	ND	(0.15)
hexachlorocyclopentadiene	ND	(0.68)	ND	(0.072)	ND	(0.071)
hexachloroethane	ND	(4.5)	ND	(0.48)	ND	(0.47)
	ND	(1.2)	ND	(0.13)	ND	(0.13)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

^: Indicates duplicate analysis is not within control limits.

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well		Beg. Depth - End Depth	Date Sampled	Sample ID	
	12H	12I				
indeno(1,2,3-cd)pyrene	ND	(2.8)	ND	(0.30)	ND	(0.29)
isophorone	ND	(1.7)	ND	(0.18)	ND	(0.17)
n-nitroso-di-n-propylamine	ND	(9.1)	ND	(0.96)	ND	(0.94)
n-nitrosodimethylamine	ND	(7.6)	ND	(0.80)	ND	(0.79)
n-nitrosodiphenylamine	ND	(1.4)	ND	(0.15)	ND	(0.15)
naphthalene	4.7	(1.2)	0.95	(0.13)	0.94	(0.13)
nitrobenzene	ND	(1.4)	ND	(0.15)	ND	(0.15)
pentachlorophenol	ND	(2.7)	ND	(0.29)	ND	(0.28)
phenanthrene	ND	(4.1)	ND	(0.43)	ND	(0.42)
phenol	ND	(1.1)	ND	(0.12)	ND	(0.12)
pyrene	ND	(1.4)	ND	(0.15)	ND	(0.15)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed
 BJ: Analyte detected in blank. Estimated value below detection limit.
 J: Estimated value (GC test codes)
 ^: Indicates duplicate analysis is not within control limits.
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well	
	Sample ID	Date Sampled
Petroleum Hydrocarbons MG/KG	12I	12J
Petroleum Hydrocarbons	12I-5	12J-2
	24-Feb-88	24-Feb-88
	19 - 24	4 - 9
	1250.0	ND (5.0)
Volatile Organic Compounds MG/KG		
1,1,1-trichloroethane	ND (0.0039)	ND (0.0045)
1,1,2,2-tetrachloroethane	ND (0.0070)	ND (0.0081)
1,1,2-trichloroethane	ND (0.0051)	ND (0.0059)
1,2-dichloroethane	ND (0.0029)	ND (0.0033)
1,2-dichloropropane	ND (0.0061)	ND (0.0071)
2-butanone	ND (0.026)	ND (0.030)
2-chloroethylvinyl ether	ND (0.0051)	ND (0.0059)
2-hexanone	ND (0.017)	ND (0.042)
4-methyl-2-pentanone	ND (0.047)	0.023J (0.054)
Benzene	ND (0.0045)	ND (0.0052)
Ethylbenzene	ND (0.0073)	ND (0.0085)
Toluene	0.016 (0.0061)	0.0062J (0.0071)
Trichloroethene	ND (0.0019)	ND (0.0022)
acetone	0.0578 (0.0077)	ND (0.0089)
bromodichloromethane	ND (0.0022)	ND (0.0026)
bromoform	ND (0.0048)	ND (0.0055)
bromomethane	ND (0.0051)	ND (0.0059)
carbon disulfide	ND (0.0017)	ND (0.0020)
carbon tetrachloride	ND (0.0029)	ND (0.0033)
chlorobenzene	ND (0.0061)	ND (0.0071)
chloroethane	ND (0.0051)	ND (0.0059)
chloroform	ND (0.0016)	ND (0.0019)
		ND (5.0)
		ND (5.0)
		ND (0.0044)
		ND (0.0080)
		ND (0.0058)
		ND (0.0032)
		ND (0.0070)
		ND (0.029)
		ND (0.0058)
		ND (0.042)
		ND (0.053)
		ND (0.0051)
		ND (0.0084)
		0.013 (0.0070)
		ND (0.0022)
		0.0358 (0.0087)
		ND (0.0026)
		ND (0.0055)
		ND (0.0058)
		ND (0.0020)
		NI (0.0032)
		ND (0.0070)
		ND (0.0058)
		ND (0.0019)

SOURCES: Radim, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

() : Detection Limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well		
	Sample ID	Date Sampled	
	Beg. Depth - End Depth		
	12I	12J	
	12I-5	12J-2	
	24-Feb-88	24-Feb-88	
	19 - 24	4 - 9	
chloromethane	ND (0.0051)	ND (0.0059)	ND (0.0058)
cis-1,3-Dichloropropene	ND (0.0051)	ND (0.0059)	ND (0.0058)
dibromochloromethane	ND (0.0032)	ND (0.0037)	ND (0.0036)
methylene chloride	0.0050 (0.0029)	0.12 (0.0033)	0.018 (0.0032)
styrene	ND (0.0031)	ND (0.0035)	ND (0.0035)
tetrachloroethene	ND (0.0042)	ND (0.0048)	ND (0.0048)
total xylenes	0.0063 (0.0047)	ND (0.0054)	ND (0.0053)
trans-1,2-Dichloroethene	ND (0.0016)	ND (0.0019)	ND (0.0019)
trans-1,3-Dichloropropene	ND (0.0051)	ND (0.0059)	ND (0.0058)
trichlorofluoromethane	ND (0.0051)	ND (0.0059)	ND (0.0058)
vinyl acetate	ND (0.0070)	ND (0.0081)	ND (0.0080)
vinyl chloride	ND (0.0051)	ND (0.0059)	ND (0.0058)
Semi-volatile Organic Compounds MG/KG			
1,2,4-trichlorobenzene	ND (0.13)	ND (0.15)	ND (0.15)
1,2-dichlorobenzene	ND (0.13)	ND (0.15)	ND (0.15)
1,3-dichlorobenzene	ND (0.13)	ND (0.15)	ND (0.15)
1,4-dichlorobenzene	ND (0.30)	ND (0.35)	ND (0.34)
2,4,5-trichlorophenol	ND (0.69)	ND (0.79)	ND (0.77)
2,4,6-trichlorophenol	ND (0.19)	ND (0.21)	ND (0.21)
2,4-dichlorophenol	ND (0.19)	ND (0.21)	ND (0.21)
2,4-dimethylphenol	ND (0.19)	ND (0.21)	ND (0.21)
2,4-dinitrophenol	ND (2.9)	ND (3.3)	ND (3.2)
2,4-dinitrotoluene	ND (0.39)	ND (0.45)	ND (0.44)
2,6-dinitrotoluene	ND (0.13)	ND (0.15)	ND (0.15)
2-chloronaphthalene	ND (0.13)	ND (0.15)	ND (0.15)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

() : Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDIA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well	
	Sample ID	Date Sampled
	Beg. Depth - End Depth	
	12I	12J
	12I-5	12J-2
	24-Feb-88	24-Feb-88
	19 - 24	4 - 9
2-chlorophenol	ND (0.23)	ND (0.26)
2-methylnaphthalene	0.84 (0.69)	ND (0.79)
2-methylphenol	ND (0.69)	ND (0.79)
2-nitroaniline	ND (3.4)	ND (3.9)
2-nitrophenol	ND (0.25)	ND (0.28)
3,3'-dichlorobenzidine	ND (1.1)	ND (1.3)
3-nitroaniline	ND (3.4)	ND (3.9)
4,6-dinitro-2-methylphenol	ND (1.6)	ND (1.9)
4-bromophenyl-phenylether	ND (0.13)	ND (0.15)
4-chloro-3-methylphenol	ND (0.21)	ND (0.24)
4-chloroaniline	ND (0.69)	ND (0.79)
4-chlorophenyl-phenylether	ND (0.29)	ND (0.33)
4-methylphenol	ND (0.69)	ND (0.79)
4-nitroaniline	ND (3.4)	ND (3.9)
4-nitrophenol	ND (0.16)	ND (0.19)
acenaphthene	ND (0.13)	ND (0.15)
acenaphthylene	ND (0.24)	ND (0.27)
aniline	ND (0.69)	ND (0.79)
anthracene	ND (0.13)	ND (0.15)
benzidine	ND (3.0)	ND (3.5)
benzo(a)anthracene	ND (0.54)	ND (0.61)
benzo(a)pyrene	ND (0.17)	ND (0.20)
benzo(b)fluoranthene	ND (0.33)	ND (0.38)
benzo(k)fluoranthene	ND (0.17)	ND (0.20)
benzoic acid	ND (3.4)	ND (3.9)
benzyl alcohol	ND (3.4)	ND (3.9)

SOURCES: Radium, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	12I		12J	
	12I-5		12J-2	
	24-Feb-88	19 - 24	24-Feb-88	4 - 9
bis(2-chloroethoxy)methane	ND	(0.36)	ND	(0.42)
bis(2-chloroethyl) ether	ND	(0.39)	ND	(0.45)
bis(2-chloroisopropyl)ether	ND	(0.39)	ND	(0.45)
bis(2-ethylhexyl)phthalate	0.86B	(0.17)	ND	(0.20)
butylbenzylphthalate	ND	(0.17)	ND	(0.20)
chrysene	ND	(0.17)	ND	(0.20)
di-n-butylphthalate	ND	(0.17)	ND	(0.20)
di-n-octyl phthalate	0.095J	(0.17)	ND	(0.20)
dibenzo(a,h)anthracene	ND	(0.17)	ND	(0.20)
dibenzofuran	ND	(0.69)	ND	(0.79)
diethylphthalate	ND	(0.13)	ND	(0.15)
dimethyl phthalate	ND	(0.11)	ND	(0.13)
fluoranthene	ND	(0.15)	ND	(0.17)
fluorene	ND	(0.13)	ND	(0.15)
hexachlorobenzene	ND	(0.13)	ND	(0.15)
hexachlorobutadiene	ND	(0.062)	ND	(0.071)
hexachlorocyclopentadiene	ND	(0.41)	ND	(0.47)
hexachloroethane	ND	(0.11)	ND	(0.13)
indeno(1,2,3-cd)pyrene	ND	(0.25)	ND	(0.29)
isophorone	ND	(0.15)	ND	(0.17)
n-nitroso-di-n-propylamine	ND	(0.82)	ND	(0.94)
n-nitrosodimethylamine	ND	(0.69)	ND	(0.79)
n-nitrosodiphenylamine	ND	(0.13)	ND	(0.15)
naphthalene	0.28	(0.11)	ND	(0.11)
nitrobenzene	ND	(0.13)	ND	(0.15)
pentachlorophenol	ND	(0.25)	ND	(0.28)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

(): Detection limit

SOURCES: Radion, 1990; ESE.

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

Primary Results

PARAMETER	Monitor Well	
	Sample ID	Date Sampled
	Beg. Depth	End Depth
phenanthrene	12I	12J
	12I-5	12J-2
	24-Feb-88	24-Feb-88
phenol	19 - 24	4 - 9
	ND (0.37)	ND (0.42)
	ND (0.10)	ND (0.12)
pyrene	ND (0.13)	ND (0.15)
	ND (0.42)	ND (0.12)
	ND (0.12)	ND (0.15)

B: Detected in Reagent Blank; background subtraction not performed
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection Limit

SOURCES: Radim, 1990; ESE

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDIA 2), CARSWELL AFB, TEXAS (Cont.)

Primary Results		Monitor Well	
		Sample ID	
		Date Sampled	
		Reg. Depth - End Depth	
	12J	12J	12K
	12J-3	12J-5	12K-5
	24-Feb-88	24-Feb-88	20-Feb-88
	9 - 14	19 - 23	20 - 25
PARAMETER			
Petroleum Hydrocarbons MG/KG	ND (6.0)	17.0	14.0
Petroleum Hydrocarbons			
Volatile Organic Compounds MG/KG			
1,1,1-trichloroethane	ND (0.0045)	ND (0.0039)	ND (0.0040)
1,1,2,2-tetrachloroethane	ND (0.0081)	ND (0.0070)	ND (0.0072)
1,1,2-trichloroethane	ND (0.0059)	ND (0.0051)	ND (0.0053)
1,2-dichloroethane	ND (0.0033)	ND (0.0029)	ND (0.0029)
1,2-dichloropropane	ND (0.0071)	ND (0.0061)	ND (0.0063)
2-butanone	ND (0.030)	ND (0.026)	0.034 (0.026)
2-chloroethylvinyl ether	ND (0.0059)	ND (0.0051)	ND (0.0053)
2-hexanone	ND (0.042)	ND (0.037)	ND (0.038)
4-methyl-2-pentanone	ND (0.054)	ND (0.047)	ND (0.048)
Benzene	ND (0.0052)	ND (0.0045)	ND (0.0046)
Ethylbenzene	ND (0.0085)	ND (0.0073)	ND (0.0076)
Toluene	ND (0.0071)	0.0064 (0.0061)	0.0011J (0.0063)
Trichloroethene	ND (0.0022)	ND (0.0019)	ND (0.0020)
acetone	0.0168 (0.0089)	0.0148 (0.0077)	0.0138 (0.0079)
bromodichloromethane	ND (0.0026)	ND (0.0022)	ND (0.0023)
bromoform	ND (0.0055)	ND (0.0048)	ND (0.0049)
bromomethane	ND (0.0059)	ND (0.0051)	ND (0.0053)
carbon disulfide	ND (0.0020)	ND (0.0017)	ND (0.0018)
carbon tetrachloride	ND (0.0033)	ND (0.0029)	ND (0.0029)
chlorobenzene	ND (0.0071)	ND (0.0061)	ND (0.0063)
chloroethane	ND (0.0059)	ND (0.0051)	ND (0.0053)
chloroform	ND (0.0019)	ND (0.0016)	ND (0.0017)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (CC test codes)

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	12J		12K	
	12J-3		12K-5	
	24-Feb-88	19 - 23	20-Feb-88	20 - 25
chloromethane	ND (0.0059)	ND (0.0051)	ND (0.0053)	ND (0.0053)
cis-1,3-Dichloropropene	ND (0.0059)	ND (0.0051)	ND (0.0053)	ND (0.0053)
dibromochloromethane	ND (0.0037)	ND (0.0032)	ND (0.0033)	ND (0.0033)
methylene chloride	0.0039 (0.0033)	0.0062 (0.0029)	ND (0.0029)	ND (0.0029)
styrene	ND (0.0035)	ND (0.0031)	ND (0.0032)	ND (0.0032)
tetrachloroethene	ND (0.0048)	ND (0.0042)	ND (0.0043)	ND (0.0043)
total xylenes	ND (0.0054)	ND (0.0047)	ND (0.0048)	ND (0.0048)
trans-1,2-Dichloroethene	ND (0.0019)	ND (0.0016)	ND (0.0017)	ND (0.0017)
trans-1,3-Dichloropropene	ND (0.0059)	ND (0.0051)	ND (0.0053)	ND (0.0053)
trichlorofluoromethane	ND (0.0059)	ND (0.0051)	ND (0.0053)	ND (0.0053)
vinyl acetate	ND (0.0081)	ND (0.0070)	ND (0.0072)	ND (0.0072)
vinyl chloride	ND (0.0059)	ND (0.0051)	ND (0.0053)	ND (0.0053)
Semi-volatile Organic Compounds $\mu\text{g}/\text{kg}$				
1,2,4-trichlorobenzene	ND (0.15)	ND (0.13)	ND (0.15)	ND (0.15)
1,2-dichlorobenzene	ND (0.15)	ND (0.13)	ND (0.15)	ND (0.15)
1,3-dichlorobenzene	ND (0.15)	ND (0.13)	ND (0.15)	ND (0.15)
1,4-dichlorobenzene	ND (0.35)	ND (0.30)	ND (0.35)	ND (0.35)
2,4,5-trichlorophenol	ND (0.80)	ND (0.69)	ND (0.79)	ND (0.79)
2,4,6-trichlorophenol	ND (0.22)	ND (0.19)	ND (0.21)	ND (0.21)
2,4-dichlorophenol	ND (0.22)	ND (0.19)	ND (0.21)	ND (0.21)
2,4-dimethylphenol	ND (0.22)	ND (0.19)	ND (0.21)	ND (0.21)
2,4-dinitrophenol	ND (3.4)	ND (2.9)	ND (3.3)	ND (3.3)
2,4-dinitrotoluene	ND (0.46)	ND (0.39)	ND (0.45)	ND (0.45)
2,6-dinitrotoluene	ND (0.15)	ND (0.13)	ND (0.15)	ND (0.15)
2-chloronaphthalene	ND (0.15)	ND (0.13)	ND (0.15)	ND (0.15)

SOURCES: Radian, 1990; ESE

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	12J		12K	
	12J-3		12K-5	
	24-Feb-88	19 - 23	20-Feb-88	20 - 25
2-chlorophenol	ND (0.26)	ND (0.23)	ND (0.26)	ND (0.26)
2-methylnaphthalene	ND (0.80)	ND (0.69)	ND (0.79)	ND (0.79)
2-methylphenol	ND (0.80)	ND (0.69)	ND (0.79)	ND (0.79)
2-nitroaniline	ND (4.0)	ND (3.5)	ND (3.9)	ND (3.9)
2-nitrophenol	ND (0.29)	ND (0.25)	ND (0.28)	ND (0.28)
3,3'-dichlorobenzidine	ND (1.3)	ND (1.1)	ND (1.3)	ND (1.3)
3-nitroaniline	ND (4.0)	ND (3.5)	ND (3.9)	ND (3.9)
4,6-dinitro-2-methylphenol	ND (1.9)	ND (1.7)	ND (1.9)	ND (1.9)
4-bromophenyl-phenylether	ND (0.15)	ND (0.13)	ND (0.15)	ND (0.15)
4-chloro-3-methylphenol	ND (0.24)	ND (0.21)	ND (0.24)	ND (0.24)
4-chloroaniline	ND (0.80)	ND (0.69)	ND (0.79)	ND (0.79)
4-chlorophenyl-phenylether	ND (0.34)	ND (0.29)	ND (0.33)	ND (0.33)
4-methylphenol	ND (0.80)	ND (0.69)	ND (0.79)	ND (0.79)
4-nitroaniline	ND (4.0)	ND (3.5)	ND (3.9)	ND (3.9)
4-nitrophenol	ND (0.19)	ND (0.17)	ND (0.19)	ND (0.19)
acenaphthene	ND (0.15)	ND (0.13)	ND (0.15)	ND (0.15)
acenaphthylene	ND (0.28)	ND (0.24)	ND (0.28)	ND (0.28)
aniline	ND (0.80)	ND (0.69)	ND (0.79)	ND (0.79)
anthracene	ND (0.15)	ND (0.13)	ND (0.15)	ND (0.15)
benzidine	ND (3.5)	ND (3.0)	ND (3.5)	ND (3.5)
benzo(a)anthracene	ND (0.62)	ND (0.54)	ND (0.61)	ND (0.61)
benzo(a)pyrene	ND (0.20)	ND (0.17)	ND (0.20)	ND (0.20)
benzo(b)fluoranthene	ND (0.38)	ND (0.33)	ND (0.38)	ND (0.38)
benzo(k)fluoranthene	ND (0.20)	ND (0.17)	ND (0.20)	ND (0.20)
benzoic acid	ND (4.0)	ND (3.5)	ND (3.9)	ND (3.9)
benzyl alcohol	ND (4.0)	ND (3.5)	ND (3.9)	ND (3.9)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

(): Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well		Beg. Depth - End Depth	Date Sampled	Sample ID
	12J	12K			
bis(2-chloroethoxy)methane	ND (0.42)	ND (0.37)	12J-3	12J-5	12K-5
bis(2-chloroethyl) ether	ND (0.46)	ND (0.39)	24-Feb-88	19 - 23	20 - 25
bis(2-chloroisopropyl)ether	ND (0.46)	ND (0.39)			
bis(2-ethylhexyl)phthalate	ND (0.20)	0.12J (0.17)			
butylbenzylphthalate	ND (0.20)	ND (0.17)			
chrysene	ND (0.20)	ND (0.17)			
di-n-butylphthalate	ND (0.20)	ND (0.17)			
di-n-octyl phthalate	ND (0.20)	ND (0.17)			
dibenzo(a,h)anthracene	ND (0.20)	ND (0.17)			
dibenzofuran	ND (0.80)	ND (0.69)			
diethylphthalate	ND (0.15)	ND (0.13)			
dimethyl phthalate	ND (0.13)	ND (0.11)			
fluoranthene	ND (0.18)	ND (0.15)			
fluorene	ND (0.15)	ND (0.13)			
hexachlorobenzene	ND (0.15)	ND (0.13)			
hexachlorobutadiene	ND (0.072)	ND (0.062)			
hexachlorocyclopentadiene	ND (0.48)	ND (0.41)			
hexachloroethane	ND (0.13)	ND (0.11)			
Indeno(1,2,3-cd)pyrene	ND (0.30)	ND (0.26)			
Isophorone	ND (0.18)	ND (0.15)			
n-nitroso-dl-n-propylamine	ND (0.96)	ND (0.83)			
n-nitrosodimethylamine	ND (0.80)	ND (0.69)			
n-nitrosodiphenylamine	ND (0.15)	ND (0.13)			
naphthalene	ND (0.13)	ND (0.11)			
nitrobenzene	ND (0.15)	ND (0.13)			
pentachlorophenol	ND (0.29)	ND (0.25)			

SOURCES: Radam, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

() : Detection limit

Table B.1-2. RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well	
	Sample ID	Date Sampled
	Req. Depth - End Depth	Req. Depth - End Depth
phenanthrene	12J	12J
	12J-3	12J-5
	24-Feb-88	24-Feb-88
phenol	9 - 14	19 - 23
	ND (0.43)	ND (0.37)
	ND (0.12)	ND (0.10)
pyrene	ND (0.15)	ND (0.13)
	ND	ND
	ND	ND

B: Detected in Reagent Blank; background subtraction not performed
 J: Estimated value (GC test codes)
 ND: Not detected at specified detection limit
 (): Detection limit

SOURCES: Radian, 1990; ESE.

207191

Table B.1-3 shows the cost and feasibility of each alternative.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

A remedial alternative was selected for Site 2 (the details of the alternative is presented in Section 2).

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

Recommendations were made for continuing studies of groundwater at Site 12.

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

6.0 STATUS OF THE PROJECT

No information regarding project status was available in the file material.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No data from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

Table B.1-3 NARRATIVE MATRIX
TECHNICAL EVALUATION OF ALTERNATIVES

Alternative	Cost ¹ (\$)	Engineering Feasibility	Regulatory Compliance
1. No action	0	-----	-----
2. Excavate top 2 ft/ aerate	27,000 ²	Proven technology	TWC approval necessary
3. Excavate top 2 ft/ landfill	93,000 ²	Proven technology	TWC approval necessary
4. Excavate top 2 ft/ incinerate	4,490,000 ²	Proven technology	TWC approval necessary
5. Excavate to bed-rock/ landfill	1,541,000 ³	Proven technology	TWC approval necessary
6. Excavate top 2 ft/ aerate/vacuum extraction	74,000	Proven technology	TWC approval necessary
7. Excavate top 2 ft/ landfill/vacuum extraction	140,000	Proven technology	TWC approval necessary

¹ Costs are based on a conceptual application of remedial technologies, and therefore should not be used for detailed budget planning purposes.

² Costs based on excavation and hauling of 2,328 yd³ of contaminated soil.

³ Cost based on excavation, hauling, and fill of 29,128 yd³ of soil.

TITLE: Decision Paper - Weapons Storage Area
AUTHOR: Radian Corporation
DOCUMENT NUMBER: 96
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1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this report was to present the results of an evaluation of remedial alternatives for the Weapons Storage Area (WSA) (SWMU 65) located at Carswell Air Force Base (CAFB).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

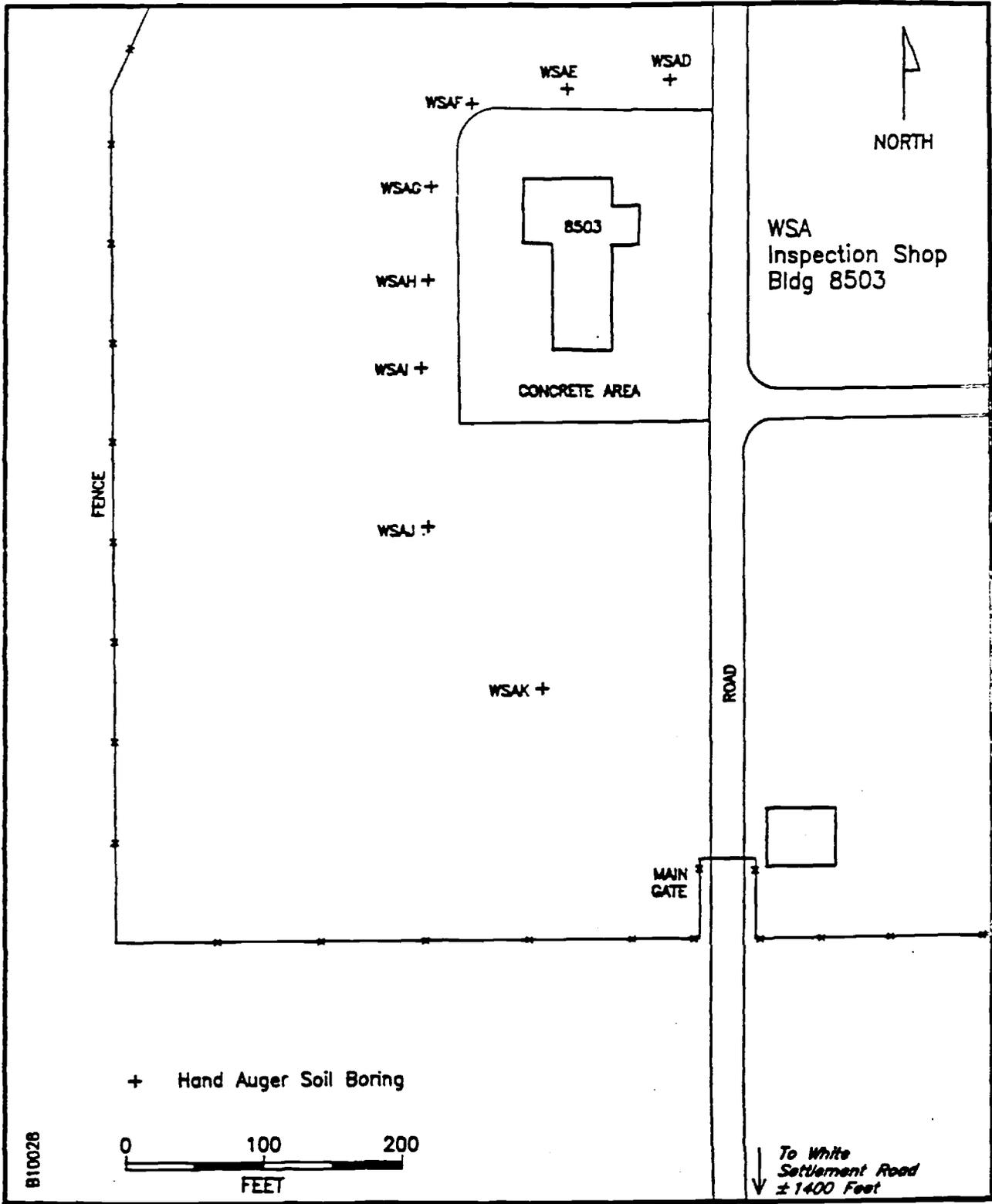
2.1 SITE HISTORY

The WSA is located approximately five miles to the west of CAFB, and north of White Settlement Road. The facility is on approximately 247 acres of land, and is surrounded by approximately 264 acres of easement. This land is located between two forks of Live Oak Creek. The WSA is the only off-base facility that was included in the Phase II study. The facility was constructed in 1956 and includes two munitions inspection shops, 16 storage buildings, a radioactive waste disposal facility, and an Explosive Ordnance Disposal range.

Waste cleaners and solvents (suspected paint thinners and trichloroethylene (TCE)) were reportedly disposed of (5-10 gallons per year) on the ground behind the inspection shop.

2.2 PROJECT ACCOMPLISHMENTS

The alternatives evaluation was conducted as part of the IRP RI/FS Stage 2 investigation at CAFB. Soil samples were collected from the ditch at the locations shown on Figure B.2-1 and were analyzed as part of the IRP RI/FS Stage 2 investigation. Tables B.2-1 and B.2-2 present the results of the soil



SOURCES: Radian, 1990; ESE.

Figure B.2-1 Location of Sampling Points, Weapons Storage Area, Carswell AFB, Texas

Table B.2-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS

Primary Results

PARAMETER	Monitor Well			
	WSAD		WSAF	
	Sample ID	Date Sampled	Sample ID	Date Sampled
Soil Moisture & MOISTURE				
Dry Weight Determination	13.0	16.0	16.0	18.0
	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)
	CAR8-03-059	WSAE-1	WSAE-2	WSAF
	30-Mar-88	30-Mar-88	30-Mar-88	CAR8-03-056
	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)	30-Mar-88
	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)
Metal Screen (ICP) MC/KG				
Ag Silver	1.5 (0.88)	1.9 (0.88)	1.5 (0.88)	1.1 (0.89)
Al Aluminum	6300.0 (20.0)	4900.0 (20.0)	6500.0 (20.0)	17000.0 (20.0)
As Arsenic	ND (29.0)	ND (29.0)	ND (29.0)	ND (30.0)
B Boron	ND (59.0)	ND (59.0)	ND (59.0)	ND (59.0)
Ba Barium	28.0 (0.88)	22.0 (0.88)	12.0 (0.88)	60.0 (0.89)
Be Beryllium	0.1 (0.098)	0.3 (0.098)	0.1 (0.098)	0.5 (0.099)
Ca Calcium	180000.0 (24.0)	210000.0 (24.0)	180000.0 (24.0)	110000.0 (12.0)
Cd Cadmium	ND (0.29)	0.8 (0.29)	ND (0.29)	1.3 (0.30)
Co Cobalt	4.0 (0.98)	2.8 (0.98)	3.2 (0.98)	4.9 (0.99)
Cr Chromium	14.0 (0.88)	17.0 (0.88)	13.0 (0.88)	25.0 (0.89)
Cu Copper	4.4 (0.98)	9.0 (0.98)	ND (0.98)	10.0 (0.99)
Fe Iron	8100.0 (2.9)	7000.0 (2.9)	10000.0 (2.9)	13000.0 (3.0)
K Potassium	970.0 (29.0)	800.0 (29.0)	1200.0 (29.0)	1900.0 (30.0)
Mg Magnesium	2600.0 (9.8)	2700.0 (9.8)	2700.0 (9.8)	3700.0 (9.9)
Mn Manganese	170.0 (0.29)	160.0 (0.29)	120.0 (0.29)	140.0 (0.30)
Mo Molybdenum	ND (4.9)	ND (4.9)	ND (4.9)	ND (5.0)
Na Sodium	40.0 (7.8)	37.0 (7.8)	ND (7.8)	57.0 (7.9)
Ni Nickel	4.0 (2.0)	7.0 (2.0)	5.0 (2.0)	12.0 (2.0)
Pb Lead	16.0 (4.9)	18.0 (4.9)	14.0 (4.9)	17.0 (5.0)
Sb Antimony	48.0 (5.9)	46.0 (5.9)	35.0 (5.9)	17.0 (5.9)
Se Selenium	ND (29.0)	ND (29.0)	ND (29.0)	79.0 (30.0)
Si Silicon	280.0 (29.0)	220.0 (29.0)	260.0 (29.0)	280.0 (30.0)
Tl Thallium	ND (8.8)	10.0 (8.8)	ND (8.8)	ND (8.9)
V Vanadium	20.0 (2.0)	18.0 (2.0)	18.0 (2.0)	32.0 (2.0)

23510

ND: Not detected at specified detection limit
(): Detection limit

SOURCES: Radim, 1990; ESE

Table B.2-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA),
 CARSWELL AFB, TEXAS (Cont.)

Primary Results

PARAMETER	WSAD		WSAE		WSAF	
	CAR8-03-059	WSAE-1	WSAE-2	WSAF	CAR8-03-056	WSAF
Zn	30-Mar-88	30-Mar-88	30-Mar-88	30-Mar-88	30-Mar-88	30-Mar-88
	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)
	19.0	17.0	9.0	27.0	27.0	(0.59)
	(0.59)	(0.59)	(0.59)	(0.59)	(0.59)	(0.59)

ND: Not detected at specified detection limit
 (): Detection limit

SOURCES: Radman, 1990; ESE

Table B.2-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

Primary Results		Monitor Well	
		Sample ID	
		Date Sampled	
		WSAR	WSAR
		CAR8-03-053	CAR8-03-054
		30-Mar-88	30-Mar-88
		(0.01 - 1)	(0.01 - 1)
PARAMETER		WSAG	
		CAR8-03-055	
		30-Mar-88	
		(0.01 - 1)	
Soil Moisture	18.0	11.0	10.0
Dry Weight Determination			
Metal Screen (ICP) MC/MG			
Ag Silver	2.6 (0.88)	4.9 (0.87)	4.0 (0.88)
Al Aluminum	12000.0 (20.0)	3300.0 (19.0)	3300.0 (20.0)
As Arsenic	ND (29.0)	70.0 (29.0)	50.0 (29.0)
B Boron	ND (59.0)	ND (58.0)	ND (59.0)
Ba Barium	40.0 (0.88)	8.6 (0.87)	9.9 (0.88)
Be Beryllium	0.3 (0.098)	0.2 (0.097)	0.2 (0.098)
Ca Calcium	170000.0 (24.0)	280000.0 (58.0)	270000.0 (59.0)
Cd Cadmium	1.9 (0.29)	0.5 (0.29)	0.8 (0.29)
Co Cobalt	2.8 (0.98)	2.3 (0.97)	3.5 (0.98)
Cr Chromium	24.0 (0.88)	20.0 (0.87)	21.0 (0.88)
Cu Copper	9.8 (0.98)	3.8 (0.97)	3.8 (0.98)
Fe Iron	11000.0 (2.9)	3800.0 (2.9)	4500.0 (2.9)
K Potassium	1600.0 (29.0)	430.0 (29.0)	450.0 (29.0)
Mg Magnesium	3000.0 (9.8)	2500.0 (9.7)	2500.0 (9.8)
Mn Manganese	130.0 (0.29)	160.0 (0.29)	170.0 (0.29)
Mo Molybdenum	ND (4.9)	ND (4.9)	ND (4.9)
Na Sodium	ND (7.8)	130.0 (7.8)	160.0 (7.8)
Ni Nickel	9.0 (2.0)	4.0 (1.9)	6.0 (2.0)
Pb Lead	18.0 (4.9)	11.0 (4.9)	15.0 (4.9)
Sb Antimony	32.0 (5.9)	62.0 (5.8)	46.0 (5.9)
Se Selenium	72.0 (29.0)	ND (29.0)	ND (29.0)
Si Silicon	370.0 (29.0)	140.0 (29.0)	140.0 (29.0)
Tl Thallium	11.0 (8.8)	ND (8.7)	ND (8.8)
V Vanadium	28.0 (2.0)	25.0 (1.9)	23.0 (2.0)

ND: Not detected at specified detection limit
 (): Detection limit
 SOURCES: Radian, 1990; ESE

Table B.2-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

Primary Results		Monitor Well	
PARAMETER	WSAC	WSAH	WSAR
Zn	CARB-03-055 30-Mar-88 (0.01 - 1)	CARB-03-053 30-Mar-88 (0.01 - 1)	CARB-03-054 30-Mar-88 (0.01 - 1)
	62.0 (0.59)	8.8 (0.58)	11.0 (0.59)

ND: Not detected at specified detection limit
 (): Detection limit
 SOURCES: Radian, 1990; ESE.

Table B.2-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Primary Results			
	WSAI		WSAJ	
	Sample ID	Date Sampled	Sample ID	Date Sampled
Soil Moisture & MOISTURE	CAR8-03-051	CAR8-03-052	CAR8-03-049	
Dry Weight Determination	30-Mar-88	30-Mar-88	29-Mar-88	
	(0.01 - 2)	(2 - 2.75)	(0.01 - 1)	
	12.0	14.0	21.0	
Metal Screen (ICP) MG/KG				
Ag Silver	4.0 (0.88)	4.0 (0.88)	4.0 (0.89)	
Al Aluminum	4000.0 (20.0)	4700.0 (20.0)	26000.0 (20.0)	
As Arsenic	50.0 (29.0)	50.0 (29.0)	ND (30.0)	
B Boron	ND (59.0)	ND (59.0)	ND (59.0)	
Ba Barium	11.0 (0.88)	22.0 (0.88)	110.0 (0.89)	
Be Beryllium	0.2 (0.098)	0.2 (0.098)	0.6 (0.099)	
Ca Calcium	270000.0 (59.0)	270000.0 (59.0)	86000.0 (12.0)	
Cd Cadmium	1.2 (0.29)	0.7 (0.29)	1.8 (0.30)	
Co Cobalt	1.8 (0.98)	2.1 (0.98)	5.6 (0.99)	
Cr Chromium	18.0 (0.88)	17.0 (0.88)	31.0 (0.89)	
Cu Copper	3.5 (0.98)	2.5 (0.98)	7.0 (0.99)	
Fe Iron	4600.0 (2.9)	4400.0 (2.9)	14000.0 (3.0)	
K Potassium	460.0 (29.0)	660.0 (29.0)	1900.0 (30.0)	
Mg Magnesium	2400.0 (9.8)	2300.0 (9.8)	3600.0 (9.9)	
Mn Manganese	110.0 (0.29)	140.0 (0.29)	240.0 (0.30)	
Mo Molybdenum	ND (4.9)	ND (4.9)	ND (5.0)	
Na Sodium	120.0 (7.8)	63.0 (7.8)	ND (7.9)	
Ni Nickel	7.0 (2.0)	5.0 (2.0)	14.0 (2.0)	
Pb Lead	11.0 (4.9)	7.0 (4.9)	16.0 (5.0)	
Sb Antimony	50.0 (5.9)	50.0 (5.9)	ND (5.9)	
Se Selenium	ND (29.0)	30.0 (29.0)	97.0 (30.0)	
Si Silicon	160.0 (29.0)	240.0 (29.0)	250.0 (30.0)	
Tl Thallium	18.0 (8.8)	ND (8.8)	13.0 (8.9)	
V Vanadium	25.0 (2.0)	23.0 (2.0)	51.0 (2.0)	

SOURCES: Radion, 1990; ESE.

ND: Not detected at specified detection limit

() : Detection limit

Table B.2-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

Primary Results		Monitor Well	
PARAMETER	WSAI	SAMPLE ID	WSAJ
Zn	12.0 (0.59)	CAR8-03-051 30-Mar-88 (0.01 - 2)	CAR8-03-049 29-Mar-88 (0.01 - 1)
Zinc	9.3 (0.59)	CAR8-03-052 30-Mar-88 (2 - 2.75)	27.0 (0.59)

ND: Not detected at specified detection limit
 (): Detection limit
 SOURCES: Radiam, 1990; ESE

Table B.2-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER		WSAJ		MSAJ		Monitor Well	
		CAR8-03-050		CAR8-03-047		MSAJ	
		29-Mar-88		29-Mar-88		CAR8-03-048	
		(3 - 4.25)		(0.01 - 1)		(2 - 3)	
		12.0		11.0		15.0	
Soil Moisture & MOISTURE							
Dry Weight Determination							
Metal Screen (ICP) MC/KG							
Ag	Silver	3.8	(0.88)	3.9	(0.89)	5.7	(0.88)
Al	Aluminum	8300.0	(20.0)	7400.0	(20.0)	5600.08	(20.0)
As	Arsenic	70.0	(29.0)	60.0	(30.0)	50.0	(29.0)
B	Boron	ND	(59.0)	ND	(59.0)	MDR	(59.0)
Ba	Barium	32.0	(0.88)	33.0	(0.89)	19.0	(0.88)
Be	Beryllium	0.3	(0.098)	0.2	(0.099)	0.2	(0.098)
Ca	Calcium	240000.0	(24.0)	260000.0	(59.0)	270000.08	(59.0)
Cd	Cadmium	0.5	(0.29)	0.8	(0.30)	0.6	(0.29)
Co	Cobalt	3.7	(0.98)	2.3	(0.99)	2.8	(0.98)
Cr	Chromium	19.0	(0.88)	18.0	(0.89)	17.0	(0.88)
Cu	Copper	3.9	(0.98)	3.7	(0.99)	3.3	(0.98)
Fe	Iron	6800.0	(2.9)	5800.0	(3.0)	4700.08	(2.9)
K	Potassium	890.0	(29.0)	600.0	(30.0)	550.0	(29.0)
Mg	Magnesium	2700.0	(9.8)	2500.0	(9.9)	2100.0	(9.8)
Mn	Manganese	180.0	(0.29)	150.0	(0.30)	130.0	(0.29)
Mo	Molybdenum	ND	(4.9)	ND	(5.0)	ND	(4.9)
Na	Sodium	96.0	(7.8)	80.0 ^A	(7.9)	95.0	(7.8)
Ni	Nickel	9.0	(2.0)	7.0	(2.0)	7.0	(2.0)
Pb	Lead	12.0	(4.9)	11.0	(5.0)	13.0	(4.9)
Sb	Antimony	40.0	(5.9)	45.0	(5.9)	56.0R	(5.9)
Se	Selenium	50.0	(29.0)	40.0	(30.0)	40.0	(29.0)

SOURCES: Radian, 1990, ESE.

B: Detected in Reagent Blank; background subtraction not performed

R: Indicates that the matrix spike recovery for this analysis was not within acceptance limits indicating an interferent present.

^A: Indicates duplicate analysis is not within control limits.

ND: Not detected at specified detection limit

(): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS

PARAMETER	Primary Results				Monitor Well Sample ID	Date Sampled	Beg. Depth - End Depth	WSAF
	WSAD	WSAE-1	WSAE-2	WSAF				
	CAR8-03-059 30-Mar-88 (0.01 - 1)	WSAE-1 30-Mar-88 (0.01 - 1)	WSAE-2 30-Mar-88 (0.01 - 1)	WSAF CAR8-03-056 30-Mar-88 (0.01 - 1)				
Volatile Organic Compounds MG/KG								
1,1,1-trichloroethane	ND (0.0043)	ND (0.0045)	ND (0.0045)	ND (0.0046)				ND (0.0046)
1,1,2,2-tetrachloroethane	ND (0.0079)	ND (0.0082)	ND (0.0082)	ND (0.0083)				ND (0.0083)
1,1,2-trichloroethane	ND (0.0057)	ND (0.0060)	ND (0.0060)	ND (0.0060)				ND (0.0060)
1,2-dichloroethane	ND (0.0032)	ND (0.0033)	ND (0.0033)	ND (0.0034)				ND (0.0034)
1,2-dichloropropane	ND (0.0068)	ND (0.0071)	ND (0.0071)	ND (0.0072)				ND (0.0072)
2-butanone	ND (0.029)	ND (0.030)	ND (0.030)	ND (0.030)				ND (0.030)
2-hexanone	ND (0.041)	ND (0.043)	ND (0.043)	ND (0.043)				ND (0.043)
4-methyl-2-pentanone	ND (0.032)	ND (0.035)	ND (0.035)	ND (0.035)				ND (0.035)
Benzene	ND (0.0050)	0.0012J	ND (0.0052)	ND (0.0053)				ND (0.0053)
Ethylbenzene	ND (0.0082)	ND (0.0086)	ND (0.0086)	ND (0.0086)				ND (0.0086)
Toluene	ND (0.0068)	ND (0.0071)	ND (0.0071)	ND (0.0072)				ND (0.0072)
Trichloroethene	ND (0.0022)	ND (0.0023)	ND (0.0023)	ND (0.0023)				ND (0.0023)
acetone	0.0096	0.013	0.0089	0.015				0.015
bromodichloromethane	ND (0.0025)	ND (0.0026)	ND (0.0026)	ND (0.0026)				ND (0.0026)
bromoform	ND (0.0054)	ND (0.0056)	ND (0.0056)	ND (0.0056)				ND (0.0056)
bromomethane	ND (0.0057)	ND (0.0060)	ND (0.0060)	ND (0.0060)				ND (0.0060)
carbon disulfide	ND (0.0019)	ND (0.0020)	ND (0.0020)	ND (0.0020)				ND (0.0020)
carbon tetrachloride	ND (0.0032)	ND (0.0033)	ND (0.0033)	ND (0.0034)				ND (0.0034)
chlorobenzene	ND (0.0068)	ND (0.0071)	ND (0.0071)	ND (0.0072)				ND (0.0072)
chloroethane	ND (0.0057)	ND (0.0060)	ND (0.0060)	ND (0.0060)				ND (0.0060)
chloroform	ND (0.0018)	ND (0.0019)	ND (0.0019)	ND (0.0019)				ND (0.0019)
chloromethane	ND (0.0057)	ND (0.0060)	ND (0.0060)	ND (0.0060)				ND (0.0060)
cis-1,3-Dichloropropene	ND (0.0057)	ND (0.0060)	ND (0.0060)	ND (0.0060)				ND (0.0060)
dibromochloromethane	ND (0.0035)	ND (0.0037)	ND (0.0037)	ND (0.0037)				ND (0.0037)

SOURCES: Radian, 1990; ESE.

B: Detected in Reagent Blank; background subtraction not performed
 J: Estimated value (GC test codes)
 JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

Primary Results

PARAMETER	Monitor Well			
	Sample ID			
	WSAD	WSAE	WSAE	WSAF
	CAR8-03-059	WSAE-1	WSAE-2	CAR8-03-056
	30-Mar-88	30-Mar-88	30-Mar-88	30-Mar-88
	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)
	ND (0.0032)	ND (0.0033)	ND (0.0033)	ND (0.0034)
methylene chloride				
styrene				
tetrachloroethene				
total xylenes				
trans-1,3-Dichloropropene				
vinyl acetate				
vinyl chloride				
Semivolatile Organic Compounds MC/KG				
1,2,4-trichlorobenzene				
1,2-dichlorobenzene				
1,3-dichlorobenzene				
1,4-dichlorobenzene				
2,4,5-trichlorophenol				
2,4,6-trichlorophenol				
2,4-dichlorophenol				
2,4-dimethylphenol				
2,4-dinitrophenol				
2,6-dinitrotoluene				
2,6-dinitrotoluene				
2-chloronaphthalene				
2-chlorophenol				
2-methylnaphthalene				
2-methylphenol				
2-nitroaniline				
	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
	ND (0.33)	ND (0.35)	ND (0.35)	ND (0.36)
	ND (0.76)	ND (0.79)	ND (0.79)	ND (0.81)
	ND (0.20)	ND (0.21)	ND (0.21)	ND (0.22)
	ND (0.20)	ND (0.21)	ND (0.21)	ND (0.22)
	ND (0.20)	ND (0.21)	ND (0.21)	ND (0.22)
	ND (3.2)	ND (3.3)	ND (3.3)	ND (3.4)
	ND (0.43)	ND (0.45)	ND (0.45)	ND (0.46)
	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
	ND (0.25)	ND (0.26)	ND (0.26)	ND (0.27)
	ND (0.76)	ND (0.79)	ND (0.79)	ND (0.81)
	ND (0.76)	ND (0.79)	ND (0.79)	ND (0.81)
	ND (3.8)	ND (3.9)	ND (3.9)	ND (4.1)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.

ND: Not detected at specified detection limit

(): Detection limit

SOURCES: Radian, 1990; ESE.

Table B.2-2

RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE USA (WEAPONS STORAGE AREA),
CARSWELL AFB, TEXAS (Cont.)

Primary Results

PARAMETER	Monitor Well			
	Sample ID		Date Sampled	
	WSAD	WSAE-1	WSAE-2	WSAF
	CAR8-03-059	30-Mar-88	30-Mar-88	CAR8-03-056
	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)
2-nitrophenol	ND (0.27)	MD (0.28)	MD (0.28)	ND (0.29)
3,3'-dichlorobenzidine	ND (1.3)	ND (1.3)	ND (1.3)	ND (1.3)
3-nitroaniline	ND (3.8)	ND (3.9)	ND (3.9)	ND (4.1)
4,6-dinitro-2-methylphenol	ND (1.8)	ND (1.9)	ND (1.9)	ND (1.9)
4-bromophenyl-phenylether	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
4-chloro-3-methylphenol	ND (0.23)	ND (0.24)	ND (0.24)	ND (0.24)
4-chloroaniline	ND (0.76)	ND (0.79)	ND (0.79)	ND (0.81)
4-chlorophenyl-phenylether	ND (0.32)	ND (0.33)	ND (0.33)	ND (0.34)
4-methylphenol	ND (0.76)	ND (0.79)	ND (0.79)	ND (0.81)
4-nitroaniline	ND (3.8)	ND (3.9)	ND (3.9)	ND (4.1)
4-nitrophenol	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.19)
acensphthene	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
acensphthylene	ND (0.27)	ND (0.28)	ND (0.27)	ND (0.28)
anthracene	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
benzo(a)anthracene	0.1J (0.59)	ND (0.61)	ND (0.61)	0.2J (0.63)
benzo(a)pyrene	0.2J (0.19)	ND (0.20)	ND (0.20)	0.2J (0.20)
benzo(b)fluoranthene	0.1J (0.36)	ND (0.38)	ND (0.38)	0.2J (0.39)
benzo(k)fluoranthene	0.1J (0.19)	ND (0.20)	ND (0.20)	0.2 (0.20)
benzoic acid	ND (3.8)	0.4J (3.9)	ND (3.9)	ND (4.1)
benzyl alcohol	ND (3.8)	ND (3.9)	ND (3.9)	ND (4.1)
bis(2-chloroethoxy)methane	ND (0.40)	ND (0.42)	ND (0.42)	ND (0.43)
bis(2-chloroethyl) ether	ND (0.43)	ND (0.45)	ND (0.45)	ND (0.46)
bis(2-chloroisopropyl)ether	ND (0.43)	ND (0.45)	ND (0.45)	ND (0.46)
bis(2-ethylhexyl)phthalate	0.3B (0.19)	0.2JB (0.20)	0.2B (0.20)	0.3B (0.20)
butylbenzylphthalate	ND (0.19)	ND (0.20)	ND (0.20)	ND (0.20)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.

ND: Not detected at specified detection limit

(): Detection limit

235205

SOURCES: Radion, 1990; EST

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

Primary Results

PARAMETER	Monitor Well			
	WSAD		WSAF	
	Sample ID	Date Sampled	Sample ID	Date Sampled
	CARB-03-059	WSAF-1	WSAF-2	WSAF
	30-Mar-88	30-Mar-88	30-Mar-88	CARB-03-056
	(0.01 - 1)	(0.01 - 1)	(0.01 - 1)	30-Mar-88
				(0.01 - 1)
chrysene	0.2J (0.19)	ND (0.20)	ND (0.20)	0.2J (0.20)
di-n-butylphthalate	0.5B (0.19)	0.7B (0.20)	0.7B (0.20)	0.3B (0.20)
di-n-octyl phthalate	0.3 (0.19)	0.2 (0.20)	0.089J (0.20)	0.4 (0.20)
dibenzo(a,h)anthracene	ND (0.19)	ND (0.20)	ND (0.20)	ND (0.20)
dibenzofuran	ND (0.76)	ND (0.79)	ND (0.79)	ND (0.81)
diethylphthalate	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
dimethyl phthalate	ND (0.12)	ND (0.13)	ND (0.13)	ND (0.13)
fluoranthene	0.3 (0.17)	0.096J (0.17)	ND (0.17)	0.5 (0.18)
fluorene	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
hexachlorobenzene	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
hexachlorobutadiene	ND (0.068)	ND (0.071)	ND (0.071)	ND (0.073)
hexachlorocyclopentadiene	ND (0.45)	ND (0.47)	ND (0.47)	ND (0.49)
hexachloroethane	ND (0.12)	ND (0.13)	ND (0.13)	ND (0.13)
1,2,3-cd)pyrene	ND (0.28)	ND (0.29)	ND (0.29)	ND (0.30)
isophorone	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.18)
n-nitroso-di-n-propylamine	ND (0.91)	ND (0.94)	ND (0.94)	ND (0.97)
n-nitrosodiphenylamine	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
naphthalene	ND (0.12)	ND (0.13)	ND (0.13)	ND (0.13)
nitrobenzene	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.15)
pentachlorophenol	ND (0.27)	ND (0.28)	ND (0.28)	ND (0.29)
phenanthrene	0.2J (0.41)	ND (0.42)	ND (0.42)	0.2J (0.44)
phenol	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.12)
pyrene	0.2 (0.14)	ND (0.15)	ND (0.15)	0.3 (0.15)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.

ND: Not detected at specified detection limit

(): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	WSAG		WSAH		Monitor Well	
	Sample ID	Date Sampled	Sample ID	Date Sampled	Sample ID	Date Sampled
	WSAG-03-055	30-Mar-88	WSAH-03-053	30-Mar-88	WSAH-03-054	30-Mar-88
	0.01 - 1	0.01 - 1	0.01 - 1	0.01 - 1	0.01 - 1	0.01 - 1
Volatile Organic Compounds MG/KG						
1,1,1-trichloroethane	ND (0.0046)	ND (0.0042)	ND (0.0043)	ND (0.0043)	ND (0.0043)	ND (0.0043)
1,1,2,2-tetrachloroethane	ND (0.0083)	ND (0.0077)	ND (0.0079)	ND (0.0079)	ND (0.0079)	ND (0.0079)
1,1,2-trichloroethane	ND (0.0060)	ND (0.0056)	ND (0.0057)	ND (0.0057)	ND (0.0057)	ND (0.0057)
1,2-dichloroethane	ND (0.0034)	ND (0.0031)	ND (0.0032)	ND (0.0032)	ND (0.0032)	ND (0.0032)
1,2-dichloropropane	ND (0.0072)	ND (0.0067)	ND (0.0068)	ND (0.0068)	ND (0.0068)	ND (0.0068)
2-butanone	ND (0.030)	ND (0.028)	ND (0.029)	ND (0.029)	ND (0.029)	ND (0.029)
2-hexanone	ND (0.043)	ND (0.040)	ND (0.041)	ND (0.041)	ND (0.041)	ND (0.041)
4-methyl-2-pentanone	ND (0.055)	ND (0.051)	ND (0.052)	ND (0.052)	ND (0.052)	ND (0.052)
Benzene	ND (0.0053)	ND (0.0049)	ND (0.0050)	ND (0.0050)	ND (0.0050)	ND (0.0050)
Ethylbenzene	ND (0.0086)	ND (0.0080)	ND (0.0082)	ND (0.0082)	ND (0.0082)	ND (0.0082)
Toluene	ND (0.0072)	ND (0.0067)	ND (0.0068)	ND (0.0068)	ND (0.0068)	ND (0.0068)
Trichloroethene	ND (0.0023)	ND (0.0021)	ND (0.0022)	ND (0.0022)	ND (0.0022)	ND (0.0022)
acetone	ND (0.0090)	0.013 (0.0083)	ND (0.0086)	ND (0.0086)	ND (0.0086)	ND (0.0086)
bromodichloromethane	ND (0.0026)	ND (0.0024)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)
bromoform	ND (0.0056)	ND (0.0052)	ND (0.0054)	ND (0.0054)	ND (0.0054)	ND (0.0054)
bromomethane	ND (0.0060)	ND (0.0056)	ND (0.0057)	ND (0.0057)	ND (0.0057)	ND (0.0057)
carbon disulfide	ND (0.0020)	ND (0.0019)	ND (0.0019)	ND (0.0019)	ND (0.0019)	ND (0.0019)
carbon tetrachloride	ND (0.0034)	ND (0.0031)	ND (0.0032)	ND (0.0032)	ND (0.0032)	ND (0.0032)
chlorobenzene	ND (0.0072)	ND (0.0067)	ND (0.0068)	ND (0.0068)	ND (0.0068)	ND (0.0068)
chloroethane	ND (0.0060)	ND (0.0056)	ND (0.0057)	ND (0.0057)	ND (0.0057)	ND (0.0057)
chloroform	ND (0.0019)	ND (0.0018)	ND (0.0018)	ND (0.0018)	ND (0.0018)	ND (0.0018)
chloromethane	ND (0.0060)	ND (0.0056)	ND (0.0057)	ND (0.0057)	ND (0.0057)	ND (0.0057)
cis-1,3-Dichloropropene	ND (0.0060)	ND (0.0056)	ND (0.0057)	ND (0.0057)	ND (0.0057)	ND (0.0057)
dibromochloromethane	ND (0.0037)	ND (0.0034)	ND (0.0035)	ND (0.0035)	ND (0.0035)	ND (0.0035)

B: Detected in Reagent Blank; background subtraction not performed
 J: Estimated value (GC test codes)
 JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	USAO		MSAH	
	CAR8-03-055	CAR8-03-053	CAR8-03-054	MSAH
	30-Mar-88	30-Mar-88	30-Mar-88	
	0.01 - 1	0.01 - 1	0.01 - 1	
methylene chloride	ND (0.0034)	ND (0.0031)	ND (0.0032)	
styrene	ND (0.0036)	ND (0.0033)	ND (0.0034)	
tetrachloroethene	ND (0.0049)	ND (0.0046)	ND (0.0047)	
total xylenes	ND (0.0055)	ND (0.0051)	ND (0.0052)	
trans-1,3-Dichloropropene	ND (0.0060)	ND (0.0056)	ND (0.0057)	
vinyl acetate	ND (0.0083)	ND (0.0077)	ND (0.0079)	
vinyl chloride	ND (0.0060)	ND (0.0056)	ND (0.0057)	
Semivolatile Organic Compounds MC/KG				
1,2,4-trichlorobenzene	ND (0.15)	ND (0.14)	ND (0.14)	
1,2-dichlorobenzene	ND (0.15)	ND (0.14)	ND (0.14)	
1,3-dichlorobenzene	ND (0.15)	ND (0.14)	ND (0.14)	
1,4-dichlorobenzene	ND (0.35)	ND (0.33)	ND (0.32)	
2,4,5-trichlorophenol	ND (0.81)	ND (0.75)	ND (0.73)	
2,4,6-trichlorophenol	ND (0.22)	ND (0.20)	ND (0.20)	
2,4-dichlorophenol	ND (0.22)	ND (0.20)	ND (0.20)	
2,4-dimethylphenol	ND (0.22)	ND (0.20)	ND (0.20)	
2,4-dinitrophenol	ND (3.4)	ND (3.2)	ND (3.1)	
2,4-dinitrotoluene	ND (0.46)	ND (0.43)	ND (0.42)	
2,6-dinitrotoluene	ND (0.15)	ND (0.14)	ND (0.14)	
2-chloronaphthalene	ND (0.15)	ND (0.14)	ND (0.14)	
2-chlorophenol	ND (0.27)	ND (0.25)	ND (0.24)	
2-methylnaphthalene	ND (0.81)	ND (0.75)	ND (0.73)	
2-methylphenol	ND (0.81)	ND (0.75)	ND (0.73)	
2-nitroaniline	ND (4.0)	ND (3.8)	ND (3.7)	

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.

ND: Not detected at specified detection limit

(): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	WSAC		WSAH	
	CAR8-03-055	CAR8-03-053	CAR8-03-054	WSAH
	30-Mar-88	30-Mar-88	30-Mar-88	
	0.01 - 1	0.01 - 1	0.01 - 1	
2-nitrophenol	ND (0.29)	ND (0.27)	ND (0.26)	
3,3'-dichlorobenzidine	ND (1.3)	ND (1.2)	ND (1.2)	
3-nitroaniline	ND (4.0)	ND (3.8)	ND (3.7)	
4,6-dinitro-2-methylphenol	ND (1.9)	ND (1.8)	ND (1.8)	
4-bromophenyl-phenylether	ND (0.15)	ND (0.14)	ND (0.14)	
4-chloro-3-methylphenol	ND (0.24)	ND (0.23)	ND (0.22)	
4-chloroaniline	ND (0.81)	ND (0.75)	ND (0.73)	
4-chlorophenyl-phenylether	ND (0.34)	ND (0.32)	ND (0.31)	
4-methylphenol	ND (0.81)	ND (0.75)	ND (0.73)	
4-nitroaniline	ND (4.0)	ND (3.8)	ND (3.7)	
4-nitrophenol	ND (0.19)	ND (0.18)	ND (0.18)	
acensphthene	ND (0.15)	ND (0.14)	ND (0.14)	
acensphthylene	ND (0.28)	ND (0.26)	ND (0.26)	
anthracene	ND (0.15)	ND (0.14)	ND (0.14)	
benzo(a)anthracene	0.097J (0.63)	ND (0.59)	ND (0.57)	
benzo(a)pyrene	ND (0.20)	ND (0.19)	ND (0.18)	
benzo(b)fluoranthene	ND (0.39)	ND (0.36)	ND (0.35)	
benzo(k)fluoranthene	ND (0.20)	ND (0.19)	ND (0.18)	
benzoic acid	0.66J (4.0)	ND (3.8)	ND (3.7)	
benzyl alcohol	ND (4.0)	ND (3.8)	ND (3.7)	
bis(2-chloroethoxy)methane	ND (0.43)	ND (0.40)	ND (0.39)	
bis(2-chloroethyl) ether	ND (0.46)	ND (0.43)	ND (0.42)	
bis(2-chloroisopropyl)ether	ND (0.46)	ND (0.43)	ND (0.42)	
bis(2-ethylhexyl)phthalate	0.308 (0.20)	0.22B (0.19)	0.18JB (0.18)	
butylbenzylphthalate	ND (0.20)	ND (0.19)	ND (0.18)	

B: Detected in Reagent Blank; background subtraction not performed
 J: Estimated value (GC test codes)
 JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE USA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	WSAC		MSAH		MSAH	
	CARB-03-055		CARB-03-053		CARB-03-054	
	30-Mar-88		30-Mar-88		30-Mar-88	
	0.01 - 1		0.01 - 1		0.01 - 1	
Monitor Well	Sample ID	Date Sampled	Res. Depth - End Depth	WSAH	WSAH	WSAH
chrysene	0.089J	(0.20)	ND	(0.19)	ND	(0.18)
di-n-butylphthalate	0.46B	(0.20)	0.35B	(0.19)	0.27B	(0.18)
di-n-octyl phthalate	0.12J	(0.20)	ND	(0.19)	ND	(0.18)
dibenzo(a,h)anthracene	ND	(0.20)	ND	(0.19)	ND	(0.18)
dibenzofuran	ND	(0.81)	ND	(0.75)	ND	(0.73)
diethylphthalate	ND	(0.15)	ND	(0.14)	ND	(0.14)
dimethyl phthalate	ND	(0.13)	ND	(0.12)	ND	(0.12)
fluoranthene	ND	(0.18)	ND	(0.17)	ND	(0.16)
fluorene	ND	(0.15)	ND	(0.14)	ND	(0.14)
hexachlorobenzene	ND	(0.15)	ND	(0.14)	ND	(0.14)
hexachlorobutadiene	ND	(0.072)	ND	(0.068)	ND	(0.066)
hexachlorocyclopentadiene	ND	(0.48)	ND	(0.45)	ND	(0.44)
hexachloroethane	ND	(0.13)	ND	(0.12)	ND	(0.12)
indeno(1,2,3-cd)pyrene	ND	(0.30)	ND	(0.28)	ND	(0.27)
isophorene	ND	(0.18)	ND	(0.17)	ND	(0.16)
n-nitroso-di-n-propylamine	NIQ	(0.97)	ND	(0.90)	ND	(0.88)
n-nitrosodiphenylamine	ND	(0.15)	ND	(0.14)	ND	(0.14)
naphthalene	ND	(0.13)	ND	(0.12)	ND	(0.12)
nitrobenzene	ND	(0.15)	ND	(0.14)	ND	(0.14)
pentachlorophenol	ND	(0.29)	ND	(0.27)	ND	(0.26)
phenanthrene	ND	(0.43)	ND	(0.41)	ND	(0.40)
phenol	ND	(0.12)	ND	(0.11)	ND	(0.11)
pyrene	ND	(0.15)	ND	(0.14)	ND	(0.14)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.

ND: Not detected at specified detection limit

(): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	WSAI		Monitor Well	
	WSAI	WSAI	Sample ID	WSAJ
	Carb-03-051	Carb-03-052	Date Sampled	Date Sampled
	30-Mar-88	30-Mar-88		29-Mar-88
	0.01 - 2	2 - 2.75		0.01 - 1
Volatile Organic Compounds MC/KC				
1,1,1-trichloroethane	ND (0.0043)	ND (0.0044)	ND (0.0044)	ND (0.0048)
1,1,2,2-tetrachloroethane	ND (0.0079)	ND (0.0079)	ND (0.0079)	ND (0.0086)
1,1,2-trichloroethane	ND (0.0057)	ND (0.0058)	ND (0.0058)	ND (0.0063)
1,2-dichloroethane	ND (0.0032)	ND (0.0032)	ND (0.0032)	ND (0.0035)
1,2-dichloropropane	ND (0.0068)	ND (0.0069)	ND (0.0069)	ND (0.0075)
2-butanone	ND (0.029)	ND (0.029)	ND (0.029)	ND (0.031)
2-hexanone	ND (0.041)	ND (0.041)	ND (0.041)	ND (0.045)
4-methyl-2-pentanone	ND (0.052)	ND (0.053)	ND (0.053)	ND (0.058)
Benzene	ND (0.0050)	ND (0.0051)	ND (0.0051)	ND (0.0055)
Ethylbenzene	ND (0.0082)	ND (0.0083)	ND (0.0083)	ND (0.0090)
Toluene	ND (0.0068)	ND (0.0069)	ND (0.0069)	0.049 (0.0075)
Trichloroethene	ND (0.0022)	ND (0.0022)	ND (0.0022)	ND (0.0024)
acetone	0.010 (0.0086)	0.0090 (0.0086)	0.0090 (0.0086)	0.010 (0.0094)
bromodichloromethane	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0028)
bromoform	ND (0.0054)	ND (0.0054)	ND (0.0054)	ND (0.0059)
bromomethane	ND (0.0057)	ND (0.0058)	ND (0.0058)	ND (0.0063)
carbon disulfide	ND (0.0019)	ND (0.0020)	ND (0.0020)	ND (0.0021)
carbon tetrachloride	ND (0.0032)	ND (0.0032)	ND (0.0032)	ND (0.0035)
chlorobenzene	ND (0.0068)	ND (0.0069)	ND (0.0069)	ND (0.0075)
chloroethane	ND (0.0057)	ND (0.0058)	ND (0.0058)	ND (0.0063)
chloroform	ND (0.0018)	ND (0.0018)	ND (0.0018)	ND (0.0020)
chloromethane	ND (0.0057)	ND (0.0058)	ND (0.0058)	ND (0.0063)
cis-1,3-Dichloropropene	ND (0.0057)	ND (0.0058)	ND (0.0058)	ND (0.0063)
dibromochloromethane	ND (0.0035)	ND (0.0036)	ND (0.0036)	ND (0.0039)

B: Detected in Reagent Blank; background subtraction not performed
 J: Estimated value (GC test codes)
 JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	WSAI		WSAJ	
	CARB-03-05j	CARB-03-052	CARB-03-049	CARB-03-049
	30-Mar-88	30-Mar-88	29-Mar-88	29-Mar-88
	0.01 - 2	2 - 2.75	0.01 - 1	0.01 - 1
	ND (0.0032)	ND (0.0032)	ND (0.0035)	ND (0.0035)
methylene chloride	ND (0.0034)	ND (0.0035)	ND (0.0038)	ND (0.0038)
styrene	ND (0.0047)	ND (0.0047)	ND (0.0051)	ND (0.0051)
tetrachloroethene	ND (0.0052)	ND (0.0053)	ND (0.0058)	ND (0.0058)
total xylenes	ND (0.0057)	ND (0.0058)	ND (0.0063)	ND (0.0063)
trans-1,3-Dichloropropene	ND (0.0079)	ND (0.0079)	ND (0.0086)	ND (0.0086)
vinyl acetate	ND (0.0057)	ND (0.0058)	ND (0.0063)	ND (0.0063)
vinyl chloride				
Semivolatile Organic Compounds MG/KG				
1,2,4-trichlorobenzene	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.16)
1,2-dichlorobenzene	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.16)
1,3-dichlorobenzene	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.16)
1,4-dichlorobenzene	ND (0.33)	ND (0.34)	ND (0.37)	ND (0.37)
2,4,5-trichlorophenol	ND (0.75)	ND (0.77)	ND (0.83)	ND (0.83)
2,4,6-trichlorophenol	ND (0.20)	ND (0.21)	ND (0.23)	ND (0.23)
2,4-dichlorophenol	ND (0.20)	ND (0.21)	ND (0.23)	ND (0.23)
2,4-dimethylphenol	ND (0.20)	ND (0.21)	ND (0.23)	ND (0.23)
2,4-dinitrophenol	ND (3.1)	ND (3.3)	ND (3.5)	ND (3.5)
2,4-dinitrotoluene	ND (0.43)	ND (0.44)	ND (0.48)	ND (0.48)
2,6-dinitrotoluene	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.16)
2-chloronaphthalene	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.16)
2-chlorophenol	ND (0.25)	ND (0.26)	ND (0.28)	ND (0.28)
2-methylnaphthalene	ND (0.75)	ND (0.77)	ND (0.83)	ND (0.83)
2-methylphenol	ND (0.75)	ND (0.77)	ND (0.83)	ND (0.83)
2-nitroaniline	ND (3.7)	ND (3.9)	ND (4.2)	ND (4.2)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.

ND: Not detected at specified detection limit

(): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE USA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

Primary Results

PARAMETER	WSAI		WSAJ	
	CAR8-03-051	CAR8-03-052	CAR8-03-049	WSAJ
	30-Mar-88	30-Mar-88	29-Mar-88	
	0.01 - 2	2 - 2.75	0.01 - 1	
2-nitrophenol	ND (0.27)	ND (0.28)	ND (0.30)	
3,3'-dichlorobenzidine	ND (1.2)	ND (1.3)	ND (1.4)	
3-nitroaniline	ND (3.7)	ND (3.9)	ND (4.2)	
4,6-dinitro-2-methylphenol	ND (1.8)	ND (1.9)	ND (2.0)	
4-bromophenyl-phenylether	ND (0.14)	ND (0.15)	ND (0.16)	
4-chloro-3-methylphenol	ND (0.22)	ND (0.23)	ND (0.25)	
4-chloroaniline	ND (0.75)	ND (0.77)	ND (0.83)	
4-chlorophenyl-phenylether	ND (0.31)	ND (0.33)	ND (0.35)	
4-methylphenol	ND (0.75)	ND (0.77)	ND (0.83)	
4-nitroaniline	ND (3.7)	ND (3.9)	ND (4.2)	
4-nitrophenol	ND (0.18)	ND (0.19)	ND (0.20)	
acensphthene	ND (0.14)	ND (0.15)	ND (0.16)	
acensphthylene	ND (0.26)	ND (0.27)	ND (0.29)	
anthracene	ND (0.14)	ND (0.15)	ND (0.16)	
benzo(a)anthracene	ND (0.58)	ND (0.60)	ND (0.65)	
benzo(a)pyrene	ND (0.19)	ND (0.19)	ND (0.21)	
benzo(b)fluoranthene	ND (0.36)	ND (0.37)	ND (0.40)	
benzo(k)fluoranthene	ND (0.19)	ND (0.19)	ND (0.21)	
benzoic acid	ND (3.7)	0.36J (3.9)	0.18J (4.2)	
benzyl alcohol	ND (3.7)	ND (3.9)	ND (4.2)	
bis(2-chloroethoxy)methane	ND (0.40)	ND (0.41)	ND (0.44)	
bis(2-chloroethyl) ether	ND (0.43)	ND (0.44)	ND (0.48)	
bis(2-chloroisopropyl)ether	ND (0.43)	ND (0.44)	ND (0.48)	
bis(2-ethylhexyl)phthalate	0.17JB (0.19)	0.22B (0.19)	0.23B (0.21)	
butylbenzylphthalate	ND (0.19)	ND (0.19)	ND (0.21)	

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.

ND: Not detected at specified detection limit

(): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	WSAI		WSAJ	
	WSAI	WSAJ	WSAI	WSAJ
	Sample ID Date Sampled Reg. Depth - End Depth			
	CAR8-03-051 30-Mar-88 0.01 - 2	CAR8-03-052 30-Mar-88 2 - 2.75	CAR8-03-049 29-Mar-88 0.01 - 1	
chrysene	ND (0.19)	ND (0.19)	ND (0.21)	
di-n-butylphthalate	0.408 (0.19)	0.438 (0.19)	0.258 (0.21)	
di-n-octyl phthalate	0.23 (0.19)	0.48 (0.19)	0.213 (0.21)	
dibenzo(a,h)anthracene	ND (0.19)	ND (0.19)	ND (0.21)	
dibenzofuran	ND (0.75)	ND (0.77)	ND (0.83)	
diethylphthalate	ND (0.14)	ND (0.15)	ND (0.16)	
dimethyl phthalate	ND (0.12)	ND (0.12)	ND (0.13)	
fluoranthene	ND (0.16)	ND (0.17)	ND (0.18)	
fluorene	ND (0.14)	ND (0.15)	ND (0.16)	
hexachlorobenzene	ND (0.14)	ND (0.15)	ND (0.16)	
hexachlorobutadiene	ND (0.067)	ND (0.070)	ND (0.075)	
hexachlorocyclopentadiene	ND (0.45)	ND (0.46)	ND (0.50)	
hexachloroethane	ND (0.12)	ND (0.12)	ND (0.13)	
indeno(1,2,3-cd)pyrene	ND (0.28)	ND (0.29)	ND (0.31)	
isophorone	ND (0.16)	ND (0.17)	ND (0.18)	
n-nitroso-di-n-propylamine	ND (0.90)	ND (0.93)	ND (1.0)	
n-nitrosodiphenylamine	ND (0.14)	ND (0.15)	ND (0.16)	
naphthalene	ND (0.12)	ND (0.12)	ND (0.13)	
nitrobenzene	ND (0.14)	ND (0.15)	ND (0.16)	
pentachlorophenol	ND (0.27)	ND (0.28)	ND (0.30)	
phenanthrene	ND (0.49)	ND (0.42)	ND (0.45)	
phenol	ND (0.11)	ND (0.12)	ND (0.13)	
pyrene	ND (0.14)	ND (0.15)	ND (0.16)	

B: Detected in Reagent Blank; background subtraction not performed
 J: Estimated value (GC test codes)
 JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.
 ND: Not detected at specified detection limit
 (): Detection limit

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Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	WSAJ		WSAK	
	CAR8-03-050	CAR8-03-047	CAR8-03-047	CAR8-03-048
	29-Mar-88	29-Mar-88	29-Mar-88	29-Mar-88
	3 - 4.25	0.01 - 1		2 - 3
Volatile Organic Compounds MG/KG				
1,1,1-trichloroethane	ND (0.0043)	ND (0.0043)	ND (0.0043)	ND (0.0044)
1,1,2,2-tetrachloroethane	ND (0.0079)	ND (0.0077)	ND (0.0077)	ND (0.0080)
1,1,2-trichloroethane	ND (0.0057)	ND (0.0056)	ND (0.0056)	ND (0.0058)
1,2-dichloroethane	ND (0.0032)	ND (0.0031)	ND (0.0031)	ND (0.0032)
1,2-dichloropropane	ND (0.0068)	ND (0.0067)	ND (0.0067)	ND (0.0070)
2-butanone	ND (0.029)	ND (0.028)	ND (0.028)	ND (0.029)
2-hexanone	ND (0.041)	ND (0.040)	ND (0.040)	ND (0.042)
4-methyl-2-pentanone	ND (0.052)	ND (0.052)	ND (0.052)	ND (0.053)
Benzene	ND (0.0050)	ND (0.0049)	ND (0.0049)	ND (0.0051)
Ethylbenzene	ND (0.0082)	ND (0.0081)	ND (0.0081)	ND (0.0084)
Toluene	0.0098 (0.0068)	0.012 (0.0067)	0.012 (0.0067)	0.0028J (0.0070)
Trichloroethene	ND (0.0022)	ND (0.0021)	ND (0.0021)	ND (0.0022)
acetone	0.012 (0.0086)	0.011 (0.0084)	0.011 (0.0084)	0.011 (0.0087)
bromodichloromethane	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0026)
bromoform	ND (0.0054)	ND (0.0053)	ND (0.0053)	ND (0.0055)
bromomethane	ND (0.0057)	ND (0.0056)	ND (0.0056)	ND (0.0058)
carbon disulfide	ND (0.0019)	ND (0.0019)	ND (0.0019)	ND (0.0020)
carbon tetrachloride	ND (0.0032)	ND (0.0031)	ND (0.0031)	ND (0.0032)
chlorobenzene	ND (0.0068)	ND (0.0067)	ND (0.0067)	ND (0.0070)
chloroethane	ND (0.0057)	ND (0.0056)	ND (0.0056)	ND (0.0058)
chloroform	ND (0.0018)	ND (0.0018)	ND (0.0018)	ND (0.0019)
chloromethane	ND (0.0057)	ND (0.0056)	ND (0.0056)	ND (0.0058)
cis-1,3-Dichloropropene	ND (0.0057)	ND (0.0056)	ND (0.0056)	ND (0.0058)
dibromochloromethane	ND (0.0035)	ND (0.0035)	ND (0.0035)	ND (0.0036)

B: Detected in Reagent Blank; background subtraction not performed
 J: Estimated value (GC test codes)
 JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.
 ND: Not detected at specified detection limit
 (): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA),
CARSWELL AFB, TEXAS (Cont.)

PARAMETER	WSAJ		MSAJ		Monitor Well	
	Sample ID	Date Sampled	Sample ID	Date Sampled	Sample ID	Date Sampled
	Beg. Depth - End Depth					
	CAR8-03-050	CAR8-03-047	CAR8-03-048	CAR8-03-048	WSAJ	WSAJ
	29-Mar-88	29-Mar-88	29-Mar-88	29-Mar-88		
	3 - 4.25	0.01 - 1	2 - 3	2 - 3		
methylene chloride	ND (0.0032)	ND (0.0031)	ND (0.0032)	ND (0.0032)	ND (0.0032)	ND (0.0032)
styrene	ND (0.0034)					
tetrachloroethene	ND (0.0047)	ND (0.0046)				
total xylenes	ND (0.0052)					
trans-1,3-Dichloropropene	ND (0.0057)	ND (0.0056)				
vinyl acetate	ND (0.0079)	ND (0.0077)				
vinyl chloride	ND (0.0057)	ND (0.0056)				
Semivolatile Organic Compounds MC/KC						
1,2,4-trichlorobenzene	ND (0.14)					
1,2-dichlorobenzene	ND (0.14)					
1,3-dichlorobenzene	ND (0.14)					
1,4-dichlorobenzene	ND (0.33)					
2,4,5-trichlorophenol	ND (0.75)	ND (0.74)				
2,4,6-trichlorophenol	ND (0.20)					
2,4-dichlorophenol	ND (0.20)					
2,4-dimethylphenol	ND (0.20)					
2,4-dinitrophenol	ND (3.2)	ND (3.1)				
2,6-dinitrotoluene	ND (0.43)	ND (0.42)				
2,6-dinitrotoluene	ND (0.14)					
2-chloronaphthalene	ND (0.14)					
2-chlorophenol	ND (0.25)					
2-methylnaphthalene	ND (0.75)	ND (0.74)				
2-methylphenol	ND (0.75)	ND (0.74)				
2-nitroaniline	ND (3.8)	ND (3.7)				

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.

ND: Not detected at specified detection limit

(): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA),
CARSWELL AFB, TEXAS (Cont.)

PARAMETER	WSAJ		WSAK	
	CAR8-03-050	CAR8-03-047	CAR8-03-048	WSAK
	29-Mar-88 3 - 4.25	29-Mar-88 0.01 - 1	29-Mar-88 2 - 3	
2-nitrophenol	ND (0.27)	ND (0.27)	ND (0.28)	
3,3'-dichlorobenzidine	ND (1.2)	ND (1.2)	ND (1.3)	
3-nitroaniline	ND (3.8)	ND (3.7)	ND (3.9)	
4,6-dinitro-2-methylphenol	ND (1.8)	ND (1.8)	ND (1.9)	
4-bromophenyl-phenylether	ND (0.14)	ND (0.14)	ND (0.15)	
4-chloro-3-methylphenol	ND (0.23)	ND (0.22)	ND (0.24)	
4-chloroaniline	ND (0.75)	ND (0.74)	ND (0.78)	
4-chlorophenyl-phenylether	ND (0.32)	ND (0.31)	ND (0.33)	
4-methylphenol	ND (0.75)	ND (0.74)	ND (0.78)	
4-nitroaniline	ND (3.8)	ND (3.7)	ND (3.9)	
4-nitrophenol	ND (0.18)	ND (0.18)	ND (0.19)	
acensphthene	ND (0.14)	ND (0.14)	ND (0.15)	
acensphthylene	ND (0.26)	ND (0.26)	ND (0.27)	
aniline			ND (0.78)	
anthracene	ND (0.14)	ND (0.14)	ND (0.15)	
benzidine			ND (3.4)	
benzo(a)anthracene	ND (0.59)	ND (0.58)	ND (0.61)	
benzo(a)pyrene	ND (0.19)	ND (0.19)	ND (0.20)	
benzo(b)fluoranthene	ND (0.36)	ND (0.36)	ND (0.38)	
benzo(k)fluoranthene	ND (0.19)	ND (0.19)	ND (0.20)	
benzoic acid	0.16J (3.8)	0.26J (3.7)	0.34J (3.9)	
benzyl alcohol	ND (3.8)	ND (3.7)	ND (3.9)	
bis(2-chloroethoxy)methane	ND (0.40)	ND (0.39)	ND (0.42)	
bis(2-chloroethyl) ether	ND (0.43)	ND (0.42)	ND (0.45)	
bis(2-chloroisopropyl)ether	ND (0.43)	ND (0.42)	ND (0.45)	

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.

ND: Not detected at specified detection limit

(): Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	WSAJ		WSAJ		WSAK	
	CARB-03-050	CARB-03-047	CARB-03-047	CARB-03-048	CARB-03-048	CARB-03-048
	29-Mar-88	29-Mar-88	29-Mar-88	29-Mar-88	29-Mar-88	29-Mar-88
	3 - 4.25	0.01 - 1	0.01 - 1	2 - 3	2 - 3	2 - 3
	WSAJ	WSAJ	WSAK	WSAK	WSAK	
	0.32B	0.14JB	0.19	0.28B	0.20	
bis(2-ethylhexyl)phthalate	MD	MD	(0.19)	MD	(0.20)	
butylbenzylphthalate	MD	MD	(0.19)	MD	(0.20)	
chrysene	MD	MD	(0.19)	MD	(0.20)	
di-n-butylphthalate	0.51B	0.32B	(0.19)	0.68B	(0.20)	
di-n-octyl phthalate	0.54	MD	(0.19)	0.33	(0.20)	
dibenzo(a,h)anthracene	MD	MD	(0.19)	MD	(0.20)	
dibenzofuran	MD	MD	(0.75)	MD	(0.78)	
diethylphthalate	MD	MD	(0.14)	MD	(0.15)	
dimethyl phthalate	MD	MD	(0.12)	MD	(0.13)	
fluoranthene	MD	MD	(0.17)	MD	(0.17)	
fluorene	MD	MD	(0.14)	MD	(0.15)	
hexachlorobenzene	MD	MD	(0.14)	MD	(0.15)	
hexachlorobutadiene	MD	MD	(0.068)	MD	(0.071)	
hexachlorocyclopentadiene	MD	MD	(0.45)	MD	(0.47)	
hexachloroethane	MD	MD	(0.12)	MD	(0.13)	
indeno(1,2,3-cd)pyrene	MD	MD	(0.28)	MD	(0.29)	
isophorone	MD	MD	(0.17)	MD	(0.17)	
n-nitroso-di-n-propylamine	MD	MD	(0.90)	MD	(0.94)	
n-nitrosodimethylamine	MD	MD	(0.14)	MD	(0.78)	
n-nitrosodiphenylamine	MD	MD	(0.12)	MD	(0.15)	
naphthalene	MD	MD	(0.14)	MD	(0.13)	
nitrobenzene	MD	MD	(0.14)	MD	(0.15)	
pentachlorophenol	MD	MD	(0.27)	MD	(0.28)	
phenanthrene	MD	MD	(0.41)	MD	(0.42)	
phenol	MD	MD	(0.11)	MD	(0.12)	

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.

MD: Not detected at specified detection limit

() : Detection limit

Table B.2-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE WSA (WEAPONS STORAGE AREA), CARSWELL AFB, TEXAS (Cont.)

PARAMETER	Monitor Well	
	Sample ID	Date Sampled
Pyrene	WSAJ	WSAK
	CARB-03-050	CARB-03-047
	29-Mar-88	29-Mar-88
	3 - 4.25	0.01 - 1
	MD (0.14)	MD (0.14)
		MD (0.15)

B: Detected in Reagent Blank; background subtraction not performed
 J: Estimated value (CC test codes)
 JB: Estimated value below detection limit; Analyte in Blank, background subtraction not performed.
 MD: Not detected at specified detection limit
 (): Detection limit

analysis. Antimony, selenium, and several volatile and semivolatile organic compounds were detected at the site.

The following three Alternatives were evaluated for the remediation of soils at WSA:

1. No action,
2. Excavation and disposal of the contaminated soil in a landfill, and
3. Alternative 2, with incineration of contaminated soil.

The alternatives were screened based on the following criteria:

- Concentration and distribution of contaminants at the WSA,
- Technical feasibility and effectiveness of remedial alternatives,
- Estimated cost, and
- Regulatory compliance.

Cost estimates for each alternative are presented in Table B.2-3. Alternative 2 was recommended since the low level of contaminants present in the soils and disposal of the soils at a non-hazardous (special waste) landfill is cost effective and expected to be acceptable to the Texas Water Commission (TWC).

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

A remedial alternative was selected for the WSA based on the previous investigation results.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional investigations at the site.

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

Table B.2-3 NARRATIVE MATRIX
TECHNICAL EVALUATION OF ALTERNATIVES

Alternative	Cost ¹ (\$)	Engineering Feasibility	Regulatory Compliance
1. No action	0	-----	-----
2. Excavate contaminated soil/landfill ²	10,600	Proven technology	TWC approval necessary
3. Excavate contaminated soil/incinerate	374,000	Proven technology	TWC approval necessary

¹ Costs based on excavation and hauling of approximately 200 yd³ of contaminated soil. These costs are based on a conceptual application of remedial technologies, and therefore should not be used for detailed budget planning purposes.

² Special waste (non-hazardous) landfill.

6.0 STATUS OF THE PROJECT

No information regarding project status was available in the file material.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No data from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None Observed.

TITLE: Draft Interim Investigation/Remediation Plan - Waste Burial Area
AUTHOR: U.S. Army Corps of Engineers
DOCUMENT NUMBER: 78
CATEGORY: Not Available
SUBMITTED: January 1991

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this report was to prepare an interim investigation/remediation plan for Waste Burial Area (SWMU 24).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

This site (Figure B.3-1) was used for burial of wastes during 1960s and reportedly received solvents, leaded sludge, and possible ordnance materials. Various phthalates (max. 390 ug/Kg) were detected in the soil samples. TCE (max. 11,000 ug/L) and chloroethene (850 ug/L) were detected in the groundwater samples. USACE proposed that the groundwater at this site be treated with the groundwater at SWMU No. 23 and SWMU No. 22 and submit a RAP at a later date.

2.2 PREVIOUS INVESTIGATION RESULTS

The geologic data developed for SWMU 24 resulted primarily from geologic sampling during drilling operations conducted during Radian Corporation's Stage 2 Installation Restoration Program Remedial Investigation. Data gathered from Radian Corporation's Stage 1 Remedial Investigation in 1985 included geophysical surveys and observations of water levels during and after monitor well installation. Groundwater occurs in the upper zone materials underlying the Waste Burial Area at depths from 20 ft at monitoring well 10C to 30 ft at 10A. Soil borings 10D, 10E, and 10F all encountered groundwater at 27 ft.

- DRAFT -

FT. WORTH AFB/CARSWELL

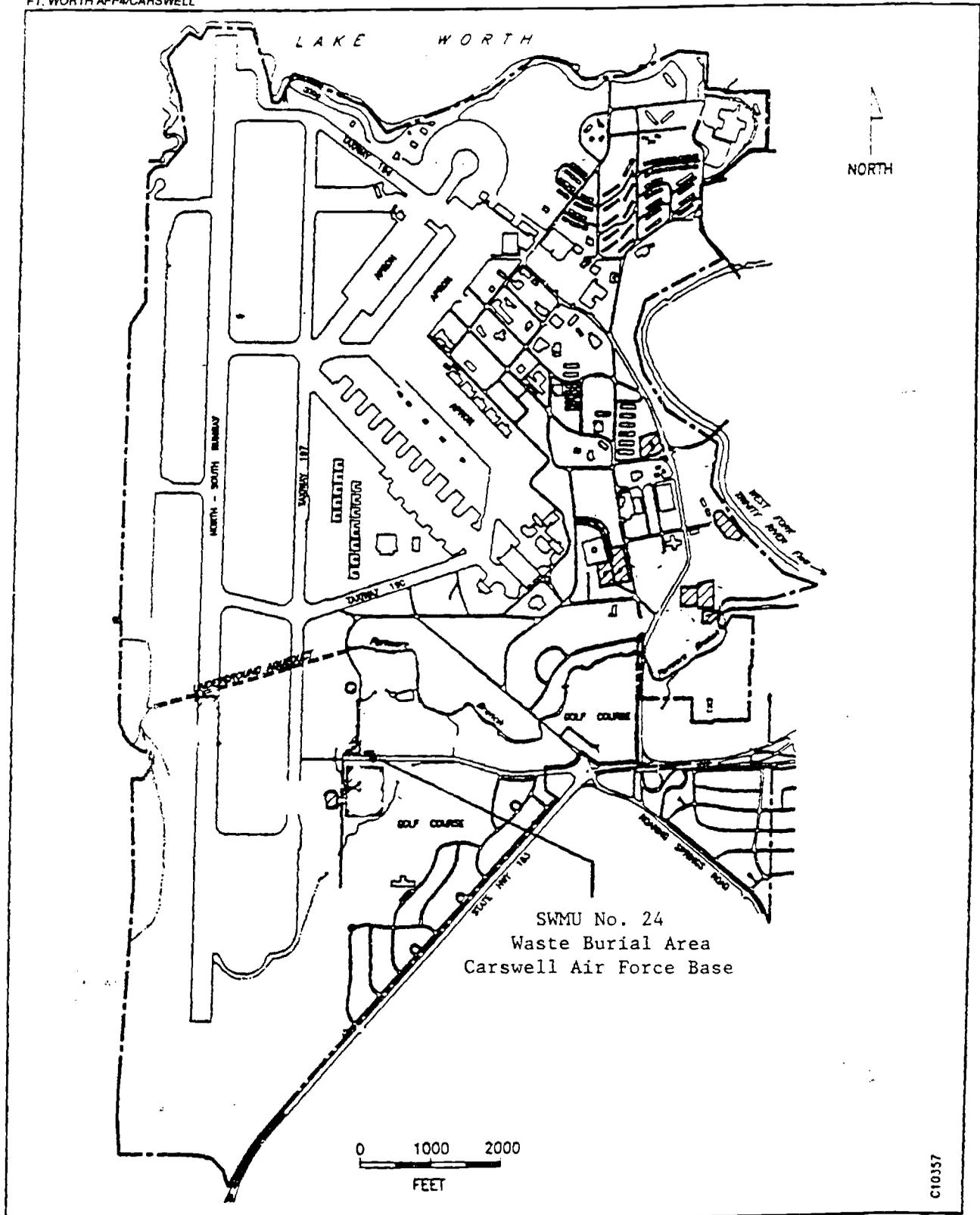


Figure B.3-1 Location of IRP Phase II (Stage 2) Sites at Carswell AFB, Texas
SOURCES: Ecology and Environment, Inc; ESE.

Groundwater exists under unconfined (aquifer) conditions in the upper zone materials.

2.3 PROJECT ACCOMPLISHMENTS

A Scope of Work was outlined in detail for the contractor to remove approximately twelve 55-gallon drums and a 5,000 gallon UST (Figure B.3-2), including technical specifications for tank, buried drum removal, and excavation of soils, and removal and disposal of Underground Storage Tanks. A Quality Assurance/Quality Control Plan dated January, 1991 was also provided in the report.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

A Remedial Investigation and Quality Assurance/Quality Control Plans were developed as a result of this project.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional studies at the site.

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

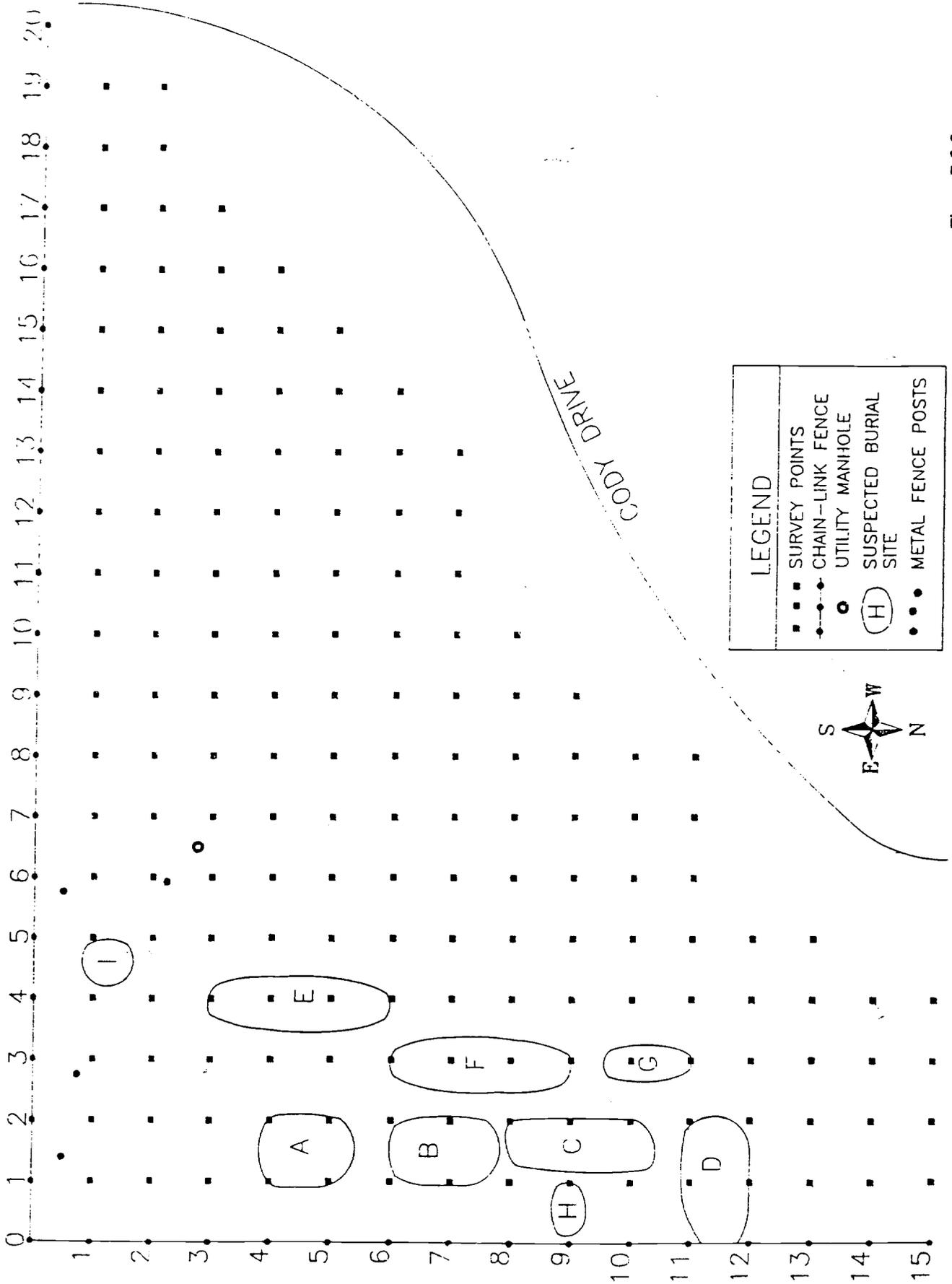
6.0 STATUS OF THE PROJECT

A Removal Action for the buried drums and contaminated soil from SWMU 24 was implemented between August and October 1991 (USACE, March 1993).

7.0 SCHEDULE

No schedule is available.

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B.3-4

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No data from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Draft Feasibility Study for the East Area
AUTHOR: Radian Corporation
DOCUMENT NUMBER: 101
CATEGORY: 01.04
SUBMITTED: May 1991

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to conduct a feasibility study for the remediation of groundwater at the following four sites located in the East Area of Carswell Air Force Base (CAFB):

1. Site LF01 - Landfill 1 (SWMU 28),
2. Site SD13 - Unnamed Stream and Abandoned Gasoline Station,
3. Site ST14 - POL Tank Farm (SWMU 68), and
4. Site BSS - Base Service Station.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

CAFB was established in 1942 and located six miles west of Fort Worth in Tarrant County, Texas. The base operates the Weapons Storage Area (WSA) located five miles west of the base on White Settlement Road.

Wastes have been generated and disposed of at CAFB since 1942. Major industrial operations include maintenance of jet engines, aerospace ground equipment, fuel systems and weapons systems. The generated wastes are primarily oils, lubricants, recoverable fuels, spent solvents, and cleaners.

2.2 PREVIOUS INVESTIGATION RESULTS

A Phase I records Search (CH2M Hill, February 1984), Phase II Confirmation/Quantification, Stage 1 (Radian, October 1986), Phase II Confirmation/Quantification Stage 2 Draft (Radian, October 1988), and a project summary report (USACE, May 1991) were completed for the SWMUs at CAFB.

The previous IRP investigations were conducted at sites LF01, SD10, OT12, SD13, ST14, and BSS at CAFB (Figure B.4-1). Following the IRP investigations, decision documents were prepared for Sites SD10 and BSS (Radian 1990a, 1990b) identifying the recommended remedial alternative. However, the remediation issue at BSS was unresolved due to insufficient data available to delineate the extent of contamination. Therefore, BSS was recommended in this FS for further investigation. Also, further investigation was recommended at Site OT12 to confirm the absence of contamination prior to planned construction at the site. However, OT12 was not included in this FS. The indicator chemicals detected at the remaining four sites (LF01, SD13, ST14, and BSS) are presented in Table B.4-1.

2.3 PROJECT ACCOMPLISHMENTS

This FS was divided into the following three sections: 1) screening of remedial technologies, 2) development of remedial alternatives, and 3) detailed evaluation of alternatives.

In Section 1, technologies were screened for 1) performance and effectiveness, 2) constructability and implementability, and 3) cost. The technologies that remained after the initial screening process are presented in Table B.4-2. Then the potentially applicable technologies were combined into remedial alternatives that were developed and screened against the broad criteria of effectiveness, implementability and cost.

The alternatives were later evaluated in detail based on the following criteria:

- Overall protection of the human health and the environment,
- Compliance with ARARs,
- Long-term effectiveness and permanence,
- Reduction of toxicity, mobility, and volume,
- Short-term effectiveness,
- Implementability, and
- Cost.

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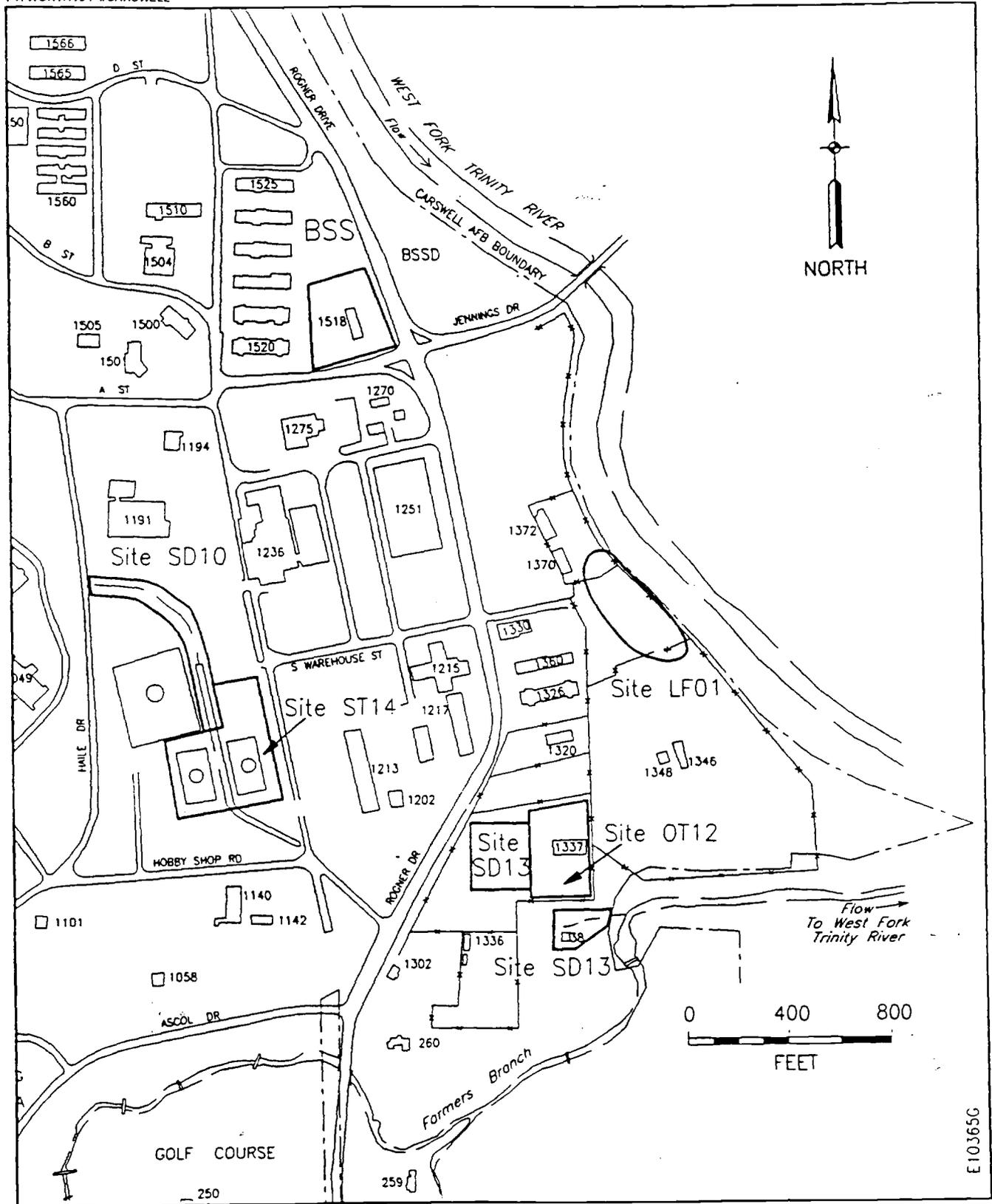


Figure B.4-1 Location of East Area IRP Sites, Carswell AFB, Texas

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Table B.4-1 INDICATOR CHEMICALS FOR SITE LF01--LANDFILL 1

Metals	Semivolatile Organic Compounds	Volatile Organic Compounds (VOCs)
Antimony	Bis(2-ethylhexyl)- phthalate	Methylene chloride
Arsenic		Toluene
Barium		Trichloroethene
Beryllium		Vinyl chloride
Cadmium		
Chromium		
Lead		
Nickel		
Selenium		
Silver		

SOURCE: ESE.

Table B.4-1 INDICATOR CHEMICALS FOR SITE SD13--UNNAMED STREAM AND
ABANDONED GASOLINE STATION

Metals	Semivolatile Organic Compounds	Volatile Organic Compounds (VOCs)
Antimony	None	Benzene
Arsenic		Tetrachloroethene
Barium		Toluene
Beryllium		
Cadmium		
Chromium		
Lead		
Nickel		
Selenium		
Silver		

SOURCE: ESE.

Table B.4-2 SUMMARY OF REMEDIAL ACTION OPTIONS FOR THE EAST AREA
IRP SITES

	Site			
	LF01	SD13	ST14	BSS
No Action	■	■	■	■
<u>Institutional</u>				
Long-Term Monitoring	■	■	■	■
<u>Containment</u>				
Hydraulic Barrier (see ground-water extraction)			■	■
<u>Ground-Water Extraction</u>				
Extraction Well Fields			■	■
Interceptor Trenches			■	■
<u>Ground-Water Pretreatment</u>				
Oil/Water Separator			■	
<u>Primary Ground-Water Treatment</u>				
Air Stripping			■	■
In-Situ Biological Treatment			■	■
<u>Treated Ground-Water Discharge</u>				
Discharge to POTW			■	■
Discharge to Stream			■	■
Aquifer Recharge			■	■
<u>Soil Treatment</u>				
Soil Vapor Extraction			■	■
In-Situ Biological Treatment			■	■
Excavation/Soil Piles		■	■	■
<u>Secondary Treatment</u>				
Carbon Adsorption			■	■
Fume Incineration			■	■
<u>Treated Soil Disposal</u>				
On Site		■		■

SOURCE: ESE.

A no-action alternative was selected for LF01 and SD13; in-situ biological treatment was selected for ST14 and BSS. In in-situ biological treatment, the contaminated groundwater will be extracted, blended with nutrients and microorganisms, and reinjected into the aquifer. The microorganisms utilize the carbon from the contaminants as an energy source, converting it to carbon dioxide and water. The results of the alternatives evaluation are presented in Tables B.4-3 and B.4-4.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THIS PROJECT

Alternatives were selected for the remediation of contaminated groundwater at the East Area of CAFB. In-situ biological treatment was selected for BSS, an air stripping alternative was selected for ST14, and a no-action alternative was selected for LF01 and SD13.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

This FS was limited to the groundwater remediation at the East Area due to limited information available on the soils. Further soil sampling and analysis was recommended to delineate the extent of soil contamination at the East Area of CAFB.

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

6.0 STATUS OF THE PROJECT

A skimmer was installed in August 1991 at SWMU 68 as a Removal Action for the removal of free-product. However, no free-product was detected at the site and the removal of the system was scheduled for April 1993 (USACE, March 1993).

Table B.4-3 REMEDIAL ALTERNATIVES COMPARATIVE EVALUATION MATRIX,
SITE ST14, EAST AREA, CARSWELL AFB, TEXAS

Alternative	Capital Cost (\$ M)	O&M Cost (\$ M)	NPH (\$ M)	Protect. Hith. & Env.	Compliance w/ARARs	Long-Term Effect.	Reduct. of Tox., Mob. & Vol.	Short-Term Effect.	Implement.	Effect. Total	Effect. Quotient
	1	1	1								
1 No Action	0.0264	0.053	0.8442	1	2	3	3	1	2	15	18
4A Air Stripping and Re-injection	0.5106	0.0943	1.3070	2	3	2	2	3	3	33	25
4B Air Stripping and Discharge to San. Sev.	0.4690	0.0918	1.8806	2	3	2	2	3	2	31	16
5 In-situ Biological Treatment	0.3919	0.1002	1.9330	3	3	2	3	2	2	36	19

M = 1,000,000 (e.g., \$2M = \$2,000,000)

SOURCE: ESE.

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Table B.4-4 REMEDIAL ALTERNATIVES COMPARATIVE EVALUATION MATRIX,
SITE BSS, EAST AREA, CARSWELL AFB, TEXAS

Alternative	Capital Cost (\$ M)	O&M Cost (\$ M)	NPW (\$ M)	Protect. Human Hith. & Env.	Compliance w/ARARs	Long-Term Effect.	Reduct. of Tox., Mob. & Vol.	Short-Term Effect.	Implement.	Effect. Total	Effect. Quotient
	1	1	1	3	2	3	3	1	2	15	35
1 No Action	0.0211	0.0266	0.4300	1	1	1	1	2	1	15	35
2A Air Stripping and Re-injection	0.5288	0.0678	1.5704	2	3	2	2	3	3	33	21
2B Air Stripping and Discharge to San. Sev.	0.5160	0.0655	1.5233	2	3	2	2	3	2	31	20
3 In-situ Biological Treatment	0.3592	0.0671	1.3904	3	3	2	3	2	2	36	26

M = 1,000,000 (e.g., \$2M = \$2,000,000)

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No information from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Summary of Permit Sites
AUTHOR: U.S. Army Corps of Engineers
DOCUMENT NUMBER: Not Available
CATEGORY: Not Available
SUBMITTED: May 1991

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to summarize the information of the permit sites located at Carswell Air Force Base. The summary includes history, investigations, findings and recommendations.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

CAFB was established in 1942 and located six miles west of Fort Worth in Tarrant County, Texas. The base operates the Weapons Storage Area (WSA) located five miles west of the base on White Settlement Road.

Wastes have been generated and disposed of at CAFB since 1942. Major industrial operations include maintenance of jet engines, aerospace ground equipment, fuel systems and weapons systems. The generated wastes are primarily oils, lubricants, recoverable fuels, spent solvents, and cleaners.

2.2 PREVIOUS INVESTIGATION RESULTS

The following 20 SWMUs were studied in the IRP investigations (CH2M Hill, 1984; Radian Corporation, 1988a, 1988b, 1990, and 1991; and Maxim Engineers, Inc., 1990) at CAFB:

- SWMU 16 - Waste Accumulation Area,
- SWMU 18 - Fire Training Area 1,
- SWMU 19 - Fire Training Area 2,
- SWMU 20 - Waste Fuel Storage Tank,
- SWMU 21 - Waste Oil Tank,

- SWMU 22 - Landfill 4,
- SWMU 23 - Landfill 5,
- SWMU 24 - Waste Burial Area,
- SWMU 28 - Landfill 1,
- SWMU 32 - Waste Accumulation Area,
- SWMU 35 - Oil/Water Separator,
- SWMU 36 - Waste Accumulation Area,
- SWMU 53 - Storm Water Drainage System,
- SWMU 61 - Waste Accumulation Area,
- SWMU 62 - Landfill 6,
- SWMU 63 - Entomology Dry Well,
- SWMU 64 - French Underdrain System,
- SWMU 65 - Weapons Area Storage Disposal Area,
- SWMU 67 - Bldg. 1340, Oil/Water Separator, and
- SWMU 68 - POL Tank Farm.

The SWMUs are shown in Figure B.5-1. During the investigations, SWMUs 19, 20, and 21 were combined into one site and SWMUs 64 and 67 were combined into another site.

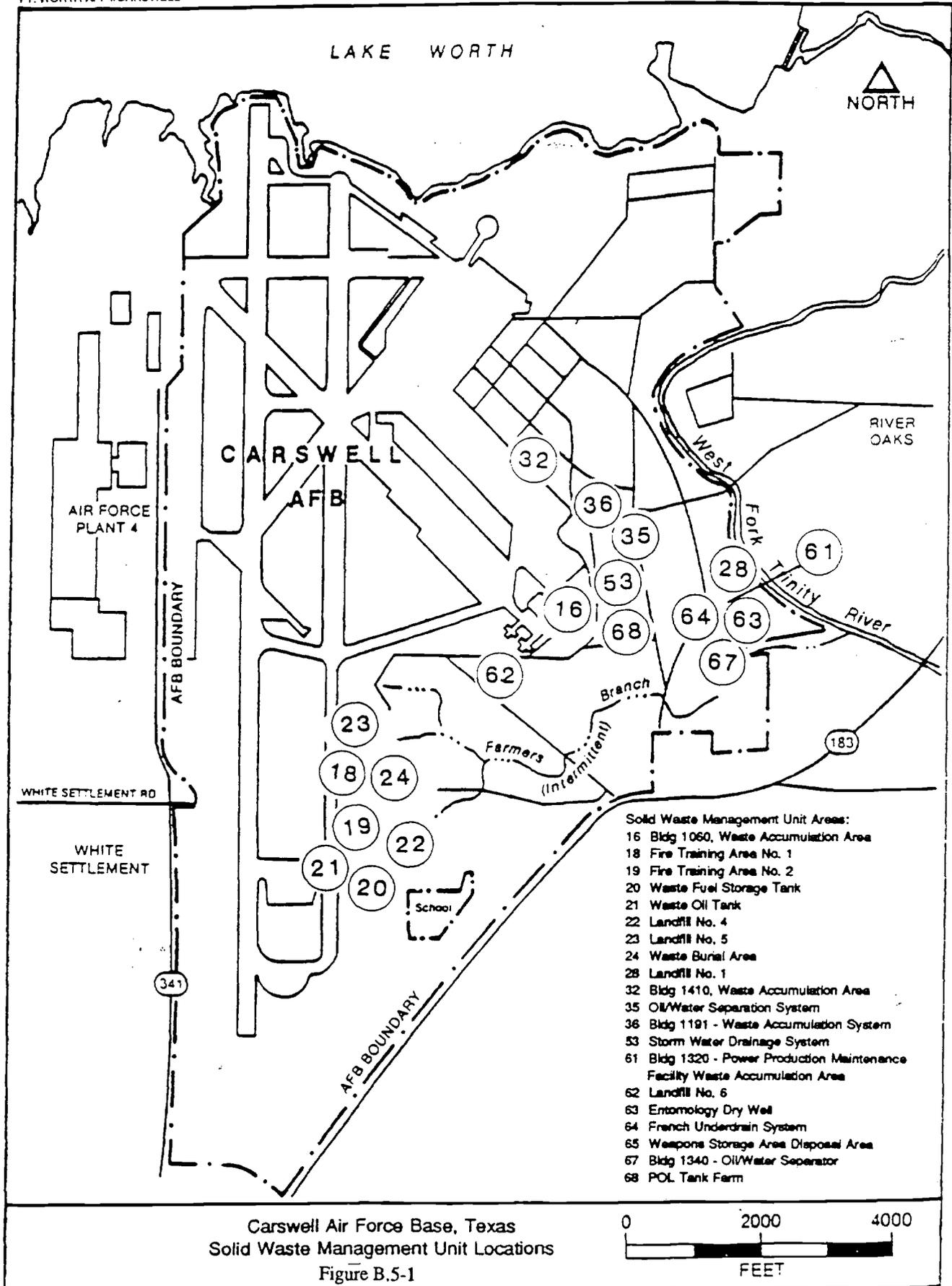
2.3 PROJECT ACCOMPLISHMENTS

In this report, a summary of the history, past investigations and recommendations for the 15 SWMUs were presented.

2.3.1 SWMU 16, Bldg. 1060, WASTE ACCUMULATION AREA

SWMU 16 is a Corrosion Control Shop for the Field Maintenance Squadron. The shop was used for operations like paint stripping, cleaning and painting of small aircraft parts. The waste from the operations was stored in 55-gallon drums on wooden pallets in a fenced area (20 ft x 40 ft) of the asphalt parking lot. The fenced storage area was recently replaced by a curbed, covered accumulation point in the same vicinity.

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This report proposed an investigation for soil contamination at this site based on the evidence of oil stains observed at the site. Since there was no documented history of releases of contaminants to groundwater, no proposals were made for groundwater investigation.

2.3.2 SWMU 18, FDTA-1

This site was used primarily for fire training exercises prior to 1963 and waste oils and contaminated fuels were reportedly used in the exercises. Two monitor wells were installed, samples were collected and analyzed for heavy metals, petroleum hydrocarbons (TPH) and purgeable hydrocarbons. Arsenic, chromium, iron, and lead exceeded the MCLs at the two wells. However, TPH or purgeable hydrocarbons were not detected. A second round of sampling, low levels of trichloroethene (TCE) were detected (max. 0.249 mg/L) in both soils and groundwater at a well located just north of SWMU 23. It was recommended that the two wells should continue monitoring for TCE contamination. However, based on the investigation results, USACE proposed no further action for this site.

2.3.3 SWMU 19 (FDTA-2), SWMU 20 (WASTE FUEL STORAGE TANK), AND SWMU 21 (WASTE OIL TANK)

SWMU 19 was used for fire training exercises prior to 1963, SWMU 20 was used to store clean or contaminated fuel, and SWMU 21 was used for storage of waste oils and solvents. Five boreholes and five upper zone monitor wells were installed at the site (no dates are reported).

Soil and groundwater samples were collected and analyzed for heavy metals, volatile organic compounds, and petroleum hydrocarbons. Selenium (30-70 mg/Kg) was detected in three borings and lead (20 mg/Kg) was detected in one boring. The detected VOCs included 1,1,2,2-tetrachloroethane (1,300 $\mu\text{g/Kg}$), benzene (370 $\mu\text{g/Kg}$), total xylenes (37,000 $\mu\text{g/Kg}$), and ethyl benzene (5,000 $\mu\text{g/Kg}$).

Arsenic, lead, cadmium, chromium, TCE, tetrachloroethene and vinyl chloride levels detected in the groundwater samples exceeded their respective MCLs. The findings of Stage I investigation was confirmed later in Stage 2 investigation. Based on the findings of the investigation, USACE proposed a remedial action plan (RAP), which will be submitted at a later date, for the contaminated soils and groundwater at this site.

2.3.4 SWMU 22 (LANDFILL 4)

SWMU 24 consists of ten acres of land located east of the runway and currently the location of the radar site. The site was used as a landfill from 1956 to 1975. Various materials suspected of being hazardous (waste paints, thinners, and strippers) were reportedly disposed at the site. Soil and groundwater samples were collected and analyzed for metals, VOCs, semi-VOCs.

The soil samples indicated that only silver (1.9 mg/Kg) in two borings. In Round 1 sampling of the groundwater, lead, chromium, barium, and cadmium exceeded the MCLS. TCE was detected (4,200 $\mu\text{g/L}$) and benzene exceeded MCLS in Round 1 and was not detected in Round 2 sampling effort.

USACE identified a TCE plume in the upper zone groundwater during Round 2 sampling in the area of SWMUs 22, 23, and 24. Further investigation was proposed to determine the extent of groundwater contamination at this site. USACE proposed to submit a preliminary RAP at a later date.

2.3.5 SWMU 23 (LANDFILL 5)

This site was used as a landfill and reportedly received all types of flightline wastes and refuse that was regularly burned prior to covering. Silver (1.8 mg/Kg), arsenic (13 mg/Kg), TCE (22 $\mu\text{g/Kg}$), toluene (31 $\mu\text{g/Kg}$), and phthalates (max. 800 $\mu\text{g/Kg}$) were detected in the soil samples. TCE (max. 3,800 $\mu\text{g/L}$), 1,1,1-trichloroethane (67 $\mu\text{g/L}$), vinyl chloride, and trans-1,2-

dichloroethene were detected in the groundwater samples. USACE proposed that the groundwater at this site be treated with the groundwater at SWMU 24 and SWMU 22 and submit a RAP at a later date.

2.3.6 SWMU 24 (WASTE BURIAL SITE)

This site was used for burial of wastes during 1960s and reportedly received solvents, leaded sludge, and possible ordnance materials. Various phthalates (max. 390 $\mu\text{g}/\text{Kg}$) were detected in the soil samples. TCE (max. 11,000 $\mu\text{g}/\text{L}$) and chloroethene (850 $\mu\text{g}/\text{L}$) were detected in the groundwater samples. USACE proposed that the groundwater at this site be treated with the groundwater at SWMU No. 23 and SWMU No. 22 and submit a RAP at a later date.

2.3.7 SWMU 28 (LANDFILL 1)

This site was reported to be original base landfill and was operated during 1940s. No information was available concerning the past waste disposal activities at this site Di-n-butylphthalate (max. 380 $\mu\text{g}/\text{Kg}$) was detected in the soil samples. TCE (max. 0.7 $\mu\text{g}/\text{L}$) and toluene (26 $\mu\text{g}/\text{L}$) were detected in the groundwater samples and metals (barium, cadmium, chromium, and selenium) exceeded the MCLs. USACE recommended continued sampling of soils and groundwater at this site and proposed a RAP for submittal at a later date.

2.3.8 SWMU 32 (BLDG. 1410, WASTE ACCUMULATION AREA)

This site is an outdoor, uncovered, concrete-based container storage area. There is no documented evidence of releases but oil stains were observed during the site inspection conducted in 1989. The unit manages engine oil [600 gallons per year (GPY)], carbon and fingerprint remover (200 GPY), PD-680 Type II (550 GPY) and JP-4 (300 GPY).

USACE proposed investigation of the soils for possible soil contamination at the site; no groundwater investigation was proposed since there was no evidence of groundwater contamination at the site.

2.3.9 SWMU 35 (OIL/WATER SEPARATOR)

The system manages floor washings which consist of wastewater contaminated with fuel, PD-680, anti-freeze, and transmission fluid, and waste oil. Soil stained with oil was observed during a visual site inspection conducted in 1989. USACE proposed investigation of the soils for possible soil contamination at the site; no groundwater investigation was proposed since there was no evidence of groundwater contamination at the site.

2.3.10 SWMU 36 (Bldg. 1191, WASTE ACCUMULATION AREA)

This area is located east of the Building 1191 and holds wastes in 55-gallon drums from Vehicle Maintenance Operations. Evidence of oily material spillage was noted during the visual site inspection. USACE proposed investigation of the soils for possible soil contamination at the site; no groundwater investigation was proposed since there was no evidence of groundwater contamination at the site.

2.3.11 SWMU 53 (STORMWATER DRAINAGE DITCH)

The site receives runoff from the flightline area and receives discharges from the aircraft washracks and the Fuel System Shop (Bldg. 1048). TPH (max. 3,500 mg/Kg), ethylbenzene (750 μ g/Kg), toluene (max. 3,000 μ g/Kg) were detected in soil samples analyzed during the investigation. USACE proposed that RAP will be submitted at a later date for the remediation of soils.

2.3.12 SWMU 61 (Bldg. 1320, WASTE ACCUMULATION AREA)

This area is an outdoor container storage area from wastes generated from inside Bldg. 1320 and holds antifreeze and waste oil in 55-gallon drums. USACE proposed investigation of the soils for possible soil contamination at the site; no groundwater investigation was proposed since there was no evidence of groundwater contamination at the site.

2.3.13 SWMU 62 (LANDFILL 6)

This unit is approximately one acre and was an active landfill site between 1975 and 1978 and was reported that several drums of hydraulic fluid were buried at the site. Since no prior investigation was conducted at the site, USACE recommended sampling of soils and groundwater at this site and proposed a RAP for submittal at a later date.

2.3.14 SWMU 63 (ENTOMOLOGY DRY WELL)

This site is located in the vicinity of new communications building and was a site for disposal of insecticide rinsate between 1965 and 1981. Chlordane (max. 32,000 $\mu\text{g}/\text{Kg}$), 4,4'-DDD (max. 140 $\mu\text{g}/\text{Kg}$), and 4,4'-DDE (29 $\mu\text{g}/\text{Kg}$) were detected in soil samples; no groundwater contamination was detected. During the second round of soil sampling (Maxim), very low concentrations of chlordane (max. 26 $\mu\text{g}/\text{Kg}$) was detected. Based on this evidence, USACE recommended that this site be removed for further action.

2.3.15 SWMU 64 (FRENCH UNDERDRAIN SYSTEM) AND SWMU 67 (BLDG. 1340, OIL/WATER SEPARATOR)

SWMU 64 receives discharge from the oil/water separator (SWMU 67). The separator was not cleaned and reportedly contains hydrocarbon constituents. Selenium (max. 24 mg/Kg) and lead (max. 20 mg/Kg) were detected in soil samples and benzene was detected (max. 120 $\mu\text{g}/\text{L}$) in the surfacewater samples. Stage 2 investigation of the sites indicated that contaminants detected in the stream can be attributed to the oil/water separator. Based on this evidence, USACE recommended that this site be further investigated and proposed to submit a detailed work plan at a later date.

2.3.16 SWMU 65 (WSA)

This site is located six miles west of CAFB and received small quantities of waste cleaners and solvents at a rate of 5-10 GPY. Toluene (max. 49 $\mu\text{g}/\text{Kg}$) was detected in soil samples. USACE reported previous groundwater investigations at

the site and detected TCE (0.0619 mg/Kg) and recommended that feasibility study be completed for the occurrence of TCE in the shallow soil.

2.3.17 SWMU 68 (POL TANK FARM)

In early 1960s, soil contamination was detected and the leaking underground pipes were replaced. No additional leakage of fuel was suspected since 1965. The soil gas investigations revealed that a 1,000 ppm organic compound plume exists in an area of approximately 100 ft by 300 ft in the vicinity of Tanks 1156 and 1157. Also, TPH was detected (max. 8,900 mg/Kg) at the site.

Arsenic, barium, cadmium, and chromium exceeded the MCLs in the groundwater samples. USACE recommended further investigation of the site for groundwater contamination and proposed that a RAP will be submitted at a later date.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THIS PROJECT

A summary of the site history, past investigations, and the recommendations made for 15 SWMUs identified at CAFB was presented.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional site investigations.

5.0 PROJECTS RESULTING FROM THE PROJECT

No information regarding this project was available in the file material.

6.0 STATUS OF THE PROJECT

Intermediate Removal Actions were initiated at SWMUs 24 and 68 (USACE, March 1993). Buried drums and contaminated soil were removed from SWMU 24 between August and October 1991. A skimmer was installed at SWMU 68 in August 1991 for the removal of free-product. No free-product was detected at the site and the system was scheduled for removal in April 1993.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No information from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: 90 % Plans and Specifications - Site 12
AUTHOR: Radian Corporation
DOCUMENT NUMBER: 93
CATEGORY: 02.01
SUBMITTED: June 1991

1.0 REMEDIATION PROJECT OBJECTIVES

The purpose of this project was to prepare bidding information and specifications for the remediation of Site 12 (SWMUS 19, 20, and 21) located at Carswell Air Force Base (CAFB).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

Site 12 is located between the north-south taxiway and the radar facility (Figure B.6-1). The site consists of a fire ring that is gravel-lined with a low earthen berm around its perimeter, was reportedly used for fire burn training exercises in the early 1960s. Two tanks at the site was used for storage of flammable liquids prior to training exercises. An underground tank (approximately 9,500 gallons) was used for storage of waste oils and solvents from the Flightline shops.

2.2 PREVIOUS INVESTIGATION RESULTS

The evaluation was conducted as part of the Installation Restoration Program (IRP) Remedial Investigation/Feasibility Study (RI/FS) Stage 2 investigation at CAFB. Results of soil sampling and analysis during the RI/FS studies indicated that several organic constituents, including benzene, ethylbenzene, xylenes, 2-methylnaphthalene, 4-methylphenol, phenol, and naphthalene occur in the soil beneath Site 12.

Typically, the highest contaminant concentrations occur at the surface, decreasing with depth. However, in boreholes that encountered a sand zone at

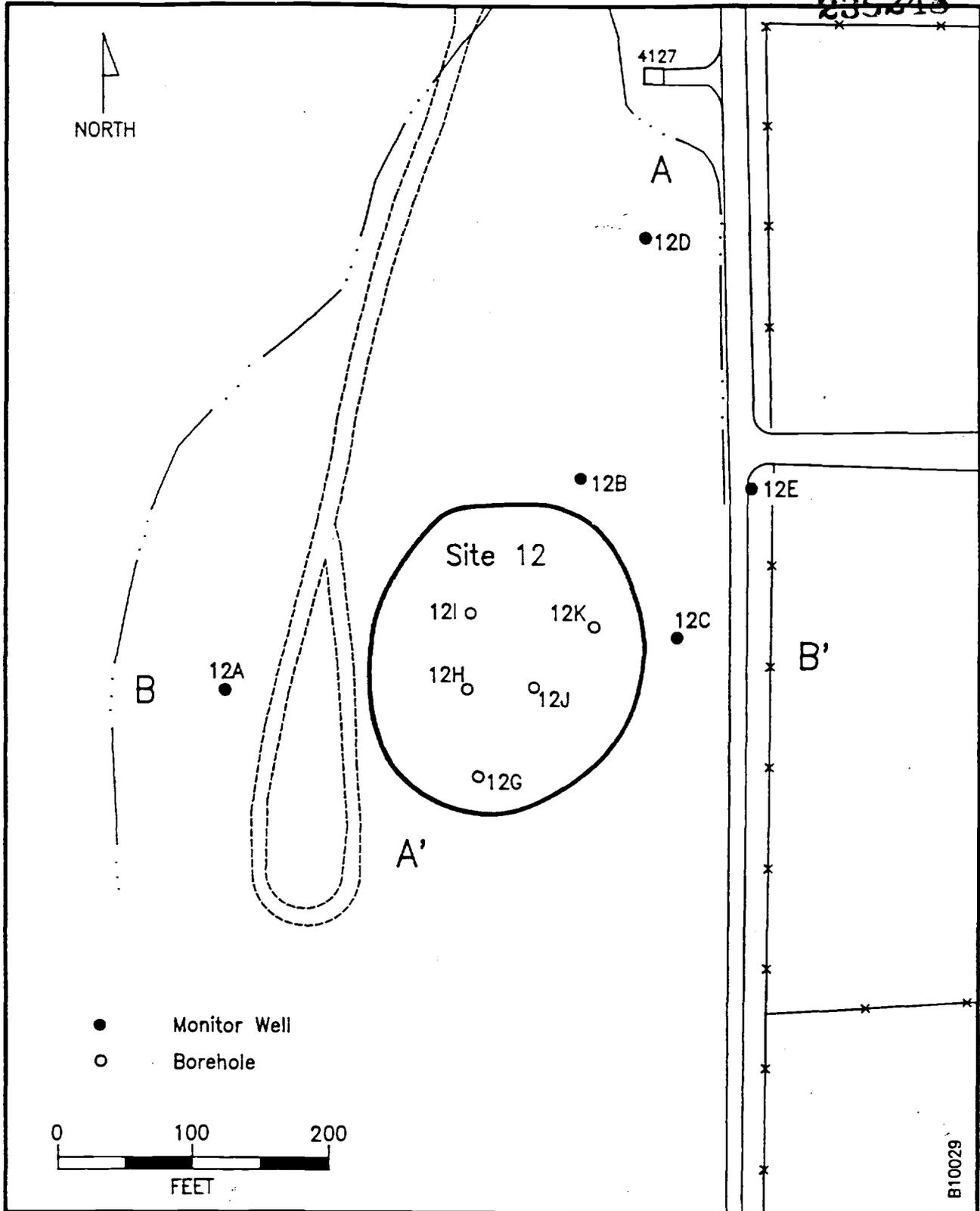


Figure B.6-1 LOCATION MAP FOR FDTA-2 (SITE 12, FT09)
SOURCES: Radian, 1990; ESE.

approximately 24 ft below land surface, the maximum values of contaminants were found in the sand strata above the water table. Petroleum hydrocarbon constituents were also detected in the groundwater (Table B.1-1). Table B.1-2 shows an example of the high concentration of petroleum hydrocarbons, along with ethylbenzene, toluene, 1,1,2,2,-tetrachloroethane, and acetone in milligrams of contaminants per kilograms of soil (mg/kg) in the 19-25 ft soil depth range in monitor well 12H, which lies directly above the groundwater zone.

2.3 PROJECT ACCOMPLISHMENTS

The plans and specifications were prepared for the work with the following principal features:

1. Remove and dispose of the dumpsters, above-ground storage tank, associated underground piping, and all remaining liquids in the tanks and piping,
2. The top two ft of overburden located within the limits of the outer berm shall be removed and disposed of properly. The contractor shall be responsible for obtaining soil samples from this material to determine the level of petroleum contamination. The sample results will govern the method of disposal,
3. The excavated area defined above shall be back-filled with a low-permeability material, and
4. All disturbed areas shall be filled with topsoil and seeded.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

Bidding information and specifications for the remediation of Site 12 were developed.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations for additional studies were made for this site.

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

6.0 STATUS OF THE PROJECT

No information regarding project status was available in the file material.

7.0 SCHEDULE

The work was scheduled for completion within 240 days from the issuance of notice to proceed (NTP) by the base civil engineer.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No data from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: 90% DESIGN COST ESTIMATE - SITE 12
AUTHOR: Radian Corporation
DOCUMENT NUMBER: Not Available
CATEGORY: Not Available
SUBMITTED: June 1991

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this report was to provide cost estimates for the remediation of Site 12 (SWMUs 19, 20, and 21) located at Carswell Air Force Base (CAFB).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

Site 12 is located between the north-south taxiway and the radar facility (Figure B.7-1). The site consists of a fire ring that is gravel-lined with a low earthen berm around its perimeter, was reportedly used for fire burn training exercises in the early 1960s (Figure B.7-1). Two tanks at the site was used for storage of flammable liquids prior to training exercises. An underground tank (approximately 9,500 gallons) was used for storage of waste oils and solvents from the Flightline shops.

2.2 PREVIOUS INVESTIGATION RESULTS

The evaluation was conducted as part of the Installation Restoration Program (IRP) Remedial Investigation/Feasibility Study (RI/FS) Stage 2 investigation at CAFB. Results of soil sampling and analysis during the RI/FS studies indicated that several organic constituents, including benzene, ethylbenzene, xylenes, 2-methylnaphthalene, 4-methylphenol, phenol, and naphthalene occur in the soil beneath Site 12.

Typically, the highest contaminant concentrations occur at the surface, decreasing with depth. However, in boreholes that encountered a sand zone at approximately 24 ft below land surface, the maximum values of contaminants

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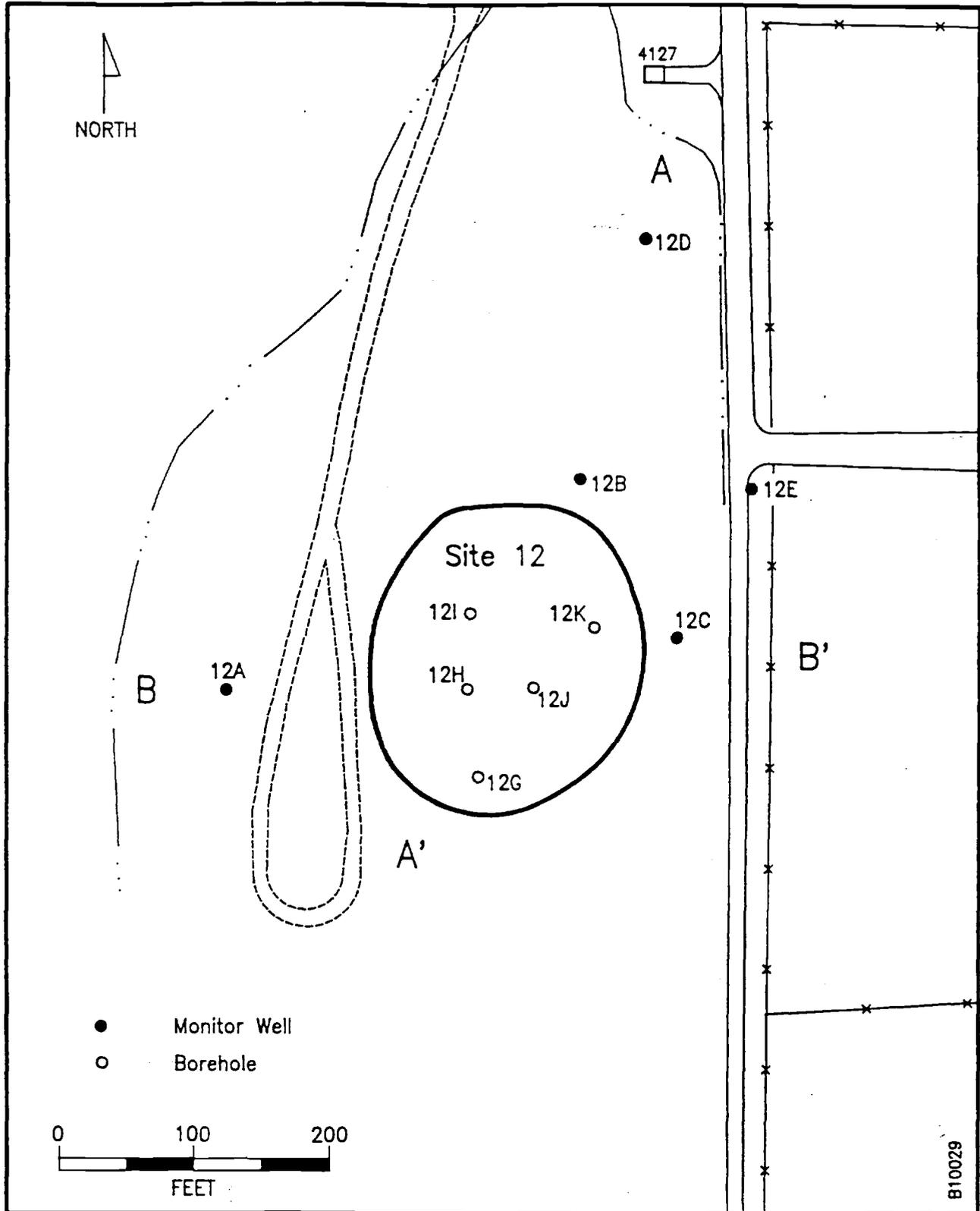


Figure B.7-1 LOCATION MAP FOR FDTA-2 (SITE 12, FT09)
SOURCES: Radian, 1990; ESE.

were found in the sand strata above the water table. Petroleum hydrocarbon constituents were also detected in the groundwater (Table B.1-1). Table B.1-2 shows an example of the high concentration of petroleum hydrocarbons, along with ethylbenzene, toluene, 1,1,2,2,-tetrachloroethane, and acetone in milligrams of contaminants per kilograms of soil (mg/kg) in the 19-25 ft soil depth range in monitor well 12H, which lies directly above the groundwater zone.

2.3 PROJECT ACCOMPLISHMENTS

This report presented the design cost estimates for the following three alternatives for soil remediation at Site 12:

Alternative A: If the soil results indicate a non-detectable level of TPH and a non-detectable level of BTEX, the contractor shall excavate the soil pile and dispose or recycle the material outside the limits of Carswell AFB in a manner that complies with all local and state regulations.

Alternative B: If the soil sample results indicate TPH or BTEX levels between detectable levels and the Texas Department of Health (TDH) limits for disposal in a Class II facility, the contractor shall dispose of the soil pile in a TDH permitted Class II disposal facility designated by the contractor in the Materials Handling Plan. The contractor shall abide by all regulations set forth by the TDH for disposal of petroleum-contaminated soil. The contractor shall also be responsible for obtaining any additional samples required by the disposal facility or the TDH before removing the soil off-site.

Alternative C: If the soil sample results are greater than the TDH's limits for TPH and BTEX for disposal in a Class II landfill, the contractor shall dispose of the contaminated soil in a Class,

(sic) non-hazardous, TDH permitted facility designated in the Materials Handling Plan. The contractor shall abide by all regulations set forth by the TDH for disposal of petroleum contaminated soil. The contractor shall be responsible for obtaining any additional samples required by the disposal facility or the TDH before removing the soil off-site.

The excavation volume calculations are presented in Table B.7-1. The work performed includes the following principal features:

1. Remove and dispose of the dumpsters, above-ground storage tank, and associated underground piping,
2. The top two feet of overburden located within the limits of the outer berm shall be removed and disposed of properly. The contractor shall be responsible for obtaining soil samples from this material to determine the level of petroleum contamination. The sample results will govern the method of disposal,
3. The excavated area defined above shall be back-filled with a low-permeability material, and
4. All disturbed areas shall be filled with topsoil and seeded.

The costs include furnishing of all equipment, labor, and materials to perform work in strict accordance with the specifications, schedules, and drawings.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

The design cost estimated for the remediation of soils at Site 12 were developed.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional studies at this site.

RADIAN
CORPORATION

GENERAL COMPUTATION SHEET

CLIENT NAME _____

PROJECT NAME _____

CALCULATION SET		
Prelim.		
Final		
Sheet 12 Of		
Charge #		
Rev.	Comp. By	Chk'd By
	Date	Date
	Date	Date

Excavation Volume Calculations

Volume of Material (Area 1)

$$V_1 = \frac{\pi(140)^2}{4} (2' \text{ deep}) (1.3 \text{ fluff})$$

$$= \underline{40,024 \text{ cf}} \quad \underline{\approx 1,483 \text{ cy}}$$

Vol (Areas 2 + 3)

$$\text{Total Vol.} - \text{Vol. 1} = \text{Vol. 2+3}$$

$$\left[\frac{\pi(280 \text{ max})^2}{4} - \frac{\pi(140)^2}{4} \right] (2') (1.3)$$

$$= (46,182 \text{ sf}) (2') (1.3)$$

$$= \underline{120,073 \text{ cf}} \quad \underline{\approx 4,448 \text{ cy}}$$

$$\text{Vol (Area 2)} = \frac{1}{3} (\text{Vol of Areas 2+3})$$

$$= \frac{1}{3} (120,073)$$

$$= \underline{40,024 \text{ cf}} \quad \underline{\approx 1,483 \text{ cy}}$$

$$\text{Vol (Area 3)} = \frac{2}{3} (\text{Vol of Areas 2+3})$$

$$= \frac{2}{3} (120,073)$$

$$= \underline{80,048 \text{ cf}} \quad \underline{\approx 2,965 \text{ cy}}$$

$$\text{Total Vol} = \underline{140,096 \text{ cf}} \quad \underline{\approx 5,930 \text{ cy}}$$

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

6.0 STATUS OF THE PROJECT

No information regarding project status was available in the file material.

7.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No data from this project is in IRPIMS.

8.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: 90 % Plans and Specifications - Site SD10
AUTHOR: Radian Corporation
DOCUMENT NUMBER: Not Available
CATEGORY: Not Available
SUBMITTED: June 1991

1.0 REMEDIATION PROJECT OBJECTIVES

The purpose of this project was to prepare bidding information and specifications for the remediation of Site SD10 (SWMU 53) located at Carswell Air Force Base (CAFB) (Figure B.8-1).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

The site receives runoff from the flightline area and receives discharges from the aircraft washracks and the Fuel System Shop (Bldg. 1048).

2.2 PREVIOUS INVESTIGATION RESULTS

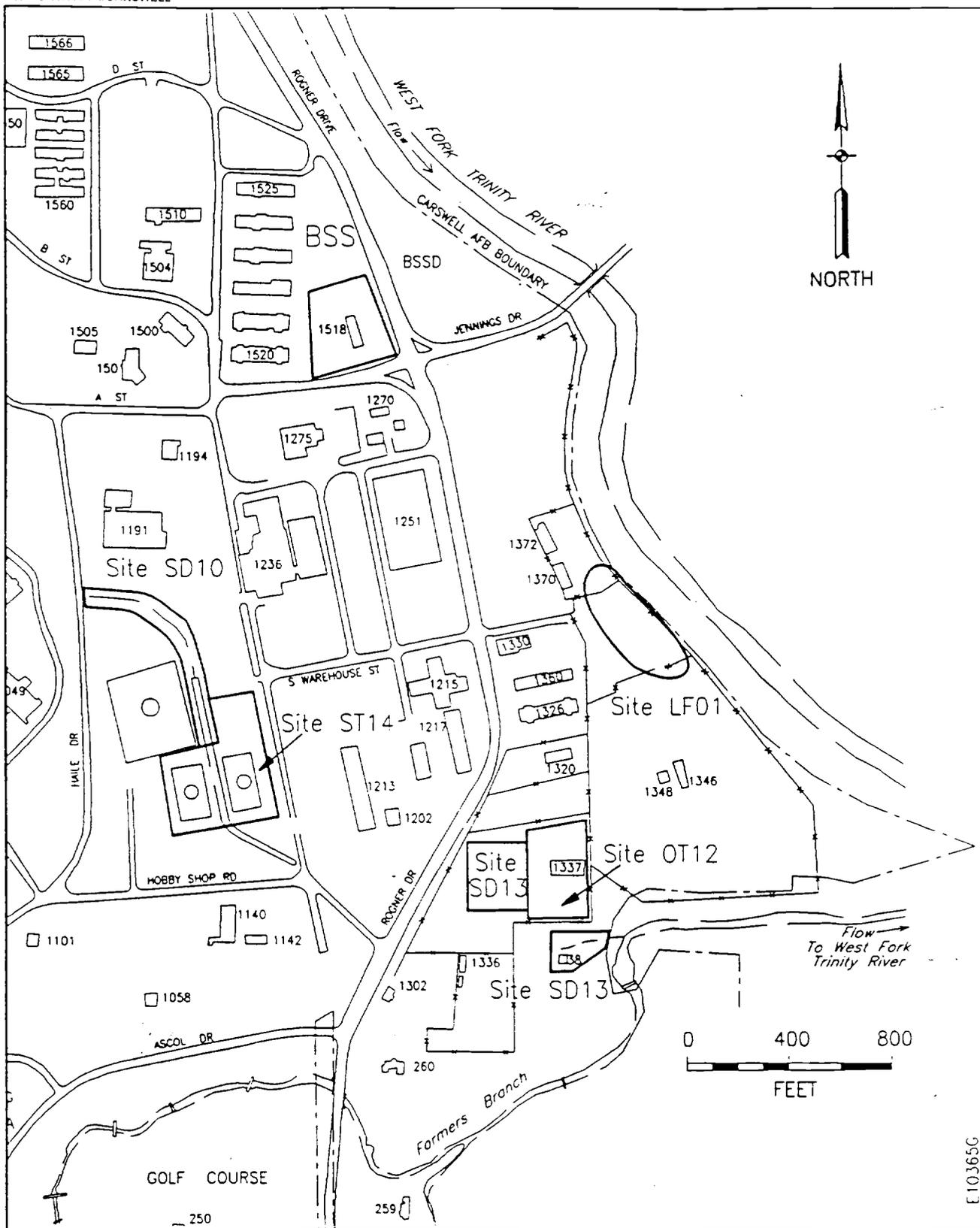
Total petroleum hydrocarbons (TPH) (max. 3,500 mg/Kg), ethylbenzene (750 μ g/Kg), toluene (max. 3,000 μ g/Kg) were detected in soil samples analyzed during the investigation.

2.3 PROJECT ACCOMPLISHMENTS

The plans and specifications were prepared for the work with the following principal features:

1. Remove and dispose of four transit pipes,
2. Remove and dispose of miscellaneous structures: includes wooden trestle, concrete structures, asbestos-containing material, and miscellaneous utility piping,
3. Analyze, excavate, remove and dispose of contaminated soils from ditch,

FT. WORTH AFB/CARSWELL



E10365C

Figure B.8-1 Location of East Area IRP Sites, Carswell AFB, Texas

4. Perform verification and disposal sampling,
5. Install a 167-foot long, 60-inch diameter RCP culvert with headwall: includes backfill, compaction and grading,
6. Install a concrete lining and drop/transition structure for 433-foot channel: includes backfill, compaction, and grading, and
7. All disturbed areas shall be filled with topsoil and seeded.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

Bidding information and specifications were developed as a result of this project (Table B.8-1).

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations for additional studies were made for this site.

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

6.0 STATUS OF THE PROJECT

No information regarding project status was available in the file material.

7.0 SCHEDULE

The work was scheduled for completion within 240 days from the issuance of notice to proceed (NTP) by the base civil engineer.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No data from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

Table B.8-1

REMEDIATION OF THE FLIGHTLINE DRAINAGE DITCH
(SITE SD10)
CARSWELL AIR FORCE BASE, TEXAS

BIDDING INFORMATION AND SPECIFICATIONS

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
DIVISION 1--ZERO ACCIDENTS	
01100 Special Clauses	01100-1
01200 Warranty of Construction	01200-1
01300 Environment Protection	01300-1
01400 Special Safety Requirements	01400-1
01500 Summary of Work	01500-1
01550 Measurement and Payment	01550-1
01600 Pre-Construction and Pre-Work Conference	01600-1
01630 Progress Meetings and Reports	01630-1
01640 Project Schedules	01640-1
01650 Project Photographs	01650-1
01700 Technical Provisions - Additional Safety Requirements	01700-1
01710 Temporary Utilities and Control	01710-1
01720 Spill Control	01720-1
01730 Dust Control	01730-1
01750 Field Offices and Sheds	01750-1
01800 Project Record Documents	01800-1
01850 Definitions	01850-1
01900 Special Project Procedures	01900-1
01950 Submittals	01950-1
DIVISION 2--SITE WORK	
02000 Site Preparation	02000-1
02050 Demolition	02050-1
02060 Contaminated Soil Removal	02060-1
02080 Asbestos Removal and Disposal	02080-1
02120 Off-Site Transportation	02120-1
02150 Off-Site Disposal	02150-1
02221 Excavation, Trenching, and Backfilling for Drainage Systems	02221-1
02430 Storm-Drainage System	02430-1
02480 Seeding	02480-1
02700 Site Maintenance	02700-1
02750 Demobilization	02750-1
03301 Concrete for Building Construction (Minor Requirements)	03301-1

TITLE: 90 % Design Cost Estimates - Site SD10
AUTHOR: Radian Corporation
DOCUMENT NUMBER: Not Available
CATEGORY: Not Available
SUBMITTED: June 1991

1.0 REMEDIATION PROJECT OBJECTIVES

The purpose of this project was to prepare bidding information and specifications for the remediation of Site SD10 (SWMU 53) located at Carswell Air Force Base (CAFB) (Figure B.9-1).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

The site receives runoff from the flightline area and receives discharges from the aircraft washracks and the Fuel System Shop (Bldg. 1048).

2.2 PREVIOUS INVESTIGATION RESULTS

Total petroleum hydrocarbons (TPH) (max. 3,500 mg/Kg), ethylbenzene (750 $\mu\text{g/Kg}$), toluene (max. 3,000 $\mu\text{g/Kg}$) were detected in soil samples analyzed during the investigation.

FT. WORTH AFB/CARSWELL

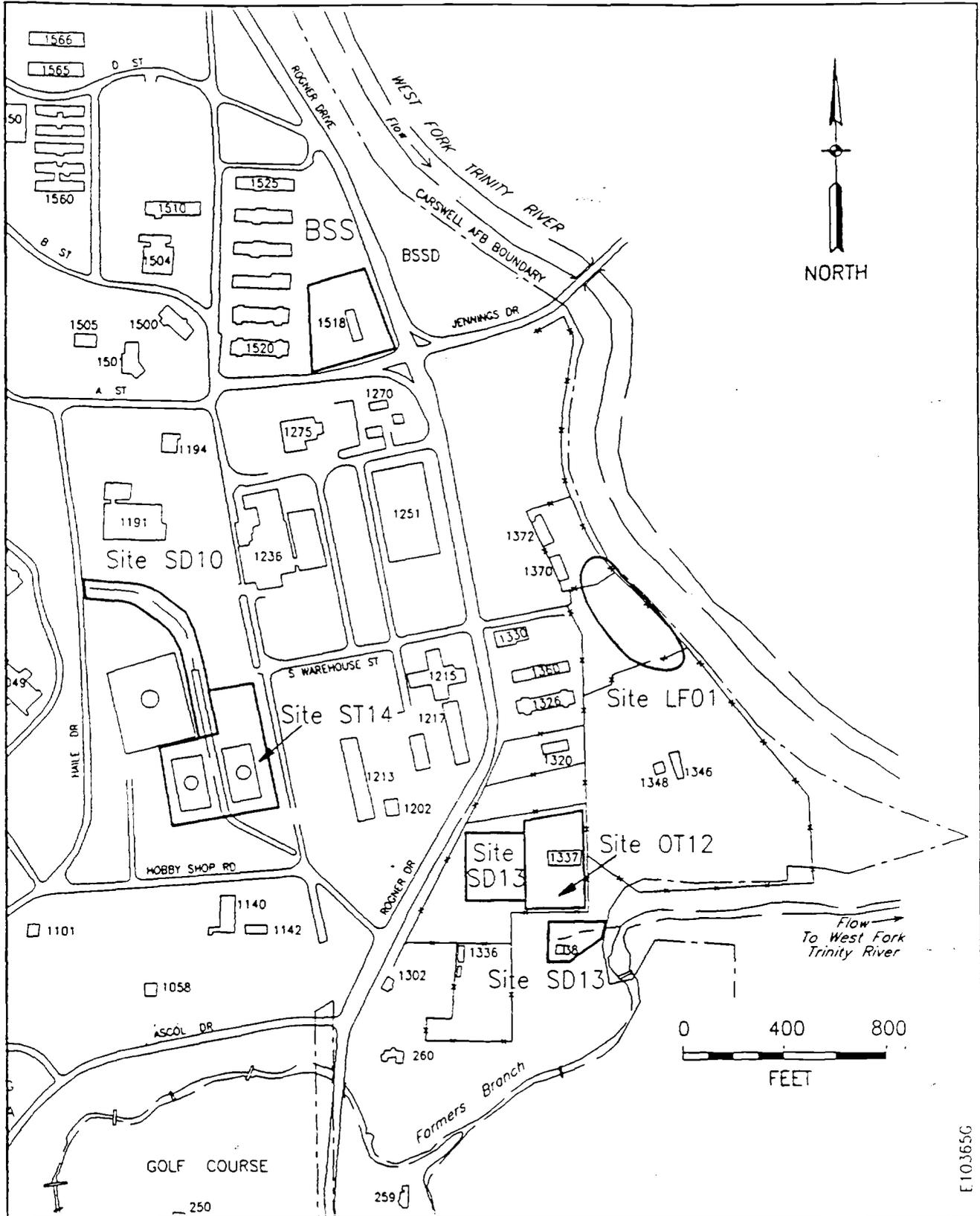


Figure B.9-1 Location of East Area IRP Sites, Carswell AFB, Texas

E10365G

2.3 PROJECT ACCOMPLISHMENTS

A cost estimate for the remediation of the Flightline Drainage Ditch was prepared based on the assumption that all contaminated soils will be disposed offsite in a Class I landfill.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THE PROJECT

Bid estimate data for SD10 was developed in the document.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations for additional studies were made for this site.

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

6.0 STATUS OF THE PROJECT

No information regarding project status was available in the file material.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No data from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Preliminary Remedial Action Plans - SWMUs 16, 22, 23, 24, 32, 35, 36, 61, and 68
AUTHOR: U.S. Army Corps of Engineers
DOCUMENT NUMBER: 69
CATEGORY: Not Available
SUBMITTED: September 1991

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to prepare preliminary Remedial Action Plans (RAP), including history, investigations, findings, and recommendations for the following Solid Waste Management Units (SWMUs):

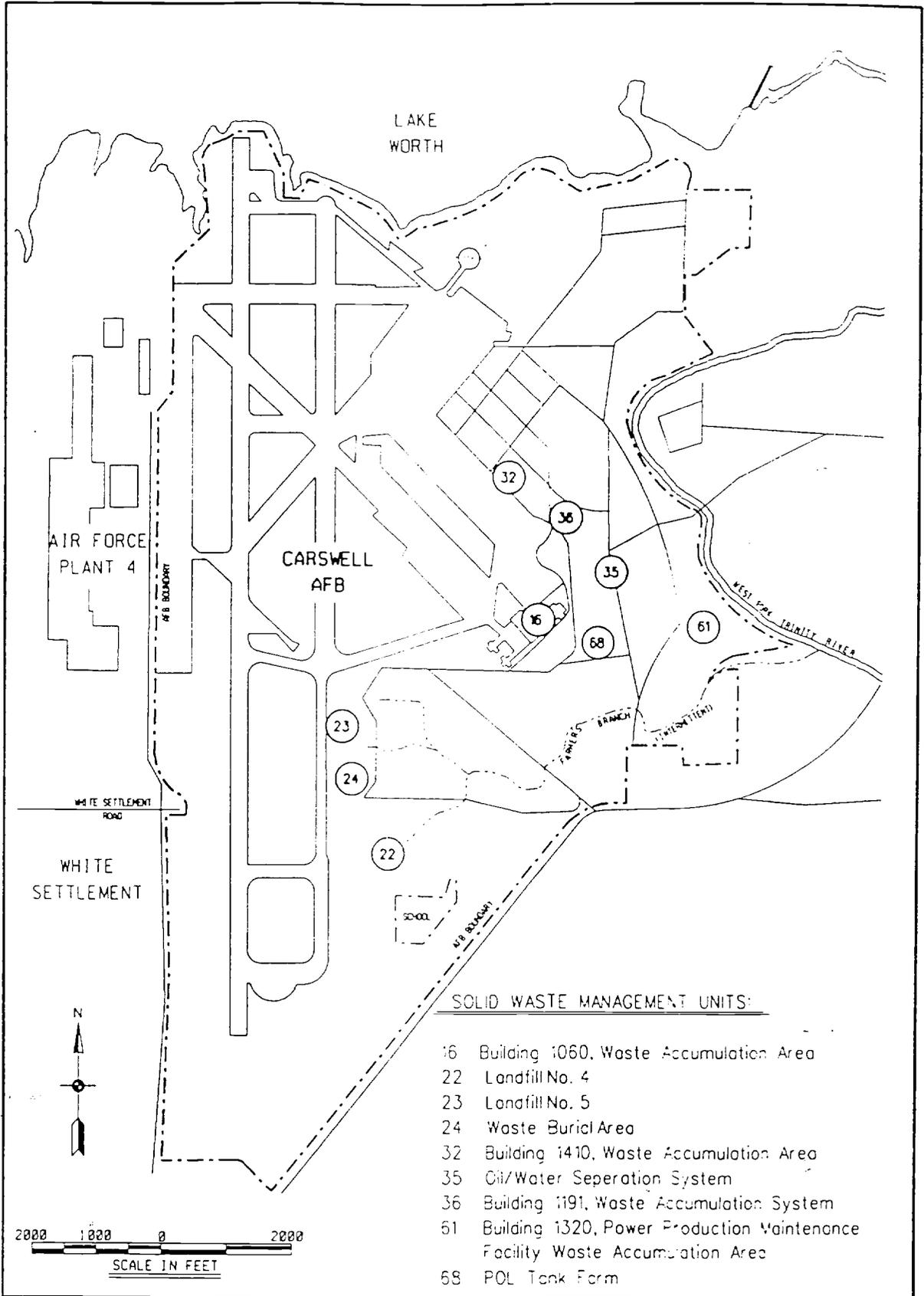
- SWMU 16: Bldg. 1060, Waste Accumulation Area,
- SWMU 22: Landfill 4,
- SWMU 23: Landfill 5,
- SWMU 24: Waste Burial Area,
- SWMU 32: Bldg. 1410, Waste Accumulation Area,
- SWMU 35: Oil/Water Separator,
- SWMU 36: Bldg. 1191, Waste Accumulation Area,
- SWMU 61: Bldg. 1320, Waste Accumulation Area, and
- SWMU 68: POL Tank Farm.

The SWMUs are shown in Figure B.10-1.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

CAFB was established in 1942 and located six miles west of Fort Worth in Tarrant County, Texas. The base operates the Weapons Storage Area (WSA) located five miles west of the base on White Settlement Road.



CARSWELL AIR FORCE BASE, TEXAS
SOLID WASTE MANAGEMENT UNIT LOCATIONS

Figure B.10-1

SOURCES: USACE, 1991; ESE.

Wastes have been generated and disposed of at CAFB since 1942. Major industrial operations include maintenance of jet engines, aerospace ground equipment, fuel systems and weapons systems. The generated wastes are primarily oils, lubricants, recoverable fuels, spent solvents, and cleaners.

2.2 PREVIOUS INVESTIGATION RESULTS

A Phase I records Search was completed in February 1984 by CH2M Hill, Inc. Phase II Confirmation/Quantification, Stage 1 was completed in October 1986 and Phase II Confirmation/Quantification Stage 2 Draft were completed in October 1988 by Radian.

A site summary report (USACE, May 1991) for all the SWMUs at CAFB and a draft Feasibility Study for SWMUs 22, 23, 24, and 68 (Radian, May 1991) were prepared.

2.3 PROJECT ACCOMPLISHMENTS

This report was prepared based on the information presented in the previous IRP investigations (CH2M Hill, 1984; Radian Corporation, 1988, 1990, and 1991a, 1991b, 1991c, and 1991d) conducted at the CAFB.

2.3.1 SWMU 16, Bldg. 1060, WASTE ACCUMULATION AREA

SWMU 16 is a Corrosion Control Shop for the Field Maintenance Squadron. The shop was used for operations like paint stripping, cleaning and painting of small aircraft parts. The waste from the operations was stored in 55-gallon drums on wooden pallets in a fenced area (20 ft x 40 ft) of the asphalt parking lot. The fenced storage area was recently replaced by a curbed, covered accumulation point in the same vicinity.

This report proposed an investigation for soil contamination at this site based on the evidence of a stain observed at the site. Since there was no documented

history of releases of contaminants to groundwater, no proposals were made for groundwater investigation.

2.3.2 SWMU 22 (Landfill 4)

SWMU 22 consists of ten acres of land located east of the runway and currently the location of the radar site. The site was used as a landfill from 1956 to 1975. Various materials suspected of being hazardous (waste paints, thinners, and strippers) were reportedly disposed at the site. Soil and groundwater samples were collected and analyzed for metals, VOCs, semi-VOCs.

The soil samples indicated that only silver (1.9 mg/Kg) in two borings. In Round 1 sampling of the groundwater, lead, chromium, barium, and cadmium exceeded the MCLS. TCE was detected (4,200 $\mu\text{g/L}$) and benzene exceeded MCLS in Round 1 and was not detected in Round 2 sampling effort.

SWMUs 22, 23, and 24 were proposed to be treated as a combined site in dealing with the problem of TCE in groundwater and proposed Round 2 sampling in the area of combined site to determine the extent of groundwater contamination.

Installing a slurry wall to prevent the migration of contamination, placing a multi-media cap to prevent infiltration, and treating the groundwater by air stripping was recommended as a remedial alternative at the site. The details of the treatment alternative were presented in the Draft Feasibility Study for the Flightline Area (Radian, May 1991).

2.3.3 SWMU 23 (LANDFILL 5)

This site was used as a landfill and reportedly received all types of flightline wastes and refuse, and was regularly burned prior to covering. Silver (1.8 mg/Kg), arsenic (13 mg/Kg), TCE (22 $\mu\text{g/Kg}$), toluene (31 $\mu\text{g/Kg}$), and phthalates (max. 800 $\mu\text{g/Kg}$) were detected in the soil samples. TCE (max.

3,800 $\mu\text{g/L}$), 1,1,1-trichloroethane (67 $\mu\text{g/L}$), vinyl chloride, and trans-1,2-dichloroethene were detected in the groundwater samples.

SWMUs 22, 23, and 24 were proposed to be treated as a combined site in dealing with the problem of TCE in groundwater and proposed Round 2 sampling in the area of combined site to determine the extent of groundwater contamination.

Installing a slurry wall to prevent the migration of contamination, placing a multi-media cap to prevent infiltration, and treating the groundwater by air stripping was recommended as a remedial alternative at the site. The details of the treatment alternative were presented in the Draft Feasibility Study for the Flightline Area (Radian, May 1991).

2.3.4 SWMU 24 (WASTE BURIAL SITE)

This site was used for burial of wastes during 1960s and reportedly received solvents, leaded sludge, and possible ordnance materials. Various phthalates (max. 390 $\mu\text{g/Kg}$) were detected in the soil samples. TCE (max. 11,000 $\mu\text{g/L}$) and chloroethene (850 $\mu\text{g/L}$) were detected in the groundwater samples.

SWMUs 22, 23, and 24 were proposed to be treated as a combined site in dealing with the problem of TCE in groundwater and proposed Round 2 sampling in the area of combined site to determine the extent of groundwater contamination.

Installing a slurry wall to prevent the migration of contamination, placing a multi-media cap to prevent infiltration, and treating the groundwater by air stripping was recommended as a remedial alternative at the site. The details of the treatment alternative were presented in the Draft Feasibility Study for the Flightline Area (Radian, May 1991).

2.3.5 SWMU 32 (BLDG. 1410, WASTE ACCUMULATION AREA)

This site is an outdoor, uncovered, concrete-based container storage area. There is no documented evidence of releases but oil stains were observed during the site inspection conducted in 1989. The unit manages engine oil (600 gallons per year (GPY)), carbon and fingerprint remover (200 GPY), PD-680 Type II (550 GPY) and JP-4 (300 GPY).

Soil sampling and analysis was proposed as part of investigation at the site. There was no documented history of releases of contamination to groundwater; therefore, groundwater was not recommended for further investigation.

2.3.6 SWMU 35 (OIL/WATER SEPARATION SYSTEM)

The system manages floor washings which consist of wastewater contaminated with fuel, PD-680, anti-freeze, and transmission fluid, and waste oil. Soil stained with oil was observed during a visual site inspection conducted in 1989.

Soil sampling and analysis was proposed as part of investigation at the site. There was no documented history of releases of contamination to groundwater; therefore, groundwater was not recommended for further investigation.

2.3.7 SWMU 36 (BLDG. 1191, WASTE ACCUMULATION AREA)

This area is located east of the Building 1191 and holds wastes in 55-gallon drums from Vehicle Maintenance Operations. Evidence of oily material spillage was noted during the visual site inspection.

Soil sampling and analysis was proposed as part of investigation at the site. There was no documented history of releases of contamination to groundwater; therefore, groundwater was not recommended for further investigation.

2.3.8 SWMU 61 (Bldg. 1320, WASTE ACCUMULATION AREA)

This area is an outdoor container storage area from wastes generated from inside Bldg. 1320 and holds antifreeze and waste oil in 55-gallon drums.

Soil sampling and analysis was proposed as part of investigation at the site. There was no documented history of releases of contamination to groundwater; therefore, groundwater was not recommended for further investigation.

2.3.9 SWMU 68 (POL TANK FARM)

In early 1960s, soil contamination was detected and the leaking underground pipes were replaced. No additional leakage of fuel was suspected since 1965. The soil gas investigations revealed that a 1,000 ppm organic compound plume exists in an area of approximately 100 ft by 300 ft in the vicinity of Tanks 1156 and 1157. Also, TPH was detected (max. 8,900 mg/Kg) at the site.

Arsenic, barium, cadmium, and chromium exceeded the MCLs in the groundwater samples. USACE recommended further investigation of the site for groundwater contamination.

Treatment of groundwater by air stripping was recommended as a remedial alternative at the site. The details of the treatment alternative were presented in the Draft Feasibility Study for the Flightline Area (Radian, May 1991).

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THIS PROJECT

Further investigation was proposed at SWMUs 16, 32, 35, 36, and 61, and treatment of groundwater by air stripping was recommended at SWMUs 22, 23, 24, and 68. In addition, installing a slurry wall and placing a multi-media cap over the contaminated areas was recommended at SWMUs 22, 23, and 24.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional site investigations.

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

6.0 STATUS OF THE PROJECT

Intermediate Removal Actions were initiated at SWMUs 24 and 68 (USACE, March 1993). Buried drums and contaminated soil were removed from SWMU 24 between August and October 1991. A skimmer was installed at SWMU 68 in August 1991 for the removal of free-product. No free-product was detected at the site and the system was scheduled for removal in April 1993.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No information from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

In the draft Feasibility Study report on the East Area (Radian, May 1991), the cost-selected alternative for SWMU No. 68 was incorrectly stated as In-situ Biological treatment.

TITLE: Final Feasibility Study for the Flightline Area
AUTHOR: Radian Corporation
DOCUMENT NUMBER: NA
CATEGORY: NA
SUBMITTED: October 1991

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to conduct a feasibility study for the remediation of groundwater at the following three sites located in the Flightline Area (Figure B.11-1) of Carswell Air Force Base (CAFB):

- 1) Site LF04 - Landfill 4 (SWMU 22),
- 2) Site LF05 - Landfill 5 (SWMU 23), and
- 3) Site WP07 - Waste Burial Area (SWMU 24).

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

CAFB was established in 1942 and located six miles west of Fort Worth in Tarrant County, Texas. The base operates the Weapons Storage Area (WSA) located five miles west of the base on White Settlement Road.

Wastes have been generated and disposed of at CAFB since 1942. Major industrial operations include maintenance of jet engines, aerospace ground equipment, fuel systems and weapons systems. The generated wastes are primarily oils, lubricants, recoverable fuels, spent solvents, and cleaners.

Phase I and Phase II of the Installation Restoration Program (IRP) at CAFB was completed. Phase I records Search was completed in February 1984 by CH2M Hill, Inc. Phase II Confirmation/Quantification, Stage 1 was completed in October 1986 by Radian Corporation and Phase II Confirmation/Quantification Stage 2 Draft was completed in October 1988 by Radian Corporation (Radian).

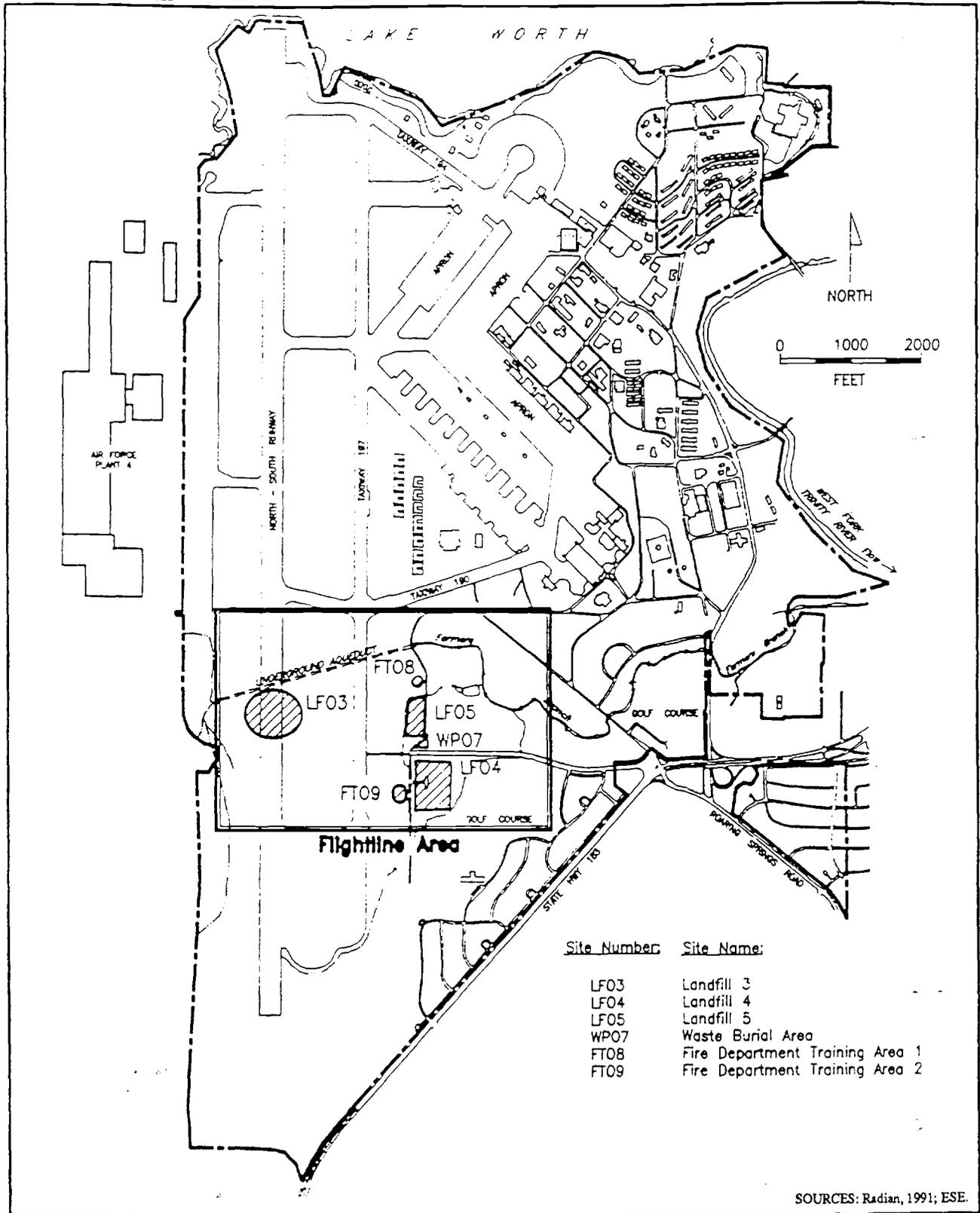


Figure B.11-1 Location of Flightline Area IRP Sites, Carswell AFB, Texas

2.2 PREVIOUS INVESTIGATION RESULTS

The Phase I Records Search was completed in February 1984 by CH2M Hill, Inc. Phase II Confirmation/Quantification, Stage 1 was completed in October 1986 and Phase II Confirmation/Quantification Stage 2 Draft was completed in October 1988 by Radian.

A site summary report (USACE, May 1991) for all the SWMUs at CAFB, a draft Feasibility Study (FS) and a RAP for SWMUs 22, 23, 24, and 68 (Radian, May 1991; September, 1991) were prepared.

Investigations performed at LF03 and FT08 provided no evidence of contamination at these two sites and No Further Action Decision Documents (NFADDs) were prepared for each of these sites (Radian 1990a, b). Documented contamination associated with FT09 was also addressed in a separate NFADD (Radian 1990c) in which the recommended remedial action was described.

Trichloroethene (TCE), vinyl chloride, tetrachloroethene (PCE), and the cis- and trans- isomers of 1,2-dichloroethene (1,2-DCE) were the main contaminants detected in the groundwater and surfacewater at LF04, LF05, and WP07. The sources of these contaminants was not fully detected but the occurrence of these compounds was documented in the upgradient wells located in the Air Force Plant No. 4 (Plant 4) property. Sites LF04, LF05, and WP07 were also suspected to be the source of contamination of groundwater at CAFB. The volatile organic compounds (VOCs) detected in groundwater and surfacewater samples collected from the Flightline Area are shown in Tables B.11-1 and B.11-2, respectively. Also, iso-concentration contour maps for TCE, vinyl chloride, and 1,2-DCE are shown in Figures B.11-2, B.11-3, and B.11-4, respectively.

2.3 PROJECT ACCOMPLISHMENTS

This FS was prepared for the Flightline Area sites LF04, LF05, and WP07. The report was divided into the following three sections: 1) screening of remedial

Table B.11-1 SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN UPPER ZONE GROUND-WATER SAMPLES FROM THE FLIGHTLINE AREA, CARSWELL AFB, TEXAS (SPRING 1990)

Analytical Parameter	EPA Standards or Proposed Standards (µg/L)	Range of Detection Limits	Range of Concentrations of Constituents Detected	Analyses for Constituent (No. of Wells)	Total Number of Samples With Constituent Detected and Second Column Confirmation (No. of Wells)	Exceeding EPA MCL/PMCL (No. of Wells)
Purgeable Halocarbons (601) µg/L						
1,1,1-Trichloroethane	200 (M)	0.2-50	0.37-0.70	74 (35 + 2 dup)	3 (3)	0
1,1,2,2-tetrachloroethane		0.15-38	ND	74 (35)	0	0
1,1,2-Trichloroethane		0.2-50	ND	74 (35)	0	0
1,1-Dichloroethane	7 (M)	0.5-120	1.1	74 (35)	1 (1)	0
1,1-Dichloroethene		0.2-50	1.3-1.5	74 (35)	2 (2)	0
1,2-Dichlorobenzene	5 (M)	0.5-120	ND	74 (35)	0	0
1,2-Dichloroethane	5 (M)	0.1-25	ND	74 (35)	0	0
1,2-Dichloropropane	5 (M)	0.1-25	ND	74 (35)	0	0
1,3-Dichlorobenzene		0.32-80	ND	74 (35)	0	0
1,4-Dichlorobenzene	75 (M)	0.24-60	9.6	74 (35)	1 (1)	0
2-Chloroethylvinyl ether		0.24-60	ND	74 (35)	0	0
Bromodichloromethane		0.5-130	ND	74 (35)	0	0
Bromoform		0.5-130	ND	74 (35)	0	0
Bromomethane		1.2-300	ND	74 (35)	0	0
Carbon tetrachloride	5 (M)	0.12-30	ND	74 (35)	0	0
Chlorobenzene		0.25-63	2.3	74 (35)	1 (1)	0
Chloroethane		0.52-130	1.8	74 (35)	1 (1)	0
Chloroform		0.1-25	ND	74 (35)	0	0
Chloromethane		0.3-75	ND	74 (35)	0	0
Dibromochloromethane		0.2-50	ND	74 (35)	0	0
Methylene chloride		0.4-100	64-90	74 (35)	2 (2)	0
Tetrachloroethene	5 (P)	0.1-25	0.55-30	74 (35)	6 (6)	3 (3)
Trichloroethene	5 (M)	0.2-50	0.56-4400	74 (35)	32 (3)	29 (27)
Trichlorofluoromethane		0.2-50	ND	74 (35)	0	0
Vinyl chloride	2 (M)	0.2-50	6.2-170	74 (35)	8 (7)	8 (7)
cis-1,2-Dichloroethene	70 (P)	0.2-50	0.37-730	74 (35)	32 (30)	23 (22)
cis-1,3-Dichloropropene		0.2-50	ND	74 (35)	0	0
trans-1,2-Dichloroethene		0.2-50	0.72-44	74 (35)	6 (6)	0
trans-1,3-Dichloropropene	100 (P)	0.34-85	ND	74 (35)	0	0

*EPA standards are designated: M - Maximum Contaminant Level (MCL) and P - Proposed Maximum Contaminant Level (PMCL). SOURCES: Radian, 1991; ESE.

Table B.11-2 SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN SURFACE WATER SAMPLES FROM THE FLIGHTLINE AREA, CARSWELL AFB, TEXAS (SPRING 1990)

Analytical Parameter	EPA Standards* (µg/L)	Range of Detection Limits	Range of Concentrations of Constituents Detected	Analyses for Constituent (No. of Locations)	Total Number of Samples With Constituent Detected and Second Column Confirmation (No. of Locations)	Exceeding EPA Standard (No. of Locations)
Purgeable Halocarbons (601) µg/L						
1,1,1-Trichloroethane	200 (M)	0.20-10.0	ND	8 (7)	0	0
1,1,2,2-Tetrachloroethane		0.15-7.5	ND	8 (7)	0	0
1,1,2-Trichloroethane		0.20-10.0	ND	8 (7)	0	0
1,1-Dichloroethane	7 (M)	0.50-25.0	ND	8 (7)	0	0
1,1-Dichlorobenzene		0.20-10.0	ND	8 (7)	0	0
1,2-Dichloroethane	5 (M)	0.50-25.0	ND	8 (7)	0	0
1,2-Dichloropropane	5 (M)	0.10-5.0	ND	8 (7)	0	0
1,3-Dichlorobenzene		0.32-16.0	ND	8 (7)	0	0
1,4-Dichlorobenzene	75 (M)	0.24-12.0	ND	8 (7)	0	0
2-Chloroethylvinyl ether		0.50-25.0	ND	8 (7)	0	0
Bromodichloromethane		0.10-5.0	ND	8 (7)	0	0
Bromoform		0.50-25.0	ND	8 (7)	0	0
Bromomethane		1.2-59.0	ND	8 (7)	0	0
Carbon tetrachloride	5 (M)	0.12-6.0	ND	8 (7)	0	0
Chlorobenzene		0.25-13.0	ND	8 (7)	0	0
Chloroethane		0.52-26.0	ND	8 (7)	0	0
Chloroform		0.10-5.0	ND	8 (7)	0	0
Chloromethane		0.30-15.0	ND	8 (7)	0	0
Dibromochloromethane		0.20-10.0	ND	8 (7)	0	0
Methylene chloride		0.40-20.0	ND	8 (7)	0	0
Tetrachloroethene	5 (P)	0.10-5.0	ND	8 (7)	0	0
Trichloroethene	5 (M)	0.20-10.0	1.8-14.00	8 (7)	8 (7)	6 (5)
Trichlorofluoromethane		0.20-10.0	ND	8 (7)	0	0
Vinyl chloride	2 (M)	0.20-10.0	0.56-3.7	8 (7)	2 (2)	1 (1)
cis-1,2-Dichloroethene	70 (P)	0.20-10.0	3.1-310.0	8 (7)	8 (7)	1 (1)
cis-1,3-Dichloropropene		0.20-10.0	ND	8 (7)	0	0
trans-1,2-Dichloroethene	100 (P)	0.20-10.0	0.46-0.66	8 (7)	2 (2)	0
trans-1,3-Dichloropropene		0.34-17.0	ND	8 (7)	0	0

*EPA standards are designated: M - Maximum Contaminant Level (MCL) and P - Proposed Maximum Contaminant Level (PMCL).

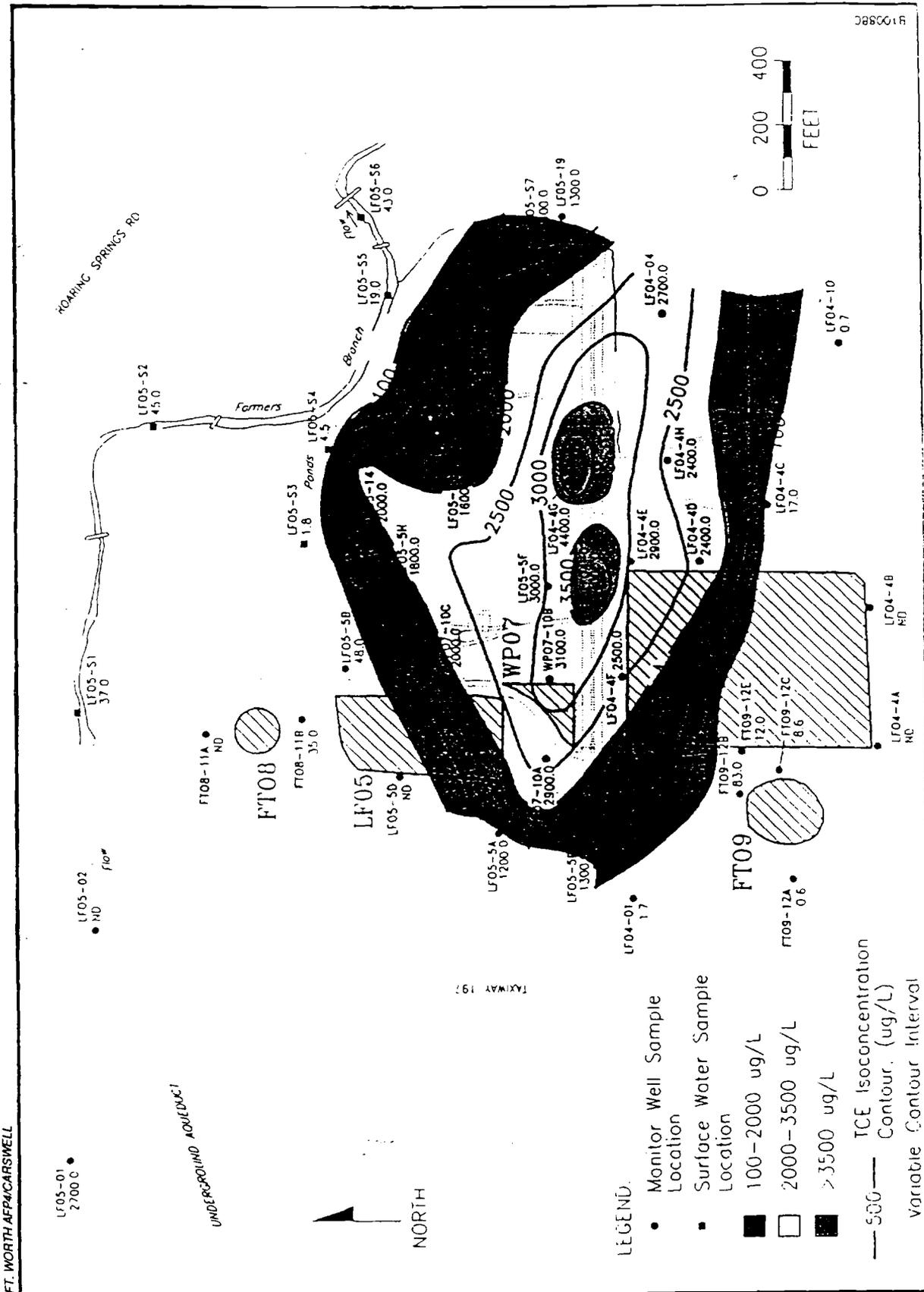


Figure B.11-2 TCE Isoconcentration Contour Map, Flightline Area, Carswell AFB, Texas
 (Based on Spring, 1990 Water Sampling)
 SOURCES: Radian, 1991; ESE.

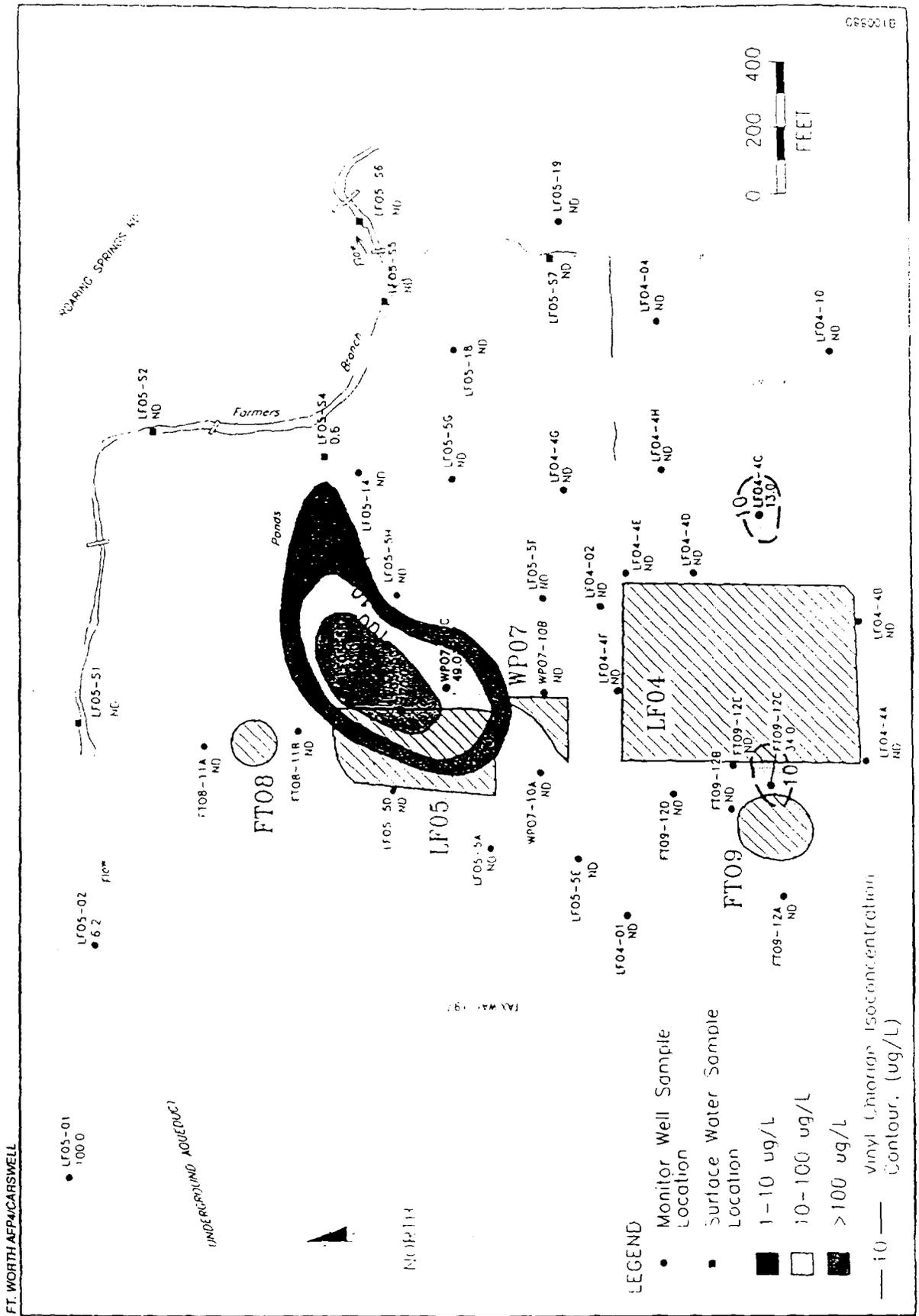


Figure B.11-3 Vinyl Chloride Isoconcentration Contour Map, Flightline Area, Grayson AFB, Texas (Based on Spring, 1990 Water Sampling)

SOURCES: Radian, 1991; ESE.

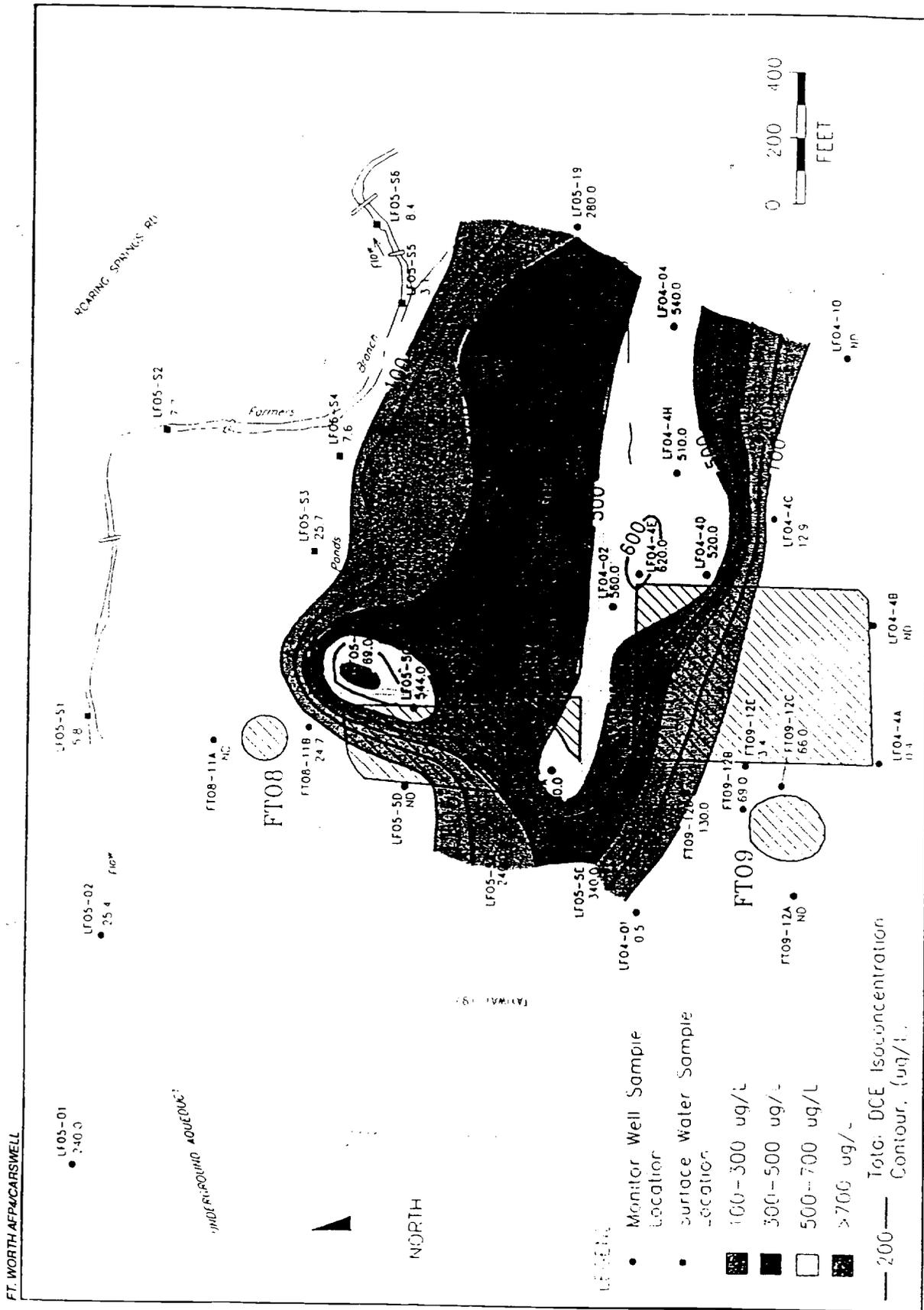


Figure B.11-4 Total 1,2-Dichloroethene Isoconcentration Contour Map, Flightline Area, Carswell AFB, Texas (Based on Spring, 1990 Water Sampling)

SOURCES: Radian, 1991; ESE.

technologies, 2) development of remedial alternatives, and 3) detailed evaluation of alternatives.

In Section 1, technologies were screened for 1) performance and effectiveness, 2) constructibility and implementability, and 3) cost. Then the potentially applicable technologies were combined into eleven remedial alternatives (Table B.11-3) that were developed and screened against the broad criteria of effectiveness, implementability and cost.

The alternatives were later evaluated in detail based on the following criteria:

- Overall protection of the human health and the environment,
- Compliance with ARARs,
- Long-term effectiveness and permanence,
- Reduction of toxicity, mobility, and volume,
- Short-term effectiveness,
- Implementability, and
- Cost.

The comparative evaluation matrix for the nine alternatives is presented in Table B.11-4. Based on this evaluation, Alternative 4B, Air Stripping and Disposal of effluent to Publicly Owned Treatment Works (POTW) Sewer Line, was selected as the preferred alternative for the remediation of groundwater at the Flightline Area.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THIS PROJECT

Air stripping and disposal to POTW was selected as the preferred alternative for the remediation of contaminated groundwater at the Flightline Area (see Section 2.0 for the treatment alternative details).

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3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THIS PROJECT

Air stripping and disposal to POTW was selected as the preferred alternative for the remediation of contaminated groundwater at the Flightline Area (see Section 2.0 for the treatment alternative details).

Table B.11-3 PRELIMINARY REMEDIAL ACTION ALTERNATIVES

	Alternatives											
	1	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	7*
<u>Waste Containment</u>												
Cap Existing Landfills	NA	■	■	■	■					■	■	
Slurry Wall Placed Around Perimeter of Landfill	NA	■	■					■	■			
Ground-Water Extraction Wells Placed on Perimeter of Landfill	NA			■	■	■	■					
<u>Ground Water</u>												
Monitoring	NA	■	■	■	■	■	■	■	■	■	■	■
Extraction Well System	NA	■	■	■	■	■	■	■	■	■	■	■
On-Site Air Stripping	NA	■	■	■	■	■	■	■	■	■	■	
<u>Disposal</u>												
Discharge Treated Effluent into Farmers Branch Creek	NA	■		■		■		■		■		
Discharge Treated Effluent into POTW	NA		■		■		■		■		■	
Seasonal Irrigation of Base Golf Course	NA	■	■	■	■	■	■	■	■	■	■	■

NA - No Action

*Alternative 7 utilizes any of the waste containment options listed in Alternatives 2, 3, 4, 5, or 6.

Table B.11-4 RESULTS OF REMEDIAL ALTERNATIVES COMPARATIVE EVALUATION

Primary Alternatives	Capital (\$ M)	O&M (\$ M)	NPV (\$ M)	Tech- nology Status	Compli- ance With ARARS	Con- struct- ability	Off- Site Impacts	Need for Further Study	Impacts to Base Operation	Products Gen- erated	Relia- bility	Regula- tory Accep- tance	Permit- ting Re- quire- ments	Effec- tive- ness Total	Effec- tive- ness Total/ Cost Total
Weighting Factors	1	1	1	4	4	4	3	2	3	3	3	5	5		
2A: Cap/- Slurry Wall/- Treatment/ Farmers Branch	5.546	1.833	7.380	3	3	1	2	2	1	2	3	2	1	71	9.8
2B: Cap/- Slurry Wall/- Treatment/POTW	5.329	1.833	7.366	3	3	1	2	2	1	2	3	3	2	81	11.0
3A: Cap/GW Ex/Treatment/ Farmers Branch	4.427	1.941	6.368	4	3	2	2	2	2	3	3	2	1	85	13.6
3B: Cap/GW Ex/Treatment/ POTW	4.424	1.941	6.365	4	3	2	2	2	2	3	3	3	2	95	15.2
4A: GW Ex/ Treatment/ Farmers Branch	0.850	1.941	2.791	4	2	3	3	2	3	3	2	2	1	88	32.5
4B: GW Ex/ Treatment/ POTW	0.847	1.941	2.788	4	2	3	3	2	3	3	2	3	2	98	36.1
5A: Slurry Wall/ Treatment/ Farmers Branch	1.970	1.833	3.803	3	3	1	2	2	1	2	3	2	1	71	18.7
5B: Slurry Wall/ Treatment/ POTW	1.956	1.833	3.789	3	3	1	2	2	1	2	3	3	2	81	21.4

O&M = Annual Operation and Maintenance Cost
 NPV = Net Present Value
 SOURCES: Radian, 1991; ESE.

235283

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

This FS was limited to the groundwater remediation at the Flightline Area due to limited information available on the soils. Further soil sampling and analysis was recommended to delineate the extent of soil contamination at the Flightline Area of CAFB.

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

6.0 STATUS OF THE PROJECT

Groundwater remediation has been initiated at LF04 and LF05.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No information from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Investigation/Remediation Plans - SWMUs 16, 32, 35, 36 and 61
AUTHOR: U.S. Army Corps of Engineers
DOCUMENT NUMBER: 68
CATEGORY: Not Available
SUBMITTED: January 1992

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to prepare Investigation/Remediation Plan, including history, investigations, findings, and recommendations for the following Solid Waste Management Units (SWMUs) shown in Figure B.12-1.

- SWMU 16: Bldg. 1060, Waste Accumulation Area,
- SWMU 32: Bldg. 1410, Waste Accumulation Area,
- SWMU 35: Oil/Water Separation System,
- SWMU 36: Bldg. 1191, Waste Accumulation Area, and
- SWMU 61: Bldg. 1320, Waste Accumulation Area.

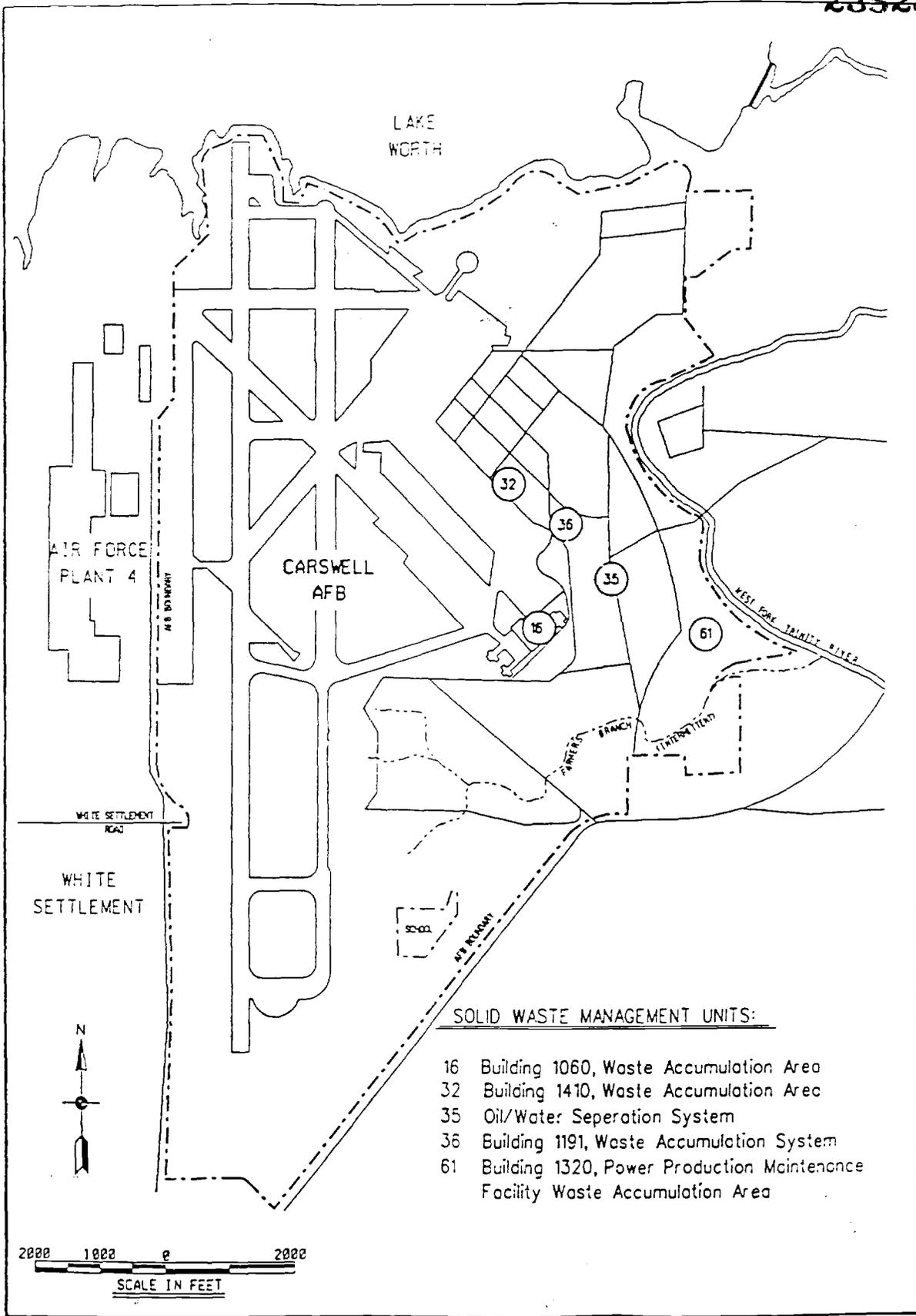
2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

CAFB was established in 1942 and located six miles west of Fort Worth in Tarrant County, Texas. The base operates the Weapons Storage Area (WSA) located five miles west of the base on White Settlement Road.

Wastes have been generated and disposed of at CAFB since 1942. Major industrial operations include maintenance of jet engines, aerospace ground equipment, fuel systems and weapons systems. The generated wastes are primarily oils, lubricants, recoverable fuels, spent solvents, and cleaners.

Phase I and Phase II of the Installation Restoration Program (IRP) at CAFB was completed. Phase I records Search was completed in February 1984 by CH2M



CARSWELL AIR FORCE BASE, TEXAS
SOLID WASTE MANAGEMENT UNIT LOCATIONS

Figure B.12-1

SOURCES: USACE, 1992; ESE.

Hill, Inc. Phase II Confirmation/Quantification, Stage 1 was completed in October 1986 by Radian Corporation and Phase II Confirmation/Quantification Stage 2 Draft was completed in October 1988 by Radian Corporation (Radian).

2.2 PREVIOUS INVESTIGATION RESULTS

A site summary report (USACE, May 1991) and a remedial action plan (USACE, September 1991) were prepared for SWMUs 16, 32, 35, 36, and 53.

2.3 PROJECT ACCOMPLISHMENTS

In this report, a summary of the history, past investigations and recommendations for the five SWMUs were presented.

2.3.1 SWMU 16, Bldg. 1060, WASTE ACCUMULATION AREA

SWMU 16 is a Corrosion Control Shop for the Field Maintenance Squadron. The shop was used for operations like paint stripping, cleaning and painting of small aircraft parts. The waste from the operations was stored in 55-gallon drums on wooden pallets in a fenced area (20 ft x 40 ft) of the asphalt parking lot. The fenced storage area was recently replaced by a curbed, covered accumulation point in the same vicinity.

Soil sampling and analysis was proposed as part of investigation at the site. There was no documented history of releases of contamination to groundwater; therefore, groundwater was not recommended for further investigation.

2.3.2 SWMU 32 (BLDG. 1410, WASTE ACCUMULATION AREA)

This site is an outdoor, uncovered, concrete-based container storage area. There is no documented evidence of releases but oil stains were observed during the site inspection conducted in 1989. The unit manages engine oil (600 gallons per year (GPY)), carbon and fingerprint remover (200 GPY), PD-680 Type II (550 GPY) and JP-4 (300 GPY).

Soil sampling and analysis was proposed as part of investigation at the site. There was no documented history of releases of contamination to groundwater; therefore, groundwater was not recommended for further investigation.

2.3.3 SWMU 35 (OIL/WATER SEPARATION SYSTEM)

The system manages floor washings which consist of wastewater contaminated with fuel, PD-680, anti-freeze, and transmission fluid, and waste oil. Soil stained with oil was observed during a visual site inspection conducted in 1989.

Soil sampling and analysis was proposed as part of investigation at the site. There was no documented history of releases of contamination to groundwater; therefore, groundwater was not recommended for further investigation.

2.3.4 SWMU 36 (Bldg. 1191, WASTE ACCUMULATION AREA)

This area is located east of the Building 1191 and holds wastes in 55-gallon drums from Vehicle Maintenance Operations. Evidence of oily material spillage was noted during the visual site inspection.

Soil sampling and analysis was proposed as part of investigation at the site. There was no documented history of releases of contamination to groundwater; therefore, groundwater was not recommended for further investigation.

2.3.5 SWMU 61 (Bldg. 1320, WASTE ACCUMULATION AREA)

This area is an outdoor container storage area from wastes generated from inside Bldg. 1320 and holds antifreeze and waste oil in 55-gallon drums.

Soil sampling and analysis was proposed as part of investigation at the site. There was no documented history of releases of contamination to groundwater; therefore, groundwater was not recommended for further investigation.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THIS PROJECT

A summary of the site history, past investigations, and the recommendations made for five SWMUs identified at CAFB was presented.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional site investigations.

5.0 PROJECTS RESULTING FROM THE PROJECT

None observed.

6.0 STATUS OF THE PROJECT

The project was not implemented.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No information from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

TITLE: Management Action Plan
AUTHOR: U.S. Army Corps of Engineers
DOCUMENT NUMBER: Not available
CATEGORY: Not Available
SUBMITTED: March 1993

1.0 REMEDIATION PROJECT OBJECTIVES

The objective of this project was to summarize the current status of the Carswell Air Force Base (CAFB) environmental restoration and associated environmental compliance programs and present a comprehensive strategy for implementing response actions necessary to protect human health and the environment.

2.0 REMEDIATION ACCOMPLISHMENTS/RESULTS

2.1 SITE HISTORY

CAFB was established in 1942 and located six miles west of Fort Worth in Tarrant County, Texas. The base operates the Weapons Storage Area (WSA) located five miles west of the base on White Settlement Road.

Wastes have been generated and disposed of at CAFB since 1942. Major industrial operations include maintenance of jet engines, aerospace ground equipment, fuel systems and weapons systems. The generated wastes are primarily oils, lubricants, recoverable fuels, spent solvents, and cleaners.

2.2 SITE SUMMARY

The RCRA permit issued to CAFB identified 20 SWMUs that require facility investigations in order to determine whether hazardous constituents listed in Title 40, 40 CFR Part 264, Appendix IX were released to the environment. Thirteen of these sites are also RCRA SWMUs. Table B.13-1 provides a brief description of these sites and Figure B.13-1 shows the geographic locations.

Table B.13-1 Site Summary Table
Page 1 of 2

Site No.	WTMS-ES Site ID	OU	Alias	Site Class	Site Title	Material Disposed of	Operation	Status	Regulatory Mechanism
1	LF01	2	SWMU 28	IRP Site	Landfill 1	Unknown	1942-1989	Analytical data suggests solvent and metal-bearing wastes. No significant risk. Under consideration for no further action	RCRA
2	LF02	N/A	N/A	IRP Site	Landfill 2	Construction rubble and materials	1952-1956	No action per RCRA Facility Assessment March 1989	RCRA
3	LF03	N/A	N/A	IRP Site	Landfill 3	Construction rubble, fill area and small amount of hazardous waste	1950-1952	No action per RCRA Facility Assessment March 1989	RCRA
4	LF04	1	SWMU 22	IRP Site	Landfill 4	Paint, thinners, strippers, cadmium batteries, waste solvents burned wastes	1956-1973	RD canceled December 1991	RCRA
5	LF05	1	SWMU 23	IRP Site	Landfill 5	All types of flightline waste and refuse. TCE regularly burned	1963-1975	RD canceled December 1991	RCRA
6	LF06	1	SWMU 62	IRP Site	Landfill 6	Construction rubble and possible drums of hydraulic fluid	1975-1978	RI	RCRA
10	WP07	1	SWMU 24	IRP Site	Waste Burial Area	Buried drums containing cleaning solvents and loaded sludge from flightline	1960s	RD canceled December 1991	RCRA
11	FT08	N/A	SWMU 18	IRP Site	Fire Training Area No. 1	Waste oils and fuels were burned	Prior 1963	NFA - 17 December 1991	RCRA
12	FT09	1	SWMU 19, 20, 21	IRP Site	Fire Training Area No. 2	Waste oils and solvents were burned. Unused JP-4 was observed	1963-1969	RA	RCRA

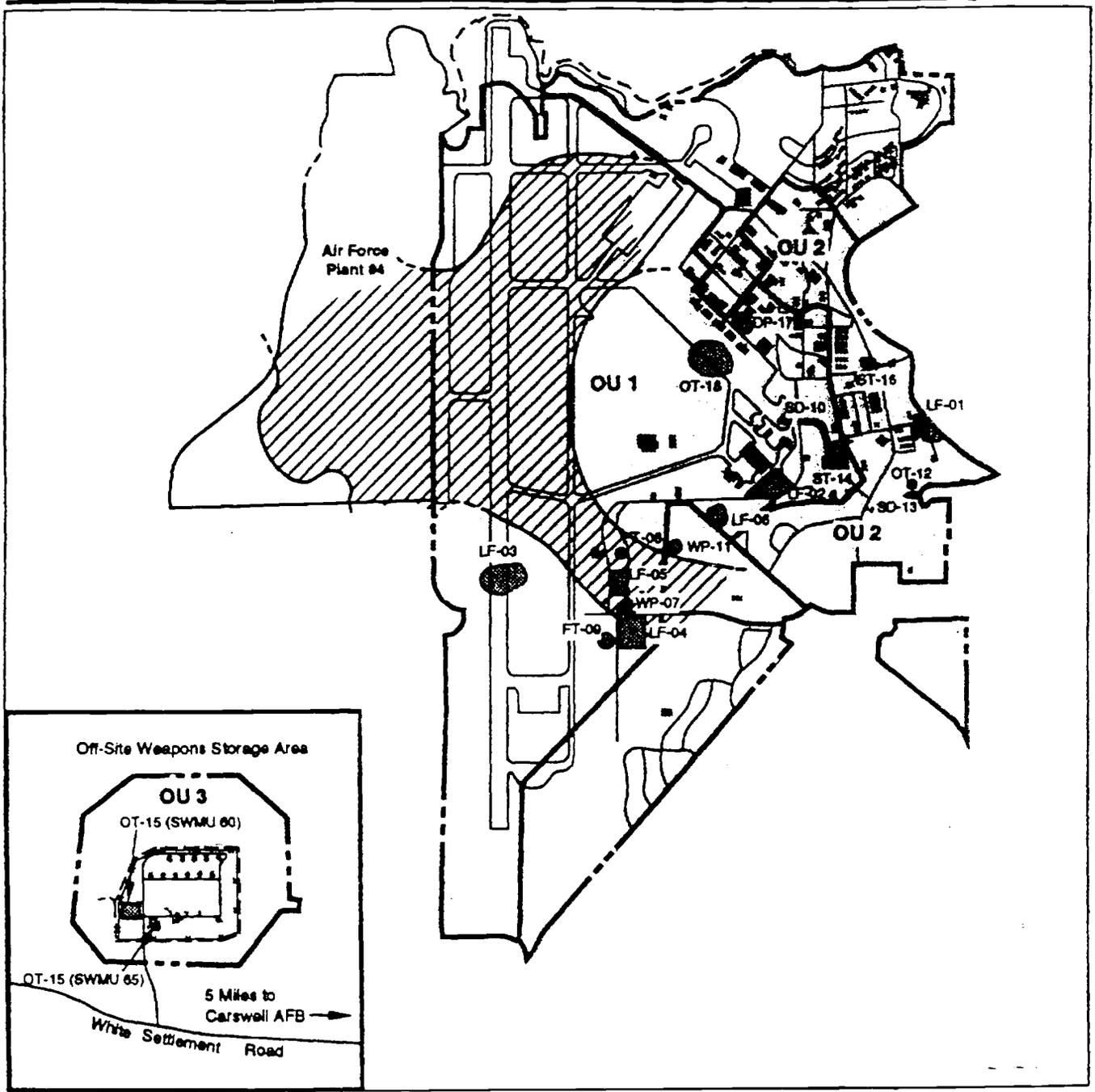
SOURCES: MAP, 1993; ESE.

Table B.13-1 Site Summary Table
Page 2 of 2

Site No.	WIMS-ES Site ID	OU	Alias	Site Class	Site Title	Material Disposed of	Operation	Status	Regulatory Mechanism
13	SD10	1	SWMU 53	IRP Site	Flightline drainage ditch	Petroleum, aircraft soap and oils have migrated from flightline	Unknown construction date but used to present	RA	RCRA
14	WP11	N/A	N/A	IRP Site	Pesticide rinse area	Rinse water from pesticide spray equipment	Unknown start up date. No longer in use	No action per RCRA Facility Assessment - March 1989	RCRA
15	OT12	N/A	SWMU 63	IRP Site	Entomology dry well	Pesticide and herbicide contaminated rinse water	1965-1981	NFA - 17 December 1991	RCRA
16	SD13	2	SWMU 64, 67	IRP Site	Unnamed stream	Hydrocarbons	1965-Present	Focused RI	RCRA
17	ST14	1	SWMU 68	IRP Site	POL Tank Farm	JP-4	Early 1960s	RD	RCRA
N/A	OT15	3	SWMU 60	IRP Site	WSA	Radium	1957-1969	Being monitored. Programmed for IRA	RCRA
N/A	ST16	2	N/A	IRP Site	Base Service Station	Hydrocarbons	Early 1970s	RJ/FS	CERCLA/PST
N/A	OT18	1	N/A	IRP Site	Airfield groundwater	JP-4		RI	CERCLA
N/A	DP17	1	N/A	IRP Site	Waste oil dump	Oils, solvents, unknown		RI	CERCLA
N/A	OT15	N/A	SWMU 65	IRP Site	WSA disposal site	Waste cleaner, solvents, and thinners, TCE	Unknown	NFA - 17 June 1991	RCRA
N/A	N/A	2	N/A	IRP Site	East area groundwater	Metals and hydrocarbons, possible solvents		Unknown	RCRA

N/A = Not applicable.

SOURCES: MAP, 1993; ESE.



EXPLANATION



IRP Site



Probable TCE Groundwater Contamination Plume - 5 ppb level (Plume boundary not fully characterized)



Carswell AFB Boundary



Air Force Plant #4 Boundary



Leased Property



MAP Cars002



Note: East Area Groundwater (OU 2) not shown because area not defined yet. Sites LF-02, LF03, FT-08, WP-11, OT-12, OT-15 (SWMU 65) are not assigned an OU.

Operable Units and IRP Sites

Figure B.13-1
SOURCES: MAP, 1993; ESE.

IRP sites were grouped into three operable units (OUs) based on reuse parcels. OU 1 (Parcel A) consists of none sites in the Flightline Area. OU 2 (Parcel B) comprises four sites in the East Area. OU 3 consists of a site in the off-site Weapons Storage Area (WSA). The remaining six sites were not assigned to an OU because they were closed prior to the use of OUs at CAFB. Three of these six sites (LF-02, LF-03, and WP-11) are former SWMUs that were eliminated during the RCRA Facility Assessment (RFA). The other three sites, OT-15 (SWMU 65), FT-08, and OT-12 have No Further Actions (NFAs) approved by Texas Water Commission (TWC).

Site LF-01 was recommended for NFA, but this is pending approval by the TWC. Two sites in OU 1, FT-09 and SD-10, are in the remedial action (RA) phase for the removal of contaminated soils. Sites LF-06, OT-18, and DP-17 are currently in the RI, ST-14 is in the remedial design (RD) phase, ST-16 is in the remedial investigation/feasibility study (RI/FS) phase, and SD-13 is undergoing a Focused RI. LF-04, LF-05, and WP-07 were in the RD phase, which was cancelled in December 1991. OT-15(SWMU 60) was programmed for interim removal action. All 13 IRP sites that are also SWMUs are regulated under RCRA. Sites ST-16, OT-18, and DP-17 are not SWMUs and are currently regulated under CERCLA.

2.3 REMEDIAL AND INTERIM ACTION PROJECTS

Interim actions to reduce or control known contamination was conducted at WP-07 and ST-14. These actions are summarized in Table B.13-2.

2.4 ACTUAL RESTORATION SCHEDULE

The IRP program began under CERCLA with Phase I, Phase II, and RI/FS documentation prior to 1989. In 1989, an RFA was conducted for all RCRA SWMUs. RCRA sites requiring no further action were regulated under the RCRA Part B permit issued February 1991. However, because of previous contractual arrangements for CERCLA documentation, additional CERCLA documents were prepared after February 1991. This included both RI and FS for the East Area

Table B.13-2 Interim Removal Actions

Site	Actions	Purpose	Status
WP-07	Remove buried drums and contaminated soil	Remove contaminant source and associated soil contamination	Removal conducted between August and October 1991
ST-14	Installed skimmer system on well	Skim free product off top of water-table to comply with NOV	Skimmer installed August 1991. No product found in well to date. Removal of system scheduled for April 1993

SOURCES: MAP, 1993; ESE.

and the Flightline Area sites, and Decision Documents for LF-01, LF-02, FT-08, FT-09, SD-10, WP-11, OT-12, OT-15 (SWMU 65) and ST-16. The actual restoration schedule for IRP sites is shown in Table B.13-3.

2.5 ENVIRONMENTAL RESTORATION/COMPLIANCE PROGRAM MASTER SCHEDULE

The projected restoration master schedule is presented in Table B.13-4 and the compliance master schedule is presented in Table B.13-5.

2.6 STATUS OF ENVIRONMENTAL RESTORATION PROGRAM

The current status of the IRP sites as of the date of the Management Action Plan (MAP) is presented in Table B.13-6.

2.7 TRANSFERIBILITY STRATEGIES

The MAP strategies are in the initial stages of development, and several technical/management guidelines need to be established. Table B.13-7 presents the recommendations and issues associated with environmental restoration, compliance, and technical/management action items guidance that require further evaluation and implementation.

3.0 DATA/INFORMATION DEVELOPED AS A RESULT OF THIS PROJECT

The current status of the CAFB environmental restoration and associated environmental compliance programs and a comprehensive strategy for implementing response actions necessary to protect human health and the environment were presented.

4.0 RECOMMENDATIONS FOR ADDITIONAL STUDIES AND/OR REMEDIATION

No recommendations were made for additional site investigations.

Table B.13-3 Actual Restoration Schedule to Date
Page 1 of 2

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
LF-01	Phase I Records Search		Phase II, Stage 1			RU/FS, Stage 2; RFA		RFI W.P.		
LF-02	Phase I Records Search		Phase II, Stage 1		RFA ¹					
LF-03	Phase I Records Search		Phase II, Stage 1			RU/FS, Stage 2; RFA ¹		RFI W.P.		
LF-04	Phase I Records Search		Phase II, Stage 1			RU/FS, Stage 2; RFA		RFI W.P.		
LF-05	Phase I Records Search		Phase II, Stage 1			RU/FS, Stage 2; RFA		Site-specific		RFI W.P.
LF-06	Phase I Records Search		Phase II, Stage 1		RFA					
WP-07	Phase I Records Search		Phase II, Stage 1			RU/FS, Stage 2; RFA		RFI W.P.; Site-specific RFI R.P., IRA		
FT-08	Phase I Records Search		Phase II, Stage 1			RU/FS, Stage 2, RFA		RFI W.P.; Request for dismissal; NFA		
FT-09	Phase I Records Search		Phase II, Stage 1			RU/FS Stage 2; RFA		RFI W.P.; RA approved		
SD-10	Phase I Records Search		Phase II, Stage 1			RU/FS Stage 2; RFA		RFI W.P.; RA approved		
WP-11	Phase I Records Search		Phase II, Stage 1		RFA ¹					
OT-12	Phase I Records Search		Phase II, Stage 1			RU/FS Stage 2; RFA		RFI W.P.; Request for dismissal; NFA		
SD-13	Phase I Records Search		Phase II, Stage 1			RU/FS Stage 2; RFA		RFI W.P.; site-specific RFI W.P.		
ST-14	Phase I Records Search		Phase II, Stage 1			RU/FS Stage 2; RFA		RFI W.P.; IRA	IRA	IRA
OT-15 (SWMU 65)	Phase I Records Search		Phase II, Stage 1			RU/FS, Stage 2; RFA		RFI W.P.; NFA		
OT-15 (SWMU 60)						RFA				

SOURCES: MAP, 1993; ESE.

Table B.13-3 Actual Restoration Schedule to Date
Page 2 of 2

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
ST-16										
DP-17										
OT-18										
East Area										
Groundwater										

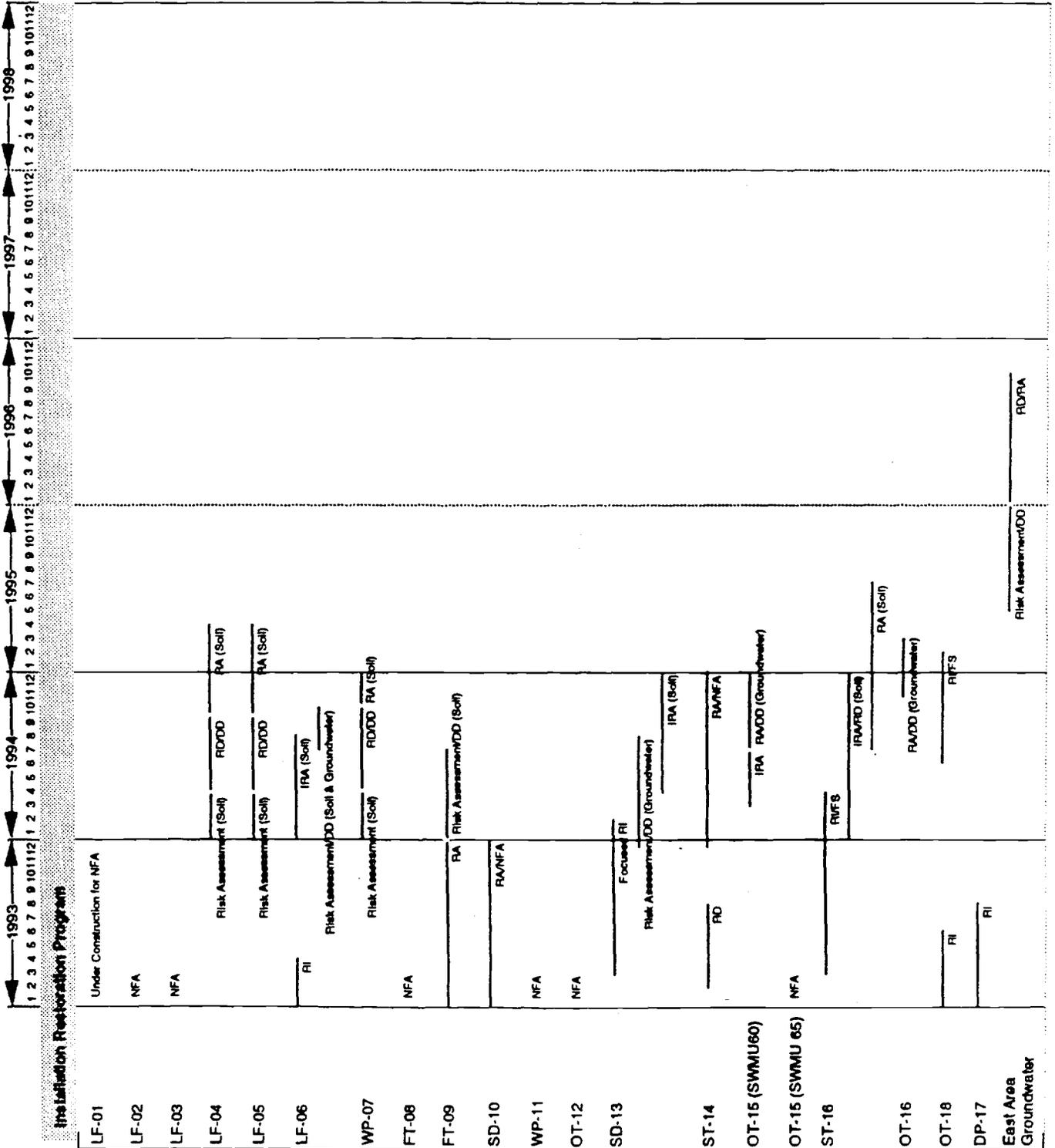
R/FS, Stage 2.

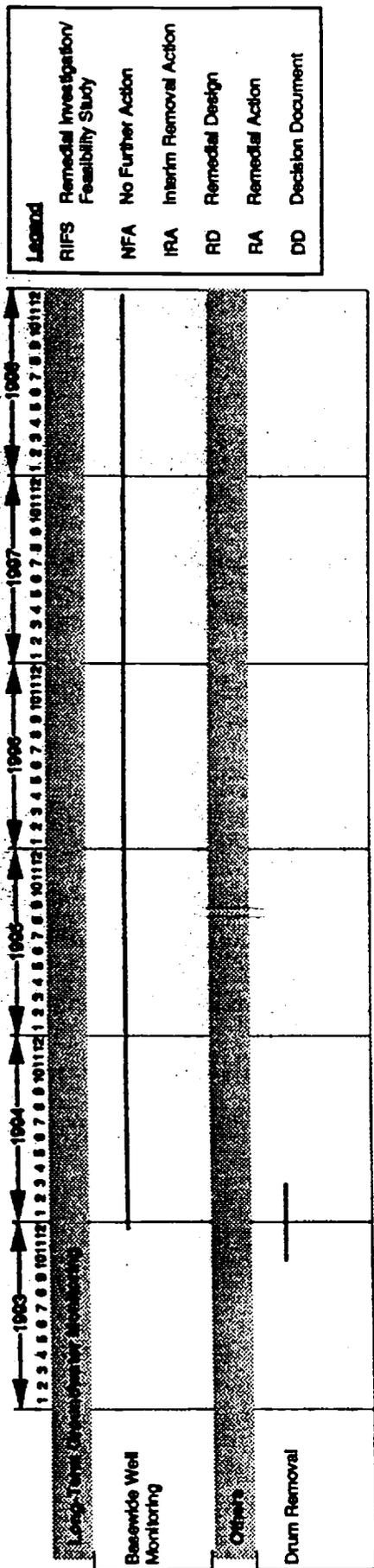
Note: 1 - RFA eliminated these sites from further evaluation.

- IRA - Interim Removal Action
- RFA - RCRA Facility Assessment
- R/FS - Remedial investigation/feasibility study
- RFI W.P. - RCRA Facility Investigation Work Plan
- RFI R.P. - RCRA Facility Investigation Work Plan
- RA - Remedial Action
- NFA - No Further Action

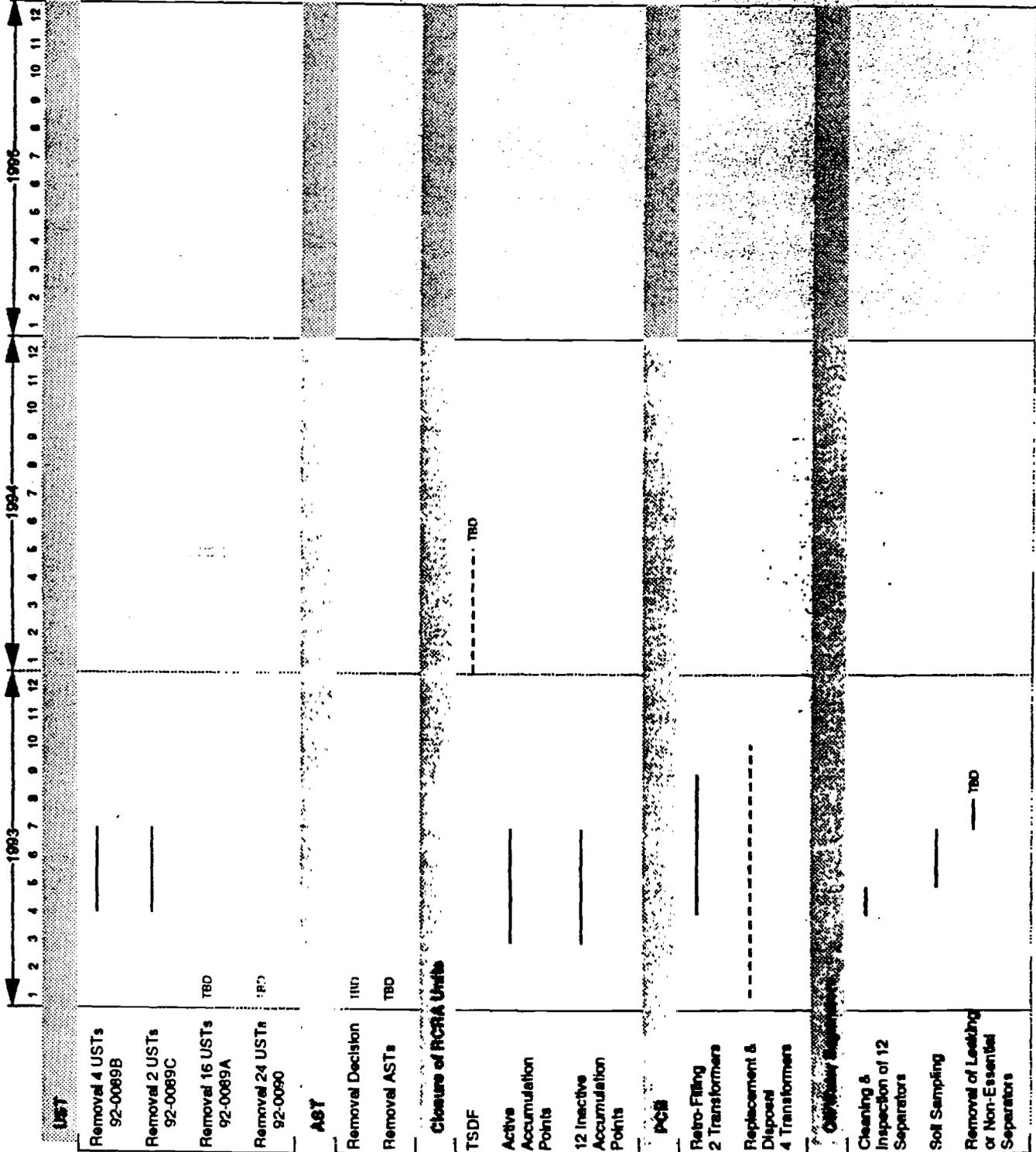
SOURCES: MAP, 1993; ESE.

Legend	
RIFS	Remedial Investigation/ Feasibility Study
NFA	No Further Action
IRA	Interim Removal Action
RD	Remedial Design
RA	Remedial Action
DD	Decision Document





Legend
 RIFS Remedial Investigation/
 Feasibility Study



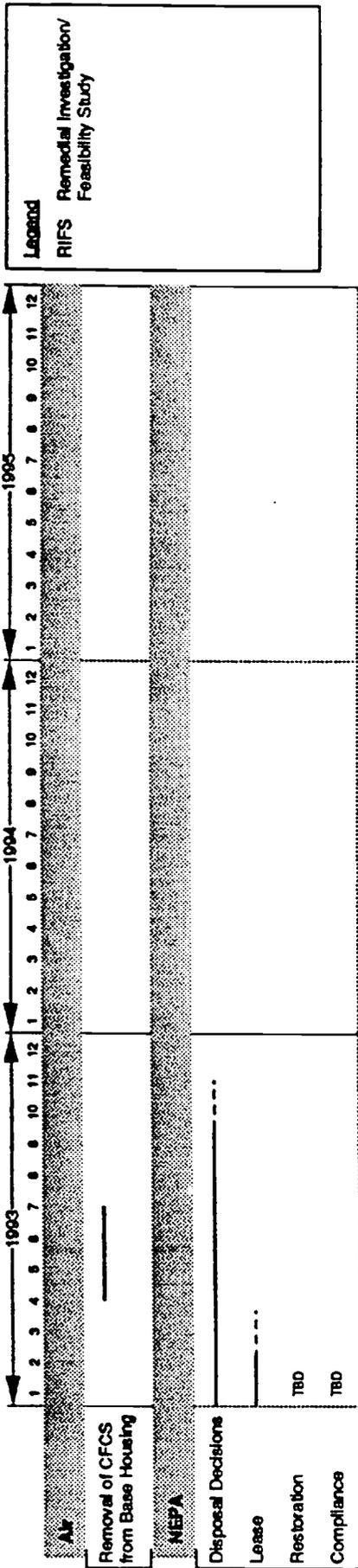


Table B.13-6 Project Deliverables
Page 1 of 2

Year	Phase	Project Title	Rpt. #	Sites Examined	Deliverable Date/By Whom
1984	I	Records Search	1	LF-01, LF-02, LF-03, LF-04, LF-05, LF-06, WP-07, FT-08, FT-09, SD-10, WP-11, OT-12, SD-13, ST-14, OT-15 (SWMU 65)	February 1984, CH2M Hill
1986	II	Phase II, Stage 1	2	LF-01, LF-03, LF-04, LF-05, WP-07, FT-08, FT-09, SD-10, OT-12, SD-13, ST-14, OT-15 (SWMU 65)	October 1986, Radian Corporation
1989	RFA	RCRA Facility Assessment PR/MSI Report	3	LF-01, LF-02, LF-03, LF-04, LF-05, LF-06, WP-07, FT-08, FT-09, SD-10, WP-11, OT-12, SD-13, ST-14, OT-15 (SWMU 65), OT-15 (SWMU 60)	March 1989, A.T. Kearney Inc.
1989	R/IFS	Remedial Investigation/Feasibility Study, Stage 2	4	LF-01, LF-03, LF-04, LF-05, WP-07, FT-08, FT-09, SD-10, OT-12, SD-13, ST-14, OT-15 (SWMU 65), ST-16	April 1989, Radian Corporation
1990	R/IFS	Decision Paper	5	FT-08	April 1990, Radian Corporation
1990	R/IFS	Decision Paper	6	FT-09	April 1990, Radian Corporation
1990	R/IFS	Decision Paper	7	SD-10	April 1990, Radian Corporation
1990	R/IFS	Decision Paper	8	OT-15 (SWMU 65)	April 1990, Radian Corporation
1991	R/IFS	Decision Paper	9	OT-12	May 1991, Radian Corporation
1991	RFI	RCRA Facility Investigation	10	LF-01, LF-04, LF-05, WP-07, FT-08, FT-09, SD-10, OT-12, SD-13, OT-15 (SWMU 65)	May 1991, U.S. Army C.O.E.
1991	NFA DD	Request for Dismissal	11	FT-08, OT-12	July 1991, U.S. Army C.O.E.
1991	R/IFS	Remedial Investigation for east area	12	LF-01, SD-13, ST-14, ST-16	October 1991, Radian Corporation
1991	R/IFS	Feasibility Study for east area	13	LF-01, SD-13, ST-14, ST-16	October 1991, Radian Corporation
1991	R/IFS	Remedial Investigation for Flightline	14	LF-04, LF-05, WP-07, FT-09	October 1991, Radian Corporation
1991	R/IFS	Feasibility Study for Flightline	15	LF-04, LF-05, WP-07	October 1991, Radian Corporation

SOURCES: MAP, 1993; ESE.

Table B.13-6 Project Deliverables
Page 2 of 2

Year	Phase	Project Title	Rpt. #	Sites Examined	Deliverable Date/By Whom
1991	RFI	RCRA Facility Investigation	16	SD-13	October 1991, U.S. Army C.O.E.
1992	RFI	RCRA Facility Investigational Remediation Plan	17	WTP-07	January, 1993, U.S. Army C.O.E.
1992	RFI	RCRA Facility Investigation Work Plan	18	SD-13	April, 1992, U.S. Army C.O.E.

SOURCES: MAP, 1993; ESE.

Table B.13-7 MAP Action Items

Action Item	Status	
	In Progress	To Be Performed
RESTORATION ACTIVITIES		
- identify additional sites for interim actions as appropriate	X	
- complete and implement community relations plan	X	
- complete and maintain administrative record	X	
- OL-H to become member of AF Plant #4 TRC		X
- research and implement thermal treatment for POL-contaminated soils	X	
- assess environmental condition of off-base properties		X
- develop process to update and maintain environmental-condition-of-property map	X	
- identify and map areas suitable for transfer		X
COMPLIANCE ACTIVITIES		
- develop pipeline removal/abandonment strategy	X	
- designate essential and nonessential aboveground storage tanks		X
- determine number and location of hazardous waste accumulation points to be closed		X
- ensure tenant compliance with RCRA		X
- review tenant hazardous waste management and spill prevention and response plans		X
- disclose asbestos status to lessees		X
- disclose location of PCB capacitors to lessee/recipient		X
- update annual PCB location documents		X
- sample and prepare report for NPDES		X
- disclose need for radon investigations		X
- identify oil/water separators for reuse		X
- identify and apply for air emissions credits		X
- use recovered Freon as credit against Freon removal costs		X
MANAGEMENT AND ADMINISTRATIVE SUPPORT		
- establish and maintain central data file (IRPIMS)		X
- determine usability of historical data sets		X
- implement data quality management for current and future projects	X	
- identify and fill data gaps		X
- establish background concentrations of elements for use in risk assessments		X
- evaluate anticipated land use as criterion in risk assessment assumptions	X	

SOURCES: MAP, 1993; ESE.

5.0 PROJECTS RESULTING FROM THE PROJECT

A review of the project file showed no indication of projects resulting from this report.

6.0 STATUS OF THE PROJECT

No information regarding project status was available in the file material.

7.0 SCHEDULE

No schedule is available.

8.0 WHETHER OR NOT INFORMATION DERIVED IS IN IRPIMS

No information from this project is in IRPIMS.

9.0 DISCREPANCIES BETWEEN VARIOUS PROJECT REPORTS

None observed.

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE