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RELEASE DETERMINATION AND NO FURTHER ACTION REQUEST FOR FORMER
UNDERGROUND STORAGE TANK OFFSITE WEAPONS STORAGE AREA NAS FORT
WORTH TX
6/14/2002
THE ENVIRONMENTAL COMPANY



CARSWELL AFB
TEXAS

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 777



Air Force Base Conversion Agency

Division C Regional Operating Location

Bergstrom AFB, TX

June 14, 2002

Mr. Dennis Rogers
 Texas Natural Resource Conservation Commission
 Petroleum Storage Tank Division-RPR Section
 P. O. Box 13087
 Austin, TX 78711-3087

Subject: No Further Action Request for Former UST Location UST-8514 at Offsite Weapons Storage Area, Former Carswell AFB, Texas

Responsible Party:	U.S. Air Force Base Conversion Agency
Facility Name:	Carswell Offsite Weapons Storage Area
Facility Address:	1100 White Settlement Road
Facility City, State:	Fort Worth, Texas
Facility County:	Tarrant
TNRCC Region:	4
Case Priority	4.2

Attachments

A	Figures
B	Notice of Construction
C	Boring Log and Site-Specific Geology/Hydrogeology
D	Tables
E	Field Sampling Forms, Chain of Custody, and Laboratory Data Sheets
F	Sample Collection and Handling Procedures
G	Quality Assurance/Quality Control Documentation

Dear Mr. Rogers:

The purpose of this letter is to request a No Further Action (NFA) notification from the Texas Natural Resource Conservation Commission (TNRCC) for former underground storage tank (UST) location UST-8514 at the Offsite Weapons Storage Area (WSA), NAS Fort Worth (see Figures 1-1, 1-2, and 1-3 in Attachment A). The notification would provide documentation for purposes of the Offsite WSA property transfer. Characterization of the soils associated with the UST-8514 location was completed as part of the Offsite WSA Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) by the United States Air Force. The Final RCRA Facility Investigation of the Offsite Weapons Storage Area at Naval Air Station Fort Worth, prepared by The Environmental Company, Inc (TEC), was issued to TNRCC Petroleum Storage Tank Division (PSTD) in June 1999. Investigation results showed no evidence of a release or

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environmental contamination at UST-8514. The remainder of the letter summarizes the investigative activities that took place at the UST-8514 location during the RFI and the associated chemistry results. The supporting documentation in this letter was extracted from the Final RFI report.

Investigation Activities Summary

The UST-8514 location formerly contained a 10-foot by 6-foot 1,000-gallon diesel fuel tank used for vehicle fueling. UST-8514 was located approximately 300 feet southwest of Building 8514 (see Figure 2-2 in Attachment A). The tank was removed on an unknown date prior to the RFI. According to TNRCC records, the tank was not registered and no records are available to document the tank removal. However, a TNRCC Construction Notification Form dated August 28, 1990 documents the planned removal of eight USTs at Carswell Air Force Base (AFB) (Attachment B). It is not known whether UST-8514 was included in this removal.

In September 1997, one subsurface soil samples (6 to 8 feet below ground surface [bgs]) and one shallow soil samples (0 to 2 feet bgs) were collected from one borehole (UST-002) (see Figure 3-9 in Attachment C) advanced in the former tank hold pit. Samples at the UST-8514 location were collected to identify contamination associated with a potential release and define the vertical extent of contamination if present. During sampling, all soil samples were screened for volatile vapors by photoionization detection (PID) headspace analyses to pre-select areas of potential contamination, as shown in Figure 2-4, Attachment A.

Soil sample collected for screening and lithologic descriptions were collected continuously through the borehole. Selected samples were analyzed for compounds indicative of contamination from fuel products. Therefore, analyses included benzene, toluene, ethylbenzene, and xylene (BTEX); polycyclic aromatic hydrocarbons (PAHs); and total petroleum hydrocarbons (TPH), in accordance with TNRCC Petroleum Storage Tank Division (PSTD) guidance RG-175.

Investigation Results

During the field investigation, TEC identified disturbed soil presumed to be fill material from surface to bedrock at the UST location. The geologic log for borehole UST-002 and a summary of site-specific geology and hydrogeology is provided in Attachment C. The combination of fill to bedrock and shallow depth to bedrock indicates that the tank was placed directly on bedrock in a shallow excavation.

The PID screening results are shown on the borehole log in Attachment C. Four PID readings were collected every 2 feet, with the last one measured at the 6 to 7 feet bgs interval, which is the interface of the tank hold pit and limestone (Figure 2-4, Attachment A). The PID reading was highest in the top 2 feet of soil (100 ppm) and decreased to 10.2 to 14.7 ppm in the 2 to 6 feet bgs interval. The last reading collected in the 6 to 7 feet bgs interval showed a level of 44.8 ppm. Based on these results, samples for laboratory analysis were collected from the intervals with the two highest PID readings because they would likely reflect the worst-case conditions. In addition, the sample collected from the 6 to 7 feet bgs interval would provide the most useful information in determining whether a release occurred because it was collected at the base of the tank hold pit where the limestone begins.

Table D-1 in Attachment D provides a summary of sample chemistry results for borehole UST-002. Analytical results for field blanks associated with the UST-002 samples are shown in Table D-2. Field sampling forms, chain of custody, and laboratory data sheets are provided in Attachments E and F.

As shown in Table D-1, the presence of petroleum related compounds at former UST-8514 was limited to the 0 to 2 feet bgs soil sample located 5 feet from a dirt service road used by vehicles

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(see Figure 2-2, Attachment A). Benzo (a) pyrene was the only compound detected in the borehole samples. It was detected at a concentration of 0.014 mg/kg, which is well below the TNRCC Plan A Target Concentration of 0.0877 mg/kg. After extensive discussions with TNRCC and U.S. EPA Region VI, it was determined during the RFI that the presences of the low-levels PAHs on the surface of the Offsite WSA were attributable to vehicle-related pollutants transported to the investigation areas via runoff, rather than a release. The lower subsurface sample, collected from 6 to 8 feet bgs, did not contain PAHs. No other compounds were detected in the UST-8514 samples.

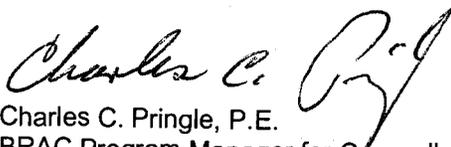
Groundwater was not encountered during assessment of the UST-8514 location. In addition, the Paluxy aquifer, which is the principal source of groundwater in the vicinity of the Offsite WSA (see Attachment C), was shown not to be impacted during the Offsite WSA RFI. The Walnut Formation aquitard, which is 25 to 30 feet thick, is present between the tank hold location and the aquitard and the water level in the aquifer is another 25 feet below the Walnut Formation (see Figure 2-3 in Attachment C).

Conclusions and Recommendations

Because of the lack of UST-related contamination, it is assumed that no release had occurred from UST-8514. Based on these results, no further action with respect to the Texas Administrative Code (TAC) 334 regulations appears to be warranted.

With the findings discussed in this summary and supporting documentation, the Air Force requests TNRCC concurrence with the recommendations and conclusions provided herein and a letter approving NFA status for the former UST location UST-8514. If after reviewing the enclosed material you have any questions, please contact TEC at 425-453-4040 or me at 210-536-4477.

Sincerely,



Charles C. Pringle, P.E.
BRAC Program Manager for Carswell
Base Conversion Restoration Division

Enclosures

cc: TNRCC Region 4 PSTD (1 copy)
The Environmental Company (1 copy)



Air Force Base Conversion Agency

Division C Regional Operating Location

Bergstrom AFB, TX

June 14, 2002

PSJ

Mr. Dennis Rogers
 Texas Natural Resource Conservation Commission
 Petroleum Storage Tank Division-RPR Section
 P. O. Box 13087, MC-137
 Austin, TX 78711-3087

Subject: Resubmittal of No Further Action Request for Former UST Location UST-8514 at Offsite Weapons Storage Area, Former Carswell AFB, Texas

Responsible Party:	U.S. Air Force Base Conversion Agency
Facility Name:	Carswell Offsite Weapons Storage Area
Facility Address:	1100 White Settlement Road
Facility City, State:	Fort Worth, Texas
Facility County:	Tarrant
TNRCC Region:	4
Case Priority	4.2

Dear Mr. Rogers:

1. Please find enclosed two resubmitted copies of the revised completed Release Determination Report Form with required attachments for underground storage tank (UST) location UST-8514, located at the Offsite Weapons Storage Area (WSA), Naval Air Station (NAS) Fort Worth Joint Reserve Base (JRB), Carswell AFB, TX.
2. The resubmitted reports are provided in response to the TNRCC's May 24, 2002 review of the Release Determination Report dated May 25, 2001 and provides the additional material required for TNRCC's evaluation of the site. Each resubmitted package contains the additional following materials:

- TNRCC PSTD Release Determination Report Form
- Attachment F: Summary of Sample Collection and Handling Procedures
- Attachment G: Quality Assurance/Quality Control Documentation
- The report has been revised to clarify the location of the soil boring. Figure 3-9, which identifies the location of the soil boring, has been relocated into Attachment C.

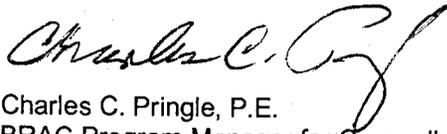
3. If there are any questions regarding this letter or the documents provided, please contact me at (210) 536-4477.

Received

JUL 08 2002

TNRCC/PST-RPR

Sincerely,

A handwritten signature in black ink, appearing to read "Charles C. Pringle". The signature is fluid and cursive, with a large, stylized initial "C" and "P".

Charles C. Pringle, P.E.
BRAC Program Manager for Carswell
Base Conversion Restoration Division

Enclosures

cc: TNRCC- Region 4 PSTD (1 copy)
TEC-Jason Strayer (1 copy)

Robert J. Huston, *Chairman*
 R. B. "Ralph" Marquez, *Commissioner*
 Kathleen Hartnett White, *Commissioner*
 Jeffrey A. Saitas, *Executive Director*



TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

September 30, 2002

Responsible Party: US Air Force Base Conversion Agency

Address: 3207 Sidney Brooks City: Brooks AFB

State: Texas Zip: 78235

Facility: UST 8514- Carswell AFB Facility ID No.: N/A

Address: 1100 White Settlement Rd City: Ft. Worth Region: 4

The attached *Release Determination Report* has been found to be incomplete and is being returned, for the reason(s) listed below. We are unable at this time to issue a letter concurring with your consultant that this site is not a leaking storage tank site. Should you wish to receive such a letter, additional information is necessary to fully evaluate the site for potential contamination.

- Provide laboratory documentation indicating temperature at which samples were received.
- Provide signed and dated laboratory Chain of Custody documentation for all samples. The Chain of Custody should be signed and dated by the person receiving the samples.
- Signature(s) missing from Section G - the Release Determination Report form must be signed by either the Licensed On-Site Supervisor or, the CAS and Project Manager.

Please revise and **resubmit with the entire original report** to the Central Office in Austin (include MC 137 in the mailing address listed below). Please contact the PST Responsible Party Remediation Section, Remediation Division at 512/239-2200 should you have any questions.

UST8514.rtn.psj

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Release Determination Report

And

No Further Action Request for
Former Underground Storage Tank

Location UST-8514

Offsite Weapons Storage Area

NAS Fort Worth JRB, Carswell AFB, TX

Contract No. F41624-95-8002
Delivery Order 0009
May 25, 2001

Resubmittal: June 14, 2002

Received
JUL 08 2002
TNRCC/PST-RPR



Air Force Center for Environmental Excellence
3207 Sidney Brooks
Brooks AFB, Texas 78235-5344

C108



Release Determination Report

And

No Further Action Request for
Former Underground Storage Tank

Location UST-8514

Offsite Weapons Storage Area

NAS Fort Worth JRB, Carswell AFB, TX

Contract No. F41624-95-8002
Delivery Order 0009
May 25, 2001

Resubmittal: June 14, 2002

Received
JUL 08 2002
TNRCC/PST-RPR



Air Force Center for Environmental Excellence
3207 Sidney Brooks
Brooks AFB, Texas 78235-5344

c108

**TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
PETROLEUM STORAGE TANK
CORRESPONDENCE IDENTIFICATION SHEET**

Date: 6/14/02 LPST ID No.: _____
 Site Name: Carswell AFB WSA UST 8514 Facility ID No.: N/A
 Site Address: 1100 White Settlement Road, Fort Worth, TX

This checklist **must** accompany all correspondence submitted to the RPR Section and should be affixed to the front of your submittal as a cover page. Please check the appropriate box for the type of correspondence which you have submitted to the RPR Section. Check all boxes that apply if you are submitting more than one type of correspondence. If you cannot find an appropriate category, please complete the "other" section.

PROPOSALS		
<input type="checkbox"/> Initial Abatement (1)	<input type="checkbox"/> Tank Removal (2)	<input type="checkbox"/> Excavation (3)
<input type="checkbox"/> Waste Treatment (4)	<input type="checkbox"/> Site Assessment (5)	<input type="checkbox"/> Aquifer Testing (6)
<input type="checkbox"/> VES/Sparge Testing (7)	<input type="checkbox"/> Qtrly. GW Monitoring (8)	<input type="checkbox"/> CAP Prep. (9)
<input type="checkbox"/> GW Extrac./Treatment (10)	<input type="checkbox"/> Soil Vapor Extrac. (11)	<input type="checkbox"/> Operation & Main. (12)
<input type="checkbox"/> Site Closure (13)	<input type="checkbox"/> Plan A Risk Ass. (14)	<input type="checkbox"/> Plan B Risk Ass. (15)
<input type="checkbox"/> Semi-annual GW Mon. (16)*	<input type="checkbox"/> Annual GW Mon. (18)	<input type="checkbox"/> Product Recovery (19)
<input type="checkbox"/> Other proposal _____		

REPORTING FORMS	
<input type="checkbox"/> Assessment Report Form (TNRCC-0562)	<input checked="" type="checkbox"/> Release Report Form (TNRCC-0621)
<input type="checkbox"/> Product Recovery Report Form (TNRCC-0016)	<input type="checkbox"/> Monitoring Event Summary and Status Report (TNRCC-0013)
<input type="checkbox"/> Site Closure Request Form (TNRCC-0028)	<input type="checkbox"/> Final Site Closure Report Form (TNRCC-0038)
<input type="checkbox"/> Other form _____	

REPORTS		
<input checked="" type="checkbox"/> Tank Closure/Removal	<input type="checkbox"/> Plan A Risk Assessment	<input type="checkbox"/> Annual Groundwater Monitoring
<input type="checkbox"/> O&M/Performance Mon.	<input type="checkbox"/> Plan B Risk Assessment	<input type="checkbox"/> CAP Installation/Modification
<input type="checkbox"/> Property Divestiture/Phase I ESA	<input type="checkbox"/> Corrective Action Plan (CAP)	<input type="checkbox"/> Aquifer/Pilot Test Results

MISCELLANEOUS	
<input type="checkbox"/> Off-site access assistance	<input type="checkbox"/> Deadline Extension Request
<input type="checkbox"/> Tank tightness test results	<input type="checkbox"/> Request for State-Lead
<input type="checkbox"/> Request for LPST Waste Code	<input type="checkbox"/> Class V Reinjection Request
<input type="checkbox"/> Notice to Owner/Operator for CAS Services	<input type="checkbox"/> Petroleum-Substance Waste Manifest
<input type="checkbox"/> Underground Storage Tank Registration Form	<input type="checkbox"/> Aboveground Storage Tank Registration Form
<input type="checkbox"/> Other (anything that does not fit into one of the categories above) _____	

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 JUL 08 2002
 TNRCC/PST-RPR

* The proposal for semi-annual monitoring and annual report (Proposal Activity 17) has been discontinued. For semi-annual monitoring, use Proposal Activity 16.

I attest that all work has been conducted in accordance with accepted industry standards/practices and adhered to TNRCC guidance and rules. I certify that I am aware that misrepresentation of any of the above claims is a violation of 30 TAC 334.453(b)(1)(E) and that this violation may result in the disciplinary actions set forth in 30 TAC 334.453 and or 334.463 and 334.465.

If a proposal is attached for preapproval, has the proposed work, in part or in whole, already been performed or in progress? Yes No

If yes, what work? _____

(Registered Corrective Action Specialist) (RCAS Reg. No.) (Expiration date)

(Signature) (Date)

(Telephone #) (FAX #)

(Project Manager) (CAPM Reg. No.) (Expiration date)

(Signature) (Date)

(Telephone #) (FAX #)

By signature below, I certify that documents checked above are included.

Mr. Charles C. Pringle, P.E.
(Name of Responsible Party Contact)

USAF HQAFCEE
(Company)

Charles C. Pringle
(Signature)

7-1-2002
(Date)

(210) 536-4477
(Telephone #)

(210) 536-3609
(FAX #)

Received
JUL 08 2002
TNRCC/PST-RPR

RELEASE DETERMINATION REPORT FORM

Owners and operators must report releases by phone to the appropriate TNRCC Region Office within 24 hours of confirmation. The owner and operator should use this form to comply with the reporting requirements in Title 30, Texas Administrative Code §334.77(b). Submit the completed form within 20 days after release confirmation. EXCEPT IN EMERGENCIES, THE TNRCC WILL INITIATE ACTION ON THIS CASE ONLY WHEN THE COMPLETED FORM (pages 6 through 15) IS SUBMITTED WITH ATTACHMENTS TO BOTH THE APPROPRIATE TNRCC REGIONAL OFFICE AND TO THE CENTRAL OFFICE IN AUSTIN (PST Division, MC 137, P.O. Box 13087, Austin, Texas 78711-3087). **DO NOT MODIFY THIS FORM IN ANY WAY. Complete all applicable blanks.** Incomplete forms will be returned without review. All proposals for the next appropriate corrective action activity must be submitted by a CAS and PM in the format outlined in the guidance document entitled *Preapproval for Corrective Action Activities* (RG-111).

SUMMARY

Based on the information obtained during this release determination and by comparing the contaminant levels to the stated action levels, check **one** of these four items as appropriate:

- This was a suspected release. No contamination was detected due to this suspected release.
- This site is an LPST site. Contaminant levels exceed action levels (or one of the other criteria applies).
- This site is **not** an LPST site. Contaminant levels do not exceed action levels (and none of the other criteria applies).
- This site is **not** an LPST site. No contamination was detected (and none of the other criteria applies).

IF THIS SITE IS AN LPST SITE, COMPLETE THE REMAINDER OF THIS FORM (except Section B). If this site is not an LPST site, stop here and complete Sections A, C, and G (and Section B if applicable) of the attached form.

Check here if this site is an existing LPST case and this Release Determination Report is being submitted only as the tank removal-from-service documentation.

Answer the following questions in this Summary Section if this is an LPST case and if the CAS and PM sign the form in Section G. This section is to be completed by a CAS and PM only. If the form is completed by someone other than a CAS and PM, leave the rest of this Summary Section blank and go to Section A.

Is this case eligible for reimbursement of necessary corrective actions? YES NO If not, appropriate corrective action in accordance with applicable rules and guidance may continue without specific direction or approval from the PST Division, however, coordination with the PST Division is recommended. If the site is eligible for reimbursement, all corrective action activities, with the exception of NAPL recovery and emergency abatement activities, must be preapproved prior to initiation.

The next appropriate step for this site, if it is an LPST site, is (check one only):

- Case closure** If checked, attach *Site Closure Request Form* (TNRCC-0028). Please be sure the site meets all requirements for closure prior to submitting the *Site Closure Request Form*. Are there costs associated with case closure? **G YES G NO** If YES, and if the site is eligible for reimbursement, attach a cost proposal and workplan with the *Site Closure Request Form*.
- Risk-Based Assessment** The risk-based assessment is needed only when the existing assessment data is not an adequate basis for site closure. Please critically evaluate the need for additional assessment before selecting this option. Refer to pamphlet RG-175 for guidance on conducting the risk-based assessment. Attach a detailed workplan and proposal if the site is eligible for reimbursement. A proposal must be submitted with this form if the RP is financially able to undertake necessary corrective actions.
- Corrective action other than risk-based assessment** Attach a detailed workplan and proposal if the site is eligible for reimbursement and the RP is financially able to undertake necessary corrective actions.

Is the responsible party financially able to complete the next appropriate step? YES NO If Yes, attach proposal as specified above. If No, contact the PST Division at 512/239-2200 to request information on the State-Lead option. Financial ability determination forms must be completed and submitted to document that the RP is financially unable to continue necessary corrective actions.

A. GENERAL INFORMATION

LPST ID No.: _____ (If known) TNRCC Region: 4 Priority: 4.2 (see pages 13-15)

Facility ID No.: _____ Required unless one of the following applies:

Check here if tank registration is not required for this site (per 30 TAC §334.7), and check one of the following as applicable:

- the tank(s) are partially excluded or exempted from jurisdiction under 30 TAC Chapter 334. Specify type or usage of tank(s): _____
- the tank(s) were permanently removed from the ground before May 8, 1986 (provide date of removal _____);
- the tank(s) remained in the ground but were emptied, cleaned, and filled with inert substance before January 1, 1974 (provide date of activities: _____);
- the tank(s) were out of operation, their existence was unknown, and they were permanently removed from service within 60 days of their discovery (provide date of discovery: _____ Describe method of discovery: _____
According to TNRCC records, UST-8514 was not registered. No records exist that document tank removal; however, during the RCRA Facility Investigation conducted at the Offsite WSA, it was confirmed that the tank had been previously removed.)

Prior to this investigation, was this site ever an LPST site? YES or NO If yes, provide LPST ID number: _____

Tank Owner: **U.S. Air Force Base conversion Agency (AFBCA)**

Tank Owner Mailing Address: **3207 Sidney Brooks**

Tank Owner City: **Brooks AFB** State: **TX** Zip: **78235**

Tank Owner Contact Person: **Charles C. Pringle** Phone: **(210) 536-4477** Fax no.: **(210) 536-3609**

Tank Operator (if different from tank owner): _____

Tank Operator Mailing Address: _____

Tank Operator City: _____ State: _____ Zip: _____

Tank Operator Contact Person: _____ Phone: _____ Fax no.: _____

Land Owner (if different from tank owner and operator): _____

Land Owner Mailing Address: _____

Land Owner City: _____ State: _____ Zip: _____

Land Owner Contact Person: _____ Phone: _____ Fax no.: _____

If this site is an LPST site, which of these parties will oversee the corrective actions at this site?

Tank Owner Tank Operator Land Owner

Other (not the contractor or consultant): Name: _____

Address: _____

City: _____ State: _____ Zip: _____ Contact person: _____

Phone: _____ Fax: _____

A representative of the party overseeing the corrective action must sign this form in Section G. Please note that no matter which party conducts corrective action, the tank owner and the tank operator are jointly responsible for the necessary corrective actions.

Facility Name: **Carswell AFB, Offsite Weapons Storage Area UST-8514**

A. GENERAL INFORMATION

Facility Physical Address: **1100 White Settlement Road**

Facility City: **Fort Worth** County: **Tarrant** County Code (see p. 16): **220**

INDICATE TYPE OF RELEASE: (check one) Suspected Confirmed but below action levels (not an LPST site)
 Confirmed and above action levels (LPST site) No evidence of contamination (all results below detection limits)

Please refer to flowchart and Title 30 Texas Administrative Code, §334.71 - 334.77 for descriptions and procedures for suspected and confirmed releases.

Were copies of this **COMPLETED** form (excluding pages 1 through 5) **AND APPROPRIATE ATTACHMENTS**, including a proposal (if RP is financially able), sent to **both** the TNRCC Central Office and to the Region Office? **YES** **NO** (IF THE FORM IS NOT COMPLETE, THIS DOCUMENT WILL BE RETURNED WITHOUT REVIEW).

Indicate number of tanks currently and formerly located at this site (attach pages as necessary):

	Type (UST/AST)	Product Type	Size (approx. gal)	Date Removed from Service
Current:	_____	_____	_____	
	_____	_____	_____	
	_____	_____	_____	
	_____	_____	_____	
Former:	UST	Diesel	1,000	
	_____	_____	_____	
	_____	_____	_____	
	_____	_____	_____	
	_____	_____	_____	

B. SUSPECTED RELEASE INFORMATION

Complete only this section and sections E through G as appropriate when the situation of a suspected release has occurred and it was documented that a release had not occurred.

Date suspected release discovered: _____ Reason release suspected: _____

Date suspected release reported to TNRCC: _____ Reported to: _____

Possible source(s) of release: (check all that apply) Tanks: USTs ASTs Piping Overfills/spills Unknown
 Other: _____

Type of substance(s) suspected released: (check all that apply) Gasoline Diesel Used Oil Aviation Gasoline
 Jet Fuel (type: _____) Alcohol-blended fuel (Type and percentage of alcohol: _____)
 Other: (be specific) _____

Were UST/AST system tank and/or line tightness tests performed? **YES** or **NO** (check one) If yes, attach test data and results.
 Did the tests indicate that all tanks and piping were tight? **YES** or **NO** (check one) If No, specify the portion of the tank system(s) that were found not to be tight: _____

Were any repairs conducted on the tank system(s)? YES or NO (check one) If yes, describe type(s) and location of repairs:

Were tightness tests performed after repairs were conducted? YES or NO (check one) If yes, attach test data and results.

Did the tests indicate that the repaired items were tight? YES or NO If No, specify the portion of the tank system(s) that were found not to be tight:

Were any soil confirmation samples collected? YES or NO (check one) If yes, were all potential source areas investigated? YES or NO If samples were collected, attach descriptions of sample locations, collection methods, and laboratory results.

Were any groundwater confirmation samples collected? YES or NO (check one) If yes, were all potential source areas investigated? YES or NO If samples were collected, attach descriptions of sample locations, collection methods, aquifer name, and laboratory results. (Groundwater sampling is not required at this point unless there is reasonable suspicion of impact.)

C. CONFIRMED RELEASE INFORMATION
Complete this section only if a release was confirmed.

Date release confirmed: _____ Date release reported to TNRCC: _____ Reported to: _____

Is this the first release from a UST or AST discovered at this site? YES NO

Is there any other contamination or potential impacts to human health from any source other than the tank systems at this site? YES NO If yes, indicate type and location of contamination:

Reported to TNRCC by: _____ Representing: _____

Method of release discovery:

- Samples collected during tank removal-from-service activities Impact to utility line
- Samples collected during other tank system construction activities Impact to surface water
- Samples collected during release determination investigation Impact to water well
- Other: _____

Method of release confirmation: (check all that apply)

- Soil samples Groundwater samples Surface water samples Documentation of presence of NAPL

Source(s) of release: (check all that apply) Tanks: USTs ASTs Piping Overfills/spills Unknown

Other: _____

Substance(s) released: (check all that apply) Gasoline Diesel Used Oil Aviation Gasoline

Alcohol-blended fuel (Type and percentage of alcohol: _____)

Jet Fuel (type: _____) Other: (be specific) _____

Amount of product released: _____ Chemical Abstract Service registry #: _____ (for hazardous substances)

Were any soil confirmation samples collected? YES or NO (check one) If yes, attach descriptions of sample locations, collection methods and laboratory results.

Type of native soil: (check one) Clay or silt Sand, gravel or rock

Were any groundwater confirmation samples collected? YES or NO (check one) If yes, attach descriptions of sample locations, collection methods, aquifer name, and laboratory results.

Known Impact(s): (check all that apply) Soil GW Surface Water Subsurface Utilities - type: _____

Buildings Water wells Other sensitive receptors:

Was the land owner (if different from the tank owner) notified of the contamination? YES or NO (check one) If Yes, attach copy of the letter which provided the notification. If No, documentation that notification was provided must be submitted within 30 days from the date the impact is discovered.

Possibly Threatened: (check all that apply) GW Surface Water Subsurface Utilities - type: _____

Buildings Water wells Other sensitive receptors:

Was NAPL detected (greater than 0.01 feet)? YES or NO (check one) If yes, describe how and where it was detected, the thickness detected, and the recovery actions taken: _____

D. ABATEMENT MEASURES
Were abatement measures initiated to stop the release or to recover the released substance? <input type="checkbox"/> YES or <input type="checkbox"/> NO (check one) If yes, describe the abatement and/or recovery measures taken and the dates and duration of the activities: <u>N/A</u>
Were UST/AST system tank and/or line tightness tests performed? <input type="checkbox"/> YES or <input type="checkbox"/> NO (check one) If yes, attach test results. Did the tests indicate that all tanks and piping were tight? <input type="checkbox"/> YES or <input type="checkbox"/> NO If No, specify the portion of the tank system(s) that were found not to be tight: <u>N/A</u>
Were any repairs conducted on the tank system(s)? <input type="checkbox"/> YES or <input type="checkbox"/> NO (check one) If yes, describe type(s) and location of repairs: <u>N/A</u>
Were tightness tests performed after repairs were conducted? <input type="checkbox"/> YES or <input type="checkbox"/> NO (check one) If yes, attach test results. Did the tests indicate that the repaired items were tight? <input type="checkbox"/> YES or <input type="checkbox"/> NO If No, specify the portion of the tank system(s) that were found not to be tight: <u>N/A</u>

E. FIRE/OTHER OFFICIALS																
Were any other officials notified? <input type="checkbox"/> YES <input type="checkbox"/> NO (check one) If Yes, indicate:																
<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black; width: 25%;"><u>Name</u></th> <th style="text-align: left; border-bottom: 1px solid black; width: 25%;"><u>Representing</u></th> <th style="text-align: left; border-bottom: 1px solid black; width: 25%;"><u>Phone number</u></th> <th style="text-align: left; border-bottom: 1px solid black; width: 25%;"><u>Date(s) Notified</u></th> </tr> </thead> <tbody> <tr> <td style="border-bottom: 1px solid black;"> </td> </tr> <tr> <td style="border-bottom: 1px solid black;"> </td> </tr> <tr> <td style="border-bottom: 1px solid black;"> </td> </tr> </tbody> </table>	<u>Name</u>	<u>Representing</u>	<u>Phone number</u>	<u>Date(s) Notified</u>												
<u>Name</u>	<u>Representing</u>	<u>Phone number</u>	<u>Date(s) Notified</u>													
Were any directives issued by the fire or other officials? G YES G NO If Yes, describe directives and actions taken in response to the directive:																
_____ _____																

F. WASTE DISPOSITION																
Indicate the status of all wastes and other materials generated:																
<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black; width: 30%;"><u>Type of waste (soil, water, product)</u></th> <th style="text-align: left; border-bottom: 1px solid black; width: 15%;"><u>Quantity</u></th> <th style="text-align: left; border-bottom: 1px solid black; width: 25%;"><u>Current location</u></th> <th style="text-align: left; border-bottom: 1px solid black; width: 30%;"><u>Method and location of disposal or treatment</u></th> </tr> </thead> <tbody> <tr> <td style="border-bottom: 1px solid black;"><u>N/A</u></td> <td style="border-bottom: 1px solid black;"> </td> <td style="border-bottom: 1px solid black;"> </td> <td style="border-bottom: 1px solid black;"> </td> </tr> <tr> <td style="border-bottom: 1px solid black;"> </td> </tr> <tr> <td style="border-bottom: 1px solid black;"> </td> </tr> </tbody> </table>	<u>Type of waste (soil, water, product)</u>	<u>Quantity</u>	<u>Current location</u>	<u>Method and location of disposal or treatment</u>	<u>N/A</u>											
<u>Type of waste (soil, water, product)</u>	<u>Quantity</u>	<u>Current location</u>	<u>Method and location of disposal or treatment</u>													
<u>N/A</u>																

G. REPORT PREPARATION

A Licensed On-Site Supervisor may complete and sign this form when the supervisor is acting in an approved capacity for tank removal-from-service or tank system repair activities.

Licensed On-Site Supervisor: _____ ILP Reg. No.: _____ Exp. Date: _____

Company: _____

Telephone No.: _____ FAX No.: _____

Based on the results of the site investigation and the additional information presented herein, I certify that the site investigation activities performed either by me, or under my direct supervision, including subcontracted work, were conducted in accordance with accepted industry standards/practices and further, that all such tasks were conducted in compliance with applicable TNRCC published rules, guidelines and the laws of the State of Texas. I have reviewed the information included within this report, and consider it to be complete, accurate and representative of the conditions discovered during the site investigation. I acknowledge that if I intentionally or knowingly make false statements, representations, or certifications in this report, I may be subject to administrative, civil, and/or criminal penalties.

Signature: _____ Date: _____

OR

Project Manager: _____ PM Reg. No.: _____ Exp. Date: _____

Company: _____

Telephone No.: _____ FAX No.: _____

Based on the results of the site investigation and the additional information presented herein, I certify that the site investigation activities performed either by me, or under my direct supervision, including subcontracted work, were conducted in accordance with accepted industry standards/practices and further, that all such tasks were conducted in compliance with applicable TNRCC published rules, guidelines and the laws of the State of Texas. I have reviewed the information included within this report, and consider it to be complete, accurate and representative of the conditions discovered during the site investigation. I acknowledge that if I intentionally or knowingly make false statements, representations, or certifications in this report, I may be subject to administrative, civil, and/or criminal penalties.

PM Signature: _____ Date: _____

AND

CAS Representative: _____ CAS Reg No.: _____ Exp. Date: _____

Company: _____

Telephone No.: _____ FAX No.: _____

By my signature affixed below, I certify that I am the duly authorized representative of the Correction Action Specialist named and that I have personally reviewed the site investigation results and other relevant information presented herein and considered them to be in accordance with accepted standards/practices and in compliance with the applicable TNRCC published rules, guidelines and the laws of the State of Texas. Further, that the information presented herein is considered complete, accurate and representative of the conditions discovered during the site investigation. I acknowledge that if I intentionally or knowingly make false statements, representations, or certifications in this report, I may be subject to administrative, civil, and/or criminal penalties.

Signature of CAS Representative: _____ Date: _____

If the CAS or On-Site Supervisor does not complete and sign this form, provide the following information on the person who has prepared the form:

Name: **Charles C. Pringle** Company: **USAF HQ AFCEE**

Telephone No.: **(210) 536-4477** FAX No.: **(210) 536-3609**

Signature: *Charles C. Pringle* Date: **7-01-2002**

Name of Tank Owner or Operator contact: **Mr. Charles C. Pringle, P.E.**

Telephone No.: **(210) 536-4477** FAX No.: **(210) 536-4477**

By my signature affixed below, I certify that I have reviewed this report for accuracy and completeness of information regarding points of contact and the facility and storage tank system history and status. I acknowledge that if I intentionally or knowingly make false statements, representations, or certifications in this report related to the contact information, and the facility and storage tank system history and status information, I may be subject to administrative, civil, and/or criminal penalties. I attest that I have reviewed this report for accuracy and completeness. I understand that I am responsible for addressing this matter.

Signature: _____ Date: _____

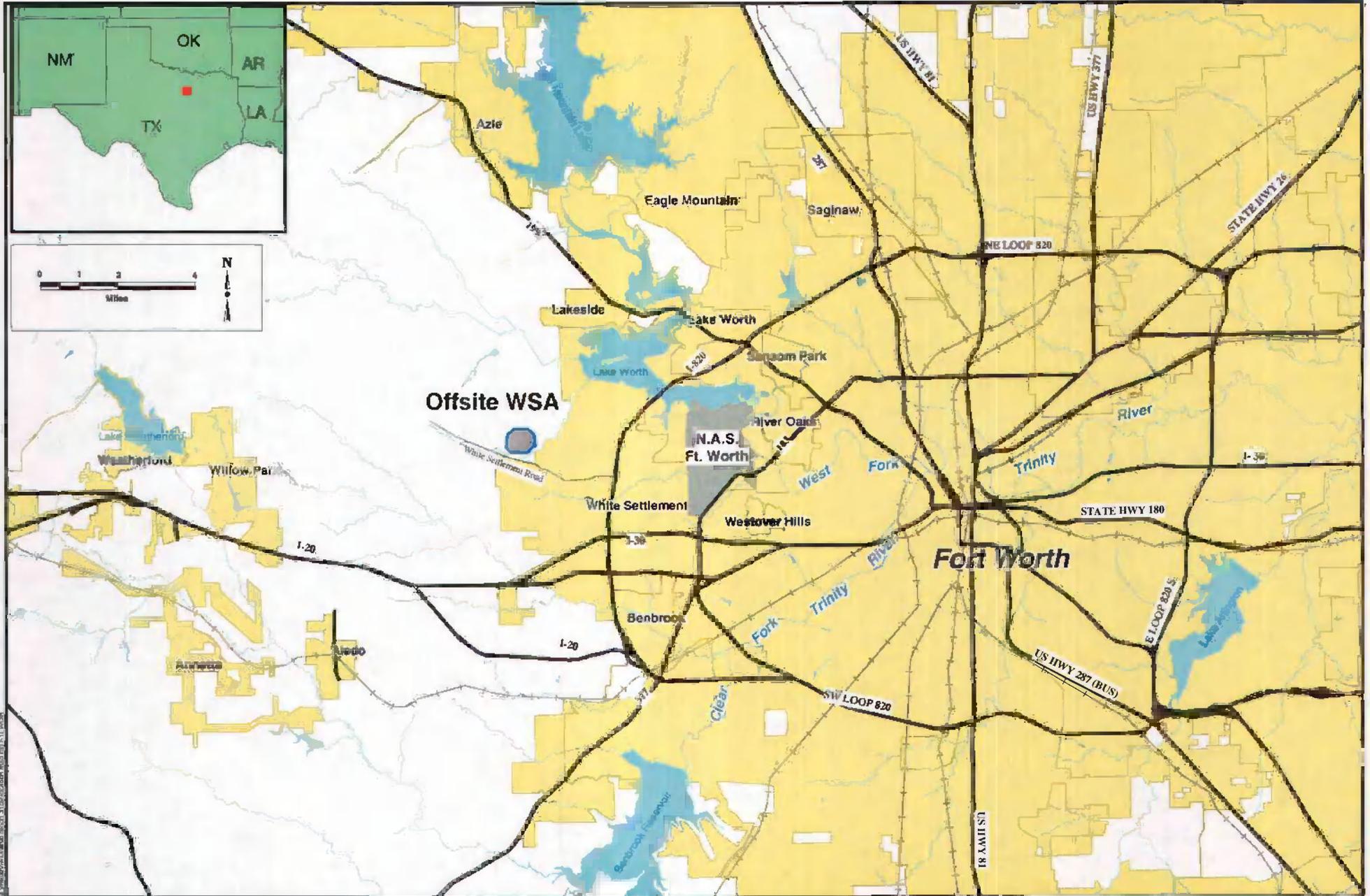


Figure 1-1 -- Location Map

Creation Date: 12/01/1997
 Rev. Date: 05/17/1999
 Project Manager: B. Duffner
 Prepared By: W. Mitchell
 Project No: P-3109

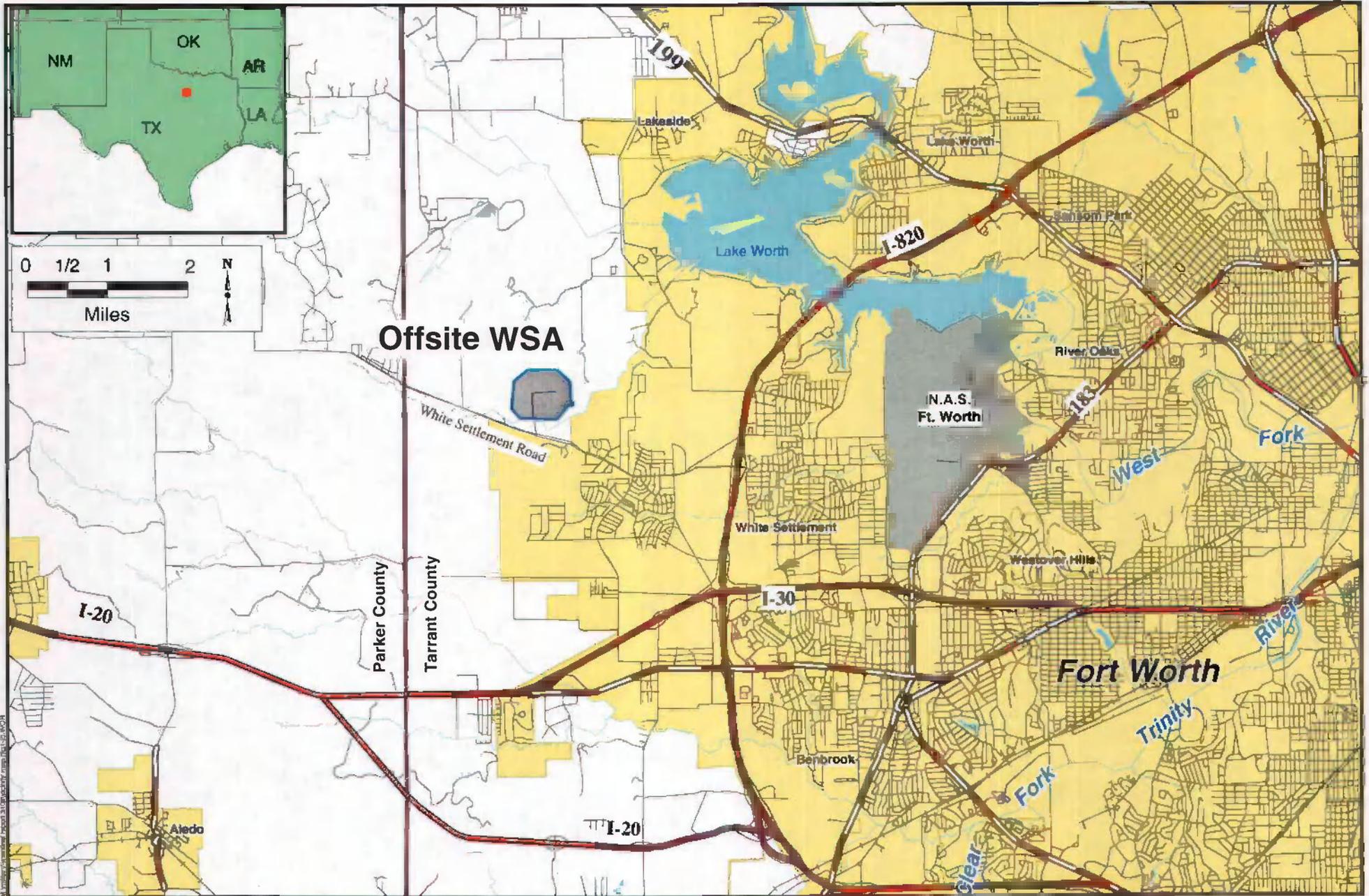
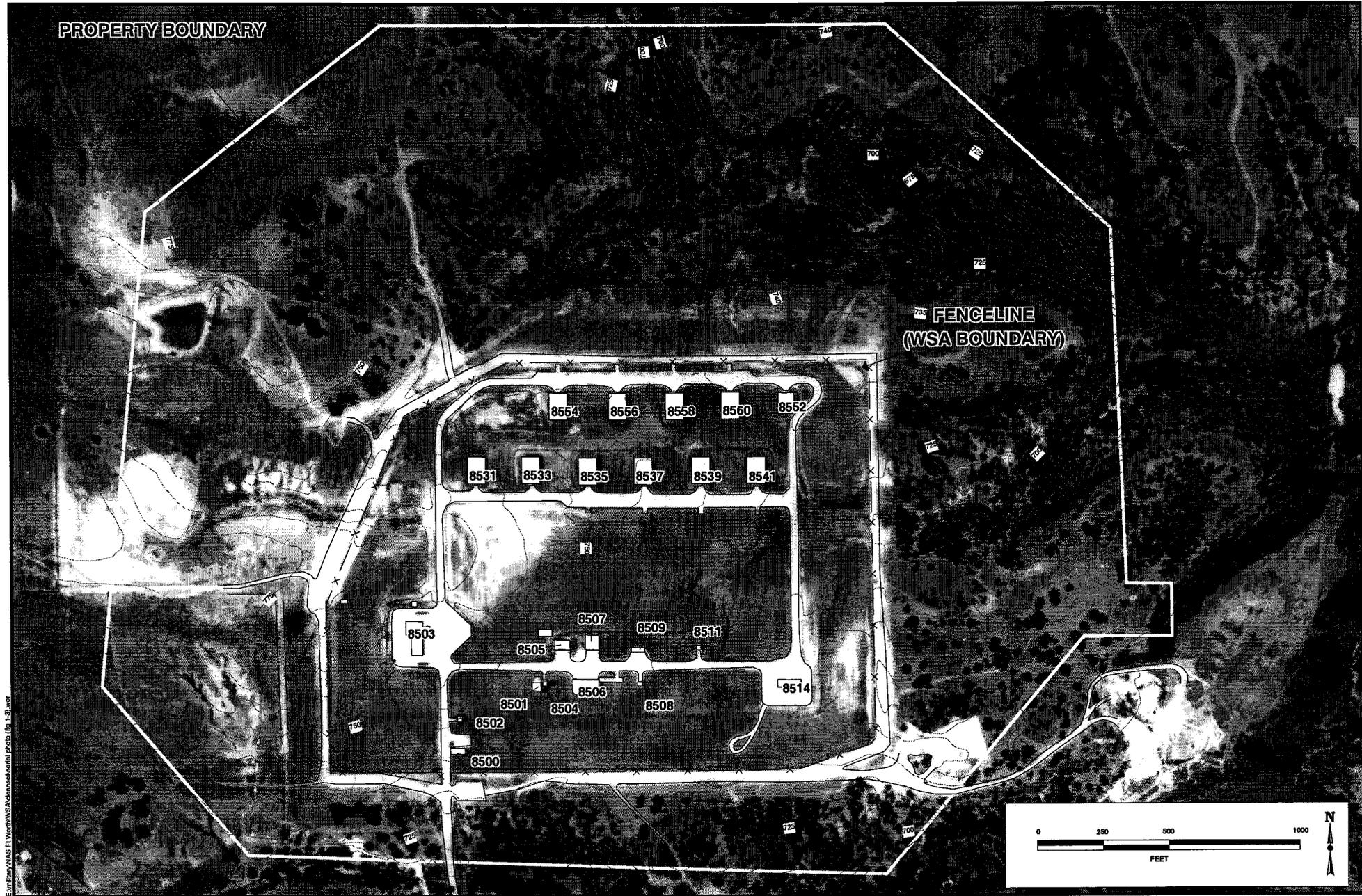


Figure 1-2 -- Vicinity Map

Creation Date: 12/01/1997
 Rev. Date: 05/17/1999
 Project Manager: B. Duffner
 Prepared By: W. Mitchell
 Project No: P-3109

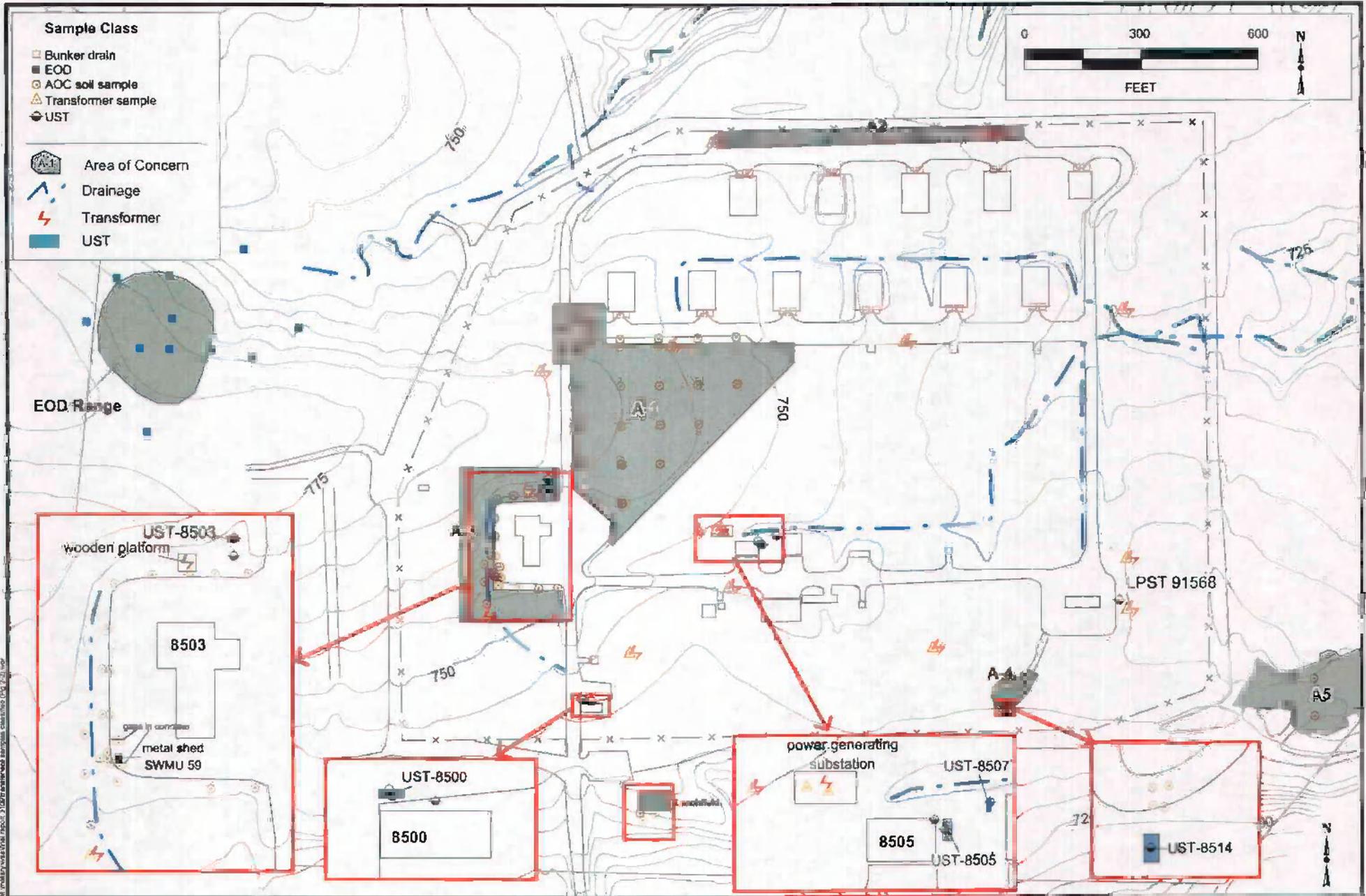


ES:\BIB\ANAS E\Work\WSA\chaco\airphoto\photo (6) 1.31.wor



Figure 1-3 -- Aerial Photo Overlay

Creation Date: 12/01/1997
 Rev. Date: 07/15/1999
 Project Manager: B. Duffner
 Prepared By: W. Mitchell
 Project No: P-3109

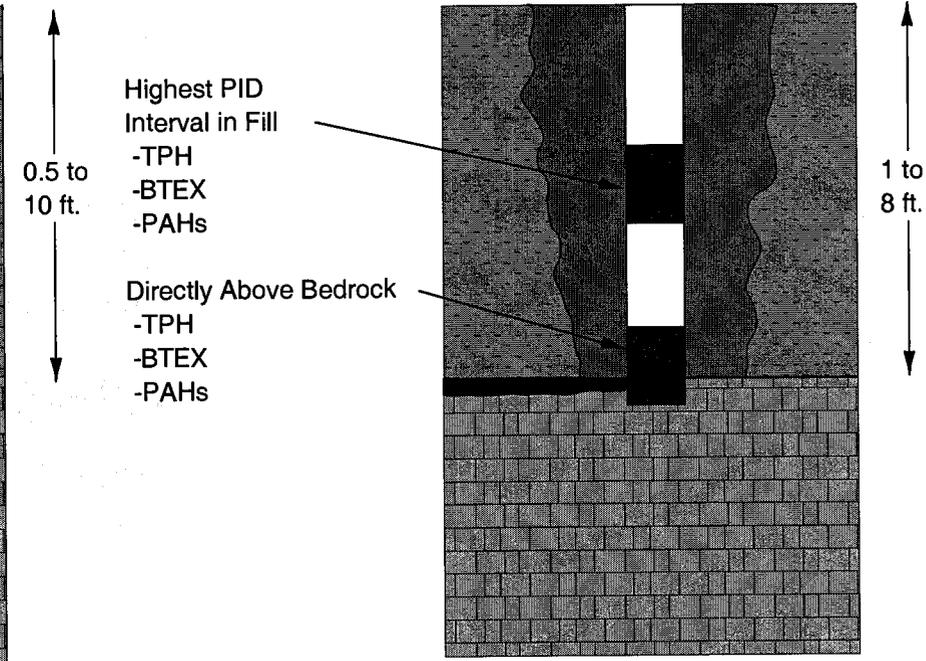
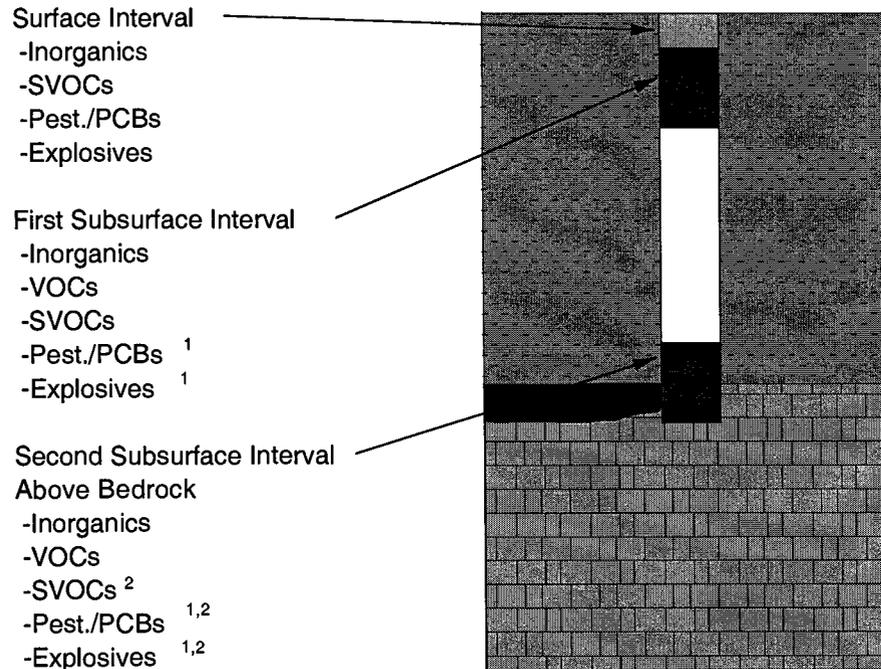


M:\military\site\report_3109\military\soil\soil\class\fig_2-2.dwg

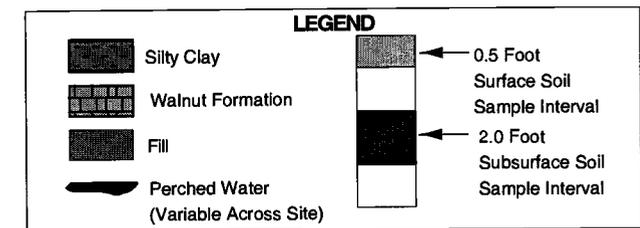
Figure 2-2 -- Surface and Subsurface Soil Sample Locations

Maintenance, EOD, and Other Locations

Fueling and UST Locations



Note: 1 Collected at 10% of locations.
 2 Analyzed only if detected in first subsurface soil interval sample.



powercad (f:\we2\gis\weapons storage agent\Figure 2-4 (B))

FIGURE 2-4 -- Typical Soil Sample Collection Scenarios

Attachment B
Notice of Construction

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November 15, 1990



Texas Water Commission
 Underground Storage Tank Section
 P. O. Box 13087, Capitol Station
 Austin, Texas 78711-3087

Gentlemen:

Please amend this original construction notification to include an additional UST, ID # 0009697 - USD 0109025, in the Ammo Storage area in Building 8514 on Carswell AFB.

We would appreciate permission to proceed immediately as personnel, equipment, and materials are already on site, and a TWC representative, Ms. Terri Hurley, has inspected portions of the already completed work.

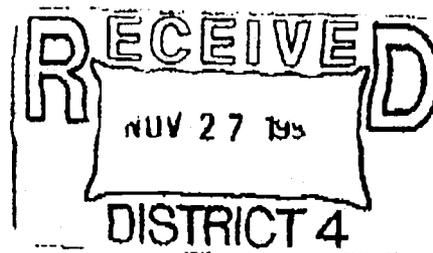
Thank you for your assistance.

Sincerely,

Oren Webb
 Project Manager

OW/km

cc: Texas Water Commission
 Duncanville, Texas



TEXAS WATER COMMISSION
UNDERGROUND STORAGE TANK (UST) CONSTRUCTION NOTIFICATION FORM

This form is provided to assist UST owners in complying with the construction notification requirements of TWC Rules, 31 TAC Chapter 334. The completion and filing of this form within the prescribed time should satisfy these requirements.

1. TYPE OF CONSTRUCTION: (Indicate all that apply.)

Installation Addition Removal Other (Specify) _____
 Replacement Improvement Abandonment _____

2. FACILITY LOCATION INFORMATION:

Facility Name: Carswell AFB
Address/Location: Carswell AFB
Fort Worth, Texas
County: Tarrant City: Fort Worth
UST Facility No. (If known): CRP000209
Telephone: 817-629-1718

3. OWNER INFORMATION:

Owner: United States of America
Representative: Donald C. Moore
Title: Contracting Officer
Address: P. O. Box 872
City/State/Zip: Carswell AFB, Texas
Telephone: 76127-5320

4. UST CONSULTANT INFORMATION:

Company: _____
Representative: _____
Address: _____
City/State/Zip: _____
Telephone: _____

5. UST CONTRACTOR INFORMATION:

Company: EAGLE CONSTRUCTION AND ENVIRONMENTAL SERVICES, INC.
Representative: Oren Webb
Address: P. O. Box 872
City/State/Zip: Eastland, Texas 76448
Telephone: 817-629-1718

6. GENERAL DESCRIPTION OF PROPOSED UST ACTIVITY: (Describe all new or replacement tanks and other UST system components. Include closure procedures for UST abandonments or removals. Attach additional information as appropriate.)

Eight UST locations will be assessed, grid mapped, and excavated to 2' below tank level. All procedures will be as per Local, State, and Federal Rules and Regulations and legal method of closure of UST location per Title 31, Texas Administration Code, Chapter 334, API Recommended Practice # 1604, and Guidance Manual for LPST, TWC 1990.

7. SCHEDULE/DATES FOR PROPOSED CONSTRUCTION:

September 4, 1990 - October 26, 1990

8. SUBMITTED BY: Oren Webb

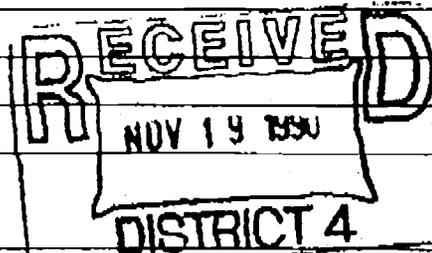
DATE: August 28, 1990

Title & Company: Project Engineer - Eagle Construction and Environmental Services, Inc.

9. MAIL COMPLETED FORM TO:

Texas Water Commission
Underground Storage Tank Section
P. O. Box 13087, Capitol Station
Austin, Texas 78711-3087

* FOR TWC STAFF USE ONLY *
* Date Rec'd: _____ Type Notice: _____ *
* District: _____ Dist. Rep.: _____ *
* Remarks: _____ *
* Logged by: _____ Date: _____ *



TEXAS WATER COMMISSION
UNDERGROUND STORAGE TANK (UST) CONSTRUCTION NOTIFICATION FORM

This form is provided to assist UST owners in complying with the construction notification requirements of TWC Rules, 31 TAC Chapter 334. The completion and filing of this form within the prescribed time should satisfy these requirements.

1. TYPE OF CONSTRUCTION: (Indicate all that apply--)
Installation Addition X Removal Other (Specify) /
Replacement Improvement Abandonment

2. FACILITY LOCATION INFORMATION:
Facility Name: Carswell AFB
Address/Location: Carswell AFB
Fort Worth, Texas
County: Tarrant City: Fort Worth
UST Facility No. (If known): CRF000209
Telephone: 817-629-1718 09697

3. OWNER INFORMATION:
Owner: United States of America
Representative: Donald C. Moore
Title: Contracting Officer
Address: P. O. Box 872
City/State/Zip: Carswell AFB, Texas
Telephone: 76127-5320

4. UST CONSULTANT INFORMATION:
Company: _____
Representative: _____
Address: _____
City/State/Zip: _____
Telephone: _____

5. UST CONTRACTOR INFORMATION:
Company: EAGLE CONSTRUCTION AND ENVIRONMENTAL SERVICES, INC.
Representative: Oren Webb
Address: P. O. Box 872
City/State/Zip: Eastland, Texas 76448
Telephone: 817-629-1718

6. GENERAL DESCRIPTION OF PROPOSED UST ACTIVITY: (Describe all new or replacement tanks and other UST system components. Include closure procedures for UST abandonments or removals. Attach additional information as appropriate.)
Eight UST locations will be assessed, grid mapped, and excavated to 2' below tank level. All procedures will be as per Local, State, and Federal Rules and Regulations and legal method of closure of UST location per Title 31, Texas Administration Code, Chapter 334, API Recommended Practice # 1604, and Guidance Manual for LPST, TWC 1990.

RECEIVED
NOV 27 1990

7. SCHEDULE/DATES FOR PROPOSED CONSTRUCTION:
~~September 4, 1990 - October 25, 1990~~ NOV. 16, 1990 DISTRICT 4 PM 11-16

8. SUBMITTED BY: Oren Webb DATE: August 28, 1990
Title & Company: Project Engineer - Eagle Construction and Environmental Services, Inc.

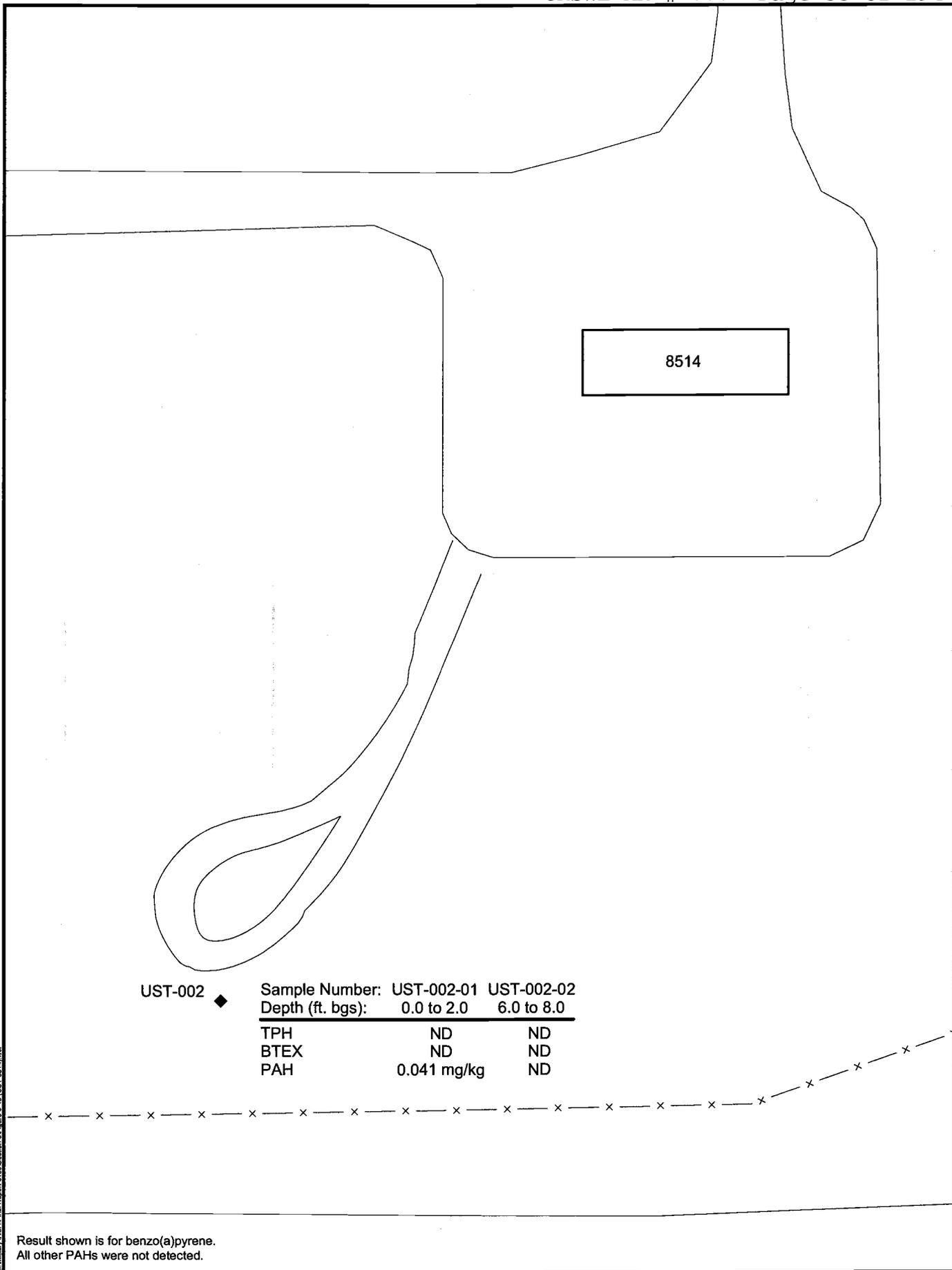
9. MAIL COMPLETED FORM TO:
Texas Water Commission
Underground Storage Tank Section
P. O. Box 13087, Capitol Station
Austin, Texas. 78711-3087

* FOR TWC STAFF USE ONLY *
* Date Rec'd: 11-19 Type Notice: _____ *
* District: 4 Dist. Rep.: _____ *
* Remarks: REM / AFTER THE GARY *
* Logged by: AS Date: 901119009 *

Attachment C

Boring Log and Site-Specific Geology/Hydrogeology

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UST-002	Sample Number:	UST-002-01	UST-002-02
	Depth (ft. bgs):	0.0 to 2.0	6.0 to 8.0
	TPH	ND	ND
	BTEX	ND	ND
	PAH	0.041 mg/kg	ND

Result shown is for benzo(a)pyrene.
All other PAHs were not detected.

M:\Military\WASA\Final Report 3109\Section 3\Figure 3-19 (UST 8514).wor



Figure 3-19 -- Soil Contaminant Distribution at the Former UST-8514 Location

Creation Date: 03/22/2001
 Rev. Date: / /
 Project Manager: B. Duffner
 Prepared By: D. Bedarf
 Project No: P-3109

GEOLOGIC BOREHOLE LOG

Borehole (Location) ID: UST-002

Page 1 of 1

AFID		CRSWL		SiteID		18 (WSA)		Location Type		BOREHOLE (BH)	
Location Description											
Tank southwest of Building 8514											
Establishing Company				Geologist				Drilling Company			
The Environmental Co				L. Myers				Maxim			
Drilling Foreman				Ground Surface Elevation				Datum			
F. Robinson											
Sampling Device				Borehole Diameter (Inches)				Total Depth (Feet)			
Splitspoon				2				7.0			
Date/Time Drilling Started						Date/Time Total Depth Reached					
9/04/97 0925						9/04/97 0945					
Depth (feet)	Sampling				USCS	ASTM CODE	Lithologic Codes	Lithology Description SOIL TYPE, modifiers/grain size, sorting, color, cement/lithification, moisture content, porosity, permeability/fracturing	Strat-order	Remarks: Drilling Problem, Equipment, Water level Samples, Weather, etc.	
	% Recov	Sample Depth	Blow Counts	PD							
1	100%	0-2'		1	HS		0-2' 100% 4/8 (dark yellowish brown) silt & clay with CaCO ₃ concretions; 20% rounded silt & clay; 10% organic, up to 20% of material; 20% root material		UST-002-01 BTEX, TPH PAH		
2						MLCL	FILL				
3	20% 24"	2-4'		2	HS		2-4' sand of above, wet				
4	83%			10.2							
5	20% 24"	4-6'		8	HS	SP	SD	4-5.5 100% 1/8 (yellow) coarse sand; obviously wet	Water at 5' depth		
6	83%			14.7		MLCL	STCL	5.5-6.0 silt & clay with coarse silt & clay; wet, silty	UST-002-5-7' BTEX, TPH PAH		
7	20% 24"	6-7'		3	HS	SP	SD	6.0-7.0 coarse sand, as in 4-5.5' interval; fill, obviously wet			
8				14.8		MACI	LS	7.0' fill refusal against dark gray silt/clayey sand			

SITE-SPECIFIC GEOLOGY AND HYDROGEOLOGY

Offsite WSA Soils

The Soil Survey of Tarrant County (Ressel, 1981) shows 10 distinct soil units in and around the Offsite WSA (see Figure 2-1). All of these soils are moderately alkaline, reflecting the limestone bedrock of the region, and most are shallow. RFI drilling confirmed that the soil layer is thin at the Offsite WSA, with depth to bedrock exceeding 6 feet only in scattered locations (TEC, 1999). Alluvial materials are found only along stream channels of Live Oak Creek and its northern tributary.

Bedrock Geology

The stratigraphy of the area surrounding the Offsite WSA consists of, from youngest to oldest, the Goodland Limestone, the Walnut Formation, the Paluxy Formation, and the Glen Rose Formation (see Figures 2-2 and 2-3).

Cretaceous bedrock is exposed both in and near the Offsite WSA. Goodland Limestone crops out west of the Offsite WSA property boundary. Erosion and the drop in elevation from the area of the background wells to the Offsite WSA have eliminated the Goodland Limestone from the surface at the Offsite WSA. Weathered Walnut Formation crops out over most of the area inside the fenced Offsite WSA (Barnes, 1972). This formation was found to be 25 to 30 feet thick at the Offsite WSA (JEG, 1997).

Outcrops of this formation within the Offsite WSA consist of weathered fossiliferous limestone. Underlying the Walnut Formation is the Paluxy Formation. This formation is not exposed within the fenced Offsite WSA facility, but only in the steeper drainages along Live Oak Creek and its northern tributary, as well as in a quarry south of the Offsite WSA. The more resistant Walnut Formation limestone caps the poorly cemented sandstones of the Paluxy, allowing weathering and erosion to produce steeper slopes in the Paluxy Formation. This formation was found to be 170 to 190 feet thick at the Offsite WSA (JEG, 1997). In the Offsite WSA area, the Paluxy Formation consists of fine- to coarse-grained sandy material with varying degrees of cementation and varying amounts of shale. The Glen Rose Formation does not crop out in the area surrounding the Offsite WSA, but is an important hydrologic unit.

Local Hydrogeology

The important hydrogeologic units beneath the Offsite WSA are:

- surficial overburden;
- Walnut Formation aquitard;
- Paluxy Aquifer; and
- Glen Rose Formation aquitard (see Figures 2-2 and 2-3).

Although the Walnut Formation can contain groundwater in shallow weathered zones, it generally functions as an aquitard. During the Offsite WSA Background Study (JEG, 1997), water was observed in weathered zones of the formation only after heavy rains via surface infiltration. Previous studies of competent Walnut Formation produced a hydraulic conductivity value of 7.0×10^{-10} cm/sec (Jacobs, 1997). This information indicates that downward flow of groundwater through the Walnut Formation is limited.

The Paluxy Aquifer is the principal source of groundwater in the vicinity of the Offsite WSA. The Paluxy is believed to exist under unconfined or semiconfined conditions, depending on depth of encounter and the local stratigraphic sequence. Most of the water wells in the area are completed in the lower, coarser-grained, and more permeable section of the Paluxy Aquifer. Geotechnical results from samples collected in background well WJEPX925 confirm that the lower portions of the Paluxy Formation are more porous and have a higher conductivity (JEG, 1997). A sample collected from 161 to 162 feet bgs in the well showed an effective porosity of 1.6 percent and an average hydraulic conductivity of 9.1×10^{-8} cm/sec. In contrast, samples collected from 195 to 196 and 249 to 250 feet bgs had effective porosities of 28.66 and 28.91 percent and average hydraulic conductivities of 2.29×10^{-3} and 3.47×10^{-3} cm/sec, respectively. It should also be noted that even the upper portions of the Paluxy Formation have significantly higher hydraulic conductivities than the overlying Walnut Formation.

Most recharge to the Paluxy Aquifer occurs where the formation crops out west and north of the Offsite WSA and in the lake bed of Lake Worth. The amount of recharge via outcrops along Live Oak Creek is unknown.

Previous studies in the region have determined that groundwater in the Paluxy Aquifer flows to the east (A.T. Kearney, 1989). Measurements made during the Offsite WSA background study (JEG, 1997) and during this RFI confirm a strong eastward flow component in the Paluxy Aquifer.

The Glen Rose Formation lies beneath the Paluxy Formation and is composed of fine-grained limestone, shale, marl, and sandstone beds. This formation is not exposed at the Offsite WSA, but was encountered in the Jacobs Engineering background wells. Although sands in the Glen Rose Formation yield small amounts of water to wells in Fort Worth and western Tarrant County, the formation generally serves as an aquitard, separating the groundwater in the Paluxy Aquifer from groundwater in the deeper Twin Mountains Aquifer.

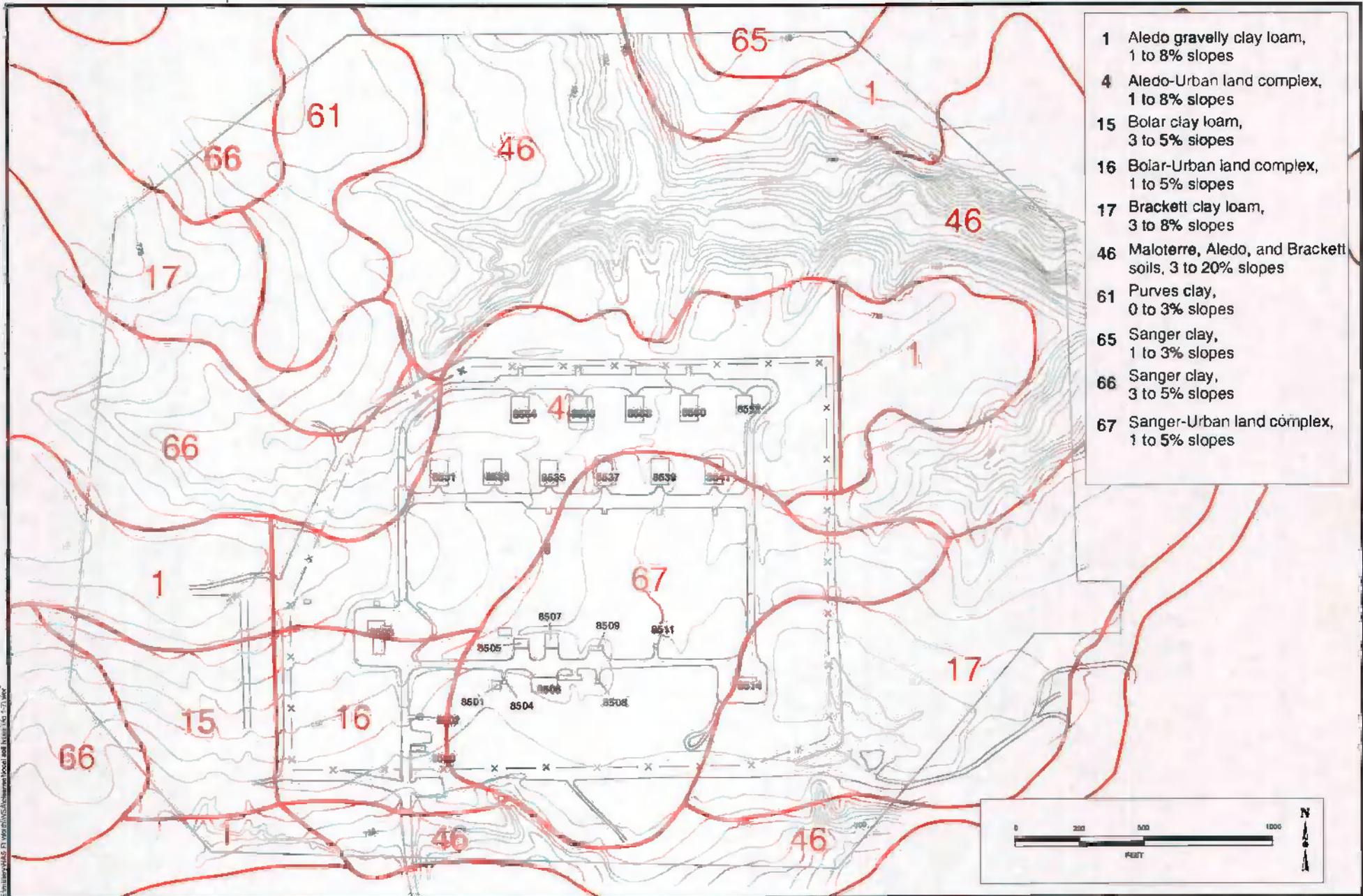
REFERENCES

A.T. Kearney, Inc. 1989 (March). *RCRA Facility Assessment PR/VS1 Report, Carswell Air Force Base, Fort Worth, Texas.*

Barnes, V.E. 1972, Revised 1988. *Geologic Atlas of Texas, Dallas Sheet.* Bureau of Economic Geology, University of Texas at Austin.

Jacobs Engineering Group (JEG). 1997 (January). *Draft, NAS Fort Worth JRB, Texas (Formerly Carswell AFB, Texas), Basewide Background Study, Volume I.* Contract No. F41624-94-D-8046, Delivery Order 0021. Jacobs Engineering Group, Denver, CO.

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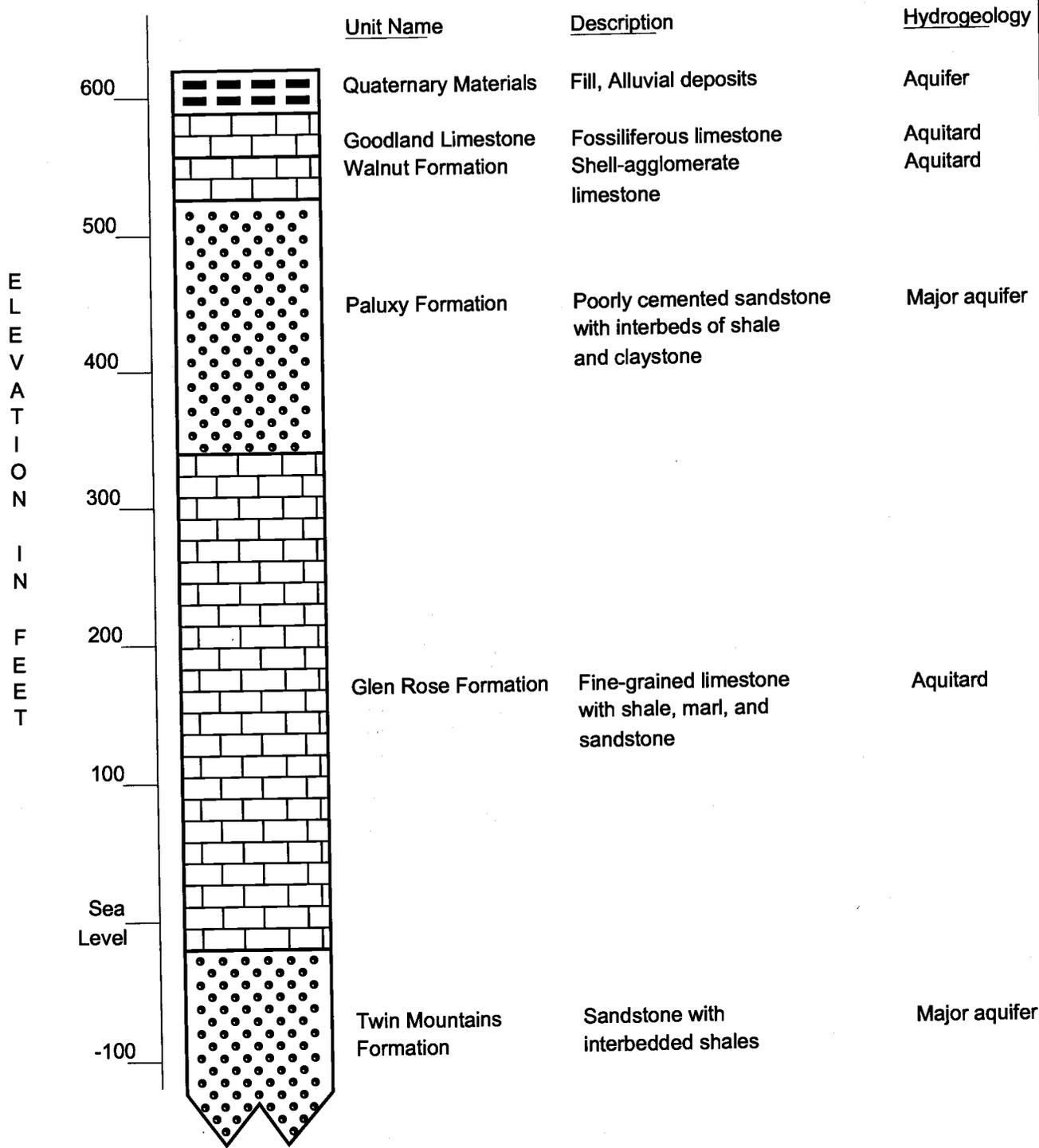


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Figure 2-1 -- Local Soil Types

Creation Date: 12/01/1997
 Rev. Date: 07/15/1999
 Project Manager: B. Duffner
 Prepared By: W. Mitchell
 Project No: P-3109

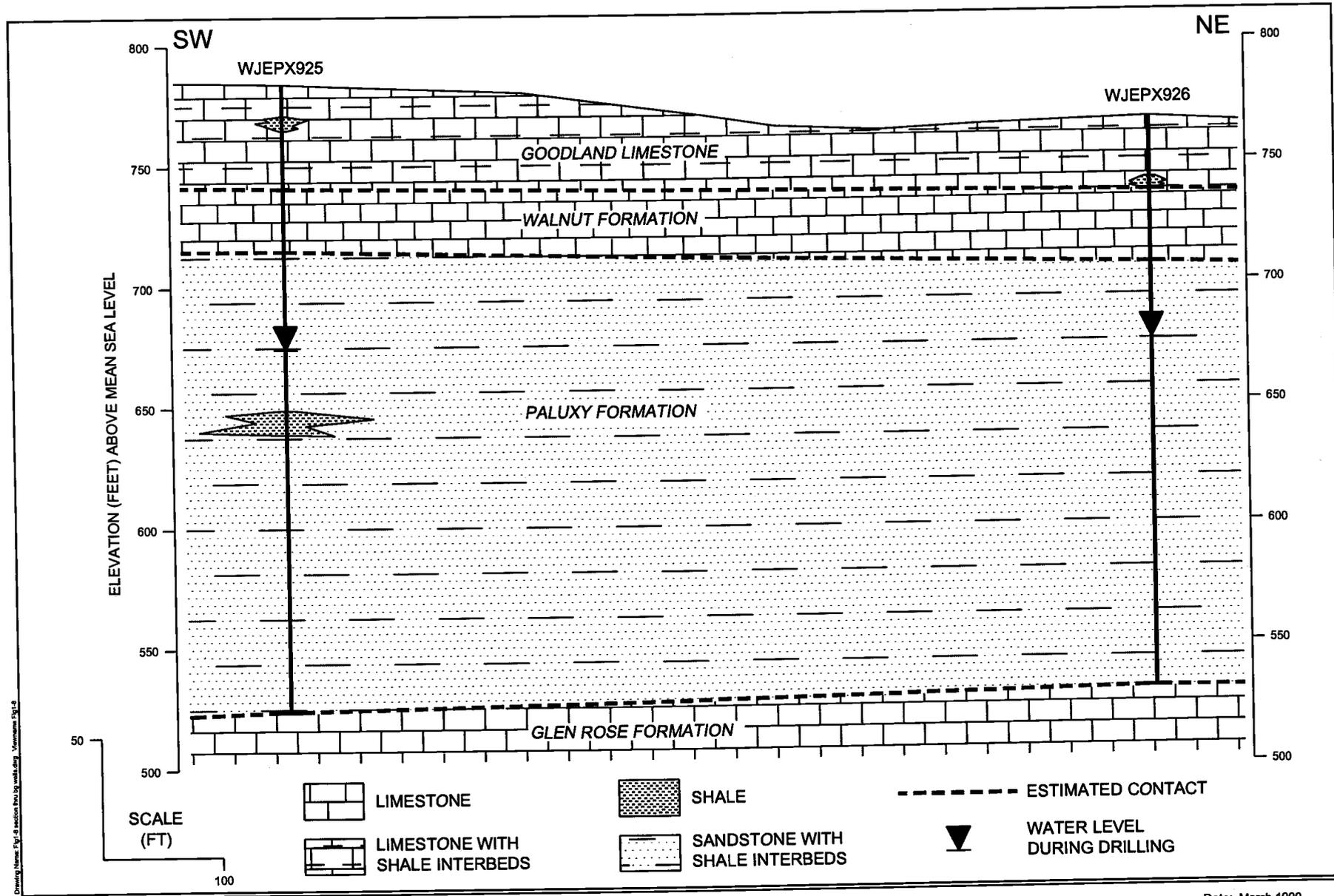


Drawing Name: Figure 2-2 Generalized Strat. Column, Aq. Venues, FIG-9



Figure 2-2 -- Generalized Regional Stratigraphic Column

Date: March 1999
 Project Manager: B. Duffner
 Prepared By: LLM/DAL
 Project No: 3109



Drawing Name: Fig. 2-3 Section Through Background Monitoring Wells.dwg Viewname: Fig. 2-3



Figure 2-3 -- Geologic Cross - Section Through Background Monitoring Wells

Date: March 1999
 Project Manager: B. Duffner
 Prepared By: L. Myers / A. Long
 Project No: 3109

Attachment D

Tables

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Table D-1. Summary of Former Underground Storage Tank Location UST-8514 Soil Sample Results

Building:	8514	
Location:	Tank	
	UST-002	
Sample Number:	UST-002-01	UST-002-02
Depth (ft bgs):	0.0 to 2.0	6.0 to 8.0

Parameters^a

TPH-(ug/g)

Total Recoverable Petroleum

Hydrocarbons 160 63.7

BTEX-(mg/kg)

Not Detected

PAH-(mg/kg)

Benzo(a)pyrene 0.041 0.017 U

U - not detected above the method detection limit.

Note: Parameters listed include only those detected in at least one sample.

Table D-2. Summary of Equipment, Trip, and Ambient Blank Results

Sample Number:	EB-015	TB-012	AB-002
Parameters	(ug/L)	(mg/kg)	(ug/L)
Semivolatiles	ND	NA	NA
Volatiles Method 8260			
Chloroform	ND	ND	0.2 F
PAHs	ND	NA	NA
TPH	ND	NA	NA
BTEX Method 8020			
	ND	NA	NA

Note: Parameters listed include only those detected in at least one sample

NA - not analyzed

ND - not detected

U - not detected at the detection limit listed.

F - the compound was positively identified; however, it was detected below the practical quantitation limit.

Attachment E

Field Sampling Forms, Chain of Custody, and Laboratory Data Sheets

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FIELD SAMPLING REPORT

LOCATION: <u>UST-002</u>		PROJECT: <u>Carswell WSA</u>			
SITE: <u>18</u>					
MATRIX: <u>SO</u>			SAMPLE ID: <u>UST-002-01</u>		
SAMPLING METHOD: <u>SS</u>			DUP./REP. OF: _____		
BEGINNING DEPTH: _____ 0			MATRIX SPIKE/MATRIX SPIKE DUPLICATE		
END DEPTH: _____ 2			YES () NO (X)		
GRAB (X)		COMPOSITE (.)		DATE: <u>04-Sep-1997</u>	TIME: <u>09:30</u>
CONTAINER SIZE/TYPE	#	PRESERVATIVE/ PREPARATION	EXTRACTION METHOD	ANALYTICAL METHOD	ANALYSIS
GW	1	Cool 4 degrees C	NONE	E418.1	TPH (soil)
GW	1	Cool 4 degrees C	SW5030	SW8020	BTEX (soil)
GW	1	Cool 4 degrees C	NONE	SW8310	PAHs (soil)
NOTABLE OBSERVATIONS					
PID READINGS		SAMPLE CHARACTERISTICS			MISCELLANEOUS
1st	1	COLOR: Orange/brown			
2nd		ODOR: None			
		OTHER:			
GENERAL INFORMATION					
WEATHER: SUN/CLEAR _____		OVERCAST/RAIN <u>X</u>		WIND <u>Light</u>	AMBIENT TEMP <u>70-80</u>
SHIPMENT VIA: FED-X <u>X</u>		HAND DELIVER _____		COURIER _____	OTHER _____
SHIPPED TO: <u>RECRA</u>					
COMMENTS: _____					
SAMPLER(S): <u>Amy McReynolds, Lesley Myers</u>					
MATRIX TYPE CODES			SAMPLING METHOD CODES		
DC=DRILL CUTTINGS	SL=SLUDGE	B=BAILER	G=GRAB		
WG=GROUND WATER	SO=SOIL	BR=BRASS RING	HA=HAND AUGER		
LH=HAZARD. LIQUID WASTE	GS=SOIL GAS	CS=COMPOSITE SAMPLE	H=HOLLOW STEM AUGER		
SH=HAZARD. SOLID WASTE	WS=SURFACE WATER	C=CONTINUOUS FLIGHT AUGER	HP=HYDRO PUNCH		
SE=SEDIMENT	SW=SWAB/WIPE	DT=DRIVEN TUBE	SS=SPLIT SPOON		
		W=SWAB/WIPE	SP=SUBMERSIBLE PUMP		

FIELD SAMPLING REPORT

LOCATION: <u>UST-002</u>		PROJECT: <u>Carswell WSA</u>		
SITE: <u>18</u>				
MATRIX: <u>SO</u>		SAMPLE ID: <u>UST-002-02</u>		
SAMPLING METHOD: <u>SS</u>		DUP./REP. OF: _____		
BEGINNING DEPTH: _____ 6		MATRIX SPIKE/MATRIX SPIKE DUPLICATE		
END DEPTH: _____ 8		YES () NO (<input checked="" type="checkbox"/>)		
GRAB (<input checked="" type="checkbox"/>)		COMPOSITE (.)		
DATE: <u>04-Sep-1997</u>		TIME: <u>09:30</u>		
CONTAINER	PRESERVATIVE/ PREPARATION	EXTRACTION METHOD	ANALYTICAL METHOD	ANALYSIS
SIZE/TYPE #				
GW 1	Cool 4 degrees C	SW5030	SW8020	BTEX (soil)
GW 1	Cool 4 degrees C	NONE	SW8310	PAHs (soil)
GW 1	Cool 4 degrees C	NONE	E418.1	TPH (soil)
NOTABLE OBSERVATIONS				
PID READINGS		SAMPLE CHARACTERISTICS		MISCELLANEOUS
1st	1	COLOR: Brown		
2nd		ODOR: None		
		OTHER:		
GENERAL INFORMATION				
WEATHER: SUN/CLEAR _____ OVERCAST/RAIN <input checked="" type="checkbox"/> WIND <u>Light</u> AMBIENT TEMP <u>80-90</u>				
SHIPMENT VIA: FED-X <input checked="" type="checkbox"/> HAND DELIVER _____ COURIER _____ OTHER _____				
SHIPPED TO: <u>RECRA</u>				
COMMENTS: _____				
SAMPLER(S): <u>Amy McReynolds, Lesley Myers</u>				
MATRIX TYPE CODES			SAMPLING METHOD CODES	
DC=DRILL CUTTINGS	SL=SLUDGE	B=BAILER	G=GRAB	
WG=GROUND WATER	SO=SOIL	BR=BRASS RING	HA=HAND AUGER	
LH=HAZARD. LIQUID WASTE	GS=SOIL GAS	CS=COMPOSITE SAMPLE	H=HOLLOW STEM AUGER	
SH=HAZARD. SOLID WASTE	WS=SURFACE WATER	C=CONTINUOUS FLIGHT AUGER	HP=HYDRO PUNCH	
SE=SEDIMENT	SW=SWAB/WIPE	DT=DRIVEN TUBE	SS=SPLT SPOON	
		W=SWAB/WIPE	SP=SUBMERSIBLE PUMP	

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CHAIN OF CUSTODY RECORD

PROJECT				CONTAINERS	ANALYSIS REQUIRED										PRESERVATION			
SAMPLERS: (Signature)					Explosives	PAH	REMARKS OR SAMPLE LOCATION										FIELD	SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN
SAMPLE NUMBER	DATE	TIME	MATRIX															
3109 WSA																		
JL BUC																		
A5-004-02	9/4/97	0740	SO	1	1													
A4-001-02		0755		1	1													
A4-002-02		0822		1	1													
A4-003-02		0835		1	1													
A4-004-02		0852		1	1													
U5T-001-01		1352		1	1													
U5T-003-01		1325		1	1													
U5T-007-01		1026		1	1													
U5T-007-04		1026		1	1													
U5T-008-01		0958		1	1													
U5T-010-01		1340		3	3													MS/MSD
U5T-002-01		0930		1	1													
U5T-002-02		0938		1	1													
U5T-004-01	✓	1243		1	1													
U5T-005-01		1215	✓	1	1													
Relinquished by: (Signature) ①		Date / Time	Received by: (Signature)		Relinquished by: (Signature) ④		Date / Time	Shipped via:										
JL BUC		9/4/97 1700																
Relinquished by: (Signature) ②		Date / Time	Received by: (Signature)		Received for Laboratory by: (Signature)		Date / Time	Shipping Ticket No.										
Relinquished by: (Signature) ③		Date / Time	Received by: (Signature)		Remarks:													

The Environmental Company, Inc.

CHAIN OF CUSTODY RECORD

PROJECT				CONTAINERS	ANALYSIS REQUIRED										PRESERVATION	
AMPLERS: (Signature)					<div style="text-align: center; border: 1px solid black; padding: 5px;"> PAHs Explosives PAHs </div>										ICED	SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN
SAMPLE NUMBER	DATE	TIME	MATRIX													
UST-006-01	9/4/97	1040	SO	1	1											
UST-009-01		1010		1	1											
UST-009-02		1010		1	1											
EOD-009-02		1420		1	1											
EOD-010-02		1520		1	1											
EOD-010-03		1540		1	EIA											
EOD-010-05		1520		1	1											
EOD-010-06		1540		1	EIA											
EOD-011-02		1432		1	1											
EOD-011-03		1507	✓	1	EIA											
EB 015	✓	1600	WQ	3	2	1										

Relinquished by: (Signature) ①	Date / Time	Received by: (Signature)	Relinquished by: (Signature) ④	Date / Time	Shipped via:
<i>[Signature]</i>	9/4/97 1700				
Relinquished by: (Signature) ②	Date / Time	Received by: (Signature)	Received for Laboratory by: (Signature)	Date / Time	Shipping Ticket No.
Relinquished by: (Signature) ③	Date / Time	Received by: (Signature)	Remarks:		

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The Environmental Company, Inc.

CHAIN OF CUSTODY RECORD

PROJECT				CONTAINERS NO.	ANALYSIS REQUIRED										PRESERVATION			
SAMPLERS: (Signature)					VOCS	SUOCS	T-Metals	Rest PCB	TPH	BTEX						REMARKS OR SAMPLE LOCATION	ICED	SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN
SAMPLE NUMBER	DATE	TIME	MATRIX															
3109 WSA																		
JL R Blk																		
A5-004-02	9/4/97	0740	SO	3	1	1	1	X								SUOCS + PCB in same container		
A4-001-02		0755		2						1	1							
A4-002-02		0822		2						1	1							
A4-003-02		0835		2						1	1							
A4-004-02		0852		2						1	1							
UST-001-01		1352		2						1	1							
UST-003-01		1325		2						1	1							
UST-007-01		1026		2						1	1							
UST-007-04		1026		2						1	1							
UST-008-01		0958		2						1	1							
UST-010-01		1340	5X/6/15	2					3	1	1					MS/MSD and 75	2 for BTEX 5 containers total	
UST-002-01		0930		2						1	1							
EOD-009-02		1420		1				1										
EOD-010-02		1520		1				1										
UST-002-02		0938		2				1		1	1							

Relinquished by: (Signature) ①	Date / Time	Received by: (Signature)	Relinquished by: (Signature) ④	Date / Time	Shipped via:
JL R Blk	9/4/97 1715				
Relinquished by: (Signature) ②	Date / Time	Received by: (Signature)	Received for Laboratory by: (Signature)	Date / Time	Shipping Ticket No.
Relinquished by: (Signature) ③	Date / Time	Received by: (Signature)	Remarks:		

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CHAIN OF CUSTODY RECORD

The Environmental Company, Inc.

PROJECT				CONTAINERS	ANALYSIS REQUIRED										PRESERVATION	
3109 WSA					NO.	BTEX	TPH	Metals	TOC	Grain Size	VOCs	Pesticides	SUOC	REMARKS OR SAMPLE LOCATION	METHOD	SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN
SAMPLERS: (Signature)																
SAMPLE NUMBER	DATE	TIME	MATRIX													
UST-004-01	9/4/97	1243	SO	2	1	1										
UST-005-01		1215		2	1	1										
UST-006-01		1040		2	1	1										
UST-009-01		1010		2	1	1										
UST-009-02		1010		2	1	1										
EOD-010-03		1540		1												
EOD-010-05		1520		1												
EOD-010-06		1540		1												
EOD-011-02		1432		1												
EOD-011-03		1507	✓	3												
E3-015		1600	WQ	10	2	1	1	1	2	1	2		BTEX preserved w/HCl; TPH preserved w/HCl; TOC preserved w/H2SO4		Metals preserved w/HNO3	
TB-012	✓	0615	WQ	2					2				Pre-preserved w/HCl		✓	

Relinquished by: (Signature) ①	Date / Time	Received by: (Signature)	Relinquished by: (Signature) ④	Date / Time	Shipped via:
<i>[Signature]</i>	9/4/97 1215				
Relinquished by: (Signature) ②	Date / Time	Received by: (Signature)	Received for Laboratory by: (Signature)	Date / Time	Shipping Ticket No.
Relinquished by: (Signature) ③	Date / Time	Received by: (Signature)	Remarks:		

Cooler A

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CHAIN OF CUSTODY RECORD

PROJECT				CONTAINERS	ANALYSIS REQUIRED										PRESERVATION																																																																																										
SAMPLERS: (Signature)					NO.	/ / / / / / / / / / / / / / / /										I	SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN																																																																																								
SAMPLE NUMBER	DATE	TIME	MATRIX			1	2	3	4	5	6	7	8	9	10			11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98
3109 WSA				6	T-metals Hg VOCs SUXES PXL/PCRS																																																																																																				
Lesley Myers																																																																																																									
mw-925-01																									metals preserved w/ H ₂ O ₂																																																																																
TB-015																								preserved w/ HCC																																																																																	
AB-002																								preserved w/ HCC																																																																																	

Relinquished by: (Signature) ①	Date / Time	Received by: (Signature)	Relinquished by: (Signature) ④	Date / Time	Shipped via:
Quay Anderson	9/15/97 1357				
Relinquished by: (Signature) ②	Date / Time	Received by: (Signature)	Received for Laboratory by: (Signature)	Date / Time	Shipping Ticket No.
Relinquished by: (Signature) ③	Date / Time	Received by: (Signature)	Remarks:		

Client Sample No.

UST-002-01

Lab Name: Recra LabNet

Contract: F46162495D80

Lab Code: RECNY

Case No.: _____

SAS No.: _____

SDG No.: _____

Matrix (soil/water): SOIL

Lab Sample ID: A7313012

% Solids: 93.6

Date Samp/Recv: 09/04/97 09/05/97

Parameter Name	Units of Measure	Result	C	Q	M	Method Number	Analyzed Date
Total Recoverable Petroleum Hydrocarbons	UG/G	160				418.1	09/16/97

Comments:

000085

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8020

AAB #: A7B07549

Lab Name: Recra LabNet

Contract #: F46162495080

Field Sample ID: UST-002-01

Lab Sample ID: A7313012

Matrix: SOIL

% Solids: 93.6

Dilution: 1.00

Date Received: 5-Sep-97

Date Extracted: _____

Date Analyzed: 9-Sep-97

Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	MDL	PQL	Concentration	Qualifier
BENZENE	0.00088	0.0020	0.00088	U
ETHYLBENZENE	0.00088	0.0020	0.00088	U
TOLUENE	0.00088	0.0020	0.00088	U
XYLENES, TOTAL	0.00088	0.0020	0.00088	U

Comments:

Handwritten signature/initials

Client Sample No.

UST-002-02

Lab Name: Recra LabNet

Contract: F46162495D80

Lab Code: RECNY

Case No.: _____

SAS No.: _____

SDG No.: _____

Matrix (soil/water): SOIL

Lab Sample ID: A7313015

% Solids: 88.3

Date Samp/Recv: 09/04/97 09/05/97

Parameter Name	Units of Measure	Result	C	Q	M	Method Number	Analyze Date
Total Recoverable Petroleum Hydrocarbons	UG/G	63.7				418.1	09/16/97

Comments:

000086

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8020

AAB #: A7B07549

Lab Name: Recra LabNet

Contract #: F46162495D80

Field Sample ID: UST-002-02

Lab Sample ID: A7313015

Matrix: SOIL

% Solids: 88.3

Dilution: 1.00

Date Received: 5-Sep-97

Date Extracted: _____

Date Analyzed: 9-Sep-97

Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	MDL	PQL	Concentration	Qualifier
BENZENE	0.00089	0.0020	0.00089	U
ETHYLBENZENE	0.00089	0.0020	0.00089	U
TOLUENE	0.00089	0.0020	0.00089	U
XYLENES, TOTAL	0.00089	0.0020	0.00089	U

Comments:

Handwritten initials/signature

AFCEE
 ORGANIC ANALYSES DATA SHEET 2
 RESULTS

Analytical Method: 8020

AAB #: A7807549

Lab Name: Recra LabNet

Contract #: F46162495D80

Field Sample ID: UST-010-01 MS

Lab Sample ID: A7313011MS

Matrix: SOIL

% Solids: 89.5

Dilution: 1.00

Date Received: 5-Sep-97

Date Extracted: _____

Date Analyzed: 9-Sep-97

Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	MDL	PQL	Concentration	Qualifier
Benzene	0.00093	0.0020	0.018	
Ethylbenzene	0.00093	0.0020	0.017	
Toluene	0.00093	0.0020	0.017	
Total Xylenes	0.00093	0.0020	0.052	

Comments:

AFCEE
 ORGANIC ANALYSES DATA SHEET 2
 RESULTS

Analytical Method: 8020

AAB #: A7807549

Lab Name: Recra LabNet

Contract #: F46162495D80

Field Sample ID: UST-010-01 SD

Lab Sample ID: A7313011SD

Matrix: SOIL

% Solids: 89.5

Dilution: 1.00

Date Received: 5-Sep-97

Date Extracted: _____

Date Analyzed: 9-Sep-97

Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	MDL	PQL	Concentration	Qualifier
Benzene	0.00092	0.0020	0.018	
Ethylbenzene	0.00092	0.0020	0.017	
Toluene	0.00092	0.0020	0.017	
Total Xylenes	0.00092	0.0020	0.050	

Comments:

Recra LabNet - ville Laboratory

PAH'S by HPLC / Method 8310

Report Date: 09/26/97 10:15

RFW Batch Number: 9709L211

Client: THE ENVIRONMENTAL CO

Work Order: 70000003001 Page: 2

Cust ID: UST-007-01 UST-007-04 UST-008-01 UST-010-01 UST-010-01 UST-010-01

Sample Information	RFW#:	008	009	010	011	011 MS	011 MSD
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.00	1.00	5.00	1.00	1.00	1.00
	Units:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg

PAH

	116	%	87	%	D	%	88	%	84	%	98	%
Triphenylene	116	%	87	%	D	%	88	%	84	%	98	%
Naphthalene	1320	U	1310	U	6450	U	1330	U	61	%	64	%
Acenaphthylene	1560	U	1540	U	7620	U	1580	U	70	%	73	%
Acenaphthene	1320	U	1310	U	6450	U	1330	U	73	%	76	%
Fluorene	153	U	151	U	746	U	154	U	75	%	80	%
Phenanthrene	468	U	465	U	2290	U	474	U	83	%	91	%
Anthracene	479	U	475	U	2340	U	485	U	88	%	89	%
Fluoranthene	540		151	U	2100		154	U	93	%	120	* %
Pyrene	380		194	U	1500		198	U	86	%	102	%
Benzo(a)anthracene	190		36		810		12		125	* %	292	* %
Chrysene	210		108	U	820		110	U	87	%	103	%
Benzo(b)fluoranthrene	220		43		760		13		114	%	228	* %
Benzo(k)fluoranthrene	120		25		430		12.1	U	111	%	181	* %
Benzo(a)pyrene	480		100		1800		42		200	* %	436	* %
Dibenzo(a,h)anthracene	28		21.6	U	107	U	22.0	U	89	%	100	%
Benzo(ghi)perylene	200		58		710		56.2	U	101	%	126	* %
Indeno(1,2,3-cd)pyrene	170		40		600		32.0	U	101	%	140	* %

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not reported. NS= Not spiked.
 %= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

T-337 P.05/09 Job-618

6107016141

SEP-26-97 17:37 From:RECRA ENVIRONMENTAL

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8260AAB #: A7B08069Lab Name: Recra LabNetContract #: F46162495D80Field Sample ID: AB-002Lab Sample ID: A7322603Matrix: WATER% Solids: Dilution: 1.00Date Received: 11-Sep-97Date Extracted: Date Analyzed: 20-Sep-97Concentration Units (ug/L or mg/kg dry weight): UG/L

Analyte	MDL	PQL	Concentration	Qualifier
1,1,1,2-Tetrachloroethane	0.1	0.500	0.1	U
1,1,1-Trichloroethane	0.2	0.800	0.2	U
1,1,2,2-Tetrachloroethane	0.2	0.400	0.2	U
1,1,2-Trichloroethane	0.2	1.0	0.2	U
1,1-Dichloroethane	0.2	0.400	0.2	U
1,1-Dichloroethene	0.2	1.2	0.2	U
1,1-Dichloropropene	0.2	1.0	0.2	U
1,2,3-Trichlorobenzene	0.2	0.300	0.2	U
1,2,3-Trichloropropane	0.2	3.2	0.2	U
1,2,4-Trichlorobenzene	0.2	0.400	0.2	U
1,2,4-Trimethylbenzene	0.2	1.3	0.2	U
1,2-Dichloroethane	0.1	0.600	0.1	U
1,2-Dichlorobenzene	0.2	0.300	0.2	U
1,2-Dibromo-3-chloropropane	0.4	2.6	0.4	U
1,2-Dichloropropane	0.09	0.400	0.09	U
1,2-Dibromoethane	0.1	0.600	0.1	U
1,3,5-Trimethylbenzene	0.3	0.500	0.3	U
1,3-Dichlorobenzene	0.2	1.2	0.2	U
1,3-Dichloropropane	0.2	0.400	0.2	U
1,4-Dichlorobenzene	0.2	0.300	0.2	U
1-Chlorohexane	0.1	0.500	0.1	U
2,2-Dichloropropane	0.2	3.5	0.2	U
o-Chlorotoluene	0.2	0.400	0.2	U
p-Chlorotoluene	0.2	0.600	0.2	U
Benzene	0.2	0.400	0.2	U

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8260AAB #: A7B08069Lab Name: Recra LabNetContract #: F46162495D80Field Sample ID: AB-002Lab Sample ID: A7322603Matrix: WATER% Solids: Dilution: 1.00Date Received: 11-Sep-97Date Extracted: Date Analyzed: 20-Sep-97Concentration Units (ug/L or mg/kg dry weight): UG/L

Analyte	MDL	PQL	Concentration	Qualifier
Bromobenzene	0.1	0.300	0.1	U
Bromochloromethane	0.2	0.400	0.2	U
Bromodichloromethane	0.2	0.800	0.2	U
Bromoform	0.09	1.2	0.09	U
Bromomethane	0.2	1.1	0.2	U
Carbon Tetrachloride	0.2	2.1	0.2	U
Chlorobenzene	0.1	0.400	0.1	U
Chloroethane	0.2	1.0	0.2	U
Chloroform	0.2	0.300	0.2	F
Chloromethane	0.2	1.3	0.2	U
cis-1,2-Dichloroethene	0.2	1.2	0.2	U
cis-1,3-Dichloropropene	0.1	1.0	0.1	U
Dibromochloromethane	0.1	0.500	0.1	U
Dibromomethane	0.1	2.4	0.1	U
Dichlorodifluoromethane	0.2	1.0	0.2	U
Ethylbenzene	0.2	0.600	0.2	U
Hexachlorobutadiene	0.2	1.1	0.2	U
Isopropylbenzene	0.2	0.500	0.2	U
m-Xylene	0.3	0.500	0.3	U
Methylene chloride	0.2	0.300	0.2	U
n-Butylbenzene	0.2	1.1	0.2	U
n-Propylbenzene	0.2	0.400	0.2	U
Naphthalene	0.2	0.400	0.2	U
o-Xylene	0.2	1.1	0.2	U
p-Cymene	0.2	1.2	0.2	U

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8260

AAB #: A7B08069

Lab Name: Recra LabNet

Contract #: F46162495D80

Field Sample ID: AB-002

Lab Sample ID: A7322603

Matrix: WATER

% Solids:

Dilution: 1.00

Date Received: 11-Sep-97

Date Extracted:

Date Analyzed: 20-Sep-97

Concentration Units (ug/L or mg/kg dry weight): UG/L

Analyte	MDL	PQL	Concentration	Qualifier
p-Xylene	0.3	1.3	0.3	U
sec-Butylbenzene	0.2	1.3	0.2	U
Styrene	0.2	0.400	0.2	U
Trichloroethene	0.2	1.0	0.2	U
tert-Butylbenzene	0.2	1.4	0.2	U
Tetrachloroethene	0.2	1.4	0.2	U
Toluene	0.2	1.1	0.2	U
trans-1,2-Dichloroethene	0.2	0.600	0.2	U
trans-1,3-Dichloropropene	0.2	0.800	0.2	U
Trichlorofluoromethane	0.2	1.1	0.2	U
Vinyl chloride	0.2	0.000	0.2	U

Comments:

007244

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8260

AAB #: A7807739

Lab Name: Recra LabNet

Contract #: F46162495D80

Field Sample ID: IB-012

Lab Sample ID: A7313027

Matrix: SOIL

% Solids: 100.0

Dilution: 1.00

Date Received: 5-Sep-97

Date Extracted: _____

Date Analyzed: 13-Sep-97

Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	MDL	PQL	Concentration	Qualifier
1,1,1,2-Tetrachloroethane	0.00093	0.0030	0.00093	U
1,1,1-Trichloroethane	0.00093	0.0040	0.00093	U
1,1,2,2-Tetrachloroethane	0.00091	0.0020	0.00091	U
1,1,2-Trichloroethane	0.00076	0.0050	0.00076	U
1,1-Dichloroethane	0.0012	0.0020	0.0012	U
1,1-Dichloroethene	0.0013	0.0060	0.0013	U
1,1-Dichloropropene	0.0011	0.0050	0.0011	U
1,2,3-Trichlorobenzene	0.00066	0.0020	0.00066	U
1,2,3-Trichloropropane	0.0011	0.020	0.0011	U
1,2,4-Trichlorobenzene	0.00070	0.0020	0.00070	U
1,2,4-Trimethylbenzene	0.00083	0.0070	0.00083	U
1,2-Dichloroethane	0.00095	0.0030	0.00095	U
1,2-Dichlorobenzene	0.00087	0.0020	0.00087	U
1,2-Dibromo-3-chloropropane	0.0015	0.010	0.0015	U
1,2-Dichloropropane	0.00080	0.0020	0.00080	U
1,2-Dibromoethane	0.0011	0.0030	0.0011	U
1,3,5-Trimethylbenzene	0.00099	0.0030	0.00099	U
1,3-Dichlorobenzene	0.00077	0.0060	0.00077	U
1,3-Dichloropropane	0.00073	0.0020	0.00073	U
1,4-Dichlorobenzene	0.00065	0.0020	0.00065	U
1-Chlorohexane	0.00080	0.0030	0.00080	U
2,2-Dichloropropane	0.0013	0.020	0.0013	U
o-Chlorotoluene	0.00064	0.0020	0.00064	U
p-Chlorotoluene	0.00077	0.0030	0.00077	U
Benzene	0.00068	0.0020	0.00068	U

SMK
3/18/00

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTSAnalytical Method: 8260AAB #: A7B07739Lab Name: Recra LabNetContract #: F46162495D80Field Sample ID: TB-012Lab Sample ID: A7313027Matrix: SOIL% Solids: 100.0Dilution: 1.00Date Received: 5-Sep-97

Date Extracted: _____

Date Analyzed: 13-Sep-97Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	MDL	PQL	Concentration	Qualifier
Bromobenzene	0.00086	0.0020	0.00086	U
Bromochloromethane	0.00048	0.0020	0.00048	U
Bromodichloromethane	0.00061	0.0040	0.00061	U
Bromoform	0.00078	0.0060	0.00078	U
Bromomethane	0.0013	0.0050	0.0013	U
Carbon Tetrachloride	0.0013	0.010	0.0013	U
Chlorobenzene	0.00083	0.0020	0.00083	U
Chloroethane	0.0013	0.0050	0.0013	U
Chloroform	0.00077	0.0020	0.00077	U
Chloromethane	0.0010	0.0070	0.0010	U
cis-1,2-Dichloroethene	0.00082	0.0060	0.00082	U
cis-1,3-Dichloropropene	0.00064	0.0050	0.00064	U
Dibromochloromethane	0.00083	0.0030	0.00083	U
Dibromomethane	0.00037	0.010	0.00037	U
Dichlorodifluoromethane	0.0032	0.0050	0.0032	U
Ethylbenzene	0.00099	0.0030	0.00099	U
Hexachlorobutadiene	0.00068	0.0050	0.00068	U
Isopropylbenzene	0.0010	0.0080	0.0010	U
m-Xylene	0.00063	0.0030	0.00063	U
Methylene chloride	0.0011	0.0020	0.0011	U
n-Butylbenzene	0.00072	0.0050	0.00072	U
n-Propylbenzene	0.00093	0.0020	0.00093	U
Naphthalene	0.00081	0.0020	0.00081	U
o-Xylene	0.00063	0.0050	0.00063	U
p-Cymene	0.00092	0.0060	0.00092	U

SMK
3/18/97

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8260AAB #: A7B07739Lab Name: Recra LabNetContract #: F46162495D80Field Sample ID: TB-012Lab Sample ID: A7313027Matrix: SOIL% Solids: 100.0Dilution: 1.00Date Received: 5-Sep-97

Date Extracted: _____

Date Analyzed: 13-Sep-97Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	MDL	PQL	Concentration	Qualifier
p-Xylene	0.00063	0.0070	0.00063	U
sec-Butylbenzene	0.00090	0.0070	0.00090	U
Styrene	0.00096	0.0020	0.00096	U
Trichloroethene	0.0010	0.010	0.0010	U
tert-Butylbenzene	0.0011	0.0070	0.0011	U
Tetrachloroethene	0.0011	0.0070	0.0011	U
Toluene	0.0010	0.0050	0.0010	U
trans-1,2-Dichloroethene	0.0013	0.0030	0.0013	U
trans-1,3-Dichloropropene	0.00082	0.0050	0.00082	U
Trichlorofluoromethane	0.0028	0.0040	0.0028	U
Vinyl chloride	0.0011	0.0090	0.0011	U

Comments:

Client Sample No.

EB-015

Lab Name: Recra LabNet

Contract: F46162495D80

Lab Code: RECN

Case No.: _____

SAS No.: _____

SDG No.: _____

Matrix (soil/water): WATER

Lab Sample ID: A7313026

% Solids: 0.0

Date Samp/Recv: 09/04/97 09/05/97

Parameter Name	Units of Measure	Result	C	Q	M	Method Number	Analyzed Date
Total Organic Carbon	MG/L	1.0	U			415.1	09/08/97
Total Recoverable Petroleum Hydrocarbons	MG/L	0.25	U			418.1	09/12/97

Comments:

000131

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8270AAB #: A7B07480Lab Name: Recra LabNetContract #: F46162495D80Field Sample ID: EB-015Lab Sample ID: A7313026Matrix: WATER

% Solids: _____

Dilution: 1.00Date Received: 5-Sep-97Date Extracted: 9-Sep-97Date Analyzed: 13-Sep-97Concentration Units (ug/L or mg/kg dry weight): UG/L

Analyte	MDL	PQL	Concentration	Qualifier
Bis(2-chloroisopropyl) ether	1	10.0	1	U
Bis(2-ethylhexyl) phthalate	2	10.0	2	U
Butyl benzyl phthalate	2	10.0	2	U
Chrysene	2	10.0	2	U
Di-n-butyl phthalate	2	10.0	2	U
Di-n-octyl phthalate	2	10.0	2	U
Dibenzo(a,h)anthracene	2	10.0	2	U
Dibenzofuran	2	10.0	2	U
Diethyl phthalate	2	10.0	2	U
Dimethyl phthalate	1	10.0	1	U
Fluoranthene	2	10.0	2	U
Fluorene	2	10.0	2	U
Hexachlorobenzene	2	10.0	2	U
Hexachlorobutadiene	1	10.0	1	U
Hexachlorocyclopentadiene	2	10.0	2	U
Hexachloroethane	0.8	10.0	0.8	U
Indeno(1,2,3-cd)pyrene	3	10.0	3	U
Isophorone	1	10.0	1	U
N-nitrosodiphenylamine	1	10.0	1	U
N-Nitroso-Di-n-propylamine	1	10.0	1	U
Naphthalene	1	10.0	1	U
Nitrobenzene	2	10.0	2	U
Phenanthrene	1	10.0	1	U
Pyrene	2	10.0	2	U
2,4,5-Trichlorophenol	3	50.0	3	U

SMX
3/16/98

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

000130

Analytical Method: 8270AAB #: A7B07480Lab Name: Recra LabNetContract #: F46162495D80Field Sample ID: EB-015Lab Sample ID: A7313026Matrix: WATER% Solids: Dilution: 1.00Date Received: 5-Sep-97Date Extracted: 9-Sep-97Date Analyzed: 13-Sep-97Concentration Units (ug/L or mg/kg dry weight): UG/L

Analyte	MDL	PQL	Concentration	Qualifier
1,2,4-Trichlorobenzene	0.8	10.0	0.8	U
1,2-Dichlorobenzene	2	10.0	2	U
1,3-Dichlorobenzene	1	10.0	1	U
1,4-Dichlorobenzene	1	10.0	1	U
2,4-Dinitrotoluene	1	10.0	1	U
2,6-Dinitrotoluene	2	10.0	2	U
2-Chloronaphthalene	2	10.0	2	U
2-Methylnaphthalene	1	10.0	1	U
2-Nitroaniline	2	50.0	2	U
3-Nitroaniline	2	50.0	2	U
3,3'-Dichlorobenzidine	2	20.0	2	U
4-Bromophenyl phenyl ether	2	10.0	2	U
4-Chloroaniline	1	20.0	1	U
4-Chlorodiphenylether	1	10.0	1	U
4-Nitroaniline	3	50.0	3	U
Acenaphthylene	1	10.0	1	U
Acenaphthene	1	10.0	1	U
Anthracene	2	10.0	2	U
Benzo(a)anthracene	2	10.0	2	U
Benzo(a)pyrene	2	10.0	2	U
Benzo(b)fluoranthene	3	10.0	3	U
Benzo(ghi)perylene	3	10.0	3	U
Benzyl alcohol	5	20.0	5	U
Bis(2-chloroethoxy) methane	1	10.0	1	U
Bis(2-chloroethyl) ether	2	10.0	2	U

SMK
3/16/97

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

007132

Analytical Method: 8270

AAB #: A7B07480

Lab Name: Recra LabNet

Contract #: F46162495080

Field Sample ID: EB-015

Lab Sample ID: A7313026

Matrix: WATER

% Solids: _____

Dilution: 1.00

Date Received: 5-Sep-97

Date Extracted: 9-Sep-97

Date Analyzed: 13-Sep-97

Concentration Units (ug/L or mg/kg dry weight): UG/L

Analyte	MDL	PQL	Concentration	Qualifier
2,4,6-Trichlorophenol	3	10.0	3	U
2,4-Dichlorophenol	0.8	10.0	0.8	U
2,4-Dimethylphenol	2	10.0	2	U
2,4-Dinitrophenol	2	50.0	2	U
2-Chlorophenol	1	10.0	1	U
2-Methylphenol	2	10.0	2	U
2-Nitrophenol	2	10.0	2	U
4,6-Dinitro-2-methylphenol	2	50.0	2	U
4-Chloro-3-methylphenol	1	20.0	1	U
4-Methylphenol	1	10.0	1	U
4-Nitrophenol	3	50.0	3	U
Benzoic acid	50	50.0	50	U
Pentachlorophenol	4	50.0	4	U
Phenol	2	10.0	2	U

Comments:

SMX
3/11

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

007111

Analytical Method: 8020

AAB #: A7807552

Lab Name: Recra LabWet

Contract #: F46162495D80

Field Sample ID: EB-015

Lab Sample ID: A7313026

Matrix: WATER

% Solids:

Dilution: 1.00

Date Received: 5-Sep-97

Date Extracted:

Date Analyzed: 9-Sep-97

Concentration Units (ug/L or mg/kg dry weight): UG/L

Analyte	MDL	PQL	Concentration	Qualifier
BENZENE	0.20	2.0	0.20	U
ETHYLBENZENE	0.20	2.0	0.20	U
TOLUENE	0.20	2.0	0.20	U
XYLENES, TOTAL	0.20	2.0	0.20	U

Comments:

SMK
3/16/97

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

00241

Analytical Method: 8260AAB #: A7807739Lab Name: Recra LabNetContract #: F46162495D80Field Sample ID: E8-015Lab Sample ID: A7313028Matrix: SOIL% Solids: 100.0Dilution: 1.00Date Received: 5-Sep-97

Date Extracted: _____

Date Analyzed: 13-Sep-97Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	MDL	PQL	Concentration	Qualifier
1,1,1,2-Tetrachloroethane	0.00093	0.0030	0.00093	U
1,1,1-Trichloroethane	0.00093	0.0040	0.00093	U
1,1,2,2-Tetrachloroethane	0.00091	0.0020	0.00091	U
1,1,2-Trichloroethane	0.00076	0.0050	0.00076	U
1,1-Dichloroethane	0.0012	0.0020	0.0012	U
1,1-Dichloroethene	0.0013	0.0060	0.0013	U
1,1-Dichloropropene	0.0011	0.0050	0.0011	U
1,2,3-Trichlorobenzene	0.00066	0.0020	0.00066	U
1,2,3-Trichloropropane	0.0011	0.020	0.0011	U
1,2,4-Trichlorobenzene	0.00070	0.0020	0.00070	U
1,2,4-Trimethylbenzene	0.00083	0.0070	0.00083	U
1,2-Dichloroethane	0.00095	0.0030	0.00095	U
1,2-Dichlorobenzene	0.00087	0.0020	0.00087	U
1,2-Dibromo-3-chloropropane	0.0015	0.010	0.0015	U
1,2-Dichloropropane	0.00080	0.0020	0.00080	U
1,2-Dibromoethane	0.0011	0.0030	0.0011	U
1,3,5-Trimethylbenzene	0.00099	0.0030	0.00099	U
1,3-Dichlorobenzene	0.00077	0.0060	0.00077	U
1,3-Dichloropropane	0.00073	0.0020	0.00073	U
1,4-Dichlorobenzene	0.00065	0.0020	0.00065	U
1-Chlorohexane	0.00080	0.0030	0.00080	U
2,2-Dichloropropane	0.0013	0.020	0.0013	U
o-Chlorotoluene	0.00064	0.0020	0.00064	U
p-Chlorotoluene	0.00077	0.0030	0.00077	U
Benzene	0.00068	0.0020	0.00068	U

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3/16/98

000242

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8260AAB #: A7807739Lab Name: Recra LabNetContract #: F46162495D80Field Sample ID: EB-015Lab Sample ID: A7313028Matrix: SOIL% Solids: 100.0Dilution: 1.00Date Received: 5-Sep-97

Date Extracted: _____

Date Analyzed: 13-Sep-97Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	MDL	PQL	Concentration	Qualifier
Bromobenzene	0.00086	0.0020	0.00086	U
Bromochloromethane	0.00048	0.0020	0.00048	U
Bromodichloromethane	0.00061	0.0040	0.00061	U
Bromoform	0.00078	0.0060	0.00078	U
Bromomethane	0.0013	0.0050	0.0013	U
Carbon Tetrachloride	0.0013	0.010	0.0013	U
Chlorobenzene	0.00083	0.0020	0.00083	U
Chloroethane	0.0013	0.0050	0.0013	U
Chloroform	0.00077	0.0020	0.00077	U
Chloromethane	0.0010	0.0070	0.0010	U
cis-1,2-Dichloroethene	0.00082	0.0060	0.00082	U
cis-1,3-Dichloropropene	0.00064	0.0050	0.00064	U
Dibromochloromethane	0.00083	0.0030	0.00083	U
Dibromomethane	0.00037	0.010	0.00037	U
Dichlorodifluoromethane	0.0032	0.0050	0.0032	U
Ethylbenzene	0.00099	0.0030	0.00099	U
Hexachlorobutadiene	0.00068	0.0050	0.00068	U
Isopropylbenzene	0.0010	0.0080	0.0010	U
m-Xylene	0.00063	0.0030	0.00063	U
Methylene chloride	0.0011	0.0020	0.0011	U
n-Butylbenzene	0.00072	0.0050	0.00072	U
n-Propylbenzene	0.00093	0.0020	0.00093	U
Naphthalene	0.00081	0.0020	0.00081	U
o-Xylene	0.00063	0.0050	0.00063	U
p-Cymene	0.00092	0.0060	0.00092	U

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3/15/97

000243

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8260

AAB #: A7B07739

Lab Name: Recra LabNet

Contract #: F46162495D80

Field Sample ID: EB-015

Lab Sample ID: A7313028

Matrix: SOIL

% Solids: 100.0

Dilution: 1.00

Date Received: 5-Sep-97

Date Extracted: _____

Date Analyzed: 13-Sep-97

Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	MDL	PQL	Concentration	Qualifier
p-Xylene	0.00063	0.0070	0.00063	U
sec-Butylbenzene	0.00090	0.0070	0.00090	U
Styrene	0.00096	0.0020	0.00096	U
Trichloroethene	0.0010	0.010	0.0010	U
tert-Butylbenzene	0.0011	0.0070	0.0011	U
Tetrachloroethene	0.0011	0.0070	0.0011	U
Toluene	0.0010	0.0050	0.0010	U
trans-1,2-Dichloroethene	0.0013	0.0030	0.0013	U
trans-1,3-Dichloropropene	0.00082	0.0050	0.00082	U
Trichlorofluoromethane	0.0028	0.0040	0.0028	U
Vinyl chloride	0.0011	0.0090	0.0011	U

Comments:

SHK
3/18/97

002112

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8020

AAB #: A7B07552

Lab Name: Recra LabNet

Contract #: F46162495D80

Field Sample ID: Matrix Spike Blank

Lab Sample ID: A7B0755202

Matrix: WATER

% Solids:

Dilution: 1.00

Date Received: 9-Sep-97

Date Extracted:

Date Analyzed: 9-Sep-97

Concentration Units (ug/L or mg/kg dry weight): UG/L

Analyte	MDL	PQL	Concentration	Qualifier
BENZENE	0.20	2.0	4.0	
ETHYLBENZENE	0.20	2.0	4.0	
TOLUENE	0.20	2.0	4.0	
XYLENES, TOTAL	0.20	2.0	12	

Comments:

SPK
3/16/97

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: 8020

AAB #: A7807552

Lab Name: Recra LabNet

Contract #: F46162495D80

Field Sample ID: Matrix Spike Blk Dup Lab Sample ID: A780755203

Matrix: WATER

% Solids:

Dilution: 1.00

Date Received: 9-Sep-97

Date Extracted:

Date Analyzed: 9-Sep-97

Concentration Units (ug/L or mg/kg dry weight): UG/L

Analyte	MDL	PQL	Concentration	Qualifier
BENZENE	0.20	2.0	4.2	
ETHYLBENZENE	0.20	2.0	4.1	
TOLUENE	0.20	2.0	4.2	
XYLENES, TOTAL	0.20	2.0	13	

Comments:

*SMK
3/16/98*

Recra LabNet - Lionville Laboratory

PAH'S by HPLC / Method 8310

Report Date: 09/26/97 10:17

Preliminary Report for :

RFW Batch Number: 9709L213

Client: THE ENVIRONMENTAL CO

Work Order: 70000003001 Page: 1

Sample Information	RFW#:	001	002	003	011	97LE1642-MB1	97LE1642-MB1
	Matrix:	SOIL	SOIL	SOIL	WATER	SOIL	SOIL
PAH	D.F.:	1.00	1.00	1.00	1.00	1.00	1.00
	Units:	ug/Kg	ug/Kg	ug/Kg	ug/L	ug/Kg	ug/Kg
	Cust ID:	UST-006-01	UST-009-01	UST-009-02	EB-015	BLK	BLK BS
Triphenylene		88 %	77 %	100 %	86 %	85 %	86 %
		fl	fl	fl	fl	fl	fl
Naphthalene		1460 U	1430 U	1420 U	18.0 U	1210 U	71 %
Acenaphthylene		1720 U	1690 U	1670 U	23.0 U	1430 U	78 %
Acenaphthene		1460 U	1430 U	1420 U	18.0 U	1210 U	80 %
Fluorene		169 U	165 U	164 U	2.10 U	140 U	79 %
Phenanthrene		518 U	508 U	503 U	6.40 U	430 U	84 %
Anthracene		530 U	520 U	515 U	6.60 U	440 U	91 %
Fluoranthene		180	165 U	360	2.10 U	140 U	85 %
Pyrene		217 U	213 U	211 U	2.70 U	180 U	86 %
Benzo (a) anthracene		82	28	46	0.13 U	9.00 U	89 %
Chrysene		120 U	118 U	117 U	1.50 U	100 U	86 %
Benzo (b) fluoranthrene		110	35	61	0.18 U	12.0 U	90 %
Benzo (k) fluoranthrene		58	19	29	0.17 U	11.0 U	89 %
Benzo (a) pyrene		280	99	160	0.23 U	15.0 U	105 %
Dibenzo (a, h) anthracene		24.1 U	23.6 U	23.4 U	0.30 U	20.0 U	93 %
Benzo (ghi) perylene		130	60.3 U	62	0.76 U	51.0 U	87 %
Indeno (1, 2, 3-cd) pyrene		99	34	42	0.43 U	29.0 U	87 %

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not reported. NS= Not spiked.
 % = Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

1-337 P.07/09 Job-518

6107016141

SEP-26-97 17:38 From:RECRA ENVIRONMENTAL

Attachment F

Sample Collection and Handling Procedures

2.0 PROJECT ACTIVITIES

This section provides a synopsis of the objectives, activities, and methods used in the investigation and surveying efforts conducted at the Offsite WSA RFI. The overall goal for the project is described, as are investigation specific objectives for each of the potential source areas examined in the field. Also provided is an overall summary of the project field activities, laboratory analytical program, and data evaluation activities and methods. Results of the investigations and surveys are described in Section 3.0.

2.1 PROJECT OBJECTIVES

The overall goal of this project is to characterize environmental conditions at the Offsite WSA in support of SWMU 59 closure and the disposal/reuse of the Offsite WSA property. Specific objectives needed to achieve this goal include:

- determination of the nature and extent of any potential equipment, structures and soil contamination associated with the Offsite WSA Waste Accumulation Area located adjacent to Bldg. 8503 (SWMU 59);
- assessment of the nature and extent of potential surface soil, subsurface soil, sediment, **surface water**, and groundwater contamination resulting from other activities and/or sources at the Offsite WSA;
- characterization of potential surface and subsurface soil contamination related to potential leaks from previously removed USTs and past UST fueling operations;
- identification and characterization of potential contaminants and/or hazardous constituents associated with buildings and structures;
- characterization of potential threats to human health and ecological receptors posed by any contamination identified; and
- development of data supporting the identification of corrective measures needed to control, minimize, or eliminate any contamination and/or hazardous constituents identified during the project.

The following section describes the field activity tasks completed in order to achieve these objectives. In doing so, the project objectives are restated in terms of area specific investigation needs.

2.2 FIELD ACTIVITIES

The RFI field tasks were completed in several consecutive stages. The preparatory stage included an initial land survey and utilities location. Environmental media field investigations began after mobilization of field equipment and personnel, and the establishment of a temporary on-site field office. Surveys of all buildings and structures (facilities) were conducted concurrently with the environmental media sampling. The environmental investigations, including those addressing surface and subsurface soils, drainageway **and seep** sediments, surface water, and groundwater sampling, are discussed in Sections 2.2.1, 2.2.2, 2.2.3, and 2.2.4 respectively. The facility surveys are discussed in Section 2.2.5.

To support the final RFI objectives, a supplemental field characterization was performed in fourth quarter of 1998 and in January 1999, following the main field investigation. The effort consisted of the following:

- verifying reported results by resampling at previous locations and depths;
- further determining the extent of contamination as needed; and
- determining association of polycyclic aromatic hydrocarbons (PAHs) with roadway run-off.

These tasks are described for each area in Sections 2.2.1 and 2.2.2. The scope of work for the final focused field characterization effort is documented in the *Final Characterization and Removal Action Work Plan* (TEC, 1998a).

Other field tasks were completed in support of the overall RFI. These tasks are discussed in Section 2.2.6 below. The chronology of the field activities is summarized in Section 2.2.7. A field data quality assessment was also performed, the results of which are given below in Section 2.2.8.

2.2.1 Surface and Subsurface Soil Investigations

The surface and subsurface soil sampling efforts focused on characterizing the areas of concern as identified in Section 1.3 of this report and background conditions. Areas associated with potential soil contamination are identified in Figure 2-1 and include:

- outdoor materiel storage and maintenance areas (A-1, A-2);
- unpaved perimeter of the Waste Accumulation Area and Bldg. 8503 (A-3);
- disturbed surface area southwest of the Control Fence (A-5);
- EOD Range;
- bunker floor drain outlets;
- removed UST locations;
- vehicle fueling area (A-4);
- areas beneath transformers; and
- leach field.

Surface and subsurface soil sample locations, including the supplemental verification and extent of contamination sample locations, are shown in Figure 2-2. Background soil sample locations are shown in Figure 2-3. Surveyed sample location coordinates and elevations are listed in Appendix C. Table 2-1 provides a summary of the sample locations and the number of samples collected during the RFI. Table 2-2 is a summary of the analyses performed on these samples.

Surface and subsurface soil sampling was typically conducted in the same manner in all areas sampled. Minor modifications were incorporated in some areas due to field conditions or types of contaminants suspected. Figure 2-4 demonstrates the general scenarios for soil sample collection.

Surface samples were collected between 0 and 0.5 feet bgs. Field personnel used stainless steel shovels, bowls, and spoons to collect the surface soil. No hand augers were used during the sampling. All equipment was decontaminated according to procedures listed in the Field Sampling Plan (FSP) (TEC, 1996a).

Subsurface soil samples were collected using direct-push techniques. Standard 2-foot-long split spoons were emplaced in the ground using the hydraulic unit of a Simco 2400 Earth Probe mounted on a flatbed truck (see Photographs SA-a and SA-b in Appendix A). Each split spoon was fitted with four 6-inch brass liners before emplacement. Subsurface samples were collected and logged continuously in the boreholes. In addition to geologic logging, all samples were screened for volatile organic vapors. Screening was completed by measuring the vapors from exposed soil between two brass liners using a photo-ionization detector (PID).

A maximum of two subsurface soil samples from each borehole was collected for chemical characterization. The first subsurface soil sample for chemical characterization was collected directly below the surface sample, in the interval of 0.5 to 2.5 feet bgs. In cases where the borehole could be extended below 2.5 feet, a second sample was collected directly above the bedrock surface (see Figure 2-4). In some areas, the borehole intersected the discontinuous water zone, and the second subsurface sample was collected directly above the water table.

Samples for VOC and BTEX analyses were prepared by sealing both ends of a completely filled brass liner with Teflon tape and plastic end caps (see Photograph SA-c in Appendix A). Soil from all other liners was composited in stainless steel bowls for inorganic, SVOC, explosive compound, and/or pesticide/PCB analyses, as needed (see Photograph SA-d in Appendix A). In some boreholes, the amount of soil recovered did not provide sufficient sample material. Additional material was generated by drilling a second borehole approximately 6 inches from the first. Headspace screening and lithologic descriptions were completed on all samples, as specified in the FSP. Borehole logs for all holes drilled at the Offsite WSA during this RFI are included in Appendix D of this report.

Chemical analyses for soil varied for each investigation area. VOC, SVOC, inorganic, pesticides/PCB, explosive compound, PAH, BTEX, and TPH analyses were selected to be performed on area samples based on area specific reported activities and material usage. Specific parameters associated with these different analytical groups are listed in Appendix E. Area specific rationale is discussed below in Sections 2.2.1.1 through 2.2.1.9.

In addition to source characteristics, chemical analyses for individual soil samples were also selected based on contaminant mobility and persistence characteristics. With the exception of the USTs, all potential sources at the Offsite WSA were above ground. Contaminants introduced from these areas would, to some extent, absorb to the soil or migrate vertically toward bedrock.

Inorganics, pesticides/PCBs, explosive compounds, and SVOCs are generally less mobile than VOCs and absorb to soil. If present, these compounds would be found in the upper soil horizons. As shown in Figure 2-4, inorganic, pesticides/PCB, explosive compound, and SVOC analyses were performed on the surface and first subsurface samples. Portions of the samples from the second subsurface sample (directly above bedrock) were extracted and archived by the laboratory until results from the upper soil horizons were available. Only if these less mobile contaminants were present in the surface or the first subsurface sample were they analyzed in the second subsurface soil sample.

VOCs, in contrast, could be removed from surface soils over time due to a combination of downward migration and surficial volatilization. Surface soil samples were therefore not analyzed for VOCs. At all locations, both subsurface soil samples were analyzed for VOCs.

The following sections provide detailed descriptions of the analyses performed on samples collected within each investigation area. Section 3.0 of this report presents a discussion of the analytical results for all samples collected during the RFI.

2.2.1.1 Outdoor Materiel Storage and Maintenance Areas (A-1, A-2)

Investigation Area

Investigations were conducted in those areas where materials storage and maintenance activities were either reported or suspected. The area between Bldg. 8503 and Munitions Storage Bunkers 8531, 8533, and 8535 (Area A-1) was reportedly used to temporarily store munition components and practice bombs. Maintenance activities such as sanding, painting, and general cleaning also have been performed in this area. A second area (A-2) potentially used for similar activities was located directly north of the road serving Munitions Storage Bunkers 8554, 8556, 8558, 8560, and 8552 (see Figure 2-1). Photographs A1-a, A1-b, and A2-a (see Appendix A) show different views of these two areas.

Task Objective

As these areas are unpaved, waste materials generated could have been deposited directly to the ground surface. The objective of this task was to identify whether contaminants were present in the surface and subsurface soils and to determine the extent of any potential contamination.

Field Activities

In order to meet this objective, surface and subsurface soil samples were collected from each area. Area A-1 encompasses approximately 156,200 square feet. Samples from 34 locations (A1-01 through A1-34) in Area A-1 were collected on an established grid pattern (see Figure 2-2). The grid lines were aligned parallel to the adjacent service roads, as it was assumed that the majority of activity had occurred next to the roads. The first grid lines adjacent to the roads were therefore placed approximately 5 feet from the edge of the pavement. The second set of grid lines was located 20 feet to the south and to the east of the first lines. All other grid lines were spaced 100 feet apart as shown in Figure 2-2. Six of the 34 locations (A1-29 through A1-34) were placed across the service roads to the west and northwest due to the presence of disturbed soil noted during the field reconnaissance effort.

Area A-2 encompasses approximately 31,000 square feet. The area is bounded by the service road to the south and the fence to the north. Service road extensions located directly across from each bunker divide the area. Assuming that activity in this area took place close to the roadside, eight sample locations (A2-001 through A2-008) were biased towards the edge of the northern service road and the road extensions as shown in Figure 2-2.

Surface and subsurface soil samples for Areas A-1 and A-2 were collected at each borehole location, as shown in Figure 2-2. Procedures outlined in Section 2.2.1 were used for sample collection. All 42 boreholes in these two areas terminated against bedrock at shallow depths.

The sanding, painting, and general cleaning activities performed in this area may have generated wastes with associated inorganic compounds, VOCs, and SVOCs. Analyses for these types of contaminants were therefore performed. The potential for explosive compound or pesticide/PCB contamination resulting from the activities performed in these areas was not expected. In order to completely characterize the investigation areas, however, samples from 10 percent of the locations were analyzed for explosive compounds and pesticides/PCBs. These

locations were evenly distributed across the investigation area. Analyses were performed on individual samples from each location as discussed in Section 2.2.1 and as shown in Figure 2-4.

Following the above initial characterization, 10 supplemental sample locations were established in the vicinity of A1-019 (four locations) and A1-028 (four locations) to verify previous anomalous detects and further define horizontal extent of the contamination. Two locations were established 20 feet north and south of A1-019 and two locations were placed 10 feet east of A1-019. Four sample locations were established 10 feet to the north, south, east, and west of A1-028 to delineate extent of contamination. Two locations were co-located at the original sample locations.

Verification and extent of contamination sample locations are shown in Figure 2-2. Samples collected in the vicinity of A1-019 were analyzed for semivolatiles. Samples collected in the vicinity of A1-028 were analyzed for metals.

2.2.1.2 Waste Accumulation Area and Bldg. 8503 (A-3)

Investigation Area

Bldg. 8503 was the primary maintenance and inspection facility at the Offsite WSA. Photographs A3-a, A3-b, and A3-c (see Appendix A) show the building and the surrounding area. Bldg. 8503 contains two open maintenance bays located on the north and south ends of the building, with each bay having two doors, one each on the east and west sides (Photograph A3-b). The southern bay contains two paint booths. Each bay also contains an overhead crane system that would allow for work on heavy equipment. The entire building is surrounded by a concrete surface. During the site reconnaissance, gaps were noted throughout the area between sections of the concrete pad. Grass has grown in these gaps, making them easily noticeable on the site photographs. The Waste Accumulation Area (SWMU 59) is located directly west of the southern end of Bldg. 8503, along the edge of the concrete surface (see Photograph A3-b in Appendix A).

The entire surface surrounding the Waste Accumulation Area and Bldg. 8503 is impervious, and stormwater flows away from the buildings to the north, south, and west onto the adjacent grassy areas. Sloping terrain in the area generally directs run-off from the north to the south. Drainageway 1, a ditch approximately 10 feet from the west side of the concrete pad, collects run-off and directs it south toward Bldg. 8500, where it discharges to Live Oaks Creek or infiltrates into the ground (see Figure 2-2). Methods used in Drainageway 1 characterization efforts are discussed separately in Section 2.2.2.

Task Objective

The task objective was to determine whether contamination had been released from the Waste Accumulation Area and/or Bldg. 8503 to the surrounding surface and subsurface soils. In addition, the investigation attempted to determine whether contamination was present in the subsurface soils directly below the Waste Accumulation Area concrete pad. Sample results from this task were evaluated in conjunction with those from the drainageway investigation to determine if contamination had migrated away from the immediate area via Drainageway 1.

Field Activities

The Waste Accumulation Area containment features were evaluated. Particular attention was given to the gaps in the concrete pad near the building. These gaps are 0.5-inch-wide separations between the individual concrete blocks that comprise the pad surrounding Bldg. 8503. Soils beneath two gaps were investigated during this RFI by drilling through the concrete and collecting subsurface soil samples for lithologic and chemical characterization. The first gap was located approximately 1 foot south of the southern edge of the Waste Accumulation Area building. The second gap was located approximately 15 feet north of the northern edge of the building. Along each of these gaps, two holes were drilled through the concrete at intervals of 10 feet (see Figure 2-2). Concrete thickness ranged from 1 to 1.2 feet in the four boreholes.

In each of the four boreholes (A3-18 through A3-21) drilled along the gaps, two subsurface soil samples were collected beneath the concrete pad. The first subsurface soil sample for chemical characterization was collected in the 2-foot interval directly below the pad. The second sample for chemical characterization was collected directly above the bedrock surface, approximately 5 to 7 feet bgs in all four boreholes. All subsurface soil samples collected beneath the concrete pad were analyzed for inorganics, VOCs, SVOCs, pesticides/PCBs, and explosive compounds.

Both surface and subsurface soil samples were collected from the unpaved area surrounding the concrete pad. The A-3 area and Drainageway 1 together encompass approximately 47,900 square feet. Around the perimeter of Bldg. 8503, three series of surface and subsurface soil samples were collected (Figure 2-2). The first series (A3-001 through A3-014) was located along the entire perimeter within 5 feet of the edge of the pad. The sample locations were spaced approximately 50 feet apart, except in the zone adjacent to the Waste Accumulation Area, where sample locations (A3-008, A3-009, and A3-010) were spaced approximately 10 feet apart. Surface and subsurface soil samples were collected from these locations to target potential contaminants transported across the pad with surface water runoff. A second series was positioned between Drainageway 1 and the first series of samples. The three locations in the second series sample locations (A3-015, A3-016, and A3-017) were spaced approximately 50 feet apart. The third series (A3-024 and A3-025) was located approximately 30 feet beyond of the edge of the pavement, west of Drainageway 1. Samples from these locations were positioned to identify the extent of any contamination related to the Waste Accumulation Area and Bldg. 8503.

Surface and subsurface soil samples were collected at each location as shown on Figure 2-2. Procedures outlined in Section 2.2.1 were followed for sample collection. Of the 23 boreholes drilled in this area, 21 terminated against bedrock, and two were terminated after the shallow, discontinuous water zone was reached at a depth of approximately 9 feet.

A previous investigation in the area indicated that VOC and inorganic contamination was present in the soils. There have been no historic analyses for pesticides/PCBs or explosive compounds in this area (Radian, 1989). Samples collected at Area A-3 were analyzed for VOCs, inorganics, and SVOCs, as described in Section 2.2.1. In order to provide complete characterization at those locations where previous contamination was reported, the surface and upper subsurface samples from the three locations directly adjacent to the Waste Accumulation Area building were also analyzed for pesticides/PCBs and explosive compounds. In addition, 10

percent of the total number of remaining samples collected at A-3 were analyzed for pesticides/PCBs and explosive compounds.

Following the initial characterization described above, a total of 22 supplemental sample locations were established in Area A-3 to verify reported PAH concentrations in the original samples (see Section 3.0) and to further define extent of the contamination. Sample locations were established at 15 and 30 feet from the edge of the pavement to determine the extent of PAH contamination. Sample locations were also established to verify previously reported anomalous antimony and mercury detects in Area A-3. Sample locations are shown in Figure 2-2.

2.2.1.3 Disturbed Surface Area (A-5)

Investigation Area

During TEC's October 1996 site reconnaissance, a disturbed surface area was noted at the southeast corner of the property, outside of the inner security fence. It appeared that earth-moving equipment had been used to excavate fill material. Photographs A5-a and A5-b (see Appendix A) provide a general view of Area A-5.

Task Objective

The objective of this task was to determine whether activities at this disturbed surface area were associated with waste products and whether these activities had resulted in contamination of surface and subsurface soils.

Field Activities

As there were no discrete anomalies at this site, four sample locations (A5-001 through A5-004) were established between 50 and 75 feet apart in the center of the area as indicated in Figure 2-2. The area of disturbed surface at A-5 encompasses approximately 47,400 square feet. Surface and subsurface samples were collected at each location. Procedures outlined in Section 2.2.1 were used for sample collection. Refusal against bedrock occurred in all four boreholes in Area A-5 at depths ranging from 1.5 to 4.5 feet bgs.

It is unknown what materials or contaminants might have been associated with this area. All locations were therefore characterized for potential contaminants associated with waste generating activities, which included inorganics, VOCs, SVOCs, pesticides/PCBs, and explosive compounds, as described in Section 2.2.1.

2.2.1.4 EOD Range

Investigation Area

The EOD range was located directly west of the fenced Offsite WSA area and consisted of approximately 40,000 square feet (see Figure 2-1). A protective bunker was built at the crest of a plateau for EOD personnel use during disposal activities (see Photograph EOD-a in Appendix A). To the west of the bunker is a 2-foot high berm forming a circle of approximately 300 feet in diameter. Based on EOD clearance reports (USAF, 1995) this berm is assumed to define the primary disposal range. However, the clearance report did identify a number of disposal pits east of the berm. Photographs EOD-b, EOD-c, and EOD-d (see Appendix A) show

views of the EOD Range from the top of the bunker. Warning signs mark the perimeter of the former range.

Task Objective

The objective of the task was to determine if residual explosive-related materials were present in the surface and subsurface soils.

Field Activities

A total of 11 sample locations were established across the EOD Range, as shown in Figure 2-2. The area enclosed by the berm around the EOD Range encompasses approximately 77,500 square feet. Sample locations EOD-001 through EOD-008 were assigned based on results of the ordnance-clearing operations conducted at the EOD Range in August and September 1996. The area outlined by the sample locations encompassed approximately 132,300 square feet. Field personnel positioned sample locations EOD-001 through EOD-009 where metallic debris had been recovered during the clearance. Location EOD-009 was positioned near the bunker. Two locations (EOD-010 and EOD-011) were randomly positioned near the center of the EOD Range. Surface and subsurface soil samples were collected at each location. Procedures outlined in Section 2.2.1 were used for sample collection.

Activity in the area was reportedly limited to ordnance disposal. Therefore, samples were analyzed for potentially related contaminants, specifically explosive compounds and inorganics. The surface and upper subsurface (0.5 to 2.5 feet) soil samples were analyzed for inorganics and explosive compounds. The deeper subsurface soil samples were archived. Where contamination was detected in the upper samples, the archived sample from that location was analyzed for the contaminants of concern.

Based on the initial characterization results, nine supplemental sample locations were established in the EOD Range to verify anomalous detects reported in the original samples (see Section 3.0) and to further define extent of the contamination. Two locations were established at the original sample locations, EOD-009 and EOD-006, to verify previously reported detects of thallium and dinitrotoluene, respectively. Three locations were positioned 10 feet to the south, east, and west of EOD-009 to determine the extent of thallium contamination. Four locations were positioned 10 feet to the north, south, and east of EOD-006 to delineate the dinitrotoluene contamination. Sample locations are shown in Figure 2-2.

2.2.1.5 Bunker Floor Drain Outlets

Investigation Area

The Offsite WSA contains 11 abandoned munitions storage bunkers. The interior floor of each of these bunkers is sloped to drainage troughs located along the side walls. Each drainage trough discharges to the exterior ground surface through drains located at the base of the front wall as indicated in Figure 2-1. Photographs BD-a and BD-b (see Appendix A) are representative of the bunker drains examined during the RFI. No signs of flow or stressed vegetation at the drains were noted during the TEC site reconnaissance. An area of approximately 4 square feet is considered the maximum zone where potential contamination from these outlet drains may have occurred.

Task Objective

The objective of this task was to determine whether spills inside the bunkers might have occurred and migrated through the drains to the exterior, thereby contaminating the surface and subsurface soils.

Field Activities

Each of the 11 bunkers contains two wall drains. As there were no signs of flow or stressed vegetation around the drains, any potential spills would most likely have infiltrated within the immediate vicinity of the drain. Therefore, sample locations BD-001 through BD-022 were established immediately outside of the wall drain (see Figure 2-2). All surface samples and most subsurface samples were collected from these locations immediately beneath the wall drains. In some cases, however, it was necessary to move the borehole location out from the bunker approximately one foot to avoid buried utilities and allow the drilling equipment room to operate. Procedures outlined in Section 2.2.1 were used for sample collection.

The bunkers provided storage for munitions. Munitions-related materials are the only potential source of contamination in the bunkers. The surface and upper subsurface soil samples were therefore analyzed for inorganics and explosive compounds. The deeper subsurface soil samples were archived. Where contamination was detected in the upper samples, the archived sample from that location was analyzed for the contaminants of concern.

Based on the initial characterization results, six supplemental sample locations were established at the bunker drains in October 1998 to verify anomalous detects of mercury and cadmium reported in the original samples (see Section 3.0). These locations were positioned at and in the vicinity of BD-002 and BD-005. Four more sample locations at each of the 11 bunkers (a total of 44 sample locations) were established in January 1999 to delineate the extent of cadmium, copper, lead, and zinc around the drains.

The latter effort was undertaken based on conversations with the TNRCC, which indicated that the presence of lead-based paint in drainage outlets could be considered an unauthorized discharge as defined by TAC Chapter 335 regulations (BCT, 1998). Sample locations are shown in Figure 2-2.

2.2.1.6 Removed UST Locations

Investigation Area

The Offsite WSA contained five USTs. These tanks provided fuel in support of emergency power generation, heating, and vehicle fueling. Each tank was associated with a building operation (see Figure 2-1). A description of each tank, including building number, contents, size, dimensions, and function, is shown in Table 2-3. These features were determined from facility use descriptions and diagrams developed as part of the tank removal effort. Photographs UST-a through UST-d (see Appendix A) show current site conditions at the locations of four of the former USTs. Diagrams showing the location of each UST and its associated piping are provided in Appendix B.

Task Objective

The objective for this task was to determine whether potential tank and piping leaks had contaminated subsurface soils and to indicate whether groundwater contamination had resulted.

Field Activities

Borehole subsurface samples were collected near each former UST in order to identify leaks associated with both the tanks and piping. Ten soil borings (UST-001 through UST-010) were installed at the USTs on the basis of the tank location and the presence of pipe joints. A summary of the borehole locations associated with each former UST location is provided in Table 2-3.

Samples at UST sites were collected to define the vertical extent of contamination as shown in Figure 2-4. Sampling at the removed UST locations varied from sampling conducted elsewhere at the Offsite WSA in that surface soil samples were not collected. As all potential contaminant sources were below the ground surface at these locations, soil samples from 0 to 0.5 feet were deemed unnecessary. Subsurface samples for volatile organic headspace screening and lithologic descriptions were collected continuously through each entire borehole. Collection of up to three analytical subsurface samples from each borehole was planned. However, due to the shallow depth to bedrock at these sites, no more than two samples could be collected from any borehole. At all locations samples were collected directly above bedrock, as there were indications that contamination may have migrated to the fill material/bedrock interface in some locations. Additional samples were collected from the borehole interval with the highest headspace reading.

Samples were analyzed for compounds indicative of contamination from gasoline, diesel, and fuel oils. Analyses included BTEX, TPHs, and PAHs, in accordance with TNRCC Petroleum Storage Tank (PST) guidance.

2.2.1.7 Vehicle Fueling Area (A-4)**Investigation Area**

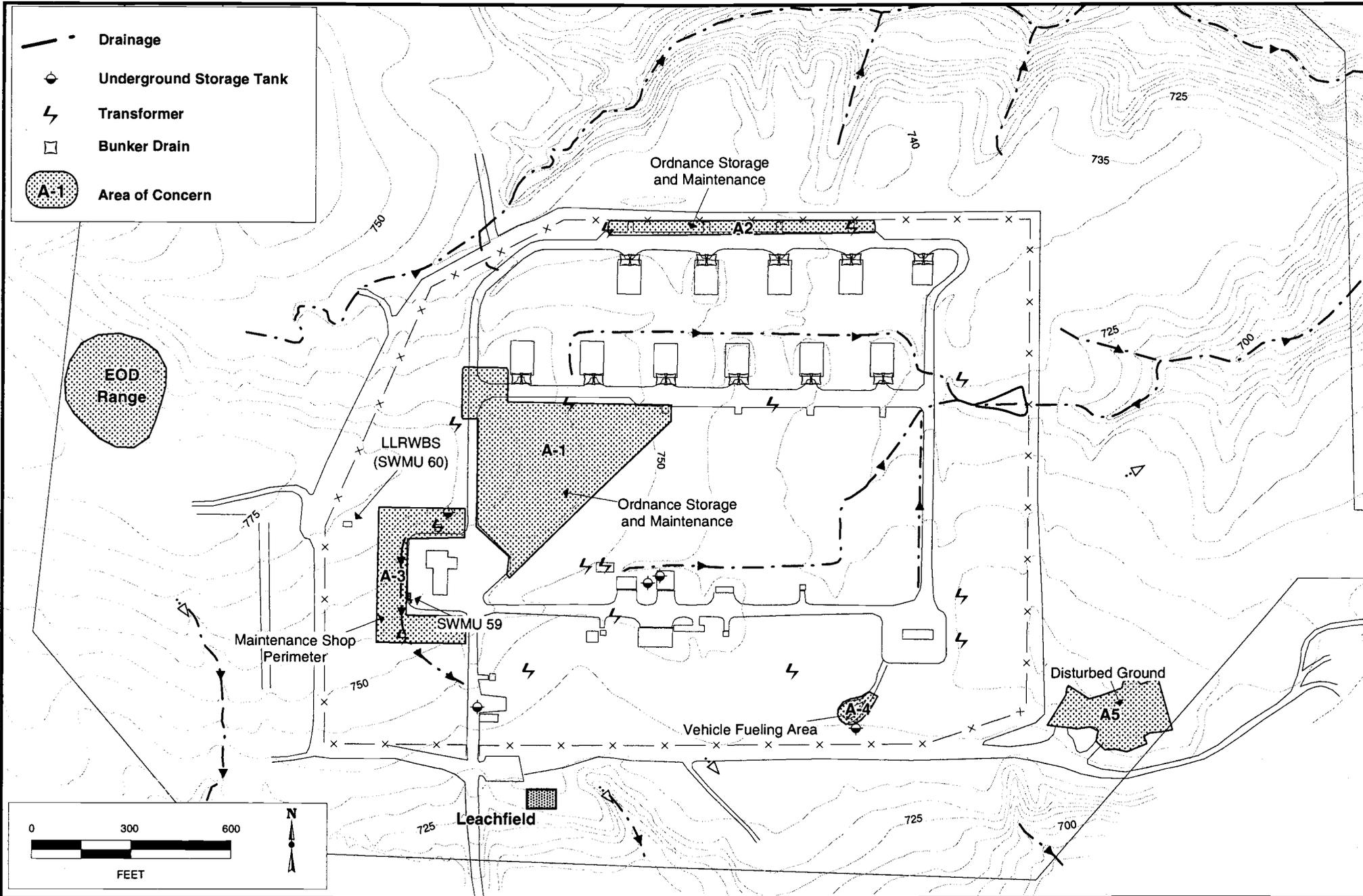
A vehicle fueling area was located approximately 300 feet southwest of Bldg. 8514 on an unpaved circular drive. Remnants of the fuel pump(s) are present on site in the form of a 2-foot by 4-foot concrete pad. The pad is located at the southern extent of the circular drive. The pump station was served by a 1,000-gallon UST located approximately 12.5 feet south of the drive. Potential contamination related to this former UST was investigated in conjunction with other former UST sites as described in Section 2.2.1.6. Photograph A4-a (see Appendix A) shows the condition of this area of concern as of August 1997.

Task Objective

As the fueling area is unpaved, spills might have resulted in soil contamination. The objective of this task was to determine if spills in the area contaminated the surface and subsurface soils.

Field Activities

Four sample locations (A4-001 through A4-004) were established directly north of the abandoned fuel pump. The sampling area encompassed roughly 65 square feet. The locations were positioned in the area where vehicle fueling would have occurred. Locations were spaced 5 to 10 feet apart based on observations made in the field.



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Figure 2-1 -- Field Investigation Areas

SUMMARY OF EXTRACTION AND ANALYSIS DATES
OFFSITE WEAPONS STORAGE AREA RFI
NAS FT WORTH JRB (FORMERLY CARSWELL AFB)

LOCATION ID	FIELD SAMPLE NO	LABORATORY SAMPLE NO	SAMPLE MATRIX	SAMPLE TYPE	ANALYTICAL METHOD	SAMPLE DATE	EXTRACTION DATE	ELAPSED TIME (DAYS)	ANALYSIS DATE	ELAPSED TIME (DAYS)
SP-002	SP-002-01	A8043105	SE	N1	SW7471	13-Feb-98	20-Feb-98	7	20-Feb-98	7
SP-002	SP-002-01	A8043105SD	SE	SD1	SW7471	13-Feb-98	20-Feb-98	7	20-Feb-98	7
SP-003	SP-003-01	A8042205	SE	N1	SW7471	12-Feb-98	20-Feb-98	8	20-Feb-98	8
SP-004	SP-004-01	A8043106	SE	N1	SW7471	13-Feb-98	20-Feb-98	7	20-Feb-98	7
WJEPX-925	MW-925-01	A7322601	WG	N1	SW7740	10-Sep-97	16-Sep-97	6	22-Oct-97	36
XU3212-901	XU3212-901-01	A7322801	WG	N1	SW7740	9-Sep-97	16-Sep-97	7	22-Oct-97	36
XU3212-902	XU3212-902-01	A7322803	WG	N1	SW7740	9-Sep-97	16-Sep-97	7	22-Oct-97	36
XU3212-902	XU3212-902-02	A7322804	WG	FD1	SW7740	9-Sep-97	16-Sep-97	7	22-Oct-97	36
A4-001	A4-001-01	A7305301	SO	N1	SW8020	29-Aug-97	3-Sep-97	5	3-Sep-97	0
A4-001	A4-001-02	A7313002	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
A4-002	A4-002-01	A7305302	SO	N1	SW8020	29-Aug-97	3-Sep-97	5	3-Sep-97	0
A4-002	A4-002-02	A7313003	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
A4-003	A4-003-01	A7305303	SO	N1	SW8020	29-Aug-97	4-Sep-97	6	4-Sep-97	0
A4-003	A4-003-02	A7313004	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
A4-003	A4-003-04	A7305304	SO	FD1	SW8020	29-Aug-97	4-Sep-97	6	4-Sep-97	0
A4-004	A4-004-01	A7305305	SO	N1	SW8020	29-Aug-97	4-Sep-97	6	4-Sep-97	0
A4-004	A4-004-02	A7313005	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
FIELDQC	EB-015	A7313026	WQ	EB1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-001	UST-001-01	A7313006	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-002	UST-002-01	A7313012	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-002	UST-002-02	A7313015	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-003	UST-003-01	A7313007	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-004	UST-004-01	A7313016	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-005	UST-005-01	A7313017	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-006	UST-006-01	A7313018	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-007	UST-007-01	A7313008	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-007	UST-007-04	A7313009	SO	FD1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-008	UST-008-01	A7313010	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-009	UST-009-01	A7313019	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-009	UST-009-02	A7313020	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0

SUMMARY OF EXTRACTION AND ANALYSIS DATES
OFFSITE WEAPONS STORAGE AREA RFI
NAS FT WORTH JRB (FORMERLY CARSWELL AFB)

LOCATION ID	FIELD SAMPLE NO	LABORATORY SAMPLE NO	SAMPLE MATRIX	SAMPLE TYPE	ANALYTICAL METHOD	SAMPLE DATE	EXTRACTION DATE	ELAPSED TIME (DAYS)	ANALYSIS DATE	ELAPSED TIME (DAYS)
UST-010	UST-010-01	A7313011	SO	N1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-010	UST-010-01	A7313011MS	SO	MS1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
UST-010	UST-010-01	A7313011SD	SO	SD1	SW8020	4-Sep-97	9-Sep-97	5	9-Sep-97	0
A1-010	A1-010-01	A7289610	SO	N1	SW8081	18-Aug-97	21-Aug-97	3	4-Sep-97	14
A1-010	A1-010-02	A7296208	SO	N1	SW8081	25-Aug-97	27-Aug-97	2	9-Sep-97	13
A1-010	A1-010-03	A7296216	SO	N1	SW8081	25-Aug-97	27-Aug-97	2	15-Oct-97	49
A1-010	A1-010-04	A7289611	SO	FD1	SW8081	18-Aug-97	21-Aug-97	3	4-Sep-97	14
A1-010	A1-010-05	A7296217	SO	FD1	SW8081	25-Aug-97	28-Aug-97	3	11-Sep-97	14
A1-020	A1-020-01	A7289634	SO	N1	SW8081	18-Aug-97	21-Aug-97	3	4-Sep-97	14
A1-021	A1-021-02	A7300212	SO	N1	SW8081	27-Aug-97	2-Sep-97	6	15-Sep-97	13
A1-021	A1-021-05	A7300213	SO	FD1	SW8081	27-Aug-97	2-Sep-97	6	15-Sep-97	13
A1-030	A1-030-01	A7289623	SO	N1	SW8081	18-Aug-97	21-Aug-97	2	4-Sep-97	14
A2-008	A2-008-01	A7289643	SO	N1	SW8081	19-Aug-97	21-Aug-97	2	4-Sep-97	14
A2-008	A2-008-02	A7305204	SO	N1	SW8081	28-Aug-97	4-Sep-97	7	15-Sep-97	11
A3-004	A3-004-01	A7293004	SO	N1	SW8081	20-Aug-97	23-Aug-97	3	5-Sep-97	13
A3-004	A3-004-02	A7305209	SO	N1	SW8081	28-Aug-97	4-Sep-97	7	15-Sep-97	11
A3-009	A3-009-01	A7293009	SO	N1	SW8081	20-Aug-97	23-Aug-97	3	5-Sep-97	13
A3-009	A3-009-02	A7305215	SO	N1	SW8081	28-Aug-97	4-Sep-97	7	15-Sep-97	11
A3-009	A3-009-04	A7293014	SO	FD1	SW8081	20-Aug-97	23-Aug-97	3	5-Sep-97	13
A3-009	A3-009-05	A7305217	SO	FD1	SW8081	28-Aug-97	4-Sep-97	7	16-Sep-97	12
A3-015	A3-015-01	A7293016	SO	N1	SW8081	20-Aug-97	23-Aug-97	3	5-Sep-97	13
A3-015	A3-015-02	A7305320	SO	N1	SW8081	29-Aug-97	4-Sep-97	6	16-Sep-97	12
A3-018	A3-018-02	A7305312	SO	N1	SW8081	29-Aug-97	4-Sep-97	6	16-Sep-97	12
A3-018	A3-018-03	A7305313	SO	N1	SW8081	29-Aug-97	4-Sep-97	6	16-Sep-97	12
A3-019	A3-019-02	A7305314	SO	N1	SW8081	29-Aug-97	4-Sep-97	6	16-Sep-97	12
A3-019	A3-019-03	A7305315	SO	N1	SW8081	29-Aug-97	4-Sep-97	6	16-Sep-97	12
A3-020	A3-020-02	A7305316	SO	N1	SW8081	29-Aug-97	4-Sep-97	6	16-Sep-97	12
A3-020	A3-020-03	A7305317	SO	N1	SW8081	29-Aug-97	4-Sep-97	6	16-Sep-97	12
A3-021	A3-021-02	A7305318	SO	N1	SW8081	29-Aug-97	4-Sep-97	6	16-Sep-97	12
A3-021	A3-021-03	A7305319	SO	N1	SW8081	29-Aug-97	4-Sep-97	6	16-Sep-97	12
A3-021	A3-021-06	A7305321	SO	FD1	SW8081	29-Aug-97	4-Sep-97	6	17-Sep-97	13

Attachment G

Quality Assurance/Quality Control Documentation

QUALITY ASSURANCE PROJECT PLAN

FOR

**FINAL CHARACTERIZATION AND REMOVAL
ACTION IN SUPPORT OF THE RCRA
FACILITY INVESTIGATION (RFI) OF THE
OFFSITE WEAPONS STORAGE AREA (WSA)**

AT

**NAVAL AIR STATION FORT WORTH
JOINT RESERVE BASE (JRB)
CARSWELL FIELD, TEXAS**

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1.0 INTRODUCTION

The Quality Assurance Project Plan (QAPP) presents, in specific terms, the policies, organization, functions, and Quality Assurance/Quality Control (QA/QC) requirements designed to achieve the data quality goals described in the approved Sampling and Analysis Plan (SAP) for the project. This detailed QAPP has been prepared to ensure that the data are scientifically valid and defensible, and establishes the analytical protocols and documentation requirements to ensure that the data are collected, reviewed, and analyzed in a consistent manner. This QAPP and a site-specific Field Sampling Plan (FSP) shall constitute, by definition, an Air Force Center for Environmental Excellence (AFCEE) SAP.

The National Contingency Plan (NCP) specifies circumstances under which a QAPP is necessary for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions. For cleanup actions at the remedial investigation/feasibility study (RI/FS) stage, the NCP requires lead agents to develop SAPs which provide a process for obtaining data of sufficient quality and quantity to satisfy data needs. Such SAPS must include a QAPP "which describes policy, organization, and functional activities and the data quality objectives and measures necessary to achieve adequate data for use in selecting the appropriate remedy" 40 CFR 300.430 (b)(8)(ii).

The U.S. Environmental Protection Agency (EPA) QA policy requires a QAPP for every monitoring and measurement project mandated or supported by the EPA through regulations, contracts, or other formalized means not currently covered by regulation. Guidelines followed in the preparation of this plan are set out in *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (U.S. EPA, 1983a), *U.S. EPA Region IX QAPP: Guidance for Preparing QAPPs for Superfund Remedial Projects* (U.S. EPA, 1989), and *AFCEE QAPP Version 1.1 and Version 2.0*, February 1997. Other documents that have been referenced for this plan include *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final* (U.S. EPA, 1988); *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, Draft Final, EPA QA/R-5* (U.S. EPA, 1993), *Compendium of Superfund Field Operations Methods* (U.S. EPA, 1987a); *Data Quality Objectives Process for Superfund, Interim Final Guidance* (U.S. EPA, 1993); *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (U.S. EPA, 1994), *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (U.S. EPA, 1994), *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (U.S. EPA SW-846, Third Edition and its first and second update), and the *Handbook for Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)* (Handbook), September 1993.

This QAPP is required reading for all staff participating in the work effort. The QAPP shall be in the possession of the field teams and in the laboratories performing all analytical methods. All contractors and subcontractors shall be required to comply with the procedures documented in this QAPP in order to maintain comparability and representativeness of the data produced.

Controlled distribution of the QAPP shall be implemented by the prime contractor to ensure that the most current version is being used. A sequential numbering system shall be used to identify controlled copies of the QAPP. Controlled copies shall be provided to applicable Air Force managers, regulatory agencies, remedial project managers, project managers, and QA coordinators. Whenever Air Force revisions are made or addenda added to the QAPP, a document control system will be put into place to ensure that all parties holding a controlled copy of the QAPP will receive the revisions/addenda and that outdated material is removed from circulation. The document control system does not preclude making and using copies of the QAPP; however, the holders of controlled copies are responsible for distributing additional material to update any copies within their organizations. The distribution list for controlled copies will be maintained by the prime contractor.

2.0 PROJECT DESCRIPTION

2.1 THE U.S. AIR FORCE INSTALLATION RESTORATION PROGRAM

The objective of the U.S. Air Force Installation Restoration Project (IRP) is to assess past hazardous waste disposal and spill sites at U.S. Air Force installations and to develop remedial actions consistent with the NCP for sites that pose a threat to human health and welfare or the environment. This section presents information on the program origins, objectives, and organization.

The 1976 Resource Conservation Recovery Act (RCRA) is one of the primary Federal laws governing the disposal of hazardous wastes. Sections 6001 and 6003 of RCRA require Federal agencies to comply with local and state environmental regulations and to provide information to the EPA concerning past disposal practices at Federal sites. RCRA Section 3012 requires state agencies to inventory past hazardous waste disposal sites and to provide information to the EPA concerning those sites.

In 1980, Congress enacted CERCLA (Superfund). CERCLA outlines the responsibility for identifying and remediating contaminated sites in the United States and its possessions. The CERCLA legislation identifies the EPA as the primary policy and enforcement agency regarding contaminated sites.

The 1986 Superfund Amendments and Reauthorization Act (SARA) extends the requirements of CERCLA and modifies it with respect to goals for remediation and the steps that lead to the selection of a remedial process. Under SARA, technologies that provide permanent removal or destruction of a contaminant are preferable to action that only contains or isolates the contaminant. SARA also provides for greater interaction with public and state agencies and extends the EPA's role in evaluating health risks associated with contamination. Under SARA, early determination of Applicable or Relevant and Appropriate Requirements (ARARs) is required, and the consideration of potential remediation alternatives is recommended at the initiation of an RI/FS. SARA is the primary legislation governing remedial action at past hazardous waste disposal sites.

Executive Order 12580, adopted in 1987, gave various Federal agencies, including the Department of Defense (DOD), the responsibility to act as lead agencies for conducting investigations and implementing remediation efforts when they are the sole or co-contributor to contamination on or off their properties.

To ensure compliance with CERCLA, its regulations, and Executive Order 12580, the DOD developed the IRP, under the Defense Environmental Restoration Program, to identify potentially contaminated sites, investigate these sites, and evaluate and select remedial actions for potentially contaminated facilities. The DOD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP program in June 1980, and implemented the policies outlined in this memorandum in December 1980. The NCP was issued by the EPA in 1980 to provide guidance on a process by which contaminant release could be reported, contamination could be identified and quantified, and remedial actions could be selected. The NCP describes the responsibility of Federal and state governments and those responsible for contaminant releases.

The DOD formally revised and expanded the existing IRP directives and amplified all previous directives and memoranda concerning the IRP through DEQPPM 81-5, dated 11 December 1981. The memorandum was implemented by a U.S. Air Force message dated 21 January 1982.

The IRP is the DOD's primary mechanism for response actions on U.S. Air Force installations affected by the provisions of SARA. In November 1986, in response to SARA and other EPA interim guidance, the U.S. Air Force modified the IRP to provide for an RI/FS program. The IRP was modified so that RI/FS studies could be conducted as parallel activities rather than serial activities. The program now includes ARAR determinations, identification and screening of technologies, and development of alternatives. The IRP may include multiple field activities and pilot studies prior to a detailed final analysis of alternatives. Over the years, requirements of the IRP have been developed and modified to ensure that DOD compliance with Federal laws, such as RCRA, NCP, CERCLA, and SARA, can be met.

2.2 PURPOSE AND SCOPE

This QAPP has been developed for a RCRA Facility Inspection (FI) at the Off-site Weapons Storage Area (WSA) located 4 miles west of Naval Air Station (NAS) Fort Worth. Refer to the Work Plan for a discussion of the purpose, scope, and use of this work effort.

2.3 PROJECT BACKGROUND

For a project background description, including the locations of sites at the base or facility, a summary of the contamination history at each site, and the findings from previous investigations, refer to the Work Plan.

2.4 PROJECT SCOPE AND OBJECTIVES

A summary of the objectives and the proposed work for each site is included in Section 3.0 of the Work Plan. The intended use of the data acquired during this project, the data quality objective process and a discussion of how the process-specific decision rules were derived is described in Section 3.1 of the Work Plan.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The project organization and responsibility discussion is included in the Work Plan and Section 4.0 of the FSP. It includes the following elements:

- A project organizational chart identifying task managers and individuals responsible for performance of the project;
- A list of names of all key participants, including organization names and telephone numbers for project, field, and laboratory QA officers;
- A description of the authority given to each key participant with an emphasis on the authority of the key individuals to initiate and approve corrective actions; and
- The role of regulatory representatives.

Subcontractors to be utilized and the scope of their performance in the project are defined in Section 4.1 of the FSP. The analytical laboratory that will be used for this project has not yet been selected as of the date of this final draft document.

4.0 QUALITY PROGRAM AND DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) specify the data type, quality, quantity, and uses needed to make decisions and are the basis for designing data collection activities. The DQOs for the project are summarized in Table 4 -1.

Table 4-1 Data Quality Objectives.

Data Type	Data Category or System	Type of Samples	Quantity of Samples ^a	Use of Data
Land Survey	State Plane Coordinates	None	NA	Accurately locate easements, soil borings, monitoring wells.
Soil Characteristics	Screening	Soil	16	To aid in the understanding of site-specific geology and contaminant migration.
Soil and Groundwater Contamination	Definitive	Soil, Stream Sediment, and Groundwater	Soil-378 Sed-34 GW-10	Quantify the magnitude and extent of contamination; risk assessment.
Groundwater Characteristics	Physical Measurement	Depth to Groundwater	10	Determine depth to groundwater and direction of groundwater flow.
Groundwater Characteristics	Screening	Temperature, conductance, pH, turbidity	10	To aid in the understanding of site-specific hydrology and contaminant migration
Waste Characteristics	Definitive	Soil and water	To be determined	Characterize to allow proper disposal of waste.

^a Exclusive of QC samples.

NA Not Applicable.

4.1 DATA CATEGORIES

The two general categories of data used by the AFCEE are defined as screening data and definitive data. Screening data are generated by rapid methods of analysis with less rigorous sample preparation, calibration, and/or QC requirements than are necessary to produce definitive data. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data may provide analyte identification and quantitation, although the quantitation may be relatively imprecise.

Physical test methods (e.g., dissolved oxygen measurements, temperature and pH measurements, moisture content, turbidity, and conductance) have been designated by definition as screening methods (see Section 6.0 of this document).

Screening methods will be confirmed where possible by analyses that generate definitive data.

Confirmation samples will be selected to include both detected and nondetected results from the screening method.

Definitive data are generated using rigorous analytical methods (see Section 7.0), such as approved EPA reference methods. The data can be generated in a mobile or off-site laboratory. Data are analyte-specific, and both identification and quantitation are confirmed. These methods have standardized QC and documentation requirements (Sections 7.0 and 8.0). Definitive data are not restricted in their use unless quality problems require data qualification.

4.2 PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, AND COMPARABILITY

The basis for assessing each of these elements of data quality is discussed in the following subsections. Precision and accuracy QC limits for each method and matrix are identified in Sections 6.0 and 7.0.

4.2.1 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Analytical precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. AFCEE uses the laboratory control sample (LCS) to determine the precision of the analytical method. If the recoveries of analytes in the LCS are within established control limits, then precision is within limits. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch, rather the comparison is between the sample and samples analyzed in previous batches.

Total precision is the measurement of the variability associated with the entire sampling and analysis process. Total precision is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and matrix duplicate spiked samples will be analyzed to assess field and analytical precision, and the precision measurement is determined using the relative percent difference (RPD) between the duplicate sample results. The formula for the calculation of precision is provided in Table 4.2.1-1 as RPD. For replicate analyses, the relative standard deviation (RSD) is determined. The formula for RSD calculation is provided in Table 4.2.1-1.

4.2.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS to a control limit. For volatile and semivolatile organic compounds, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed. Analysis of performance evaluation (PE) samples will also be used to provide additional information for assessing the accuracy of the analytical data being produced.

Both accuracy and precision are calculated for each AFCEE analytical batch, and the associated sample results are interpreted by considering these specific measurements. The formula for calculation of accuracy is included in Table 4.2.1-1 as percent recovery (%R) from pure and sample matrices.

Table 4.2.1-1 Statistical Calculations

Statistic	Symbol	Formula	Definition	Uses
Mean	\bar{X}	$\left(\frac{\sum_{i=1}^n x_i}{n} \right)$	Measure of central tendency	Used to determine average value of measurements
Standard Deviation	S	$\left(\frac{\sum (x_i - \bar{x})^2}{(n-1)} \right)^{>}$	Measure of relative scatter of the data	Used in calculating variation of measurements
Relative Standard Deviation	RSD	$(S / \bar{X}) \times 100$	Relative standard deviation, adjusts for magnitude of observations	Used to assess precision for replicate results
Percent Difference	%D	$\frac{x_1 - x_2}{x_1} \times 100$	Measure of the difference of 2 observations	Used to assess accuracy
Relative Percent Difference	RPD	$\left(\frac{(X_1 - X_2)}{(X_1 + X_2) / 2} \right) \times 100$	Measure of variability that adjusts for the magnitude of observations	Used to assess total and analytical precision of duplicate measurements
Percent Recovery	%R	$\left(\frac{X_{\text{meas}}}{X_{\text{true}}} \right) \times 100$	Recovery of spiked compound in pure matrix	Used to assess accuracy
Percent Recovery	%R	$\left(\frac{\text{value of spiked sample} - \text{value of unspiked sample}}{\text{Value of added spike}} \right) \times 100$	Recovery of spiked compound in sample matrix	Used to assess matrix effects and total precision

x = Observation (concentration)

n = Number of observations

> = Square root

4.2.3 Representativeness

Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Representativeness will be achieved through use of the standard field sampling and analytical procedures. Representativeness is also determined by appropriate program design, with consideration of elements such as proper well locations, drilling and installation procedures, and sampling locations. Decisions regarding sample/well/ boring locations and numbers and the statistical sampling design are documented in Section 3.3 of the FSP.

4.2.4 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with an "R" flag (see Section 8.0 for an explanation of flagging criteria). The requirement for completeness is 95 percent for aqueous samples and 90 percent for soil samples. For any instances of samples that could not be analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, or other reason), the numerator of this calculation becomes the number of valid results minus the number of possible results not reported.

The formula for calculation of completeness is presented below:

$$\% \text{ completeness} = \frac{\text{number of valid (i.e., non-R flagged) results}}{\text{number of possible results}}$$

4.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another data set. The objective for this QA/QC program is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms will support the assessment of comparability. Analysis of PE samples and reports from audits will also be used to provide additional information for assessing the comparability of analytical data produced among subcontracting laboratories. Historical comparability will be achieved through consistent use of methods and documentation procedures throughout the project.

4.3 METHOD DETECTION LIMITS, PRACTICAL QUANTITATION LIMITS, AND INSTRUMENT CALIBRATION REQUIREMENTS

4.3.1 Method Detection Limits

The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The laboratory will establish MDLs for each method, matrix, and analyte for each instrument the laboratory plans to use for the project. The laboratory will revalidate these MDLs at least once per 12 month period. The laboratory will provide the MDL demonstrations to AFCEE at the beginning of the project (i.e., before project samples are analyzed) and upon request in the format specified in Section 8.0. Results less than the MDL will be reported as the MDL value and flagged with a "U" (see Section 8.0).

Laboratories participating in this work effort will demonstrate the MDLs for each instrument, including confirmatory columns, method of analysis, analyte, and matrix (i.e., water and soil) using the following instructions:

1. Obtain the concentration value that corresponds to:
 - a) an instrument signal/noise ratio within the range of 2.5 to 5.0, or
 - b) the region of the standard curve where there is a significant change in sensitivity (i.e., a break in the slope of the standard curve).
2. Analyze seven replicates of a matrix spike (ASTM Type II water for aqueous methods, Ottawa sand for soil methods) containing the analyte of interest at a concentration three to five times the estimated MDL.
3. Determine the variance (S^2) for each analyte as follows:

$$S^2 = \frac{1}{n-1} \left[\sum_{i=1}^n (x_i - \bar{x})^2 \right]$$

where x_i = the i th measurement of the variable x and \bar{x} = the average value of x

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

4. Determine the standard deviation(s) for each analyte as follows:

$$s = (S^2)^{1/2}$$

5. Determine the MDL for each analyte as follows:

$$\text{MDL} = 3.14(s)$$

(note: 3.14 is the one-sided t-statistic at the 99 percent confidence level appropriate for determining the MDL using 7 samples)

4.3.2 Practical Quantitation Limits

The practical quantitation limit (PQL) is the lowest level that can be reasonably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The laboratories participating in this work effort will compare the results of the MDL demonstrations to the PQLs for each method listed in Section 7.0. All MDLs will be lower than the relevant PQLs. The laboratories will also verify PQLs by including a standard at or below the PQL as the lowest point on the calibration curve. All results will be reported at or above the MDL values; however, for those results falling between the MDL and the PQL, an "F" flag will be applied to the results indicating the variability associated with the result (see Section 8.0).

4.3.3 Instrument Calibration

Analytical instruments will be calibrated in accordance with the analytical methods. All analytes reported will be present in the initial and continuing calibrations, and these calibrations must meet the acceptance criteria specified in Section 7.0. All results reported shall be within the calibration range. Records of standard preparation and instrument calibration will be maintained. Records will unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards will be traceable to standard materials.

Instrument calibration will be checked using all of the analytes listed for a given method in the QC acceptance criteria table in Section 7.0. This applies equally to multi-response analytes. All calibration criteria will satisfy SW-846 requirements at a minimum. The initial calibration will be checked at the frequency specified in the method using materials prepared independently of the calibration standards. Acceptance criteria for the calibration check are presented in Section 7.0. Analyte concentrations are determined with either calibration curves or response factors (RFs). For gas chromatography (GC) and gas chromatography/mass spectroscopy (GC/MS) methods, when using RFs to determine analyte concentrations, the average RF from the initial five point calibration will be used. The continuing calibration will not be used to update the RFs from the initial five point calibration. The continuing calibration verification cannot be used for the laboratory control sample (LCS).

4.4 ELEMENTS OF QUALITY CONTROL

QC elements relevant to screening data are presented in Section 6.0. This section presents QC requirements relevant to analysis of environmental samples that will be followed during all analytical activities for fixed-base, mobile, and field laboratories producing definitive data. The purpose of this QC program is to produce data of known quality that satisfy the project objectives and that meet or exceed the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials.

Laboratory QC samples (e.g., blanks and laboratory control samples) will be included in the preparation batch with the field samples. An AFCEE analytical batch is a number of samples (not to exceed 20 environmental samples and the associated laboratory QC samples) that are similar in composition (matrix) and that are extracted or digested at the same time and with the same lot of reagents. Matrix spikes and matrix spike duplicates will count as environmental samples.

The term AFCEE analytical batch also extends to cover samples that do not need separate extraction or digestion (e.g., volatile analyses by purge and trap). This AFCEE analytical batch is a number of samples (not to exceed 20 environmental samples and the associated laboratory QC samples) that are similar in composition (matrix) analyzed sequentially within a calibration period. The identity of each AFCEE analytical batch will be unambiguously reported with

the analyses so that a reviewer can identify the QC samples and the associated environmental samples. All references to the analytical batch in the following sections and tables in this QAPP refer to the AFCEE analytical batch.

The type of QC samples and the frequency of use of these samples are discussed below and in the method-specific subsections of Section 7.0.

4.4.1 Laboratory Control Sample

The LCS is analyte-free water for aqueous analyses or Ottawa sand (or equivalent) for soil analyses spiked with known concentrations of all analytes listed in the QC acceptance criteria table in Section 7.0 for the method. The LCS will be carried through the complete sample preparation and analysis procedure.

The LCS is used to evaluate each AFCEE analytical batch and to determine if the method is in control. One LCS will be included in every AFCEE analytical batch. The performance of the LCS is evaluated against the QC acceptance limits given in the tables in Section 7.0. The LCS cannot be used for the continuing calibration verification.

Whenever an analyte in an LCS is outside the acceptance limit, corrective action will be performed.

After the system problems have been resolved and system control has been re-established, all samples in the AFCEE analytical batch will be reanalyzed for the out-of-control analyte(s). When an analyte in an LCS exceeds the upper or lower control limit and no corrective action is performed, or the corrective action was ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, will be applied to all affected results.

4.4.2 Matrix Spike/Matrix Spike Duplicate

A matrix spike (MS) and matrix spike duplicate (MSD) are aliquots of the sample spiked with a known concentration of all analytes listed in the QC acceptance criteria table in Section 7.0 for the method. The spiking occurs prior to sample preparation and analysis. Only AFCEE samples will be used for spiking. The MS/MSD will be designated on the chain-of-custody.

The MS/MSD is used to document the bias of a method due to sample matrix. AFCEE does not use MSs and MSDs to control the analytical process.

A minimum of one MS and one MSD sample will be analyzed for every 20 AFCEE samples of the same matrix.

The performance of the MS and MSD is evaluated against the QC acceptance limits given in the tables in Section 7.0. If either the MS or the MSD is outside the QC acceptance limits, the analytes in all related samples will be qualified according to the data flagging criteria in Sections 7.0 and 8.0.

4.4.3 Surrogates

Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but that are not normally found in environmental samples.

Surrogates are used to evaluate accuracy, method performance, and extraction efficiency.

Surrogates will be added to environmental samples, controls, and blanks in accordance with the method requirements.

Whenever a surrogate recovery is outside the acceptance limit, corrective action must be performed. After the system problems have been resolved and system control has been re-established, the sample should be reprepared and reanalyzed. If corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, will be applied to the sample results.

4.4.4 Internal Standards

Internal standards (ISs) are measured amounts of certain compounds added after preparation or extraction of a sample. They are used in an IS calibration method to correct sample results affected by column injection losses, purging losses, or viscosity effects. ISs will be added to environmental samples, controls, and blanks in accordance with the method requirements.

When the IS results are outside of the acceptance limits, corrective actions will be performed. After the system problems have been resolved and system control has been re-established, all samples analyzed while the system was malfunctioning will be reanalyzed. If corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, will be applied to the sample results.

4.4.5 Retention Time Windows

Retention time windows are used in GC and high-performance liquid chromatography (HPLC) analysis for qualitative identification of analytes. They are calculated from replicate analyses of a standard on multiple days. The procedure and calculation method are given in SW-846 Method 8000A.

When the retention time is outside of the acceptance limits, corrective action will be performed. After the system problems have been resolved and system control has been re-established, all the samples analyzed since the last acceptable retention time check should be reanalyzed. If corrective actions are not performed, the appropriate validation flag, as described in Sections 7.0 and 8.0, will be applied to the sample results.

4.4.6 Interference Check Sample

The interference check sample (ICS), used in inductively coupled plasma (ICP) analyses only, contains both interfering and analyte elements of known concentrations. The ICS is used to verify background and inter-element correction factors. The ICS is run at the beginning and end of each run sequence.

When the interference check sample results are outside of the acceptance limits stated in the method, corrective action will be performed. After the system problems have been resolved and system control has been re-established, the ICS should be reanalyzed. If the ICS result is acceptable, all affected samples should be reanalyzed. If corrective action is not performed or was ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, will be applied to all affected results.

4.4.7 Method Blank

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank will be carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process. A method blank will be included in every AFCEE analytical batch.

The presence of analytes in a method blank at concentrations greater than the PQL indicates a need for corrective action. Corrective action will be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated, all samples in the analytical batch will be reprepared and reanalyzed. No analytical data will be corrected for the presence of analytes in blanks. When an analyte is detected in the method blank and in the associated samples and corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, will be applied to the sample results.

4.4.8 Ambient Blank

The ambient blank consists of ASTM Type II reagent grade water poured into a volatile organic compound (VOC) sample vial at the sampling site (in the same vicinity as the associated samples). It is handled like an environmental sample and transported to the laboratory for analysis. Ambient blanks are prepared only when VOC samples are taken and analyzed only for VOC analytes.

Ambient blanks are used to assess the potential introduction of contaminants from ambient sources (e.g., active runways, engine test cells, gasoline motors in operation) to the samples during sample collection.

The frequency of collection for ambient blanks is specified in Section 6.4 of the FSP. Ambient blanks will be collected downwind of possible VOC sources.

4.4.9 Equipment Blank

An equipment blank is a sample of ASTM Type II reagent-grade water poured into, over, or pumped through the sampling device; collected in a sample container; and transported to the laboratory for analysis. Equipment blanks are used to assess the effectiveness of equipment decontamination procedures.

The frequency of collection for equipment blanks is specified in Section 6.4 of the FSP. Equipment blanks will be collected immediately after the equipment has been decontaminated. The blank will be analyzed for all laboratory analyses requested for the environmental samples collected at the site.

When an analyte is detected in the equipment blank, the appropriate validation flag, as described in Section 8.0, will be applied to all sample results from samples collected.

4.4.10 Trip Blank

The trip blank consists of a VOC sample vial filled in the laboratory with ASTM Type II reagent-grade water, transported to the sampling site, handled like an environmental sample, and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes. Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures.

When an analyte is detected in the trip blank, the appropriate validation flag, as described in Section 8.0, will be applied to all sample results from samples in the cooler with the affected trip blank. One trip blank will accompany each cooler of samples sent to the laboratory for analysis of VOCs.

4.4.11 Field Duplicates

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis. Specific locations are designated for collection of field duplicate samples prior to the beginning of sample collection.

Duplicate sample results are used to assess precision of the sample collection process. Precision of soil samples to be analyzed for VOCs is assessed from collocated samples because the compositing process required to obtain uniform samples could result in loss of the compounds of interest. The frequency of collection for field duplicates is specified in Section 6.4 of the FSP.

4.4.12 Field Replicates

A field replicate sample, also called a split, is a single sample divided into two equal parts for analysis. The sample containers are assigned an identification number in the field such that they cannot be identified as replicate samples by laboratory personnel performing the analysis. Specific locations are designated for collection of field replicate samples prior to the beginning of sample collection. Replicate sample results are used to assess precision.

4.5 QUALITY CONTROL PROCEDURES

4.5.1 Holding Time Compliance

All sample preparation and analysis will be completed within the method-required holding times. The holding time begins at the time of sample collection. Some methods have more than one holding time requirement (e.g., methods SW8080 and SW8270B). The preparation holding time is calculated from the time of sample collection to the time of completion of the sample preparation process as described in the applicable method, prior to any necessary extract cleanup and/or volume reduction procedures. If no preparation (e.g., extraction) is required, the analysis holding time is calculated from the time of sample collection to the time of completion of all analytical runs, including dilutions, second-column confirmations, and any required reanalyses. In methods requiring sample preparation prior to analysis, the analysis holding time is calculated from the time of preparation completion to the time of completion of all analytical runs, including dilutions, second-column confirmations, and any required reanalyses.

If holding times are exceeded and the analyses are performed, the results will be flagged according to the procedures as described in Section 8.0.

4.5.2 Confirmation

Quantitative confirmation of results at or above the MDL for samples analyzed by GC or HPLC will be required, except for BTEX analysis by SW8020A, and will be completed within the method-required holding times. For GC methods, with the exception of multi-response analytes, a second column is used for confirmation. For HPLC methods, a second column or a different detector is used. The result of the first column/detector will be the reported result. If holding times are exceeded and the analyses are performed, the results will be flagged according to the procedures as described in Section 8.0.

4.5.3 Standard Materials

Standard materials, including second-source materials, used in calibration and to prepare samples will be traceable to National Institute Standards and Technology (NIST), EPA, American Association of Laboratory Accreditation (A2LA) or other equivalent AFCEE-approved source, if available. If an NIST, EPA, or A2LA standard material is not available, the standard material proposed for use will be included in an addendum to the SAP and approved before use. The standard materials will be current, and the expiration policy described below will be followed.

A second-source standard is used to independently confirm initial calibration. A second-source standard is a standard purchased from a different vendor than the vendor supplying the material used in the initial calibration standards. The second-source material can be used for the continuing calibration standards or for the LCS (but shall be used for one of the two). Two different lot numbers from the same vendor does constitute a second-source.

The expiration dates for ampulated solutions will not exceed the manufacturer's expiration date or 1 year from the date of receipt, whichever comes first. Expiration dates for laboratory-prepared stock and diluted standards will be no later than either the expiration date of the stock solution or material, or the date calculated from the holding time allowed by the applicable analytical method, whichever comes first. Expiration dates for pure chemicals will be established by the laboratory and be based on chemical stability, possibility of contamination, environmental conditions, and storage conditions. Expired standard materials will be revalidated prior to use or discarded. Revalidation may be performed through assignment of a true value and error window statistically derived from replicate analyses of the material as compared to an unexpired standard. The laboratory will label standard and QC materials with expiration dates.

4.5.4 Supplies and Consumables

The laboratory will inspect supplies and consumables prior to their use in analysis. The materials description in the methods of analysis will be used as a guideline for establishing the acceptance criteria for these materials. Purity of reagents will be monitored by analysis of LCSs. An inventory and storage system for these materials will ensure their use before manufacturers' expiration dates and that they are stored under safe and chemically compatible conditions.

5.0 SAMPLING PROCEDURES

5.1 FIELD SAMPLING

The field sampling procedures for collecting samples and sampling methods are included in Section 6.0 of the FSP.

5.1.1 Sample Containers

Sample containers are purchased precleaned and treated according to EPA specifications for the methods. Sampling containers that are reused are decontaminated between uses by the EPA-recommended procedures (i.e., EPA 540/R-93/051). Containers are stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. Amber glass bottles are used routinely where glass containers are specified in the sampling protocol.

5.1.2 Sample Volumes, Container Types, and Preservation Requirements

Sample volumes, container types, and preservation requirements for the analytical methods performed on AFCEE samples are listed in Table 5.1.2-1. The required sample volumes, container types, and preservation requirements for analytical methods proposed for project work that are not listed in Table 5.1.2-1 will be included in an addendum to the FSP and will be approved by AFCEE before use.

Table 5.1.2-1 Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

Name	Analytical Methods	Con-tainer ^a	Preserva-tives ^{b,c}	Minimum Sample Amount	Maximum Holding Time
Hydrogen ion (pH) (W, S)	SW9040/ SW9045	P, G	None required	N/A	Analyze immediately
Conductance	SW9050	P, G	None required	N/A	Analyze immediately
Temperature	E170.1	P, G	None required	N/A	Analyze immediately
Turbidity	E180.1	P, G	4°C	N/A	48 hours
Mercury	SW7470 SW7471	P, G, T	HNO ₃ to pH < 2, 4°C	500 mL or 8 ounces	28 days (water and soil)
Metals (except chromium (VI) and mercury)	SW6010A SW6020 and SW-846 AA methods	P, G, T	HNO ₃ to pH < 2, 4°C	500 mL or 8 ounces	180 days (water and soil)

Table 5.1.2-1 Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times (Continued)

Name	Analytical Methods	Con-tainer ^a	Preserva-tives ^{b,c}	Minimum Sample Amount	Maximum Holding Time
Total Petroleum Hydrocarbons (TPH)	EPA 418.1 (modified)	G, T	4°C, HCl to pH < 2	1 liter or 8 ounces	14 days (water and soil); 7 days if unpreserved by acid (water)
Total Organic Carbon (TOC)	EPA 415.1 (modified)	G, T	4°C, H ₂ SO ₄ to pH < 2	1 liter or 8 ounces	28 days (water and soil)
Asbestos	EPA	G, T	None	8 ounces	Not Applicable
Geotechnical Analyses	ASTM	G, T	4°C	32 ounces	Not Applicable
Volatile aromatics	SW8020A	G, Teflon-lined septum, T	4°C, HCl to pH < 2, 0.008% Na ₂ S ₂ O ₃	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid (water)
Polynuclear Aromatic Hydrocarbons (PAHs)	SW8310	G, amber, T	4°C	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Semivolatile organics	SW8270B	G, Teflon-lined cap, T	4°C, 0.008% Na ₂ S ₂ O ₃	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Volatile organics	SW8260A	G, Teflon-lined septum, T	4°C, 0.008% Na ₂ S ₂ O ₃ (HCl to pH < 2 for volatile aromatics by SW8240 and SW8260) ^b	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid (water)
Explosive residues	SW8330	P, G, T	Cool, 4°C	1 liter or 8 ounces	7 days to extraction (water); 14 days to extraction (soil); analyze within 40 days after extraction

- a. Polyethylene (P); glass (G); brass sleeves in the sample barrel, sometimes called California brass (T).
- b. No pH adjustment for soil.
- c. Preservation with 0.008 percent Na₂S₂O₃ is only required when residual chlorine is present.

5.2 SAMPLE HANDLING AND CUSTODY

Procedures to ensure the custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis, and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records.

The contractor will maintain chain-of-custody (COC) records for all field and field Quality Control (QC) samples. A sample is defined as being under a person's custody if any of the following conditions exist: (1) it is in their possession, (2) it is in their view, after being in their possession, (3) it was in their possession and they locked it up or, (4) it is in a designated secure area.

The following information concerning the sample will be documented on the AFCEE COC form (as illustrated in Section 8.0):

- Unique sample identification;
- Date and time of sample collection;
- Source of sample (including name, location, and sample type);
- Designation of MS/MSD;
- Preservative used;
- Analyses required;
- Name of collector(s)
- Pertinent field data (pH, temperature);
- Serial numbers of custody seals and transportation cases (if used);
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories; and
- Bill of lading or transporter tracking number (if applicable).

All samples will be uniquely identified, labeled, and documented in the field at the time of collection in accordance with Section 6.2 of the FSP.

Samples collected in the field will be transported to the laboratory or field testing site as quickly as possible. When a 4°C requirement for preserving the sample is indicated, the samples will be packed in ice or chemical refrigerant to keep them cool during collection and transportation. During transit, it is not always possible to rigorously control the temperature of the samples. As a general rule, storage at a low temperature is the best way to preserve most samples. A temperature blank (a volatile organics compounds sampling vial filled with tap water) will be included in every cooler and used to determine the internal temperature of the cooler upon receipt at the laboratory. When, in the judgment of the laboratory, the temperature of the samples upon receipt may have affected the stability of the analytes of interest, the problem will be documented in laboratory records and discussed with AFCEE. The resolution of the problem will also be documented.

Once the samples reach the laboratory, they will be checked for anomalies against information on the COC form. The condition, temperature, and appropriate preservation of samples will be checked and documented on the COC form. Checking an aliquot of the sample using pH paper is an acceptable procedure, except for VOCs, where an additional sample is required to check preservation. The occurrence of any anomalies in the received samples and their resolution will be documented in laboratory records. All sample information will then be entered into a tracking system, and unique analytical sample identifiers will be assigned. A copy of this information will be reviewed by the laboratory for accuracy. Sample holding time tracking begins with the collection of samples and continues until the analysis is complete. Holding times for methods required routinely for AFCEE work are specified in Table 5.1.2-1. **Samples not preserved or analyzed in accordance with these requirements will be resampled and analyzed, at no additional cost to AFCEE.** Subcontracted analyses will be documented with a COC form that includes all the elements required by AFCEE, an example of which is provided in the FSP. Procedures ensuring internal laboratory COC will also be implemented and documented by the laboratory. Specific instructions concerning the analysis specified for each sample will be communicated to the analysts. Analytical batches will be created, and laboratory QC samples will be introduced into each batch.

While in the laboratory, samples will be stored in limited-access, temperature-controlled areas. Refrigerators, coolers, and freezers will be monitored for temperature 7 days per week. Acceptance criteria for the temperatures of the refrigerators and coolers is less than 8°C. Acceptance criteria for the temperatures of the freezers will be less than 0°C. All of the cold storage areas will be monitored by thermometers that have been calibrated with an NIST-traceable thermometer. As indicated by the findings of the calibration, correction factors will be applied to each thermometer. Records that include acceptance criteria will be maintained. Samples for volatile organics determination will be stored separately from other samples, standards, and sample extracts. Samples will be stored after analysis and then disposed of in accordance with applicable local, state, and Federal regulations. Disposal records will be maintained by the laboratory.

Standard operating procedures (SOPs) describing sample control and custody will be maintained by the laboratory.

6.0 SCREENING ANALYTICAL METHODS

The analytical screening methods contained in this section are shown in Table 6-1. This section includes brief descriptions of the methods and QC required for screening procedures commonly used to conduct work efforts. The methods and QC procedures were taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (U.S. EPA SW-846, Third Edition, and its first and second update), *Methods for Chemical Analysis of Water and Waste* (U.S. EPA 1979), *ASTM Annual Book of Standards* (1993), and from manufacturer's literature.

Table 6-1. Screening Analytical Methods

Method	Parameter
SW846 (3550)	Moisture
SW9040	pH (water)
SW9045	pH (soil)
SW9050	Conductance
E170.1	Temperature
E180.1	Turbidity
E415.1(mod)	Total Organic Carbon (TOC)
E418.1(mod)	Total Petroleum Hydrocarbons (TPH)
Organic Vapor (FID and PID)	Soil gas screening-halogenated, aromatic, and petroleum hydrocarbons
ASTM D422	Particle size
EPA /60/R-93/116, 40CFR763 Subpart E	Interim Method for the Determination of Asbestos in Bulk Insulation

6.1 ANALYTICAL SCREENING METHOD DESCRIPTIONS

This section contains subsections for each analytical procedure. Each subsection contains the following information:

- A brief method description; and
- The PQL (if applicable).

6.1.1 EPA Method SW9040 (Water)/SW9045 (Soil)-pH

Measurements of pH will be performed for water samples using method SW9040 and method SW9045 for soil samples. Measurements are determined electrometrically using either a glass electrode in combination with a reference potential combination electrode.

6.1.2 EPA Method SW9050—Conductance

Standard conductivity meters are used for this analysis. The temperature is also measured and reported for this analysis.

6.1.3 EPA Method SW9060—Total Organic Carbon

Not applicable.

6.1.4 EPA Method 160.1—Filterable Residue

Not applicable.

6.1.5 EPA Method 160.2—Nonfilterable Residue

Not applicable.

6.1.6 EPA Method 170.1—Temperature

Temperature measurements are made with a mercury-filled or dial-type centigrade thermometer, or a thermistor.

6.1.7 EPA Method 180.1—Turbidity

This method is based on a comparison of the light scattered by the sample under defined conditions with the light intensity scattered by a standard reference suspension. The higher the intensity, the greater the turbidity. Turbidity measurements are made in a nephelometer and are reported in terms of nephelometric turbidity units (NTUs). The working range for the method is from 0 to 40 NTUs. Higher levels of turbidity can be measured by diluting the sample with turbidity-free deionized water.

6.1.8 EPA Method 415.1—Total Organic Carbon(TOC)

This method includes the measurement of organic carbon in water, wastes, and is modified to include soil. Organic carbon in a sample is converted to carbon dioxide by catalytic combustion or wet chemical oxidation. The carbon dioxide can be measured directly by an infrared detector or converted to methane and measured by a flame ionization detector. The amount of carbon dioxide or methane is directly proportional to the concentration of carbonaceous material in the sample.

6.1.9 EPA Method 418.1—Total Petroleum Hydrocarbons(TPH)

This method is for the measurement of extractable petroleum hydrocarbons from water, wastes, and soil (modified). Samples are prepared and extracted with a freon or freon-like chemical in a separatory funnel or soxhlet. Interferences are removed with silica gel adsorbant. Infrared analysis of the extract is performed by the direct comparison with standards.

6.1.10 ASTM D422—Standard Method for Particle-Size Analysis of Soils

This method covers the quantitative determination of the distribution of particle sizes in soils. The distribution of particle sizes larger than 75 μm is determined by sieving (retained on the No. 200 sieve), while the distribution of particle sizes smaller than 75 μm is determined by a sedimentation process using a hydrometer.

6.1.11 ASTM D1498–Oxidation-Reduction Potential

Not applicable.

6.1.12 ASTM D3416–Methane in Soil Gas

Not applicable.

6.1.13 Draft Method SW4020–Screening for Polychlorinated Biphenyls by Immunoassay

Not applicable.

6.1.14 Draft Method SW4030–Screening for Petroleum Hydrocarbons by Immunoassay

Not applicable.

6.1.15 SW-846 (Described in Method SW3550)–Percent Moisture

Percent moisture is determined for solid samples undergoing analysis for inorganic and organic analytes. The sample is weighed, dried, and then reweighed. Percent moisture is calculated as:

$$\frac{\text{Initial Weight} - \text{Dried Weight}}{\text{Initial Weight}} \times 100 = \% \text{ Moisture}$$

The moisture content is used to calculate results for soil on a dry weight basis using the calculation presented below:

$$\text{Result of analysis on wet weight basis} = \text{Result of analysis on a dry weight basis}$$

$$1 - (\% \text{ Moisture}/100)$$

All soil or sediment results and detection limits will be reported on a dry weight basis.

6.1.16 Real-Time Portable Organic Vapor Analyzers

A portable analyzer will be used to perform real-time nonspecific analyses of hydrocarbon vapors. A photoionization detector (PID) organic vapor monitor will be used.

The portable analyzer will be used as a screening tool to help determine the optimum locations for the collection of samples. Field data recorded on the COC forms give the laboratory analysts an indication of the approximate concentration of contaminants and aid in calculating dilution factors before analysis. Additionally, the real-time instruments are used to aid in selecting the proper level of personal protective equipment and monitoring air emissions during sampling activities.

The PID detects and measures total hydrocarbon vapors. The instrument has an operating range of 0 to 2,000 ppm. During operation, a gas sample is drawn into the probe and past an ultraviolet light source by an internal pumping system. Contaminants in the sample are ionized, which produces an instrument response if their ionization potential is equal to or less than the ionizing energy supplied by the lamp. The radiation produces a free electron for each molecule of ionized contaminant, which generates a current that is directly proportional to the number of ions produced. This current is measured and displayed on the meter. The PID measures the total value for all species present with ionization potentials less than or equal to that of the lamp.

6.1.17 Method for the Determination of Asbestos in Bulk Building Materials

Sample preparation requirements will depend on the type of building materials under consideration. Bulk samples submitted for analysis are usually friable and may release fibers during handling; therefore, adequate ventilation and personal protection are recommended. Representative subsampling may not be readily available. In most cases, the best preparation is made by using forceps to sample at several places from the bulk material. Forceps samples are then immersed in a refractive index liquid on a microscope slide, teased apart, covered with a cover glass, and observed with a polarized light microscope.

A mortar and pestle can sometimes be used in the size reduction of soft or loosely bound materials. Calcium carbonate, gypsum, and bassanite (plaster) are frequently present in sprayed or trowelled insulation materials. These may be removed by treatment with warm dilute acetic acid. If acid treatment is required, wash the sample at least twice with distilled water, being careful not to lose particles during decanting. Coatings and binders adhering to fiber surfaces may also be removed by treatment with sodium metaphosphate. In samples with a large portion of cellulosic or other organic fibers, it may be useful to ash part of the sample (muffle furnace at temperatures less than 500°C). Neither ashing nor acid treatment should be used as standard procedures since they may change the fiber characteristics. Therefore, materials should be viewed microscopically before and after any sample preparation. If quantitation is required, use of these procedures will require a correction for percent weight loss.

The method of analysis for asbestiform materials employs Polarized Light Microscopy (PLM). Bulk samples are first examined at low magnification using a stereomicroscope in its container or after placing it on a glassine transfer paper or clean glass plate. Positive identification of suspect fibers is subsequently made with PLM using two polarized filters to observe specific optical characteristics of a sample. When discrete strata are identified, each is treated separately so that fibers are first qualified in that layer only, then the results of the examination of each layer are combined to yield an estimate of the asbestos contents of the whole.

Quantitative analysis involves the use of point counting which provides a determination of the area percent asbestos (0-100 percent asbestos). Upper detection limit is 100 percent while the lower detection limit may be less than 1 percent. Any sample analyzed that contains greater than 1 percent asbestos fibers is considered to be an asbestosis hazard (i.e. carcinogenic). The three most common asbestos fibers identified during this type of analysis are chrysotile, amosite, and crocidolite. An ocular reticle (cross-hair or point array) is used to visually superimpose a point or points on the microscope field of view. The number of points positioned directly above each kind of particle or fiber of interest is recorded. A total of 400 points superimposed on either asbestos fibers or non-asbestos matrix material must be counted over at least eight different preparations of representative subsamples. Reliable conversion of area percent to percent of dry weight is not currently feasible unless the specific gravities and relative volumes of the materials are known.

Adequate data for measuring the accuracy and precision of this method for samples with various matrices are not currently available. Data obtained for samples containing a single asbestos type in a simple matrix are available in the EPA report *Bulk Sample Analysis for Asbestos Content: Evaluation of the Tentative Method*.

6.2 CALIBRATION AND QC PROCEDURES FOR SCREENING METHODS

All screening data will be flagged with an "S" data qualifier to show that the reported data are screening data (see Section 8.0). The other data qualifiers that will be used with screening data are also shown in Table 6.2-2 and Section 8.0. Flagging criteria are applied (except for the "S" flag) when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

Table 6.2-1 presents the calibration and QC procedures for each method. These requirements as well as the corrective actions and data flagging criteria are included. In this table, the first two columns designate the method number and the class of analytes that may be determined by the method. The third column lists the method-required calibration and QC elements. The fourth column designates the minimum frequency for performing each calibration and QC element. The fifth column designates the acceptance criteria for each calibration and QC element. The sixth column designates the corrective action in the event that a calibration or QC element does not meet the acceptance criteria. The last column designates the data flagging criteria that must be applied in the event that the method-required calibration and QC acceptance criteria are not met.

Table 6.2-1. Summary of Calibration and QC Procedures for Screening Methods

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Data Flagging Criteria ^b
SW-846 ^c	Moisture	Duplicate sample	1 per 20 samples	% solid RPD ≤ 15%	Correct problem, repeat measurement. If still out, flag data	J
SW9050	Conductance	Calibration with KCl standard	Once per day at beginning of testing	± 5%	If calibration is not achieved, check meter, standards, and probe; recalibrate	R
		Field duplicate	10% of field samples	± 5%	Correct problem, repeat measurement	J
SW9040	pH (water)	2-point calibration with pH buffers	Once per day	± 0.05 pH units for every buffer	If calibration is not achieved, check meter, buffer solutions, and probe; replace if necessary; repeat calibration	R
		pH 7 buffer	At each sample location	± 0.1 pH unit	Correct problem, recalibrate	R
		Field duplicate	10% of field samples	± 0.1 pH unit	Correct problem, repeat measurement	J
SW9045	pH (soil)	2-point calibration with pH buffers	1 per 10 samples analyzed	± 0.05 pH unit	Check with new buffers; if still out, repair meter; repeat calibration check	R
		pH 7 buffer	At each sample location	± 0.1 pH unit	Recalibrate	R
		Duplicate sample	10% of field samples	± 0.1 pH unit	Correct problem, repeat measurement. If still out, repeat calibration.	J

Table 6.2-1. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Data Flagging Criteria ^b
E170.1	Temperature	Field duplicate	10% of field samples	± 1.0°C	Correct problem, repeat measurement	J
E180.1	Turbidity	Calibration with one formazin standard/instrument range used	Once per day at beginning of testing	± 5 units, 0–100 range ± 0.5 units, 0–0.2 range ± 0.2 units, 0–1 range	If calibration is not achieved, check meter; replace if necessary, recalibrate	R
		Field duplicate	10% of field samples	RPD ≤ 20%	Correct problem, repeat measurement	J
E415.1	TOC	Calibrate per manufacturer instruction	At beginning of day, and once every ten samples	Response within 20% of expected value	Recalibrate, repeat measurements	J
		Field Duplicate	5% of Field Samples	RPD < 20%(w) RPD < 35%(s)	Correct problem, repeat measurement	J
E418.1	TPH	Calibrate per manufacturer instruction	At beginning of day, and once every ten samples	Response within 20% of expected value	Recalibrate, repeat measurements	J
		Field Duplicate	5% of Field Samples	RPD < 20%(w) RPD < 35%(s)	Correct problem, repeat measurement	J
None	Organic vapor concentrations (FID and PID)	2 point calibration	Monthly	Response ± 20% of expected value	Recalibrate; check instrument and replace if necessary	R
		Calibration verification and check	Daily at beginning/end of day	Response ± 20% of exp. value	Correct problem, recalibrate	R
EPA/60/R-93/116	Asbestos (PLM)	Field Duplicates	5% dups sent to a second lab		Correct problem, recalibrate	J

a. All corrective actions will be documented and the records will be maintained by TEC.

b. All screening results will first be flagged with an "S" and also any other appropriate validation flags identified in the Data Flagging Criteria column of the table. For example "SJ", "SB", "SR".

c. Described in method SW3550.

7.0 DEFINITIVE DATA ANALYTICAL METHODS AND PROCEDURES

Section 7.1 contains brief descriptions of preparation methods. Section 7.2 contains subsections for each analytical procedure. Each subsection contains the following information:

- A brief method description;
- A table of PQLs;
- A table of QC acceptance criteria; and
- A table of calibration procedures, QC procedures, and data validation guidelines.

This information was obtained from the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (U.S. EPA SW-846, Third Edition, and its first and second update); *Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)* (Handbook), September 1993; *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, U.S. EPA, Office of Solid Waste and Emergency Response, Washington, D.C., Publication 9240.1-05-01, EPA-540/R-94-013, PB94-963502, February 1994; and *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, U.S. EPA, Office of Solid Waste and Emergency Response, Washington, D.C., Publication 9240.1-05, EPA-540/R-94-012, PB94-963501, February 1994. Definitions of terms are given in Section 4.0 and data validation guidelines are presented in Section 8.0.

7.1 PREPARATION METHODS

Extraction and digestion procedures for liquid and solid matrices presented in this section are outlined in Table 7.1-1. The appropriate preparation method to be used (if applicable) for each analytical method is given in the PQL tables.

Table 7.1-1. Extraction and Digestion Procedures

Method	Parameter
SW3005A	Acid Digestion of Water Samples for Metals Analysis
SW3010	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP spectroscopy
SW3015	Microwave Assisted Acid Digestion of Aqueous Samples and Extracts
SW3020A	Acid Digestion of Aqueous Samples and Extracts for Metals Analysis
SW3050A	Acid Digestion for Solids, Sediments, and Sludges for Metals Analysis
SW3051	Microwave Assisted Acid Digestion of Sediments, Sludges Soils, and Oils
SW3510B	Separatory Funnel Liquid-Liquid Extraction
SW3520B	Continuous Liquid-Liquid Extraction
SW3540B/SW3541	Soxhlet Extraction
SW3550A	Ultrasonic Extraction
SW5030A	Purge and Trap Method

7.1.1 Method SW1311-Toxicity Characteristic Leaching Procedure

Not applicable.

7.1.2 Method SW3005A—Acid Digestion of Water Samples for Metals Analysis

This method is an acid digestion procedure used to prepare water samples for metals analysis. The digested samples are analyzed for total recoverable and dissolved metals determination by either flame atomic absorption (FLAA) or inductively coupled plasma (ICP). For analysis of total recoverable metals, the entire sample is acidified at collection time. For analysis of dissolved metals, the samples are filtered then acidified upon collection.

7.1.3 Method SW3020A— Acid Digestion of Aqueous Samples and Extracts for Metals Analysis

Method SW3020A prepares aqueous or waste samples for total metals determination by graphite furnace atomic absorption spectroscopy (GFAA). The samples are vigorously digested with acid and then diluted.

7.1.4 Method SW3050A—Acid Digestion for Solids, Sediments, and Sludges for Metals Analysis

Method SW3050A is applicable to the preparation of sediment, sludge, and soil samples for metals analysis by FLAA, GFAA, or ICP. In this method the sample is digested then refluxed with acid. A separate aliquot of the sample is dried for a total solids and/or percent moisture determination.

7.1.5 Method SW3510B—Separatory Funnel Liquid-Liquid Extraction

Method SW3510B is designed to quantitatively extract nonvolatile and semi-volatile organic compounds from liquid samples using standard separatory funnel techniques. The sample and the extracting solvent must be immiscible in order to yield recovery of target compounds. Subsequent cleanup and detection methods are described in the organic analytical method used to analyze the extract.

7.1.6 Method SW3540B/SW3541—Soxhlet Extraction

Method SW3540B is a procedure for extracting nonvolatile and SVOCs from solids such as soils and sludges. Method SW3541 is an automated Soxhlet extraction. The Soxhlet extraction process ensures intimate contact of the sample matrix with the extraction solvent.

7.1.7 Method SW3550A—Ultrasonic Extraction

Method SW3550A is a procedure for extracting nonvolatile and SVOCs from solids such as soils and sludges. The sonication process ensures intimate contact of the sample matrix with the extraction solvent.

7.1.8 Method SW5030A—Purge and Trap Method

Method SW5030A describes sample preparation and extraction for the analysis of VOCs. The method is applicable to nearly all types of samples including aqueous sludges, caustic liquors, acid liquors, waste solvents, oily wastes, water, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments. The success of this method depends on the level of interferences in the sample. Results may vary due to the large variability and complexity of matrices of solid waste samples.

An inert gas is bubbled through the sample solution at ambient temperature to transfer the volatile components to the vapor phase. The vapor is swept through a sorbent column where the volatile components are trapped. After purging is completed, the sorbent column is heated and backflushed with inert gas to desorb the components onto a GC column. For SW8020A, drying of the trap for under a helium flow is required. For methods SW8010B and SW8020A, the GC column is heated to elute the components that are detected by an appropriate detector.

7.1.9 Method SW3015-Microwave Assisted Acid Digestion of Aqueous Samples and Extracts

This digestion procedure can be used for the preparation of samples for analysis by FLAA, GFAA, ICP, or ICP-MS. A representative 45 mL aqueous sample is digested in 5 mL of concentrated nitric acid in a fluorocarbon (PFA or TFM) digestion vessel for 20 minutes using microwave heating. After the digestion process, the sample is cooled, and then filtered, centrifuged, or allowed to settle in a clean sample bottle prior to analysis.

7.1.10 Method SW3051-Microwave Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils

This is an alternative method to SW3050A that provides a rapid multi-element acid leach digestion. A representative sample of up to 0.5 grams is digested in 10 mL of concentrated nitric acid for 10 minutes using microwave heating with a suitable laboratory microwave unit. The sample and acid are placed in a fluorocarbon (PFA or TFM) microwave vessel. The vessel is capped and heated in the microwave unit. After cooling, the vessel contents are filtered, centrifuged, or allowed to settle and then diluted to volume and analyzed by the appropriate SW-846 method.

7.1.11 Method SW3010-Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP spectroscopy

This procedure is used for the determination of total metals. A mixture of nitric acid and the material to be analyzed is refluxed in a covered Griffin beaker. This step is repeated with additional portions of nitric acid until the digestate is light in color or until its color has stabilized. After the digestate has been brought to a low volume, it is refluxed with hydrochloric acid and brought up to volume.

7.1.12 Method SW3520B-Continuous Liquid-Liquid Extraction

This method is a procedure for isolating organic compounds from aqueous samples and describes concentrating techniques. A measured volume of sample is placed into a continuous liquid-liquid extractor, adjusted if necessary to a specific pH, and extracted with organic solvent for 18 to 24 hours. The extract is dried, concentrated (if necessary), and exchanged into a solvent that is compatible with the cleanup or determinative method being employed.

7.2 ANALYTICAL PROCEDURES

The analytical procedures presented in this section are outlined in Table 7.2-1. For method SW8020A a reduced list of analytes will be targeted (the BTEX analytes), as chlorinated benzenes are not suspected as contaminants from the USTs.

A brief description and three tables for each method are included in the following subsections. The first table presents the PQLs for each analyte in the method. The PQLs are presented for both soil and water matrices. The second table presents the acceptance criteria for the accuracy of spiked analyte and surrogate recoveries. This table also presents the

acceptance criteria for the precision of matrix, field, and laboratory duplicate recoveries. The third table presents the calibration and QC procedures for each method. Corrective actions and data flagging criteria are also included in this table.

In the third table, the first two columns designate the method number and the class of analytes that may be determined by the method. The third column lists the method-required calibration and QC elements. The fourth column designates the minimum frequency for performing each calibration and QC element. The fifth column designates the acceptance criteria for each calibration and QC element. The sixth column designates the corrective action in the event that a calibration or QC element does not meet the acceptance criteria. The last column designates the data flagging criteria that will be applied in the event that the method-required calibration and QC acceptance criteria are not met.

Table 7.2-1. Analytical Procedures

EPA SW Methods	Parameter
SW8020A	Aromatic Volatile Organics (water and soil)
SW8260A	Volatile Organics (water and soil)
SW8270B	Semivolatile organics (water and soil)
SW8310	Polynuclear Aromatic Hydrocarbons (water and soil)
SW8330	Explosive residues (water, soil, and wipes)
SW6010A	Trace metals by ICP (water, soil, paint, and wipes)
SW7470A	Mercury (water)
SW7471A	Mercury (soil)

7.2.1 Method SW8010B-Halogenated Volatile Organics

Not applicable.

7.2.2 Method SW8011—Ethylene Dibromide

Not applicable.

7.2.3 Method SW8015 (Modified)-Volatile and Extractable Total Petroleum Hydrocarbons (TPH)

Not applicable.

7.2.4 Method SW8020A-Aromatic Volatile Organics

Aromatic volatile organics in water and soil samples are prepared using method SW5030 and analyzed using method SW8020A. This method (also known as the BTEX method since the compounds of interest include benzene, toluene, ethylbenzene, and xylene) is a purge and trap GC method. An inert gas is bubbled through a water matrix to transfer the volatile aromatic hydrocarbons from the liquid to the vapor phase. The aromatics are removed from the inert gas by

passing the gas through a sorbent trap, which is then backflushed onto a GC column with a PID to separate and quantify the compounds of interest. Soil samples are first extracted. Low concentration contaminated soils may be prepared using method SW5030A. PQLs for method SW8020A are presented in Table 7.2.4-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.4-2 and 7.2.4-3.

Only a subset of the analytes listed in the method are proposed (the BTEX analytes) since chlorinated benzenes are not suspected as contaminants at the pipeline. For samples collected in the leachfield area, method 8260A will be used for analysis.

Table 7.2.4-1. PQLs for Method SW8020A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Aromatic Volatile	Benzene	2.0	$\mu\text{g/L}$	0.002	mg/kg
Organics	Ethylbenzene	2.0	$\mu\text{g/L}$	0.002	mg/kg
SW5030A/SW8020A	Toluene	2.0	$\mu\text{g/L}$	0.002	mg/kg
(W, S)	Xylenes, total	2.0	$\mu\text{g/L}$	0.002	mg/kg

Table 7.2.4-2. QC Acceptance Criteria for Method SW8020A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8020A	Benzene	75-125	≤ 20	66-135	≤ 30
	Ethylbenzene	71-129	≤ 20	61-139	≤ 30
	Toluene	70-125	≤ 20	60-135	≤ 30
	Xylenes, total	71-133	≤ 20	61-143	≤ 30
	Surrogates:				
	Bromochlorobenz.	46-136		36-146	
	Bromofluorobenz.	48-138		38-148	
	Difluorobenzene	48-138		38-148	
	Fluorobenzene	44-165		34-175	
	1,1,1-Trifluorotol.	44-165		34-175	

Table 7.2.4-3. Summary of Calibration and QC Procedures for Method SW8020A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8020A	Aromatic volatile organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	%RSD for all calibration analytes <20%	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results outside $\pm 15\%$ for specific analyte(s) for all samples associated with the calibration
		Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Initial calibration verification	Daily, before sample analysis	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results outside $\pm 15\%$ for specific analyte(s) for all samples associated with the calibration
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results outside $\pm 15\%$ for specific analyte(s) for all samples since the last acceptable calibration

Table 7.2.4-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8020A	Aromatic volatile organics	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.4-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.4-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		MDL study	Once per year	Detection limits established will be < the PQLs in Table 7.2.4-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed

Table 7.2.4-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8020A	Aromatic volatile organics	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.4-2	Correct problem then reextract and analyze sample If matrix interference is confirmed, no further action is necessary	For the samples; if the %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects If any surrogate recovery is < 10%, apply R to all results
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.4-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

- a. All corrective actions associated with AFCEE project work will be documented, and all records will be maintained by the laboratory.
- b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.5 Method SW8021A-Halogenated Volatile Organics

Not applicable.

7.2.6 Method SW8070-Nitrosamines

Not applicable.

7.2.7 Method SW8080A-Organochlorine Pesticides and Polychlorinated Biphenyls

Not applicable.

7.2.8 Method SW8081-Organochlorine Pesticides and Polychlorinated Biphenyls

Not applicable.

7.2.9 Method SW8140-Organophosphorus Pesticides

Not applicable.

7.2.10 Method SW8141A-Organophosphorus Pesticides

Not applicable.

7.2.11 Method SW8150B-Chlorinated Herbicides

Not applicable.

7.2.12 Method SW8151-Chlorinated Herbicides

Not applicable.

7.2.13 Method SW8240B-Volatile Organics

Not applicable.

7.2.14 Method SW8260A-Volatile Organics

Volatile (or purgeable) organics in water and soil samples are analyzed using method SW8260A. This method uses a capillary column GC/MS technique. Volatile compounds are introduced into the GC by purge and trap (SW5030A). An inert gas is bubbled through the water samples (or a soil-water slurry for soil samples) to transfer the purgeable organic compounds from the liquid to vapor phase. Soil samples with higher contaminant levels are extracted using methanol before purging. The vapor is then swept through a sorbent trap where the purgeable organics are trapped. The trap is backflushed and heated to desorb the purgeable organics onto a capillary GC column where they are separated and then detected with a mass spectrometer. The analytes detected and PQLs (using a 25 mL purge) for this method are listed in Table 7.2.14-1.

Calibration—The mass spectrometer is tuned daily to give an acceptable spectrum for bromofluorobenzene (BFB). The tuning acceptance criteria are given in the following list as an ion abundance for each specified mass:

- 50-15 percent to 40 percent of mass 95
- 75-30 percent to 60 percent of mass 95
- 95-base peak, 100 percent relative abundance
- 96-5 percent to 9 percent of mass 95
- 173-less than 2 percent of mass 174
- 174-greater than 50 percent of mass 95
- 175-5 percent to 9 percent of mass 174
- 176-greater than 95 percent, but less than 101 percent of mass 174
- 177-5 percent to 9 percent of mass 176.

The internal standard (IS) method is used for quantitation of analytes of interest. For quantitation, RFs are calculated from the base ion peak of a specific IS added to each calibration standard, blank, QC sample, and sample. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.14-2 and 7.2.14-3.

Table 7.2.14-1. PQLs for Method SW8260A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
VOCs SW5030A/SW8260A (W, S)	1,1,1,2-Tetrachloroethane	0.5	µg/L	0.003	mg/kg
	1,1,1-TCA	0.8	µg/L	0.004	mg/kg
	1,1,2,2-Tetrachloroethane	0.4	µg/L	0.002	mg/kg
	1,1,2-TCA	1.0	µg/L	0.005	mg/kg
	1,1-DCA	0.4	µg/L	0.002	mg/kg
	1,1-DCE	1.2	µg/L	0.006	mg/kg
	1,1-Dichloropropene	1.0	µg/L	0.005	mg/kg
	1,2,3-Trichlorobenzene	0.3	µg/L	0.002	mg/kg
	1,2,3-Trichloropropane	3.2	µg/L	0.02	mg/kg
	1,2,4-Trichlorobenzene	0.4	µg/L	0.002	mg/kg
	1,2,4-Trimethylbenzene	1.3	µg/L	0.007	mg/kg
	1,2-DCA	0.6	µg/L	0.003	mg/kg
	1,2-DCB	0.3	µg/L	0.002	mg/kg
	1,2-Dibromo-3-chloropropane	2.6	µg/L	0.01	mg/kg
	1,2-Dichloropropane	0.4	µg/L	0.002	mg/kg
	1,2-EDB	0.6	µg/L	0.003	mg/kg
	1,3,5-Trimethylbenzene	0.5	µg/L	0.003	mg/kg
	1,3-DCB	1.2	µg/L	0.006	mg/kg
	1,3-Dichloropropane	0.4	µg/L	0.002	mg/kg
	1,4-DCB	0.3	µg/L	0.002	mg/kg
	1-Chlorohexane	0.5	µg/L	0.003	mg/kg
	2,2-Dichloropropane	3.5	µg/L	0.02	mg/kg
	2-Chlorotoluene	0.4	µg/L	0.002	mg/kg
	4-Chlorotoluene	0.6	µg/L	0.003	mg/kg
	Benzene	0.4	µg/L	0.002	mg/kg
	Bromobenzene	0.3	µg/L	0.002	mg/kg
	Bromochloromethane	0.4	µg/L	0.002	mg/kg
	Bromodichloromethane	0.8	µg/L	0.004	mg/kg
Bromoform	1.2	µg/L	0.006	mg/kg	

Table 7.2.14-1. Concluded

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
VOCs SW5030A/SW8260A (W, S) (concluded)	Bromomethane	1.1	µg/L	0.005	mg/kg
	Carbon tetrachloride	2.1	µg/L	0.01	mg/kg
	Chlorobenzene	0.4	µg/L	0.002	mg/kg
	Chloroethane	1.0	µg/L	0.005	mg/kg
	Chloroform	0.3	µg/L	0.002	mg/kg
	Chloromethane	1.3	µg/L	0.007	mg/kg
	Cis-1,2-DCE	1.2	µg/L	0.006	mg/kg
	Cis-1,3-Dichloropropene	1.0	µg/L	0.005	mg/kg
	Dibromochloromethane	0.5	µg/L	0.003	mg/kg
	Dibromomethane	2.4	µg/L	0.01	mg/kg
	Dichlorodifluoromethane	1.0	µg/L	0.005	mg/kg
	Ethylbenzene	0.6	µg/L	0.003	mg/kg
	Hexachlorobutadiene	1.1	µg/L	0.005	mg/kg
	Isopropylbenzene	0.5	µg/L	0.008	mg/kg
	m-Xylene	0.5	µg/L	0.003	mg/kg
	Methylene chloride	0.3	µg/L	0.002	mg/kg
	n-Butylbenzene	1.1	µg/L	0.005	mg/kg
	n-Propylbenzene	0.4	µg/L	0.002	mg/kg
	Naphthalene	0.4	µg/L	0.002	mg/kg
	o-Xylene	1.1	µg/L	0.005	mg/kg
	p-Isopropyltoluene	1.2	µg/L	0.006	mg/kg
	p-Xylene	1.3	µg/L	0.007	mg/kg
	Sec-Butylbenzene	1.3	µg/L	0.007	mg/kg
	Styrene	0.4	µg/L	0.002	mg/kg
	TCE	1.0	µg/L	0.01	mg/kg
	Tert-Butylbenzene	1.4	µg/L	0.007	mg/kg
	Tetrachloroethene	1.4	µg/L	0.007	mg/kg
	Toluene	1.1	µg/L	0.005	mg/kg
	Trans-1,2-DCE	0.6	µg/L	0.003	mg/kg
	Trans-1,3-Dichloropropene	1.0	µg/L	0.005	mg/kg
Trichlorofluoromethane	0.8	µg/L	0.004	mg/kg	
Vinyl chloride	1.1	µg/L	0.009	mg/kg	

Table 7.2.14-2. QC Acceptance Criteria for Method SW8260A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8260A	1,1,1,2-Tetrachloroethane	72-125	≤ 20	62-108	≤ 30
	1,1,1-TCA	75-125	≤ 20	65-135	≤ 30
	1,1,2,2-Tetrachloroethane	74-125	≤ 20	64-135	≤ 30
	1,1,2-TCA	75-127	≤ 20	65-135	≤ 30
	1,1-DCA	72-125	≤ 20	62-135	≤ 30
	1,1-DCE	75-125	≤ 20	65-135	≤ 30
	1,1-Dichloropropene	75-125	≤ 20	65-135	≤ 30
	1,2,3-Trichlorobenzene	75-137	≤ 20	65-147	≤ 30
	1,2,3-Trichloropropane	75-125	≤ 20	65-135	≤ 30
	1,2,4-Trichlorobenzene	75-135	≤ 20	65-145	≤ 30
	1,2,4-Trimethyl Benzene	75-125	≤ 20	65-135	≤ 30
	1,2-DCA	68-127	≤ 20	58-137	≤ 30
	1,2-DCB	75-125	≤ 20	65-135	≤ 30
	1,2-Dibromo-3-chloropropane	59-125	≤ 20	49-135	≤ 30
	1,2-Dichloropropane	70-125	≤ 20	60-135	≤ 30
	1,2-EDB	75-125	≤ 20	65-135	≤ 30
	1,3,5-Trimethylbenzene	72-112	≤ 20	62-135	≤ 30
	1,3-DCB	75-125	≤ 20	65-135	≤ 30
	1,3-Dichloropropane	75-125	≤ 20	65-135	≤ 30
	1,4-DCB	75-125	≤ 20	65-135	≤ 30
	1-Chlorohexane	75-125	≤ 20	65-135	≤ 30
	2,2-Dichloropropane	75-125	≤ 20	65-135	≤ 30
	2-Chlorotoluene	73-125	≤ 20	63-135	≤ 30
	4-Chlorotoluene	74-125	≤ 20	64-135	≤ 30
	Benzene	75-125	≤ 20	65-135	≤ 30

Table 7.2.14-2. Continued

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8260A	Bromobenzene	75-125	≤ 20	65-135	≤ 30
(Continued)	Bromochloromethane	73-125	≤ 20	63-135	≤ 30
	Bromodichloromethane	75-125	≤ 20	65-135	≤ 30
	Bromoform	75-125	≤ 20	65-135	≤ 30
	Bromomethane	72-125	≤ 20	62-135	≤ 30
	Carbon Tetrachloride	62-125	≤ 20	52-135	≤ 30
	Chlorobenzene	75-125	≤ 20	65-135	≤ 30
	Chloroethane	65-125	≤ 20	55-135	≤ 30
	Chloroform	74-125	≤ 20	64-135	≤ 30
	Chloromethane	75-125	≤ 20	65-135	≤ 30
	Cis-1,2-DCE	75-125	≤ 20	65-135	≤ 30
	Cis-1,3-Dichloropropene	74-125	≤ 20	64-135	≤ 30
	Dibromochloromethane	73-125	≤ 20	63-135	≤ 30
	Dibromomethane	69-127	≤ 20	59-137	≤ 30
	Dichlorodifluoromethane	75-125	≤ 20	65-135	≤ 30
	Ethylbenzene	75-125	≤ 20	65-135	≤ 30
	Hexachlorobutadiene	75-125	≤ 20	65-135	≤ 30
	Isopropylbenzene	75-125	≤ 20	65-135	≤ 30
	m-Xylene	75-125	≤ 20	65-135	≤ 30
	Methylene chloride	75-125	≤ 20	65-135	≤ 30
	n-Butylbenzene	75-125	≤ 20	65-135	≤ 30
	n-Propylbenzene	75-125	≤ 20	65-135	≤ 30
	Naphthalene	75-125	≤ 20	65-135	≤ 30
	o-Xylene	75-125	≤ 20	65-135	≤ 30
	p-Isopropyltoluene	75-125	≤ 20	65-135	≤ 30
	p-Xylene	75-125	≤ 20	65-135	≤ 30
	Sec-Butylbenzene	75-125	≤ 20	65-135	≤ 30
	Styrene	75-125	≤ 20	65-135	≤ 30
	TCE	71-125	≤ 20	61-135	≤ 30
	Tetrachloroethene	71-125	≤ 20	61-135	≤ 30
	Toluene	74-125	≤ 20	64-135	≤ 30

Table 7.2.14-2. Concluded

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8260A (Concluded)	Trans-1,2-DCE	75-125	≤ 20	65-135	≤ 30
	Trans-1,3-Dichloropropene	66-125	≤ 20	56-135	≤ 30
	Trichlorofluoromethane	67-125	≤ 20	57-135	≤ 30
	Vinyl Chloride	46-134	≤ 20	36-144	≤ 30
	Tert-butylbenzene	75-125	≤ 20	65-135	≤ 30
	Surrogates:				
	Dibromofluoromethane	75-125		65-135	
	Toluene-D8	75-125		65-135	
	4-Bromofluorobenzene	75-125		65-135	
	1,2-DCA-D4	62-139		52-149	

Table 7.2.14-3. Summary of Calibration and QC Procedures for Method SW8260A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8260A	Volatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF $\geq 0.30^c$; and %RSD for all calibration analytes $\leq 30\%$	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm 25\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Calibration verification	Daily, before sample analysis, and every 12 hours of analysis time	SPCCs average RF $\geq 0.30^c$; and CCCs $< 20\%$ drift; and all calibration analytes within $\pm 25\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.14-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.14-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8260A	Volatile Organics	Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (section 7.2.14)	Retune instrument and verify	Apply R to all results for all samples associated with the tune
		ISs	Immediately after or during data acquisition of calibration check standard	Retention time ± 0.06 rt units; EICP area within -50% to +100% of last calibration verification (12 hours) for each	Inspect mass spectrometry or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning. If matrix interference is demonstrated, no further corrective action is needed.	Apply R to all results for specific analytes for all samples associated with the IS
		Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.14-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects

Table 7.2.14-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8260A	Volatile Organics	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.14-2	Correct problem then reextract and analyze sample. If matrix interference is demonstrated, no further corrective action is needed.	For the samples; if the %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects If any surrogate recovery is < 10%, apply R to all results
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.14-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3) MS/MSD RPD > CL
		MDL study	Once per year	Detection limits established will be < the PQLs in Table 7.2.14-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

- a.. All corrective actions associated with AFCEE project work will be documented, and all records will be maintained by the laboratory.
- b. Flagging criteria are applied by data validator when acceptance criteria were not met and corrective action was not successful or corrective action was performed.
- c. Except > 0.10 for bromoform, and ≥ 0.10 for chloromethane and 1,1-dichloroethane

7.2.15 Method SW8270B-Semivolatile Organics

Semivolatile organics (also known as base/neutral and acid extractables) in water and soil samples are analyzed using method SW8270B. This technique determines quantitatively the concentration of a number of SVOCs. Aqueous samples are prepared using method SW3510B or SW3520B, solid samples are prepared by method SW3550A or SW3540B. Samples are extracted and both base/neutral and acid extracts are then concentrated through evaporation. Compounds of interest are separated and quantified using a capillary column GC/mass spectrometer. The PQLs are listed in Table 7.2.15-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.15-2 and 7.2.15-3.

The mass spectrometer is tuned every 12 hours to give an acceptable spectrum for decafluorotriphenylphosphine (DFTPP). The tuning acceptance criteria are given in the following list as an ion abundance for each specified mass:

- 51-30 percent to 60 percent of mass 198;
- 68-less than 2 percent of mass 69;
- 70-less than 2 percent of mass 69;
- 127-40 percent to 60 percent of mass 198;
- 197-less than 1 percent of mass 198;
- 198-base peak, 100 percent relative abundance;
- 199-5 percent to 9 percent of mass 198;
- 275-10 percent to 30 percent of mass 198;
- 365-greater than 1 percent of mass 198;
- 441-present, but less than mass 443;
- 442-greater than 40 percent of mass 198; and
- 443-17 percent to 23 percent of mass 442.

The IS method is used for quantitation of analytes of interest. For quantitation, RFs are calculated from the base ion peak of a specific IS that is added to each calibration standard, blank, QC sample, and sample. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.15-2 and 7.2.15-3.

The PQLs for several polynuclear aromatic hydrocarbon (PAH) compounds in Method 8270A are substantially higher (greater than a factor of 10) than the potential Texas ARARs for these compounds in soil and water. However, no alternative analysis with lower detection limits is proposed at this time because there is no record or reason to suspect a PAH contamination problem at the site and this analysis is only a general screening tool at this stage. Analysis of additional samples with an alternative method will be considered based on the results of the initial sampling.

Table 7.2.15-1 PQLs for Method SW8270B

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Semivolatile organics	1,2,4-Trichlorobenzene	10.0	µg/L	0.7	mg/kg
Base/Neutral Extractables	1,2-DCB	10.0	µg/L	0.7	mg/kg
SW3510B or SW3520B/SW8270B (W)	1,3-DCB	10.0	µg/L	0.7	mg/kg
SW3540B or SW3550A /SW8270B (S)	1,4-DCB	10.0	µg/L	0.7	mg/kg
	2,4-DNT	10.0	µg/L	0.7	mg/kg
	2,6-DNT	10.0	µg/L	0.7	mg/kg
	2-Chloronaphthalene	10.0	µg/L	0.7	mg/kg
	2-Methylnaphthalene	10.0	µg/L	0.7	mg/kg
	2-Nitroaniline	50.0	µg/L	3.3	mg/kg
	3-Nitroaniline	50.0	µg/L	3.3	mg/kg
	3,3'-Dichlorobenzidine	20.0	µg/L	1.3	mg/kg
	4-Bromophenyl phenyl ether	10.0	µg/L	0.7	mg/kg
	4-Chloroaniline	20.0	µg/L	1.3	mg/kg
	4-Chlorophenyl phenyl ether	10.0	µg/L	0.7	mg/kg
	4-Nitroaniline	50.0	µg/L	3.3	mg/kg
	Acenaphthylene	10.0	µg/L	0.7	mg/kg
	Acenaphthene	10.0	µg/L	0.7	mg/kg
	Anthracene	10.0	µg/L	0.7	mg/kg
	Benz (a) anthracene	10.0	µg/L	0.7	mg/kg
	Benzo (a) pyrene	10.0	µg/L	0.7	mg/kg
	Benzo (b) fluoranthene	10.0	µg/L	0.7	mg/kg
	Benzo (g,h,i) perylene	10.0	µg/L	0.7	mg/kg
	Benzyl alcohol	20.0	µg/L	1.3	mg/kg
	Bis (2-chloroethoxy) methane	10.0	µg/L	0.7	mg/kg
	Bis (2-chlorethyl) ether	10.0	µg/L	0.7	mg/kg
	Bis (2-chloroisopropyl) ether	10.0	µg/L	0.7	mg/kg
	Bis (2-ethylhexyl) phthalate	10.0	µg/L	0.7	mg/kg
	Butyl benzylphthalate	10.0	µg/L	0.7	mg/kg
	Chrysene	10.0	µg/L	0.7	mg/kg
	Di-n-butylphthalate	10.0	µg/L	0.7	mg/kg
	Di-n-octylphthalate	10.0	µg/L	0.7	mg/kg

Table 7.2.15-1. Concluded

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Semivolatile organics	Dibenz (a,h) anthracene	10.0	µg/L	0.7	mg/kg
Base/Neutral Extractables	Dibenzofuran	10.0	µg/L	0.7	mg/kg
SW3510B or	Diethyl phthalate	10.0	µg/L	0.7	mg/kg
SW3520B/SW8270B (W)	Dimethyl phthalate.	10.0	µg/L	0.7	mg/kg
SW3540B or	Fluoranthene	10.0	µg/L	0.7	mg/kg
SW3550A/SW8270B (S)	Fluorene	10.0	µg/L	0.7	mg/kg
(concluded)	Hexachlorobenzene	10.0	µg/L	0.7	mg/kg
	Hexachlorobutadiene	10.0	µg/L	0.7	mg/kg
	Hexachlorocyclopentadiene	10.0	µg/L	0.7	mg/kg
	Hexachloroethane	10.0	µg/L	0.7	mg/kg
	Indeno (1,2,3-cd) pyrene	10.0	µg/L	0.7	mg/kg
	Isophorone	10.0	µg/L	0.7	mg/kg
	n-Nitrosodiphenylamine	10.0	µg/L	0.7	mg/kg
	n-Nitrosodi-n-propylamine	10.0	µg/L	0.7	mg/kg
	Naphthalene	10.0	µg/L	0.7	mg/kg
	Nitrobenzene	10.0	µg/L	0.7	mg/kg
	Phenanthrene	10.0	µg/L	0.7	mg/kg
	Pyrene	10.0	µg/L	0.7	mg/kg
Semivolatile organics	2,4,5-Trichlorophenol	50.0	µg/L	3.3	mg/kg
Acid Extractables	2,4,6-Trichlorophenol	10.0	µg/L	0.3	mg/kg
SW3510B or	2,4-Dichlorophenol	10.0	µg/L	0.3	mg/kg
SW3520B/SW8270B (W)	2,4-Dimethylphenol	10.0	µg/L	0.3	mg/kg
SW3540B or	2,4-Dinitrophenol	50.0	µg/L	3.3	mg/kg
SW3550A/SW8270B (S)	2-Chlorophenol	10.0	µg/L	0.3	mg/kg
	2-Methylphenol	10.0	µg/L	0.3	mg/kg
	2-Nitrophenol	10.0	µg/L	0.3	mg/kg
	4,6-Dinitro-2-methylphenol	50.0	µg/L	3.3	mg/kg
	4-Chloro-3-methylphenol	20.0	µg/L	1.3	mg/kg
	4-Methylphenol	10.0	µg/L	0.3	mg/kg
	4-Nitrophenol	50.0	µg/L	1.6	mg/kg
	Benzoic acid	50.0	µg/L	1.6	mg/kg
	Pentachlorophenol	50.0	µg/L	3.3	mg/kg
	Phenol	10.0	µg/L	0.3	mg/kg

Table 7.2.15-2. QC Acceptance Criteria for Method SW8270B

Method	Analyte	Accuracy	Precision	Accuracy	Precision
		Water (% R)	Water (% RPD)	Soil (% R)	Soil (% RPD)
SW8270B	1,2,4-Trichlorobenzene	44-142	≤ 20	34-152	≤ 30
	1,2-DCB	42-155	≤ 20	32-135	≤ 30
	1,3-DCB	36-125	≤ 20	26-135	≤ 30
	1,4-DCB	30-125	≤ 20	25-135	≤ 30
	2,4-DNT	39-139	≤ 20	29-149	≤ 30
	2,6-DNT	51-125	≤ 20	41-135	≤ 30
	2-Chloronaphthalene	60-125	≤ 20	50-135	≤ 30
	2-Methylnaphthalene	41-125	≤ 20	31-135	≤ 30
	2-Nitroaniline	50-125	≤ 20	40-135	≤ 30
	3,3'-Dichlorobenzidine	29-175	≤ 20	25-175	≤ 30
	3-Nitroaniline	51-125	≤ 20	41-135	≤ 30
	4-Bromophenyl phenyl ether	53-127	≤ 20	43-137	≤ 30
	4-Chloroaniline	45-136	≤ 20	35-146	≤ 30
	4-Chlorophenyl phenyl ether	51-132	≤ 20	41-142	≤ 30
	4-Nitroaniline	40-143	≤ 20	30-153	≤ 30
	Acenaphthylene	47-125	≤ 20	37-135	≤ 30
	Acenaphthene	49-125	≤ 20	39-135	≤ 30
	Anthracene	45-165	≤ 20	35-175	≤ 30
	Benz (a) anthracene	51-133	≤ 20	41-143	≤ 30
	Benzo (a) pyrene	41-125	≤ 20	31-135	≤ 30
	Benzo (b) fluoranthene	37-125	≤ 20	27-135	≤ 30
	Benzo (g,h,i) perylene	34-149	≤ 20	25-159	≤ 30
	Benzyl alcohol	35-125	≤ 20	25-135	≤ 30
	Bis (2-chloroethoxy) methane	49-125	≤ 20	39-135	≤ 30
	Bis (2-chloroethyl) ether	44-125	≤ 20	34-135	≤ 30
	Bis (2-chloroisopropyl) ether	36-166	≤ 20	26-175	≤ 30
	Bis (2-ethylhexyl) phthalate	33-129	≤ 20	25-139	≤ 30
	Butyl Benzyl Phthalate	26-125	≤ 20	25-135	≤ 30
	Chrysene	55-133	≤ 20	45-143	≤ 30
	Di-n-Butyl Phthalate	34-126	≤ 20	25-136	≤ 30
	Di-n-Octyl Phthalate	38-127	≤ 20	28-137	≤ 30
	Dibenz (a,h) Anthracene	50-125	≤ 20	40-135	≤ 30
	Dibenzofuran	52-125	≤ 20	42-135	≤ 30

Table 7.2.15-2. Continued

Method	Analyte	Accuracy	Precision	Accuracy	Precision
		Water (% R)	Water (% RPD)	Soil (% R)	Soil (% RPD)
SW8270B	Diethyl Phthalate	37-125	≤ 20	27-135	≤ 30
	Dimethyl Phthalate	25-175	≤ 20	25-175	≤ 30
	Fluoranthene	47-125	≤ 20	37-135	≤ 30
	Hexachlorobenzene	46-133	≤ 20	36-143	≤ 30
	Hexachlorobutadiene	25-125	≤ 20	25-135	≤ 30
	Hexachlorocyclopentadiene	41-125	≤ 20	31-135	≤ 30
	Hexachloroethane	25-153	≤ 20	25-163	≤ 30
	Indeno (1,2,3-c,d) Pyrene	27-160	≤ 20	25-170	≤ 30
	Isophorone	26-175	≤ 20	25-175	≤ 30
	n-Nitrosodi-n-propylamine	37-125	≤ 20	27-135	≤ 30
	n-Nitrosodiphenylamine	27-125	≤ 20	25-135	≤ 30
	Naphthalene	50-125	≤ 20	40-135	≤ 30
	Nitrobenzene	46-133	≤ 20	36-143	≤ 30
	Phenanthrene	54-125	≤ 20	44-135	≤ 30
	Pyrene	47-136	≤ 20	37-146	≤ 30
	2,4,5-Trichlorophenol	25-175	≤ 20	25-175	≤ 30
	2,4,6-Trichlorophenol	39-128	≤ 20	29-138	≤ 30
	2,4-Dichlorophenol	46-125	≤ 20	36-135	≤ 30
	2,4-Dimethylphenol	45-139	≤ 20	35-149	≤ 30
	2,4-Dinitrophenol	30-151	≤ 20	25-161	≤ 30
	2-Chlorophenol	41-125	≤ 20	31-135	≤ 30
	2-Methylphenol	25-125	≤ 20	25-135	≤ 30
	2-Nitrophenol	44-125	≤ 20	34-135	≤ 30
	4,6-Dinitro-2-Methyl Phenol	26-134	≤ 20	25-144	≤ 30
	4-Chloro-3-Methyl Phenol	44-125	≤ 20	34-135	≤ 30
	4-Methylphenol	33-125	≤ 20	25-135	≤ 30
	4-Nitrophenol	25-131	≤ 20	25-141	≤ 30
	Benzoic Acid	As detected- 172	≤ 20	As detected-182	≤ 30
	Pentachlorophenol	28-136	≤ 20	38-146	≤ 30
	Phenol	25-125	≤ 20	25-135	≤ 30

Table 7.2.15-2. Concluded

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8270B (Concluded)	Surrogates: 2,4,6-Tribromophenol 2-Fluorobiphenyl 2-Fluorophenol Nitrobenzene-D5 Phenol-D5 Terphenyl-D14	25-134 43-125 25-125 32-125 25-125 42-126		25-144 34-135 25-135 25-135 25-135 32-136	

Table 7.2.15-3. Summary of Calibration and QC Procedures for Method SW8270B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8270B	Semi-volatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs avg RF ≥ 0.05 , and %RSD for all CCCs $\leq 30\%$; other cmpds $\leq 15\%$	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm 25\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results outside $\pm 25\%$ for specific analyte(s) for all samples assoc. with the calibration
		Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples run since last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Calibration verification	Daily, before sample analysis, every 12 hours of analysis time	SPCCs average RF ≥ 0.05 ; and CCCs $< 20\%$ drift; and all calibration analytes within $\pm 25\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results not meeting acceptance criteria for RF and drift and outside $\pm 25\%$ expected value for all samples associated with the calibration
		Demonstrate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.15-2	Recalculate results; locate and fix problem with system then rerun for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.15-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8270B	Semi-volatile Organics	Check of mass spectral ion intensities using DFTPP	Prior to initial calibration and calibration verification	Refer to criteria in the method description (Sec. 7.2.15)	Retune instrument and verify	Apply R to all results for all samples associated with the tune
		ISs	Immediately after or during data acquisition of calibration check standard	Retention time ± 0.06 rt units; EICP area within -50% to +100% of last calibration verification (12 hours) for each	Inspect equip. for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning If matrix interference is confirmed, no further action is necessary	Apply R to all results for specific analytes for all samples associated with the IS
		Method blank	One per analytical batch	No analytes detected >PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.15-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects

Table 7.2.15-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8270B	Semi-volatile Organics	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.15-2	Correct problem then reextract and analyze sample If matrix interference is confirmed, no further action is necessary	For the samples; if the %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects If any surrogate recovery is < 10%, apply R to all results
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.15-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3) MS/MSD RPD > CL
		MDL study	Once per year	Detection limits established will be < the PQLs in Table 7.2.15-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

- a. All corrective actions associated with AFCEE project work will be documented, and all records will be maintained by the laboratory.
- b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.16 Method SW8280-Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans

Not applicable.

7.2.17 Method SW8310-Polynuclear Aromatic Hydrocarbons

Method SW8310 is used to determine the concentration of ppb levels of selected polynuclear aromatic hydrocarbons (PAHs) in groundwater and soils by HPLC. Aqueous samples are prepared using method SW3510B, solid samples are prepared by method SW3550A. Samples are analyzed by direct injection. Detection is by ultraviolet and fluorescent detectors. PQLs are listed in Table 7.2.17-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.17-2 and 7.2.17-3.

Table 7.2.17-1. PQLs for Method SW8310

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Polynuclear Aromatic Hydrocarbons SW3510B/SW8310 (W) SW3550A/SW8310 (S)	Acenaphthene	18.0	µg/L	1.2	mg/kg
	Acenaphthylene	23.0	µg/L	1.54	mg/kg
	Anthracene	6.6	µg/L	0.44	mg/kg
	Benzo (a) anthracene	0.13	µg/L	0.009	mg/kg
	Benzo (a) pyrene	0.23	µg/L	0.015	mg/kg
	Benzo (b) fluoranthene	0.18	µg/L	0.012	mg/kg
	Benzo (g,h,i) perylene	0.76	µg/L	0.05	mg/kg
	Benzo (k) fluoranthene	0.17	µg/L	0.011	mg/kg
	Chrysene	1.5	µg/L	0.1	mg/kg
	Dibenzo (a,h) anthracene	0.3	µg/L	0.02	mg/kg
	Fluoranthrene	2.1	µg/L	0.14	mg/kg
	Fluorene	2.1	µg/L	0.14	mg/kg
	Indeno (1,2,3-c,d) pyrene	0.43	µg/L	0.03	mg/kg
	Naphthalene	18.0	µg/L	1.2	mg/kg
	Phenanthrene	6.4	µg/L	0.42	mg/kg
	Pyrene	2.7	µg/L	0.18	mg/kg

Table 7.2.17-2. QC Acceptance Criteria for Method SW8310

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8310	Acenaphthylene	49-125	≤ 30	39-135	≤ 50
	Acenaphthene	43-130	≤ 30	33-140	≤ 50
	Anthracene	54-125	≤ 30	44-135	≤ 50
	Benzo (a) Anthracene	39-135	≤ 30	29-145	≤ 50
	Benzo (a) Pyrene	52-125	≤ 30	42-135	≤ 50
	Benzo (b) Fluoranthene	31-137	≤ 30	25-147	≤ 50
	Benzo (g,h,i) Perylene	53-125	≤ 30	43-135	≤ 50
	Benzo (k) Fluoranthene	60-129	≤ 30	50-139	≤ 50
	Chrysene	59-134	≤ 30	49-144	≤ 50
	Dibenzo (a,h) Anthracene	51-125	≤ 30	41-135	≤ 50
	Fluoranthene	42-125	≤ 30	32-135	≤ 50
	Fluorene	53-125	≤ 30	43-135	≤ 50
	Indeno (1,2,3-c,d) Pyrene	55-125	≤ 30	45-135	≤ 50
	Naphthalene	43-125	≤ 30	33-135	≤ 50
	Phenathrene	52-129	≤ 30	42-139	≤ 50
	Pyrene	55-125	≤ 30	45-135	≤ 50
	Surrogates:				
	Terphenyl-D14	25-157		22-167	

Table 7.2.17-3. Summary of Calibration and QC Procedures for Method SW8310

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8310	PAHs	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	RSD < 20% for CFs or RFs	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with calibration
		Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Initial calibration verification	Daily, before sample analysis	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with calibration.
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration verification
		Demonstrate ability to generate acceptable accuracy and precision analyzing 4 reps of QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.17-2	Recalculate results; locate and fix problem with system and rerun demo for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.17-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8310	PAHs	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprep and analyze method blank and all samples processed with contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.17-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all NDs
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.17-2	Correct problem then reextract and analyze sample	For the samples; if the %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply J to all positive results, apply R to all NDs If any surrogate recovery is < 10%, apply R to all results

Table 7.2.17-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8310	PAHs	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.17-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		Confirmation ^c	100% for all positive results	RPD ± 25%	Same as for initial or primary analysis	Apply R to the result for the specific analyte(s) in the sample
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.2.17-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

- a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.
- b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.
- c. Use a second column or different detector

7.2.18 Method SW8330—Explosive Residues

Method SW8330 provides HPLC conditions for the detection of parts per billion (ppb) levels of certain explosive residues in a water, soil, and sediment matrix. Prior to using this method, appropriate sample preparation techniques must be used.

In the low-level, salting-out method with no evaporation, aqueous samples of low concentration are extracted by a salting-out extraction procedure. An aliquot of the extract is separated on a C-18 reverse-phase column, determined at 254 nanometers (nm), and confirmed on a cyanide reverse-phase column.

In the high-level direct injection method, aqueous samples of higher concentration can be diluted, filtered, separated on a C-18 reverse-phase column, determined at 254 nm, and confirmed on a cyanide reverse-phase column.

Soil and sediment samples are extracted in an ultrasonic bath and filtered before chromatography.

PQLs are listed in Table 7.2.18-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.18-2 and 7.2.18-3.

Table 7.2.18-1. PQLs for Method SW8330

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Explosive Residues SW8330	1,3,5- TNB	7.3	µg/L	0.25	mg/kg
	1,3- DNB	4.0	µg/L	0.25	mg/kg
	2,4,6- TNT	6.9	µg/L	0.25	mg/kg
	2,4-DNT	5.7	µg/L	0.25	mg/kg
	2,6-DNT	9.4	µg/L	0.26	mg/kg
	HMX	13.0	µg/L	2.2	mg/kg
	m-Nitrotoluene	7.9	µg/L	0.25	mg/kg
	Methyl-2,4,6-trinitrophenylnitramine	44.0	µg/L	0.65	mg/kg
	Nitrobenzene	7.0	µg/L	0.26	mg/kg
	o-Nitrotoluene	12.0	µg/L	0.25	mg/kg
	p-Nitrotoluene	8.5	µg/L	0.25	mg/kg
RDX	14.0	µg/L	1.0	mg/kg	

Table 7.2.18-2. QC Acceptance Criteria for Method SW8330

Method	Analyte	Accuracy	Precision	Accuracy	Precision
		Water (% R)	Water (% RPD)	Soil (% R)	Soil (% RPD)
SW8330	1,3,5-TNB	75-142	≤ 30	65-152	≤ 50
	1,3-DNB	75-125	≤ 30	65-135	≤ 50
	2,4,6-TNT	75-128	≤ 30	65-138	≤ 50
	2,4-DNT	75-125	≤ 30	65-135	≤ 50
	2,6-DNT	75-129	≤ 30	65-139	≤ 50
	HMX	74-137	≤ 30	64-147	≤ 50
	m-Nitrotoluene	60-134	≤ 30	50-144	≤ 50
	Methyl-2,4,6-Trinitrophenylnitramine	44-142	≤ 30	34-152	≤ 50
	Nitrobenzene	29-134	≤ 30	25-144	≤ 50
	o-Nitrotoluene	75-129	≤ 30	65-139	≤ 50
	p-Nitrotoluene	42-150	≤ 30	32-160	≤ 50
	RDX	75-132	≤ 30	65-142	≤ 50
	Surrogates^a:				

- a. Use an analyte and its LCS limit from the method that is not expected to be present in the sample as the surrogate.

Table 7.2.18-3. Summary of Calibration and QC Procedures for Method SW8330

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8330	Explosives	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	RSD < 20% for CFs or RFs	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Initial calibration verification	Daily, before sample analysis	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration verification
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.18-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.18-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8330	Explosives	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.18-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.18-2	Correct problem then reextract and analyze sample. If matrix interference is confirmed, no further corrective action is needed.	For the samples; if the %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply J to all positive results; apply R to all non-detects If any surrogate recovery is < 10%, apply R to all results

Table 7.2.18-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8330	Explosives	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.18-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		Confirma-tion ^c	100% for all positive results	RPD ± 25%	Same as for initial or primary analysis	Apply R to the result for the specific analyte(s) in the sample
		MDL study	Once per year	Detection limits established will be < the PQLs in Table 7.2.18-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

a. All corrective actions associated with AFCEE project work will be documented, and all records will be maintained by the laboratory.

b. Flagging criteria are applied by data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

c. Use a second column or different detector

7.2.19 Method SW6010A-Trace Elements (Metals) by Inductively Coupled Plasma Atomic Emission Spectroscopy for Water and Soil

Samples are analyzed for trace elements or metals using method SW6010A for water and soils. Analysis for most metals requires digestion of the sample. This digestion is performed by method SW3005A or SW3015 for water or method SW3050A or SW3051 for soil. Following digestion, the trace elements are determined simultaneously or sequentially using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICPAES). The elements and corresponding PQLs for this method are listed in Table 7.2.19-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.19-2 and 7.2.19-3.

The PQLs for Method 6010 A are substantially higher (by a factor of ten) than the potential ARARs for thallium in soil and water (ARARs are listed in the Work Plan). However, there is no reason to suspect that thallium is a concern at the site; therefore, a method specific to thallium with lower detection limits is not proposed at this time. If thallium is found to be a significant contaminant in the initial phase of sampling, an alternative method will be considered for any additional sample analysis.

Table 7.2.19-1. PQLs for Method SW6010A

Parameter/Method	Analyte	Water (mg/l)		Soil (mg/kg)	
		ICP PQL	Trace ICP PQL	ICP PQL	Trace ICP PQL ^a
ICP Screen for Metals SW3015 or SW3005A/ SW6010A (W) SW3051 or SW3050A/ SW6010A (S)	Aluminum		0.05		5.0
	Antimony		0.01		1.0
	Arsenic		0.01		2.0
	Barium		0.005		0.5
	Beryllium	0.003	0.001	0.3	0.3
	Cadmium		0.001		0.1
	Calcium	0.1	0.20	10.0	20.0
	Chromium		0.005		0.5
	Cobalt		0.002		0.2
	Copper		0.005		0.5
	Iron	0.07	0.05	7.0	5.0
	Lead		0.01		1.0
	Magnesium	0.3	0.05	30.0	5.0
	Manganese		0.005		0.5
	Molybdenum		0.005		0.5
	Nickel		0.005		0.5
	Potassium	5.0	0.20	500.0	10.0
	Selenium		0.01		1.0
	Silver		0.005		0.2
	Sodium	0.3	0.50	30.0	100
Thallium		0.02		2.0	
Vanadium		0.005		0.5	
Zinc	0.02	0.02	2.0	3.0	

Table 7.2.19-2. QC Acceptance Criteria for Method SW6010A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW6010A	Aluminum	80-120	≤ 15	80-120	≤ 25
	Antimony	80-120	≤ 15	80-120	≤ 25
	Arsenic	80-120	≤ 15	80-120	≤ 25
	Barium	80-120	≤ 15	80-120	≤ 25
	Beryllium	80-120	≤ 15	80-120	≤ 25
	Cadmium	80-120	≤ 15	80-120	≤ 25
	Calcium	80-120	≤ 15	80-120	≤ 25
	Chromium	80-120	≤ 15	80-120	≤ 25
	Cobalt	80-120	≤ 15	80-120	≤ 25
	Copper	80-120	≤ 15	80-120	≤ 25
	Iron	80-120	≤ 15	80-120	≤ 25
	Lead	80-120	≤ 15	80-120	≤ 25
	Magnesium	80-120	≤ 15	80-120	≤ 25
	Manganese	80-120	≤ 15	80-120	≤ 25
	Molybdenum	80-120	≤ 15	80-120	≤ 25
	Nickel	80-120	≤ 15	80-120	≤ 25
	Potassium	80-120	≤ 15	80-120	≤ 25
	Selenium	80-120	≤ 15	80-120	≤ 25
	Silver	80-120	≤ 15	80-120	≤ 25
	Sodium	80-120	≤ 15	80-120	≤ 25
Thallium	80-120	≤ 15	80-120	≤ 25	
Vanadium	80-120	≤ 15	80-120	≤ 25	
Zinc	80-120	≤ 15	80-120	≤ 25	

Table 7.2.19-3. Summary of Calibration and QC Procedures for Method SW6010A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW6010A	ICP Metals	Initial multipoint calibration (minimum 3 standards and a blank)	Daily initial calibration prior to sample analysis	Correlation coefficient ≥ 0.995 for linear regression	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Highest calibration standard	Before beginning a sample run	All analytes within $\pm 5\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Calibration blank	After every 10 samples and at end of the analysis sequence	No analytes detected $>PQL$	Correct problem then analyze calibration blank and previous 10 samples	Apply B to all results for specific analyte(s) in all samples associated with the blank
		Continuing calibration verification (Instrument Check Standard)	After every 10 samples and at the end of the analysis sequence	All analyte(s) within $\pm 10\%$ of expected value	Repeat calibration and reanalyze all samples since last successful calibration	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.19-2	Recalculate results; locate and fix problem with system, then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.19-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW6010A	ICP Metals	Method blank	One per analytical batch	No analytes detected >PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for specific analyte(s) in all samples associated with the blank
		Interference check solution (ICS)	At the beginning and end of an analytical run or twice during an 8 hour period, whichever is more frequent	Within $\pm 20\%$ of expected value	Terminate analysis; correct problem; reanalyze ICS; reanalyze all affected samples	Apply R to all results for specific analyte(s) in all samples associated with the ICS
		LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.2.19-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Dilution test	Each new analytical batch	1:4 dilution must agree within $\pm 10\%$ of the original determination	Perform post digestion spike addition	Apply J to all sample results if either of following exist: (1) new matrix check not run (2) RPD $\geq 10\%$

Table 7.2.19-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW6010A	ICP Metals	Post digestion spike addition	When dilution test fails	Recovery within 75-125% of expected results	Correct problem then reanalyze post digestion spike addition	Apply J to all sample results (for same matrix) for specific analyte(s) for all samples associated with the post digestion spike addition
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.19-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		MDL study	Once per year	Detection limits established will be < the PQLs in Table 7.2.19-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

a. All corrective actions associated with AFCEE project work will be documented, and all records will be maintained by the laboratory.

b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.20 Method SW6020—Trace Elements (Metals) by Inductively Coupled Plasma Mass Spectroscopy for Water and Soil

Not applicable.

7.2.21 Method SW7041—Graphite Furnace Atomic Absorption (Antimony)

Not applicable.

7.2.22 Method SW7060A—Graphite Furnace Atomic Absorption (Arsenic)

Not applicable.

7.2.23 Method SW7131A—Graphite Furnace Atomic Absorption (Cadmium)

Not applicable.

7.2.24 Method SW7191—Graphite Furnace Atomic Absorption (Chromium)

Not applicable.

7.2.25 Method SW7196A—Hexavalent Chromium (Colorimetric)

Not applicable.

7.2.26 Method SW7421—Graphite Furnace Atomic Absorption (Lead)

Not applicable.

7.2.27 Method SW7470A/SW7471A—Mercury Manual Cold-Vapor Technique

Water and soil samples are analyzed for mercury using methods SW7470A and SW7471A, respectively. This method is a cold-vapor, flameless atomic absorption (AA) technique based on the absorption of radiation by mercury vapor. Mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an AA spectrophotometer. Mercury concentration is measured as a function of absorbance. The PQLs for these methods are listed in Table 7.2.27-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.27-2 and 7.2.27-3.

Table 7.2.27-1. PQLs for Method SW7470A/SW7471A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
SW7470A /SW7471A	Mercury	0.001	mg/L	0.1	mg/kg

Table 7.2.27-2. QC Acceptance Criteria for Method SW7470A/SW7471A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW7470A/7471A	Mercury	77-120	≤ 15	77-120	≤ 25

Table 7.2.27-3. Summary of Calibration and QC Procedures for Method SW7470A/SW7471A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW7470A/ 7471A	Mercury	Initial multipoint calibration (minimum 5 standards and a blank)	Daily initial calibration prior to sample analysis	Correlation coefficient ≥ 0.995 for linear regression	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Second-source calibration check standard	Once per initial daily multipoint calibration	Analyte within $\pm 10\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Calibration blank	Once per initial daily multipoint calibration	No analyte detected $>PQL$	Correct problem then reanalyze calibration blank and all samples associated with blank	Apply B to all results for specific analyte(s) in all samples associated with the blank
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	The analyte within $\pm 20\%$ of expected value	Correct problem then repeat calibration and reanalyze all samples since last successful calibration	Apply R to all results for the specific analyte in all samples since the last acceptable calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.27-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.27-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW7470A/ 7471A	Mercury	Method blank	One per analytical batch	No analyte detected >PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for specific analyte(s) in all samples associated with the blank
		LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.2.27-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to non-detects
		New matrix check; five-fold dilution test	Each new sample matrix	Five times dilution sample result must be $\pm 10\%$ of the undiluted sample result	Perform recovery test	Apply J to all sample results if either of following exist: (1) new matrix check not run (2) RPD $\geq 10\%$
		Recovery test	When new matrix check fails	Recovery within 85-115% of expected results	Run all samples by the method of standard addition	Apply J to all sample results (for same matrix) in which method of standard addition was not run when recovery outside of 85-115% range

Table 7.2.27-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW7470A/ 7471A	Mercury	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.27-2	none	For the specific analyte in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		MDL study	Once per year	Detection limits established will be < the PQLs in Table 7.2.27-1	none	Apply R to all results for the specific analyte in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

- a. All corrective actions associated with AFCEE project work will be documented, and all records will be maintained by the laboratory.
- b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.28 Method SW7740-Graphite Furnace Atomic Absorption (Selenium)

Not applicable.

7.2.29 Method SW7841-Graphite Furnace Atomic Absorption (Thallium)

Not applicable.

7.2.30 Method SW7911-Graphite Furnace Atomic Absorption (Vanadium)

Not applicable.

7.2.31 Method SW9010A/SW9012-Total Cyanide and Cyanide Amenable to Chlorination

Not applicable.

7.2.32 Method SW9056-Common Anions

Not applicable.

8.0 DATA REDUCTION, REVIEW, VERIFICATION, REPORTING, VALIDATION, AND RECORDKEEPING

The data reduction, review, reporting, and validation procedures described in this section will ensure that; (1) complete documentation is maintained, (2) transcription and data reduction errors are minimized, (3) the data are reviewed and documented, and (4) the reported results are qualified if necessary. Laboratory data reduction and verification procedures are required to ensure that the overall objectives of analysis and reporting meet method and project specifications.

8.1 DATA REVIEW, VALIDATION, AND REPORTING REQUIREMENTS FOR SCREENING DATA

The analysts will perform a 100 percent review of the screening data. The screening data methods are identified in Table 6-1. All screening data will be qualified with an "S" flag and will be further qualified if critical calibration and QC requirements are not acceptable. The calibration, QC requirements, corrective action requirements, and flagging criteria required are shown in Table 6.2-1. The flagging criteria are applied when acceptance criteria are not met and corrective action was not successful or corrective action was not performed. "S" designator flags will be maintained in the final data qualification. When the data are reviewed and qualified, the analyst will apply a final qualifier to any data that has been affected by multiple qualifiers. This final qualifier will reflect the most severe qualifier that was applied to the data. The allowable final data qualifiers for screening data and the hierarchy of data qualifiers, listed in order of the most severe through the least severe, are "SR", "SJ", "SB", and "SU". Therefore, the allowable final data qualifiers for screening data are "SR", "SJ", "SB", "SU", and "S".

The definition of the data qualifiers are shown in Table 8.2-1. A summary of the flagging conventions of field screening methods is given in Table 6.2-1.

Screening data report packages will be prepared for all field analyses as described in Section 8.8. The screening data will be reported on the AFCEE screening data report forms (AFCEE Forms S-1 through S-3), as illustrated in Section 8.8. TEC's project manager will review the entire screening data report package with the field records. TEC will determine if the data quality objectives have been met, and will calculate the data completeness for the project. These results will be included in the data package deliverable.

8.2 DATA REVIEW, VALIDATION, AND REPORTING REQUIREMENTS FOR DEFINITIVE DATA

In each laboratory analytical section, the analyst performing the tests will review 100 percent of the definitive data. After the analyst's review is complete, 100 percent of the data will be reviewed independently using the same criteria by a senior analyst or by the supervisor of the respective analytical section.

TEC or TEC's data validation subcontractor will conduct 10 percent full data validation based on the requirements of this QAPP and the SW846 methodologies.

The definitive data methods are identified in Section 7.2. The calibration, QC requirements, corrective action requirements, and flagging criteria required for definitive data are shown in the tables in Section 7.2, and in summary Tables 8.2-2, 8.2-3, and 8.2-4. The flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

Data qualifiers will be added by the laboratory supervisor of the respective analytical section, after the first and second level of laboratory data reviews have been performed. Analytical batch comments will be added to the first page of the definitive data report packages to explain any nonconformance or other issues. When data are qualified, the laboratory

supervisor will apply a final qualifier to any data that have been affected by multiple qualifiers. This final qualifier will reflect the most severe qualifier that was applied to the data, i.e., all data will have only one data qualifying flag associated with it. The allowable final data qualifiers for definitive data and the hierarchy of data qualifiers, listed in order of the most severe through the least severe, are "R", "M", "F", "J", "B", "E", and "U". The definitions of the data qualifiers are shown in Table 8.2-1.

The one exception to these data flagging criteria rules applies to the tentatively identified compounds (TICs) that are identified only in the GC/MS methods. These TICs numerical results will always be qualified with one and only one flag for any reason, and that is the "T" flag.

The laboratory QA section will review 10 percent of the completed data packages, and the laboratory project manager will perform a sanity check review on all the completed data packages.

TEC's project manager will review the entire definitive data report package, and with the field records, apply the final data qualifiers for the definitive data. The laboratory will apply data qualifying flags to each environmental field QC sample, e.g., ambient blanks, equipment blanks, trip blanks, field duplicates, MS samples, and MSD samples. TEC will review the field QC samples and field logs, and will then appropriately flag any of the associated samples identified with the field QC sample, as explained in Tables 8.2-2 and 8.2-3. For example, each matrix spike sample would only be qualified by the laboratory, while TEC would apply the final qualifying flag for a matrix effect to all samples collected from the same site as the parent sample.

TEC will determine if the data quality objectives have been met, and will calculate the data completeness for the project. These results will be included in the data package deliverable as described in Section 8.8.

Table 8.2-1 Data Qualifiers

Qualifier	Description
J	The analyte was positively identified, the quantitation is an estimation.
U	The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
F	The analyte was positively identified but the associated numerical value is below the PQL.
R	The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
B	The analyte was found in an associated blank, as well as in the sample.
M	A matrix effect was present (see tables in Section 7.0).
E	Exceeds calibration range.
S	To be applied to all field screening data.
T	Tentatively identified compound (using GC/MS).

Table 8.2-2. General Flagging Conventions

QC Requirement	Criteria	Flag	Flag Applied To
Holding Time	Time exceeded for extraction or analysis	R	All analytes in the sample
Equipment Blank	Analyte(s) detected >PQL	B	The specific analyte(s) in all samples with the sampling date
Field duplicates	Field duplicates >PQLs AND RPD outside CL	J for positive and nondetects	Field duplicate pair
MS/MSD	MS or MSD %R >UCL or MS or MSD %R <LCL or MS/MSD RPD >CL	M for all results	The specific analyte(s) in all samples collected from the same site as the parent sample
Sample Preservation/Collection	Preservation/collection requirements not met	R for all results	All analytes in the sample
Sample Storage	<0°C or > 8°C	J for positive results R for nondetects	All analytes in the sample
Quantitation	Analyte(s) detected ≥ MDL but < PQL	F	All affected results
Quantitation	Analyte(s) detected over calibration range	E	All affected results
Quantitation of TICs	Analyte(s) detected as TICs	T	All affected results
Ambient Blank (VOC samples only)	Analyte(s) detected >PQL	B	The specific analyte(s) in all samples with the same matrix and sampling date
Trip Blank (VOC samples only)	Analyte(s) detected >PQL	B	The specific analyte(s) in all samples shipped in the same cooler

UCL = upper control limit

LCL = lower control limit

CL = control limit

8.3 QUALITY ASSURANCE REPORTS

The laboratory QA staff will issue QA reports to the laboratory management, laboratory supervisors, and task leaders. These reports will describe the results of QC measurements, performance audits, systems audits, and confirmation sample comparisons performed for each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data including field and confirmatory data, and data storage will be documented with the corrective actions that have been taken to correct the deficiencies identified.

8.4 IRPIMS ELECTRONIC DATA REPORTS

The prime contractor will provide an electronic deliverable report in the Installation Restoration Program Information Management System (IRPIMS) format as specified by the SOW for the project.

IRPIMS is a data management system designed to accommodate all types of data collected for IRP projects. Specific codes and data forms have been developed to allow consistent and efficient input of information to the system. The database information will be provided by the prime contractor via ASCII files in specified IRPIMS format on 3.5-inch floppy diskettes. The information transferred will include all required technical data such as site information; well characteristics; and hydrogeologic, geologic, physical, and chemical analysis results. Electronic data reporting formats and requirements are given in the most current version of the *IRPIMS Data Loading Handbook*.

8.5 ARCHIVING

Hard copy and electronic data will be archived in project files and on electronic archive tapes for the duration of the project or a minimum of 5 years, whichever is longer.

8.6 PROJECT DATA FLOW AND TRANSFER

The data flow from the laboratory and field to the project staff and data users will be sufficiently documented to ensure the data are properly tracked, reviewed, and validated for use.

8.7 RECORDKEEPING

The laboratory will maintain electronic and hard copy records sufficient to recreate each analytical event conducted pursuant to the SOW. The minimum records the laboratory will keep will contain the following:

- COC forms;
- Initial and continuing calibration records including standards preparation traceable to the original material and lot number;
- Instrument tuning records (as applicable);
- Method blank results;
- IS results;

- Surrogate spiking records and results (as applicable);
- Spike and spike duplicate records and results;
- Laboratory records;
- Raw data, including instrument printouts, bench work sheets, and/or chromatograms with compound identification and quantitation reports;
- Corrective action reports;
- Other method and project required QC samples and results; and
- Laboratory-specific written SOPs for each analytical method and QA/QC function in place at the time of analysis of project samples.

8.8 HARD COPY DATA REPORTS FOR SCREENING AND DEFINITIVE DATA

The hard copy data reports will conform to the formats identified in this section.

A screening data report package will consist of the following AFCEE forms: S-1, S-2, and S-3.

A definitive data inorganic report package will consist of the following AFCEE forms: I-1, I-2, I-3, I-4, I-5, I-6, I-7, I-8 and

A definitive data organic report package will consist of the following AFCEE forms: O-1, O-2, O-3, O-4, O-5, O-6, O-7, O-8, O-9 and O-10.

Exceptions to these report forms are as follows: for mercury analysis, form I-3A will be substituted for form I-3 in the inorganic report package; for cyanide analysis, form I-3B will be substituted for form I-3 in the inorganic report package; for GC/MS analyses, form O-5A will be added to the organic report package. All forms and instructions for completing them are contained in Appendix A.

9.0 SYSTEMS AND PERFORMANCE AUDITS, PERFORMANCE EVALUATION PROGRAMS, MAGNETIC TAPE AUDITS, AND TRAINING

Technical systems and performance audits will be performed as independent assessments of sample collection and analysis procedures. Audit results will be used to evaluate the ability of an analytical contractor to (1) produce data that fulfill the objectives established for the program, (2) comply with the QC criteria, and (3) identify any areas requiring corrective action. The systems audit is a qualitative review of the overall sampling or measurement system, while the performance audit is a quantitative assessment of a measurement system. Full data validation is also a quantitative check of the analytical process, where all documentation and calculations are evaluated and verified. Data validation is discussed in Section 8.

9.1 PROJECT AUDITS

9.1.1 State/Federal Project Audits

Audits by various state and Federal agencies are commonly conducted for the laboratories that will analyze project samples. Audit reports from these agencies will be reviewed by the prime contractor to determine whether data produced by the analytical contractor will fulfill the objectives of the program.

Audit findings will be transmitted to the prime contractor and to AFCEE. The prime contractor will review the audit findings and provide a written report to AFCEE. This report will include the recommended corrective actions or procedures to correct the deficiencies identified during the state/Federal audits(s). The audit results and discussion will be incorporated into the QA report for each sampling effort.

9.1.2 Technical Systems Audits

A technical systems audit is an on-site, qualitative review of the sampling or analytical system to ensure that the activity is being performed in compliance with the Sampling and Analysis Plan (SAP) specifications. Sampling and field procedures, and the analytical laboratories will be audited by the prime contractor at the beginning of the field work. A laboratory systems audit will be performed by AFCEE if previous audit reports indicate that corrective actions are outstanding, that a recent audit has not been conducted, or that quality concerns have arisen based upon the use of that laboratory for other projects. The laboratory systems audit results will be used to review laboratory operation and will ensure that technical procedures and documentation are in place and operating to provide sufficient data to fulfill the project objectives and ensure that corrective actions have been addressed.

Critical items for a laboratory or field systems audit include:

- Sample custody procedures;
- Calibration procedures and documentation;
- Completeness of data forms, notebooks, and other reporting requirements;
- Data review and validation procedures;
- Data storage, filing, and recordkeeping procedures;
- QC procedures, tolerances, and documentation;
- Operating conditions of facilities and equipment;

- Documentation of training and maintenance activities,
- Systems and operations overview; and
- Security of laboratory automated systems.

Critical items for a sampling systems audit include:

- Calibration procedures and documentation for field equipment;
- Documentation in field log books and sampling data sheets;
- Organization and minimization of potential contamination sources while in the field;
- Proper sample collection, storage, and transportation procedures; and
- Compliance with established COC and transfer procedures.

After each on-site audit, a debriefing session will be held for all participants to discuss the preliminary audit results. The auditor will then complete the audit evaluation and submit an audit report including observations of the deficiencies and the necessary recommendations for corrective actions. Compliance with the specifications presented in the SAP will be noted and noncompliance or deviations will be addressed in writing by the prime contractor to AFCEE with corrective actions and a time frame for implementation of the corrective actions. Follow-up audits will be performed prior to completion of the project to ensure that corrective actions have been taken.

9.1.3 Project-Specific Performance Evaluation Audits

Not applicable.

9.1.4 Magnetic Tape Audits

Not applicable.

9.1.5 Performance Evaluation Sample Programs

All laboratories will participate in the USEPA performance evaluation (PE) Water Supply and Water Pollution Studies programs or equivalent programs for state certifications. Satisfactory performance in these nonproject-specific PE programs also demonstrate proficiency in methods used to analyze AFCEE samples. The laboratory will document the corrective actions to unacceptable PE results to demonstrate resolution of the problems.

9.2 TRAINING

Not applicable.

10.0 PREVENTIVE MAINTENANCE

A preventive maintenance program will be in place to promote the timely and effective completion of a measurement effort. The preventive maintenance program is designed to minimize the downtime of crucial sampling and/or analytical equipment due to unexpected component failure. In implementing this program, efforts are focused in three primary areas: (1) establishment of maintenance responsibilities, (2) establishment of maintenance schedules for major and/or critical instrumentation and apparatus, and (3) establishment of an adequate inventory of critical spare parts and equipment.

10.1 MAINTENANCE RESPONSIBILITIES

Maintenance responsibilities for equipment and instruments are assumed by the respective facility managers. The managers then establish maintenance procedures and schedules for each major equipment item. This responsibility may be delegated to laboratory personnel, although the managers retain responsibility for ensuring adherence to the prescribed protocols.

10.2 MAINTENANCE SCHEDULES

The effectiveness of any maintenance program depends to a large extent on adherence to specific maintenance schedules for each major equipment item. Other maintenance activities are conducted as needed. Manufacturer's recommendations provide the primary basis for the established maintenance schedules, and manufacturer's service contracts provide primary maintenance for many major instruments (e.g., GC/MS instruments, AA spectrometers, and analytical balances).

10.3 SPARE PARTS

Along with a schedule for maintenance activities, an adequate inventory of spare parts is required to minimize equipment downtime. The inventory includes those parts (and supplies) that are subject to frequent failure, have limited useful lifetimes, or cannot be obtained in a timely manner should failure occur.

Field sampling task leaders and the respective laboratory managers are responsible for maintaining an adequate inventory of spare parts. In addition to spare parts and supply inventories, the contractor will maintain an in-house source of backup equipment and instrumentation.

10.4 MAINTENANCE RECORDS

Maintenance and repair of major field and laboratory equipment will be recorded in field or laboratory log books. These records will document the serial numbers of the equipment, the person performing the maintenance or repairs, the date of the repair, the procedures used during the repair, and proof of successful repair prior to the use of the equipment.

11.0 CORRECTIVE ACTION

Requirements and procedures for documenting the need for corrective actions are described in this section.

11.1 CORRECTIVE ACTION REPORT

Problems requiring corrective action in the laboratory are documented by the use of a corrective action report. The QA coordinator or any other laboratory member can initiate the corrective action request in the event that QC results are unacceptable, or upon identification of some other laboratory problem. Corrective actions can include reanalysis of the sample or samples affected, resampling and analysis, or a change in procedures, depending upon the severity of the problem.

11.2 CORRECTIVE ACTION SYSTEM

A system for issuing, tracking, and documenting completion of formal Recommendations for Corrective Action (RCA) exists for addressing significant and systematic problems. Recommendations for corrective actions are issued only by a member of the QA group, or a designee in a specific QA role. Each RCA addresses a specific problem or deficiency, usually identified during QA audits of laboratory or project operations. An RCA requires a written response from the party to whom the RCA was issued. A summary of unresolved RCAs is included in the monthly QA report to management. The report lists all RCAs that have been issued, the manager responsible for the work area, and the current status of each RCA. An RCA requires verification by the QA group that the corrective action has been implemented before the RCA is considered to be resolved. In the event there is no response to an RCA within 30 days, or if the proposed corrective action is disputed, the recommendation and/or conflict is pursued to successively higher management levels until the issue is resolved.

12.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

At a minimum, the laboratory QA coordinator will prepare a quarterly summary report of the status of the project, of QA/QC problems, corrective actions taken, and unresolved RCAs with recommended solutions for management. The report will also include results from all PE samples, audit findings, and periodic data quality assessments. This report will be available for review by AFCEE auditors upon request.

13.0 VARIANCES

This project-specific QAPP was developed using the AFCEE model QAPP (version 1.1, February, 1996) as a guide. All significant variances from the model document and the rationale for the change are identified in Table 13-1.

Table 13-1 Changes from AFCEE Model QAPP to WSA QAPP

Section	Change	Rationale
4.4.1, first sentence	"or Ottawa sand (<i>or equivalent</i>) for soil analyses . . ." (Addition italicized)	Common lab protocol or request
4.5.2, 2nd sentence	"For GC methods, <i>with the exception of multi-response analytes</i> , a second-column is used for confirmation." (Addition italicized)	Common lab protocol or request
6.1.3	Inserted EPA 415.1 for SW9060 under Total Organic Carbon analysis section	Project change
6.1.4	Inserted EPA 418.1-Total Petroleum Hydrocarbons for EPA 160.1-Filterable Residue	Project change
6.2, Table 6.2-1	Organic vapor concentrations, QC check changed from 3-point calibration in AFCEE to 2-point calibration in WSA; also acceptance criteria changed from "correlation coefficient ≥ 0.995 " to "Response $\pm 20\%$ of expected value"	These analyses do not require a high degree of accuracy; they will be used only for general screening for health & safety or for headspace screening of soil samples
	Added TOC and TPH to table	Project change
6.2	Added information for the EPA method for asbestos (EPA/60/R-93/116 and 40 CFR 763 Subpart E)	Not applicable
7.1, Table 7.1-1	Added info for 4 methods: SW3010, SW3015, SW3051, SW3520B	Methods suggested by lab as needed for this project
7.1.9-7.1.13	Paragraphs describing above 5 methods added to AFCEE model	See above
Table 7.2.3-3	Acceptance Criteria for five point initial calibration for all analytes changed to add a second possibility: "Coefficient of determination ≥ 0.990 "	Common lab protocol or request
Table 7.2.3-3	Corrective Action for Surrogate Spike, added "If matrix interference is confirmed, no further action is necessary."	Common lab protocol or request

Table 13-1

Continued

Section	Change	Rationale
Table 7.2.4-1	Compounds dropped from the list of analytes (1,2-DCB, 1,3-DCB, 1,4-DCB, and Chlorobenzene)	Chlorinated benzenes are not suspected as contaminants
Table 7.2.4-3	Acceptance Criteria for five point initial calibration for all analytes changed to add a second possibility: "Coefficient of determination ≥ 0.990 "	Common lab protocol or request
Table 7.2.4-3	Minimum Frequency for Retention time window calculated for each analyte: "Each initial calibration and calibration verifications " (Bold material dropped)	Common lab protocol or request
Table 7.2.4-3	Minimum Frequency for Second-column confirmation: Added "at or above the PQL"	Common lab protocol or request
Table 7.2.4-3	Corrective Action for Surrogate Spike, added "If matrix interference is confirmed, no further action is necessary."	Common lab protocol or request
Table 7.2.14-3	Bracketing Standard removed from table	New criteria-per latest revision of AFCEE QAPP
Table 7.2.14-3	Corrective Action for Surrogate Spike, added "If matrix interference is confirmed, no further action is necessary."	Common lab protocol or request
Table 7.2.15-1	Extraction methods SW3520B for water and SW3540B for solids have been added to the list of possible extraction techniques the lab can use	Common lab protocol or request
Table 7.2.15-3	Bracketing Standard removed from table	New criteria-per latest revision of AFCEE QAPP
Table 7.2.15-3	Corrective Action for Surrogate Spike, added "If matrix interference is confirmed, no further action is necessary."	Common lab protocol or request

Table 13-1 **Concluded**

Section	Change	Rationale
Table 7.2.18-3	Corrective Action for Surrogate Spike, added "If matrix interference is confirmed, no further action is necessary."	Common lab protocol or request
Table 7.2.19-1	Extraction methods SW3015 for water and SW3051 for soil were added to the list of possible extraction methods the lab could use	Common lab protocol or request
Table 7.2.19-1	Information on Trace ICP PQLs added	Trace ICP analyses are planned for certain metals for lower detection limits
Table 7.2.19-3	Minimum frequency for Dilution Test changed from "Each new sample matrix" to "Each new analytical batch"	Common lab protocol or request
Section 8.2	Ten percent full data validation request added to text	Common request
Table 8.2-1	Added "E" qualifier for over calibration reported results	Additional information for data reviewers
Table 8.2-2	Flag for field duplicates changed from R for non-detects to J for non-detects	Based on past experience, applying R flags to non-detects is unrealistic & will result in large amounts of data being qualified as unusable.
Table 8.2-2	Flag Applied to Field Duplicates has been changed from "The specific analyte(s) in all samples collected on the same sampling date" to "Field Duplicate pair"	See above note
Section 8	Forms and instructions for completing them are now included as Appendix A rather than in Section 8.	Clarity
Section 8	Tables 8.2-3 and 8.2-4 have been removed and information on ambient and trip blanks placed in Table 8.2-2	The information removed was already contained in other Tables in the QAPP

Quality Assurance/Quality Control Sample Summary

Field Sample ^a			Location	Equipment Blank ^a	Trip Blank ^a	Method Blank ^b	Ambient Blank ^a
DW1	007	03	Drainageway 1	EB-013	TB-010		
DW1	008	02					
DW1	008	03					
DW1	009	02					
DW1	009	03					
DW1	010	02					
DW1	010	03	Area A5				
A5	001	02					
A5	001	03					
A5	002	02					
A5	003	02					
A5	003	03					
A5	003	05	Bunker Drains				AB-002
BD	013	02					
BD	014	02					
BD	015	02					
BD	016	02					
BD	017	02					
BD	017	03	Transformers				
BD	018	02					
BD	018	03					
BD	019	02					
BD	020	02					
BD	020	05					
BD	021	02	EB-014	TB-011			
BD	022	02					
TRF	003	02					
TRF	003	03					
TRF	004	02					
TRF	005	02					
TRF	006	02	Area A4				
TRF	006	03					
TRF	007	02					
TRF	007	03					
TRF	008	02					
TRF	009	02					
TRF	009	05					
TRF	010	02					
TRF	011	02					
TRF	012	02					
TRF	012	03					
TRF	013	02					
TRF	014	02					
TRF	015	02					
TRF	016	02					
TRF	016	03					
TRF	016	05					
A4	001	02	Area A4				
A4	002	02					
A4	003	02					
A4	004	02					
A5	004	02	EOD Range				
EOD	009	02					
EOD	010	02					
EOD	010	03					
EOD	010	05	EOD Range				
EOD	010	06					
EOD	011	02					
EOD	011	03					
UST	001	01	Former UST Locations	EB-015	TB-012		
UST	002	01					
UST	002	02					
UST	003	01					
UST	004	01					

Quality Assurance/Quality Control Sample Summary

Field Sample ^a		Location	Equipment Blank ^a	Trip Blank ^a	Method Blank ^b	Ambient Blank ^a	
UST	005 01	Former UST Locations	EB-015	TB-012			
UST	006 01						
UST	007 01						
UST	007 04						
UST	008 01						
UST	009 01						
UST	009 02						
UST	010 01						
BK	002 02	Background				AB-002	
BK	002 03						
BK	003 02						
BK	004 02						
BK	005 02						
BK	007 01						
BK	007 02						
BK	007 03						
BK	008 01						
BK	008 02						
BK	008 03	EB-016	TB-013				
BK	008 05						
BK	008 06						
EOD	001 02	EOD Range					
EOD	002 02						
EOD	003 02						
EOD	003 03						
EOD	004 02						
EOD	004 03						
EOD	005 02						
EOD	005 03						
EOD	006 02						
EOD	007 02						
EOD	008 02						
EOD	008 03						
A6	002 01	PE Sample					
XU-32-12	901 01	Monitoring Wells	EB-017	TB-014			
XU-32-12	902 01						
XU-32-12	902 02						
MW	925 01			TB-015			
DC	001	Drum Composite					
DC	002						
DC	003						
DW5	004 10	Drainageway 5	EB-018	TB-017		AB-003	
DW5	004 11						
DW9	003 10	Drainageway 9					
DW9	003 11						
SP	003 01	Seeps					
SP	003 10						
SP	003 11						
BK	011 10	Background					
BK	011 11						
DW1	002 10	Drainageway 1		TB-018			
DW1	002 11						

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ADMINISTRATIVE RECORD

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