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NAS FORT WORTH
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BASEWIDE QUARTERLY GROUNDWATER MONITORING FINAL SCOPING DOCUMENTS
NAS FORT WORTH TX
3/1/1995
LAW ENGINEERING AND ENVIRONMENTAL



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

**ADMINISTRATIVE RECORD
COVER SHEET**

AR File Number 250

11-3517-3201

**INSTALLATION RESTORATION PROGRAM (IRP)
BASE-WIDE QUARTERLY GROUND-WATER MONITORING**

FINAL SCOPING DOCUMENTS

Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

March 1995



PREPARED FOR

AIR FORCE BASE CONVERSION AGENCY (AFBCA/OL-H)
NAVAL AIR STATION FORT WORTH, JOINT RESERVE BASE, CARSWELL FIELD
FORT WORTH, TEXAS 76127-5000

UNITED STATES AIR FORCE
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
ENVIRONMENTAL RESTORATION DIRECTORATE
BASE CLOSURE RESTORATION DIVISION (ERB)
BROOKS AIR FORCE BASE, TEXAS 78235-5328



March 27, 1995

Air Force Center for Environmental Excellence
HQ AFCEE/ERB
8001 Inner Circle Drive, Suite 2
Brooks Air Force Base, TX 78235-5328

Attention: Capt. Joe Feaster (Team Chief)

Subject: Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Base-Wide Quarterly Ground-Water Monitoring
Final Scoping Documents
Contract No. F41624-94-D-8050, Delivery Order No. 0001
Law Environmental Project No. 11-3517-3201

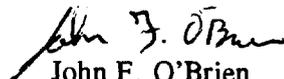
Dear Capt. Feaster:

Law Environmental, Inc., is pleased to submit the enclosed six copies of the Base-Wide Quarterly Ground-Water Monitoring Final Scoping Documents to the Air Force Center for Environmental Excellence (AFCEE) for approval. Also, four copies of the Final Scoping Documents have been submitted to Mr. Frank Grey at NAS Fort Worth.

If you have any questions or comments, please contact us at (404) 499-6800.

Sincerely,

LAW ENVIRONMENTAL, INC.
d/b/a Law Engineering and Environmental Services


John F. O'Brien
Project Manager


E. Fred Sharpe, Jr., P.E.
Principal

LAW ENVIRONMENTAL, INC.
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3517-3201.09



LAW

ENGINEERING AND ENVIRONMENTAL SERVICES

250 3

May 30, 1995

Captain Joe Feaster (Team Chief)
Air Force Center for Environmental Excellence
HQ AFCEE/ESB
8001 Inner Circle Drive, Suite 2
Brooks Air Force Base, TX 78235-5328

**Subject: Naval Air Station Fort Worth Joint Reserve Base
(formerly Carswell Air Force Base)
Revision to Final Scoping Documents
Base-Wide Well Monitoring Program
Contract No. F41624-94-8050
Delivery Order No. 01**

Dear Captain Feaster:

Law Environmental, Inc. (LAW) has revised the final scoping documents, issued March 27, 1995, for the above referenced delivery order in order to update and document pertinent information related to the quarterly ground water sampling program. Based on site information obtained during the first round of ground-water sample collections conducted April 3 to 15, 1995, revisions to the final scoping documents, dated March 27, 1995, were generated and are attached to this letter as replacement pages.

Due to the presence of free floating fuel ("free product"), the three monitoring wells located at Building 1628 (LSA1628-1, LSA1628-2, and LSA 1628-3), were not sampled during the April 3 to 15, 1995, sample collection trip. As per the request of the U.S. Air Force the three Building 1628 monitoring wells will be sampled the week of May 29, 1995, as part of the first round of ground-water sample collection. A QED "Well Wizard" pump will be used to purge the three wells before sample collection, in order to reduce the generation of volatile vapors from the free product. The purge pump will be decontaminated and the pump discharge tubing will be replaced between wells. The purge water generated from the Building 1628 monitoring wells will be drummed and stored at a 90 day hazardous waste accumulation area near Building 1628.

If you have any questions or comments, please contact us at (404) 499-6800.

LAW ENVIRONMENTAL, INC.

John F. O'Brien
Project Manager

E. Fred Sharpe, Jr. P.E.
Principal

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**LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES DIVISION**

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11-3517-3201

**INSTALLATION RESTORATION PROGRAM (IRP)
BASE-WIDE QUARTERLY GROUND-WATER MONITORING
REVISED FINAL SCOPING DOCUMENTS**

Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

May 1995



PREPARED FOR

AIR FORCE BASE CONVERSION AGENCY (AFBCA/OL-H)
NAVAL AIR STATION FORT WORTH, JOINT RESERVE BASE, CARSWELL FIELD
FORT WORTH, TEXAS 76127-5000

UNITED STATES AIR FORCE
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
ENVIRONMENTAL RESTORATION DIRECTORATE
BASE CLOSURE RESTORATION DIVISION (ERB)
BROOKS AIR FORCE BASE, TEXAS 78235-5328

May 30, 1995

Air Force Center for Environmental Excellence
HQ AFCEE/ERB
8001 Inner Circle Drive, Suite 2
Brooks Air Force Base, TX 78235-5328

Attention: **Capt. Joe Feaster (Team Chief)**

Subject: **Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Base-Wide Quarterly Ground-Water Monitoring
Revised Final Scoping Documents
Contract No. F41624-94-D-8050, Delivery Order No. 0001
Law Environmental Project No. 11-3517-3201**

Dear Capt. Feaster:

Law Environmental, Inc., is pleased to submit the enclosed six copies of the Base-Wide Quarterly Ground-Water Monitoring Revised Final Scoping Documents to the Air Force Center for Environmental Excellence (AFCEE) for approval. Also, four copies of the Revised Final Scoping Documents have been submitted to Mr. Alvin Brown at NAS Fort Worth.

If you have any questions or comments, please contact us at (404) 499-6800.

Sincerely,

LAW ENVIRONMENTAL, INC.

John F. O'Brien
Project Manager

E. Fred Sharpe, Jr., P.E.
Principal

TAB

VOLUME I

11-3517-3201

**INSTALLATION RESTORATION PROGRAM (IRP)
BASE-WIDE QUARTERLY GROUND-WATER MONITORING**

REVISED FINAL WORK PLAN

Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

May 1995



PREPARED FOR

**AIR FORCE BASE CONVERSION AGENCY (AFBCA/OL-H)
NAVAL AIR STATION FORT WORTH, JOINT RESERVE BASE, CARSWELL FIELD
FORT WORTH, TEXAS 76127-5000**

**UNITED STATES AIR FORCE
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
ENVIRONMENTAL RESTORATION DIRECTORATE
BASE CLOSURE RESTORATION DIVISION (ERB)
BROOKS AIR FORCE BASE, TEXAS 78235-5328**

INSTALLATION RESTORATION PROGRAM (IRP)
QUARTERLY BASE-WIDE GROUND-WATER MONITORING
REVISED FINAL WORK PLAN
FOR
NAVAL AIR STATION FORT WORTH, JOINT RESERVE BASE, CARSWELL FIELD
FORT WORTH, TEXAS 76127-5000

MAY 1995

Prepared by:

Law Environmental, Inc.
114 TownPark Drive
Kennesaw, Georgia 30144

CONTRACTOR CONTRACT NO. F41624-94-D-8050

DELIVERY ORDER NO. 0001

United States Air Force
Air Force Center For Environmental Excellence
Base Closure Restoration Division (ERB)
Brooks Air Force Base, Texas 78235-5328
Captain Joe Feaster (Team Chief)
Environmental Restoration Directorate

LIST OF ACRONYMS

AFCEE	Air Force Center for Environmental Excellence
ARAR	applicable or relevant and appropriate requirements
DQO	data quality objectives
FSP	Field Sampling Plan
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
ITIR	Informal Technical Information Report
LAW	Law Environmental, Inc.
LENL-P	Law Environmental National Laboratories - Pensacola, Florida
NAS FORT WORTH	Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
OSHA	Occupational Safety and Health Administration
PARCC	precision, accuracy, representativeness, completeness, comparability
PID	photoionization detector
POC	point of contact
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SSHP	Site Safety and Health Plan
TC	team chief
USAF	United States Air Force
USEPA	United States Environmental Protection Agency

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1.0 INTRODUCTION

Law Environmental, Inc., (LAW) Kennesaw, Georgia, has prepared this Work Plan in compliance with the United States Air Force (USAF) Installation Restoration Program (IRP). This Work Plan summarizes site characterization efforts performed at the Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field (NAS Fort Worth) (formerly Carswell Air Force Base), Texas as part of past IRP and non-IRP efforts. The objective of the quarterly ground-water sampling and analysis is to determine the configuration of the ground-water potentiometric surface, to assess variations of the ground-water flow directions, and to assess the extent of previously identified constituents of concern in the ground water on a base-wide scale. The wells to be monitored were selected following Air Force Center for Environmental Excellence (AFCEE) monitoring well construction guidance, well construction data provided from NAS Fort Worth, and a site reconnaissance (LAW, 1995c).

1.1 HISTORY OF PAST IRP WORK AT NAS FORT WORTH

The IRP was developed as a four phase program:

- Phase I - Initial Assessment/Records Search
- Phase II - Confirmation and Quantification
- Phase III - Technology Base Development
- Phase IV - Operation/Remedial Actions

1.1.1 Previous Investigative Activities and Documentation

The Phase I Records Search study was conducted to identify past waste disposal activities at NAS Fort Worth which may have caused environmental contamination and the migration of contaminants off of the base (CH₂M Hill, 1984). After ranking each site for potential adverse environmental effects, further investigation was recommended for 11 sites on the base and the Weapons Storage Area west of the base.

The 12 sites were investigated in the Phase II Stage 1 confirmation and quantification study (Radian, 1986). These sites include landfills, fire department training areas, industrial areas, and spills. The on-base sites were concentrated in two areas, the Flightline Area and the East Area (Figure 1-1). The Phase II, Stage 1 investigation was intended to determine the effect of past waste disposal activities at NAS Fort Worth including the magnitude and extent of contamination and its potential for further migration.

A Phase II Stage 2 Remedial Investigation was conducted to further detail the extent of existing contamination in the East Area (Radian, 1991a). This study focused on the hydrogeology and ground-water quality at Landfill 1, Unnamed Stream, POL Tank Farm, and the Base Service Station.

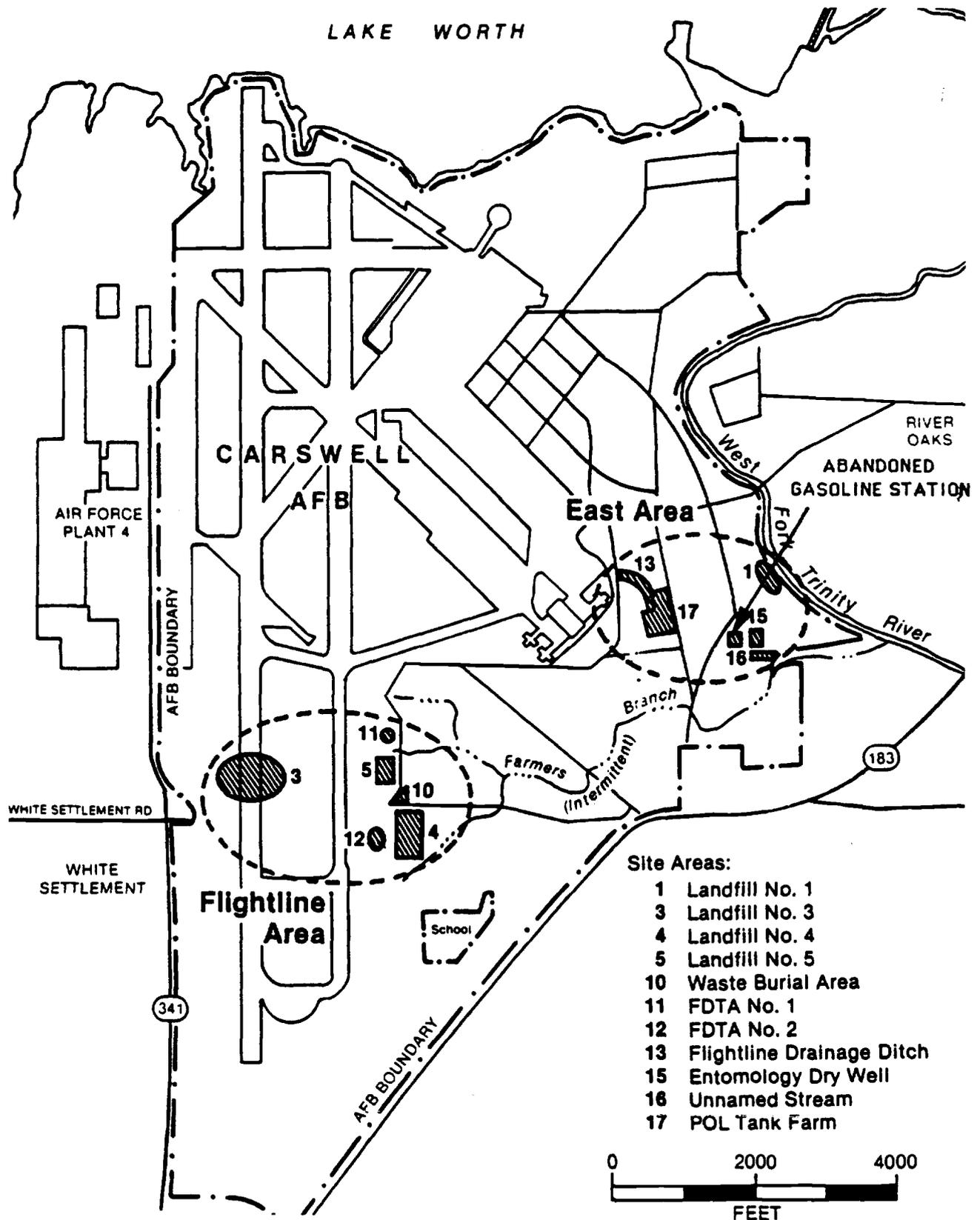
Data from Radian's 1991 Remedial Investigation were used in the selection of alternatives in a Feasibility Study conducted for 22 sites suspected of containing hazardous waste. Sites classed in Category II (requiring additional monitoring or work to assess the extent of current or future contamination) included the POL Tank Farm and the Unnamed Stream (Radian, 1991b).

A non-IRP investigation was conducted prior to construction at Building 1337-White House Communication, to determine if pesticide contamination posed an environmental concern (Maxim, 1991). No significant pesticide contamination was detected in the soil or ground water at that time, however, evidence of fuel-related contamination was detected in soil samples from two soil borings at this location.

A pilot test/treatability study has been recently completed by Engineering-Science, Inc., (ES, 1993) at the POL Tank Farm site to test the effectiveness of bioventing on the petroleum impacted soil.

FIGURE 1-1
LOCATION OF PHASE II, STAGE 1 SITES
 (AFTER RADIAN, 1986)
 CARSWELL AIR FORCE BASE, TEXAS

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1.1.2 Existing Remedial Actions

Engineering-Science is in the process of modeling ground-water contamination at the POL Tank Farm area to evaluate if soil contamination is entering the ground water and to evaluate the risk of exposure from ground water in the area (ES, 1994).

International Technology Corporation is currently remediating trichloroethylene (TCE) contamination in the Landfill 4 and Landfill 5 area. The ground-water extraction and treatment system (i.e., recovery well) is designed for the removal of TCE in the uppermost aquifer in the Terrace Alluvium Deposits (IT, 1994).

1.2 DESCRIPTION OF STUDY

This section describes project objectives, scoping documents, and the role of subcontractors. Ground-water sampling is being conducted by others in the vicinity at Air Force Plant No. 4. Therefore, the area of investigation for this quarterly ground-water monitoring excludes the area west of the main north-south runway. Additionally, the off-base weapons storage area located approximately three miles west of the base is not included in this study.

1.2.1 Project Objectives

The objective of the quarterly ground-water sampling and analysis is to determine the configuration of the ground-water potentiometric surface, to assess variations of the ground-water flow directions, and to assess the extent of previously identified constituents of concern in the ground water on a base-wide scale. The findings of this investigation will be compared to Texas Risk Reduction Standards (TNRCC, 1994).

1.2.2 Scoping Documents

Documents being prepared for this effort include:

- Work Plan (this document)
- Sampling and Analysis Plan (LAW, 1995a)
- Health and Safety Plan Addendum (LAW, 1995b)

1.2.2.1 Work Plan - Preparation of the Work Plan for the quarterly base-wide ground-water monitoring effort has been based on findings and recommendations in part from past investigations and also from observations of potential environmental concerns at NAS Fort Worth. The Work Plan details recommendations and the decision rationale for conducting field investigations and Data Quality Objectives (DQOs). The format used for writing this Work Plan was provided by the AFCEE Handbook (AFCEE, 1993) and in accordance with guidance provided by the NAS Fort Worth RCRA Part B Permit issued on February 7, 1991.

1.2.2.2 Sampling and Analysis Plan - A Sampling and Analysis Plan (SAP) has also been developed as a companion document to the Work Plan. The SAP consists of two parts, the Quality Assurance Project Plan (QAPP) and the Field Sampling Plan (FSP). The QAPP describes the policy, organization, functional activities, and quality assurance/quality control (QA/QC) procedures which will be implemented in order to achieve the DQOs dictated by the intended use of the data. The FSP provides guidance for all field activities and defines, in detail, the sampling and data gathering methods to be used during the investigation.

1.2.2.3 Health and Safety Plan - A site safety and health plan (SSHP) addendum has been prepared to comply with the Occupational Safety and Health Administration (OSHA) health and safety regulations regarding the work effort detailed in the Work Plan.

The SSHP uses OSHA guidelines for designating the appropriate level of protection needed at the study sites.

1.2.3 Identity of Subcontractors and Their Roles

LAW will manage the project and provide services related to field sampling, data analysis, ground-water site characterization, and reporting.

Law Environmental National Laboratories-Pensacola, Florida (LENL-P) has been subcontracted to perform the ground-water chemical analysis. Details of project organization, personnel, and subcontractor responsibility are provided in the QAPP.

2.0 SUMMARY OF EXISTING INFORMATION

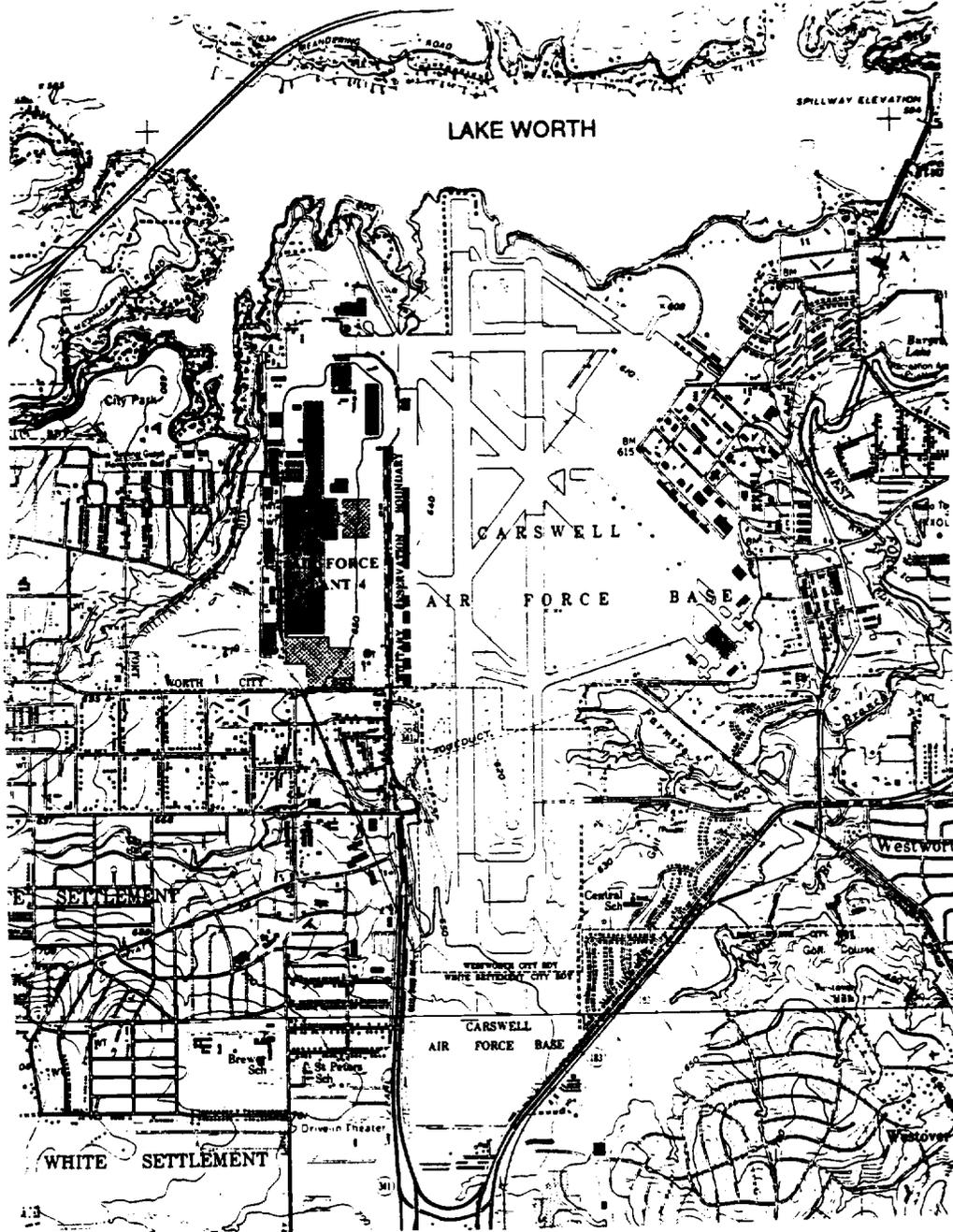
The following discussion of the Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field (NAS Fort Worth) environmental setting is derived primarily from the Installation Restoration Program Phase I Records Search Report (CH₂M Hill, 1984). Information from that report is supplemented by information from the literature and from the general findings of studies conducted by the U.S. Army Corps of Engineers (USACE, 1991) and Radian Corporation (Radian, 1986; 1991a).

2.1 NAS FORT WORTH ENVIRONMENTAL SETTING

NAS Fort Worth is located in northeastern Texas in Tarrant County, 6 miles west of downtown Fort Worth (Figure 2-1). The installation is bordered by Lake Worth to the north, the West Fork of the Trinity River and the community of Westworth to the east and southeast, the community of White Settlement to the south and southwest and Air Force Plant 4 to the west.

The majority of the base is covered by Quaternary terrace deposits of the Trinity River. The terrace deposits are composed of sand, silt, clay, and gravels of variable thickness and lateral extent. These deposits are underlain by Cretaceous limestones. The uppermost limestone in the southeastern portion of the base is the Goodland Formation. The Goodland Formation is a chalky white fossiliferous limestone and marl. The Goodland Formation outcrops approximately 200 feet east of the 1337 Storage Yard in the Farmers Branch Creek. Beneath the Goodland Formation is the Walnut Formation, a coquinoidal limestone with variable quantities of clay and shale. Underlying the Walnut Formation is the Paluxy Formation, a fine to coarse-grained sand with minor quantities of clay, sandy clay, pyrite, lignite, and shale. The regional dip of the rocks in the vicinity of NAS Fort Worth ranges from 35 to 40 feet per mile to the east and southeast.

250-20



UNITED STATES AIR FORCE
NAVAL AIR STATION-FORT WORTH JOINT RESERVE BASE
FORT WORTH, TEXAS

BASE-WIDE QUARTERLY GROUND WATER MONITORING
SITE
VICINITY MAP

Source: USGS Lake Worth, Texas Topographic Quadrangle, 1982
USGS Benbrook, Texas Topographic Quadrangle, 1981

PREPARED BY: 08, NOV. 94	FIGURE NUMBER: 2-1	FILE DATE: CP
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APPROVED BY:		FILE NAME:

2.2 HYDROGEOLOGY

The three uppermost hydrogeological units identified at NAS Fort Worth are as follows:

- A perched water zone occupying the Quaternary terrace deposits of the Trinity River
- An aquitard consisting of predominantly unsaturated limestone of the Goodland and Walnut Creek Formations
- The Paluxy Sands

The Quaternary terrace deposits which form the perched-water zone are composed of sand, silt, clay, and gravel. Ground water is first encountered within the perched-water zone at depths ranging from approximately 5 to 15 feet below the ground surface. Annual ground-water fluctuations are typically on the order of 5 feet. Recharge to the perched-water zone is from rainfall and infiltration from stream channels and drainage ditches.

The perched-water zone in the Quaternary terrace deposits is separated from the underlying aquifers by the low-permeability limestone and shale of the Goodland and Walnut Formations. Although primarily dry, drillers in the area have reported small quantities of water in the Walnut Formation, indicating that ground water may move through the Goodland and Walnut Formations along fractures and bedding planes. The thickness of the Goodland/Walnut Formations is approximately 25 feet or greater beneath most of the base. However, the top of the formations is an erosional surface and weathering may locally reduce the thickness of the formations. In areas of greater erosion, the Quaternary alluvium may be in contact with the Paluxy Formation.

The Paluxy Formation forms the shallowest bedrock aquifer beneath NAS Fort Worth. Ground water within the Paluxy Formation normally

occurs under confined conditions beneath the aquitard of the Goodland/Walnut Formations at depths of approximately 100 feet below ground surface (450 feet above mean sea level) along the eastern portion of the base. Extensive pumping of ground water in the Fort Worth area has lowered the potentiometric surface within the Paluxy Aquifer beneath the top of the formation, resulting in unconfined conditions of the aquifer in the area of the base.

The Paluxy Formation is divided into upper and lower sand members and the aquifer is likewise divided into upper and lower aquifers. The upper sand is fine grained and shaley, while the lower sand is coarser; therefore, most water-production wells are screened in the lower section of the aquifer (USACE, 1991). In the vicinity of NAS Fort Worth, the Paluxy Aquifer is recharged from surface outcrops of the formation west of the base and from outcrops north of the base located under Lake Worth.

3.1 SITE OBJECTIVES

The objective of the quarterly ground-water sampling and analysis is to determine the configuration of the ground-water potentiometric surface, to assess variations of the ground-water flow directions, and to assess the extent of previously identified constituents of concern in the ground water on a base-wide scale.

3.2 GROUND-WATER MONITORING

For one year, LAW will perform quarterly ground-water monitoring on selected monitoring wells (Table 3-1) located across the base. The list of monitoring wells selected for this project originated from LAW's monitoring well selection process which included review of well construction, location, and other characteristics of the existing wells. Refer to Figure 2-1 of the Sampling and Analysis Plan for this project (LAW, 1995a). The ground-water samples and QA/QC samples will be transported by overnight courier to Law Environmental National Laboratories in Pensacola, Florida (LENL-P) for analysis. All ground-water and (QA/QC) samples will be analyzed for volatiles (EPA SW846 8260), semi-volatiles (EPA SW846 8270), and metals (EPA SW846 6010/7000). Additionally, the ground-water samples from monitoring well OT-15C, located in the vicinity of an abandoned pesticide disposal well will be analyzed for pesticides by EPA SW846 8080 (Table 3-1).

3.2.1 Field Tasks

Each ground-water sampling event will be conducted by two or more sampling teams. To reduce the risk of cross contamination of the ground-water samples, the project field coordinator will assign one team to sample the monitoring wells thought to form the perimeter of the plumes (relatively clean locations) while another team will

MONITORING WELL SAMPLING LOCATIONS
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

SITE NAME/ SMWU #/ IRP #		
Landfill 01	POL Tank Farm	Various GMI04-
SWMU 28	SWMU 68	GMI22-
IRP #1	IRP #17	GMI04-01M
LF01-1C	ST14-01	GMI22-01M
LF01-1D	ST14-02	GMI22-02M
LF01-1E	ST14-04	GMI22-03M
LF01-1F	ST14-W05	GMI22-04M
	ST14-W06	GMI22-05M
	ST14-W07	GMI22-06M
Landfill 04	ST14-W08	GMI22-07M
SWMU 22	ST14-W09	GMI22-08M
IRP #4	ST14-W11	
LF04-4A	ST14-W13	
LF04-4B	ST14-W14	Waste Burial Site
LF04-4D	ST14-W15	SWMU #24
LF04-4E	ST14-W16	IRP #10
LF04-4F	ST14-W19	WP07-10B
	ST14-W20	WP07-10C
	ST14-W21	
Landfill 05	ST14-W22	
SWMU #23	ST14-W23	Entomology Dry Well
IRP #5		SWMU #63
LF05-5C	Base Service Station	IRP #15
LF05-5D	BSSA	OT15C
LF05-5G	BSSB	
	MW-5	Unnamed Stream
FDTA 1	MW-7	SWMU #64
SWMU 18	MW-8	IRP #16
IRP #11	MW-9	SD13-01
FT08-11A	MW-10	SD13-02
FT08-11B	MW-11	SD13-03
	MW-12	SD13-05
		SD13-06
FDTA 2		SD13-07
SWMU 19	Building 3340	
IRP #12	P3A	Northern Area of Base
FT09-12A		East of Taxiway Drive
FT09-12B	Building 3249	P6A
FT09-12C	T3	
		Building 1628
2nd & Boyston,	Building 1027	LSA1628-1
Open Lot	T4A	LSA1628-2
T7		LSA1628-3

PREPARED/DATE: DRJ 3-6-95
 CHECKED/DATE: JFO 3-6-95

be assigned to sample the monitoring wells within the plumes (relatively contaminated locations). Based on the results of the initial quarter of ground-water sampling, the assignments for the sampling teams may be modified.

During each quarterly ground-water sampling event, the depth to ground-water will be measured in each well and the volume of water to be purged will be calculated. See Sampling and Analysis Plan, Section 2.0, for purge volume calculation. The ground water from each monitoring well then will be purged using a dedicated PVC bailer decontaminated following the procedures outlined in the Sampling and Analysis Plan (LAW, 1995c).

For each well, after the purging activities are completed, the ground-water sample will be collected following the procedures outlined in the Sampling and Analysis Plan (LAW, 1995a). The ground-water samples will be collected using the dedicated bailer after the water level has recovered 80 percent of its static water level, or 24 hours after completion of purging, whichever comes first. The sample for the volatile analyses will be collected first, followed by the semi-volatile, metals, and then pesticides (where required). When possible, the ground-water samples will be sent to the laboratory on a daily basis.

3.3 RECORD KEEPING

This section discusses and describes field and laboratory record keeping.

3.3.1 Field Record Keeping

Field records will be maintained to document field work, sampling events, and personnel at the site. This information will be used to assist in the preparation of the Semi-Annual Ground-Water Monitoring Report. A summary of field record documents that will be used during field work follows.

Field Log Book

A field log book will be maintained during operations at NAS Fort Worth. The log book will be bound and the pages will be sequentially numbered. The log book will be completed by the site manager and notes will be kept throughout the day, recording pertinent events and time of occurrence.

Chain of Custody Record

Figure 3-1 illustrates the Chain of Custody Record form used to transfer custody of the samples from LAW to the shipping agent, and ultimately to the analyzing laboratory. Sample identification names and required signatures will be recorded on this form prior to shipment.

3.3.2 Laboratory Record Keeping

The laboratory will maintain records sufficient to document phases of sample control, from initial receipt of the samples through all stages of analysis and data generation. The laboratory will maintain written procedures for the analytical methods, and adhere to strict QA/QC guidelines. Specific laboratory procedures are outlined in the Sampling and Analysis Plan (LAW, 1995a).

3.4 DATA ASSESSMENT

Quality assurance is an important factor in maintaining the integrity of a project in which data collection consumes much of the project time and effort. A structured quality control process to include all stages of the project will be followed so that the project effort will build on data confidence as the investigation data base expands. The following steps will be followed to maintain this effort.

- A complete and thorough knowledge of the Statement of Work will be provided to all project personnel.
- Open channels of communication will be maintained between LAW and AFCEE and that communication will be documented.
- Project scoping documents (and all other documents submitted) will be prepared and reviewed for completeness and accuracy.
- Field investigations and laboratory analysis will follow approved procedures outlined in the Work Plan and Sampling and Analysis Plan (LAW, 1995a).
- Field records will be complete and activities will be documented as outlined in the Sampling and Analysis Plan (LAW, 1995a).
- Laboratory methods and QA/QC will be complete and all activities will be documented (Sampling and Analysis Plan (LAW, 1995a)).

The field and laboratory data will be reviewed for precision, accuracy, representativeness, comparability, and completeness. Discrepancies in any data set will be noted.

4.0 REPORTING REQUIREMENTS

4.1 DELIVERABLES

Draft and final scoping documents outlining the project requirements and procedures, and the results of the sampling and analysis events will be prepared and submitted for review. Other documents, such as interim reports of information or progress will also be submitted.

4.1.1 R&D Status Reports

Monthly status reports will be prepared monthly to describe the progress of the project. These reports will discuss the following items:

- Identification of installation and activity in progress
- Status of work and progress to date
- Percentage completion of project
- Difficulties encountered during the reporting period
- Actions being taken to rectify problems
- Activities planned for the next month
- Changes in personnel

The monthly progress report will list target completion dates for each element of activity. The report will include supporting information for hours invoiced for the time period and will identify activities such as ground-water collection, analysis of data, report writing and other items requiring major manpower commitments.

4.1.2 Work Plan

The Work Plan will be prepared pursuant to the project activities outlined in the Statement of Work. The Work Plan will present evaluations and decisions made during the scoping process, and will present a detailed plan for conducting tasks associated with quarterly ground-water monitoring at NAS Fort Worth.

4.1.3 Sampling and Analysis Plan

The Sampling and Analysis Plan (LAW, 1995a) consists of two parts: the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP). The FSP presents detailed data collection methods to be followed, and the QAPP outlines policy, organization, functional activities, and detailed laboratory and quality control procedures necessary to achieve stated data quality objectives (DQOs).

4.1.4 Health and Safety Plan Addendum

The Health and Safety Plan Addendum (LAW, 1995b) describes safety requirements and procedures to be implemented during field activities. The Health and Safety Plan Addendum is tailored to fit the needs of this specific site investigation.

4.1.5 Technical Report

Technical reports will be prepared every two quarters. Based on the assumption that the quarterly ground-water sampling will be performed for one year, two technical reports will be prepared.

Each technical report will document the findings of two quarters of the base-wide quarterly ground-water monitoring and will include our interpretation of ground-water flow direction and, where possible, the extent of contaminant plumes; and a comparison of the

concentration of the constituents detected to the Texas Risk Reduction Standards (TNRCC, 1994).

4.1.6 Data Management

The Installation Restoration Program Information Management System (IRPIMS) is not included as part of this statement of work.

4.2 SPECIAL NOTIFICATION

The AFCEE Team Chief and NAS Fort Worth Point of Contact (POC) will be contacted immediately by telephone and receive written notification of imminent health hazards along with the supporting documentation within three days after telephone notification.

4.3 VARIATIONS

If variations in technical efforts, including field work are necessary, written concurrence from the Contracting Officer's Technical Representative will be obtained prior to variation from the agreed upon scope. Under such circumstances, the ceiling price of the order will remain unchanged. Should an increase in the ceiling amount be necessary, contracting officer authorization will be required prior to proceeding with the variations.

5.0 PROJECT SCHEDULE

The summary schedule for this project will be updated on a quarterly basis and submitted with the respective R & D status report to show any changes for each of the projected tasks for the work plan, field activities, and reports.

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VOLUME II

11-3517-3201

**INSTALLATION RESTORATION PROGRAM (IRP)
BASE-WIDE QUARTERLY GROUND-WATER MONITORING
REVISED FINAL SAMPLING AND ANALYSIS PLAN**

Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

May 1995



PREPARED FOR

AIR FORCE BASE CONVERSION AGENCY (AFBCA/OL-H)
NAVAL AIR STATION FORT WORTH, JOINT RESERVE BASE, CARSWELL FIELD
FORT WORTH, TEXAS 76127-5000

UNITED STATES AIR FORCE
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
ENVIRONMENTAL RESTORATION DIRECTORATE
BASE CLOSURE RESTORATION DIVISION (ERB)
BROOKS AIR FORCE BASE, TEXAS 78235-5328

INSTALLATION RESTORATION PROGRAM (IRP)
BASE-WIDE QUARTERLY GROUND-WATER MONITORING
REVISED FINAL SAMPLING AND ANALYSIS PLAN
FOR
NAVAL AIR STATION FORT WORTH, JOINT RESERVE BASE, CARSWELL FIELD
FORT WORTH, TEXAS 76127-5000

MAY 1995

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CONTRACTOR CONTRACT NO. F41624-94-D-8050-0001 DELIVERY ORDER NO. 0001

United States Air Force
Air Force Center For Environmental Excellence
Environmental Restoration Directorate
Base Closure Restoration Division (HQ AFCEE/ESB)
Brooks Air Force Base, Texas 78235-5328
Capt. Feaster (Team Chief)

LIST OF ACRONYMS

AB	ambient conditions blank
ABB-ENV	ABB Environmental Services, Inc.
AFCEE	Air Force Center for Environmental Excellence
ARAR	applicable or relevant and appropriate requirements
ASTM	American Society for Testing and Materials
BFB	4-bromo-fluorobenzene
CA	corrective action
CCB	continuing calibration blank
CCC	continuing calibration check
CCV	continuing calibration verification
CE	civil engineering
CEO	chief executive officer
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (PL-96-510) - Superfund
CES	civil engineering squadron
CF	calibration factor
CFR	Code of Federal Regulations
CLP	contract laboratory program
CV	coefficient of variation
CVAA	cold vapor atomic absorption
DFTPP	decafluorotriphenylphosphine
DOT	Department of Transportation
DQO	data quality objectives
EB	equipment blank (rinsate)
EMSL	USEPA Environmental Monitoring Systems Laboratory
FS	feasibility study
FSP	field sampling plan
GC/MS	gas chromatography/mass spectrometry
GFAA	graphite furnace atomic absorption
ICB	initial calibration blank
ICP	inductively coupled plasma

LIST OF ACRONYMS
(Continued)

ICV	initial calibration verification
ID	sample identification
IDL	instrument detection limit
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
ITIR	Informal Technical Information Report
LAW	Law Environmental, Inc.
LCS	laboratory control standards
LENL-P	Law Environmental National Laboratories - Pensacola, Florida
MCL	maximum contaminant level
MDL	method detection limit
mg/L	milligrams per liter
MS	matrix spike
MSD	matrix spike duplicate
MW	monitoring well
NAS FORT WORTH	Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
NCP	National Contingency Plan
NTU	nephelometric turbidity unit
OSWER	Office of Solid Waste and Emergency Response
PARCC	precision, accuracy, representativeness, completeness, comparability
PCB	polychlorinated biphenyls
PE	professional engineer
PID	photoionization detector
POC	point of contact
ppb	parts per billion
ppm	parts per million
PQL	practical quantification limit
QA	quality assurance
QA/QC	quality assurance/quality control

LIST OF ACRONYMS
(Continued)

QAMS	quality assurance management staff
QAPP	quality assurance project plan
QC	quality control
QCCS	quality control check samples
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RF	response factor
RLS	registered land surveyors
RPD	relative percent difference
RRF	relative response factor
RRT	relative retention time
RSD	relative standard deviation
RT	retention time
S	standard deviation
SAP	sampling and analysis plan
SB	soil boring
SC	specific conductance
SD	surface sediment
SI	site investigation
SOP	standard operating procedures
SPCC	system performance check compound
SPT	standard penetration test
SW	surface water
TB	trip blank
TC	team chief
TPM	technical project manager
TWC	Texas Water Commission
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
$\mu\text{g/L}$	micrograms per liter

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1.0 QUALITY ASSURANCE PROJECT PLAN

1.1 INTRODUCTION

This quality assurance project plan (QAPP) is provided in support of the United States Air Force Installation Restoration Program (IRP) for Base-Wide Quarterly Ground-Water Sampling of selected monitoring wells at the Naval Air Station Fort Worth, Joint Reserve Base (NAS Fort Worth), formerly Carswell Air Force Base, Fort Worth, Texas (Figure 1-1). This investigation will be conducted in accordance with the Air Force Center for Environmental Excellence (AFCEE) Statement of Work for Delivery Order 0001, dated May 16, 1994, and revised September 3, 1994. The AFCEE Handbook (AFCEE, 1993) will be used as a source supplemental guidance in developing the approach of the project.

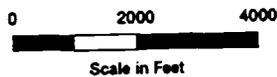
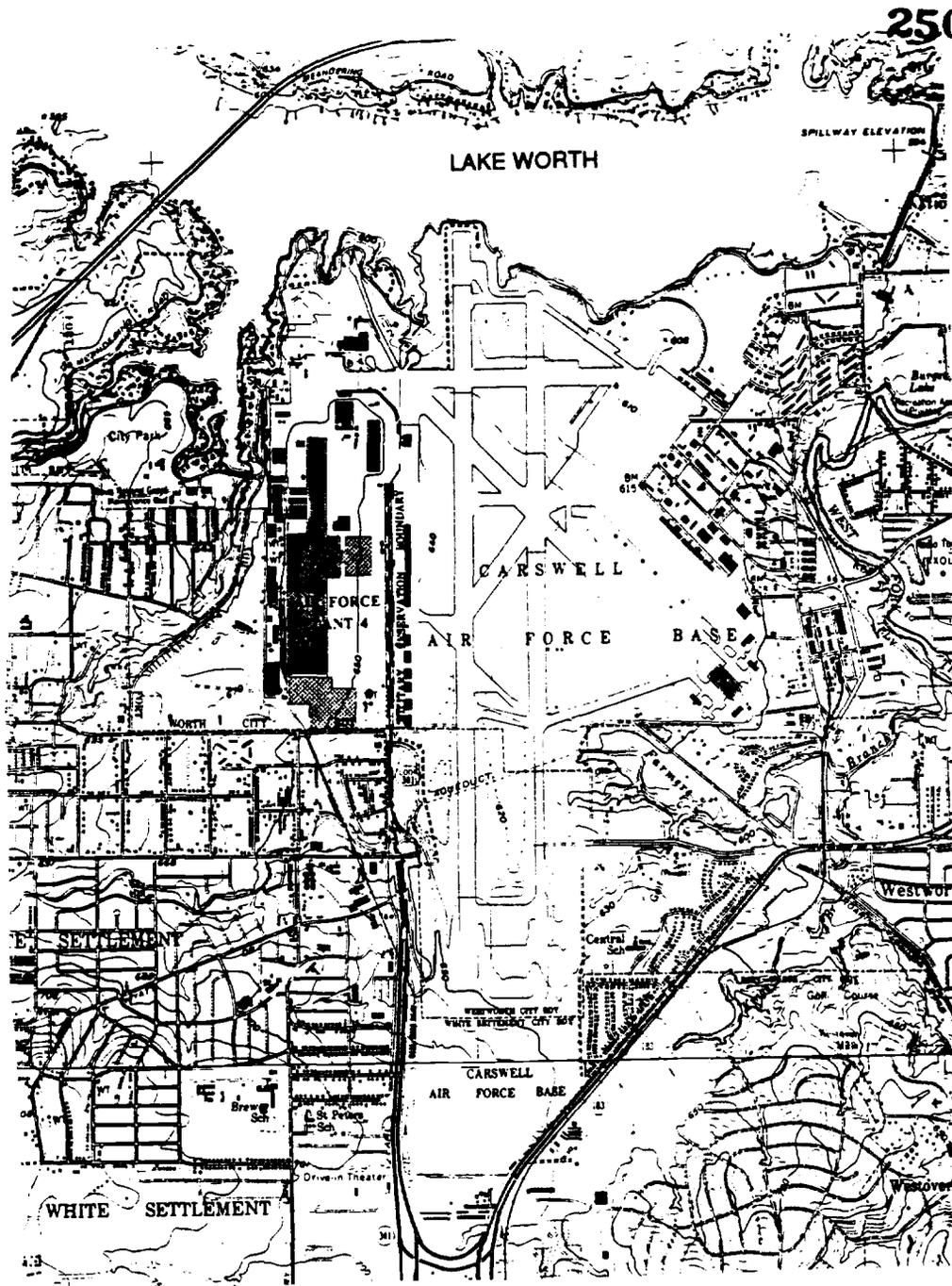
1.1.1 The U.S. Air Force Installation Restoration Program

The objective of the Air Force IRP is to assess past hazardous waste disposal and spill sites at Air Force installations and to develop remedial actions consistent with the National Contingency Plan (NCP) for those sites which present a threat to human health and welfare or the environment. Additional information regarding the Air Force IRP is discussed in Section 1.0 of the work plan.

1.1.2 Purpose and Scope

The sampling and analysis plan (SAP) describes those procedures necessary to perform the sampling and analytical activities during the execution of the project's scope of work. The elements addressed in the SAP include:

- Acquisition of ground-water samples
- Decontamination of equipment



UNITED STATES AIR FORCE
NAVAL AIR STATION-FORT WORTH JOINT RESERVE BASE
FORT WORTH, TEXAS

BASE-WIDE QUARTERLY GROUND WATER MONITORING

SITE
VICINITY MAP

Source: USGS Lake Worth, Texas Topographic Quadrangle, 1962
 USGS Benbrook, Texas Topographic Quadrangle, 1981

PREPARED BY: 08, NOV. 94	FIGURE NUMBER: 1-1	FILE DATE: CP
CHECKED BY:		PLOT DATE:
APPROVED BY:		FILE NAME:

- Calibration of field instruments
- Maintenance of laboratory and field quality assurance/quality control (QA/QC)
- Chemical analysis
- Preventative maintenance
- Data quality assessment
- Corrective action
- Quality control checks
- Quality assurance audits and reports

Specific quality control requirements are specified in Appendix A.

1.2 PROJECT DESCRIPTION

This project has been designed to record static ground-water measurements and to collect ground-water samples for chemical analysis on a quarterly basis for one calendar year at NAS Fort Worth. Static ground-water measurements will be recorded to map the potentiometric surface of the ground water and identify ground-water flow patterns. Chemical analyses will be performed on ground-water samples to investigate the presence of suspected ground-water contaminants and to assess the extent of ground-water contaminants above regulatory standards.

1.2.1 Project Background

The sites included under this base-wide quarterly sampling program were identified as possibly contaminated sites through the review of the Installation Restoration Program Phase I Records Search Report (CH2M Hill, 1984). Information from this report is supplemented by information from the literature and from the

general findings of studies conducted by the Radian Corporation (Radian, 1986, 1991), and personal communications with NAS Fort Worth and their consultants (ES,1993).

1.2.2 Project Scope and Objectives

The scope and objectives of this project are to record static ground-water measurements to identify ground-water flow patterns, and to collect ground-water samples in order to assess the extent of ground-water contamination above regulatory standards. The objectives will be accomplished through the collection of environmental samples; the laboratory analysis of these samples, the evaluation of the analytical results and field measurements with respect to quality control data, and the interpretation and analysis of all data collected.

Health and Safety data will be used to establish the level of protection needed for the work party and other site-related personnel. The data will be gathered by the use of field monitoring devices which will be utilized during intrusive activities.

1.2.3 Subcontractors

The subcontractors to be utilized for this investigation, along with the services to be performed, are identified in Section 1.3.

1.3 PROJECT ORGANIZATION AND RESPONSIBILITIES

Project organization and responsibilities for the base-wide quarterly ground water sampling for NAS Fort Worth are discussed in the following sections.

1.3.1 Project Organization

Law Environmental, Inc., (LAW) will manage the project and provide services related to field samples, data analysis, site characterization, and reporting.

The project organization is shown on Figure 1-2.

1.3.1.1 Law Environmental, Inc. - Law Environmental's Government Services Division will provide the project management, engineering and analysis, and sampling through its in-house resources. It is a branch of Law Environmental, Inc., which, in turn, is a wholly-owned subsidiary of Law Companies Group, Inc. Law Companies Group, Inc., is an employee-owned company.

1.3.1.2 Chemical Analysis Laboratories - The Law Environmental, Inc., National Laboratories facility in Pensacola, Florida (LENL-P), is a LAW chemical testing laboratory which was established in 1989. LENL-P will be the laboratory responsible for providing sample shipping containers, chain-of-custody documents, chemical analysis, reporting, and laboratory quality assurance/quality control (QA/QC). LENL-P will perform ground-water analyses and associated QC samples. LENL-P will report directly to the LAW project manager during the project. LENL-P has integrated QA/QC procedures into their laboratory design and standard operating procedures. LENL-P is certified in several states. In order to perform analyses for AFCEE projects, LENL-P has undergone and complied fully with audits conducted under the auspices of the Air Force. LENL-P's key personnel and their positions and responsibilities are outlined in Appendix B.

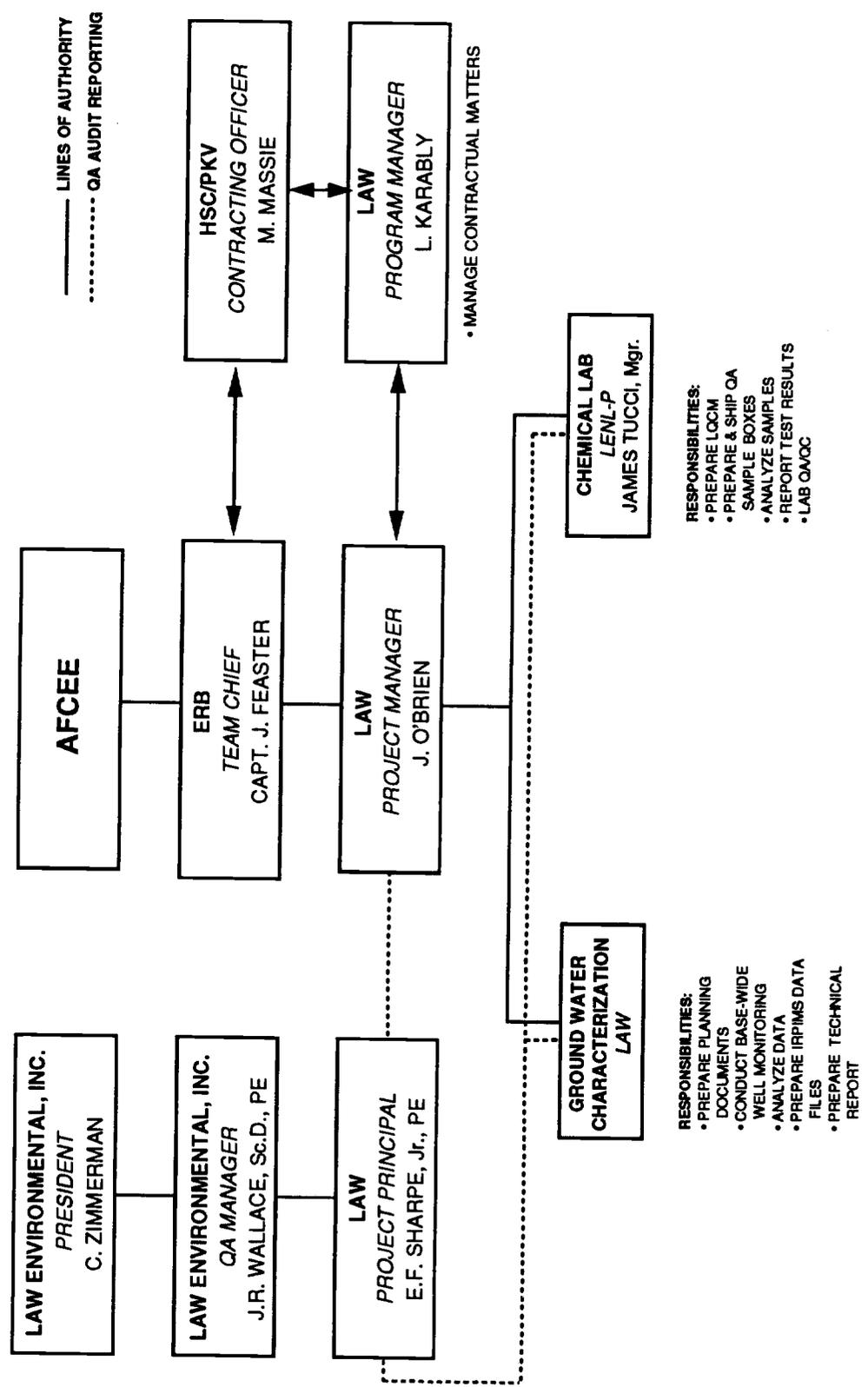
1.3.2 Key Project Individuals

Key project participants for this project include the project principal, project manager, project chemist, project geologist,

PROJECT ORGANIZATION AND QUALITY MANAGEMENT RESPONSIBILITIES

BASE-WIDE QUARTERLY GROUND WATER MONITORING
 NAVAL AIR STATION – FORT WORTH JOINT RESERVE BASE
 FORT WORTH, TEXAS

FIGURE 1-2



site manager, health and safety officer, laboratory manager, and field team. The following paragraphs provide a description of the proposed project assignments and responsibilities, a list of individuals expected to serve in each capacity, and a brief synopsis of the participants' related experience.

1.3.2.1 Project Principal - The project principal, Mr. E. Fred Sharpe, Jr., P.E., will provide technical quality control, oversight and direction for all aspects of the site investigation and data evaluation. Mr. Sharpe has over 25 years experience with Law Companies.

1.3.2.2 Project Manager - The project manager, Mr. John O'Brien, will be responsible for the overall management of the project. He will coordinate between office and field personnel, manage administrative requirements, and supervise schedules, technical approach, implementation, and report preparation. Mr. O'Brien has over seven years of professional experience in site and project management. He is presently managing projects under RCRA, CERCLA, and IRP guidance.

1.3.2.3 Site Manager - The site manager will coordinate and supervise the field investigation activities. The site manager may also serve as the health and safety officer for the field operations, and will be responsible for the implementation of the work plans and health and safety plans. Ms. Dianna Johnson will serve as the site manager for this project.

1.3.2.4 Project Chemist - The project chemist will be responsible for preparing and implementing the field sampling, sample preservation, chain-of-custody documentation, and shipping activities. The project chemist will also perform data evaluation on the chemical data. Ms. Dianna Johnson will serve as the project chemist for this investigation. Ms. Johnson is a chemist with over four years of experience in environmental chemistry, QA/QC, and data evaluation.

1.3.2.5 Laboratory Project Manager - The laboratory project manager will be responsible for the handling and analysis of ground-water samples received by the laboratory. This person will oversee sample distribution through the lab, analytical procedures, quality control, reporting, and sample disposal. Mr. James Tucci is LENL's chemical laboratory manager. His areas of expertise include environmental field studies, laboratory analyses and personnel management.

1.3.2.6 Field Team - The field team party will perform on-site tasks contained in this plan, including analytical sampling under the direction of the site manager.

1.3.2.7 Project Safety Officer - The project safety officer, Ms. Dianna Johnson, will be responsible for the project site safety and health plan requirements. While conducting field activities, if a health and safety issue arises that is not covered by the health and safety plan, the project safety officer will contact LAW's Health and Safety Coordinator, Sherri Hall (404) 499-6800, who will provide advice and assist in resolving any health and safety issues.

1.3.3 Project QA Responsibilities

LAW has established a strong internal quality assurance (QA) program with an associated QA Manual, Engineering Procedures Manual, Equipment Calibration Procedures Manual, and specialty manuals for hazardous waste site investigations and software documentation. LAW employees use these manuals as the basis for conducting company work within the QA program.

LAW's principal review system is an integral part of the QA Program. Each project is assigned to a principal reviewer who is responsible for maintaining the required professional quality from beginning to completion of the project. Every proposal and report

must be reviewed and signed by a LAW principal with experience relevant to the area of work.

LAW will control the quality of subcontractor furnished data and services by source evaluation and selection, evaluation of objective evidence of quality compliance to procurement documents furnished to the subcontractor, site and/or source inspections, audits, and/or examination of items or services upon delivery or completion. Prior to the award of a subcontract, potential suppliers of quality affecting items or services will be evaluated by LAW personnel. The evaluation may be performed by any appropriate means, including but not limited to, surveys, inspections, audits, or surveillance, depending upon the complexity of the item or service being supplied. When the project principal determines it necessary, on-site audits of subcontractor facilities may be conducted under the quality assurance program. While the responsibility for quality remains with the subcontractor under his quality control program, LAW will conduct certain quality assurance activities to determine compliance with the quality program.

1.4 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

QA objectives for measurement data are expressed in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC). QA objectives provide the mechanism for ongoing control and evaluation of measurement data quality throughout the project and will ultimately be used to define data quality for the various measurement parameters. These QA/QC objectives will be accomplished through the collection of field duplicates, rinsates, trip blanks, and field blanks. The analytical QA/QC will be assessed by the internal QC such as method blanks, laboratory control sample data, surrogate recoveries, adherence to holding times and matrix spike/matrix spike duplicate data. Quality control requirements and reporting limits are included in Appendix A.

1.4.1 QA Criteria

The following sections list and define the QA criteria applicable to this project.

1.4.1.1 Accuracy - Accuracy refers to the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value, or actual concentration, the more accurate the measurement. Analytical accuracy may be expressed as the percent recovery of an analyte which has been added to the environmental sample at a known concentration before analysis. For example, accuracy can be determined from the results of matrix spike analyses performed at the rate of one set every 20 samples or one per batch. The equation used to calculate percent recovery can be found in Section 1.13.1.

The accuracy of simple, yet fundamental, field analyses is difficult to assess quantitatively. Sampling accuracy can be maximized, however, by the adoption and adherence to a strict QA program. Specifically, all procedures will be documented and all equipment and instrumentation will be properly calibrated and well maintained. Trip blanks and equipment rinsates will be included in all sample batches to assess the potential for cross-contamination. In addition to equipment operation and standard operating procedures, a high level of accuracy will be maintained by thorough and frequent review of field procedures. In this manner, any deficiencies will be quickly documented and corrected.

1.4.1.2 Precision - Precision refers to the reproducibility or degree of agreement among duplicate measurements of a single analyte. This allows for comparison of the results of duplicate samples analyzed by the same method. Analytical precision for a single analyte is expressed as a percentage of the difference between results of duplicate samples or matrix spike duplicates

(MS/MSD) for a given analyte. Relative percent difference is calculated as shown in Section 1.13.1.

Precision will be determined through the collection of field duplicates and the analysis of matrix spikes and matrix spike duplicates. The chemist will select 1 sample in 20 (or 1 per batch, whichever is fewer) for that matrix and split the sample into three aliquots. The first aliquot will be analyzed routinely for the parameters of interest, while the other two aliquots will be spiked with known quantities of the parameters of interest prior to analysis. The relative percent difference (RPD) will be calculated and used as an indication of the precision for the analyses performed.

During the collection of data using field methods or field instrumentation, precision is checked by reporting several duplicate measurements taken at one location and comparing the results. Precision will be reported as the RPD for two results. Sample collection precision will be measured in the laboratory with the analysis of field replicates. Laboratory precision will be measured in the laboratory with the analysis of matrix spike duplicates.

1.4.1.3 Completeness - Completeness is expressed as the percentage of valid data obtained from a measurement system. For data to be considered valid, it must meet all the acceptance criteria including accuracy, precision, and any other criteria specified for the analytical method used. The data quality objective for completeness is 90 percent for each analyte by method.

Field sampling conditions are often unpredictable and non-uniform. However, the objective of the field sampling program is to obtain samples for all analyses required at each individual site, provide sufficient sample material to complete those analyses, and to collect QC samples to monitor all possible contamination potential;

i.e., contamination during sample collection, transportation, and storage. The field sampling completeness goal is 100 percent.

Samples for which critical data points (not identified at this point) fail the accuracy, precision, interference, or contamination data quality objectives may be reanalyzed (providing adequate sample volume and holding times are met) or resampled (with approval of the project manager) to meet data quality objectives.

1.4.1.4 Representativeness - Representativeness is defined by the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. If the results are reproducible, the data can be said to represent the environmental condition. Representativeness is ensured by collecting sufficient samples of an environmental medium, properly chosen with respect to place and time. The precision of a representative set of samples reflects the degree of variability of the sampled medium, as well as the effectiveness of the sampling techniques and laboratory analysis. The methods and protocols used to select samples that are representative of a particular sampling site are described in the sampling and analysis plan.

1.4.1.5 Comparability - Comparability is defined by the confidence with which one data set can be compared to another. Field and laboratory procedures affect comparability. To optimize comparability, only the EPA established methods and protocols that have been specified as appropriate for this investigation will be used to collect and analyze samples.

1.4.1.6 Analytical Levels - Data generated by the quarterly ground-water monitoring activities are categorized into two groups; field screening data and laboratory generated data.

Field screening data (field measurements) are collected for two objectives: (1) to conduct health and safety monitoring described in the health and safety plan; (2) to indicate that the water quality parameters have stabilized and adequate purge volumes were removed before sample collection. The water quality parameters include: pH, conductivity, turbidity, and temperature. The instruments used to gather the data will be calibrated and maintained as described in Section 2.3 and real-time results recorded in the field log books.

Field data will be of sufficient quality to monitor health and safety risks, and to indicate whether acceptable monitoring well purge volumes were removed prior to sampling.

Analytical results for this project will be compared to Texas Natural Resources Conservation Commission (TNRCC) Risk Reduction Rules. The laboratory will perform the requested methods, meet specific limits (method detection limits and surrogate recoveries) and implement corrective actions listed in Appendix A.

1.4.2 Goals

Method-specific goals for precision and accuracy are presented in Section 1.13.1. Comparability goals will be established by adhering to the use of standard sampling and analytical methods and the use of quality control samples. The completeness goals are 90 percent for each analyte by method. Failure to meet these goals may result in qualification of the data, rejection of the data, or resampling and reanalysis of samples.

1.5 SAMPLING PROCEDURES

Sampling procedures consist of sample collection, transport and storage protocols. These protocols which pertain to the field

activities are presented in detail in the field sampling plan (FSP) and are only referenced in Section 2.0.

1.5.1 Sampling Protocols

The AFCEE Handbook (AFCEE, 1993) will be used as the primary guidance for sample collection, transport and storage.

1.5.2 Sample Handling

The sample containers, sample volume, method of preservation, shipping and handling procedures are presented in Section 2.2.2.

1.6 SAMPLE CUSTODY

Sample custody procedures during the collection of samples in the field and sample receipt in the laboratory are discussed in the following subsections.

1.6.1 Field Operations

Maintenance of sample custody in the field starts with the collection, preservation and labeling of the sample. Field sampling activities will be documented. Specific procedures for the maintenance and documentation of the custody of the samples is discussed in detail in Section 2.2.3.

1.6.2 Laboratory Operations

Sample custody and documentation procedures in the laboratory are outlined in Figure 1-3.

1.7 FIELD EQUIPMENT CALIBRATION PROCEDURES

Several instruments will be used in the field investigation. These instruments consist of a photoionization detector, oxygen monitor,

FIGURE 1-3

LENL SAMPLE FLOW AND DOCUMENTATION CHART

Sample Flow		Documentation
A.	Incoming Samples	- Chain of Custody - Request for Analysis - Work Authorization
B.	Log-In and Assignment	- Master Logbook - Test Entry Form
C.	Sample Handling and QC	- Extraction Record
	(1) Organics Prep Lab	- Percent Moisture - Standards Prep Logs - QC Sample Logs
	(2) GC Lab	- Chromatograms - Bench Sheets - Condition Reports - Linearity Checks - Surrogate Recovery Logs - Blank, Standard and Spike Results - Standards Logbook
	(3) GC/MS Lab	- Instrument Maintenance Logs - Sample Logbook - Quantitation Reports - Chromatograms - Initial Calibration Forms - Continuing Calibration Checks - Surrogate Recovery Logs - Blank, Standard and Spike Results - Computer Streamer Tapes - Instrument Maintenance Logs
	(4) Metals Lab	- Digestion Log - Bench sheets - Blank, Standard and Spike Results - Percent Moisture - Standards Prep Logs - QC Sample Logs
D.	Reporting	- Transmittal Letters - Test Data Reports - GC/MS Data Reports
E.	Sample Disposal	- Internal Sample Disposal Forms

combustible gas indicator, pH meter, temperature meter, specific conductance meter, and turbidimeter. Each field instrument will be calibrated a minimum of twice a day. Calibration data will be documented in the field book. Details of calibration and maintenance are presented in Section 2.3 of the FSP.

1.8 ANALYTICAL PROCEDURES

The following sections identify the analytical methods to be utilized.

1.8.1 Identification of Methods

The analytical methods to be utilized are presented in Table 1-1.

1.8.2 Detection Limits and Quantitation Criteria

1.8.2.1 Terminology - Each analytical parameter concentration will be reported as a specific number or less than the Instrument Detection Limit for inorganic methods, and less than the Practical Quantification Limit (PQL) for organic methods. Ground-water values will be reported in parts per billion (ppb, $\mu\text{g/L}$) for organics and in parts per million (ppm, mg/L) for inorganics. Method detection limits (MDLs) are defined below.

1.8.2.2 Procedures - The following procedures are used to establish limits of detection and quantification.

Method detection limits (MDL) limits are established using the required USEPA procedure specified in 40 CFR Part 136 Appendix B. The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the value is above zero. A data pool of at least seven standards analyzed at a concentration approximately three times the anticipated MDL is generated. The MDL is estimated by employing the "t" distribution with a 99 percent confidence interval by the following equation:

TABLE 1-1

ANALYTICAL TEST METHODS
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

MATRIX: EQUIPMENT RINSATE/GROUND WATER	
Volatile Organics ($\mu\text{g/L}$)	SW 5030/8260
Semi-Volatile Organics ($\mu\text{g/L}$)	SW 3520/8270
Total Metals Screen (mg/L)	SW 3005/6010
Arsenic (mg/L)	SW 3020/7060
Lead (mg/L)	SW 3020/7421
Selenium (mg/L)	SW 3020/7740
Mercury (mg/L)	SW 7470
Pesticides ($\mu\text{g/L}$)	SW 3520/8080

If the lead concentration detected on the inductively coupled plasma (ICP) is >5 x the instrument detection limit (IDL) on the ICP, the ICP value can be used. If the lead concentration detected on the ICP is <5 x the IDL on the ICP, then the Graphite Furnace Atomic Absorption (GFAA) analysis is required.

$$MDL = (t) (S)$$

where:

t = is a factor for n-1 degrees of freedom
at the 99 percent confidence factor

S = is the standard deviation of the data
pool

Instrument detection limits (IDL) are established by the USEPA Contract Laboratory Program (CLP) protocol, which allows for generating a data pool by analyzing a minimum of seven standards at three times the anticipated IDL on three non-consecutive days. The standard deviation (S) of the seven data for each of the three days is calculated and the IDL established by the following equation:

$$IDL = \frac{S1 + S2 + S3}{3} * 3$$

The PQL is the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

For this project the PQL is defined as the lowest calibration standard analyzed for a given method that meets the AFCEE reporting requirements. For certain methods, SW-8260 and SW-8270, results will be reported below the PQL but above the MDL, and data will be flagged as estimated values. In cases where AFCEE PQLs cannot routinely be achieved, a request for variance will be issued to the team chief.

1.8.2.3 Values - The 1995 laboratory established detection and quantitation limits are listed in Appendix A-1.

1.8.3 Method Calibration

The calibration procedures, preparation of calibration standards, and frequency of initial and continuing calibration checks are described for each analytical method in the following subsections.

At a minimum, all instruments and other equipment used by LAW will be calibrated for all analytes of interest and monitored at the recommended intervals prescribed by the analytical method employed. In those cases where it has been demonstrated that more frequent calibration or maintenance is required, the base method will be enhanced as necessary. Calibration checks and preventive maintenance procedures are permanently recorded in a log book for future reference. Whenever possible, calibration checks on instruments and support equipment are performed using reference materials (e.g., weights) which are traceable to the USEPA Environmental Monitoring Systems Laboratory (EMSL) or bear certificates of standardization from the National Institute of Standards and Technology.

All chemical standards used by LAW are certified to have the highest reasonable purity with assays or certificates of analysis provided with material. All materials are purchased from established and reputable chemical suppliers. All standard materials are dated and stored under appropriate conditions in order to maintain chemical stability. Each time a specific standard is prepared, the material mass and dilution information is recorded in the standards record book. All prepared standards (stock and working) are labeled in reference to the book number, page number, and entry number of the Analytical Standards Preparations Record Book. Additionally, the description, date, and preparation technician's name are recorded on the standard label.

1.8.3.1 Organics by Gas Chromatography (GC) with Second Column Confirmation - Pesticide analyses performed on the GC will follow

EPA Method 8080. Second column confirmation is required for samples which exhibit a positive result at or above the PQL. The confirmation system must contain a dissimilar column and is calibrated and subject to the same QC as the primary GC system. Data from both analyses will be reported and the laboratory will identify the most reliable of the two results. Prior to calibration, retention time windows for each standard on each GC column are determined whenever a new GC column is installed as follows.

Three injections of each standard are made over a 72-hour period at approximately equal intervals. A standard deviation is calculated from the three absolute retention times. For multi-response analytes, one major peak is chosen from the envelope for the retention time study. Retention time windows for each analyte are updated daily at a minimum and are equal to the continuing calibration analyte retention time plus or minus three times the standard deviation determined in the study. If the retention time window for an analyte is zero, a standard deviation of a similar compound is used.

Tentative identification of an analyte occurs when a peak from a sample falls within the daily retention time window. Multi-response analytes are identified primarily by pattern recognition.

Calibration procedures for both systems are presented below.

1. GC system is checked daily prior to analysis of samples by reviewing temperatures of injector parts, detectors and columns, verifying that the system is set up according to the method specifications to ensure reliability and reproducibility of analytical results.
2. The gas chromatograph is calibrated for all analytes of interest with five standards and a calibration blank using external standard technique.

3. If the percent relative standard deviation (RSD) of the response factor (RF) (internal standard technique) or calibration factor (CF) (external standard technique) for the five standards is less than or equal to 20 percent, then the average RF is used for quantitation. If the RF is greater than 20 percent, a calibration curve is established by plotting response versus amount. The correlation coefficient for a calibration curve must be 0.995 or greater.
4. After development of each new five-point gas calibration and at the start of every analytical sequence, a mid-point initial calibration verification (ICV) containing all single peak analytes of interest is run. Pesticide/PCB standards also include Toxaphene, Chlordane, and Aroclors 1016/1260. The standard's RF or CF must agree with the initial calibration average RF or CF within plus or minus 15 percent difference (D). For a calibration curve, the RF or CF of the mid-point initial calibration standard is compared to the ICV RF or CF.
5. After every ten samples within the sequence and at the end of the sequence, a mid-level continuing calibration verification (CCV) is analyzed for all analytes of interest and must be within plus or minus 15 percent difference (D) of the ICV. For a calibration curve, the RF or CF of the mid-point initial calibration standard is compared to the RF or CF of the CCV.
6. The retention time (RT) for all identified analytes in an analytical sequence must match the RT windows calculated for the analytical standards.
7. Second column analysis is also subject to the preceding acceptance criteria.

1.8.3.2 Volatile and Semi-Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Analyses performed by GC/MS will follow EPA Method 8260 (Volatile) and EPA Method 8270 (Semi-Volatile). This includes the following calibration procedure:

1. Instrument calibration will be performed every 12-hour time period. The GC/MS will be tuned to meet ion abundance criteria given in Tables 1-2 and 1-3

TABLE 1-2

DFTPP KEY IONS AND ABUNDANCE CRITERIA*
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

Mass	Ion Abundance Criteria
51	30-60% of mass 198
68	<2% of mass 69
70	<2% of mass 69
127	40-60% of mass 198
197	<1% of mass 198
198	Base peak, 100% relative abundance
199	5-9% of mass 198
275	10-30% of mass 198
365	>1% of mass 198
441	Present but less than mass 443
442	>40% of mass 198
443	17-23% of mass 442

*J.W. Eichelberger, L.E. Harris, and W.L. Budde. "Reference Compound to Calibrate Ion Abundance Measurement in Gas Chromatography-Mass Spectrometry," *Analytical Chemistry*, 47, 995 (1975).

TABLE 1-3

BFB KEY IONS AND ABUNDANCE CRITERIA*
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

MASS	ION ABUNDANCE CRITERIA
50	15-40% of mass 95
75	30-60% of mass 95
95	base peak, 100% relative abundance
96	5-9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5-9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5-9% of mass 176

* EPA Method 8260, SW-846, 3rd Edition, November 1986.

2. Initial calibration will be performed on calibration standards at five concentration levels containing each compound of interest and each surrogate standard.

The relative retention time (RRT) of each compound in each calibration run should agree within 0.06 RRT units. The average relative response factor (RRF) and percent RSD is calculated for each compound. The RRF for the System Performance Check Compounds (SPCC: Volatiles: Chloromethane, 1,1-Dichloroethane, Bromoform, 1,1,2,2-Tetrachloroethane, Chlorobenzene. Semi-volatiles: N-nitroso-di-n-propylamine, Hexachlorocyclopentadiene, 2,4-Dinitrophenol, 4-Nitrophenol) must be greater than or equal to 0.300 (0.250 for Bromoform) for volatiles and must be greater than or equal to 0.050 for semi-volatiles. The %RSD for the Calibration Check compounds (CCC: Volatiles - Vinyl chloride, 1,1-Dichloroethene, Chloroform, 1,2-Dichloropropane, Toluene, Ethylbenzene; Semi-volatiles Base/Neutrals - Acenaphthene, 1,4-Dichlorobenzene, Hexachlorobutadiene, N-Nitroso-di-n-phenylamine, Di-n-octylphthalate, Fluoranthene, Benzo(a)pyrene; Acids - 4-Chloro-3-methylphenol, 2,4-Dichlorophenol, 2-Nitrophenol, Phenol, Pentachlorophenol, 2,4,6-Trichlorophenol) must not exceed 30 percent. The %RSD for the other compounds should be less than 30 percent. If not, a notation is made in the sample documentation.

3. After the preparation of each new initial five-point calibration curve and after tune criteria are met for each 12-hour time period, the initial calibration is verified (using a midpoint calibration standard containing all analytes) prior to running any samples. This initial calibration verification (ICV) must satisfy the above SPCC criteria. In addition, the percent difference (%D) for the CCC must be less than or equal to 25 percent for the volatiles and less than or equal to 30 percent for the semi-volatiles. If these criteria are not met for any single CCC, corrective action must be taken or a new five point calibration must be performed.
4. Internal standards for GC/MS volatiles will be added to each sample, standard and reagent blank. The final concentration of each internal standard will be 10 µg/L. The internal standards are as follows:

- Bromochloromethane
- 1,4-Difluorobenzene
- Chlorobenzene-d₅

Table 1-4 presents the volatile analytes quantitated by each internal standard.

Internal standards for GC/MS semi-volatiles will be added to each sample, standard, and reagent blank. The final concentration of each internal standard will be 40 nanograms per microliter (ng/ μ L). The internal standards are as follows:

- 1,4-Dichlorobenzene-d₄
- Naphthalene-d₈
- Acenaphthene-d₁₀
- Phenanthrene-d₁₀
- Chrysene-d₁₂
- Perylene-d₁₂

Table 1-5 presents the semi-volatile analytes quantitated by each internal standard.

1.8.3.3 Metals by Inductively Coupled Plasma (ICP) - Metal analyses on the ICP will follow current EPA SW846 method procedures. The instrument will be calibrated daily or once every 24 hours for all analytes of interest. This exceeds the calibration frequency requirement of SW-846.

The following calibration procedure will be used:

1. Verify instrument is operating satisfactorily by checking automatic gain setting and optical alignment.
2. Calibrate instrument daily with matrix matched mixed standards at four concentration levels and a blank. The correlation coefficient must be greater than or equal to 0.995.
3. Verify the calibration with a 2nd source Initial Calibration Verification (ICV) standard containing all analytes of interest. The observed result must be plus or minus 10 percent of the expected value.
4. Verify the calibration blank. The observed result can not exceed \pm the practical quantitation limit. This criteria is used in lieu of daily blank comparisons to the mean blank value (described in

TABLE 1-4

**VOLATILE INTERNAL STANDARDS WITH CORRESPONDING ANALYTES
ASSIGNED FOR QUANTITATION**

**Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas**

BROMOCHLOROMETHANE	1,4-DIFLUOROBENZENE	CHLOROBENZENE-d5
Chloromethane	Trichloroethene	Chlorobenzene
Vinyl chloride	1,2-Dichloropropane	Ethylbenzene
Bromomethane	Bromodichloromethane	Styrene
Chloroethane	2-Chloroethyl vinyl ether	Bromoform
Acetone	cis-1,3-Dichloropropene	1,1,2,2-Tetrachloroethane
Carbon disulfide	trans-1,3-Dichloropropene	Xylenes(total)
1,1-Dichloroethene	Dibromochloromethane	Bromofluorobenzene(surr)
Methylene chloride	1,1,2-Trichloroethane	
trans-1,2-Dichloroethene	Tetrachloroethene	
1,1-Dichloroethane	Toluene	
Vinyl acetate	4-Methyl-2-pentanone	
cis-1,2-Dichloroethene	2-Hexanone	
2-Butanone	Toluene-d8(surr)	
Chloroform		
1,1,1-Trichloroethane		
Carbon tetrachloride		
Benzene		
1,2-Dichloroethane		
1,2-Dichloroethane-d4(surr)		

* Surrogate

PREPARED/DATE: DRJ 3-6-95

CHECKED/DATE: JFO 3-6-95

TABLE 1-5

**SEMI-VOLATILE INTERNAL STANDARDS WITH CORRESPONDING ANALYTES
ASSIGNED FOR QUANTITATION**

**Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Forth Worth, Texas**

1,4-DICHLOROBENZENE-d4	NAPHTHALENE-d8	ACENAPHTHENE-d10
Phenol	Nitrobenzene	Hexachlorocyclopentadiene
bis(2-Chlorethyl)ether	Isophorone	2,4,6-Trichlorophenol
2-Chlorophenol	2-Nitrophenol	2,4,5-Trichlorophenol
1,3-Dichlorobenzene	2,4-Dimethylphenol	2-Chloronaphthalene
1,4-Dichlorobenzene	Benzoic acid	2-Nitroaniline
Benzyl alcohol	bis(2-Chloroethoxy)methane	Dimethylphthalate
1,2-Dichlorobenzene	2,4-Dichlorophenol	Acenaphthylene
2-Methylphenol	1,2,4-Trichlorobenzene	2,4-Dinitrophenol
bis(2-Chloroisopropyl)ether	Naphthalene	3-Nitroaniline
4-Methylphenol	4-Chloroaniline	Acenaphthene
N-nitrosodi-n-propylamine	Hexachlorobutadiene	4-Nitrophenol
Hexachloroethane	4-Chloro-3-methylphenol	Dibenzofuran
2-Fluorophenol(surr)	2-Methylnaphthalene	2,4-Dinitrotoluene
Phenol-d6(surr)	Nitrobenzene-d5(surr)	2,6-Dinitrotoluene
		Diethylphthalate
		4-Chlorophenyl phenyl ether
		Fluorene
		4-Nitroaniline
		2-Fluorobiphenyl(surr)

* Surrogate

TABLE 1-5

**SEMI-VOLATILE INTERNAL STANDARDS WITH CORRESPONDING ANALYTES
ASSIGNED FOR QUANTITATION**

**Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas**

PHENANTHRENE-d10	CHRYSENE-d12	PERYLENE-d12
4-6-Dinitro-2-methylphenol	Pyrene	Di-n-octyl-phthalate
N-nitrosodi-phenylamine	Butyl benzyl phthalate	Benzo(b)fluoranthene
4-Bromophenyl phenyl ether	3,3'-Dichlorobenzidine	Benzo(k)fluoranthene
Hexachlorobenzene	Benz(a)anthracene	Benzo(a)pyrene
Pentachlorophenol	Chrysene	Indeno(1,2,3-cd)pyrene
Phenanthrene	bis(2-Ethylhexyl)phthalate	Dibenz(a,h)anthracene
Anthracene	Terphenyl-d14(surr)	Benzo(g,h,i)perylene
Di-n-butyl-phthalate		
Fluoranthene		
2,4,6-Tribromophenol(surr)		

* Surrogate

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SW-846) because daily calibration eliminates the need for day-to-day blank evaluations. In the case of blank contamination over the reporting limit, all affected data will be flagged as estimated due to possible blank contamination.

5. Verify high-level standard calibration. The observed result must be plus or minus 5 percent of expected value.
6. Every ten samples, a Continuing Calibration Verification (CCV)/Continuing Calibration Blank (CCB) pair is run which must be plus or minus 10 percent of expected value and less than three times detection limit, respectively.
7. Check for interferences. An interference check solution must be analyzed at the beginning and at the end of the run (or at least every 8 hours); refer to EPA Methods for acceptable limits which are plus or minus 20 percent. The interference check solution contains aluminum, calcium, iron, and magnesium.

1.8.3.4 Cold-Vapor Atomic Absorption - Mercury is analyzed using cold-vapor atomic absorption (CVAA). An aliquot of sample is acidified and then undergoes a heated, oxidation digestion with potassium permanganate and potassium persulfate. After digestion, a solution of sodium chloride-hydroxylamine sulfate is added to the sample digestate to reduce excess permanganate and remove free chlorine. A reducing agent (stannous chloride) is then added to the solution, resulting in a reduction of the mercury to an elemental state. The elemental mercury is aerated from the solution in a closed system and the mercury vapor content is measured as it passes through a cell positioned in the light path of an atomic absorption spectrophotometer. The calibration procedure is as follows:

1. Optimize instrument setting and alignment by maximizing the energy setting.
2. Align cell minimizing absorbance reading.

3. Calibrate instrument with standards at five concentration levels and a blank. The correlation coefficient must be greater than or equal to 0.995.
4. Verify calibration by running an initial calibration verification standard (ICV) and a calibration blank (ICB). The observed result of the ICV must be within plus or minus 10 percent of the expected value and the observed result of the calibration blank must be less than the detection limit.
5. Analyze a CCV/CCB pair every ten samples. The response must be within 20 percent of the initial response and less than three times the detection limit, respectively.

1.8.3.6 Metals by Graphite Furnace Atomic Absorption (GFAA) - Metal analyses performed on the GFAA will follow current EPA SW 846 Methods. Instrument must be calibrated daily or once every 24 hours for all analytes of interest. This includes the following calibration procedures:

1. The lamp must be peaked for position and for wavelength (the temperature of the furnace is automatically calibrated at 2600 degrees centigrade).
2. After the proper conditions for each element are programmed for furnace operation, distilled water is injected and run as a sample. This is done several times until the instrument response produces a steady base line absorbance.
3. Verify instrument is operating satisfactorily by checking the energy output of the lamp and by checking the characteristic mass on the midpoint standard, which must be plus or minus 10 percent of the true value for that standard.
4. Calibrate instrument with four standards and a calibration blank. The calibration curve must have a correlation coefficient of greater than or equal to 0.995.

5. Verify the calibration with a second source Initial Calibration Verification (ICV) standard containing all analytes of interest. The observed result must be within plus or minus 10 percent of the expected result.
6. Verify the calibration blank. The blank must be less than three times detection limit.
7. Verify low level standard calibration.
8. Every ten samples, a continuing calibration verification (CCV) and continuing calibration blank (CCB) pair is run and must be plus or minus 10 percent of expected value and less than the detection limit, respectively.

1.9 DATA REDUCTION, VALIDATION, AND REPORTING

The following sections describe the reduction, validation, and reporting of data after samples are analyzed.

1.9.1 Data Management

Analytical data are collected and processed in the laboratory in accordance with the requirements of the laboratory's protocols. These requirements include data entry and review, report assembly, and document review.

1.9.2 Data Reduction

Computerized data systems are present for all analytical equipment. The majority of data reduction is performed on the data station associated with that particular piece of equipment.

The analyst performs the analysis and enters the data on the parameter bench sheet and corresponding data station(s). Bench sheets contain all necessary information to establish sample identity, integrity, calibration evaluation, and analytical observation/results to process/validate the sample test data. A bench sheet key is provided to the analyst which specifies the way

in which bench sheets are to be filled out (i.e., notation, significant figures, etc.), the data reduction formula and the QC samples required and their control criteria. QC samples include duplicates, matrix spikes, or matrix spike duplicates, CCV samples, etc. Calculations are performed on the data station or on specialized software utilized by MIS Department. The use of significant figures for numerical data are in accordance with EPA-600/4-79-019 publication, Handbook for Analytical Quality Control in Water and Wastewater Laboratories. Raw data are to be reduced as specified by each analytical method and reported in the following units:

	<u>AQUEOUS</u>
Organic parameters	$\mu\text{g/L}$
Inorganic parameters	mg/L

1.9.3 Data Quality Assessment

The parameters of precision, accuracy, representativeness, completeness, and comparability are indicators of data quality (USEPA, 1987a). Establishing goals for these parameters serves to guide the choice of the analytical methodology. It also establishes a strategy for the evaluation of the data once it has been acquired to determine whether the goals of the project have been met. Upon receipt from the laboratory, the chemical analysis data will be evaluated by experienced personnel against pre-determined criteria to determine whether data quality meets the requirements of the project. The laboratory quality control (QC) data and the field QC data will be evaluated to objectively ascertain the quality of the data. The data quality will then be compared to the project requirements. If quality control problems are found, qualification of the affected data points will be recommended. Upon determination of the level of quality for each data point, the data interpretation can be performed. The following sections describe the data quality evaluation and data qualification process.

1.9.3.1 Data Quality Evaluation - The objective of the evaluation of the quality of the chemical data is to determine if qualifications of the data are necessary. This evaluation will be based upon the evaluation of the laboratory QC data, the field QC data, and the project DQOs presented in Section 1.4. The first step will be to perform an evaluation of the laboratory QC data, a process often termed "data validation." This will provide a rating of the quality of each data point produced by the laboratory. The second part will provide an overall rating of each data point based upon the field QC data. The final step in the evaluation will compare the quality of the data acquired to the project's DQOs to determine whether the data are useful. These three steps are described in the following sub-sections. Each step will be completely documented. The overall goal of the data quality evaluation is to determine whether the data can be used to satisfy the objectives of the project.

Evaluation of Laboratory QC Data - Laboratory QC data for an analytical parameter fall within one of eight categories for evaluation purposes. These categories are listed in Table 1-6 in the order in which they will be considered. All QC data provided will be evaluated against the criteria established by each method after modification as presented in this document to achieve the objectives of this project. Each review will be completely documented to indicate the criteria used and the results and recommendations of the evaluation. For this investigation, the evaluation of calibration data will be performed by the laboratory.

Evaluation of Field QC Data - Field QC data for an analytical parameter fall within one of eight categories for evaluation purposes. These categories are also listed in Table 1-6 in the order in which they will be considered. Field QC data reported will be evaluated to assure the objectives of this project are achieved. Each review will be completely documented to indicate the criteria used and the results and recommendations of the evaluation.

TABLE 1-6

DATA EVALUATION CATEGORIES
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

CATEGORY	QC DATA EVALUATED
<u>LABORATORY QC:</u>	
1. Sample Integrity	Sample container condition; preservation performance and applicability; condition upon receipt at laboratory
2. Instrument Set-up/Method Applicability	Correct method; detection/quantitation limits achieved; method applicability for analytes and matrix, instrument set-up
3. Calibration Accuracy and Precision *	Standard preparation; accuracy verification, precision achieved
4. Calibration Stability *	Stability verification; frequency of performance
5. Laboratory Contamination	Laboratory blanks
6. Method Accuracy and Precision	Method accuracy and precision data
7. Sample Preparation	Procedures; holding times
8. Sample Analysis	Procedures and sequences; holding times; sample-specific accuracy and precision; interferences; dilutions
<u>FIELD QC:</u>	
1. Sample Integrity	Sample container condition; preservation performance and applicability; condition prior to shipment; custody
2. Location Installation	Sampling location installation
3. Sampling Procedures	Sampling protocols
4. Contamination From Sampling	Rinsates
5. Contamination From Site	Field blanks (volatile organics only)
6. Contamination From Shipping	Trip blanks (volatile organics only)
7. Sampling Precision	Field duplicates
8. Miscellaneous +	Blind QC samples; performance evaluation data; split sample data

* These categories are assumed to be correct and will not be provided for evaluation.

+ No blind data for QC samples, blind performance evaluation samples, or split samples will be collected.

Usability Determination - Once the laboratory and field QC data have been evaluated, the uncertainty associated with each data point can be estimated. The estimated accuracy and precision of each data point can then be compared to the data quality objectives of the project to determine its usefulness for evaluating the site. Recommendations for the qualification of a data point can also be made when necessary.

Precision will be determined by evaluation of the RPDs for the laboratory and field duplicates. The laboratory and field blank data, MS/MSD and surrogate (if applicable) recoveries, and other applicable QC data will be used to determine the accuracy of the data. The evaluator will use their judgement based upon established principles and the guidelines described in this document in the assignment of qualifications to the data.

The completeness parameter will be evaluated after the determination of the usability of each data point; it will be expressed in quantitative terms and then compared to the project objectives to determine whether enough data were collected. Representativeness will be determined through an evaluation of sampling procedures and sampling locations chosen, and will be expressed in qualitative terms. Comparability will be determined by the evaluation of analytical methodologies, reporting units, and the traceability of standards and will also be expressed in qualitative terms.

1.9.3.2 Data Qualification - Each data point will essentially be graded using one of the following categories:

- Usable as reported
- Usable with qualifications
- Unusable

These categories correspond to the DQO grading categories presented in Section 1.4. Data for which the laboratory and field QC data

are all within acceptance limits will be assigned the grade "usable as reported." Data for which QC problems are indicated but the QC data are still within the action limits will be assigned the grade "usable with qualifications." These data may be usable if the QC problems are not excessive. Data for which the corresponding QC data are outside the action limits will be assigned the grade "unusable" and will not be used. Each data point following under the second or third category will receive a flag indicating its level of usability. The flags to be used are presented in Table 1-7.

1.9.4 Data Reporting

Data reports will be included in the technical report. The data will be presented in tables in the text or in the appendices of the report. Tables will include the following information:

- Sampling dates
- Extraction and analysis dates
- Surrogate recovery (if applicable)
- MS/MSD results
- Duplicate/replicate results
- Rinsate results
- Positive results
- Field characterization data (pH, SC, temp)
- Control limits (surrogates, MS/MSD, duplicates)

1.10 INTERNAL QUALITY CONTROL CHECKS

The following sections describe the quality control checks employed in the field and laboratory.

1.10.1 Field Quality Control

Quality control of field measurements will be implemented through the calibration of instruments. The control parameters, control limits, and corrective actions are outlined in Section 2.4.

TABLE 1-7

DATA QUALIFICATION FLAGS
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

FLAG	POSITIVE RESULTS	NEGATIVE RESULTS
FLAGS FOR DATA WITHIN ACCEPTANCE LIMITS (Usable as Reported)		
(no flag)	{Use datum without qualification}	{Use datum without qualification}
FLAGS FOR DATA WITHIN ACTION LIMITS (Usable With Qualification)		
J	Estimated quantitation based upon QC data	Estimated quantitation based upon QC data
JB	Estimated quantitation: possible biased high or false positive based upon blank data	(Not applicable)
JH	Estimated quantitation - possibly biased high based upon QC data	(Not applicable)
JL	Estimated quantitation - possibly biased low based upon QC data	Possible false negative based upon QC data
Jd	Estimated result due to dilution	Reporting limit raised due to dilution
JQ	Estimated quantitation; result below the PQL	(Not applicable)
FLAGS FOR DATA OUTSIDE OF ACTION LIMITS (Unusable)		
R	Datum rejected based upon QC data: do not use	Datum rejected based upon QC data: do not use
MISCELLANEOUS FLAGS		
t	Tentatively identified compound; identity not confirmed with standard and quantitation estimated (applicable to GC/MS data only)	(Not applicable)

Note that if the QC results suggest contradictory flags, the following hierarchy should be used to select the appropriate flag to assign:

R > J, JH, JL, JB, Jd

JH + JL = J

Jd > JH, JL

Jd > JB (where JB is due to laboratory method blank or field blanks)

JB > Jd (where JB is due to laboratory system blank)

JB > J

JH or JL > J

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CHECKED/DATE: JFO 3-6-95

1.10.2 Laboratory Quality Control

The minimum requirements of laboratory quality control consist of an initial demonstration of laboratory capability and an ongoing analysis of quality control samples to evaluate and document data quality. The laboratory must maintain records to document the quality of the data generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method. Calibration stability will be assessed and documented as specified in each method.

Before processing samples, the analyst should demonstrate, through the analysis of a reagent water blank, that interferences from the analytical system, glassware, and reagents are under control. Each time a set of samples is extracted or there is a change in reagents, a reagent water blank should be processed. The blank samples should be carried through all the stages of the sample preparation and measurement steps.

Spiked samples are analyzed with each preparation batch. Both laboratory control spikes and matrix spikes are evaluated against laboratory generated QC ranges and AFCEE acceptance criteria.

If any spiked analyte fails the acceptance criteria for recovery, a QC check standard for each analyte that failed must be prepared and analyzed. As part of the QC program for the laboratory, method accuracy for each matrix studied must be assessed and records must be maintained.

The types and numbers of laboratory quality control samples to be used are presented in Table 1-8. They are defined as follows:

Method blanks. Method blanks consist of organic-free or deionized water that is carried through the analytical scheme like a sample. They measure contamination associated with laboratory storage,

TABLE 1-8

SAMPLING PLAN DETAIL
 PREPARED: 03/27/95
 DATE: 10:17
 TIME:

CLIENT: AFCEE
PROJECT: CARSWELL AFB
PHASE: 11-3517-3201
SITE: Groundwater
AFID: LAW
LOGCODE: LAW (Law Environmental, Inc.)

PARAMETER:
 Method: SW 8260
 Container: 40 mL VOA vials
 Preservative 1: HCl to pH < 2
 Preservative 2: Cool to 4C

NO. OF SAMPLE CONTAINERS PER PARAMETER BY LAB

Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
SW 8260	SW8270	SW 8080	SW 6010/7000
40 mL VOA vials	1 L amber glass	1 L amber glass	1 L polyethylene
HCl to pH < 2	Cool to 4C	Cool to 4C	HNO ₃ to pH < 2
Cool to 4C	None	None	Cool to 4C

SAMPLING INFORMATION

LOGDATE	LOGTIME	TEG	LENL-P	TEG	LENL-P	TEG	LENL-P	TEG	LENL-P
---------	---------	-----	--------	-----	--------	-----	--------	-----	--------

FIELD SAMPLES

LOCID	SAMPLE ID	COMMENT	LOGDATE	LOGTIME	TEG	LENL-P	TEG	LENL-P	TEG	LENL-P	TEG	LENL-P
Landfill 01/	LF01-1C				5	2	0	0	1	1		
SWMU 28/	LF01-1D				5	2	0	0	1	1		
IRP # 1	LF01-1E				5	2	0	0	1	1		
	LF01-1F				5	2	0	0	1	1		
Landfill 04/	LF04-4A				5	2	0	0	1	1		
SWMU 22/	LF04-4B				5	2	0	0	1	1		
IRP # 4	LF04-4D				5	2	0	0	1	1		
	LF04-4E	MS/MSD			15	6	0	0	3	3		
	LF04-4F				5	2	0	0	1	1		
Landfill 05/	LF05-5C				5	2	0	0	1	1		
SWMU 23/	LF05-5D				5	2	0	0	1	1		
IRP # 5	LF05-5G				5	2	0	0	1	1		
FDTA 1/	FT08-11A				5	2	0	0	1	1		
SWMU 18/	FT08-11B				5	2	0	0	1	1		
IRP # 11												
FDTA 2/	FT09-12A				5	2	0	0	1	1		
SWMU 19/	FT09-12B	MS/MSD			15	6	0	0	3	3		
IRP # 12	FT09-12C				5	2	0	0	1	1		

TABLE 1-8

SAMPLING PLAN DETAIL
 PREPARED: 03/27/95
 DATE: 10:17

CLIENT: AFCEE
PROJECT: CARSWELL AFB
NUMBER: 11-3517-3201
PHASE:
SITE:
Matrix: Groundwater
AFID: LAW
LOGCODE: (Law Environmental, Inc.)

PARAMETER:
Method: SW 8260
Container: 40 mL VOA vials
Preservative 1: HCl to pH < 2
Preservative 2: Cool to 4C
NO. OF SAMPLE CONTAINERS PER PARAMETER BY LAB

Volatiles	Semi-Volatile Organics	Pesticides	ICP, GF-AA and Mercury
SW 8260	SW 8270	SW 8080	SW 6010/7000
1 L amber glass	1 L amber glass	1 L amber glass	1 L polyethylene
Cool to 4C	Cool to 4C	Cool to 4C	HNO ₃ to pH < 2
	None	None	Cool to 4C

FIELD SAMPLES	LOCID	SAMPLE ID	COMMENT	SAMPLING INFORMATION		NO. OF SAMPLE CONTAINERS PER PARAMETER BY LAB							
				LOGDATE	LOGTIME	TEG	LENL-P	TEG	LENL-P	TEG	LENL-P	TEG	LENL-P

Various		GMI04-01M				5	2	2	0	0	0	1
GMI04-/		GMI22-01M				5	2	2	0	0	0	1
GMI22-		GMI22-02M				5	2	2	0	0	0	1
		GMI22-03M				5	2	2	0	0	0	1
		GMI22-04M				5	2	2	0	0	0	1
		GMI22-05M				5	2	2	0	0	0	1
		GMI22-06M				5	2	2	0	0	0	1
		GMI22-07M				5	2	2	0	0	0	1
		GMI22-08M				15	6	6	0	0	0	3

Waste Burial Site	WP07-10B					5	2	2	0	0	0	1
SWMU 24	WP07-10C					5	2	2	0	0	0	1
IRP #10												

Entomology	OT15C		MS/MSD			15	6	6	3	3	3	3
Dry Well/												
SWMU 63/			(Equipment blank and EDup collected for pesticides)									
IRP #15												

Unnamed Stream	SD13-01					5	2	2	0	0	0	1
SWMU 64	SD13-02					5	2	2	0	0	0	1
IRP #16	SD13-03		MS/MSD			15	6	6	0	0	0	3
	SD13-05					5	2	2	0	0	0	1
	SD13-06					5	2	2	0	0	0	1
	SD13-07					5	2	2	0	0	0	1

Building 3340	P3A					5	2	2	0	0	0	1
Building 3240	T3					5	2	2	0	0	0	1

TABLE 1-6

SAMPLING PLAN DETAIL				CLIENT: AFCEE				PROJECT: CARSWELL AFB			
PREPARED: 09/28/96				PROJECT NUMBER: 11-3817-3201				PARAMETER:			
DATE: 09/28/96				PHASE: 11-3817-3201				Method: SW 8280			
TIME: 11:20				SITE: [REDACTED]				HQ to pH < 2			
				Matrix: [REDACTED]				Cool to 4C			
				AFID: [REDACTED]				None			
LOGCODE:				LAW [REDACTED]				SW 8080			
				(Law Environmental, Inc.)				Cool to 4C			
								None			
								ICP, GFAA			
								and Mercury			
								SW 6010/7000			
								1 L polyethylene			
								HNO ₃ to pH < 2			
								Cool to 4C			

FIELD SAMPLES	LOCID	SAMPLE ID	COMMENT	SAMPLING INFORMATION		NO. OF SAMPLE CONTAINERS PER PARAMETER BY LAB								
				LOGDATE	LOGTIME	TEG	LENL-P	TEG	LENL-P	TEG	LENL-P	TEG	LENL-P	
Building 1027	T4A					5	2	2	0	0	0	1		
2nd & Boyston	T7					5	2	2	0	0	0	1		
Open Lot														
Northern Area of Base, East of Turnkey Drive	PeA					5	2	2	0	0	0	1		
Building 1028		LSA1028-1				5	2	2	0	0	0	1		
		LSA1028-2				5	2	2	0	0	0	1		
		LSA1028-3				5	2	2	0	0	0	1		
Trip Blank														
		TB-				2	0	0	0	0	0	0		
		TB-				2	0	0	0	0	0	0		
		TB-				2	0	0	0	0	0	0		
		TB-				2	0	0	0	0	0	0		
		TB-				2	0	0	0	0	0	0		
		TB-				2	0	0	0	0	0	0		
		TB-				2	0	0	0	0	0	0		
		TB-				2	0	0	0	0	0	0		
		TB-				2	0	0	0	0	0	0		

preparation, or instrumentation. For most analyses, a method blank is analyzed for each sample batch and at a frequency of 1 per 20 samples if more than 20 samples or 1 per batch. If the analyte of interest is detected above the reporting limit, corrective action must be taken, except for common contaminants such as methylene chloride, acetone, toluene, 2-butanone and phthalates or the metals aluminum, calcium, iron, magnesium, sodium and potassium which are not to exceed 3x the reporting limit.

Calibration blanks. Calibration blanks are prepared with standards to create a calibration curve. They differ from the other standards only by the absence of analyte and provide the "zero-point" for the curve.

Internal standards. Internal standards are measured amounts of certain compounds added after preparation or extraction of a sample. They are used in an internal standard calibration method to correct sample results for capillary column injection losses, purging losses, or viscosity effects.

Surrogates. Surrogates are measured amounts of certain compounds added before preparation or extraction of a sample. The recovery of a surrogate may be used to determine extraction recovery. Surrogates are added to all samples analyzed for chlorinated pesticides, semi volatiles and volatiles.

Spiked Samples. Spiked samples are aliquots of samples to which known amounts of analyte have been added. They are subjected to the sample preparation or extraction procedure and analyzed as samples. The stock solutions used for spiking are purchased or prepared independently of calibration standards.

The spike recovery measures the effects of in the sample matrix, on the reported results, and reflects the accuracy of sample determinations. Spike recoveries are calculated as follows:

Matrix Spike

$$\text{Percent Recovery} = \frac{\text{SSR} - \text{SR}}{\text{SA}} \times 100$$

where:

SSR = spike sample result
 SR = sample result
 SA = spike added from spiking mix

Spikes are prepared and analyzed for all method analytes with each batch and at a frequency of at least 1 matrix spike per 20 samples or as required by the specific analytical method. The following compounds have been chosen as spiking compounds based on their prevalence as compounds of interest at Air Force installations.

Method SW-8240	1,1-Dichloroethene	Dibromochloromethane
	Trichloroethene	Chloroform
	Benzene	Ethylbenzene
	Toluene	Tetrachloroethene
	Chlorobenzene	1,1,1-Trichloroethane

Method SW-8270	Phenol
	2-Chlorophenol
	1,4-Dichlorobenzene
	N-Nitroso-di-n-propylamine
	1,2,4-Trichlorobenzene
	4-Chloro-3-methylphenol
	Acenaphthene
	4-Nitrophenol
	2,4-Dinitrotoluene
	Pentachlorophenol
	Pyrene
	bis (2-Chloroethoxy)methane
	Butyl benzyl phthalate
	Hexachlorobenzene
	Benzo (a)pyrene
	Benzo (a)anthracene
	Naphthalene

Method SW-8080 gamma-BHC (Lindane)
 Heptachlor
 Aldrin
 Dieldrin
 Endrin
 4,4'-DDT
 PCB 1016/1260

Duplicate Samples or Duplicate Spikes. The relative percent difference (RPD) between duplicates or duplicate spikes measures the precision of a given analysis. RPDs are calculated as according to the equation presented in Section 1.13.1.

Duplicates or duplicate spikes are prepared and analyzed for each method analyte with each batch, or at a frequency of at least 1 per 20 samples if more than 20 samples are run in a given batch.

Laboratory Control Standards. Laboratory control standards (LCSs) and quality control check samples (QCCSs) are aliquots of organic-free or deionized water to which known amounts of analyte have been added. They are subjected to the sample preparation or extraction procedure and analyzed as samples with each batch. The stock preparation solutions used for LCSs are purchased or prepared independently of calibration standards. The LCS recovery checks the performance of analytical methods and equipment. The percent recovery for LCSs is compared to method specific criteria and laboratory generated control limits. When results of an organic method aqueous matrix spike indicate recovery failures, and the associated quality control check standard is within control limits, a matrix effect may be indicated.

LCSs are prepared and analyzed for all method analytes with each batch or at a frequency of 1 per 20 samples. Laboratory control limits are established annually.

The LCS is used to monitor overall performance of all steps in analysis, including sample preparation. If 80 percent of the

compounds included in the LSC spike fall within the laboratory established range, acceptable instrument performance is verified. When the LCS results are used in conjunction with matrix spikes, matrix spike recoveries can be more accurately interpreted.

1.10.3 Control Limits

Control limits for this project are laboratory established. Control limits for each analytical method will be experimentally established and reevaluated at regular intervals. Control limits are developed by the laboratory based on historical data. If historical data are not complete then control limits are set based on the method. Appendix A-2 presents the control limits for each analytical method. Appendix A-3 presents a summary of calibration and internal quality control procedures.

1.11 PERFORMANCE AND SYSTEM AUDITS

Quality assurance is the monitoring of the quality of the various day-to-day operations carried out under the QA/QC program. The goals associated with the QA/QC program are listed below:

- QA reviews determine compliance with mandated QC procedures.
- QA reviews provide a structured means of communicating problems between the technical and administrative portions of the company.
- QA audits provide a mechanism by which QC procedures are constantly being reviewed and reported so that corrective actions can accurately be implemented.

1.11.1 Systems Audits

Systems audits are qualitative evaluations of each component of field and laboratory QC measurement systems. An internal systems

audit will be performed quarterly by the QA manager and will consist of inspecting the following procedures:

- Sampling
- Sample custody
- Sample storage and preservation
- Standard preparation
- Sample preparation
- Analytical methodology
- Data management
- Preventative maintenance
- Personnel qualifications
- Corrective actions, reporting and documentation of out-of-control events
- Recordkeeping

1.11.2 Performance Audits

A performance audit is a quantitative evaluation of a measurement system. Law Environmental National Laboratories, Pensacola participates in the following performance evaluation programs:

- EPA, Environmental Monitoring Support Laboratory - Cincinnati
- Florida Department of Environmental Regulation (DER)
- EPA Inorganic and Organic CLP
- U.S. Army Corps of Engineers, Missouri River Division
- Florida Department of Health and Rehabilitative Services (FDHRS)
- U.S. Air Force Performance Audit conducted by MITRE, in support of AFCEE

1.11.3 Certifications

Law Environmental National Laboratories, Pensacola currently holds certifications with several states for the various matrices and parameters. They have also been approved by AFCEE and the U.S. Army Corps of Engineers.

1.12 PREVENTIVE MAINTENANCE

Equipment maintenance is the responsibility of the analyst and the department manager. All repairs and/or modifications are recorded in bound maintenance logbooks. Daily equipment checks include visual and/or manual inspections of cooling fans, pumps, indicator readings, detectors, gas supplies, and other method-specific inspections. Service schedules are established for performing routine preventive maintenance on all major equipment. Tables 1-9 through 1-12 list the maintenance required for each instrument.

1.13 FIELD AND LABORATORY PROCEDURES USED TO ASSESS DATA QUALITY INDICATORS

1.13.1 Formulas

Accuracy - Accuracy is a measure of the bias in a system. Accuracy is defined as the degree of agreement of a measurement with an accepted reference or true value. To determine the accuracy of an analytical method, a sample spiking program will be conducted. The results of sample spiking will be used to calculate the percent recovery (%R). The percent recovery is defined as follows:

$$\%R = \frac{X - T}{K} \times 100$$

where: X = analytical result from the spiked sample

TABLE 1-9

ROUTINE MAINTENANCE SCHEDULE FOR GC
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

Maintenance	Frequency
1. Check carrier gas supply	Daily
2. Check head pressure	Daily
3. Change septums	As needed
4. Change carrier gas filters	As needed
5. Check baseline and detector response at highest sensitivity	Quarterly
6. Air dust electronics and main frame	Annually

TABLE 1-10

ROUTINE MAINTENANCE SCHEDULE FOR GC/MS
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

Maintenance	Frequency
1. <u>System Diagnostics</u>	
a. Scan box I/O test	Daily
b. Scan box DMA test	Daily
c. MS I/O test	Daily
d. Filament test	Daily
e. RF power test	Daily
f. Electromultiplier test	Daily
g. Background signal noise test	Daily
2. <u>Vacuum/Carrier Flow Check</u>	
a. Column headpressure check	Daily
b. Vacuum check	Daily
c. Replace septum	As needed
d. Leak check and tighten fittings	As needed
3. <u>Instrument Tune Check</u>	
a. BFB/DFTPP tune check	Daily
b. PFTBA tuning	As needed
4. <u>Calibration Check</u>	
a. VOA standards check	Daily
b. BNA standards check	Daily
Replace inlet liner	As needed
5. Clean source	As needed
6. Clean quadrupole rods	As needed
7. Replace column (or remove front end)	As needed

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TABLE 1-11

ROUTINE MAINTENANCE SCHEDULE FOR ICP
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Forth Worth, Texas

MAINTENANCE	FREQUENCY
1. Check Argon pressure at tank and at nebulizer.	Daily
2. Inspect cooling water supply.	Daily
3. Inspect vacuum pump.	Daily
a. Oil level	
b. Vacuum monochromator gauge	
4. Inspect peristaltic pump windings and capillary tubing.	Daily
5. Check ICP ignition sequence.	Daily
a. Argon to torch	
b. Preignition discharge	
c. Ignition	
6. Disassemble and clean ICP nebulizer, spray chamber and torch assembly.	Weekly
7. Check peak resolution and monochromator stability using profile routines and internal Hg lamp.	Weekly
8. Change pump windings and all capillary tubing to nebulizer.	Monthly
9. Change vacuum pump oil.	Monthly

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TABLE 1-12

ROUTINE MAINTENANCE SCHEDULE FOR AA SPECTROPHOTOMETER
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

Maintenance

1. Contact cylinders, tube, and platform should be cleaned and checked each day before running samples. Use cotton swab and methanol for cleaning.
 2. Contact cylinders should be checked for cracks and pitting. Tubes should be checked for pitting, peeling pyrolytic coating and burn marks around sample port hole. Any of the above indicate a worn tube or cylinder.
 3. Furnace/spectrometer windows should be checked and cleaned daily.
 4. Check coolant level in recirculator and temperature setting daily.
 5. Spectroscopy lab should be wet mopped, counters dusted, and exterior of instruments cleaned on a weekly basis to ensure a dust-free environment.
 6. Consult instrument operations manual for further maintenance instructions.
 7. All maintenance is to be recorded in the Maintenance Log Book.
 8. Argon gas pressure to furnace should be 60 psi. Check regulator to ensure proper pressure.
-

To determine accuracy, surrogate, matrix spike and matrix spike duplicates (MS/MSD), and internal standards will be analyzed. The control limits will be based on the mean percent recovery plus or minus 3 standard deviations of the mean using a population of 20 or more recovery values.

Precision - Precision is the measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of standard deviation or relative percent difference (RPD). Precision is assessed through the use of duplicate samples. An RPD for each component is calculated using the following equation:

$$RPD = \frac{A - B}{(A + B)/2} \times 100$$

where:

A = replicate value 1
 B = replicate value 2
 RPD = relative percent difference

To determine precision, matrix spikes and matrix spike duplicates will be analyzed. The laboratory established control limits will be based on a population of ten RPD values. They are calculated by determining the mean RPD plus three times the standard deviation for the upper limit and zero as the lower limit.

Completeness - Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. The result is expressed as a percentage.

$$\text{Percent completeness} = \frac{\text{Number of valid measurements}}{\text{Total number of measurements}} \times 100$$

The percent completeness for this project is 90 percent.

1.13.2 Control Limits

Control limits for analytical methods are presented in Appendix A-2. Control limits are developed by the laboratory based on historical QC data. If historical data are not complete then control limits are set based on those established by the method. The limits included in this SAP were established in 1995. These limits are updated on an annual basis.

1.13.3 Documentation

Complete documentation of all procedures used to generate laboratory data is required. Laboratory log books on data sheets must contain all data and calculations associated with each independent determination. These include such things as operating parameters, sample weight(s), dilution factor(s), applicable determinative measurements such as titration values, spectrometer readings, injection quantities, and standard(s) identity and concentrations, as well as all calculations related to each final value reported.

Each laboratory report sheet will be reviewed and initialed by a second analyst for completeness of data and correctness of all calculations in the report. All work sheets and raw data including chromatograms, spectra, etc., associated with every analysis will be archived at the laboratory for a minimum of five years. This documentation will be available to LAW on its client upon request.

1.14 CORRECTIVE ACTION

An effective QC program requires rapid and thorough correction of the QC problems.

Depending on the nature of the corrective action (CA), it is classified as one of two types, immediate and long-term. Immediate corrective actions are activities resulting in reversal of an out-of-control situation such as the repair of instrumentation that is working improperly. Long-term corrective actions are the correction of systematic errors, which may require a series of events to occur before the system regains compliance. In this case, analyses are suspended until system compliance is achieved. Corrective actions associated with field activities are presented in Appendix A-3.

1.14.1 Response

Many times the source of a nonsystematic problem is obvious to the analyst and can be corrected immediately. Immediate corrective action routinely made by field technicians or laboratory analysts should be documented as normal operating procedures in instrument log books or personal notebooks. The supervisor and analyst should compile a list of commonly encountered problems and the appropriate routine corrective actions (in addition to manufacturer's troubleshooting guides). The operations manager and QA/QC coordinator are responsible for approving all corrective actions.

1.14.2 Reestablishment of Control

Corrective action is not complete until the system is returned to compliance. Continuing monitoring of the system is an important step in the corrective action procedure. Routine corrective actions, such as recalibrating the instrument, are incorporated into the standard operating procedures (SOPs). Major corrective actions, such as a systems failure, are handled in the following manner: Once a problem has been defined, the operations manager and the QA/QC coordinator discuss the problem and jointly take the following steps:

1. Determine what specific corrective action is needed to eliminate the problem and assign responsibility for investigating, implementing, and documenting the situation.
2. Set a time schedule for determining the required action.
3. Assign responsibility and time schedule to implement the desired action.
4. Establish desired effectiveness of the corrective action and implement the correction.
5. Verify that the corrective action has corrected the problem and document all actions taken.
6. Continue to monitor the system for compliance.

1.14.3 Documentation

All QC activities, including QC problems and corrective actions implemented, must be documented. Historical records assist laboratory management in identifying long-term corrective actions, such as personnel training, replacement of instrumentation, improvement of sampling procedures, etc. Corrective action documentation associated with field activities are recorded in field logbooks.

1.15 QUALITY ASSURANCE REPORTS

Laboratory management is informed of QA activities in three ways: (1) by immediate verbal notification of QA problems, (2) by interim QA reports, and (3) QA audit reports. The following subsections discuss the reporting procedures to be followed and report contents.

1.15.1 Reporting Procedure

A final report containing sample results and QA information is prepared by the laboratory QA coordinator and submitted to LAW. The QA results are presented according to the following procedures:

- An assessment of QC (accuracy, precision, and completeness)
- Significant QA problems encountered and results of corrective action taken
- Name and position of the individual preparing the reports

1.15.2 Report Content

The laboratory has developed reporting procedures and forms in order to document the sample analysis and QA procedures, including case narratives, QC tables, and Deficient Incident Reports (DIRs). Case narratives are included at the beginning of a data report to give the reviewer an overview of the samples and parameters analyzed, and identifying flags which are applied to the data to indicate quality control discrepancies. QC tables and laboratory limits are included to list the criteria and reporting requirements which apply to the data. DIRs are also included as part of the report format as documentation of the corrective actions implemented by the laboratory.

2.0 FIELD SAMPLING PLAN

Field tasks to be conducted during this project are explained in detail in the following sections.

2.1 FIELD OPERATIONS

The base-wide quarterly ground-water monitoring investigation will involve sampling 70 existing monitoring wells, located at various locations across the base. Monitoring wells selected for quarterly sampling are based on LAW's final-revised letter report which lists the criteria for selecting monitoring wells suitable for sampling. Refer to Appendix C. These wells are listed on Table 2-1 along with their associated site. The monitoring locations are presented in Figure 2-1.

The methods for conducting the field activities are discussed in the following sections.

2.1.1 Site Reconnaissance, Preparation, and Restoration

A well survey was performed in October 1994 by representatives of LAW. During the survey, LAW representatives checked the integrity of the wells and took total depth and static water levels. Site access was also determined (LAW, 1995).

2.1.2 Equipment Decontamination

The following decontamination procedures will apply to non-dedicated ground-water bailers. The decontamination steps are as follows:

1. Hand wash with a solution of Alconox (or equivalent).
2. Rinse with copious quantities of potable water.

TABLE 2-1

250105

MONITORING WELL SAMPLING LOCATIONS
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

SITE NAME/ SWMU #/ IRP #		
Landfill 01 SWMU 28 IRP #1	POL Tank Farm SWMU 68 IRP #17	Various GMI04- GMI22- GMI04-01M GMI22-01M GMI22-02M GMI22-03M GMI22-04M GMI22-05M GMI22-06M GMI22-07M GMI22-08M
LF01-1C LF01-1D LF01-1E LF01-1F	ST14-01 ST14-02 ST14-04 ST14-W05 ST14-W06 ST14-W07 ST14-W08 ST14-W09 ST14-W11 ST14-W13 ST14-W03 ST14-W15 ST14-W16 ST14-W19 ST14-W20 ST14-W21 ST14-W22 ST14-W23	
Landfill 04 SWMU 22 IRP #4		Waste Burial Site SWMU #24 IRP #10 WP07-10B WP07-10C
LF04-4A LF04-4B LF04-4D LF04-4E LF04-4F		
Landfill 05 SWMU #23 IRP #5		Entomology Dry Well SWMU #63 IRP #15 OT15C
LF05-5C LF05-5D LF05-5G	Base Service Station BSSA BSSB MW-5 MW-7 MW-8 MW-9 MW-10 MW-11 MW-12	
FDTA 1 SWMU 18 IRP #11		Unnamed Stream SWMU #64 IRP #16 SD13-01 SD13-02 SD13-03 SD13-05 SD13-06 SD13-07
FT08-11A FT08-11B		
FDTA 2 SWMU 19 IRP #12	Building 3340 P3A	Northern Area of Base East of Taxiway Drive P6A
FT09-12A FT09-12B FT09-12C	Building 3249 T3	
2nd & Boyston, Open Lot T7	Building 1027 T4A	Building 1628 LSA1628-1 LSA1628-2 LSA1628-3

PREPARED/DATE: DRJ 3-6-95
 CHECKED/DATE: JFO 3-6-95

3. Rinse with deionized (Reagent Grade II) water.
4. Spray-rinse with pesticide grade methanol.
5. Spray-rinse with pesticide grade hexane (Entomology Area only).
6. Air dry.

2.1.3 Waste Handling

All purge water and any other investigation derived wastes (IDW) will be containerized in clean, Department of Transportation (DOT), 17 H drums. All drums of IDW will be adequately labeled and moved to a staging area designated by the base. Each drum of IDW will be marked at the start of waste accumulation with the following information:

- Date upon which accumulation begins
- Site identification
- Monitoring well identification number
- Drum contents (soil, wash, water, etc.)

Upon completion of the field program, a drum log (inventory) will be prepared that accounts for all drums and wastes generated.

The results of the ground-water analysis will be used to prepare a manifest for drummed purge water for the shipment of the drums requiring disposal at a disposal facility.

2.2 ENVIRONMENTAL SAMPLING

Field sampling activities include the collection of ground-water samples. The collection methods, including sample handling, sample custody, QC samples, and sample analysis are presented in the following subsections.

2.2.1 Procedure for Collection of Samples

This section presents the procedure for collection of samples for chemical analysis. The parameters to be analyzed at each site are included in the sampling plan detail and presented in Table 1-8. The following sections present the site-specific sampling requirements, the sample collection procedures, and the procedures to be used to maintain sample integrity.

Field instruments will be calibrated as described in Section 2.3.2, Site conditions and sampling information will be recorded in the field log books. The site manager will brief the sampling team on safety, decontamination, and any other sampling protocols necessary. Each sampling team member will wear the appropriate level of PPE and safety gear as specified in the health and safety plan.

2.2.1.1 Ground-Water Sampling - Ground-water samples will be obtained using dedicated PVC bailers. Polyethylene rope will be used to lower the bailer into the well.

The sampling protocol is as follows:

- a. Floating Hydrocarbon Measurement - An electronic interface probe will be used to test for the presence of floating product in all existing wells. The probe will be lowered into the wellbore and if product is present, its thickness will be recorded. The presence of floating product will be confirmed by withdrawing a sample. The probe will be decontaminated after each use by the protocol described in Section 2.1.2.
- b. Measure Water Level - An electronic water level indicator will be used to measure the static water level in the well prior to purging. The water level probe will be lowered into the wellbore and the water level will be recorded. The volume of water in the wellbore and filter pack will be calculated using the equation found in Figure 2-2.

FIGURE 2-2 PURGE VOLUME CALCULATIONS

250108

TABLE FOR CALCULATING WELL VOLUMES

Auger ID (inches)	Borehole Diameter (inches)	Well Casing Diameter	Casing Volume/ Linear Ft.	Annular *Volume/ Linear Ft.
	$(2r_1)$	$(2r_2)$	(V_c)	(V_a)
6.25	10.25	2	0.16	1.24
8.25	12.25	4	0.65	1.64
8.25	12.25	6	1.47	1.40

*Volume (Gal.)/Linear Ft. of annulus has been compensated for 30% porosity.

WELL VOLUME CALCULATION USING THE ABOVE TABLE

- 1) Measure TD and SWL from TOC.
- 2) Calculate h_w ; obtain h_f from installation diagram.
- 3a) If $h_w < h_f$ (water table within the screen), use:

$$V = (h_w \times V_c) + (h_w \times V_a)$$
- 3b) If $h_w > h_f$ (water table above the screen), use:

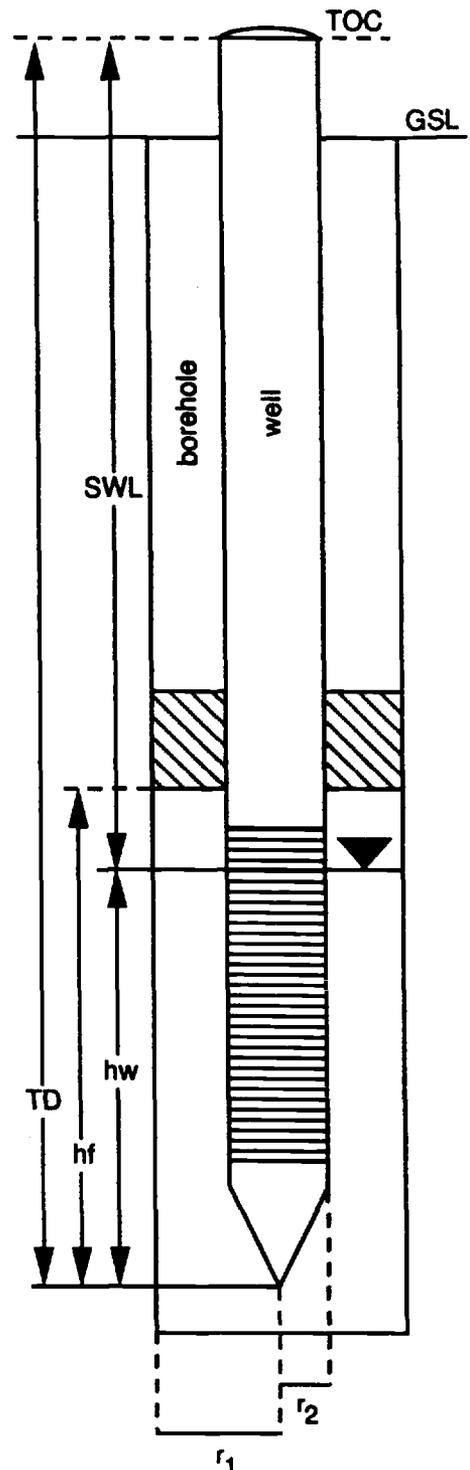
$$V = (h_w \times V_c) + (h_f \times V_a)$$

EXAMPLE:

TD of newly installed well is 30.58 ft. (TOC)
 SWL is 24.25 ft. (TOC)
 h_w is 6.33 ft.
 The well is 2-in. PVC
 The annulus (boring) is 8.25 inches

$$V = (6.33 \times .17) + (6.33 \times .76)$$

$$= 5.9 \text{ gallons}$$



LEGEND:

- GSL = Ground surface level
- TOC = Top of casing
- TD = Total depth
- SWL = Static water level
- V = 1 Well volume
- h_f = Thickness of the filter pack
- h_w = Height of the water (TD - SWL)
- r_1 = Radius of borehole
- r_2 = Radius of well
- ▼ = Water table

Decontamination of the probe will be performed as described in Section 2.1.2 to minimize the potential for cross-contamination between wells.

- c. Purge Well - The well will be purged until the pH, specific conductance, and temperature have stabilized within plus or minus 0.1 pH units, plus or minus 5 percent, and plus or minus 1 degree Celsius, respectively. PH, specific conductance, temperature and turbidity will be measured and recorded after the removal of each well bore volume (WBV). If, after three fluid casing volumes have been removed, the parameters have not been stabilized, remove WBV until the parameters stabilize or until a total of six WBV have been purged. If the well is purged to dryness, and does not recharge within a reasonable time to permit three volumes to be removed, record the volume removed and sample as soon as the water level has recovered to 80 percent of its static level or 16 hours after completion of purging, whichever occurs first. The calculation for well volume is presented in Figure 2-2.
- d. Label Sample - Label the sample container as outlined in Section 2.2.2.2.
- e. Collect Sample - Ground-water sampling will be conducted by using dedicated bailers. The collection procedure is described below.

After purging the well and allowing for sufficient recharge, samples for volatile organics will be collected using the first bailer volume. Lower the bailer slowly until it contacts the water surface. Allow the bailer to sink to the desired depth, and fill. Slowly withdraw the bailer, taking care to prevent contact of the bailer line with the ground. Slowly discharge the contents into the appropriate sample containers. Repeat the process as necessary to fill each container to the required volume (see Section 2.2.2.1). Vials for volatile analysis will be completely filled, leaving no air space above the liquid portion (to minimize volatilization). Check that the septum is toward the sample in the caps and secure the cap tightly. Semi-volatile compounds are to be sampled next. Complete the collection of samples for all remaining analyses.

- f. Measure pH, Temperature and Specific Conductance - Follow procedures as outlined in Section 2.3.

- g. Custody, Handling and Shipping - Complete the procedures as outlined in Sections 2.2.2 and 2.2.3.
- h. Measure Water Level - Water levels will be measured and recorded before and after purging.

2.2.2 Sample Handling

The following sections describe the procedures to be used to containerize, label, identify, ship, and preserve samples.

2.2.2.1 Sample Containers, Amounts and Preservation - Samples will be placed in appropriate containers as required by AFCEE (AFCEE, 1993). The amount of sample to be collected and preservation procedures specified by AFCEE will be followed. These requirements are specified in Table 2-2.

2.2.2.2 Sample Labels - Field sampling personnel must properly identify all samples taken in the field with an adhesive sample label attached to the sample container. The sample label must contain the site name, field identification number; the date, time, and location of sample collection; notation of the type of sample (e.g., ground-water, soil boring, etc.); identification of preservatives used; any remarks; and the initials of the sampler. The sample labels will be placed on the bottles so as not to obscure any QA/QC data, and sample information will be legibly printed with waterproof ink. Field identification must be sufficient to allow easy cross-reference with the site logbook. Clear tape will be placed over the label to prevent removal or damage.

2.2.2.3 Sample Identification - The existing monitoring well names will be used to identify the samples collected from each well.

2.2.2.4 Handling and Shipping - The properly labeled and sealed sample containers will be placed in plastic "Ziploc" type bags and

TABLE 2-2

250111

**SAMPLE CONTAINERS, AMOUNTS, AND PRESERVATION
GROUND-WATER SAMPLES
Quarterly Sampling Study
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Forth Worth, Texas**

PARAMETER (a)	SAMPLE CONTAINER (b)	AMOUNT	PRESERVATION	HOLD TIME (a)
Volatile Organics (SW 8260)	Five 40 mL G vials	Full; no headspace	HCl to pH < 2; Cool to 4°C	A: 14d
Semi-Volatile Organics (SW 8270)	Two 1 L AG bottles(c)	7/8 full	Cool to 4°C	P: 7d A: 40d
Metals, total ICP Screen (SW 6010)	One 1 L P bottle(c)	7/8 full	HNO ₃ to pH < 2; Cool to 4°C	A: 6m
Arsenic (SW 7060)	One 1 L P bottle (d)	7/8 full	HNO ₃ to pH < 2; Cool to 4°C	A: 6m
Mercury (SW 7471)	One 1 L P bottle (d)	7/8 full	HNO ₃ to pH < 2; Cool to 4°C	A: 28d
Selenium (SW 7740)	One 1 L P bottle (d)	7/8 full	HNO ₃ to pH < 2; Cool to 4°C	A: 6m
Lead (SW 7421)	One 1 L P bottle (d)	7/8 full	HNO ₃ to pH < 2; Cool to 4°C	A: 6m
Pesticides (SW 8080)	One 1 L G bottle (c)	7/8 full	Cool to 4°C	P: 7d A: 40d

NOTES:

- (a) Hold times from date of sampling preparation (P) or analysis (A): d = days; m = months; h = hours
 (b) All containers to have Teflon®-lined lids except for vials for volatile organics which will have Teflon®-lined septa. Container codes: G = glass; AG = amber glass; P = polyethylene
 (c) Samples chosen for MS/MSD and/or Laboratory Duplicate require triple the number of containers indicated
 (d) Sample aliquot will be obtained from ICP metals (SW 6010) sample container
 (e) Extracts to be analyzed within 40 days of date of extraction

sealed. Bagged sample containers will be placed in the bottom of the cooler. Bagged sample containers will be arranged in such a manner as to minimize breakage, and will be packed in double-bagged ice and additional packing material to prevent breakage. Samples should be packed so as to maintain a temperature of 4 degrees Celsius during shipment.

Analytical request forms, Figure 2-3, and chain-of-custody documents (see Section 2.2.3) will be sealed in air-tight plastic bags and taped to the inside of the cooler lid. The lid of the container will be taped shut and sealed with custody seals (see Section 2.2.3). Samples will be shipped directly to the laboratory by overnight courier on the day they are collected. No samples will be held more than 24 hours on site, unless special arrangements are made with the laboratory. The laboratory will be notified by phone of the sample shipment schedule.

2.2.3 Sample Custody

Documentation of sample custody from the time of collection will be maintained. Chain-of-custody records will be prepared for each shipping container. The custody record will be completed, in triplicate, by the field technician designated as responsible for sample shipment to the laboratory. The custody record will include the following information: name of person(s) collecting the samples, date samples were collected, the sample identification code (ID), type of sampling conducted (composite/grab), and number and type of containers used. Figure 2-4 presents an example of a chain-of-custody record.

Transfer of sample custody shall be indicated by the signatures of the sampler(s) and the person receiving the samples on the chain-of-custody record, with date and time noted. Prior to sealing the shipping container, the original and first copy of the chain-of-custody record shall be placed in a plastic bag that will be

FIGURE 2-3

REQUEST FOR ANALYSIS FORM

LENL-P

Project #: 11-3571-3201
 Project: NAS Fort Worth
 Project Manager: Mr. John O'Brien
 Project Chemist: Ms. Dianna Johnson
 Matrix: Ground Water

(Sample I.D.)

ANALYTICAL REQUEST

CONTAINER	NO.	PRESERVATION	PARAMETER	METHOD
40 mL VOA vial	5	Cool to 4°C; HCl to pH < 2	Volatile Organics	SW 8260
1 L amber glass jar	2	Cool to 4°C	Semi-Volatile Organics	SW 3520/8270
1 L amber glass jar	2	Cool to 4°C	Pesticides	SW 3520/8080
1 L polyethylene bottle	1	Cool to 4°C; HNO ₃ to pH < 2	ICP Screen Arsenic Lead Selenium Mercury	SW 3005/6010 SW 7060 SW 3020/7421 SW 7740 SW 7470

Remarks: None
 Turn-around Time: 30 days

[Please return a copy of this form with the data package.]

FIGURE 2-4

CHAIN OF CUSTODY RECORD

4636

SAMPLING INFORMATION

NAME OF FACILITY: _____

STREET ADDRESS: _____

CITY/STATE: _____ ZIP: _____

PROJECT NAME		JOB NO.		TOTAL NO. OF CONTAINERS
SAMPLERS (SIGNATURE)				
SAMPLING DATE				
TIME	GRAB	COMP.	SOURCE CODE	SAMPLE STATION DESCRIPTION

CONTAINER TYPE				
40 ml/g (Res. 5% O ₂) - 5 H ₂ O				
1 L g. p. (MnO ₂)				
1 L g. p. (NaOH)				
1 L g. p. (H ₂ SO ₄)				
1 L p. (NaOH + Ascorbic Acid)				
1 L g. p. (2n Acetate + NaOH)				
1 L g. p.				
8oz. g. p.				
1 L p. - Orange				
250 ml/g - Amber				

RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME
RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME
RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME

DISTRIBUTION: ORIGINAL AND PINK COPIES ACCOMPANY SAMPLE SHIPMENT TO LABORATORY.
 PINK COPY RETAINED BY LABORATORY. YELLOW COPY RETAINED BY SAMPLERS.

REMARKS: _____

* SOURCE CODES:
 RECOVERY WELL - RW
 RCRA MONITORING WELL - MW
 SOIL/SEDIMENT - SO
 SLUDGE - SL
 NPDES DISCHARGE - ND
 DRINKING WATER - DW

250114

250115

attached to the inside of the shipping container lid. The second copy remains with the sampler(s). If a courier service is to be used, the signature of the receiving person will be replaced by the shipper's airbill number. Receipt at the laboratory shall be indicated by signature of the laboratory's sample custodian, with the date and time recorded.

Custody seals will be placed on the shipping containers. Custody seals will be pre-printed, adhesive-backed seals with security slots designed to break if disturbed. Sample shipping containers will be sealed in as many places as necessary to ensure security. Seals will be signed and dated before use. Upon receipt by the laboratory, the sample custodian will check and document whether the custody seals are intact and will also record the cooler temperature. Additional sample receipt information will be recorded on the chain of custody and cooler receipt forms as required.

2.2.4 QC Samples

Quality control (QC) samples are collected and analyzed for the purpose of assessing the quality of the sampling effort and the analytical data. QC samples include duplicates of field samples, equipment blanks, trip blanks, and ambient condition blanks. The type, description, preparation, collection, and frequency of field QC samples are discussed in the following section.

- Field Sample - The total sample collected at a specific site location. The field sample may be divided to provide material for analysis for QC samples.
- QC Samples - Samples analyzed by the laboratory to assess the quality of the analytical procedures. QC samples represent approximately 10 percent of the field samples.

- Field Duplicate Samples - Multiple grab samples, collected separately, that equally represent a medium at a given time and location. This is a co-located sample for volatile organic analyses and most ground-water samples. One duplicate samples is required for every 10 field samples collected.
- Equipment Blank - Samples consisting of reagent water collected from a final rinse of sampling equipment after the decontamination procedure has been performed. The purpose of equipment blanks is to determine whether the sampling equipment is causing cross contamination of samples. One equipment blank is required per day (per equipment type).
- Trip Blank - Containers of the organic-free reagent water that are kept with the field sample containers from the time they leave the laboratory until the time they are returned to the laboratory. The purpose of the trip blank is to determine whether samples are being contaminated during transit. Trip blanks pertain only to volatile organic analyses. Only one trip blank is required per day and that will satisfy trip blank requirements for all water matrices for volatile samples shipped in the same cooler.
- Ambient Conditions Blank - Containers of organic-free reagent water opened during sampling at the site. The purpose of the ambient condition blank is to determine whether site activities are contributing to sample contamination. Ambient condition blanks are only required when samples are being collected downwind of possible VOC sources such as active runways.

2.3 FIELD MEASUREMENTS

Field measurements will consist of calibration and measurement with safety monitoring equipment and ground-water pH, temperature, specific conductivity, and turbidity meters.

2.3.1 Parameters for Field Characterization of Samples

Field measurements must be performed as soon as possible after sampling in order to get accurate results. These parameters

include pH, temperature, turbidity, and specific conductivity. Other field parameters to be collected include measurements of air vapors during well sampling.

2.3.2 Equipment Calibration

All equipment will be calibrated according to manufacturers instructions or a generally accepted practice. Calibration of all instruments will be recorded in the field log book. The following subsections describe calibration procedures.

- Measurement of pH will be performed on site with a pH meter. The instrument will be field-calibrated with two buffer solutions at the beginning of each day's use. Accuracy of the measurement is maintained by selecting a standard buffer with a pH close to that of the sample (preferably within three pH units). The pH of the buffers used will be dependent upon the pH of the sample, but in each case will "bracket" the range of measurement. The stability of the calibration will be verified through the analysis of one standard periodically throughout the day as deemed necessary by the site manager, but at least once every 5 hours.
- Temperature and specific conductivity will be measured with a portable meter. Calibration of the instrument is periodically performed at the factory as part of LAW's internal QA program. The instrument probe will be rinsed with reagent water between each use and the calibration of the specific conductivity probe will be checked at the beginning and middle of each day using a potassium chloride (KCl) solution with known conductance values.
- The hand held portable organic vapor analyzer (OVA) with a photoionization detector (PID) is used to screen the air vapors when the well casing cap is removed. It will be calibrated daily with a 100 ppm level of isobutylene. The battery power supply will be recharged each evening prior to the next day field activities.
- The hand held portable organic vapor analyzer (OVA) will be used to screen the air vapors at the head

of the augers and in the breathing zone. The OVA will be calibrated daily with an isobutylene standard of known concentration. The battery poser supply will be recharged each evening prior to the next day drilling operation and instrument use.

- The hand held portable atmospheric monitor used to screen the breathing zone for explosive conditions and H₂S will be calibrated daily as described in the manufacturer's manual.
- Turbidity will be measured with a nephelometer (also known as a turbidimeter). Calibration of the instrument is periodically performed at the factory as part of LAW's internal QA program. The stability of the calibration will be verified through the analysis of one standard periodically throughout the day as deemed necessary by the site manager, but at least once every 5 hours.

2.3.3 Equipment Maintenance

Field equipment is located in a controlled storage room, and must be returned decontaminated and any malfunctions must be reported to the site manager. The site manager will initiate any actions necessary for the repair or replacement of the equipment. Equipment maintenance logs are kept updated and on file. Battery powered instruments will have their power supplies checked daily. Rechargeable instruments will be recharged daily.

2.3.4 Decontamination of Field Instruments

Decontamination of field instruments will depend upon the instrument. The probes of the pH, temperature, and specific conductivity meters will be rinsed with reagent grade water before and after each use, and at the end of each day. The measurement vial for the turbidity meter will be rinsed out with deionized water before and after each use. No decontamination is required for the organic vapor analyzer.

2.4 FIELD QA/QC PROGRAM

The field quality assurance and quality control program is a team effort and will be monitored by the site manager. The following text describes the factors that govern field QA/QC procedures.

2.4.1 Control Parameters

Control parameters for field procedures are similar to those parameters applied to analytical data. These parameters are monitored through the assessment of data collected for the evaluation of precision, accuracy, representativeness, and completeness. Control parameters consist of the following:

- Collection of field QC samples
- Calibration of field equipment
- Decontamination of field equipment
- Collection of field measurements
- Record keeping

2.4.2 Control Limits and Corrective Actions

Appendix A-3 presents a summary of quality control procedures and acceptance criteria for field measurements. Corrective action requirements are also presented in this table.

2.5 RECORD KEEPING

Pertinent information concerning all aspects of sampling and field measurements will be recorded in hard-bound field notebooks. The bound field notebook will have pre-numbered pages, and entries will be made in indelible ink. Environmental conditions will also be characterized. Each sampling site will be characterized by the following criteria:

1. Location of work
2. Weather
3. Rainfall
4. Temperature - minimum and maximum
5. Wind direction
6. Ongoing activities that may influence or disrupt sampling efforts
7. Accessibility to the sampling locations, e.g., rough terrain, fallen trees, flooding, etc.

2.6 SITE MANAGEMENT

The AFCEE Team Chief (TC) for the NAS Fort Worth RFI is Capt. Joe Feaster. Captain Feaster's address and phone number are:

Capt. Joe Feaster
Team Chief (TC)
HQ AFCEE/ERB
8001 Inner Circle Drive
Brooks AFB, Texas 78235-5328
Phone: (210) 536-5275

The NAS Fort Worth Point of Contact (POC) is Mr. Frank Grey. Mr. Grey's address and phone number are:

Air Force Base Conversion Agency
Chief Environmental Engineer
AFBCA/OL-H
Building 1215
Depot Avenue
NAS Fort Worth, JRB, Carswell Field
Fort Worth, TX 76127
(817) 782-6311

NAS Fort Worth personnel will assist in base cooperation for the following:

- Personnel identification and vehicle passes
- Temporary field office
- A water supply for large quantities of potable water to be used in equipment cleaning, etc.
- Rights of easement and access to all Air Force and private property to perform all required field investigations

All field personnel will adhere to the procedures as described in the work plans. The site manager will supervise all field activities and continually update the AFCEE Team Chief and LAW's Project Manager of the daily activities. Problems occurring during field activities requiring deviation from the SAP will be brought to the attention of the Team Chief for his input into the resolution of the problem.

REFERENCES

250122

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250123



LAW

ENGINEERING AND ENVIRONMENTAL SERVICES

GOVERNMENT SERVICES DIVISION
FAX TRANSMITTAL COVER LETTER

	FROM:	DELIVERY TO:
NAME:	Jim Forbes	<i>Chuck Smith</i>
COMPANY:	Law Engineering & Environmental Services, Inc. Government Services Division	
LOCATION:	114 TownPark Drive Kennesaw, Georgia 30144-5569	
FAX:	770-421-3593	
TELEPHONE:	770-499-6819	<i>713-462-1653</i>

NUMBER OF PAGES (INCLUDING THIS PAGE): 2

OPERATOR: _____ TIME: _____ DATE: _____

NOTES:

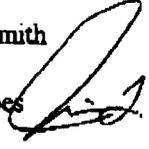
Elliot Smith

250124



LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

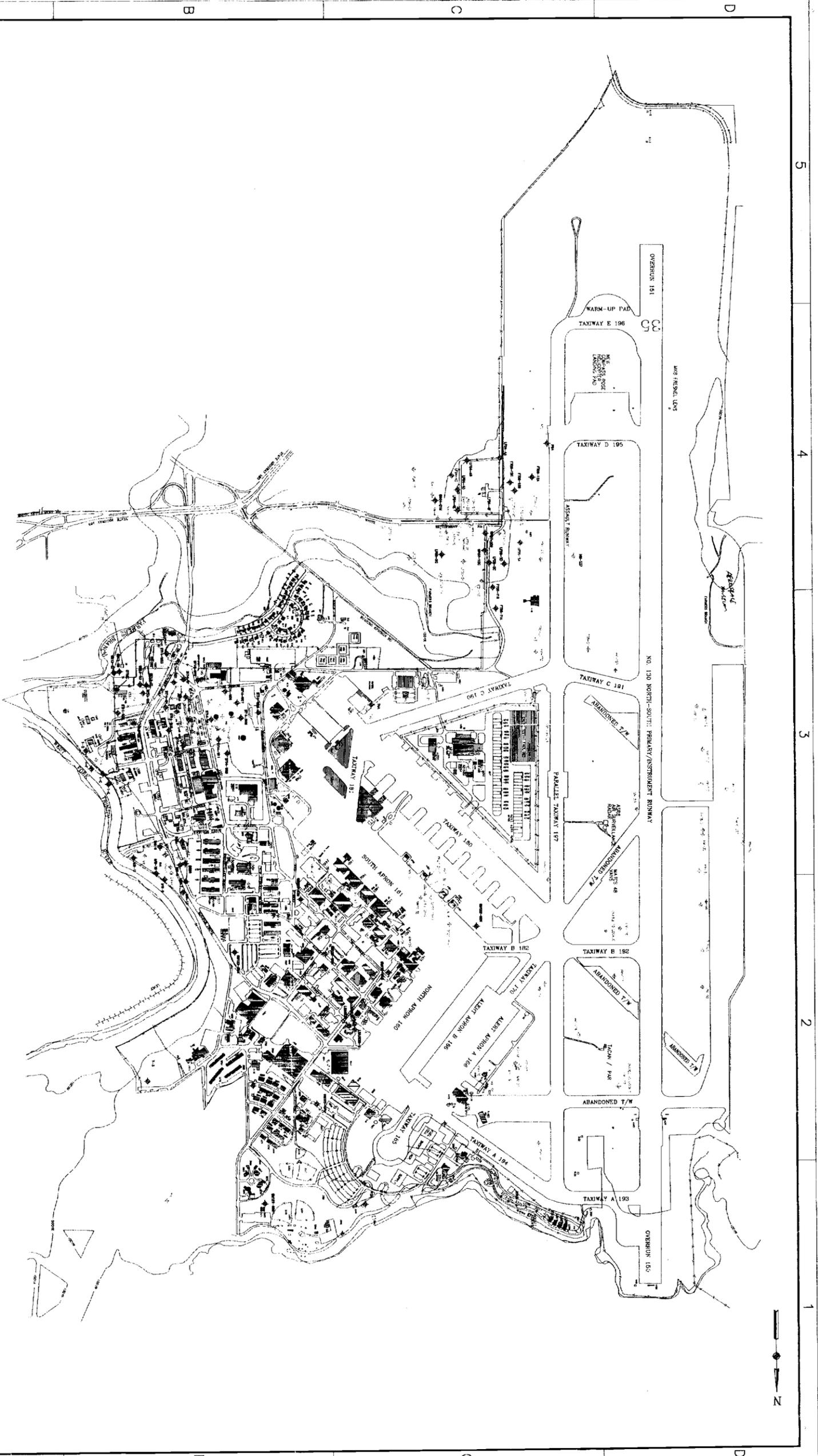
INTEROFFICE MEMO

TO: Chuck Smith
FROM: Jim Forbes 
DATE: 12/18/95
SUBJECT: Carswell Quarterly Sampling

We have been made aware of agreements the Base has with TNRCC regarding discovery and reporting of free product in wells. Whenever free product is detected, it is important that we follow the following procedure:

1. Measure the thickness and remove the free product from the well.
2. Notify Base personnel (Alan Flolo or his designee). They, in turn, must notify TNRCC within 24 hours. *Elliot Smith*
3. Re-check the well at 24, 48, and 72-hour intervals and repeat the procedure, as necessary.
4. Record the results and send them to me at the conclusion of the event so I can issue a report to AFCEE.

Thanks, and any questions, please let me know.



LEGEND
 ◆ MONITORING WELLS SELECTED FOR QUARTERLY SAMPLING
 ⊕ EXISTING MONITORING WELL



<p>LAW ENGINEERING AND ENVIRONMENTAL SERVICES BRANCH KENNESAW, GEORGIA</p>	<p>AFCEE</p>
<p>Assigned by: CFS</p>	<p>NAVAL AIR STATION FORT WORTH NORTH WORTH, TEXAS</p>
<p>Checked by: DRJ</p>	<p>BASE-WIDE QUARTERLY GROUND-WATER MONITORING MONITORING WELLS SELECTED FOR QUARTERLY SAMPLING</p>
<p>Reviewed by: JFO</p>	<p>Scale: 1" = 500' Date: 03 MARCH 95</p>
<p>Sheet No. 1</p>	<p>Project No. 11-3517-3201 File Name: J040000009</p>
<p>Date: 03</p>	<p>Sheet 1 of 1</p>

TAB

APPENDIX A

250127

APPENDIX A-1

LABORATORY ESTABLISHED DETECTION
AND QUANTITATION LIMITS

LABORATORY – ESTABLISHED DETECTION AND QUANTITATION LIMITS
 VOLATILE ORGANIC COMPOUNDS
 Sampling Analysis Plan
 Naval Air Station For Worth, Joint Reserve Base, Carswell Field
 Fort Worth, Texas

250128

LENL – Pensacola

DV012495

PARAMETER	EPA METHOD	UNITS	MATRIX	MDL	PQL	#	AFCEE MQL 9/93
Acetone	8260	ug/L	Water	2.10	5.0		NE
Benzene	8260	ug/L	Water	0.20	0.5	*	0.4
Bromodichloromethane	8260	ug/L	Water	0.15	0.5		0.8
Bromoform	8260	ug/L	Water	0.16	1.0		1.2
Bromomethane	8260	ug/L	Water	0.29	2.0	*	1.1
2-Butanone	8260	ug/L	Water	4.00	5.0		NE
Carbon disulfide	8260	ug/L	Water	0.82	1.0		NE
Carbon tetrachloride	8260	ug/L	Water	0.23	0.5		2.1
Chlorobenzene	8260	ug/L	Water	0.17	0.5	*	0.4
Dibromochloromethane	8260	ug/L	Water	0.17	0.5		0.5
Chloroethane	8260	ug/L	Water	0.23	2.0	*	1
2-Chloroethyl vinyl ether	8260	ug/L	Water	2.90	5.0		NE
Chloroform	8260	ug/L	Water	0.20	0.5	*	0.3
Chloromethane	8260	ug/L	Water	0.69	2.0	*	1.3
1,1-Dichloroethane	8260	ug/L	Water	0.19	0.5	*	0.4
1,2-Dichloroethane	8260	ug/L	Water	0.24	1.0	*	0.6
1,1-Dichloroethene	8260	ug/L	Water	0.21	0.5		1.2
cis-1,2-Dichloroethene	8260	ug/L	Water	0.19	0.5		1.2
trans-1,2-Dichloroethene	8260	ug/L	Water	0.17	0.5		0.6
1,2-Dichloropropane	8260	ug/L	Water	0.17	0.5	*	0.4
cis-1,3-Dichloropropene	8260	ug/L	Water	0.20	0.5		NE
trans-1,3-Dichloropropene	8260	ug/L	Water	0.17	0.5		NE
Ethylbenzene	8260	ug/L	Water	0.14	0.5		0.6
2-Hexanone	8260	ug/L	Water	0.67	5.0		NE
Methylene chloride	8260	ug/L	Water	1.40	2.0		0.3
4-Methyl-2-pentanone	8260	ug/L	Water	0.99	5.0		NE

LABORATORY – ESTABLISHED DETECTION AND QUANTITATION LIMITS
 VOLATILE ORGANIC COMPOUNDS
 Sampling Analysis Plan
 Naval Air Station For Worth, Joint Reserve Base, Carswell Field
 Fort Worth, Texas

250129

LENL – Pensacola

DV012495

PARAMETER	EPA METHOD	UNITS	MATRIX	MDL	PQL	#	AFCEE MQL 9/93
Styrene	8260	ug/L	Water	0.33	0.5	*	0.4
1,1,2,2-Tetrachloroethane	8260	ug/L	Water	0.23	0.5	*	0.4
Tetrachloroethene	8260	ug/L	Water	0.16	0.5		1.4
Toluene	8260	ug/L	Water	0.16	0.5		1.1
1,1,1-Trichloroethane	8260	ug/L	Water	0.21	0.5		0.8
1,1,2-Trichloroethane	8260	ug/L	Water	0.22	1.0		1
Trichloroethene	8260	ug/L	Water	0.17	0.5		1
Vinyl acetate	8260	ug/L	Water	0.90	5.0		NE
Vinyl chloride	8260	ug/L	Water	0.86	2.0	*	1.1
Xylenes (total)	8260	ug/L	Water	0.43	1.0		1.1

#: This column flags PQL that exceeds AFCEE MQL.
 *: PQL exceeds AFCEE MQL.
 MDL: Method Detection Limit.
 PQL: Practical Quantitation Limit.
 NE: Not established.
 (a) AFCEE MQL increased by 10 per AFCEE auditor

PREPARED/DATE: DRJ 3-27-95
 CHECKED/DATE: JFO 3-27-95

LABORATORY – ESTABLISHED DETECTION AND QUANTITATION LIMITS
SEMIVOLATILE ORGANIC COMPOUNDS
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Forth Worth, Texas

250130

LENL – Pensacola

DV012495

PARAMETER	EPA METHOD	UNITS	MATRIX	MDL	PQL	#	AFCEE MQL 9/93
Base/Neutral Extractables:							
Acenaphthene	8270	ug/L	Water	0.4	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Acenaphthylene	8270	ug/L	Water	0.31	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Anthracene	8270	ug/L	Water	0.95	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Benz(a)anthracene	8270	ug/L	Water	1.1	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Benzo(b)fluoranthene	8270	ug/L	Water	0.72	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Benzo(ghi)perylene	8270	ug/L	Water	3.0	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Benzo(a)pyrene	8270	ug/L	Water	0.7	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Benzyl alcohol	8270	ug/L	Water	6	20		20
	8270	mg/Kg	Soil	–	0.66		1.3
bis(2-Chloroethoxy)methane	8270	ug/L	Water	1	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
bis(2-Chloroethyl)ether	8270	ug/L	Water	2.1	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
bis(2-Chloroisopropyl)ether	8270	ug/L	Water	2.2	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
bis(2-ethylhexyl)phthalate	8270	ug/L	Water	3.4	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
4-Bromophenyl phenyl ether	8270	ug/L	Water	1.1	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Butyl benzyl phthalate	8270	ug/L	Water	0.82	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
4-Chloroaniline	8270	ug/L	Water	6.8	20		20
	8270	mg/Kg	Soil	–	0.66		1.3
2-Chloronaphthalene	8270	ug/L	Water	1.4	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
4-Chlorophenyl phenyl ether	8270	ug/L	Water	1.4	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Chrysene	8270	ug/L	Water	0.34	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Dibenz(a,h)anthracene	8270	ug/L	Water	0.88	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Dibenzofuran	8270	ug/L	Water	0.82	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Di-n-butylphthalate	8270	ug/L	Water	0.52	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
1,2-Dichlorobenzene	8270	ug/L	Water	1	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
1,3-Dichlorobenzene	8270	ug/L	Water	2.2	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
1,4-Dichlorobenzene	8270	ug/L	Water	1.6	10		10
	8270	mg/Kg	Soil	–	0.33		0.7

LABORATORY – ESTABLISHED DETECTION AND QUANTITATION LIMITS
SEMIVOLATILE ORGANIC COMPOUNDS
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Forth Worth, Texas

250131

LENL – Pensacola

DV012495

PARAMETER	EPA METHOD	UNITS	MATRIX	MDL	PQL	#	AFCEE MQL 9/93
3,3'-Dichlorobenzidine	8270	ug/L	Water	7.3	20		20
	8270	mg/Kg	Soil	-	0.66		1.3
Diethyl phthalate	8270	ug/L	Water	1.2	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Dimethyl phthalate	8270	ug/L	Water	0.95	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
2,4-Dinitrotoluene	8270	ug/L	Water	1.9	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
2,6-Dinitrotoluene	8270	ug/L	Water	1.9	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Di-n-octyl phthalate	8270	ug/L	Water	0.69	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Fluoranthene	8270	ug/L	Water	0.25	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Fluorene	8270	ug/L	Water	0.21	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Hexachlorobenzene	8270	ug/L	Water	2.1	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Hexachlorobutadiene	8270	ug/L	Water	3	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Hexachlorocyclopentadiene	8270	ug/L	Water	10	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Hexachloroethane	8270	ug/L	Water	2.3	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Indeno(1,2,3-cd)pyrene	8270	ug/L	Water	1.3	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Isophorone	8270	ug/L	Water	1.2	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
2-Methylnaphthalene	8270	ug/L	Water	1.2	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Naphthalene	8270	ug/L	Water	0.37	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
2-Nitroaniline	8270	ug/L	Water	1.9	50		50
	8270	mg/Kg	Soil	-	1.65		3.3
3-Nitroaniline	8270	ug/L	Water	1.9	50		50
	8270	mg/Kg	Soil	-	1.65		3.3
4-Nitroaniline	8270	ug/L	Water	1.8	50		50
	8270	mg/Kg	Soil	-	1.65		3.3
Nitrobenzene	8270	ug/L	Water	1.6	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
n-Nitrosodiphenylamine	8270	ug/L	Water	2.8	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
n-Nitrosodipropylamine	8270	ug/L	Water	2.7	10		10
	8270	mg/Kg	Soil	-	0.33		0.7
Phenanthrene	8270	ug/L	Water	0.59	10		10
	8270	mg/Kg	Soil	-	0.33		0.7

LABORATORY – ESTABLISHED DETECTION AND QUANTITATION LIMITS
SEMIVOLATILE ORGANIC COMPOUNDS
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Forth Worth, Texas

250132

LENL – Pensacola

DV012495

PARAMETER	EPA METHOD	UNITS	MATRIX	MDL	PQL	#	AFCEE MQL 9/93
Pyrene	8270	ug/L	Water	0.53	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
1,2,4–Trichlorobenzene	8270	ug/L	Water	1.9	10		10
	8270	mg/Kg	Soil	–	0.33		0.7
Acid: Benzoic acid	8270	ug/L	Water	33	50		50
	8270	mg/Kg	Soil	–	1.6		1.6
4–Chloro–3–methylphenol	8270	ug/L	Water	1.4	10		20
	8270	mg/Kg	Soil	–	0.33		1.3
2–Chlorophenol	8270	ug/L	Water	1.8	10		10
	8270	mg/Kg	Soil	–	0.33		0.3
2,4–Dichlorophenol	8270	ug/L	Water	3	10		10
	8270	mg/Kg	Soil	–	0.33		0.3
2,4–Dimethylphenol	8270	ug/L	Water	1.7	10		10
	8270	mg/Kg	Soil	–	0.33		0.3
4,6–Dinitro–2–methylphenol	8270	ug/L	Water	2.0	50		50
	8270	mg/Kg	Soil	–	1.65		3.3
2,4–Dinitrophenol	8270	ug/L	Water	20	50		50
	8270	mg/Kg	Soil	–	1.65		3.3
2–Methylphenol	8270	ug/L	Water	2	10		10
	8270	mg/Kg	Soil	–	0.33		0.3
4–Methylphenol	8270	ug/L	Water	2.1	10		10
	8270	mg/Kg	Soil	–	0.33		0.3
2–Nitrophenol	8270	ug/L	Water	1.9	10		10
	8270	mg/Kg	Soil	–	0.33		0.3
4–Nitrophenol	8270	ug/L	Water	20	50		50
	8270	mg/Kg	Soil	–	1.6		1.6
Pentachlorophenol	8270	ug/L	Water	2.9	30		50
	8270	mg/Kg	Soil	–	1.0		3.3
Phenol	8270	ug/L	Water	2.4	10		10
	8270	mg/Kg	Soil	–	0.33		0.3
2,4,5–Trichlorophenol	8270	ug/L	Water	1.7	20		50
	8270	mg/Kg	Soil	–	0.66		3.3
2,4,6–Trichlorophenol	8270	ug/L	Water	1.5	10		10
	8270	mg/Kg	Soil	–	0.33		0.3

#: This column flags PQL that exceeds AFCEE MQL.
*: PQL exceeds AFCEE MQL.
MDL: Method Detection Limit.
PQL: Practical Quantitation Limit.

PREPARED/DATE: DRJ 3–27–95
CHECKED/DATE: JFO 3–27–95

LABORATORY – ESTABLISHED DETECTION AND QUANTITATION LIMITS
 ORGANOCHLORINE PESTICIDES & PCBs
 Sampling and Analysis Plan
 Naval Air Station fort Worth, Joint Reserve Base, Carswell Field
 Fort Worth, Texas

250133

LENL – Pensacola

DV012495

PARAMETER	EPA METHOD	UNITS	MATRIX	MDL	PQL	#	AFCEE MQL 9/93
Aldrin	8080	ug/L	Water	0.009	0.04		0.04
	8080	mg/Kg	Soil	–	0.001		0.003
alpha-BHC	8080	ug/L	Water	0.004	0.03		0.03
	8080	mg/Kg	Soil	–	0.001		0.002
beta-BHC	8080	ug/L	Water	0.011	0.05		0.06
	8080	mg/Kg	Soil	–	0.002		0.004
delta-BHC	8080	ug/L	Water	0.002	0.05		0.09
	8080	mg/Kg	Soil	–	0.002		0.006
gamma-BHC (Lindane)	8080	ug/L	Water	0.004	0.04		0.04
	8080	mg/Kg	Soil	–	0.001		0.003
Chlordane (technical)	8080	ug/L	Water	0.078	0.5 *		0.14
	8080	mg/Kg	Soil	–	0.017 *		0.009
alpha-Chlordane	8080	ug/L	Water	0.013	0.05		NE
	8080	mg/Kg	Soil	–	0.002		NE
gamma-Chlordane	8080	ug/L	Water	0.006	0.05		NE
	8080	mg/Kg	Soil	–	0.002		NE
4,4'-DDD	8080	ug/L	Water	0.006	0.1		0.11
	8080	mg/Kg	Soil	–	0.003		0.007
4,4'-DDE	8080	ug/L	Water	0.011	0.04		0.04
	8080	mg/Kg	Soil	–	0.001		0.003
4,4'-DDT	8080	ug/L	Water	0.041	0.1		0.12
	8080	mg/Kg	Soil	–	0.003		0.008
Dieldrin	8080	ug/L	Water	0.01	0.02		0.02
	8080	mg/Kg	Soil	–	0.0007		0.01
Endosulfan I	8080	ug/L	Water	0.009	0.05		0.14
	8080	mg/Kg	Soil	–	0.002		0.009
Endosulfan II	8080	ug/L	Water	0.018	0.04		0.04
	8080	mg/Kg	Soil	–	0.001		0.003
Endosulfan sulfate	8080	ug/L	Water	0.015	0.1		0.66
	8080	mg/Kg	Soil	–	0.003		0.04
Endrin	8080	ug/L	Water	0.015	0.06		0.06
	8080	mg/Kg	Soil	–	0.002		0.004
Endrin Aldehyde	8080	ug/L	Water	0.047	0.1		0.23
	8080	mg/Kg	Soil	–	0.003		0.02
Heptachlor	8080	ug/L	Water	0.006	0.03		0.03
	8080	mg/Kg	Soil	–	0.001		0.002
Heptachlor epoxide	8080	ug/L	Water	0.008	0.05		0.83
	8080	mg/Kg	Soil	–	0.002		0.06
Methoxychlor	8080	ug/L	Water	0.03	0.5		1.76
	8080	mg/Kg	Soil	–	0.017		0.10
Toxaphene	8080	ug/L	Water	0.988	2.0		2.4
	8080	mg/Kg	Soil	–	0.066		0.20

**LABORATORY – ESTABLISHED DETECTION AND QUANTITATION LIMITS
 ORGANOCHLORINE PESTICIDES & PCBs
 Sampling and Analysis Plan
 Naval Air Station fort Worth, Joint Reserve Base, Carswell Field
 Fort Worth, Texas**

250134

LENL – Pensacola

DV012495

PARAMETER	EPA METHOD	UNITS	MATRIX	MDL	PQL	#	AFCEE MQL 9/93
PCB-1016	8080	ug/L	Water	0.178	1.0		1.0
	8080	mg/Kg	Soil	–	0.033		1.0
PCB-1221	8080	ug/L	Water	0.257	1.0		1.0
	8080	mg/Kg	Soil	–	0.033		1.0
PCB-1232	8080	ug/L	Water	0.168	1.0		1.0
	8080	mg/Kg	Soil	–	0.033		1.0
PCB-1242	8080	ug/L	Water	0.385	1.0		1.0
	8080	mg/Kg	Soil	–	0.033		1.0
PCB-1248	8080	ug/L	Water	0.224	1.0		1.0
	8080	mg/Kg	Soil	–	0.033		1.0
PCB-1254	8080	ug/L	Water	0.384	1.0		1.0
	8080	mg/Kg	Soil	–	0.033		1.0
PCB-1260	8080	ug/L	Water	0.222	1.0		1.0
	8080	mg/Kg	Soil	–	0.033		1.0

#: This column flags PQL that exceeds AFCEE MQL.
 *: PQL exceeds AFCEE MQL.
 MDL: Method Detection Limit.
 PQL: Practical Quantitation Limit.

PREPARED/DATE: DRJ 3-27-95
 CHECKED/DATE: JFO 3-27-95

LABORATORY--ESTABLISHED DETECTION LIMITS
Inorganic Analytes
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

250135

PARAMETER	EPA METHOD	UNITS	MATRIX	IDL	PQL	#	DV012495 AFCEE MQL 9/93
Aluminum	6010	mg/L	Water	0.045	0.5		0.5
	6010	mg/Kg	Soil	4.5	50		50
Antimony	6010	mg/L	Water	0.022	0.25		0.4
	6010	mg/Kg	Soil	2.2	25		40
Arsenic	6010	mg/L	Water	0.024	0.5		0.6
	6010	mg/Kg	Soil	2.4	50		60
Barium	6010	mg/L	Water	0.014	0.02		0.02
	6010	mg/Kg	Soil	1.4	2.0		2.0
Beryllium	6010	mg/L	Water	0.002	0.003		0.003
	6010	mg/Kg	Soil	0.2	0.3		0.3
Cadmium	6010	mg/L	Water	0.003	0.01		0.04
	6010	mg/Kg	Soil	0.3	1.0		4.0
Calcium	6010	mg/L	Water	0.069	0.1		0.1
	6010	mg/Kg	Soil	6.9	10		10
Chromium	6010	mg/L	Water	0.009	0.05		0.07
	6010	mg/Kg	Soil	0.9	5.0		7.0
Cobalt	6010	mg/L	Water	0.009	0.05		0.07
	6010	mg/Kg	Soil	0.9	5.0		7.0
Copper	6010	mg/L	Water	0.004	0.05		0.06
	6010	mg/Kg	Soil	0.4	5.0		6.0
Iron	6010	mg/L	Water	0.026	0.05		0.07
	6010	mg/Kg	Soil	2.6	5.0		7.0
Lead	6010	mg/L	Water	0.018	0.12		0.5
	6010	mg/Kg	Soil	1.8	12		50
Magnesium	6010	mg/L	Water	0.071	0.25		0.3
	6010	mg/Kg	Soil	7.1	25		30
Manganese	6010	mg/L	Water	0.007	0.01		0.02
	6010	mg/Kg	Soil	0.7	1.0		2.0
Molybdenum	6010	mg/L	Water	0.015	0.05		0.08
	6010	mg/Kg	Soil	1.5	5.0		8.0
Nickel	6010	mg/L	Water	0.011	0.05		0.15
	6010	mg/Kg	Soil	1.1	5.0		15
Potassium	6010	mg/L	Water	0.226	0.6		5.0
	6010	mg/Kg	Soil	22.6	60		500
Selenium	6010	mg/L	Water	0.066	0.5		0.8
	6010	mg/Kg	Soil	6.6	50		80
Silver	6010	mg/L	Water	0.006	0.05		0.07
	6010	mg/Kg	Soil	0.6	5.0		7.0
Sodium	6010	mg/L	Water	0.226	0.25		0.3
	6010	mg/Kg	Soil	22.6	25		30
Thallium	6010	mg/L	Water	0.047	0.25		0.4
	6010	mg/Kg	Soil	4.7	25		40
Vanadium	6010	mg/L	Water	0.006	0.05		0.08
	6010	mg/Kg	Soil	0.6	5.0		8.0
Zinc	6010	mg/L	Water	0.006	0.01		0.02
	6010	mg/Kg	Soil	0.6	1.0		2.0

LABORATORY-ESTABLISHED DETECTION LIMITS
Inorganic Analytes
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

250136

PARAMETER	EPA METHOD	UNITS	MATRIX	IDL	PQL	#	DV012496 AFCEE MQL 9/93
Antimony	7041	mg/L	Water	0.001	0.005		0.005
	7041	mg/Kg	Soil	0.1	0.5		0.5
Arsenic	7060	mg/L	Water	0.001	0.005		0.005
	7060	mg/Kg	Soil	0.1	0.5		0.5
Hexavalent Chromium	7196	mg/L	Water	0.007	0.02		-
	7196	mg/Kg	Soil	0.7	2.0		-
Lead	7421	mg/L	Water	0.001	0.005		0.005
	7421	mg/Kg	Soil	0.1	0.5		0.5
Mercury	7470	mg/L	Water	0.0001	0.0005		0.001
	7471	mg/Kg	Soil	0.01	0.05		0.1
Selenium	7740	mg/L	Water	0.001	0.005		0.005
	7740	mg/Kg	Soil	0.1	0.5		0.5
Cadmium	7131	mg/L	Water	0.0003	0.001		0.001
	7131	mg/Kg	Soil	0.03	0.1		0.1
Thallium	7841	mg/L	Water	0.001	0.002 *		0.001
	7841	mg/Kg	Soil	0.1	0.2 *		0.1
Cyanide	9010	mg/L	Water	0.001	0.01		0.02
	9010	mg/Kg	Soil	0.1	1.0		1.0

GFAA analytes may be analyzed by SW6010 (ICP) if the concentration is greater than 5 times the ICP PQL.

#: This column flags IDL that exceeds AFCEE MQL.

*: PQL exceeds AFCEE MQL.

IDL: Instrument Detection Limit

PQL: Practical Quantitation Limit

MQL: Maximum Allowable Quantitation Limit

PREPARED/DATE: DRJ 3-27-95

CHECKED/DATE: JFO 3-27-95

APPENDIX A-2

CONTROL LIMITS FOR MATRIX SPIKES,
MATRIX SPIKE DUPLICATES, LABORATORY CONTROL SAMPLES
AND SURROGATE SPIKES

**CONTROL LIMITS FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATES, LABORATORY
CONTROL SAMPLES, AND SURROGATE SPIKES**

250138

**Volatile Organics
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas**

LENL - Pensacola										DV012495
EPA METHOD	PARAMETER	#	MATRIX	UNITS	MS/MSD SPIKE CONC. LOW	MS/MSD ACCURACY % REC	MS/MSD PRECISION MAX. RPD	LCS SPIKE CONC. LOW	LCS ACCURACY % REC	
8260	Acetone		Water	ug/L	NS	NA	NA	10	34-221	
8260	Benzene		Water	ug/L	10	68-124	40	10	68-124	
8260	Bromodichloromethane		Water	ug/L	NS	NA	NA	10	68-124	
8260	Bromoform		Water	ug/L	NS	NA	NA	10	71-131	
8260	Bromomethane		Water	ug/L	NS	NA	NA	10	67-124	
8260	2-Butanone		Water	ug/L	NS	NA	NA	10	35-207	
8260	Carbon disulfide		Water	ug/L	NS	NA	NA	10	63-133	
8260	Carbon tetrachloride		Water	ug/L	NS	NA	NA	10	62-109	
8260	Chlorobenzene		Water	ug/L	10	73-127	40	10	73-127	
8260	Dibromochloromethane		Water	ug/L	10	64-120	40	10	64-120	
8260	Chloroethane		Water	ug/L	NS	NA	NA	10	71-116	
8260	2-Chloroethyl vinyl ether		Water	ug/L	NS	NA	NA	10	D-192	
8260	Chloroform		Water	ug/L	10	63-117	40	10	63-117	
8260	Chloromethane		Water	ug/L	NS	NA	NA	10	65-121	
8260	1,1-Dichloroethane		Water	ug/L	NS	NA	NA	10	74-125	
8260	1,2-Dichloroethane		Water	ug/L	NS	NA	NA	10	71-124	
8260	1,1-Dichloroethene		Water	ug/L	10	69-122	40	10	69-122	
8260	cis-1,2-Dichloroethene		Water	ug/L	NS	NA	NA	10	71-131	
8260	trans-1,2-Dichloroethene		Water	ug/L	NS	NA	NA	10	69-120	
8260	1,2-Dichloropropane		Water	ug/L	NS	NA	NA	10	70-126	
8260	cis-1,3-Dichloropropene		Water	ug/L	NS	NA	NA	10	53-149	
8260	trans-1,3-Dichloropropene		Water	ug/L	NS	NA	NA	10	48-158	
8260	Ethylbenzene		Water	ug/L	10	72-125	40	10	72-125	
8260	2-Hexanone		Water	ug/L	NS	NA	NA	10	57-156	
8260	Methylene chloride		Water	ug/L	NS	NA	NA	10	67-124	
8260	4-Methyl-2-pentanone		Water	ug/L	NS	NA	NA	10	67-148	
8260	Styrene		Water	ug/L	NS	NA	NA	10	72-123	
8260	1,1,2,2-Tetrachloroethane		Water	ug/L	NS	NA	NA	10	73-118	
8260	Tetrachloroethene		Water	ug/L	10	66-116	40	10	66-116	
8260	Toluene		Water	ug/L	10	73-122	40	10	73-122	
8260	1,1,1-Trichloroethane		Water	ug/L	10	69-127	40	10	69-127	
8260	1,1,2-Trichloroethane		Water	ug/L	NS	NA	NA	10	78-135	
8260	Trichloroethene		Water	ug/L	10	76-117	40	10	76-117	

CONTROL LIMITS FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATES, LABORATORY
CONTROL SAMPLES, AND SURROGATE SPIKES

250139

Volatile Organics
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

LENL - Pensacola								DV012495	
EPA METHOD	PARAMETER	#	MATRIX	UNITS	MS/MSD SPIKE CONC. LOW	MS/MSD ACCURACY % REC	MS/MSD PRECISION MAX. RPD	LCS SPIKE CONC. LOW	LCS ACCURACY % REC
8260	Vinyl acetate		Water	ug/L	NS	NA	NA	10	3-175
8260	Vinyl chloride		Water	ug/L	NS	NA	NA	10	69-127
8260	Xylenes (total)		Water	ug/L	NS	NA	NA	30	71-123
SURROGATES									
8260	1,2-Dichloroethane - d4		Water	ug/L	10	76-114			
8260	Toluene - d8		Water	ug/L	10	88-110			
8260	Bromofluorobenzene		Water	ug/L	10	86-115			

- NA: Not applicable.
 NE: Not established.
 NS: Not spiked.
 #: Column to be used to flag analytes not in 5/91 and 9/93 AFCEE handbooks.
 a: Analyte not in 5/91 AFCEE handbook.
 b: Analyte not in 9/93 AFCEE handbook.

PREPARED/DATE: DRJ 3-27-95
 CHECKED/DATE: JFO 3-27-95

CONTROL LIMITS FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATES, LABORATORY
CONTROL SAMPLES, AND SURROGATE SPIKES
SEMIVOLATILE ORGANIC COMPOUNDS
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Forth Worth, Texas

250140

LENL-Pensacola

DV010505

EPA METHOD	PARAMETER	#	MATRIX	UNITS	MS/MSD SPIKE CONC. LOW	MS/MSD ACCURACY % REC	MS/MSD PRECISION MAX. RPD	LCS SPIKE CONC. LOW	LCS ACCURACY % REC
Base/Neutral Extractables:									
8270	Acenaphthene		Water	ug/L	100	47-136		50	47-136
8270			Soil	mg/Kg	3.3	47-135	40	1.65	47-135
8270	Acenaphthylene		Water	ug/L	NS	NA	NA	50	39-135
8270			Soil	mg/Kg	NS	NA	NA	1.65	33-144
8270	Anthracene		Water	ug/L	NS	NA	NA	50	43-133
8270			Soil	mg/Kg	NS	NA	NA	1.65	40-127
8270	Benz(a)anthracene		Water	ug/L	100	48-139	40	50	48-139
8270			Soil	mg/Kg	3.3	43-136	40	1.65	43-136
8270	Benzo(b)fluoranthene		Water	ug/L	NS	NA	NA	50	24-159
8270			Soil	mg/Kg	NS	NA	NA	1.65	24-153
8270	Benzo(k)fluoranthene	b	Water	ug/L	NS	NA	NA	50	11-162
8270			Soil	mg/Kg	NS	NA	NA	1.65	11-162
8270	Benzo(ghi)perylene		Water	ug/L	NS	NA	NA	50	2-158
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-154
8270	Benzo(a)pyrene		Water	ug/L	100	17-156	40	50	17-156
8270			Soil	mg/Kg	3.3	17-152	40	1.65	17-152
8270	Benzyl alcohol		Water	ug/L	NS	NA	NA	50	D-229
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-118
8270	bis(2-Chloroethoxy)methane		Water	ug/L	100	33-154	40	50	33-154
8270			Soil	mg/Kg	3.3	33-154	40	1.65	33-154
8270	bis(2-Chloroethyl)ether		Water	ug/L	NS	NA	NA	50	12-140
8270			Soil	mg/Kg	NS	NA	NA	1.65	12-145
8270	bis(2-Chloroisopropyl)ether		Water	ug/L	NS	NA	NA	50	36-166
8270			Soil	mg/Kg	NS	NA	NA	1.65	36-160
8270	bis(2-ethylhexyl)phthalate		Water	ug/L	NS	NA	NA	50	29-156
8270			Soil	mg/Kg	NS	NA	NA	1.65	49-156
8270	4-Bromophenyl phenyl ether		Water	ug/L	NS	NA	NA	50	53-127
8270			Soil	mg/Kg	NS	NA	NA	1.65	60-127
8270	Butyl benzyl phthalate		Water	ug/L	100	36-152	40	50	36-152
8270			Soil	mg/Kg	3.3	54-143	40	1.65	54-143
8270	4-Chloroaniline		Water	ug/L	NS	NA	NA	50	D-189
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-134
8270	2-Chloronaphthalene		Water	ug/L	NS	NA	NA	50	60-118
8270			Soil	mg/Kg	NS	NA	NA	1.65	60-115
8270	4-Chlorophenyl phenyl ether		Water	ug/L	NS	NA	NA	50	49-134
8270			Soil	mg/Kg	NS	NA	NA	1.65	48-133
8270	Chrysene		Water	ug/L	NS	NA	NA	50	52-138
8270			Soil	mg/Kg	NS	NA	NA	1.65	36-146
8270	Dibenz(a,h)anthracene		Water	ug/L	NS	NA	NA	50	D-194
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-166
8270	Dibenzofuran		Water	ug/L	NS	NA	NA	50	27-127
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-142
8270	Di-n-butylphthalate		Water	ug/L	NS	NA	NA	50	37-118
8270			Soil	mg/Kg	NS	NA	NA	1.65	43-118
8270	1,2-Dichlorobenzene		Water	ug/L	NS	NA	NA	50	32-124
8270			Soil	mg/Kg	NS	NA	NA	1.65	32-126
8270	1,3-Dichlorobenzene		Water	ug/L	NS	NA	NA	50	10-138
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-132
8270	1,4-Dichlorobenzene		Water	ug/L	100	20-124	40	50	20-124
8270			Soil	mg/Kg	3.3	20-124	40	1.65	20-124
8270	3,3'-Dichlorobenzidine		Water	ug/L	NS	NA	NA	50	D-262
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-262
8270	Diethyl phthalate		Water	ug/L	NS	NA	NA	50	41-114
8270			Soil	mg/Kg	NS	NA	NA	1.65	36-114
8270	Dimethyl phthalate		Water	ug/L	NS	NA	NA	50	48-112
8270			Soil	mg/Kg	NS	NA	NA	1.65	33-112
8270	2,4-Dinitrotoluene		Water	ug/L	100	44-135	40	50	44-135
8270			Soil	mg/Kg	3.3	47-129	40	1.65	47-129

CONTROL LIMITS FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATES, LABORATORY
CONTROL SAMPLES, AND SURROGATE SPIKES
SEMIVOLATILE ORGANIC COMPOUNDS
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Forth Worth, Texas

250141

LENL--Pensacola		DV010595							
EPA METHOD	PARAMETER	#	MATRIX	UNITS	MS/MSD SPIKE CONC. LOW	MS/MSD ACCURACY % REC	MS/MSD PRECISION MAX. RPD	LCS SPIKE CONC. LOW	LCS ACCURACY % REC
8270	2,6-Dinitrotoluene		Water	ug/L	NS	NA	NA	50	50-135
8270			Soil	mg/Kg	NS	NA	NA	1.65	51-132
8270	Di-n-octyl phthalate		Water	ug/L	NS	NA	NA	50	4-146
8270			Soil	mg/Kg	NS	NA	NA	1.65	4-146
8270	Fluoranthene		Water	ug/L	NS	NA	NA	50	49-137
8270			Soil	mg/Kg	NS	NA	NA	1.65	41-136
8270	Fluorene		Water	ug/L	NS	NA	NA	50	64-121
8270			Soil	mg/Kg	NS	NA	NA	1.65	58-121
8270	Hexachlorobenzene		Water	ug/L	100	34-152	40	50	34-152
8270			Soil	mg/Kg	3.3	42-144	40	1.65	42-144
8270	Hexachlorobutadiene		Water	ug/L	NS	NA	NA	50	33-116
8270			Soil	mg/Kg	NS	NA	NA	1.65	24-116
8270	Hexachlorocyclopentadiene		Water	ug/L	NS	NA	NA	50	D-136
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-121
8270	Hexachloroethane		Water	ug/L	NS	NA	NA	50	40-113
8270			Soil	mg/Kg	NS	NA	NA	1.65	40-113
8270	Indeno(1,2,3-cd)pyrene		Water	ug/L	NS	NA	NA	50	D-171
8270			Soil	mg/Kg	NS	NA	NA	1.65	3-153
8270	Isophorone		Water	ug/L	NS	NA	NA	50	36-132
8270			Soil	mg/Kg	NS	NA	NA	1.65	21-134
8270	2-Methylnaphthalene		Water	ug/L	NS	NA	NA	50	D-163
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-146
8270	Naphthalene		Water	ug/L	100	42-126	40	50	42-126
8270			Soil	mg/Kg	3.3	33-127	40	1.65	33-127
8270	2-Nitroaniline		Water	ug/L	NS	NA	NA	100	D-194
8270			Soil	mg/Kg	NS	NA	NA	3.3	D-130
8270	3-Nitroaniline		Water	ug/L	NS	NA	NA	100	D-194
8270			Soil	mg/Kg	NS	NA	NA	3.3	D-130
8270	4-Nitroaniline		Water	ug/L	NS	NA	NA	50	D-250
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-250
8270	Nitrobenzene		Water	ug/L	NS	NA	NA	50	35-140
8270			Soil	mg/Kg	NS	NA	NA	1.65	35-142
8270	n-Nitrosodiphenylamine		Water	ug/L	NS	NA	NA	50	D-245
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-250
8270	n-Nitrosodipropylamine		Water	ug/L	100	30-144	40	50	30-144
8270			Soil	mg/Kg	3.3	D-139	40	1.65	D-139
8270	Phenanthrene		Water	ug/L	NS	NA	NA	50	60-120
8270			Soil	mg/Kg	NS	NA	NA	1.65	60-120
8270	Pyrene		Water	ug/L	100	52-115	40	50	52-115
8270			Soil	mg/Kg	3.3	60-115	40	1.65	60-115
8270	1,2,4-Trichlorobenzene		Water	ug/L	100	44-124	40	50	44-124
8270			Soil	mg/Kg	3.3	44-142	40	1.65	44-142
8270	Acid: Benzoic acid		Water	ug/L	NS	NA	NA	50	D-250
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-250
8270	4-Chloro-3-methylphenol		Water	ug/L	150	44-136	40	50	44-136
8270			Soil	mg/Kg	4.95	39-131	40	1.65	39-131
8270	2-Chlorophenol		Water	ug/L	150	28-134	40	50	28-134
8270			Soil	mg/Kg	4.95	23-127	40	1.65	23-127
8270	2,4-Dichlorophenol		Water	ug/L	NS	NA	NA	50	39-135
8270			Soil	mg/Kg	NS	NA	NA	1.65	39-135
8270	2,4-Dimethylphenol		Water	ug/L	NS	NA	NA	50	32-113
8270			Soil	mg/Kg	NS	NA	NA	1.65	32-119
8270	4,6-Dinitro-2-methylphenol		Water	ug/L	NS	NA	NA	50	D-153
8270			Soil	mg/Kg	NS	NA	NA	1.65	D-140

CONTROL LIMITS FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATES, LABORATORY
CONTROL SAMPLES, AND SURROGATE SPIKES
SEMIVOLATILE ORGANIC COMPOUNDS
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Forth Worth, Texas

250142

LENL-Pensacola								DV010595	
EPA METHOD	PARAMETER	#	MATRIX	UNITS	MS/MSD SPIKE CONC. LOW	MS/MSD ACCURACY % REC	MS/MSD PRECISION MAX. RPD	LCS SPIKE CONC. LOW	LCS ACCURACY % REC
8270	2,4-Dinitrophenol		Water	ug/L	NS	NA	NA	50	D-147
8270			Soil	mg/Kg	NS	NA	NA	1.85	D-134
8270	2-Methylphenol		Water	ug/L	NS	NA	NA	50	D-169
8270			Soil	mg/Kg	NS	NA	NA	1.85	13-141
8270	4-Methylphenol		Water	ug/L	NS	NA	NA	50	24-142
8270			Soil	mg/Kg	NS	NA	NA	1.85	23-132
8270	2-Nitrophenol		Water	ug/L	NS	NA	NA	50	31-139
8270			Soil	mg/Kg	NS	NA	NA	1.85	29-137
8270	4-Nitrophenol		Water	ug/L	150	D-132	40	50	D-132
8270			Soil	mg/Kg	4.95	D-132	40	1.85	D-132
8270	Pentachlorophenol		Water	ug/L	150	14-178	40	50	14-178
8270			Soil	mg/Kg	4.95	14-155	40	1.85	14-155
8270	Phenol		Water	ug/L	150	19-112	40	50	19-112
8270			Soil	mg/Kg	4.95	29-112	40	1.85	29-112
8270	2,4,5-Trichlorophenol		Water	ug/L	NS	NA	NA	50	38-142
8270			Soil	mg/Kg	NS	NA	NA	1.85	35-141
8270	2,4,6-Trichlorophenol		Water	ug/L	NS	NA	NA	50	42-144
8270			Soil	mg/Kg	NS	NA	NA	1.85	45-144
SURROGATES									
8270	Nitrobenzene-d5		Water	ug/L	100	35-114			
8270			Soil	mg/Kg	3.3	23-120			
8270	2-Fluorobiphenyl		Water	ug/L	100	43-116			
8270			Soil	mg/Kg	3.3	30-115			
8270	Terphenyl-d14		Water	ug/L	100	38-141			
8270			Soil	mg/Kg	3.3	18-137			
8270	2-Fluorophenol		Water	ug/L	150	21-100			
8270			Soil	mg/Kg	4.95	25-121			
8270	Phenol-d6		Water	ug/L	150	10-94			
8270			Soil	mg/Kg	4.95	24-113			
8270	2,4,6-Tribromophenol		Water	ug/L	150	10-123			
8270			Soil	mg/Kg	4.95	19-122			

NA: Not applicable.
NS: Not spiked.
NE: Not established.
#: Column to be used to flag analytes not in 5/91 and 9/93 AFCEE handbook.
a: Analyte not in 5/91 AFCEE handbook.
b: Analyte not in 9/93 AFCEE handbook.

PREPARED/DATE: DRJ 3-27-95
CHECKED/DATE: JFO 3-27-95

CONTROL LIMITS FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATES, LABORATORY
CONTROL SAMPLES, AND SURROGATE SPIKES

250143

Pesticides

Sampling and Analysis Plan

Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

LENL--Pensacola

DV012495

EPA METHOD	PARAMETER	MS/MSD SPIKE CONC. LOW	MS/MSD ACCURACY % REC	MS/MSD PRECISION MAX. RPD	LCS SPIKE CONC. LOW	LCS ACCURACY % REC
8080	Aldrin	0.4	42-122		0.2	42-122
8080		0.013	42-122	40	0.0067	42-122
8080	alpha-BHC	NS	NA	NA	0.2	49-134
8080		NS	NA	NA	0.0067	37-134
8080	beta-BHC	NS	NA	NA	0.2	25-147
8080		NS	NA	NA	0.0067	26-147
8080	delta-BHC	NS	NA	NA	0.2	19-139
8080		NS	NA	NA	0.0067	20-140
8080	gamma-BHC (Lindane)	0.4	55-127	40	0.2	55-127
8080		0.013	32-127	40	0.0067	32-127
8080	Chlordane	NS	NA	NA	NS	NA
8080		NS	NA	NA	NS	NA
8080	alpha-Chlordane	NS	NA	NA	0.2	38-161
8080		NS	NA	NA	0.0067	24-168
8080	gamma-Chlordane	NS	NA	NA	0.2	42-155
8080		NS	NA	NA	0.0067	30-164
8080	4,4'-DDD	NS	NA	NA	0.4	36-141
8080		NS	NA	NA	0.013	36-141
8080	4,4'-DDE	NS	NA	NA	0.4	40-145
8080		NS	NA	NA	0.013	30-145
8080	4,4'-DDT	1.0	59-148	40	0.4	59-148
8080		0.033	32-160	40	0.013	32-160
8080	Dieldrin	1.0	40-146	40	0.4	40-146
8080		0.033	40-146	40	0.013	40-146
8080	Endosulfan I	NS	NA	NA	0.2	45-149
8080		NS	NA	NA	0.0067	45-153
8080	Endosulfan II	NS	NA	NA	0.4	24-159
8080		NS	NA	NA	0.013	32-161
8080	Endosulfan sulfate	NS	NA	NA	0.4	36-144
8080		NS	NA	NA	0.013	26-144
8080	Endrin	1.0	42-147	40	0.4	42-147
8080		0.033	33-147	40	0.013	33-147
8080	Endrin Aldehyde	NS	NA	NA	0.4	39-159
8080		NS	NA	NA	0.013	26-172
8080	Heptachlor	0.4	43-111	40	0.2	43-111
8080		0.013	34-111	40	0.0067	34-111
8080	Heptachlor epoxide	NS	NA	NA	0.2	42-142
8080		NS	NA	NA	0.0067	37-142
8080	Methoxychlor	NS	NA	NA	2.0	62-161
8080		NS	NA	NA	0.067	31-190
8080	Toxaphene	NS	NA	NA	NS	NA
8080		NS	NA	NA	NS	NA
8080	PCB-1016	10	50-114	40	10	50-114
8080		0.33	50-114	40	0.33	50-114
8080	PCB-1221	NS	NA	NA	NS	NA
8080		NS	NA	NA	NS	NA
8080	PCB-1232	NS	NA	NA	NS	NA
8080		NS	NA	NA	NS	NA

**CONTROL LIMITS FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATES, LABORATORY
CONTROL SAMPLES, AND SURROGATE SPIKES**

250144

Pesticides

Sampling and Analysis Plan

**Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas**

DV012495

LENL-Pensacola

EPA METHOD	PARAMETER	MS/MSD SPIKE CONC. LOW	MS/MSD ACCURACY % REC	MS/MSD PRECISION MAX. RPD	LCS SPIKE CONC. LOW	LCS ACCURACY % REC
8080	PCB-1242	NS	NA	NA	NS	NA
8080		NS	NA	NA	NS	NA
8080	PCB-1248	NS	NA	NA	NS	NA
8080		NS	NA	NA	NS	NA
8080	PCB-1254	NS	NA	NA	NS	NA
8080		NS	NA	NA	NS	NA
8080	PCB-1260		10	8-127	40	10
8080			0.33	8-127	40	0.33
						8-127
						8-127
	SURROGATES					
8080	Dibutylchloroendate		1.0	33-186		
8080			0.067	10-181		
8080	2,4,5,6-tetrachloro-meta-xylene		0.2	24-151		
8080			0.013	18-145		

NA: Not applicable.
NE: Not established.
NS: Not spiked.

PREPARED/DATE: DRJ 3-27-95
CHECKED/DATE: JFO 3-27-95

CONTROL LIMITS FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATES, LABORATORY
CONTROL SAMPLES, AND SURROGATE SPIKES

250145

Inorganic Analytes
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field

LENL-Pensacola

DV012405

EPA METHOD	PARAMETER	MATRIX	UNITS	MS/MSD SPIKE CONC. LOW	MS/MSD ACCURACY % REC	MS/MSD PRECISION MAX. RPD	LCS SPIKE CONC. LOW	LCS ACCURACY % REC
6010 6010	Aluminum	Water Soil	mg/L mg/Kg	NS	2.0 75-125	NS	20 5	60-120 80-120
6010 6010	Antimony	Water Soil	mg/L mg/Kg		0.5 75-125	20 20	1.0 100	80-120 80-120
6010 6010	Arsenic	Water Soil	mg/L mg/Kg		2.0 75-125	20 20	1.0 100	80-120 80-120
6010 6010	Barium	Water Soil	mg/L mg/Kg		2.0 75-125	20 20	5 500	80-120 80-120
6010 6010	Beryllium	Water Soil	mg/L mg/Kg		0.05 75-125	20 20	0.2 20	80-120 80-120
6010 6010	Cadmium	Water Soil	mg/L mg/Kg		0.05 75-125	20 20	0.2 20	80-120 80-120
6010 6010	Calcium	Water Soil	mg/L mg/Kg	NS NS	NS NS	NS NS	12.5 1250	80-120 80-120
6010 6010	Chromium	Water Soil	mg/L mg/Kg		0.2 75-125	20 20	0.2 20	80-120 80-120
6010 6010	Cobalt	Water Soil	mg/L mg/Kg		0.5 75-125	20 20	1.0 100	80-120 80-120
6010 6010	Copper	Water Soil	mg/L mg/Kg		0.25 75-125	20 20	1.0 100	80-120 80-120
6010 6010	Iron	Water Soil	mg/L mg/Kg	NS	1.0 75-125	NS	5 500	80-120 80-120
6010 6010	Lead	Water Soil	mg/L mg/Kg		0.5 75-125	20 20	1.0 100	80-120 80-120
6010 6010	Magnesium	Water Soil	mg/L mg/Kg	NS NS	NS NS	NS NS	12.5 1250	80-120 80-120
6010 6010	Manganese	Water Soil	mg/L mg/Kg		0.5 75-125	20 20	1.0 100	80-120 80-120
6010 6010	Molybdenum	Water Soil	mg/L mg/Kg		0.5 75-125	20 20	0.2 20	80-120 80-120
6010 6010	Nickel	Water Soil	mg/L mg/Kg		0.5 75-125	20 20	1.0 100	80-120 80-120
6010 6010	Potassium	Water Soil	mg/L mg/Kg	NS NS	NS NS	NS NS	12.5 1250	80-120 80-120
6010 6010	Selenium	Water Soil	mg/L mg/Kg		2.0 75-125	20 20	1.0 100	80-120 80-120
6010 6010	Silver	Water Soil	mg/L mg/Kg		0.1 75-125	20 20	0.2 20	80-120 80-120
6010 6010	Sodium	Water Soil	mg/L mg/Kg	NS NS	NS NS	NS NS	12.5 1250	80-120 80-120
6010 6010	Thallium	Water Soil	mg/L mg/Kg		2.0 75-125	20 20	1.0 100	80-120 80-120
6010 6010	Vanadium	Water Soil	mg/L mg/Kg		0.5 75-125	20 20	1.0 100	80-120 80-120
6010 6010	Zinc	Water Soil	mg/L mg/Kg		0.5 75-125	20 20	1.0 100	80-120 80-120
7041 7041	Antimony	Water Soil	mg/L mg/Kg		0.05 75-125	20 20	0.05 5.0	80-120 80-120
7060 7060	Arsenic	Water Soil	mg/L mg/Kg		0.05 75-125	20 20	0.05 5.0	80-120 80-120
7196 7196	Hexavalent Chromium	Water Soil	mg/L mg/Kg		0.25 75-125	20 20	0.25 25	80-120 80-120
7421 7421	Lead	Water Soil	mg/L mg/Kg		0.05 75-125	20 20	0.05 5.0	80-120 80-120

CONTROL LIMITS FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATES, LABORATORY
CONTROL SAMPLES, AND SURROGATE SPIKES
Inorganic Analytes
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field

250146

LENL-Pensacola

DV012495

EPA METHOD	PARAMETER	MATRIX	UNITS	MS/MSD SPIKE CONC. LOW	MS/MSD ACCURACY % REC	MS/MSD PRECISION MAX. RPD	LCS SPIKE CONC. LOW	LCS ACCURACY % REC
7470	Mercury	Water	mg/L	0.001	75-125	20	0.001	80-120
7471		Soil	mg/Kg	0.1	75-125	20	0.1	80-120
7740	Selenium	Water	mg/L	0.05	75-125	20	0.05	80-120
7740		Soil	mg/Kg	5.0	75-125	20	5.0	80-120
7131	Cadmium	Water	mg/L	0.005	75-125	20	0.005	80-120
7131		Soil	mg/Kg	0.5	75-125	20	5.0	80-120
7841	Thallium	Water	mg/L	0.05	75-125	20	0.05	80-120
7841		Soil	mg/Kg	5.0	75-125	20	5.0	80-120
9010	Cyanide	Water	mg/L	0.1	75-125	20	0.1	80-120
9010		Soil	mg/Kg	100	75-125	20	100	80-120

NA: Not applicable.
NE: Not established.
NS: Not spiked.

PREPARED/DATE: DRJ 3-27-95
CHECKED/DATE: JFO 3-27-95

250147

APPENDIX A-3

**SUMMARY OF CALIBRATION
AND INTERNAL QUALITY CONTROL PROCEDURES**

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES

Sampling and Analysis Plan
 Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
 Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW8260	Volatile Organics	<u>FIELD QC:</u> Trip Blank	1 for each batch of samples shipped to laboratory	No analytes detected at > reporting limit with the exception of methylene chloride, 2-butanone, acetone, and toluene should not exceed > 3x reporting limit.	Review lab QC data to determine if there is a laboratory problem. If not, and same compounds are found in field samples at similar concentrations, resample entire batch.
		Ambient Blank	Collected when samples are collected downwind of possible volatile sources.	No analytes detected at > reporting limit with the exception of methylene chloride, 2-butanone, acetone, and toluene should not exceed > 3x reporting limit.	Review lab QC data to determine if there is a laboratory problem. If not, and same compounds are found in field samples at similar concentrations, resample entire batch.
		Duplicate	1 for every 10 field samples collected	Above 10x detection limit, %RPD must be less than current control limits: Aqueous samples - RPD < 50% Non-aqueous samples - RPD < 50%	Review lab QC data to determine if they are in control. If not in control, flag data. Use data to evaluate whether proper collection procedures were followed. If not, determine further corrective action.
	Refer to: SW846-8260 IRP Handbook, 9/93	Rinsate	1 per day	Less than reported detection limits	Qualify data.
		<u>LABORATORY QC:</u> Check of mass spectral ion intensities using BFB Five-point calibration Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Initially, prior to calibration, once per every 12-hour shift Initial calibration prior to sample analysis Once per analyst	Established criteria in Table 3 of SW846-8240 1) SPCCs average RF ≥ 0.30 (Bromoform ≥ 0.25) 2) RSD $\leq 30\%$ for CCC RFs Analyte-specific limits as per SW846	1) Repeat BFB analysis 1) Repeat calibration 1) Recalculate results 2) Locate and fix the source of the problem 3) Rerun demonstration for those analytes that did not meet criteria
		MDL Study	Once per year	Detection limits established shall not exceed those in Table 2-3 of IRP Handbook 9/93	Detection limits that exceed established criteria shall be submitted to the Air Force for approval prior to the analysis of any project samples

250148

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES

Sampling and Analysis Plan

Naval Air Station - Fort Worth Joint Reserve Base
Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW8260 (Continued)		Projects requiring 25 ml purge volume pre-arranged with LLENL-P	Screen performed by 5 ml purge volume	If target compound is ≤ 50 ppb or 100 ppb for ketones, sample is analyzed by 25 ml purge. If any target compound is > 50 ppb or 100 ppb for ketones, sample is analyzed by 5 ml purge.	<ol style="list-style-type: none"> 1) Evaluate system and take corrective action 2) Rerun cal. check; if still out, 3) Prepare new calibration curve for any analyte not meeting criteria 4) Reinject any samples analyzed after criteria were exceeded
		Daily calibration check	Once per each 12 hours, prior to sample analysis (criteria for these checks must be met prior to sample analysis)	<ol style="list-style-type: none"> 1) SPCCs RF ≥ 0.30 (Bromofom ≥ 0.25) 2) CCC percent difference $\leq 25\%$ from average response factors calculated following initial calibration 	
		Internal Standards (IS) - Retention Time (RT) and area response checked from daily calibration check	Immediately after or during data acquisition of sample, spike, standard, and reagent blank	RT ± 30 seconds and EICP within -50% to $+100\%$ of last daily calibration check (12 hrs) for each IS compound	<ol style="list-style-type: none"> 1) Inspect MS or GC for malfunctions 2) Take appropriate corrective actions 3) Mandatory reanalysis of samples analyzed while system was malfunctioning 4) If sample exceeds criteria <ol style="list-style-type: none"> a) Reanalyze sample; if still out, b) Report both analyses and document corrective action
		Matrix spike (MS) and matrix spike duplicate (MSD)	1 matrix spike per every 20 Air Force project samples	Within limits listed in Appendix A-2	<ol style="list-style-type: none"> 1) Analyze LCS containing each analyte that failed criteria 2) If recovery for LCS is outside of designated range, the system is considered to be out of control. Identification and correction of problem is required. 3) See LCS corrective action
		Laboratory Control Sample (LCS)	One per day/instrument	Within limits. See Appendix A-2	<ol style="list-style-type: none"> 1) Evaluate LCS for any MS/MSD analyte exceeding criteria 2) If that LCS analyte out, reanalyze LCS; if still out 3) Correct problem 4) Re-extract and reanalyze associated samples

Record of assessed accuracy for each matrix studied should be maintained and updated on a regular basis as per SW846-8000 and the IRP Handbook 95/93

NA

NA

250149

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES
Sampling and Analysis Plan
Naval Air Station - Fort Worth Joint Reserve Base
Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW8260 (Continued)		Surrogate standards spiked	Every sample, spike, standard, and reagent blank	Limits determined as per SW846-8000 (limits are to be updated annually on a matrix-by-matrix basis). See Appendix A-2	<ol style="list-style-type: none"> 1) Recalculate result, if still out 2) Reanalyze sample, if still out 3) Report both analyses and document in report that steps 1 and 2 were performed
		Reagent blank	One per day/instrument	No analytes detected at > reporting limit with the exception of methylene chloride, 2-butanone, acetone, and toluene should not exceed > 3X reporting limit	<ol style="list-style-type: none"> 1) Source of contamination investigated 2) Appropriate corrective action taken and documented 3) All samples processed with a contaminated blank are to be reanalyzed

NA = Not Applicable
 SPCC = System Performance Check Compounds
 CCC = Calibration Check Compounds
 EICP = Extracted Ion Current Profile

250150

PREPARED/DATE: DRJ 3-6-95
 CHECKED/DATE: JFO 3-6-95

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES

Sampling and Analysis Plan

Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW8270	Semi-Volatile Organics	<u>FIELD QC:</u> Duplicate	1 for every 10 field samples collected	Above 10x detection limit, %RPD must be less than current control limits: Aqueous samples - RPD < 50% Non-aqueous samples - RPD < 50%	Review lab QC data to determine if they are in control. If not in control, flag data. Use data to evaluate whether proper collection procedures were followed. If not, determine further corrective action.
	Refer to: SW846-3500 SW846-3600 SW846-8270 IRP Handbook, 9/93	Rinsate <u>LABORATORY QC:</u> Check of mass spectral ion intensities using DFPPP Five-point calibration Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	1 per day Initially, prior to calibration, once per every 12-hour shift Initial calibration prior to sample analysis Once per analyst	Less than reporting limit Established criteria in Table 3 of SW846-8270 1) SPCCs average RF ≥ 0.05 2) RSD $\leq 30\%$ for CCC RFs Analyte-specific limits as per SW846	Qualify data. 1) Repeat DFPPP analysis 1) Repeat calibration 1) Recalculate results 2) Locate and fix the source of the problem 3) Rerun demonstration for those analytes that did not meet criteria
		MDL Study	Once per year	Detection limits established shall not exceed those in Table 2-3 of IRP Handbook 9/93	Detection limits that exceed established criteria shall be submitted to the Air Force for approval prior to the analysis of any project samples
		Daily calibration check	Once per each 12 hours, prior to sample analysis (criteria for these checks must be met prior to sample analysis)	1) SPCCs RF ≥ 0.05 2) CCC percent difference $\leq 30\%$ from average response factors calculated following initial calibration	1) Evaluate system and take corrective action 2) Rerun cal. check; if still out, 3) Prepare new calibration curve for any analyte not meeting criteria 4) Reinject any samples analyzed after criteria were exceeded

250151

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES

Sampling and Analysis Plan

Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW8270 (Continued)		Internal Standards (IS) - Retention Time (RT) and area response checked from daily calibration check	Immediately after or during data acquisition of sample, spike, standard, and reagent blank	RT \pm 30 seconds and EICP within -50% to +100% of last daily calibration check (12 hrs) for each IS compound	<ol style="list-style-type: none"> 1) Inspect MS or GC for malfunctions 2) Take appropriate corrective actions 3) Mandatory reanalysis of samples analyzed while system was malfunctioning 4) If sample exceeds criteria <ol style="list-style-type: none"> a) Reanalyze sample; if still out, b) Report both analyses and document corrective action
		Matrix spike (MS) and matrix spike duplicate (MSD)	1 MS and 1 MSD per analytical batch if sufficient aliquot is received (minimum 1 pair per every 20 Air Force project samples)	Laboratory-established control limits (see Appendix A-2)	<p><u>Accuracy</u> If any matrix spike target compound (MSTC) is out of control in the MS or MSD, the LCS is evaluated for that compound. If that compound fails to meet LCS criterion as well, the analytical batch must be reprocessed.</p> <p><u>Precision</u> Department supervisor will evaluate failure with respect to an extraction problem, which will initiate analytical MS/MSD reprocessing. If failure is determined to be matrix related, no further action will be taken.</p> <p>If more than 20% of all analytes are not within criteria, the analytical batch must be reprocessed. Any data reported for a compound with an out-of-control LCS result will be flagged as an estimated value by the consultant.</p>
		Laboratory Control Sample (LCS)	1 per analytical/extraction batch, minimum 1 per 20 samples	Laboratory-established control limits (see Appendix A-2)	NA
		Record of assessed accuracy for each matrix studied should be maintained and updated on a regular basis as per SW846-8000 and the IRP Handbook 9/93	After analysis of initial five spiked samples	NA	NA

250152

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW8270 (Continued)		Surrogate standards spiked	Every sample, spike, standard, and reagent blank	Limits determined as per SW846-8000 (see Appendix A-2)	<ol style="list-style-type: none"> 1) Reanalyze sample; if still out 2) Re-extract and reanalyze sample; if still out 3) Report two analyses and document in report that steps 1 and 2 were performed
		Reagent blank	One per analytical/extraction batch, minimum 1 per 20 samples	No analytes detected at > reporting limit with the exception of bis(2-ethylhexyl)phthalate, Di-n-butyl-phthalate, and Di-n-octyl-phthalate, which should not exceed > 3X reporting limit	<ol style="list-style-type: none"> 1) Source of contamination investigated 2) Appropriate corrective action taken and documented 3) All samples processed with a contaminated blank are to be re-extracted and reanalyzed

NA = Not Applicable
 SPCC = System Performance Check Compounds
 CCC = Calibration Check Compounds
 EICP = Extracted Ion Current Profile

250153

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES

Sampling and Analysis Plan
 Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
 Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW7060	Metals-AA	<u>FIELD QC:</u>			
SW7421	As	Duplicate	1 for every 10 field samples collected	Above 10x detection limit, %RPD must be less than current control limits: Aqueous samples - RPD < 50% Non-aqueous samples - RPD < 50%	Review lab QC data to determine if they are in control. If not in control, flag data. Use data to evaluate whether proper collection procedures were followed. If not, determine further corrective action.
SW7740	Pb				
SW7841	Se				
SW7470/7471	Tl				
	Hg				
		Rinsate	1 per day	Less than reported detection limits	Qualify data if sample result is < 5x rinsate result.
		<u>LABORATORY QC:</u>			
	Refer to:	Four point calibration (for Hg - five point calibration)	Daily, prior to sample analysis (prepare fresh standards daily)	Correlation coefficient ≥ 0.995	1) Repeat calibration
SW846-7000		Initial (ICV) and Continuing (CCV) Calibration	ICV-Prior to sample analysis CCV-After every 10 samples and at end of analytical run	Within $\pm 10\%$ of expected value Within $\pm 20\%$ of expected value for Hg	1) Terminate analysis 2) Locate and correct problem 3) Recalibrate 4) Reanalyze samples analyzed since last good CCV
SW846-3005					
SW846-3050					
IRP Handbook, 9/93					
		Calibration blank: Initial (ICB) and Continuing (CCB) Calibration Blank	ICB-Prior to sample analysis CCB-After every 10 samples and end of analytical run	No analytes detected at > reporting limit	1) Terminate analysis 2) Locate and correct problem 3) Recalibrate 4) Reanalyze samples since good CCB
		Digested, liquid, second source Laboratory Control Sample (LCS)	1 per digestion batch, minimum 1 per 20 samples	Laboratory-established control limits (see Appendix A-2)	1) Reanalyze LCS, if still out 2) Correct problem 3) Redigest and reanalyze associated samples

250154

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Metals-AA (Continued)	Matrix spike (MS)/matrix spike duplicate (MSD) (portion of sample is spiked prior to digestion)	1 MS and MSD per analytical batch if sufficient aliquot received (minimum 1 pair per every 20 Air Force project samples)	Laboratory-established control limits (see Appendix A-2)	<u>Accuracy</u> Analyze post digestion spike <u>Precision</u> Department supervisor will evaluate failure with respect to an extraction problem, which will initiate analytical MS/MSD reprocessing. If failure is determined to be matrix related, no further action will be taken.	NA
	Record of assessed accuracy for each matrix studied should be maintained and updated on a regular basis as per the IRP Handbook 9/93	NA	NA		
	Reagent blank	1 per batch of samples, minimum 1 per 20 samples	No analytes detected at > reporting limit		1) Source of contamination investigated 2) Appropriate corrective action taken and documented 3) All samples processed with a contaminated blank are to be redigested and reanalyzed
	IDL Study	Semi-annually	Detection limits established shall not exceed those in Table 2-2 of IRP Handbook		Detection limits which exceed established criteria shall be submitted to the Air Force for approval prior analysis of any project samples
	Analytical Spike - As, Pb, and Se only	Every sample and reagent blank	85-115% recovery		1) Dilute and reanalyze if recovery is <40%. If analytical spike recovery is still <40%, report data. 2) If recovery >40% and sample concentration <50% of spike concentration, report data. 3) If recovery >40% and sample >50% of spike concentration, rerun by Method of Standard Addition.

NA = Not Applicable

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES

Sampling and Analysis Plan

Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW6010	Trace Metals - ICPES	<u>FIELD QC:</u> Duplicate	1 for every 10 field samples collected	Above 10x detection limit, % RPD must be less than current control limits: Aqueous samples - RPD < 50 % Non-aqueous samples - RPD < 50%	Review lab QC data to determine if they are in control. If not in control, flag data. Use data to evaluate whether proper collection procedures were followed. If not, determine further corrective action.
	Refer to: SW846-3005 SW846-3050 SW846-6010				
	Rinsate		1 per day	No more than 4 target compounds, each with a concentration exceeding 3 times the method detection limit can be present.	Qualify data if sample result is < 5x rinsate result.
	<u>LABORATORY QC:</u> Four point calibration		Daily, prior to sample analysis	Correlation coefficient ≥ 0.995 Top standard $\pm 5\%$ of expected value	1) Repeat calibration
	Initial (ICV) and Continuing (CCV) Calibration Verification		ICV - Prior to sample analysis CCV - After every 10 samples and at end of analytical run	Within $\pm 10\%$ of expected value	1) Terminate analysis 2) Locate and correct problem 3) Recalibrate 4) Reanalyze samples analyzed since last good CCV
	Calibration blank: Initial (ICB) and Continuing (CCB) Calibration Blank		ICB - Prior to sample analysis CCB - After every 10 samples and end of analytical run	No analytes detected at > reporting limit with the exception of Al, Ca, Fe, Mg, Na, and K, which should not exceed > 3X reporting limit	1) Terminate analysis 2) Locate and correct problem 3) Recalibrate 4) Reanalyze samples since good CCB
	Digested, liquid, second source Laboratory Control Sample (LCS)		1 per digestion batch, minimum 1 per 20 samples	Laboratory-established control limits (see Appendix A-2)	1) Reanalyze LCS, if still out 2) Correct problem 3) Redigest and reanalyze associated samples

250156

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES

Sampling and Analysis Plan

**Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas**

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW6010 (Continued)		Interference check sample	Run at the more frequent of the following: 1) Beginning and end of analytical run; or 2) Twice during every 8-hour work shift	Within $\pm 20\%$ of expected value for instrument check standard elements	1) Terminate analysis 2) Locate and correct problem 3) Recalibrate 4) Reanalyze samples since last compliant ICS
		Matrix spike (MS)/matrix spike duplicate (MSD) (portion of sample is spiked prior to digestion)	1 MS and MSD per analytical batch if sufficient aliquot received (minimum 1 pair per every 20 Air Force project samples)	Laboratory-established control limits (see Appendix A-2)	<u>Accuracy</u> Analyze post digestion spike <u>Precision</u> Department supervisor will evaluate failure with respect to an extraction problem, which will initiate analytical MS/MSD reprocessing. If failure is determined to be matrix related, no further action will be taken.
		Record of assessed accuracy for each matrix studied should be maintained and updated on a regular basis as per the IRP Handbook 9/93	NA	NA	NA
		Reagent blank	1 per batch of samples, minimum 1 per 20 samples	No analytes detected at $>$ reporting limit with the exception of Al, Ca, Fe, Mg, Na, and K, which should not exceed $>$ 3X reporting limit	1) Investigate sources of contamination 2) Appropriate corrective action taken and document 3) All samples processed with a contaminated blank are to be redigested and reanalyzed
		IDL Study	Semi-annually	Detection limits established shall not exceed those in Table 2-2 of IRP Handbook 9/93	Detection limits which exceed established criteria shall be submitted to the Air Force for approval prior to analysis of any project samples
		Linear Range Study	Once per year	NA	NA

NA = Not Applicable

250157

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

ANALYTICAL METHOD (a,b)	PARAMETER	QUALITY CONTROL CHECK	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
EPA 170.1	Temperature	<u>INSTRUMENT QC:</u> Calibration	Prior to trip	± 1°C	1. Check against precision thermometer certified by NIST. 2. Replace instrument.
		<u>FIELD QC:</u> Duplicate	1 per day	± 1°C	1. Analyze 3rd aliquot of sample. 2. Flag Data.
		<u>INSTRUMENT QC:</u> Calibration	Prior to trip	±0.2 NTUs	1. Check system as per manufacturer's instructions. 2. Check standard. 3. Replace instrument.
EPA 180.1	Turbidity	Calibration Stability	At beginning and end of day	±0.2 NTUs	1. Check standard. 2. Check system as per manufacturer's instructions. 3. Replace instrument.
		<u>FIELD QC:</u> Duplicate	1 per day	± 1 NTU	1. Analyze 3rd aliquot of sample. 2. Flag data.
		<u>INSTRUMENT QC:</u> Calibration	Prior to trip	± 25 umhos/cm	1. Check system as per manufacturer's instructions. 2. Check standard. 3. Replace instrument.
EPA 120.1	Specific Conductance	Calibration Stability	At beginning and end of day	±25 umhos/cm	1. Check standard. 2. Check system as per manufacturer's instructions. 3. Replace instrument.
		<u>FIELD QC:</u> Duplicate	1 per day	±50 umhos/cm	1. Analyze 3rd aliquot of sample. 2. Flag data.
		<u>INSTRUMENT QC:</u> Calibration	Prior to trip	± 25 umhos/cm	1. Check system as per manufacturer's instructions. 2. Check standard. 3. Replace instrument.

250158

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES

Sampling and Analysis Plan
 Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
 Fort Worth, Texas

ANALYTICAL METHOD (a,b)	PARAMETER	QUALITY CONTROL CHECK	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
EPA 150.1	pH	<u>INSTRUMENT QC:</u> Calibration	1 per day at two levels	±0.1 units	1. Check system as per manufacturer's instructions. 2. Check standard. 3. Replace instrument.
		Calibration Stability	1 per hour at two levels	±0.2 units	1. Check standard. 2. Check system. 3. Recalibrate.
		<u>FIELD QC:</u> Duplicate	1 per day	±0.5 units	1. Analyze 3rd aliquot of sample. 2. Flag data.

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SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES

Sampling and Analysis Plan

Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW8080	Organochlorine Pesticides	<u>FIELD QC:</u> Duplicate	1 for every 10 field samples collected 5% (wipe samples)	Above 10x detection limit, % RPD must be less than current control limits: Aqueous samples - RPD < 30% Non-aqueous samples - RPD < 40%	Review lab QC data to determine if they are in control. If not in control, flag data. Use data to evaluate whether proper collection procedures were followed. If not, determine further corrective action. Qualify data.
		Rinsate	1 for every 10 field samples collected	Less than reported detection limit	Qualify data.
		Field Blanks	(wipe samples only) 2 from each category	Less than reported detection limit	Qualify data.
		<u>LABORATORY QC:</u> Five point calibration	Initial calibration prior to sample analysis	A) RSD ≤ 20% for RFs or Correlation coefficient of ≥ 0.995 b) Quantitation by average RF if RSD ≤ 20% or use calibration curve	1) Repeat calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	Analyte-specific limits as per SW846	1) Recalculate results 2) Locate and fix problem with system 3) Rerun demonstration for those analytes which did not meet criteria
		MDL Study	Once per year	Detection limits established shall not exceed those in Table 2-3 of IRP Handbook, 9/93	Detection limits that exceeded established criteria shall be submitted to the Air Force for approval prior to the analysis of any project sample 1) Perform maintenance 2) Repeat test
		Retention time (RT) windows calculated for each analyte	One 72-hour study performed on each GC column and whenever a new column is installed	See Method 8000	
		Breakdown check (Endrin and DDT)	Daily prior to analysis of samples	Degradation ≤ 20% (each)	Perform system maintenance as per SW846-8000
		Initial (ICV) and Continuing (CCV) Calibration Verification (all single component analytes only, multi-component analyte standard analyzed within 72 hours of tentatively identifying component in environmental sample)	ICV-Prior to sample analysis CCV-After every 10 samples and end of analytical run	Within ± 15% of expected response	1) Perform maintenance 2) Rerun verification, if still out 3) Prepare new calibration curve for any analyte not meeting criteria 4) Reinject any samples analyzed after criteria were exceeded

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SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES
Sampling and Analysis Plan
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
SW8080 (Continued)	Matrix spike (MS) and matrix spike duplicate (MSD)	Matrix spike (MS) and matrix spike duplicate (MSD)	1 MS and 1 MSD per analytical batch if sufficient aliquot is received (minimum 1 pair per every 20 Air Force project samples)	Laboratory-established control limits (see Appendix A-2)	Accuracy If any matrix spike target compound (MSTC) is out of control in the MS or MSD, the LCS is evaluated for that compound. If that compound fails to meet LCS criterion as well, the analytical batch must be reprocessed. <u>Precision</u> Department supervisor will evaluate failure with respect to an extraction problem, which will initiate analytical MS/MSD reprocessing. If failure is determined to be matrix related, no further action will be taken. LCS is evaluated independent of MS/MSD. If more than 20% of all analytes are not within criteria, the analytical batch must be reprocessed. NA
		Laboratory Control Sample (LCS)	1 per extraction batch, minimum 1 per 20 samples	Laboratory-established control limits (see Appendix A-2)	
	Record of assessed accuracy for each matrix studied should be maintained and updated on a regular basis as per SW846-8000 and the IRP Handbook 9/93		After analysis of initial five spiked samples	NA	
	Two surrogate standards spiked into each sample Dibutylchloroendate (DBC) is primary surrogate		Every sample, spike, standard, and reagent blank	Limits determined as per SW846-8000 (limits are to be updated annually on a matrix-by-matrix basis) If low DBC recovery or interferences indicated, calculate secondary surrogate recovery. Proceed with corrective action when both surrogates are out of limits.	1) Reanalyze sample; if still out 2) Re-extract and reanalyze sample; if still out 3) Report two analyses and document in report that steps 1 and 2 were performed
	Reagent blank		One per extraction batch, minimum of 1 per 20 samples	No analytes detected at > reporting limit	1) Source of contamination investigated 2) Appropriate corrective action taken and documented 3) All samples processed with a contaminated blank are to be re-extracted and reanalyzed

250161

SUMMARY OF CALIBRATION AND INTERNAL QUALITY CONTROL PROCEDURES

Sampling and Analysis Plan

**Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas**

ANALYTICAL METHOD	APPLICABLE PARAMETER	QUALITY CONTROL CHECK	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
		Second-column confirmation	All positive results above the reporting limit	Analysis of standards and samples performed on a second GC column of dissimilar phase and retention characteristics within specified holding times	Same as for initial or primary column analysis

NA = Not Applicable

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APPENDIX B

APPENDIX B

LENL-P & KEY PERSONNEL AND THEIR POSITIONS AND RESPONSIBILITIES

Law Environmental, Inc.
National Laboratories Branch (LENL)
Pensacola, Florida

LENL KEY PERSONNEL AND RESPONSIBILITIES

Position/Key Personnel	Responsibilities
Laboratory Manager James M. G. Tucci	<ul style="list-style-type: none">- Provide overall management and operation of the laboratory- Provide a safe working environment for employees- Provide resolutions to items requiring corrective actions- Interact with QA/QC Coordinator to resolve analytical, methodology and QA problems- Schedule work in a manner consistent with personnel and instrumentation- Implement actions required to establish our laboratory as a premier laboratory in the field of environmental analytical chemistry- Maintain profitability of the laboratory in relation to the concept of legally defensible data- Plan, design and direct the branch marketing efforts- Plan, design and direct long-term business development and opportunities- Interact with technical coordinator to resolve technical problems- Insure accountability of all branch staff in the performance of their jobs

LENL KEY PERSONNEL AND RESPONSIBILITIES

Position/Key Personnel	Responsibilities
QA/QC Coordinator Keith Greene	<ul style="list-style-type: none"><li data-bbox="715 449 1450 506">- Establish and update laboratory standard operating procedures<li data-bbox="715 544 1433 666">- Issue recommendations and corrective actions required for any aspect of laboratory operations inconsistent with established QA/QC policies and procedures<li data-bbox="715 704 1480 795">- Monitor and identify out-of-control or potentially out-of-control situations to Laboratory Manager, Supervisors, and Project Managers<li data-bbox="715 834 1433 891">- Provide technical guidance for chemistry program development<li data-bbox="715 929 1405 987">- Interact with external QA personnel concerning regulatory QA/QC compliance requirements<li data-bbox="715 1025 1496 1117">- Keep abreast of new techniques and programs for QA and inform Laboratory Manager, Project Managers and Supervisors<li data-bbox="715 1155 1466 1183">- Provide historical QA reports to Laboratory Manager<li data-bbox="715 1221 1466 1278">- Perform QA/QC audits, provide blind check samples and monitor results<li data-bbox="715 1317 1443 1374">- Judiciously examine QA/QC program in relation to profitability<li data-bbox="715 1412 1384 1440">- Enforce and augment the branch QA program<li data-bbox="715 1478 1443 1506">- Develop laboratory/project specific QA/QC manual<li data-bbox="715 1544 1433 1602">- Ensure accountability of all laboratory staff in the performance of their jobs<li data-bbox="715 1640 1476 1727">- Implement methodologies and procedures consistent with the generation of legally defensible data in accordance with state, local and federal guidelines

LENL KEY PERSONNEL AND RESPONSIBILITIES

Position/Key Personnel	Responsibilities
QA/QC Coordinator Burnie D. Fuson	<ul style="list-style-type: none">- Implement the branch QA program- Develop the QA/QC manual- Establish and maintain safety standards and operating procedures- Coordinate and audit the technical review of deliverables- Issue recommendations and corrective actions required for any aspect of laboratory operations inconsistent with established policies and procedures- Monitor and identify out-of-control or potentially out-of-control situations to Operations Manager, Supervisors, and Branch Manager- Provide guidance for the chemistry QA/QC program development- Interact with external QA personnel concerning the lab's certifications and QA policies/procedures and coordinating QA compliance as required- Keep abreast of new techniques and programs for QA and safety and inform Branch Manager and Operations Manager- Coordinate the development of project QA plans as required- Provide historical QA reports for each method to the Branch Manager- Perform QA/QC audits, provide blind check samples and monitor results- Judiciously examine QA/QC program in relation to laboratory profitability

LENL KEY PERSONNEL AND RESPONSIBILITIES

Position/Key Personnel	Responsibilities
Management Information Systems Department Damon Abbott	<ul style="list-style-type: none"> - Establish and maintain the computer systems, the network, and the LIMS (Laboratory Information Management System) - Provide data deliverables in U.S. EPA CLP format with hard copy and disc deliverable formats - Develop software necessary to meet other client's deliverable formats - Interpret U.S. EPA CLP Statements of Work - Organics and Inorganics for requirements and deliverables - Interface analytical instruments' data systems with our IBM Token Ring Network and develop software required at the interface - Train department personnel in various data entry software packages purchased or developed internally - Provide guidance and direction to other departments where required or requested or as determined by Branch Manager - Provide support to QA/QC Coordinator where necessary to automate, archive and generate QC trends from historical records - Provide support and guidance for entire laboratory operation, from sample receiving through the generation of data deliverable packages, to streamline and increase productivity through computer automation

LENL KEY PERSONNEL AND RESPONSIBILITIES

Position/Key Personnel	Responsibilities
Lab Supervision Cheryl Oliver (Organics) Bruce Hunt (GC/MS) Carl Causey (GC) Gary St Pere (Inorganics)	<ul style="list-style-type: none"> - Provide overall supervision of department/section operations - Implement procedures consistent with the generation of legally defensible data - Provide QC activities consistent with the branch QC procedures - Provide additional QC activities, as needed, which are consistent with the Branch QA philosophies - Provide final report review before releasing - Provide work assignments to departmental personnel - Provide analytical job training and cross-training within the department and between departments where applicable and warranted - Provide corrective action for deficiencies - Provide quarterly instrument detection limit (IDL) studies - Maintain maintenance logs on all instruments - Maintain all standards logs - Provide leadership and management philosophies consistent with those of the Branch - Provide legally defensible data from each department - Maximize throughput of samples - Plan, organize, and schedule work to obtain maximum profitability

LENL KEY PERSONNEL AND RESPONSIBILITIES

Position/Key Personnel	Responsibilities
Sample Receiving and Shipment Sharon Taber	<ul style="list-style-type: none">- Provide sample control via entry of all parameters to be analyzed per sample in LIMS when sample arrives- Provide chain-of-custody receipt of samples externally, and internal from our walk-in cooler to analysts and prep- Provide sample analysis report daily for all samples in-house- Provide prepared sample bottles in refrigerated shippers- Provide for sample disposal/return to sender- Keep track of supplies, order when needed, bill clients for those used

TAB

APPENDIX C

APPENDIX C

**SITE-SPECIFIC GROUND-WATER ANALYSES LETTER REPORT
REVISION NO. 4**

May 30, 1995

Captain Joe Feaster
HQ AFCEE/ERB
8001 Inner Circle Drive, Suite 2
Brooks Air Force Base, Texas 78235-5328

**Subject: Site-Specific Ground-Water Analyses Letter Report - Revision No. 4
Base-Wide Well Monitoring
Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field, Texas
Contract No. F41624-94-D-8050, D.O. No. 0001
LAW Project No. 11-3517-3201**

Dear Captain Feaster:

Law Environmental, Inc., (LAW) is submitting this revised letter report to update information at the Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field, Fort Worth, Texas (NAS Fort Worth) and to document which existing monitoring wells will be included in the 1995 quarterly ground-water sampling program. The quarterly ground-water sampling program will provide information on monitoring of ground-water flow and contaminant plume(s) for the base. Monitoring well information was initially gathered via a reconnaissance of existing monitoring wells and review of available records to determine the number, location, and likely contaminants present in the wells. The information resultant from the site reconnaissance and records search activities was compiled and reviewed during the March 2-3, 1995, On-Board Review Meeting, held at NAS Fort Worth. The final list of 70 monitoring wells and analytical parameters to be included in the 1995 quarterly ground-water sampling program was agreed to by LAW, the Air Force Center for Environmental Excellence (AFCEE), and the Air Force Base Conversion Agency (AFBCA) at NAS Fort Worth during the On-Board Review Meeting. Also, the Texas Natural Resource Conservation Commission (TNRCC) was contacted via a conference call on March 2, 1995, and concurred with the 1995 quarterly ground-water sampling program monitoring well selection and analytical analyses.

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Site information obtained during the first round of ground-water sample collection conducted April 3 to 15, 1995, has been incorporated into this letter report in order to update and revise the selection of existing monitoring wells to be included in the 1995 quarterly ground-water sampling program. The following bulleted items summarize the revisions made to this letter report.

- The construction of monitoring well ST14-W14 would not permit a standard ground-water bailer to be lowered into the well for either purging or sample collection. LAW, with AFCEE concurrence, made a field decision to sample monitoring well ST14-W03 in place of ST14-W14. ST14-W03 is located in close proximity to ST14-W14.
- The three monitoring wells located at Building 1628 (LSA1628-1, LSA1628-2, and LSA1628-3) were found to contain free product and were excluded from the April 1995 sample collection. As discussed in this letter report, the presence of free product is a criterion for excluding a monitoring well from the quarterly ground-water sampling program; however, the U.S. Air Force requested that these three monitoring wells remain as part of the quarterly ground-water sampling program.
- A thin layer of free product was encountered in MW-10. MW-10 was purged and a sample of ground water was collected for chemical analysis.

Summary of Well Reconnaissance and Records Search

A reconnaissance of the existing monitoring wells at NAS Fort Worth, Texas, was performed between October 26 and 29, 1994. During this survey, 82 monitoring wells were located, observed for visible damage, and a sampling bailer was inserted to verify that ground water could be collected from the well. Prior to field reconnaissance, a meeting was arranged by base environmental personnel for International Technologies Corporation (IT) and LAW field personnel to discuss the location of wells which were indicated on the existing base map. IT personnel were in the process of conducting a water level survey of the monitoring wells at NAS Fort Worth and had plotted these well locations on a base map.

LAW's objectives for this monitoring well field reconnaissance were to:

- Locate and identify the monitoring wells.
- Observe and record the visible condition of the monitoring well.
- Measure the depth to ground water and total depth of the well, detection of vapors emanating from the wellhead using a PID organic vapor analyzer, and check for sediment accumulation at the bottom of the well.

250175

- Obtain a sample using a bailer and observe any phase separation, difficulty of sample retrieval, turbidity, and measure/record the pH.

In order to complete the task more efficiently, a presurvey checklist was generated in the office and completed in the field for each monitoring well. A copy of the form is provided as Attachment 1.

The well number on the monitoring well was identified and recorded along with the date and time of the reconnaissance. Accessibility to the well was noted, including overgrowth/vegetation, insect infestation, and the need for flightline clearance.

Information relating to the physical characteristics of the well was recorded, including flush mount/stick up type, amount of stick up, if any, and casing diameter. The visible condition of the grout collar and its ability to block the migration of surface water into the well was noted. Notes were made to indicate the presence of guard posts, an operable lock, vented cap, and dedicated sampling equipment.

An HNu hand-held organic vapor analyzer equipped with a photoionization detector (PID) was used to detect organic vapors inside the well casing. This measurement was taken immediately after the well cap was removed and prior to the water level measurement. The static water level and total depth of the well was measured using an oil/water interface probe. The probe was also used to determine if the bottom of the well was "soft" or "hard," which indicated whether sediment had collected in the bottom of the well.

Each monitoring well was checked for sampler accessibility using a Teflon bailer. The bailer was a 1.66-inch diameter by 36-inch long type bailer with a one-way ball valve. Only one bailer volume was removed from each well. Observations recorded included the degree of turbidity in the sample, any phase separation, the general color, and the presence of odors. A pH reading was taken using pH paper.

Types of Data Collected in the Records Search

Information and details on well drilling and construction were found in documents provided by NAS Fort Worth. Cases of conflicting or inconsistent data are noted in Attachment 2. Data obtained from documents are summarized as follows:

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- Well Locations and Groupings — Maps, tables, and text were reviewed for information on well locations and groupings, whether by IRP Site, SWMU, or facility.
- Borehole Summary — Well boring records were reviewed to obtain depth to top of rock, zone of termination (terrace deposits, shallow bedrock or Paluxy Aquifer), and total boring depth.
- Casing Details (Size, Material, Construction, and Fittings) — Monitoring well installation diagrams were reviewed for data on well casing materials and construction. Information collected includes casing material, diameter, grade, assembly method (whether glue was used to seal casing joints) and stickup (the distance from ground surface to the top of casing).
- Screened Interval — Monitoring well installation diagrams and text summary tables were reviewed for screening intervals, referenced to the top of casing.
- Filter Pack — Monitoring well installation diagrams were reviewed for the depth of filter pack intervals, referenced to ground surface.
- Bentonite Seal — Monitoring well installation diagrams were consulted for bentonite seal intervals, referenced to ground surface.
- Survey — Survey information was obtained from text summary tables and monitoring well installation diagrams, and consists of ground surface and reference point elevations. Information was also gathered to verify that each well's reference point was the top of casing (TOC).

Existing Monitoring Well Evaluation Summary Table

Attachment 2 contains the detailed information gathered from the field reconnaissance and the records search. The information is organized according to site name or area, solid waste management unit (SWMU)/IRP number, and well designation within each of these areas. Based on the review of data for each well, a preliminary decision was made on whether to sample the monitoring well. Well selection criteria also included representative location and spacing of the wells. Selected monitoring wells are presented in Figure 1.

Rationale for Acceptance/Rejection of Monitoring Wells for Quarterly Sampling

The following criteria were not considered in selection of monitoring wells for the base-wide monitoring program:

- Survey data — Surveying criteria was not used in determining the usability of monitoring wells. Due to some inconsistency in well survey data across NAS Fort Worth, wells used in quarterly sampling may be resurveyed or surveyed for the first time.
- Date of well installation.
- Well drilling method.
- Well development information.
- Aquifer material.
- Hydraulic conductivity.

The following criteria were utilized in selection of monitoring wells to be included in the base-wide monitoring program:

- Well Locations and Groupings — This study does not include wells located on Air Force Plant 4, or within the runway area west of Taxiway 197. Therefore, any wells located in this flightline area were not considered for quarterly sampling. Also, several wells in close proximity to other selected wells were not chosen for the program.
- Well Protection — Wells exhibiting evidence of, or susceptibility to the entry of surface water into the production zone, tampering, and structural damage were not considered for quarterly sampling.
- Access to Well — Some wells located in areas of difficult access (due to security or operational constraints) were not evaluated during the field reconnaissance.
- Borehole (Drilling Results) Summary — Borehole information used in well evaluation included the stratigraphy of penetrated zones, depth to top of rock, and total boring depth. This information was utilized in determining the aquifer in which the well is completed.
- Casing Details (size, material, construction, and fittings) — Well construction plays a major role in the suitability of monitoring wells for quarterly sampling. Wells installed with PVC casing at sites with high organic contaminant concentrations could exhibit casing degradation. Wells cased with stainless steel could produce nonrepresentative ground-water samples in cases of abnormal ground-water pH or metals contamination.
- Screened Interval — Several aspects of well screen construction should be considered when evaluating the suitability of wells for quarterly sampling. As in the well casing, the screen can be degraded by high contaminant levels and

abnormal ground-water pH. The location of the screen with respect to aquifer units governs the source from which ground-water samples are derived.

- **Filter Pack** — The length of filter pack above the well screen provides a barrier against migration of bentonite and grout installed above the filter pack. Filter pack installed below the base of the well screen provides a conduit for entry of ground water from intervals below the well screen. The location of the filter pack determines the subsurface interval capable of contributing water to the well.
- **Bentonite Seal** — Bentonite seal integrity was considered a significant well evaluation criterion. While the majority of monitoring wells installed at NAS Fort Worth possess a bentonite seal of approximately 2 feet in thickness, the completion of wells in close proximity to ground surface dictated that seals of less than 2 feet in thickness be installed. Wells possessing a seal thickness of less than 2 feet were eliminated from consideration, unless the well was deemed critical to the investigation.
- **Product** — The current or past occurrence of measurable free phase product (whether light, nonaqueous phase liquid [LNAPL] or dense, nonaqueous phase liquid [DNAPL]) disqualifies a well from quarterly sampling, unless the well has been deemed critical to the investigation.

Analytical Approach

Analytes listed in Table 6 of the Texas Risk Reduction Rules (TRRR) (Final June 1994) were used to formulate the analytical approach. The data generated from the quarterly sampling events will be compared to the TRRR values for ground water at industrial sites.

Based on the review of ground-water chemical analyses from previous investigations and in conjunction with the analytical requirements of the TRRR, the proposed analytical methods to be used base-wide are:

Volatile Organic Compounds	EPA SW846 8260
Semi-Volatile Organic Compounds	EPA SW846 8270
Total Metals	EPA SW846 6010/7000

The additional proposed method for the former Entomology Drywell (SWMU No. 63/IRP No. 15) area is:

Pesticides	EPA SW846 8080
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Analytes included in these methods listed with the TRRR limits, are included as Attachment 3.

Recommendations

I. Accepted Wells

A total of 70 wells met all evaluation criteria and were selected for quarterly sampling. The wells selected are identified in Attachment 2.

II. Rejected Wells

The rationale for rejecting wells from quarterly sampling included noncompliance with the well acceptance criteria, or the well's close proximity to wells better suited for use as monitoring points. The wells were rejected due to one or more of the following criteria:

- Lacking or incomplete well construction data
- Wells which could not be inspected during the reconnaissance
- Wells which were either dry or lacked an adequate length of saturated section wells)
- Wells with greater than 20 feet of well screen
- Wells compromised or damaged
- Wells completed in a distinct interval below the terrace deposits (Paluxy formation)
- Wells with an obstruction in the well or out of plumb
- Wells found to contain free phase product
- Wells not locked
- Wells improperly installed
- Wells specifically designed and used as tank pit monitoring wells
- Wells included in Jacobs Engineering ground-water study
- Wells non-strategically located due to their close proximity to wells better suited for quarterly sampling

Attachment 2 identifies the wells rejected for quarterly sampling.

250180

Conclusion

Based on our evaluation, 70 wells have been identified for inclusion in the base-wide monitoring program. Development of the planning documents for this project will be based on these 70 wells and the analytical approach contained in this report.

If you should have any questions regarding this letter report, please do not hesitate to contact Fred Sharpe at 404/421-7008 or John O'Brien at 404/499-6886.

Sincerely,

LAW ENVIRONMENTAL, INC.

John F. O'Brien
Project Manager

E. Fred Sharpe, Jr., P.E.
Principal

ATTACHMENT 1

PRE-SURVEY CHECKLIST
Field Information

1. Date well checked:	Time:
2. Checked by:	
3. Condition of protective casing, cap and lock:	
4. Condition of pad surrounding protective casing:	
5. Does lock work?	
6. Cap vented (Y or N):	
7. PID reading:	
8. Is there dedicated sampling equipment present?	
9. Static water level (TOC):	
10. Total depth (TOC):	
11. Is sediment present at bottom? (Hard or soft bottom)	
12. Bailer run down well:	
A. <i>Were there any obstructions?</i>	
B. <i>Physical characteristics of water:</i>	
1. <i>Color</i>	
2. <i>Odor</i>	
3. <i>Turbidity</i>	

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Well # _____

13. Verify background information (see background data form):
A. <i>Well #</i>
B. <i>Amount of stick up</i>
C. <i>Casing diameter</i>
14. Additional Information:

Key to Attachment 2

Definition of Header Terms:

Site Name/SWMU #/IRP #	Site name, building, or area/SWMU number/IRP number
Well #	Well designation number
Reference Point	Location from which well measurements are taken
Stick up	Distance from top of the well to ground surface
Elev	Elevation, referenced to 1929 National Geodetic Vertical Datum (NGVD), feet
Ref. Pt. Elev	Reference point elevation, referenced to 1929 NGVD, in feet
TD When Installed G.S.	Total depth of well referenced to ground surface, in feet
TD When Inspctd	Total depth of well when measured during this event, referenced to top of casing (TOC), in feet
SWL When Inspctd	Static water level measured from top of casing (TOC), in feet
Ground-Water Elev	Ground-water elevation referenced to mean sea level (NGVD), in feet
Depth to Bdrck	Depth to bedrock measured from ground surface level (GSL), in feet
Screened Interval	Depth range of well screen interval referenced to below ground surface (bgs)
Strat Unit	Geological unit comprising the screened interval
Casing/Diam	Well casing diameter in inches
Casing/PVC Matrl	Is well casing comprised of polyvinyl chloride material (yes or no)
Parameters When Inspected	
pH	Field pH measurement, in standard units
Bailer Run Down Well	A 3-ft. Teflon bailer was used to extract a sample of water and to determine if the well could be sampled ["Plumb" if well accommodated bailer to (or near to) total depth]
HNu ppm	OVA-PID was used to take measurements at the well head immediately after removing the cap, readings in ppm

Product Present	An interface probe was used to measure if any free phase product was present at the top or bottom of the water column
Elimination Criteria	
GJ	Glued joints in construction of the well casing
MU	Well screen interval is comprised of multiple geological units
OT	Other disqualifications - see remarks
Disq	Well has been disqualified for ground-water sampling
Accepted	Well has been accepted for ground-water sampling
Well Casing Fittings	T = Treaded riser casing per existing reports
Filter Pack Int.	Filter pack interval referenced to ground surface level
Seal Int.	Bentonite seal interval referenced to ground surface level
Well Protections	No = well may be compromised; Yes = problems not detected, meaning locks on well, outer protective casing intact, post protection, water tight cap on flush mound wells
Not Inspected	These wells are currently used as part of IRP site ground-water programs, and site evaluation was deemed unnecessary.
Not Included in Well Survey	These wells were included after the survey.

EXISTING MONITORING WELL EVALUATION SUMMARY

WELL #	WELL #	REF. POINT	STICKUP (ft)	ELV. (GRL) (ft)	REF. FT. ELV. (ft)	TD WHEN INSTALLED (G.S.)	TD (ft)	TD WHEN INSPECTED (TOC)	SWL (ft) WHEN INSPECTED (TOC)	DEPTH TO BDRK (ft)	SCREENED INTERVAL (ft)	BOREHOLE ANNULES DIAMETER (in)	STRAUT UNIT	CASING DIA (in)	CASING PVC MATERIAL	PH	WHEN INSPECTED (ft)	PARAMETERS WHEN INSPECTED (ft)	PRODUCT PRESBINT (Y/N)	WELL CASING FITTINGS	FILTER PACK INT.	SEAL INT.	REMARKS	ACCEPTED? (Y/N)
LP01-1A	TOC	3.77	566.50	570.27	31.76	28'	31.76	15.94	7.0	7.0	2.8'	AL	2"	Yes	6.0	Plumb	4.0	No	T	2.6'	1.5'	Replaces LP01-1C	Y	
LP01-1B	TOC	Phub	560.50	560.25	19.87	19.1'	19.87	14.97	NE	19.0 (10')	9.0'	AL	2"	Yes	7.0	Plumb	4.0	No	T	20.0'	5.5'	Included in Jacobs Engineering ground-water study	N	
LP01-1C	TOC	Phub	560.50	560.00	32.54	33.1'	32.54	18.80	33.0	32.7 (10')	22.7'	AL	2"	Yes	7.0	Plumb	5.7	No	T	31.1'	17.2'	Cannot locate	N	
LP01-1D	TOC	3.43	560.50	563.93	28.14	21.3	28.14	20.05	23.0	13.0'	23.0 (10')	AL	2"	Yes	7.0	Plumb	16.1	No	T	21.3'	12.0'	Inside filling range	Y	
LP01-1E	TOC	2.85	559.40	562.25	32.12	28.0	32.12	17.97	NE	16.5' - 17.25'	24.5 (11.75')	AL	2"	Yes	7.0	Plumb	73.2	No	T	29.8'	12.0'		Y	
LP01-1F	TOC	2.76	559.00	562.26	30.36	30.36	30.36	17.25		17.25'	28.0 (10.75')	AL	2"	Yes	7.0	Plumb		No	T	30.36'	12.5'		Y	
LP04-4A	TOC	1.10	624.60	623.76	24.0	24.0	24.79	12.04	18.0	14.0'	24.0 (10')	AL	2"	Yes	7.0	Plumb	ND	No	T	24.0'	10.5'	difficult track across - make potential	Y	
LP04-4B	TOC	1.50	618.40	619.90	25.30	24.0	25.30	14.17	18.0	13.0'	23.0 (10')	AL	2"	Yes	7.0	Plumb	ND	No	T	24.0'	9.0'	crack - alkali leak	Y	
LP04-4C	TOC	2.14	610.50	613.04	28.00	29.5	28.00	19.74	28.0	18.5'	24.5 (10')	AL	2"	Yes	7.0	Plumb	ND	No	T	29.5'	16.0'	Included in Jacobs Engineering ground-water study	N	
LP04-4D	TOC	2.25	611.10	613.33	27.69	30.5	27.69	21.47	30.0	18.0'	28.0 (10')	AL	2"	Yes	7.0	Plumb	ND	No	T	30.5'	14.5'		Y	
LP04-4E	TOC	1.04	612.50	614.54	30.76	35.0	30.76	24.98	31.7	24.7'	35.0 (10.7')	AL	2"	Yes	7.0	Plumb	ND	No	T	35.0'	21.0'		Y	
LP04-4F	TOC	2.56	622.80	625.36	37.26	35.0	37.26	30.31	?	21.0'	28.0'	AL	2"	Yes	7.0	Plumb	ND	No	T	35.0'	15.5'		Y	
LP04-4G	TOC	0.92	618.10	620.02	33.30	36.0	33.30	27.22	39.5	31.0 (14')	31.0 (14')	AL	2"	Yes	7.0	Plumb	ND	No	T	36.0'	17.0'	Included in Jacobs Engineering ground-water study	N	
LP04-4H	TOC	2.97	610.50	613.43	18.33	28.0	18.33	None	27.0	13.0'	27.0 (14')	AL	2"	Yes	7.0	Plumb	ND	No	T	28.0'	8.0'	Dry	N	
LP04-01		Z			41.41		41.41	31.61						Yes	7.0	Plumb	ND	No	T			WCDNA	N	
LP04-02		Z			38.76		38.76	29.76						Yes	7.0	Plumb	ND	No	T			WCDNA	N	
LP04-03														Yes	7.0	Plumb	ND	No	T			Destroyed - removed in recovery well; WCDNA in recovery well; WCDNA Over gross leak	N	
LP04-04		Z			26.50		26.50	19.68						Yes	7.0	Plumb	16	No	T			ground leak; WCDNA	N	
F2	NA		663.8						32'	106.6-124.4 (19.4')	133.1-149' (19.5')	P	5.5"	Yes				No	T	NA	NA	2-3' clay separates 2 screened intervals; WCDNA	N	

AL = Well completed in Quaternary Alluvium
 L = Well completed in Pleistocene
 G = Well completed in Glacial/Lake Deposits
 GI = Well completed in Glacial/Lake Deposits
 MU = Screened across multiple units
 ND = Not Determined
 OT = Other - See remarks
 T = Threaded
 WCDNA = Well completion data not available
 NE = Not encountered
 D = Data Gap

Y = Yes
 N = No
 A = Adequate
 I = Inadequate

N = 7
 Y = 12

EXISTING MONITORING WELL EVALUATION SUMMARY

SITE NAME/ SWMU #/ IEP #	WELL #	REFERENCE POINT	STICKUP (ft)	RELV (ft)	ELEV FT.	TD WHEN INSTALLED G.S.	TD (ft) WHEN INSPECTED (G.S.)	SWL (ft) WHEN INSPECTED (G.S.)	DEPTH TO DRY (ft)	SCREENED INTERVAL (ft)	BOREHOLE ANNULAR SPACE Diameter	STRAIT UNIT	CASING		PARAMETERS WHEN INSPECTED PER DOWN WELL	PRODUCT PRESENT? (Y/N)	WELL CASING FITTINGS	FILTER PACK INT.	SEAL INT.	REMARKS	ACCEPTED? (Y/N)	
													DIAM (in)	MATERIAL								
L-ANDER 05 SWMU #29 IEP #5	LPS-1A	TOC	3.78	619.60	623.18	32.0	30.38	25.06	31.0	18.0 - 28.0 (10)	6.625"	A	Z	Yes	7.0	Phumb	No	T	16.0 - 16.0	16.0	Included in Leach Exposure log ground-water study	N
	LPS-1B	TOC	3.05	597.60	600.65	9.0			8.0	4.0 - 9.0 (5)		A	Z	Yes			No	T	3.5 - 9.0	2.0 - 3.5	Unable to access	N
	LPS-1C	TOC	1.88	608.00	608.68	22.0	20.44	11.41	20.0	7.0 - 22.0 (15)	6.625"	A	Z	Yes	7.0	Phumb	No	T	6.0 - 22.0	6.0 - 6.0		Y
	LPS-1D	TOC	3.21	608.00	611.71	20.5	21.18	12.98	NE	10.5 - 18.5 (8.0)	6.625"	A	Z	Yes	1.0	Phumb	No	T	20.5 - 21.5	8.0 - 19.5	DDE's notes due to needs First 48 inches of well casing fractured	Y
	LPS-1E	TOC	2.99	633.00	626.89	39.1	35.85	29.13	NE	24.1 - 34.1 (10.0)	6.625"	A	Z	Yes	7.0	Phumb	No	T	39.1 - 11.0	21.5 - 9.0		N
FDTA 1 SWMU 18 IEP #11	LPS-1G	TOC	3.39	612.00	613.39	27.0	30.22	22.10	29.0	14.25 - 26.0 (11.75)	6.625"	A	Z	Yes	7.0	Phumb	No	T	27.0 - 8.0	11.0 - 6.0	Bottomhole caplets retained in boiler	Y
	LPS-1H	TOC	2.22	604.00	610.62	25.0	27.81	18.40	25.0	12.85 - 23.0 (10.15)	6.625"	A	Z	Yes	7.0	Phumb	No	T	25.0 - 25.0	6.0 - 6.0		N
	LPS-1I		Z				29.98	24.34					Z	Yes	7.0	Phumb	No	T			WCDNA	N
	LPS-1J		Phumb				21.35	19.85					Z	Yes	7.0	Phumb	No	T			WCDNA	N
	LPS-1K		Phumb				19.54	14.65					Z	Yes	7.0	Phumb	No	T			WCDNA	N
FDTA 2 SWMU 19 IEP #12	FT09-11A	TOC	3.42	604.00	608.22	14.5	17.54	11.00	13.5	4.0 - 14.0 (10)		A	Z	Yes	7.0	Phumb	No	T	3.5 - 14.5	2.0 - 3.5		Y
	FT09-11B	TOC	4.38	603.00	608.14	15.0	17.06	8.92	14.0	3.5 - 13.5 (10)		A	Z	Yes	7.0	Phumb	No	T	15.0 - 10.5	3.0 - 3.0		Y
	FT09-11A	TOC	3.66	632.00	635.66	25.0	27.85	18.85	19.0	13.0 - 23.5 (10.5)		A	Z	Yes	7.0	Phumb	No	T	10.5 - 26.0	10.5 - 24.0		Y
	FT09-12B	TOC	1.95	625.00	627.55	40.0	37.66	31.67	34.5	27.0 - 37.5 (10)		A	Z	Yes	7.0	Phumb	No	T	40.0 - 25.0	26.0 - 23.0		Y
	FT09-12C	TOC	2.55	625.00	628.05	38.0	39.96	32.71	30.5	27.0 - 37.5 (10)		A	Z	Yes	7.0	Phumb	No	T	38.0 - 38.0	25.0 - 25.0		Y
FT09-12D	FT09-12D	TOC	2.65	624.00	627.65	35.0	36.99	31.22	NE	21.4 - 34.0 (13)		A	Z	Yes	7.0	Phumb	No	T			MW is same proximity as FT12-12B	N
	FT09-12E	TOC	2.98	624.00	627.48	34.5	38.68	32.12	40.0	24.0 - 27.5 (3.5)		A	Z	Yes	7.0	Phumb	No	T			MW is same proximity as FT12-12C	N

P = Completed in Primary Formation
 G = Cased Inlets
 MU = Screened across multiple units
 OT = Other - See remarks
 T = Threaded
 WCDNA = Well completion data not available
 NE = Not encountered
 D = Dirt Gap

Y = Yes
 A = Adequate
 I = Inadequate

N = 9
Y = 1

EXISTING MONITORING WELL EVALUATION SUMMARY

SITE NAME/ SWMU #/ REF #	WELL #	REFERENCE POINT	STICKUP	ELV (OSL)	REF. PT. ELV.	TD WHEN INSTALLED G.S.	TD WHEN INSPECTED (TOC)	SWL (ft) WHEN INSPECTED (TOC)	DEPTH TO BDRK (XGSL)	SCREENED INTERVAL (ft)	BOREHOLE ANNULUS DIAMETER	STRAT UNIT	CASING PVC MATERIAL	PARAMETERS WHEN INSPECTED PE BARBER KUN DOWN WELL	PRODUCT PRESENTY (Y/N)	WELL CASING FITTINGS	FILTER PACK INT.	SEAL INT.	REMARKS	ACCEPTED (Y/N)
PCC Tech Firm SWMU 04 REF #17	17A														No	T			WCDA	N
	17B														No	T			WCDA	N
	17C														No	T			WCDA	N
	17D														No	T			WCDA	N
	17E														No	T			WCDA	N
	17F														No	T			WCDA	N
	17G														No	T			WCDA	N
	17H														No	T			WCDA	N
	17I	TOC	2.99	575.30	578.19	17.5	19.3	11.08	20.0	4.0' 16.7 (12.5)	7	A	Z	7.0	No	T	6.0'	4.0'	WCDA	N
	17J	TOC	1.19	577.0	578.19	26.2	18.0	19.20 (11.2)	18.0	7.45' 19.20 (11.2)	7	A	Z	Yes	No	T	5.5'	3.5'	WCDA	N
	17K	TOC	1.54	578.00	575.34	16.7	16.55	10.11	18.0	6.7' 17.30 (9.0)	7	A	Z	Yes	No	T	6.0'	4.0'	WCDA	N
	17L	TOC	2.87	576.00	577.27	20.2	20.0	19.20 (11.2)	20.0	7.45' 19.20 (11.2)	7	A	Z	Yes	No	T	5.5'	3.5'	WCDA	N
	17M	TOC	1.68	572.60	574.28	15.9	16.0	14.90 (9.0)	16.0	5.9' 14.90 (9.0)	6.625"	A	Z	Yes	No	T	4.0'	2.0'	WCDA	N
	ST14-01	TOC	2.69	573.30	575.89	18.40	18.2	18.20 (9.7)	18.2	6.45' 18.20 (9.7)	8.00"	A	Z	Yes	No	T	6.50'	6.50'	WCDA	Y
	ST14-02	TOC	2.94	572.70	575.64	17.10	19.48	12.16	17.1	7.05' 16.80 (9.7)	8.00"	A	Z	Yes	No	T	5.00'	5.00'	WCDA	Y
	ST14-03	TOC	1.89	574.83	576.72	17.90	18.2	17.60 (9.7)	18.2	7.45' 17.60 (9.7)	8.00"	A	Z	Yes	No	T	5.80'	5.80'	WCDA	Y
	ST14-04	TOC	2.64	573.90	575.14	16.90	16.5	16.20 (9.7)	16.5	6.45' 16.20 (9.7)	8.00"	A	Z	Yes	No	T	4.30'	4.30'	WCDA	Y

P = Completed in Primary Formation
 GI = Ground Joint
 MU = Screened across multiple units
 OT = Other - See remarks
 T = Threaded
 WCDA = Wall completion data not available
 NE = Not encountered
 D = Data Gap
 Y = Yes
 A = Adequate
 I = Inadequate

250187

ATTACHMENT 2

EXISTING MONITORING WELL EVALUATION SUMMARY

SITE NAME/ SWMU #/ WELL #	REFERENCE POINT	STICKUP (ft)	ELVY (OBS) (ft)	BAR. FT. HLVY.	TD WHEN INSTALLED (ft)	TD WHEN INSPECTD (ft)	SWL (ft) WHEN INSPECTD (ft)	DRIFT TO BACK (ft)	SCREENED INTERVAL (ft)	BOREHOLE ANNULUS DIAMETER (in)	STRAT UNIT	CASING DIAM (in)	PVC MATERIAL	PARAMETERS WHEN INSPECTED PB BAILER RUN DOWN WELL	PRODUCT PRESENT? (Y/N)	WELL CASING FITTINGS	FILTER PACK INT.	SEAL INT.	REMARKS	ACCEPTED? (Y/N)
ST14-W05		16.6			15.0	15.07 (8.5)	6.59-				A	2"	Yes		No	T	4.0-	2.0-	Not Inspected	Y
ST14-W06		27.0			27.0	25.87 (18.5)	6.99-				A	2"	Yes		No	T	3.0-	3.0-	Not Inspected	Y
ST14-W07		26.0			25.7	24.87 (18.5)	5.89-				A	2"	Yes		No	T	4.0-	1.8-	Not Inspected	Y
ST14-W08		26.0			NE	24.87 (18.5)	4.19-				A	2"	Yes		No	T	6.0-	4.0-	Not Inspected	Y
ST14-W09		22.0			NE	20.87 (13.8)	7.04-				A	2"	Yes		No	T	5.0-	3.0-	Not Inspected	Y
ST14-W10		21.0			21.0	19.87 (13.8)	6.04-				A	2"	Yes		No	T	4.0-	2.0-	Not Inspected at the request of AFCEE	Y
ST14-W11		21.0			21.0	19.87 (13.8)	6.04-				A	2"	Yes		No	T	2.0-	2.0-	Not Inspected	N
ST14-W12		19.0			19.0	17.87 (11.7)	6.19-				A	2"	Yes		No	T	4.0-	2.0-	Not Inspected at the request of AFCEE	Y
ST14-W13		19.0			NE	17.87 (11.7)	6.19-				A	2"	Yes		No	T	1.8-	1.8-	Not Inspected at the request of AFCEE	N
ST14-W14		21.66			22.0	20.57 (12.5)	6.70-				A	2"	Yes		No	T	19.0	4.0	Not Inspected	Y
ST14-W15		19.40			19.0	17.87 (11.7)	6.19-				A	2"	Yes		No	T	21.55	5.0	Unable to pass bailer	N
ST14-W16		20.0			20.0	18.87 (11.7)	7.19-				A	2"	Yes		No	T	4.0-	2.0-	Not Inspected	Y
ST14-W17											A	2"	Yes		No	T	26.0	3.0	Not Inspected	Y
ST14-W18		17.0			17.0	15.87 (11.7)	4.19-				A	2"	Yes		No	T	3.0-	1.0-	WCDNA	N
ST14-W19		17.0			17.0	15.87 (11.7)	6.99-				A	2"	Yes		No	T	17.0	3.0	Uninspected at the request of AFCEE	N
ST14-W20		17.0			17.0	16.47 (9.45)	6.99-				A	2"	Yes		No	T	17.0	5.0	Not Inspected	Y
ST14-W21		18.0			18.0	16.87 (8.5)	7.99-				A	2"	Yes		No	T	17.0	4.0	Not Inspected	Y
ST14-W22		15.4			15.0	14.47 (8.85)	7.59-				A	2"	Yes		No	T	6.0-	4.0	Not Inspected	Y
ST14-W23		10.5			NE	7.57 (5.0)	3.54-				A	2"	Yes		No	T	10.5	1.0	Not Inspected	Y

P = Completed in Primary Formation
 CU = Cased Joint
 MU = Screened across multiple units
 OT = Other - See remarks
 T = Threaded
 WCDNA = Well completion data not available
 NE = Not examined
 D = Data Gap
 Y = Yes
 N = No
 A = Inspected
 I = Indeterminate
 N = 1
 Y = 18

ATTACHMENT 2

EXISTING MONITORING WELL EVALUATION SUMMARY

SITE NAME/ WVWU #/ INE #	WELL #	REFERENCE POINT	STICKUP	ELEV. (ORL) (%)	ELEV. PT. ELEV.	TD WHEN DESTALLED (S.F.)	TD (ft) WHEN DISINCTD (COS)	SWL (ft) WHEN DISINCTD (COS)	DEPTH TO BENCH (DAGS)	SCREENED INTERVAL (ft - ft)	BOREHOLE ANNULUS DIAMETER	STRAT UNIT	CASING Diam (in)	PVC MATERL	PARAMETERS WHEN INSPECTED		PRODUCT PRESENT? (Y/N)	WELL CASING FITTINGS	FILTER PACK INT.	SEAL INT.	REMARKS	ACCEPTED? (Y/N)
															PER FE	DOWN WELL SPM						
Building 3340 UN05	F1A	TDC	Flub	604.97	604.77	20.5	19.97	11.18	20.5	10.0 - 20.0 (10)		A	Z	Yes	7.0	Phumb	No	T	9.0 - 20.5		No bottom the well, but has a flow read and from 8.0' - 9.0'	Y
Building 3109 & 3115 UN05	F1		Flub				30.6	19.40					Z	Yes	7.0	Phumb	No	T				N
Building 3249 UN05	T1	TDC	Flub	575.23	575.11	8.5	8.54	2.16	8.0	5.5 - 8.0 (2.5)		A	Z	Yes	7.0	Phumb	No	T	4.5 - 8.3		No bottom the well, but has a flow read and from 3.5' - 4.5'	Y
Building 1027 UN05	T4A	TDC	Flub	606.64	606.49	24.5	21.45	18.15	21.0	12.0 - 22.0 (10)		A	Z	Yes	7.0	Phumb	No	T	11.0 - 22.5		No bottom the well, but has a flow read and from 8.0' - 11.0'	Y
Open Lot @ 2nd & Bryerton UN05	T7	TDC	Flub	605.10	604.85	26.5	22.85	18.40	26.5	15.5 - 25.5 (10)		A	Z	Yes	7.0	Phumb	No	T	13.0 - 26.5		No bottom the well, but has a flow read and from 11.5' - 13.0'	Y
Members area of base East of Trenchy Drive	M1A	TDC	Flub	612.57	612.45	16.5	15.15	10.52	16.0	11.0 - 16.0 (5)		A	Z	Yes	7.0	Phumb	No	T	9.5 - 16.5		No bottom the well, but has a flow read and from 6.5' - 9.5'	Y

P = Completed by Palmy Formation
 GJ = Ground Jobs
 NU = Screened section multiple units
 OT = Other - See remarks
 T = Thruflow
 ND = Not Detected

WCDMA = With completing data not reliable
 NG = Not Geotagged
 D = Data Gap

Y = Yes
 A = Adequate
 I = Inadequate

250189

EXISTING MONITORING WELL EVALUATION SUMMARY

SITE NAME/ S WAKO #/ WEL #	WELL #	REFERENCE POINT	STICKUP	ELEV (GRL) (ft)	ELF. FT.	TD WHEN INSTALLED G.S.	TD (ft) WHEN DEFECTED GUSE	SWL (ft) WHEN DEFECTED GUSE	DEPTH TO BOREHOLE DIPPER (ft)	SCREENED INTERVAL (ft)	BOREHOLE ANNULAR DIAMETER	STRAT UNIT	CASING DIAM (in)	PVC MATERIAL	PH	WELL INSPECTED W/IN 30 DAYS	PARAMETERS W/IN INSPECTED WELL	PRODUCT PRESENT (Y/N)	WELL CASING FITTINGS	FILTER PACK INT.	SEAL INT.	REMARKS	ACCEPTED (Y/N)
Pod labeled W. of Building 1400	MW-34		Plumb				19.58	16.34					4"	Yes	7.0	Plumb	ND	No	T			Pod labeled # 14 - actual well ID # 34. WCDNA	N
	MW-39		Plumb				19.25	16.27					4"	Yes	7.0	Plumb	ND	No	T			WCDNA	N
	MW-40		Plumb				19.49	16.31					4"	Yes	7.0	Plumb	ND	No	T			WCDNA	N
	MW-41		Plumb				19.26	16.84					4"	No	7.0	No	ND	No	T			WCDNA	N
	MW-42		Plumb				19.21	16.76					4"	Yes	7.0	Plumb	140	No	T			WCDNA	N
Pod Addressed Bldg. 1194	MW-43		Plumb				19.43	16.43					4"	Yes	7.0	Plumb	104	No	T			WCDNA	N
	MW-36		Plumb				19.49	4.02					4"	Yes	7.0	Plumb	ND	No	T			WCDNA	N
Building 1427	MW-37		Plumb				19.28	6.57					4"	Yes	7.0	Plumb	ND	No	T			WCDNA	N
	MW-37		Plumb				14.30	12.84					4"	Yes	7.0	Plumb	1	No	T			WCDNA	N
Building 1425	MW-58		Plumb				19.62	19.26					4"	Yes	7.0	Plumb	ND	No	T			Pod labeled 1194 - actual well ID # 58. WCDNA	N

P = Completed in Place Formation
 GI = Good Jobs
 MU = Screened across multiple units
 OT = Other - See remarks
 NI = Not Inspected
 ND = Not Determined
 WCDNA = Well completion data not available
 NE = Not encountered
 D = Data Gap

Y = Yes
 A = Adequate
 I = Inadequate

N = 10
Y = 0

ATTACHMENT 2

EXISTING MONITORING WELL EVALUATION SUMMARY

WELL NAME/ SWMU #/ IRP #	WELL #	REFERENCE POINT	STICKUP	ELEV. (GAL.) (F)	RIP. PT. ELEV.	TD WHEN INSTALLED G.S.	TD (F) WHEN INSPECTED Q105	SWL (F) WHEN INSPECTED Q105	DEPTH TO BORNE DORCE (D)(GSL)	SCREENED INTERVAL (F-TO-F)	BORHOLE ANNULAR DIAMETER	STRAT UNIT	CASING DIAM (IN)	PVC MATERIAL	PER DOWN WELL FITTING	PARAMETERS WHEN INSPECTED PR BAILER RUN DOWN WELL	PRODUCT PRESENT? (Y/N)	WELL CASING FITTINGS	FILTER PACK INT.	SEAL INT.	REMARKS	ACCEPTED? (Y/N)
Various GM121-	GM121-01M					33.0	34.77	20.86	27.5	16.5- 31.2 (15)	7.625"	A	2"	Yes	7.0	Plumb	ND	T	15.0- 33.0	15.0		Y
	GM121-01M					24.5			24.0	18.0- 24.0 (15)	7.625"	A	2"	Yes			No	T	11.0- 24.5	9.0	Not Inspected	Y
	GM121-01M					30.5			30.0	15.0- 30.0 (15)	7.625"	A	2"	Yes			No	T	3.0- 30.5	1.0	Not Inspected	Y
	GM121-01M					32.5			19.0	12.0- 32.0 (20)	7.625"	A	2"	Yes			No	T	10.5- 32.5	8.5	Not Inspected	Y
	GM121-04M					23.7			22.0	13.0- 23.0 (10)	7.625"	A	2"	Yes			No	T	11.0- 23.3	9.5	Not Inspected	Y
	GM121-05M					11.0			11.0	5.5- 11.0 (5)	7.625"	A	2"	Yes			No	T	3.3- 11.0	2.0	Not Inspected	Y
	GM121-06M					24.0			23.0	13.5- 23.5 (10)	7.625"	A	2"	Yes			No	T	11.5- 24.0	9.5	Not Inspected	Y
	GM121-07M					20.5			19.0	10.0- 20.5 (10.5)	7.625"	A	2"	Yes			No	T	8.5- 20.5	6.5	Not Inspected	Y
	GM121-08M					24.5			24.5	10.0- 24.5 (14.5)	7.625"	A	2"	Yes			No	T	7.0- 24.5	5.0	Not Inspected	Y

P = Completed in Place Formation
 G = Good Grout
 MU = Screened across multiple units
 OT = Other - See remarks
 T = Threaded
 ND = Not Detected
 WCDMA = Well completion data not available
 N = Not Inspected
 D = Data Gap
 Y = Yes
 A = Adequate
 I = Inadequate
 N = 0
 Y = 9

EXISTING MONITORING WELL EVALUATION SUMMARY

SITE NAME/ SWMU #/ IEP #	WELL #	REFERENCE POINT	STICKUP	ELEV (OBL) (N) RELV.	REP. FT. RELV.	TD WHEN INSTALLED G.S.	TD (G) WHEN INSPECTD (TOC)	SWL (G) WHEN INSPECTD (TOC)	DEPTH TO SDRCK (DUGGELL)	SCREENED INTERVAL (L-B)	BOREHOLE ANNULUS DIAMETER	STRAT UNIT	CASING		PARAMETERS WHEN INSPECTED		PRODUCT PRESENT (Y/N)	WELL CASING FITTINGS	FILTER FACE INT.	SEAL INT.	REMARKS	ACCEPTED? (Y/N)	
													DRAM (IN)	PVC MATERIAL	PR BARRE RUN DOWN WELL	PERM							
Residential 1015	NW-20		Plumb				19.70	19.57					4"	Yes	Plumb	3.2	No	T			Dry, WCDNA	N	
	NW-21		Plumb				19.54	19.20					4"	Yes	Plumb	4.1	No	T			Dry, WCDNA	N	
Hot Charge Area Near Buildings 4141 & 4145	NW-48																No	T			WCDNA	N	
	NW-49																No	T			WCDNA	N	
	NW-50																No	T			WCDNA	N	
Hot Charge Area Near Buildings 4215 & 4216	NW-51																No	T			WCDNA	N	
	NW-53																No	T			WCDNA	N	
	NW-55																No	T			WCDNA	N	
Spot 35	NW-56																No	T			WCDNA	N	
	SPOT 35-1		Plumb	613.95	27.5	26.58	22.47	NE					2"	Yes	7.0	Plumb	104	No	T	10.0-	4.0-	Leak detection walk	N
	SPOT 35-2		Plumb	612.70	25.0	26.26	20.80	NE					4"	Yes	7.0	Plumb	124	No	T	7.0-	5.0-	Leak detection walk	N
	SPOT 35-3		Plumb	612.81	25.0	23.78	19.24	NE					2"	Yes	7.0	Plumb	ND	No	T	7.0-	5.0-	Leak detection walk	N
	SPOT 35-4		Plumb	613.70	26.3	24.41	19.82	NE	14.5-	24.5 (10')	Unknown		4"	Yes	7.0	Plumb	94	No	T	12.5-	8.7-	Leak detection walk	N
	SPOT 35-5		Plumb	613.94	27.2	24.3	26.6 (10')	NE	16.0-	24.5 (10')	Unknown		4"	Yes	7.0	Plumb	ND	No	T	13.0-	10.0-	Leak detection walk	N
SPOT 35-6		Plumb	615.53	26.4	26.64	22.66	NE	15.0-	24.5 (10')	Unknown		4"	Yes	7.0	Plumb	ND	No	T	13.0-	10.0-	Leak detection walk	N	

C = Completed in Primary Formation
 OI = Other - See Remarks
 NI = Not Inspected
 ND = Not Detected
 WCDNA = Well completion data not available
 NE = Not Entered
 D = Data Gap
 Y = Yes
 A = Adequate
 I = Inadequate
 N = 15
 Y = 0

EXISTING MONITORING WELL EVALUATION SUMMARY

SITE NAME/ SWMU #/ IEP #	WELL #	REFERENCE POINT	STICKUP	ELEV. (OBS.)	RFB. FT.	TD WHEN INSTALLED	TD WHEN INSPECTED	RWL (ft) WHEN INSPECTED	DEPTH TO SDBCK (OBS.)	SCREENED INTERVAL (ft-sq)	BOREHOLE ANNULUS DIAMETER	STRAUT UNIT	CASING DIAM. (in)	PVC MATERIAL	PS	PARAMETERS WHEN INSPECTED	PRODUCT PRESENT? (Y/N)	WELL CASING FITTINGS	FILTER PACK INT.	SEAL INT.	REMARKS	ACCEPTED? (Y/N)	
																							BAKERS RUN DOWN WELL
Waste Borehole Site SWMU #24 IEP #10	WPT-10A	TOC	0' (T)	626.70'	626.70'	39.0'			NE	31.0' - 37.0' (10')		A	2"	Yes			No	T	24.0' - 39.0'	26.0'	Not inspected due to borehole seal	Y	
	WPT-10B	TOC	1.36'	611.10'	614.46'	36.0'	34.50'	28.78'	34.5'	33.0' (10')		A	2"	Yes	7.0'	Plumb	ND	T	18.0' - 36.0'	18.0'		Y	
	WPT-10C	TOC	1.84'	615.40'	617.24'	32.5'	28.95'	21.15'	30.5'	30.0' (10')		A	2"	Yes	7.0'	Plumb	ND	T	11.5' - 32.5'	17.5'		Y	
Saturated Dry Well SWMU #43 IEP #15	OT15A	TOC	-0.18'	570.62'	570.24'	15.0'			14.0'	12.5' (10')		A	2"	Yes			No	T	3.0' - 15.0'	3.0'	(See comment below)	N	
	OT15B									2.0' - 7.0' (5')				Yes			No	T				Well installation diagram shows top of screen is grout	N
	OT15C	TOC	3.7'	564.17'	562.27'	12.0'			9.0'	11.5' (6.5')		A	2"	Yes			No	T	4.5' - 12.0'	4.5'	Not Inspected	Y	
Unsanctioned Screen SWMU #44 IEP #16	SD13-01	TOC	2.94'	570.30'	573.24'	14.50'			14.5'	7.12' - 14.32' (7.2')	8.00"	A	2"	Yes			No	T	5.0' - 14.60'	2.9'	Not Inspected	Y	
	SD13-02	TOC	2.75'	570.64'	573.39'	14.30'			14.0'	9.50' - 13.50' (4.0')	8.00"	A	2"	Yes			No	T	7.40' - 14.20'	7.40'	Not Inspected	Y	
	SD13-03	TOC	2.94'	566.00'	571.54'	14.10'			13.5'	13.05' (6.38')	8.00"	A	2"	Yes			No	T	5.00' - 14.10'	2.70' - 5.00'	Not Inspected	Y	
	SD13-05	TOC	Flush	571.39'	571.40'	13.00'			NE		3.86' - 13.53' (9.67')		A	4"	Yes			No	T	1.79' - 13.95'	0.41' - 1.79'	Not Inspected	Y
	SD13-06	TOC	2.45'	555.74'	557.68'	11.30'			6.9'	6.9'	10.87' (4.65')	AL-L	4"	Yes			No	T	2.37' - 11.35'	0.15' - 2.37'	Not Inspected	Y	
	SD13-07	TOC	2.38'	554.42'	556.30'	19.13'			13.0'	13.0'	18.00'	AL-L	4"	Yes			No	T	19.13'	6.97'	Not Inspected	Y	
Drinking Water SWMU #44 IEP #16	LSA1023-1	TOC	Flush	602.43'	601.67'	26.0'			16.0'	6.66' - 18.66' (10')	10.25"	AL-L	4"	Yes			Yes	T	18.66'	4.66' - 6.66'	Free product not included in the survey	Y	
	LSA1023-2	TOC	Flush	602.26'	601.97'	26.0'			14.0'	10.0' - 20.0' (10')	10.00"	AL-L	4"	Yes			No	T	20.0'	6.0' - 8.0'	Free product not included in the survey	Y	
	LSA1023-3	TOC	Flush	605.63'	601.71'	18.5'			16.5'	8.5' - 18.5' (10')	10.00"	AL-L	4"	Yes			No	T	18.5'	4.5' - 6.5'	Free product not included in the survey	Y	

Y = Yes
 N = No
 T = Truncated
 ND = Not Detected
 WCDNA = Wall completion data not available
 NE = Not considered
 D = Data Gap
 OT = Other - See remarks
 T = Truncated
 ND = Not Detected
 P = Completed in Palmy Formation
 GI = Ground Levels
 AU = Screened across multiple units

ATTACHMENT 3

**TNRCC INDUSTRIAL GROUND WATER
RISK REDUCTION RULES (CATEGORY #2)
JUNE 1994**

8260 Ground water PARAMETER	MDL (µg/L)	PQL (µg/L)	AFCEE MQL 9/93	TNRCC (µg/L) 1994	TNRCC (µg/L) 1994 (*2.8) a
Volatile Organic Compounds:					
Acetone	2.1	10	–	3650	10220
Benzene	0.5	1.0	0.04	5	14
Bromodichloromethane	0.8	1.0	0.08	100	280
Bromoform	0.8	2.0	0.12	100	280
Bromomethane	0.8	5.0	0.11	51.1	143.08
2-Butanone	4.0	10	0.11	1830	5124
Carbon disulfide	0.5	5.0	NE	3650	10220
Carbon tetrachloride	0.4	1.0	0.21	5	14
Chlorobenzene	0.5	2.0	0.04	100	280
Dibromochloromethane	0.9	1.0	0.05	100	280
Chloroethane	0.9	5.0	0.1	730	2044
2-Chloroethyl vinyl ether	2.9	10	NE	NA	NA
Chloroform	0.3	0.5	NE	100	280
Chloromethane	0.6	1.0	0.13	NA	NA
1,1-Dichloroethane	0.6	1.0	0.04	3650	10220
1,2-Dichloroethane	0.6	1.0	0.06	5	14
1,1-Dichloroethene	0.6	1.0	0.12	7	19.6
cis-1,2-Dichloroethene	0.6	1.0	0.12	70	196
trans-1,2-Dichloroethene	0.6	1.0	0.06	100	280
1,2-Dichloropropane	0.8	1.0	0.04	5	14
cis-1,3-Dichloropropene	0.8	1.0	NE	NA	NA
trans-1,3-Dichloropropene	0.8	1.0	NE	NA	NA
Ethylbenzene	0.4	4.0	0.06	700	1960
2-Hexanone	1.9	10	NE	1830	5124
Methylene chloride	0.8	2.0	0.03	5	14
4-Methyl-2-pentanone	3.0	10	NE	NA	NA
Styrene	0.5	5.0	0.04	100	280
1,1,2-Tetrachloroethane	0.8	1.0	0.04	4.26	11.93
Tetrachloroethene	0.6	1.0	0.14	5	14
Toluene	0.6	2.0	0.11	1000	2800
1,1,1-Trichloroethane	0.8	1.0	0.08	70	196
1,1,2-Trichloroethane	0.8	1.0	0.1	55	154
Trichloroethene	0.5	1.0	0.1	5	14
Vinyl acetate	0.9	10	NE	36500	102200
Vinyl chloride	0.8	2.0	0.11	200	560
Xylenes (total)	1.5	2.0	0.11	10000	28000

MDL: Method Detection Limit.

PQL: Practical Quantitation Limit.

NE: Not established.

NA: Not available.

TRNCC June 1994 (relating to closure/remediation)

(a): As required by TNRCC, 2.8 is a factor used to account for lower injection rates associated with non-residential worker exposure.

ATTACHMENT 3

**TNRCC INDUSTRIAL GROUND WATER
RISK REDUCTION RULES (CATEGORY #2)
JUNE 1994**

8270 Ground water PARAMETER	MDL (µg/L)	PQL (µg/L)	AFCBE MQL 9/93	TNRCC (µg/L) 1994	TNRCC (µg/L) 1994 (*2.8) a
Semi-Volatile Organics:					
Base/Neutral Extractables:					
Acenaphthene	0.32	10	10	2190.00	6132.00
Acenaphthylene	0.89	10	10	NA	NA
Anthracene	0.4	10	10	11000.00	30800.00
Benz(a)anthracene	0.33	10	10	NA	NA
Benzo(b)fluoranthene	0.49	10	10	NA	NA
Benzo(ghi)perylene	3.0	10	10	NA	NA
Benzo(a)pyrene	0.39	10	10	NA	NA
Benzyl alcohol	10	10	20	NA	NA
bis(2-Chloroethoxy)methane	0.42	10	10	NA	NA
bis(2-Chloroethyl)ether	0.61	10	10	0.08	0.22
bis(2-Chloroisopropyl)ether	0.57	10	10	12.20	34.16
bis(2-ethylhexyl)phthalate	0.53	10	10	6.08	17.02
4-Bromophenyl phenyl ether	1.1	10	10	NA	NA
Butyl benzyl phthalate	0.53	10	10	NA	NA
4-Chloroaniline	0.96	10	20	144.00	403.20
2-Chloronaphthalene	0.52	10	10	2920.00	8176.00
4-Chlorophenyl phenyl ether	0.51	10	10	NA	NA
Chrysene	0.28	10	10	NA	NA
Dibenz(a,h)anthracene	0.33	10	10	NA	NA
Dibenzofuran	0.73	10	10	NA	NA
Di-n-butylphthalate	0.3	10	10	3650.00	10220.00
1,2-Dichlorobenzene	0.6	10	10	600.00	1680.00
1,3-Dichlorobenzene	0.78	10	10	600.00	1680.00
1,4-Dichlorobenzene	0.85	10	10	75.00	210.00
3,3'-Dichlorobenzidine	10	20	20	NA	NA
Diethyl phthalate	0.92	10	10	29200.00	81760.00
Dimethyl phthalate	0.47	10	10	NA	NA
2,4-Dinitrotoluene	0.77	10	10	NA	NA
2,6-Dinitrotoluene	4.0	10	10	NA	NA
Di-n-octyl phthalate	0.56	10	10	730.00	2044.00
Fluoranthene	0.44	10	10	1460.00	4088.00
Fluorene	0.62	10	10	1460.00	4088.00
Hexachlorobenzene	2.3	10	10	1.00	2.80
Hexachlorobutadiene	2.10	10	10	10.90	30.52
Hexachlorocyclopentadiene	10	10	10	NA	NA
Hexachloroethane	2.3	10	10	68.00	190.40
Indeno(1,2,3-cd)pyrene	10	10	10	NA	NA
Isophorone	0.66	10	10	NA	NA
2-Methylnaphthalene	0.7	10	10	NA	NA
Naphthalene	0.42	10	10	1440.00	4032.00
2-Nitroaniline	1.8	50	50	NA	NA
3-Nitroaniline	1.8	50	50	NA	NA
4-Nitroaniline	1.8	50	50	NA	NA
Nitrobenzene	0.62	10	10	18.30	51.24
n-Nitrosodiphenylamine	3.6	10	10	NA	NA
n-Nitrosodipropylamine	1.7	10	10	0.01	0.03
Phenanthrene	0.39	10	10	NA	NA
Pyrene	0.55	10	10	1100.00	3080.00
1,2,4-Trichlorobenzene	1.2	10	10	70.00	196.00

ATTACHMENT 3

**TNRCC INDUSTRIAL GROUND WATER
RISK REDUCTION RULES (CATEGORY #2)
JUNE 1994**

8270 Ground water PARAMETER	MDL (µg/L)	PQL (µg/L)	AFCEE MQL 9/93	TNRCC (µg/L) 1994	TNRCC (µg/L) 1994 (*2.8) a
Acid:					
Benzoic acid	33	50	50	NA	NA
4-Chloro-3-methylphenol	0.83	10	20	NA	NA
2-Chlorophenol	1.3	10	10	18.30	51.24
2,4-Dichlorophenol	0.96	10	10	11.00	30.80
2,4-Dimethylphenol	2.4	10	10	730.00	2044.00
4,6-Dinitro-2-methylphenol	3.0	50	50	NA	NA
2,4-Dinitrophenol	20	50	50	73.00	204.40
2-Methylphenol	0.79	10	10	NA	NA
4-Methylphenol	1.1	10	10	NA	NA
2-Nitrophenol	0.73	10	10	NA	NA
4-Nitrophenol	20	50	50	NA	NA
Pentachlorophenol	10	30	50	1.00	2.80
Phenol	0.6	10	10	21000.00	58800.00
2,4,5-Trichlorophenol	0.81	50	50	3650.00	10220.00
2,4,6-Trichlorophenol	1.3	10	10	7.40	20.72

MDL: Method Detection Limit.

PQL: Practical Quantitation Limit.

NA : not available

TNRCC June 1994 (relating to closure/remediation)

(a): As required by TNRCC, 2.8 is a factor used to account for lower injection rates associated with non-residential worker exposure.

ATTACHMENT 3

**RISK REDUCTION RULES (CATEGORY #2)
TNRCC INDUSTRIAL GROUND WATER
JUNE 1994**

METALS GROUND WATER PARAMETER SW 6010	PQL (mg/L)	AFCEE MQL 9/93	TNRCC (mg/L)	TNRCC 1994 (*2.8) a
Aluminum	0.1	0.5	NA	NA
Antimony	0.024	0.4	0.01	0.02
Arsenic	0.037	0.6	0.05	0.14
Barium	0.02	0.02	2.00	5.60
Beryllium	0.003	0.003	0.00	0.01
Cadmium	0.005	0.04	0.01	0.01
Calcium	0.1	0.1	NA	NA
Chromium	0.01	0.07	0.10	0.28
Cobalt	0.011	0.07	NA	NA
Copper	0.004	0.06	NA	NA
Iron	0.05	0.07	NA	NA
Lead	0.025	0.5	0.02	0.04
Magnesium	0.2	0.3	NA	NA
Manganese	0.005	0.02	NA	NA
Molybdenum	0.01	0.08	NA	NA
Nickel	0.023	0.15	0.10	0.28
Potassium	0.2	5.0	NA	NA
Selenium	0.064	0.8	0.05	0.14
Silver	0.005	0.07	0.18	0.51
Sodium	0.2	0.3	NA	NA
Thallium	0.042	0.4	NA	NA
Vanadium	0.007	0.08	NA	NA
Zinc	0.014	0.02	NA	NA
Antimony SW 7041	0.005	0.005	0.01	0.02
Arsenic SW 7060	0.005	0.005	0.05	0.14
Hexavalent Chromium SW 7196	0.02	-	0.10	0.28
Lead SW 7421	0.005	0.005	0.02	0.04
Mercury SW 7470	0.0002	0.001	0.00	0.01
Selenium SW 7740	0.005	0.005	0.05	0.14
Thallium SW 7841	0.001	0.001	NA	NA
Cyanide SW 9010	0.01	0.02	0.02	0.06

GFAA analytes may be analyzed by SW6010 (ICP) if the concentration is greater than 5 times the ICP PQL.

IDL: Instrument Detection Limit

MQL: Maximum Allowable Quantitation Limit

NA : Not available

(a) : As required by TNRCC, 2.8 is a factor used to account for lower injection rates associated with non-residential worker exposure.

ATTACHMENT 3

**TNRCC INDUSTRIAL GROUND WATER
RISK REDUCTION RULES (CATEGORY #2)
JUNE 1994**

8080 Ground water PARAMETER	MDL (µg/L)	PQL (µg/L)	AFCEE MQL 9/93	TNRCC (µg/L) 1994	TNRCC (µg/L) 1994 (*2.8) ^a
Pesticides/PCBs:					
Aldrin	0.017	0.04	0.04	0.00501	0.01403
alpha-BHC	0.008	0.03	0.03	NA	NA
beta-BHC	0.009	0.05	0.06	NA	NA
delta-BHC	0.008	0.05	0.09	NA	NA
gamma-BHC (Lindane)	0.01	0.04	0.04	NA	NA
Chlordane	0.45	0.5	0.14	2.00	5.6
4,4'-DDD	0.013	0.1	0.11	0.355	0.994
4,4'-DDE	0.025	0.04	0.04	0.250	0.7
4,4'-DDT	0.013	0.1	0.12	0.250	0.7
Dieldrin	0.019	0.05	0.02	0.00532	0.0149
Endosulfan I	0.012	0.05	0.14	183.00	512.4
Endosulfan II	0.017	0.04	0.04	183.00	512.4
Endosulfan sulfate	0.011	0.5	0.66	NA	NA
Endrin	0.059	0.06	0.06	2.00	5.6
Endrin Aldehyde	0.013	0.1	0.23	NA	NA
Heptachlor	0.008	0.03	0.03	0.4	1.12
Heptachlor epoxide	0.011	0.05	0.83	0.2	0.56
Methoxychlor	0.112	0.5	1.76	40.00	112
Toxaphene	1.16	2.5	2.4	3.00	8.4
PCB-1016	0.513	1.0	1.0	NA	NA
PCB-1221	0.53	1.0	1.0	NA	NA
PCB-1232	0.165	1.0	1.0	NA	NA
PCB-1242	0.243	1.0	1.0	NA	NA
PCB-1248	0.582	1.0	1.0	NA	NA
PCB-1254	0.54	1.0	1.0	NA	NA
PCB-1260	0.347	1.0	1.0	NA	NA

MDL: Method Detection Limit.

PQL: Practical Quantitation Limit.

NA: Not available.

TNRCC June 1994 (relating to closure/remediation)

(a): As required by TNRCC, 2.8 is a factor used to account for lower injection rates associated with non-residential worker exposure.

SEE FIGURE 2-1
OF
FINAL SAMPLING AND ANALYSIS PLAN

250201

TAB

VOLUME III

11-3517-3201

**INSTALLATION RESTORATION PROGRAM (IRP)
BASE-WIDE QUARTERLY GROUND-WATER MONITORING**

**FINAL SITE HEALTH
& SAFETY PLAN ADDENDUM**

Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field
Fort Worth, Texas

March 1995



PREPARED FOR

AIR FORCE BASE CONVERSION AGENCY (AFBCA/OL-H)
NAVAL AIR STATION FORT WORTH, JOINT RESERVE BASE, CARSWELL FIELD
FORT WORTH, TEXAS 76127-5000

UNITED STATES AIR FORCE
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
ENVIRONMENTAL RESTORATION DIRECTORATE
BASE CLOSURE RESTORATION DIVISION (ERB)
BROOKS AIR FORCE BASE, TEXAS 78235-5328

INSTALLATION RESTORATION PROGRAM (IRP)
BASE-WIDE QUARTERLY GROUND-WATER MONITORING
FINAL SITE SAFETY AND HEALTH PLAN ADDENDUM
FOR
NAVAL AIR STATION FORT WORTH, JOINT RESERVE BASE, CARSWELL FIELD
FORT WORTH, TEXAS 76127-5000

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1.0 INTRODUCTION

This addendum to the original site health and safety plan (SHSP) entitled Installation Restoration Program (IRP) RCRA Facility Investigation Health and Safety Plan, Carswell Air Force Base, Fort Worth, Texas, Law Environmental, Inc., February 1994, has been prepared by Law Environmental, Inc., (LAW) in response to the scope of work for Naval Air Station Fort Worth (NAS Fort Worth), Joint Reserve Base, Texas (formerly Carswell Air Force Base). The revised scope of work was issued under the Air Force Center for Environmental Excellence's (AFCEE) Contract No. F41624-94-D-8050, Delivery Order 0001.

1.1 PLAN OBJECTIVE

The objective of this addendum is to address health and safety requirements for performing base-wide quarterly ground-water monitoring at NAS Fort Worth. The field activities to complete base-wide ground-water monitoring are addressed in this addendum. The primary chemical hazards are those associated with petroleum fuels and their decomposition products. This addendum is to be used in conjunction with the original SHSP.

1.2 OVERVIEW

This addendum will address sites not previously discussed in the original LAW SHSP. The information and requirements of the original LAW SHSP will remain the same for the following topics:

- Site Description and Contaminant Characterization (Section 2.0 of the original SHSP)
- Hazard Assessment/Risk Analysis (Section 3.0 of the original SHSP)
- Accident Prevention (Section 4.0 of the original SHSP)

- Staff Organization, Qualifications, and Responsibilities (Section 5.0 of the original SHSP)
- Training Requirements (Section 6.0 of the original SHSP)
- Personnel Monitoring and Protective Equipment (Section 7.0 of the original SHSP)
- Medical Surveillance (Section 8.0 of the original SHSP)
- Exposure Monitoring/Air Sampling Program (Section 9.0 of the original SHSP)
- Standard Operating Procedures/Engineering Controls and Work Practices (Section 10.0 of the original SHSP)
- Site Control Measures (Section 11.0 of the original SHSP)
- Personal Hygiene and Decontamination (Section 12.0 of the original SHSP)
- Emergency Equipment and First Aid Requirements (Section 13.0 of the original SHSP)
- Logs, Reports, and Record Keeping (Section 15.0 of the original SHSP)

Section 14.0 (Emergency Response and Contingency Procedures) will remain as discussed in Section 14.0 of the SHSP (LAW, 1993), with the exceptions of Dianna Johnson (404) 499-6870 as site manager and John O'Brien (404) 499-6886 as project manager.

Section 16.0 (Site-Specific Concerns) is being replaced by the next section. Section 2 contains the constituents of concern, action levels, and work activities for the Base-wide Quarterly Ground-Water Monitoring Project.

2.0 BASE-WIDE QUARTERLY GROUND-WATER SAMPLING (SOLVENT, PETROLEUM, AND PESTICIDE SITES)

This section presents information and procedures for those monitoring wells selected for quarterly ground-water sampling that are located at sites identified as containing solvents, petroleum, and/or pesticide constituents of concern.

2.1 CONTAMINANT CHARACTERIZATION

The primary constituents of concern at these sites are solvents, pesticides, and/or petroleum fuel constituents. Table 2-1 presents the important properties for each chemical of concern.

2.2 TASK-SPECIFIC HAZARDS

A description of anticipated potential hazards and an evaluation of these hazards is presented in the following subsections.

2.2.1 Potential Hazards

Potential hazards that may be associated with field activities at this site include the following:

- Personnel exposure to organic and inorganic chemicals via inhalation, incidental ingestion, and/or skin contact with ground-water contaminants
- Explosion and/or flammability of contaminants
- Biological hazards (snakes, mosquitoes, ticks)
- Heat or cold stress, depending on season
- Excessive noise level from aircraft

TABLE 2-1

**IMPORTANT PROPERTIES OF CONSTITUENTS OF CONCERN
BASE-WIDE QUARTERLY GROUND-WATER SAMPLING
(SOLVENT, PETROLEUM, and PESTICIDE SITES)
NAS Fort Worth, Texas**

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%)/LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
CLASS: HALOGENATED SOLVENTS								
Tetrachloroethylene	25	50 200 [ST]	500	NC/NC	50	107	9.32	Acute: Irritation of eyes, nose, or throat, nausea, flush face, neck, vertigo, dizziness, incoordination, headache, somnolence, skin erythema Chronic: Kidney and liver damage, carcinogen
Trichloroethylene	50 200 [ST]	50	1000	10.5/8	82	55	9.45	Acute: Headache, vertigo, visual disturbances, nausea, vomiting Chronic: Lung and liver cancer (in animals)
1,2-trans-Dichloroethene	200	200	4000	12.8/5.6	0.085	33	9.65	Acute: Eye and skin irritant, central nervous system depression, dizziness, nausea and vomiting Chronic: Liver and kidney dysfunction
Vinyl chloride	1 5 [C] [Ca]	5 [A1]	NE	33/3.6	4000	3.8	9.99	Acute: Eye and skin irritant, nausea, lightheadedness, dulling of vision and hearing Chronic: Cancer (liver, lung, CNS, lymphatic system), Raymond's phenomenon, liver damage
CLASS: PETROLEUM FUEL CONSTITUENTS								
Benzene	1 5 [ST]	10 [A2]	3000	7.9/1.3	4.68	73	9.24	Acute: Irritation of eyes, nose, or respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis Chronic: Bone marrow depression, carcinogen
Coal tar pitch volatiles (PAHs)	0.2 mg/m ³ [Ca]	0.2 mg/m ³	700 mg/m ³	V	V	V	V	Acute: Dermatitis, bronchitis Chronic: Lung, skin, urinary tract cancers

NOTES: B : Time to reach 1% breakthrough (tested at 1000 ppm, 50% relative humidity, 22°C, and 53 L/min)

C : Ceiling limit

ST : Short term exposure limit

skin: Recognized as having potential for dermal absorption

A2 : Suspected human carcinogen (ACGIH)

Ca : Carcinogen (NIOSH)

FMP : 5 minute maximum peak in any two hours

CP : Combustible in dust or powdered form

NC : Noncombustible solid or liquid

NE : No evidence found for the existence of an IDLH (NIOSH)

NA : Not available

ND/NR : Not relevant

UEL : Upper Explosive Limit

LEL : Lower Explosive Limit

Ukn : Unknown

V : Varies according to compound

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REFERENCES: ACGIH, Threshold Limit Values, 1994-1995.
NIOSH, Pocket Guide to Chemical Hazards, 1990.
OSHA, Permissible Exposure Limits, 29 CFR 1910.1000.

Sittig, Hazardous and Toxic Effects of Industrial Chemicals, 1979.
ATSDR, Toxicological Profiles for Constituents, 1987-1991.

TABLE 2-1

IMPORTANT PROPERTIES OF CONSTITUENTS OF CONCERN
 BASE-WIDE QUARTERLY GROUND-WATER SAMPLING
 (SOLVENT, PETROLEUM, and PESTICIDE SITES)
 NAS Fort Worth, Texas

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%) / LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
Ethyl benzene	100 125 (ST)	100 125 (ST)	2000	6.7/1.0	2.3	84	8.76	Acute: Irritation of eyes, mucous membrane, headache, dermatitis, narcosis, coma Chronic: Liver and kidney damage
Naphthalene	10 15 (ST)	10	500	5.9/0.9	0.084	NA	8.12	Acute: Eye and skin irritant, nausea, vomiting, headache, confusion, sweating, abdominal pain, jaundice, kidney damage Chronic: Kidney damage, cataracts
Toluene	100 150 (ST)	50	2000	7.1/1.2	2.9	94	8.82	Acute: Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis Chronic: CNS effects, brain dysfunction, liver and kidney damage
Xylene (o-,m-,p-isomers)	100 150 (ST)	100 150 (ST)	1000	7.0 / 1.1 (o) / 1.0 (m) / 1.1 (p)	1.1	NA (o) / 99 (m) / NA (p)	8.56 (o) / 8.54 (m) / 8.44 (p)	Acute: Dizziness, excitement, drowsiness, incoordination, staggering gait, irritation of eyes, nose, or throat, eye disorders, anorexia, nausea, vomiting, abdominal pain, dermatitis Chronic: Lung and liver effects
Total Petroleum Hydrocarbons (as gasoline)	300 500 (ST)	300 500 (ST)	NA	NA/NA	0.25	NR	NR	Acute: Irritation of upper respiratory tract, depression of central nervous system, irregular heartbeat, irritation of mucous membrane Chronic: Ukn

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Sittig, Hazardous and Toxic Effects of Industrial Chemicals, 1979.
 ATSDR, Toxicological Profiles for Constituents, 1987-1991.

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 OSHA, Permissible Exposure Limits, 29 CFR 1910.1000.

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 NAS Fort Worth, Texas

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%) / LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
CLASS: PESTICIDES								
Alpha-BHC	NA	NA	1000 mg/m ³	NA/NA	0.088 (water)	NA	NA	Acute: Lung irritation, headache, heart and blood disorders, convulsions Chronic: Liver disease, liver cancer
Beta-BHC	NA	NA	1000 mg/m ³	NA/NA	0.00032 (water)	NA	NA	Acute: Headache, vertigo, convulsions, coma, blood and heart disorders Chronic: Liver and kidney disease, possible mutagenic activity, liver cancer
Carbaryl (Sevin®)	5 mg/m ³	5 mg/m ³	600 mg/m ³	NA/NA	NA	NA	?	Acute: Nausea, vomiting, dizziness, headache, difficulty in breathing, weakness, tremor, blurred vision, convulsions, nasal discharge Chronic: CNS effects, neuropathy
Chlordane	0.5 mg/m ³ [skin]	0.5 mg/m ³ [skin]	5600 mg/m ³ [Ca]	NA/NA	NA	NA	Ukn	Acute: Blurred vision, confusion, ataxia, cough, delirium, abdominal pain, nausea, vomiting, diarrhea, irritability, tremor, convulsions, anuria Chronic: Genotoxicity, decreased fertility (in animals), liver tumors [Ca] in mice
DDT	1 mg/m ³ [skin]	1 mg/m ³	NE [Ca]	Ukn/Ukn	0.35	NA	Ukn	Acute: Movements of the tongue, lips, face, tremor, apprehension, dizziness, confusion, malaise, headache, fatigue, convulsions, vomiting, eye and skin irritant Chronic: Cancer

NOTES: B : Time to reach 1% breakthrough (tested at 1000 ppm, 50% relative humidity, 22°C, and 53 L/min)

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 ATSDR, Toxicological Profiles for Constituents, 1987-1991.

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 NAS Fort Worth, Texas

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%) / LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
Diazinon	NA	0.1 mg/m ³ [skin]	5000	NC/NC	ND	NA	NA	Acute: Moderate organophosphate insecticide toxicity (see malathion for symptoms) Chronic: Minimal toxicity
Dieldrin	0.25 mg/m ³ [skin] [Ca]	0.25 mg/m ³ [skin]	450 mg/m ³	NA/NA	0.041 (water)	NA	NA	Acute: Headache, dizziness, nausea, vomiting, malaise, sweating, limb jerks, convulsions, coma Chronic: Liver and kidney damage in animals, liver cancer in mice
Endosulfan sulfate	0.1 mg/m ³ [skin]	0.1 mg/m ³ [skin]	NE	ND/ND	ND	NA	NA	Acute: Dyspnea, cyanosis, GI distress, hyperactivity, salivation, tremor, convulsions Chronic: Neurotoxicity (EEG changes, brain damage), kidney damage in animals
Endrin	0.1 mg/m ³ [skin]	0.1 mg/m ³ [skin]	2000 mg/m ³	NA/NA	0.28-6.4 mg/m ³	NA	NA	Acute: Muscle twitching, dizziness, confusion, seizures Chronic: Pneumonia, respiratory effects, increased liver enzymes
Heptachlor	0.5 mg/m ³ [skin] [Ca]	0.5 mg/m ³ [skin]	700 mg/m ³	NA/NA	0.3 mg/m ³	NA	?	Acute: Liver toxicity (increased liver weight, increased enzyme levels), hypoactivity, tremors, ataxia, convulsions, EEG changes Chronic: Kidney, adrenal, blood effects, in animals: fetotoxic, carcinogenic

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REFERENCES: ACGIH, Threshold Limit Values, 1994-1995.
 NIOSH, Pocket Guide to Chemical Hazards, 1990.
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Sittig, Hazardous and Toxic Effects of Industrial Chemicals, 1979.
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 (SOLVENT, PETROLEUM, and PESTICIDE SITES)
 NAS Fort Worth, Texas

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%) / LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
Lindane (gamma-BHC)	0.5 mg/m ³ [skin]	0.5 mg/m ³ [skin]	1000 mg/m ³	NA/NA	12 mg/kg (water)	NA	Ukn	Acute: Eye, nose, and throat irritant, headache, nausea, clonic convulsion, respiratory difficulty, cyanosis, aplastic anemia, skin irritant, muscle spasms Chronic: Nausea, spasms, ataxia, blood dyscrasia, aplastic anemia, liver damage
Malathion	10 mg/m ³ [skin]	10 mg/m ³ [skin]	5000 mg/m ³	NA/NA	13.5 mg/m ³	NA	?	Acute: Headache, wheezing, tightness in chest, pinpoint pupils, blurred vision, nausea, vomiting, lacrimation, salivation, diarrhea, tremors, weakness Chronic: Pulmonary edema, dermatitis, decrease cholinesterase levels

NOTES: B : Time to reach 1% breakthrough (tested at 1000 ppm, 50% relative humidity, 22°C, and 53 L/min)

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REFERENCES: ACGIH, Threshold Limit Values, 1994-1995.
 NIOSH, Pocket Guide to Chemical Hazards, 1990.
 OSHA, Permissible Exposure Limits, 29 CFR 1910.1000.

Sittig, Hazardous and Toxic Effects of Industrial Chemicals, 1979.
 ATSDR, Toxicological Profiles for Constituents, 1987-1991.

2.2.2 Hazard Evaluation

The only intrusive activity at this site is ground-water sampling with a potential for exposure to hazardous materials via contaminated ground-water contact.

2.3 CHEMICAL INDICATORS OF HAZARD

Chemical indicators of hazard were selected from the primary constituents of concern at the site based on toxic and hazardous properties. The chemicals that have the greatest potential to cause adverse health effects at the lowest concentrations were selected as indicators in order to establish the most protective action level guidelines during field investigations. Exposure monitoring for the presence of these chemicals will be conducted during all intrusive investigative activities at this site.

Action guidelines for each chemical have been established based on regulatory or guideline exposure limits, or on toxic properties (where exposure limits are not available). These action guidelines will also protect workers from the other constituents anticipated to be encountered at the site.

The chemicals selected to serve as indicators of airborne organic vapor hazards at this site are:

- Benzene
- Naphthalene

2.4 PERSONNEL PROTECTIVE EQUIPMENT

Level D protection will be used initially during nonintrusive field activities, and Modified Level D will be used continuously during intrusive field activities covered by this plan. Skin protection shall be used at all times because some of the constituents of concern (i.e., pesticides) that may be present can be absorbed

through the skin, and because current real-time monitoring technology for the presence of pesticides in ground water is not practical. PPE will be upgraded to Level C and/or Level B, as warranted by the monitoring of site conditions during work, according to the action levels for monitoring equipment described in Section 7.0 of the original SHSP.

2.5 AIR MONITORING

Air monitoring equipment will be used to measure combustible gases, oxygen, and organic vapors during site activities. Air monitoring is not practical for pesticides; however, pesticides dissolved in ground water are unlikely to present an inhalation hazard. Organic vapors, combustible gas, and oxygen levels will be measured at the tops of monitoring wells and in the breathing zone of the worker nearest to the monitoring well during ground-water sampling activities.

The monitoring equipment includes a combustible gas indicator, oxygen monitor, photoionization detector (PID), and detector tubes (Draeger tubes). A combustible gas indicator will be used at sites where methane is a potential contaminant (i.e., landfill and swampy sites). Action levels for the monitoring equipment are presented in Table 2-2.

A 10.2 eV lamp will be used in the PID and the span control will be set at 9.8 (benzene equivalent). Action levels for the PID are A designed to be used in conjunction with the benzene detector tubes (Draeger tubes) and are based on half of the lowest TWA PEL or TLV of the suspected contaminants. Readings for the Draeger tubes for the PID are referenced to above background and reflect those sustained for more than 5 seconds in the breathing zone. If action levels requiring the use of Draeger tubes are reached, Draeger tube monitoring shall be performed every 15 minutes until PID concentrations fall below action levels.

TABLE 2-2

MONITORING EQUIPMENT AND ACTION GUIDELINES
 BASE-WIDE QUARTERLY GROUND-WATER SAMPLING
 (SOLVENT, PETROLEUM, AND PESTICIDE SITES)
 NAS Fort Worth, Texas

EQUIPMENT:	* OXYGEN MONITOR ^{(a)(b)}		COMBUSTIBLE GAS INDICATOR ^(a) (EXPLOSIMETER)		PHOTOIONIZATION METER (PID) AND CHEMICAL-SPECIFIC DETECTOR TUBES ^(c)		
	Oxygen Level	Action	LEL Levels	Action	PID Levels (ppm)	Draeger Tube Benzene Levels (ppm)	Action
	19.5-23.5%	Normal Oxygen Level	0-10%	No explosion hazard	0-1		Modified Level D
	> 23.5%	Fire/Explosion hazard; Stop tasks, evacuate site; notify Site Manager			1-5	and 0-0.5	Modified Level D; begin monitoring for benzene (with 0.5/a Draeger tube) every 15 min.
	< 19.5%	Oxygen deficient; Stop tasks, evacuate site; notify Site Manager; upgrade to Level B	> 10%	Explosive hazard exists; stop tasks; evacuate site; notify Site Manager	5-250	and/or 1-25	Level C
					> 250	and > 25	Stop work; notify COE regarding need to upgrade to Level B

(a) Monitoring to be conducted at top of monitoring well

(b) Used in conjunction with combustible gas indicator to confirm combustible gas indicator function

(c) Monitoring to be conducted in breathing zone of worker nearest to monitoring well; concentrations sustained for 5 min. above background

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