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DRAFT QUALITY ASSURANCE PROJECT PLAN FOR CHARACTERIZATION OF OFFSITE
WEAPONS STORAGE AREA NAS FORT WORTH TX
12/1/1996
THE ENVIRONMENTAL COMPANY

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A.F.

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

**ADMINISTRATIVE RECORD
COVER SHEET**

AR File Number 317

File:
A.F. 17A 78

317 3171

QUALITY ASSURANCE PROJECT PLAN

SITE ASSESSMENT, INVESTIGATION, AND
CHARACTERIZATION OF THE
OFF-SITE WEAPONS STORAGE AREA (WSA)

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



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

Contract No. F41624-95-D-8002
Delivery Order 0009

December 1996

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LIST OF ACRONYMS AND ABBREVIATIONS

AA	Atomic Absorption
AFCEE	Air Force Center for Environmental Excellence
AFIID	Air Force installation identification
A2LA	American Association for Laboratory Accreditation
ARAR	Applicable or Relevant and Appropriate Requirement
ASCII	American Standard Code Information Interchange
ASTM	American Society for Testing and Materials
BFB	bromofluorobenzene
Br	bromide
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CCC	Calibration Check Compound
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Calibration Factor
CFR	Code of Federal Regulation
Cl	chloride
CL	Control Limit
CLP	Contract Laboratory Program
COC	Chain of Custody
2,4 - D	2,4-dichlorophenoxy acetic acid
2,4 - DB	2,4-dichlorophenoxy butyric acid
DCA	dichloroethane
DCB	dichlorobenzene
DCBP	decachlorobiphenyl
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DFTPP	decafluorotriphenylphosphine
DNB	dinitrobenzene
DNT	dinitrotoluene
DOD	Department of Defense

DQO	Data Quality Objective
DRO	Diesel Range Organics
EDB	ethylene dibromide
EI CP	Extracted Ion Current Profile
EPA	Environmental Protection Agency
F ⁻	fluoride
FID	Flame Ionization Detector
FLAA	Flame Atomic Absorption
FS	Feasibility Study
FSP	Field Sampling Plan
g	gram
G	Glass
GC	Gas Chromatography
GC/ MS	Gas Chromatography/Mass Spectroscopy
GFAA	Graphite Furnace Atomic Absorption
GRO	Gasoline Range Organics
<i>Handbook</i>	<i>Handbook for the Installation Restoration Program (IRP) Remedial Investigation and Feasibility Studies (RI/FS), September 1993</i>
HCl	hydrochloric acid
HECD	(Hall) electrolytic conductivity detector
HpCDD	heptachlorodibenzo-p-dioxin
HpCDF	heptachlorodibenzofuran
HxCDD	hexachlorodibenzo-p-dioxin
HxCDF	hexachlorodibenzofuran
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HNO ₃	nitric acid
HPLC	High-Performance Liquid Chromatography
H ₂ SO ₄	sulfuric acid
IAW	In Accordance With
ICP	Inductively Coupled Plasma
ICPES	Inductively Coupled Plasma Emission Spectroscopy
ICP- MS	Inductively Coupled Plasma - Mass Spectroscopy
ICS	Interference Check Sample

ID	identification
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
IS	Internal Standard
LCL	Lower Control Limit
LCS	Laboratory Control Sample
MCPA	(4-chloro-2-methylphenoxy) acetic acid
MCPP	2-(4-chloro-2-methylphenoxy) propionic acid
MDL	Method Detection Limit
mg/ kg	milligrams per kilogram
mg/ L	milligrams per liter
mL	milliliter
mm	millimeter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MTBE	Methyl Tert Butyl Ether
N/ A	not applicable
NAS	Naval Air Station
Na ₂ S ₂ O ₃	sodium thiosulfate
NCP	National Contingency Plan
ng/ L	nanograms per liter
ng/ mL	nanograms per milliliter
NIST	National Institute of Standards and Technology
nm	nanometer
NO ₂ ⁻	nitrite
NO ₃ ⁻	nitrate
NTU	Nephelometric Turbidity Unit
OCDD	octachlorodibenzo-p-dioxin
ORP	Oxidation-Reduction Potential
OVA	Organic Vapor Analyzer
P	polyethylene
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl

PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran
PE	Performance Evaluation
PeCDD	pentachlorodibenzo-p-dioxin
PeCDF	pentachlorodibenzofuran
PID	Photoionization Detector
PLM	Polarized Light Microscopy
PO ₄ ⁻³	phosphate
ppb	parts per billion
ppm	parts per million
ppmv	parts per million volume
PQL	Practical Quantitation Limit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
R	Recovery
RCA	Recommendations for Corrective Action
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RF	Response Factor
RI	Remedial Investigation
RI / FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
S	Soil
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SO ₄ ⁻²	sulfate
SOP	Standard Operating Procedure
SOW	Statement of Work
SPCC	System Performance Check Compound
SVOC	Semivolatile Organic Compound
2,4,5-T	2,4,5-trichlorophenoxy propanoic acid

T	California brass
TCA	trichloroethane
TCDD	tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofuran
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TCMX	tetrachlorometaxylene
TIC	Tentatively Identified Compound
TNB	trinitrobenzene
TNT	trinitrotoluene
2,4,5-TP	2,4,5-trichlorophenoxy acetic acid (silvex)
TPH	Total Petroleum Hydrocarbon
UCL	Upper Control Limit
VOC	Volatile Organic Compound
v/v	volume to volume
W	water
WSA	Weapons Storage Area

SYMBOLS

°C	degrees Celsius
µg/ kg	micrograms per kilogram
µg/ L	micrograms per liter
µg/ mL	micrograms per milliliter
µL	microliter
µm	micrometer

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) and *U.S. EPA Region IX QAPP: Guidance for Preparing QAPPs for Superfund Remedial Projects* (U.S. EPA, 1989). 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 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	Grain Size Analysis	16	To aid in the understanding of site-specific geology and contaminant migration.
Soil and Groundwater Contamination	Definitive	Soil, Stream Sediment, and Groundwater	Soil-430 Sed-42 GW-11	Quantify the magnitude and extent of contamination; risk assessment.
Groundwater Characteristics	Physical Measurement	Depth to Groundwater	11	Determine depth to groundwater and direction of groundwater flow.
Groundwater Characteristics	Screening	Temperature, conductance, pH, turbidity	11	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 Air Force Center for Environmental Excellence (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}	$\frac{\left(\sum_{i=1}^n x_i \right)}{n}$	Measure of central tendency	Used to determine average value of measurements
Standard Deviation	S	$\left(\frac{\sum (x_i - \bar{x})^2}{(n-1)} \right)^{1/2}$	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	$\frac{\left(\begin{array}{l} \text{value of} \\ \text{spiked} \\ \text{sample} \end{array} - \begin{array}{l} \text{value of} \\ \text{unspiked} \\ \text{sample} \end{array} \right)}{\text{Value of added spike}} \times 100$	Recovery of spiked compound in sample matrix	Used to assess matrix effects and total precision

x = Observation (concentration)
n = Number of observations

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 plus 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 do not 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 plus 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 reprep 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 SW8080A 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 PQL for samples analyzed by GC or HPLC will be required 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 do not 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	Container ^a	Preservatives ^{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	Container ^a	Preservatives ^{b,c}	Minimum	
				Sample Amount	Maximum Holding Time
Total petroleum hydrocarbons (TPH)-volatile	SW8015 (modified)	G, Teflon-lined septum, T	4°C, HCl to pH < 2	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid
Total petroleum hydrocarbons (TPH)-extractable	SW8015 (modified)	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)
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
Organochlorine pesticides and polychlorinated biphenyls (PCBs)	SW8080A, SW8081,	G, Teflon-lined cap, T	4°C, pH 5-9	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	SW8240B, SW8010B, 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
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 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 chain-of-custody (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
Organic Vapor (FID and PID)	Soil gas screening-halogenated, aromatic, and petroleum hydrocarbons
ASTM D422	Particle size
EPA 160/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, or a 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 310.1–Alkalinity

Not applicable.

6.1.9 EPA Method 360.1–Dissolved Oxygen

Not applicable.

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:

$$\frac{\text{Result of analysis on wet weight basis}}{1 - (\% \text{ Moisture}/100)} = \text{Result of analysis on a dry weight basis}$$

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	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 per 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
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 and end of day	Response ± 20% of expected value	Correct problem, recalibrate	R
EPA/60/R-93/116	Asbestos (PLM)	Field Duplicates	5% duplicates sent to a second lab		Correct problem, recalibrate	J

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

SW Methods	Parameter
8015 (modified)	TPH volatile and extractable (water and soil)
8020A	Aromatic volatile organics (water and soil)
8080A	Organochlorine pesticides and PCBs (water and soil)
8260A	Volatile organics (water and soil)
8270B	Semivolatile organics (water and soil)
8330	Explosive residues (water and soil)
6010A	Trace metals by ICP (water and soil)
7470A	Mercury (water)
7471A	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)

Volatile petroleum hydrocarbon components, such as gasoline, jet fuel, and other low molecular weight petroleum products, are analyzed by the direct purge and trap technique described in method SW5030 followed by a modified approach to method SW8015. Extractable TPH components are analyzed by extraction method SW3520B, SW3550A, or SW3510B followed by a modified method SW8015.

For volatile TPH, the sample is placed in the purge and trap sparge vessel and analysis is conducted using a GC equipped with an FID.

Extractable TPH components, such as kerosene, diesel, motor oil, and other high molecular weight extractable petroleum products, are analyzed by method SW3520B (continuous liquid/liquid extraction) for water-based matrices or by method SW3550A (sonication extraction) for soil/sludge matrices. The sample is extracted and analysis is accomplished on a GC equipped with a capillary or megabore column and an FID. PQLs for volatile TPH and extractable TPH are provided in Table 7.2.3-1.

Identification and quantitation of TPH components require more analytical judgment than other GC methods. The TPH chromatograms consist of groups of peaks that fall within a noted carbon retention time range (i.e., number of carbon atoms in the molecule). Standard fuel components are used to calibrate the instruments. The TPH results are reported in mg/kg or mg/L based on quantitation of the total area count for the gasoline range organics (i.e., C6-C13) or the diesel range organics (i.e., C13-C28). The retention time window will be set such that the window encompasses only the C6 through C28 range of organics. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.3-2 and 7.2.3-3.

Table 7.2.3-1. PQLs for Method SW8015 (Modified)

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Petroleum Hydrocarbons SW5030/SW8015 (Mod)	Gasoline	0.1	mg/L	1.0	mg/kg
SW3550A/SW8015 (Mod) SW3550A/SW8015 (Mod) SW3510B/SW8015 (Mod)	Diesel, Jet Fuel	1.0	mg/L	10.0	mg/kg

Table 7.2.3-2. QC Acceptance Criteria for Method SW8015 (Modified)

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8015 (Modified) GPD	TPH-Gasoline	67-136	≤ 30	57-146	≤ 50
	Surrogate: Chlorobenzene	74-138		64-148	
SW8015 (Modified) DRO	TPH-Diesel	61-143	≤ 30	51-153	≤ 50
	TPH-Jet Fuel	61-143	≤ 30	51-153	≤ 50
	Surrogates: Octacosane	26-152		25-162	
	Ortho-Terphenyl	57-132		47-142	

Table 7.2.3-3. Summary of Calibration and QC Procedures for Method SW8015 (Modified)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8015 (mod)	Volatile and Extractable Total Petroleum Hydrocarbons	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Coefficient of determination ≥ 0.990	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		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 specific analyte(s) for 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 7.2.3-2	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 7.2.3-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8015 (mod)	Volatile and Extractable Total Petroleum Hydrocarbons	Method blank	One per analytical batch	No TPH 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 7.2.3-2	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 7.2.3-2	Correct problem then re-extract 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

Table 7.2.3-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8015 (mod)	Volatile and Extractable Total Petroleum Hydrocarbons	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.3-2	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 7.2.3-1	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.

7.2.4 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 Organics SW5030A/SW8020A (W, S)	Benzene	2.0	µg/L	0.002	mg/kg
	Ethylbenzene	2.0	µg/L	0.002	mg/kg
	Toluene	2.0	µg/L	0.002	mg/kg
	Xylenes, total	2.0	µg/L	0.002	mg/kg

Table 7.2.4-2. QC Acceptance Criteria for Method SW8020A

Method	Analyte	Accuracy	Precision	Accuracy	Precision
		Water (% R)	Water (% RPD)	Soil (% R)	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	Coefficient of determination ≥ 0.990	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	± 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
		Second-column confirmation	100% for all positive results at or above the PQL	Same as for initial or primary column analysis	Same as for initial or primary column 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 7.2.4-1	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

Organochlorine pesticides and PCBs in water and soil samples are analyzed using method SW8080A. This analytical method involves extraction of water samples using a separatory funnel (method SW3510B) or using continuous liquid-liquid extraction (method SW3520B). Extraction of solid samples is accomplished using ultrasonic extraction (method SW3550A) procedures. The pesticides and PCBs are separated and quantified by GC using electron capture detection. PQLs for this method are presented in Table 7.2.7-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.7-2 and 7.2.7-3.

The PQLs for Method 8080 A are substantially higher (greater than a factor of 10) than the potential Texas ARAR (technically a To-Be-Considered criteria) for PCBs in soil (0.05 mg/kg). However, no alternative analysis with lower detection limits is proposed at this time because there is no record or reason to suspect a PCB contamination problem at the site, and this analysis is only a general screening tool at this stage.

Table 7.2.7-1. PQLs for Method SW8080A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Organochlorine Pesticides and PCBs SW3510B or SW3520B/SW8080A(W) SW3550A/SW8080A	Aldrin	0.04	µg/L	0.003	mg/kg
	α-BHC	0.03	µg/L	0.002	mg/kg
	β-BHC	0.06	µg/L	0.004	mg/kg
	δ-BHC	0.09	µg/L	0.006	mg/kg
	γ-BHC (Lindane)	0.04	µg/L	0.003	mg/kg
	Chlordane (technical)	0.14	µg/L	0.009	mg/kg
	4,4'-DDD	0.11	µg/L	0.007	mg/kg
	4,4'-DDE	0.04	µg/L	0.003	mg/kg
	4,4'-DDT	0.12	µg/L	0.008	mg/kg
	Dieldrin	0.02	µg/L	0.01	mg/kg
	Endosulfan I	0.14	µg/L	0.009	mg/kg
	Endosulfan II	0.04	µg/L	0.003	mg/kg
	Endosulfan Sulfate	0.66	µg/L	0.04	mg/kg
	Endrin	0.06	µg/L	0.004	mg/kg
	Endrin Aldehyde	0.23	µg/L	0.02	mg/kg
	Heptachlor	0.03	µg/L	0.002	mg/kg
	Heptachlor Epoxide	0.83	µg/L	0.06	mg/kg
	Methoxychlor	1.76	µg/L	0.1	mg/kg
	Toxaphene	2.4	µg/L	0.2	mg/kg
	PCB-1016	1.0	µg/L	1.0	mg/kg
PCB-1221	1.0	µg/L	1.0	mg/kg	
PCB-1232	1.0	µg/L	1.0	mg/kg	
PCB-1242	1.0	µg/L	1.0	mg/kg	
PCB-1248	1.0	µg/L	1.0	mg/kg	
PCB-1254	1.0	µg/L	1.0	mg/kg	
PCB-1260	1.0	µg/L	1.0	mg/kg	

Table 7.2.7-2. QC Acceptance Criteria for Method SW8080A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8080A	α -BHC	75-125	≤ 30	65-135	≤ 50
	β -BHC	51-125	≤ 30	41-133	≤ 50
	4,4'-DDD	48-136	≤ 30	38-146	≤ 50
	4,4'-DDE	45-139	≤ 30	35-149	≤ 50
	Endosulfan I	49-143	≤ 30	39-153	≤ 50
	PCB-1016	54-125	≤ 30	44-135	≤ 50
	PCB-1260	41-126	≤ 30	31-136	≤ 50
	Surrogates:				
	DCBP	34-133		34-133	
	TCMX	45-120		45-120	

Table 7.2.7-3. Summary of Calibration and QC Procedures for Method SW8080A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8080A	Organo-chlorine pesticides and PCBs	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Coefficient of Determination ≥ 0.990	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	± 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 7.2.7-3 Continued.

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8080A	Organo-chlorine pesticides and PCBs	Breakdown check (Endrin and DDT)	Daily prior to analysis of samples	Degradation $\leq 20\%$	Repeat breakdown check	Apply J to all positive DDT, DDE, DDD, endrin, endrin ketone and endrin aldehyde results; apply R to the analytes listed above if minimum frequency is not met
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.7-2	Recalculate results; locate and fix problem with system and then rerun 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 reprep and analyze method blank and all associated samples	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 7.2.7-2	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

Table 7.2.7-3 Continued.

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8080A	Organo-chlorine pesticides and PCBs	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.7-2	<p>Correct problem then reextract and analyze sample</p> <p>If matrix interference is confirmed, no further action is necessary</p>	<p>For the samples;</p> <p>if the %R > UCL for any surrogate, apply J to all positive results</p> <p>if the %R < LCL for any surrogate, apply J to all positive results; apply R to all non-detects</p> <p>If any surrogate recovery is < 10%, apply R to all results</p>
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.7-2	none	<p>For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if;</p> <p>(1)%R for MS or MSD > UCL or</p> <p>(2)%R for MS or MSD < LCL</p> <p>or</p> <p>(3)MS/MSD RPD > CL</p>

Table 7.2.7-3 Concluded.

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
SW8080A	Organo-chlorine pesticides and PCBs	Second-column confirmation	100% for all positive results at or above the PQL	Same as for initial or primary column analysis	Same as for initial or primary column 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 7.2.7-1	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.

7.2.8 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	1,1,1,2-Tetrachloroethane	0.5	µg/L	0.003	mg/kg
SW5030A/SW8260A (W, S)	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	Precision	Accuracy	Precision
		Water (% R)	Water (% RPD)	Soil (% R)	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	Precision	Accuracy	Precision
		Water (% R)	Water (% RPD)	Soil (% R)	Soil (% RPD)
SW8260A (Continued)	Bromobenzene	75-125	≤ 20	65-135	≤ 30
	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
	Tert-butylbenzene	75-125	≤ 20	65-135	≤ 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 $\geq 0.30\%$; 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 $\geq 0.30\%$; 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 ± 30 seconds; 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 not performed.
- c. Except > 0.10 for bromoform, and \geq 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 SW 3520B, 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
- 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 Base/Neutral Extractables SW3510B or SW3520B/SW8270B (W) SW3540B or SW3550A/SW8270B (S) (concluded)	Dibenz (a,h) anthracene	10.0	µg/L	0.7	mg/kg
	Dibenzofuran	10.0	µg/L	0.7	mg/kg
	Diethyl phthalate	10.0	µg/L	0.7	mg/kg
	Dimethyl phthalate	10.0	µg/L	0.7	mg/kg
	Fluoranthene	10.0	µg/L	0.7	mg/kg
	Fluorene	10.0	µg/L	0.7	mg/kg
	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 Acid Extractables SW3510B or SW3520B/SW8270B (W) SW3540B or SW3550A/SW8270B (S)	2,4,5-Trichlorophenol	50.0	µg/L	3.3	mg/kg
	2,4,6-Trichlorophenol	10.0	µg/L	0.3	mg/kg
	2,4-Dichlorophenol	10.0	µg/L	0.3	mg/kg
	2,4-Dimethylphenol	10.0	µg/L	0.3	mg/kg
	2,4-Dinitrophenol	50.0	µg/L	3.3	mg/kg
	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	40-135	≤ 20	30-145	≤ 30
	3,3'-Dichlorobenzidine	19-185	≤ 20	15-185	≤ 30
	3-Nitroaniline	41-135	≤ 20	31-145	≤ 30
	4-Bromophenyl phenyl ether	53-127	≤ 20	43-137	≤ 30
	4-Chloroaniline	35-146	≤ 20	25-156	≤ 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 Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision 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	15-185	≤ 20	15-185	≤ 30
	2,4,6-Trichlorophenol	29-138	≤ 20	19-148	≤ 30
	2,4-Dichlorophenol	36-135	≤ 20	26-145	≤ 30
	2,4-Dimethylphenol	35-149	≤ 20	25-159	≤ 30
	2,4-Dinitrophenol	As detected- 161	≤ 20	As detected- 171	≤ 30
	2-Chlorophenol	31-135	≤ 20	21-145	≤ 30
	2-Methylphenol	15-135	≤ 20	15-145	≤ 30
	2-Nitrophenol	34-135	≤ 20	24-145	≤ 30
	4,6-Dinitro-2-Methyl Phenol	16-144	≤ 20	15-154	≤ 30
	4-Chloro-3-Methyl Phenol	34-135	≤ 20	24-145	≤ 30
	4-Methylphenol	23-135	≤ 20	15-145	≤ 30
	4-Nitrophenol	15-141	≤ 20	15-151	≤ 30
	Benzoic Acid	As detected- 172	≤ 20	As detected- 182	≤ 30
	Pentachlorophenol	18-146	≤ 20	28-156	≤ 30
	Phenol	15-135	≤ 20	15-145	≤ 30

Table 7.2.15-2. Concluded

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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 \geq 0.05, and %RSD for all CCCs \leq 30%; other cmpds \leq 15% otherwise use quadratic fit	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	\pm 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 \geq 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

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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 ± 30 seconds: 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

Not applicable.

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
	<i>Surrogates^a:</i>				

- 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 SW 8330

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
		Confirmation ^c	100% for all positive results	Same as for initial or primary analysis	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

- All corrective actions associated with AFCEE project work will be documented, and all records will be maintained by the laboratory.
- 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.
- 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 Emission Spectroscopy (ICPES). 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		0.3	
	Cadmium		0.001		0.1
	Calcium	0.1		10.0	
	Chromium		0.005		0.5
	Cobalt		0.002		0.2
	Copper		0.005		0.5
	Iron	0.07		7.0	
	Lead		0.01		1.0
	Magnesium	0.3		30.0	
	Manganese		0.005		0.5
	Molybdenum		0.005		0.5
	Nickel		0.005		0.5
	Potassium	5.0		500.0	
	Selenium		0.01		1.0
	Silver		0.005		0.2
	Sodium	0.3		30.0	
Thallium		0.02		2.0	
Vanadium		0.005		0.5	
Zinc	0.02		2.0		

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 (W) SW7471A (S)	Mercury	0.001	mg/L	0.1	mg/kg

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

Method	Analyte	Accuracy	Precision	Accuracy	Precision
		Water (% R)	Water (% RPD)	Soil (% R)	Soil (% RPD)
SW7470A/ SW7471A	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 SW7471A	Mercury	Initial multipoint calibration (minimum 5 standards and a blank)	Daily initial calibration prior to sample analysis	Correlation coefficient \geq 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 SW7471A	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 SW7471A	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.

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 associate 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", 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).
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/collect ion requirements not met	R for all results	All analytes in the sample
Sample Storage	<2°C or > 6°C	J for positive results R for nondetects	All analytes in the sample
Quantitation	Analyte(s) detected ≥ MDL but < PQL	F	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 I-9.

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.

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, 3rd sentence, 2nd paragraph	"Matrix spikes and matrix spike duplicates <i>do not</i> count as environmental samples." (Addition italicized)	Methodologies & previous AFCEE guidelines do not count MS/MSD as environmental samples
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
6.2, 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
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 13-1 Continued

Section	Change	Rationale
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 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 7.2.7-1	Under Parameter/Method, added "or SW3520B"	Common lab protocol or request
Table 7.2.7-2	A representative list of pesticides/PCB analytes (not all) is including for spiking	To reduce high analytical costs; pest./PCB contam. is not a major concern, but is being included as a general screen

Table 13-1 Continued

Section	Change	Rationale
Table 7.2.7-3	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 7.2.7-3	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 7.2.7-3	Corrective Action for Surrogate Spike, added "If matrix interference is confirmed, no further action is necessary."	Common lab protocol or request
Table 7.2.7-3	Minimum Frequency for Second-column confirmation: Add "at or above the PQL"	Common lab protocol or request
Table 7.2.14-3	Minimum Frequency for Calibration verification: "Daily, before sample analysis, every 12 hours of analysis time, and at end of analysis sequence " (Bold material deleted)	Common lab protocol or request
Table 7.2.14-3	Corrective Action for ISs: Add sentence "If matrix interference is demonstrated, no further corrective action is needed."	Common lab protocol or request
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 13-1 Continued

Section	Change	Rationale
Table 7.2.15-2	The upper & lower control limits increased by $\pm 10\%$ for the following compounds: 2-Nitroaniline, 3,3'-Dichlorobenzidine, 3-Nitroaniline, 4-Chloroaniline, 2,4,5-Trichlorophenol, 2,4,6-Trichlorophenol, 2,4-Dichlorophenol, 2,4-Dimethylphenol, 2-Chlorophenol, 2-Methylphenol, 2-Nitrophenol, 4,6-Dinitro-2-Methyl Phenol, 4-Chloro-3-Methyl Phenol, 4-Methylphenol, 4-Nitrophenol, Pentachlorophenol, Phenol	Common lab protocol or request
Table 7.2.15-2	Lower control limit changed to "as detected," upper control limit raised by 10% for 2,4-Dinitrophenol and Benzoic Acid	Common lab protocol or request
Table 7.2.15-3	Acceptance Criteria for Five-point initial calibration changed: "SPCCs average RF ≥ 0.05 ; and RSD for all CCCs $\leq 30\%$; <i>other compounds $\leq 15\%$, otherwise use quadratic fit.</i> " (Revisions italicized)	Common lab protocol or request
Table 7.2.15-3	Minimum Frequency for Calibration verification: "Daily, before sample analysis, every 12 hours of analysis time, and at end of analysis sequence " (Bold material deleted)	Common lab protocol or request
Table 7.2.15-3	Corrective Action for ISs: Add sentence "If matrix interference is demonstrated, no further corrective action is needed."	Common lab protocol or request
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
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

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APPENDIX A

AFCEE HARD COPY REPORT FORMS

INSTRUCTIONS FOR COMPLETING AFCEE REPORT FORMS

The following instructions shall be used in completing the AFCEE report forms for screening and definitive data. The bold lettering identifies the fields on the AFCEE report form.

ALL INORGANIC AND ORGANIC FORMS

Analytical Method: enter the method name (e.g., SW6010A, SW8270B)

AAB#: enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

Lab Name: enter the laboratory name (e.g., Garland Labs, Inc.)

Contract #: enter the Air Force contract number and delivery order number under which the analytical work is being performed (e.g., F21625-94-D-8005/0001)

Comments: any comments

FORM I-1

Base/Command: enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)

Prime Contractor: enter the name of the prime contractor (e.g., RDS, Inc)

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Lab Sample ID: enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

FORM I-2

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Lab Sample ID: enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

Matrix: enter the sample matrix (e.g., water, soil)

FORM I-2 (continued)

% Solids: enter the % solids

Dilution: enter the dilution (if applicable) (e.g., 1:5)

Date Received/Extracted/Analyzed: enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 96)

Concentration Units: enter the appropriate units (i.e., μ g/L or mg/kg)

MDL: enter the laboratory derived method detection limit

PQL: enter the project practical quantitation limit as stated in the QAPP or approved variance for each analyte

Concentration: enter the result

Qualifier: enter the qualifier flag (see QAPP Sections 7 and 8)

FORM I-3

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

RF Blank, RF1, RF2, RF3: enter the response factor corresponding to the standard with the same number: RF Blank is the response factor for the blank

Std 1, Std2, Std3: enter the concentration of the standard

r: enter the correlation coefficient

Q: enter a "*" for all corresponding correlation coefficients that were not acceptable as per QAPP Section 7

FORM I-3A (Mercury analyses only) and I-3B (cyanide analyses only)

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

FORM I-3A and I-3B (continued)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

RF Blank, RF1, RF2, RF3, RF4, RF5, RF6: enter the response factor corresponding to standard with the same number: RF Blank is the response factor for the blank

Std 1, Std 2, Std 3, Std 4, Std 5, Std 6: enter the concentration of the standard

r: enter the correlation coefficient

Q: enter a "*" for all corresponding correlation coefficients that were not acceptable as per QAPP Section 7

FORM I-4

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

Highest Std ID: enter the unique identifier for the highest standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., HS960603)

2nd Source ID: enter the unique identifier for the 2nd source standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., 2S960603)

CCV #1 ID: enter the unique identification number for the first CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-1)

CCV #2 ID: enter the unique identification number for the second CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-2)

Expected, Expected 1: enter the expected result (i.e., the concentration of the calibration material)

Found, Found 1, Found 2: enter the measured result

FORM I-4 (continued)

%D: enter the per cent difference between the expected and found

Q: enter a "*" for all %Ds that were not acceptable as per QAPP Section 7

FORM I-5

Units: enter the appropriate units (i.e., μ g/L or mg/kg)

Calibration Blank ID: enter the identification number for the calibration blank (the same ID number will be found in the run sequence log, e.g., CB960603)

Method Blank ID: enter the identification number for the method blank (the same ID number will be found in the run sequence log, e.g., MB960603)

CCB #1 ID: enter the identification number for the first CCB (the same ID number will be found in the run sequence log, e.g., CCB960603-1)

CCB #2 ID: enter the identification number for the second CCB (the same ID number will be found in the run sequence log, e.g., CCB960603-2)

CCB #3 ID: enter the identification number for the third CCB (the same ID number will be found in the run sequence log, e.g., CCB960603-3)

Calibration Blank: enter the result for the calibration blank

Continuing Calibration Blank 1: enter the result for the continuing calibration blank 1

Continuing Calibration Blank 2: enter the result for the continuing calibration blank 2

Continuing Calibration Blank 3: enter the result for the continuing calibration blank 3

Method Blank: enter the result for the method blank

PQL: enter the project practical quantitation limit as stated in the QAPP or approved variance for each analyte

Q: enter a "*" for all calibration and method blank analytes that were not acceptable as per QAPP Section 7

FORM I-6

LCS ID: enter the unique identification number for the laboratory control sample such that the LCS could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., LCS960603)

Units: enter the appropriate units (i.e., μ g/L or mg/kg)

Expected: enter the expected result (i.e., the concentration of the calibration material)

Found: enter the measured result

%R: enter the per cent difference between the expected and found

Control Limits: enter the control limits required to be met (see QAPP Section 7)

Q: enter a "*" for all %Rs that were not acceptable as per QAPP Section 7

FORM I-7

Parent Field Sample ID: enter the field sample ID of the parent sample (the sample spiked for the MS and MSD)

Units: enter the appropriate units (i.e., μ g/L or mg/kg)

% Solids: enter the % solids

MS ID: enter the unique identification number for the matrix spike such that the MS could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log, e.g., MS960603)

MSD ID: enter the unique identification number for the matrix spike duplicate such that the MSD could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log, e.g., MSD960603)

Parent Sample Result: enter the result of the parent sample

Spike Added: enter the amount of spike added to the parent sample

Spike Sample Result: enter the result of the MS

%R: enter the per cent recovery

FORM I-7 (continued) _

Duplicate Spike Sample Result: enter the result of the MSD

%RPD: enter the relative per cent difference between the spike (MS) and spike duplicate (MSD)

Control Limits: enter the control limits required to be met (see QAPP Section 7)

Q: enter the qualifier flag as needed (see QAPP Sections 7 and 8)

FORM I-8

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Date Collected: enter the date the sample was taken in the field in the format DD-MMM-YY (e.g., 6 Jun 96)

Date Received: enter the date the sample was received at the laboratory in the format DD-MMM-YY (e.g., 6 Jun 96)

Date Analyzed: enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 6 Jun 96)

Max. Holding Time: enter the maximum allowable holding time in days (see QAPP Section 5)

Time Held: enter the time in days elapsed between the date collected and the date analyzed

Q: enter a "*" for all holding times that were greater than the maximum allowable holding time as per QAPP Section 5

FORM I-9

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Field Sample ID/Std ID/Blank ID/QC Sample ID: enter the unique identifying number of each sample (environmental sample, standard, blank, LCS, MS, MSD, etc.) in the sequence they were analyzed

FORM I-9 (continued)

Date Analysis Started: enter the date the sample analysis was started in the format DD-MMM-YY (e.g., 6 Jun 96)

Time Analysis Started: enter the time the sample analysis was started in 24 hour format (e.g., 0900, 2130)

Date Analysis Completed: enter the date the sample analysis was completed in the format DD-MMM-YY (e.g., 6 Jun 96)

Time Analysis Completed: enter the time the sample analysis was completed in 24 hour format (e.g., 0900, 2130)

FORM O-1

Base/Command: enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)

Prime Contractor: enter the name of the prime contractor (e.g., RDS, Inc)

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Lab Sample ID: enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

FORM O-2

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Lab Sample ID: enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

Matrix: enter the sample matrix (e.g., water, soil)

% Solids: enter the % solids

Dilution: enter the dilution (if applicable) (e.g., 1:5)

FORM O-2 (continued)

Date Received/Extracted/Analyzed: enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 96)

Concentration Units: enter the appropriate units (i.e., μ g/L or mg/kg)

MDL: enter the laboratory derived method detection limit

PQL: enter the project practical quantitation limit as stated in the QAPP or approved variance for each analyte

Concentration: enter the result

Qualifier: enter the qualifier flag as needed (see QAPP Sections 7)

FORM O-3

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Compound: enter BFB or DFTPP as appropriate

Injection Date/Time: enter the date (in the format DD-MMM-YY) and time (in 24 hour format) of the performance check

Mass: enter the mass of the ion used for tuning (see QAPP Section 7)

Ion Abundance Criteria: enter the criteria for the specific mass (see QAPP Section 7)

% Relative Abundance: enter the per cent relative abundance as the result of the tune

Q: enter a "*" for all % relative abundance results that were not acceptable as per QAPP Section 7

Field Sample ID/Std ID/Blank ID/QC Sample ID: enter the unique identifying number of each sample (environmental sample, standard, blank, LCS, MS, MSD, etc.)

Date Analyzed: enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 3 June 96)

FORM O-3 (continued)

Time Analyzed: enter the time the sample was analyzed by the laboratory in 24 hour format (e.g., 0900, 2130)

FORM O-4

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

Calibration ID: enter the unique identifier for the specific calibration event

RF Blank, RF1, RF2, RF3, RF4, RF5: enter the response factor corresponding to the standard with the same number. RF Blank is the response factor for the blank

Std 1, Std 2, Std 3, Std 4, Std 5: enter the concentration of the standard

%RSD: enter the per cent relative standard deviation

Q: enter a "*" for all % RSDs that were not acceptable as per QAPP Section 7

FORM O-5

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

2nd Source ID: enter the unique identifier for the 2nd source standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., 2S960603)

CCV #1 ID: enter the unique identification number for the first CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-1)

CCV #2 ID: enter the unique identification number for the second CCV such that the second CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-2)

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FORM O-5 (continued)

Expected, Expected 1: enter the expected result (i.e., the concentration of the calibration material)

Found, Found 1, Found 2: enter the measured result

%D: enter the per cent difference between the expected and found

Q: enter a "*" for all % Ds that were not acceptable as per QAPP Section 7

FORM O-5A

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

SPCC #1 ID: enter the unique identification number for the SPCC associated with the initial multipoint calibration such that the SPCC could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., SPCC960603-1)

SPCC #2 ID: enter the unique identification number for the SPCC associated with the daily calibration such that the SPCC could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., SPCC960603-1)

SPCC #3 ID: enter the unique identification number for the SPCC run after 12 hours of operation such that the SPCC could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., SPCC960603-2)

CCC #1 ID: enter the unique identification number for the CCC associated with the daily calibration such that the CCC could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCC960603-1)

CCC #2 ID: enter the unique identification number for the CCC run after 12 hours of operation such that the CCC could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCC960603-2)

FORM O-5 (continued)

RF: enter the response factor

Min RF: enter the minimum acceptable response factor (see QAPP Section 7)

Expected: enter the expected result (i.e., the concentration of the calibration material)

Found: enter the measured result

%D: enter the per cent difference between the expected and found

Q: enter a "*" for (1) any % Ds that were not acceptable or (2) any RFs not meeting minimum acceptable requirements as per QAPP Section 7

FORM O-6

Units: enter the appropriate units (i.e., μ g/L or mg/kg)

Method Blank ID: enter the unique identification number for the method blank (the same ID number will be found in the run sequence log, e.g., MB960603)

Analyte: enter the name of the analyte (use the same name as used in the tables in Section 7 of the QAPP)

Method Blank: enter the result for the method blank

PQL: enter the project practical quantitation limit as stated in this QAPP or approved variance for each analyte

Q: enter a "*" for all method blank analyte results that were not acceptable as per QAPP Section 7

FORM O-7

LCS ID: enter the unique identification number for the laboratory control sample such that the LCS could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., LCS960603)

Units: enter the appropriate units (i.e., μ g/L or mg/kg)

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FORM O-7 (continued)

Analyte: enter the name of the analyte (use the same name as used in the tables in Section 7 of the QAPP)

Expected: enter the expected result (i.e., the concentration of the calibration material)

Found: enter the measured result

%R: enter the per cent recovery

Control Limits: enter the control limits required to be met (see QAPP Section 7)

Q: enter a "*" for all % Rs that were not acceptable as per QAPP Section 7

FORM O-8

Parent Field Sample ID: enter the field sample ID of the parent sample (the sample spiked for the MS and MSD)

Units: enter the appropriate units (i.e., μ g/L or mg/kg)

% Solids: enter the % solids

MS ID: enter the unique identification number for the matrix spike such that the MS could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log, e.g., MS960603)

MSD ID: enter the identification number for the matrix spike duplicate such that the MSD could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log, e.g., MSD960603)

Parent Sample Result: enter the result of the parent sample

Spike Added: enter the amount of spike added to the parent sample

Spike Sample Result: enter the result of the MS

%R: enter the per cent recovery

Duplicate Spike Sample Result: enter the result of the MSD

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FORM O-8 (continued)

%RPD: enter the relative per cent difference between the spike (MS) and spike duplicate (MSD)

Control Limits: enter the control limits required to be met (see QAPP Section 7)

Q: enter the qualifier flag as needed (see QAPP Sections 7)

FORM O-9

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Date Collected: enter the date the sample was taken in the field in the format DD-MMM-YY (e.g., 3 Jun 96)

Date Received: enter the date the sample was received at the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)

Date Extracted: enter the date the sample was extracted by the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)

Max. Holding Time E: enter the maximum allowable holding time in days until the sample is extracted (see QAPP Section 5)

Time Held Ext.: enter the time in days elapsed between the date collected and the date extracted

Date Analyzed: enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)

Max. Holding Time A: enter the maximum allowable holding time in days until the sample is analyzed (see QAPP Section 5)

Time Held Anal.: enter the time in days elapsed between the date collected and the date analyzed

Q: enter a "*" for all holding times (Max. Holding Time E, or Max. Holding Time A, or Time Held Anal.) that were greater than the maximum holding time that were not acceptable as per QAPP Section 5

FORM O-10

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Field Sample ID/Std ID/Blank ID/QC Sample ID: enter the unique identifying number of each sample (environmental sample, standard, blank, LCS, MS, MSD, etc.) in the sequence they were analyzed

Date Analysis Started: enter the date the sample analysis was started in the format DD-MMM-YY (e.g., 3 Jun 96)

Time Analysis Started: enter the time the sample analysis was started in 24 hour format (e.g., 0900, 2130)

Date Analysis Completed: enter the date the sample analysis was completed in the format DD-MMM-YY (e.g., 3 Jun 96)

Time Analysis Completed: enter the time the sample analysis was completed in 24 hour format (e.g., 0900, 2130)

Form S-1

Base/Command: enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)

Prime Contractor: enter the name of the prime contractor (e.g., RDS, Inc)

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

FORM S-2

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Matrix: enter the sample matrix (e.g., water, soil)

Date Analyzed: enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 96)

Concentration Units: enter the appropriate units (i.e., μ g/L or mg/kg)

FORM S-2 (continued)

MDL: enter the laboratory derived method detection limit

PQL: enter the project practical quantitation limit as stated in the QAPP or approved variance for each analyte

Concentration: enter the result

Qualifier: enter the qualifier needed (see QAPP Sections 7 and 8)

FORM S-3

Units: enter the appropriate units (i.e., μ g/L or mg/kg)

Sample Result: enter the result of the sample

Duplicate Sample Result: enter the result of the duplicate sample

%D or %RPD: enter the per cent or difference relative per cent difference between the sample and duplicate

Acceptance Criteria: enter the acceptance criteria required to be met (see QAPP Section 6)

Q: enter a "" for all %Ds or %RPDs that were not acceptable as per QAPP Section 6

MDL FORM

Analyte: enter the name of the analyte (use the same name as used in the tables in Section 7 of the QAPP)

Amt. Spiked: enter the amount of spike added to the parent sample

Replicate 1,2,3,4,5,6,7: enter the result of the replicate

Std. Dev.: enter the standard deviation of the seven replicates

MDL: enter the calculated MDL

CHAIN OF CUSTODY FORM

COC#: enter a unique number for each chain of custody form

Ship to: enter the laboratory name and address

Carrier: enter the name of the transporter (e.g., FedEx) or handcarried

Airbill#: enter the airbill number or transporter tracking number (if applicable)

Project Name: enter the project name (e.g., Banks AFB RI/FS)

Sampler Name: enter the name of the person collecting the samples

Sampler Signature: signature of the person collecting the samples

Send Results to: enter the name and address of the prime contractor

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Date: enter the year and date the sample was collected in the format M/D (e.g., 6/3)

Time: enter the time the sample was collected in 24 hour format (e.g., 0900)

Matrix: enter the sample matrix (e.g., water, soil)

Pres: enter the preservative used (e.g., HNO₃) or "none"

CHAIN OF CUSTODY FORM (continued)

Filtered/Unfilt.: enter "F" if the sample was filtered or "U" if the sample was not filtered

of Containers: enter the number of containers associated with the sample

MS/MSD: enter "X" if the sample is designated the MD/MSD

Analyses Requested: enter the method name of the analysis requested (e.g., SW6010A)

Comments: enter comments

Sample Condition Upon Receipt at Laboratory: enter any problems with the condition of any sample(s)

Cooler Temperature: enter the internal temperature of the cooler, in degrees C, upon opening

Special Instructions/Comments: enter any special instructions or comments

Released by: (SIG): enter the signature of the person releasing custody of the samples

Company Name: enter the company name employing the person releasing/receiving custody

Received by: (SIG): enter the signature of the person receiving custody of the samples

Date: enter the date in the format M/D/YY (e.g., 6/3/96) when the samples were released/received

Time: enter the time in 24 hour format (e.g., 0900) when the samples were released/received

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AFCEE
INORGANIC ANALYSES DATA SHEET 3
MERCURY INITIAL MULTIPOINT CALIBRATION

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Date of Calibration: _____

Analyte	RF Blank	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	Std 4	RF 4	Std 5	RF 5	r	Q
Mercury													

r = correlation coefficient

Comments:

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AFCEE
INORGANIC ANALYSES DATA SHEET 3
CYANIDE INITIAL MULTIPOINT CALIBRATION

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Date of Calibration: _____

Analyte	RF Blank	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	Std 4	RF 4	Std 5	RF 5	Std 6	RF 6	r	Q
Cyanide															

r = correlation coefficient

Comments:

AFCEE FORM I-3B

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AFCEE
ORGANIC ANALYSES DATA PACKAGE

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Base/Command: _____ Prime Contractor: _____

Field Sample ID

Lab Sample ID

Comments:

I certify this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: _____

Date: _____ Title: _____

AFCEE FORM O-1

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AFCEE
SCREENING DATA PACKAGE

Analytical Method: _____

Contract #: _____

Base/Command: _____

Prime Contractor: _____

Field Sample ID

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Comments:

Signature: _____

Name: _____

Date: _____

Title: _____

AFCEE FORM S-1

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FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

31715b

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE