N83447.AR.000502
NAS FORT WORTH
5090.3a

FINAL 2000 BASEWIDE QUALITY ASSURANCE PROJECT PLAN NAS FORT WORTH TX
3/1/2000
HYDROGEOLOGIC

514 0

File: 17G
P.W.

NAVAL AIR STATION
FORT WORTH JRB
CARSWELL FIELD
TEXAS

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 514

514 1

File:
P.W. 17A-79

MAR 0 6 REC'D

514

HYDRO GeoLogic INC.

FINAL
2000 BASEWIDE
QUALITY ASSURANCE PROJECT PLAN
NAS FORT WORTH JRB, TEXAS

AF CENTER FOR ENVIRONMENTAL EXCELLENCE

Contract No. F41624-95-D-8005-0026

Prepared for

U.S. Air Force Center for Environmental Excellence
Brooks AFB, Texas

March 2000

HydroGeoLogic, Inc.
1155 Herndon Parkway
Suite 900
Herndon, Virginia 20170
(703) 478-5186

FINAL
2000 BASEWIDE
QUALITY ASSURANCE PROJECT PLAN
NAS FORT WORTH JRB, TEXAS

Prepared for

U.S. Air Force Center for Environmental Excellence
Brooks AFB, Texas

Contract No. F41624-95-D-8005-0026

Prepared by

HydroGeoLogic, Inc.
1155 Herndon Parkway, Suite 900
Herndon, VA 20170

March 2000

REPORT DOCUMENTATION PAGE

Form Approved

QMB No. 0704-0188

Public reporting for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1024, Arlington, VA 22202-1302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE March 2000	3. REPORT TYPE AND DATES COVERED Final Quality Assurance Project Plan
4. TITLE AND SUBTITLE Final 2000 Basewide Quality Assurance Project Plan NAS Fort Worth JRB, Texas		4. FUNDING NUMBERS F41624-95-D-8005 Delivery Order 0026
6. AUTHOR(S) HydroGeoLogic, Inc		
7. PERFORMANCE ORGANIZATION NAMES(S) AND ADDRESS(S) HydroGeoLogic, Inc. 1155 Herndon Parkway, Suite 900 Herndon, VA 20170		8. PERFORMANCE ORGANIZATION REPORT NUMBER AFC001
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(S) AFCEE/ERD Brooks AFB Texas 78235-5328		10. SPONSORING/MONITORING AGENCY REPORT NUMBER CDRL No. A003C

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT Unlimited	12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This document presents the policies, organizational functions, and specific quality assurance and quality control requirements associated with analytical data generation and assessment. The document lists preparation and analytical methods required for use at NAS Fort Worth JRB environmental investigations.

14. SUBJECT TERMS	15. NUMBER OF PAGES
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE.	19. SECURITY CLASSIFICATION OF ABSTRACT.	20. LIMITATION OF ABSTRACT

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1-1
1.1	QAPP OBJECTIVES	1-1
1.2	ADMINISTRATIVE PROCEDURES	1-2
1.2.1	Document Control	1-2
1.2.2	Communications	1-3
1.3	QAPP ORGANIZATION	1-3
2.0	SITE DESCRIPTION AND HISTORY	2-1
2.1	SITE HISTORY	2-1
2.2	SUMMARY OF WASTE HANDLED	2-3
3.0	PROGRAM ORGANIZATION AND RESPONSIBILITIES	3-1
3.1	AIR FORCE, U.S. ENVIRONMENTAL PROTECTION AGENCY, AND TEXAS NATURAL RESOURCE CONSERVATION COMMISSION	3-1
3.2	CONTRACTOR PROJECT ORGANIZATION	3-1
3.3	LABORATORIES	3-3
4.0	QUALITY PROGRAM AND DATA QUALITY OBJECTIVES	4-1
4.1	DATA CATEGORIES	4-1
4.2	PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, AND COMPARABILITY	4-1
4.2.1	Precision	4-1
4.2.2	Accuracy	4-2
4.2.3	Representativeness	4-2
4.2.4	Completeness	4-2
4.2.5	Comparability	4-3
4.3	METHOD DETECTION LIMITS, PRACTICAL QUANTITATION LIMITS, AND INSTRUMENT CALIBRATION REQUIREMENTS	4-4
4.3.1	Method Detection Limits	4-4
4.3.2	Practical Quantitation Limits	4-6
4.3.3	TNRCC Guidance on Detection and Quantitation Limits	4-6
4.3.4	Instrument Calibration	4-6
4.4	ELEMENTS OF QUALITY CONTROL	4-7
4.4.1	Laboratory Control Samples	4-7
4.4.2	Matrix Spike/Matrix Spike Duplicate	4-8
4.4.3	Surrogates	4-8
4.4.4	Internal Standards	4-9
4.4.5	Retention Time Windows	4-9
4.4.6	Interference Check Sample	4-9
4.4.7	Method Blank	4-10
4.4.8	Ambient Blank	4-10

TABLE OF CONTENTS

		Page
	4.4.9 Equipment Blank	4-10
	4.4.10 Material Blank	4-11
	4.4.11 Trip Blank	4-11
	4.4.12 Field Duplicates	4-11
	4.4.13 Field Replicates	4-12
4.5	QUALITY CONTROL PROCEDURES	4-12
	4.5.1 Holding Time Compliance	4-12
	4.5.2 Confirmation	4-12
	4.5.3 Standard Materials	4-13
	4.5.4 Supplies and Consumables	4-13
5.0	SAMPLING PROCEDURES	5-1
5.1	FIELD SAMPLING	5-1
	5.1.1 Sample Containers	5-1
	5.1.2 Sample Volumes, Container Types, and Preservation Requirements	5-1
5.2	SAMPLE HANDLING AND CUSTODY	5-6
6.0	SCREENING ANALYTICAL METHODS	6-1
6.1	ANALYTICAL SCREENING METHOD DESCRIPTION	6-1
	6.1.1 EPA Method SW9040 (Water)/SW9045 (Soil)-pH	6-2
	6.1.2 SW-846 (Described in Method SW3550)-Percent Moisture	6-2
	6.1.3 SW-846 (Section 7.3) - Reactivity (Cyanide and Sulfide)	6-2
	6.1.4 EPA Method SW1020A - Ignitability	6-2
	6.1.5 EPA Method SW1110 -Corrosivity	6-2
	6.1.6 EPA Method SW9030A-Sulfide	6-2
	6.1.7 EPA Method SW9050A-Conductance	6-3
	6.1.8 EPA Method SW9060 (SW9060M)-Total Organic Carbon	6-3
	6.1.9 EPA Method 160.1-Filterable Residue	6-3
	6.1.10 EPA Method 160.2-Nonfilterable Residue	6-3
	6.1.11 EPA Method 170.1-Temperature	6-4
	6.1.12 EPA Method 180.1-Turbidity	6-4
	6.1.13 EPA Method 310.1-Alkalinity	6-4
	6.1.14 EPA Method 360.1-Dissolved Oxygen	6-4
	6.1.15 Hach® Test Kit-Ferrous Iron	6-4
	6.1.16 ASTM D422-Standard Method for Particle-Size Analysis of Soils	6-4
	6.1.17 Real-Time Portable Organic Vapor Analyzer	6-5
	6.1.18 ASTM D1498-Oxidation-Reduction Potential	6-6
	6.1.19 ASTM D3416-Methane in Soil Gas	6-6

TABLE OF CONTENTS

Page

6.1.20 Variable Methods–Organic Vapors in Soil Gas 6-6
6.1.21 Draft Method SW4020–Screening for Polychlorinated Biphenyls by Immunoassay 6-6
6.1.22 Draft Method SW4030–Screening for Petroleum Hydrocarbons by Immunoassay 6-6
6.2 CALIBRATION AND QC PROCEDURES FOR SCREENING METHODS 6-6

7.0 DEFINITIVE DATA ANALYTICAL METHODS AND PROCEDURES 7-1
7.1 PREPARATION METHODS 7-1
7.1.1 Method SW1311–Toxicity Characteristic Leaching Procedure 7-2
7.1.2 Method SW1312–Synthetic Precipitation Leaching Procedure 7-2
7.1.3 Method SW3005A–Acid Digestion of Water Samples for Metals Analysis 7-2
7.1.4 Method SW3010A–Acid Digestion of Aqueous Samples and Extracts for Metals Analysis 7-3
7.1.5 Method SW3015–Microwave Assisted Acid Digestion of Aqueous Samples and Extracts for Metals Analysis 7-3
7.1.6 Method SW3020A–Acid Digestion of Aqueous Samples and Extracts for Metals Analysis 7-3
7.1.7 Method SW3050B–Acid Digestion for Solids, Sediments, and Sludges for Metals Analysis 7-3
7.1.8 Method SW3051–Microwave Assisted Acid Digestion of Solids, Sediments, and Sludges for Metals Analysis 7-3
7.1.9 Method SW3060A–Alkaline Extraction 7-3
7.1.10 Method SW3510C–Separatory Funnel Liquid-Liquid Extraction . . . 7-4
7.1.11 Method SW3520C–Continuous Liquid-Liquid Extraction 7-4
7.1.12 Method SW3540C/SW3541–Soxhlet Extraction 7-4
7.1.13 Method SW3550A–Ultrasonic Extraction 7-4
7.1.14 Method SW5030B–Purge and Trap Method 7-4
7.1.15 Method SW5035–Closed System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples 7-5
7.1.16 Method ASTMD3987–Neutral Leach 7-5
7.2 ANALYTICAL PROCEDURES 7-5
7.2.1 Method SW8011–Ethylene Dibromide 7-7
7.2.2 Method SW8021B–Aromatic Volatile Organics 7-10
7.2.3 Method SW8070A–Nitrosamines 7-14
7.2.4 Method SW8080A-Organochlorine Pesticides and Polychlorinated Biphenyls 7-17
7.2.5 Method SW8081A–Organochlorine Pesticides 7-23
7.2.6 Method SW8082–Polychlorinated Biphenyls (PCBs) 7-27
7.2.7 Method SW8141A–Organophosphorus Pesticides 7-31

TABLE OF CONTENTS

Page

7.2.8 Method SW8150B–Chlorinated Herbicides 7-34
7.2.9 Method SW8151–Chlorinated Herbicides 7-37
7.2.10 Method SW8260B–Volatile Organics 7-40
7.2.11 Method SW8270C–Semivolatile Organics 7-47
7.2.12 Method SW8280A–Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans 7-54
7.2.13 Method SW8290–Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans 7-57
7.2.14 Method SW8310–Polynuclear Aromatic Hydrocarbons 7-59
7.2.15 Method SW8330–Explosive Residues 7-63
7.2.16 Method SW6010B–Trace Elements (Metals) by Inductively Coupled Plasma Emission Spectroscopy for Water and Soil 7-67
7.2.17 Method SW6020–Trace Elements (Metals) by Inductively Coupled Plasma Mass Spectroscopy for Water and Soil 7-71
7.2.18 Method Series SW7000A–Graphite Furnace Atomic Absorption . . 7-75
7.2.19 Method SW7196A-Hexavalent Chromium (Colorimetric) 7-80
7.2.20 Method SW7470A/SW7471A–Mercury Manual Cold-Vapor Technique 7-83
7.2.21 Method SW9012–Total Cyanide and Cyanide Amenable to Chlorination 7-86
7.2.22 Method SW9056 (E300.0)–Common Anions 7-88
7.2.23 Method RSK-175 - Methane, Ethane, and Ethene 7-91
7.2.24 Method SW9060M - Total Organic Carbon in Soil 7-93
7.2.25 Method TO-14-Volatile Organics in Ambient Air 7-97
7.2.26 Method TX1005-Total Petroleum Hydrocarbons 7-101

8.0 DATA REDUCTION, REVIEW, VERIFICATION, REPORTING, VALIDATION, AND RECORDKEEPING 8-1
8.1 DATA REVIEW, VALIDATION, AND REPORTING REQUIREMENTS FOR SCREENING DATA 8-1
8.2 DATA REVIEW, VALIDATION, AND REPORTING REQUIREMENTS FOR DEFINITIVE DATA 8-1
8.3 QUALITY ASSURANCE REPORTS 8-10
8.4 IRPIMS ELECTRONIC DATA REPORTS 8-10
8.5 ARCHIVING 8-10
8.6 PROJECT DATA FLOW AND TRANSFER 8-10
8.7 RECORDKEEPING 8-10
8.8 HARDCOPY DATA REPORTS FOR SCREENING AND DEFINITIVE DATA 8-11

TABLE OF CONTENTS

		Page
9.0	SYSTEMS AND PERFORMANCE AUDITS, PERFORMANCE EVALUATION PROGRAMS, MAGNETIC TAPE AUDITS, AND TRAINING	9-1
9.1	PROJECT AUDITS	9-1
9.1.1	State/Federal Project Audits	9-1
9.1.2	Technical Systems Audits	9-1
9.1.3	Project-Specific Performance Evaluation Audits	9-2
9.1.4	Magnetic Tape Audits	9-3
9.1.5	Performance Evaluation Sample Programs	9-3
9.2	TRAINING	9-3
10.0	PREVENTIVE MAINTENANCE	10-1
10.1	MAINTENANCE RESPONSIBILITIES	10-1
10.2	MAINTENANCE SCHEDULES	10-1
10.3	SPARE PARTS	10-1
10.4	MAINTENANCE RECORDS	10-1
11.0	CORRECTIVE ACTION	11-1
11.1	CORRECTIVE ACTION REPORT	11-1
11.2	CORRECTIVE ACTION SYSTEM	11-1
12.0	QUALITY ASSURANCE REPORTS TO MANAGEMENT	12-1
13.0	REFERENCES	13-1
APPENDIX A	SUPPLEMENTAL APPENDIX IX ANALYTES	A-1

LIST OF TABLES

		Page
Table 1.1	Points of Contact NAS Fort Worth JRB	1-3
Table 2.1	Identification of Solid Waste Management Units at NAS Fort Worth JRB	2-5
Table 2.2	Identification of Areas of Concern at NAS Fort Worth JRB	2-7
Table 4.1	Statistical Calculations	4-3
Table 5.1	Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times	5-1
Table 6.1	Screening Analytical Methods	6-1
Table 6.2	Summary of Calibration and QC Procedures for Screening Methods	6-7
Table 7.1	Extraction and Digestion Procedures	7-1
Table 7.2	Analytical Procedures	7-6
Table 7.3	PQL for Method SW8011	7-7
Table 7.4	QC Acceptance Criteria for Method SW8011	7-7
Table 7.5	Summary of Calibration and QC Procedures for Method SW8011	7-8
Table 7.6	PQLs for Method SW8021B	7-10
Table 7.7	QC Acceptance Criteria for Method SW8021B	7-11
Table 7.8	Summary of Calibration and QC Procedures for Method SW8021B	7-12
Table 7.9	PQLs for Method SW8070A	7-14
Table 7.10	QC Acceptance Criteria for Method SW8070A	7-14
Table 7.11	Summary of Calibration and QC Procedures for Method SW8070A	7-15
Table 7.12	PQLs for Method SW8080A	7-18
Table 7.13	QC Acceptance Criteria for Method SW8080A	7-19

LIST OF TABLES

		Page
Table 7.14	Summary of Calibration and QC Procedures for Method SW8080A	7-20
Table 7.15	PQLs for Method SW8081A	7-23
Table 7.16	QC Acceptance Criteria for Method SW8081A	7-24
Table 7.17	Summary of Calibration and QC Procedures for Method SW8081A	7-25
Table 7.18	PQLs for Method SW8082	7-27
Table 7.19	QC Acceptance Criteria for Method SW8082	7-28
Table 7.20	Summary of Calibration and QC Procedures for Method SW8082	7-29
Table 7.21	PQLs for Method SW8141A	7-31
Table 7.22	QC Acceptance Criteria for Method SW8141A	7-31
Table 7.23	Summary of Calibration and QC Procedures for Method SW8141A	7-32
Table 7.24	PQLs for Method SW8150B	7-34
Table 7.25	QC Acceptance Criteria for Method SW8150B	7-34
Table 7.26	Summary of Calibration and QC Procedures for Method SW8150B	7-35
Table 7.27	PQLs for Method SW8151A	7-37
Table 7.28	QC Acceptance Criteria for Method SW8151A	7-37
Table 7.29	Summary of Calibration and QC Procedures for Method SW8151A	7-38
Table 7.30	PQLs for Method SW8260B	7-41
Table 7.31	QC Acceptance Criteria for Method SW8260B	7-43
Table 7.32	Summary of Calibration and QC Procedures for Method SW8260B	7-45
Table 7.33	PQLs for Method SW8270C	7-48
Table 7.34	QC Acceptance Criteria for Method SW8270C	7-50

LIST OF TABLES

		Page
Table 7.35	Summary of Calibration and QC Procedures for Method SW8270C	7-52
Table 7.36	PQLs for Method SW8280A	7-54
Table 7.37	QC Acceptance Criteria for Method SW8280A	7-54
Table 7.38	Summary of Calibration and QC Procedures for Method SW8280A	7-55
Table 7.39	PQLs for Method SW8290	7-57
Table 7.40	QC Acceptance Criteria for Method SW8290	7-58
Table 7.41	PQLs for Method SW8310	7-59
Table 7.42	QC Acceptance Criteria for Method SW8310	7-60
Table 7.43	Summary of Calibration and QC Procedures for Method SW8310	7-61
Table 7.44	PQLs for Method SW8330	7-63
Table 7.45	QC Acceptance Criteria for Method SW8330	7-64
Table 7.46	Summary of Calibration and QC Procedures for Method SW8330	7-65
Table 7.47	PQLs for Method SW6010B	7-67
Table 7.48	QC Acceptance Criteria for Method SW6010B	7-68
Table 7.49	Summary of Calibration and QC Procedures for Method SW6010B	7-69
Table 7.50	PQLs for Method SW6020	7-71
Table 7.51	QC Acceptance Criteria for Method SW6020	7-72
Table 7.52	Summary of Calibration and QC Procedures for Method SW6020	7-73
Table 7.53	RLs for GFAA Method Series SW7000A	7-75
Table 7.54	QC Acceptance Criteria for Method SW7000A	7-76
Table 7.55	Summary of Calibration and QC Procedures for Method SW7000A	7-77

LIST OF TABLES

		Page
Table 7.56	PQLs for Method SW7196A	7-80
Table 7.57	QC Acceptance Criteria for Method SW7196A	7-80
Table 7.58	Summary of Calibration QC Procedures for Method SW7196A	7-81
Table 7.59	PQLs for Methods SW7470A/SW7471A	7-83
Table 7.60	QC Acceptance Criteria for Methods SW7470A/SW7471A	7-83
Table 7.61	Summary of Calibration and QC Procedures for Methods SW7470A/SW7471A	7-84
Table 7.62	PQL for Method SW9012A	7-86
Table 7.63	QC Acceptance Criteria for Method SW9012A	7-86
Table 7.64	Summary of Calibration and QC Procedures for Method SW9012A	7-87
Table 7.65	PQLs for Method SW9056 (E300.0)	7-88
Table 7.66	QC Acceptance Criteria for Method SW9056 (E300.0)	7-88
Table 7.67	Summary of Calibration and QC Procedures for Method SW9056 (E300.0)	7-89
Table 7.68	PQLs for Method RSK-175	7-91
Table 7.69	QC Acceptance Criteria for Method RSK-175	7-91
Table 7.70	Summary of Calibration and QC for Method RSK-175	7-92
Table 7.71	PQLs for Method SW9060M	7-94
Table 7.72	QC Acceptance Criteria for Method SW9060M	7-94
Table 7.73	Summary of Calibration and QC Procedures for Method SW9060M	7-95
Table 7.74	PQLs for Method TO-14	7-97
Table 7.75	QC Acceptance Criteria for Method TO-14	7-98

LIST OF TABLES

		Page
Table 7.76	Summary of Calibration and QC Procedures for Method TO-14	7-99
Table 7.77	PQLs for Method TX1005	7-101
Table 7.78	Acceptance Criteria for Method TX1005	7-101
Table 7.79	Summary of Calibration and QC Procedures for Method TX1005	7-102
Table 8.1	Data Qualifiers	8-3
Table 8.2	Flagging Conventions for NAS Fort Worth JRB—Minimum Data Evaluation Criteria Specific to Organic Methods	8-4
Table 8.3	Flagging Conventions for NAS Fort Worth JRB—Minimum Data Evaluation Criteria Specific to Inorganic Methods	8-7
Table 8.4	Flagging Conventions for NAS Fort Worth JRB—Minimum Data Evaluation Criteria Specific to General Chemistry	8-9

LIST OF FIGURES

		Page
Figure 2.1	Site Location Map	2-2
Figure 2.2	SWMU/AOC Location Map	2-4

LIST OFACRONYMS AND ABBREVIATIONS

A2LA	American Association of Laboratory Accreditation
AA	atomic absorption
AF	Air Force
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
AFP-4	Air Force Plant 4
AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
BFB	bromofluorobenzene
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, xylenes (total)
CAR	corrective action report
CCB	continuing calibration blank
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chain of custody
COD	coefficient of determination
COR	contracting officer's representative
DAD	diode array detector
DCA	dichloroethane
DCB	dichlorobenzene
DCE	dichloroethyelene
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DERP	Defense Environmental Restoration Program
DL	detection limit
DNT	dinitrotoluene
DOD	Department of Defense
DPDO	Defense Property Disposal Office
DQO	Data Quality Objective
DRMO	Defense Reutilization and Marketing Office
EC	electrical conductivity
EDB	ethylene dibromide
EPA	U.S. Environmental Protection Agency
ERA	Environmental Restoration Account

LIST OFACRONYMS AND ABBREVIATIONS (continued)

ERB	Environmental Restoration BRAC
ERD	Environmental Restoration DERA
ERPIMS	Environmental Restoration Program Information Management System
eV	electron volt
F^-	fluoride
FID	flame-ionization detector
FLAA	flame atomic absorption
FPM	Field Project Manager
FSP	Field Sampling Plan
g	gammas
G	glass
GC	gas chromatography
GC/MS	gas chromatography/mass spectroscopy
GFAA	graphite furnace atomic absorption
HSP	Health and Safety Plan
H_2SO_4	sulfuric acid
Handbook	Handbook for the Installation Restoration Program (IRP) Remedial Investigation and Feasibility Studies (RI/FS), September 1993
HCl	hydrochloric acid
HNO_3	nitric acid
HPLC	high performance liquid chromatography
ICB	initial calibration blank
ICP	inductively coupled plasma
ICPES	inductively coupled plasma emission spectroscopy
ICS	interference check sample
ICV	initial calibration verification
IS	internal standard
IRP	Installation Restoration Program
JRB	Joint Reserve Base
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LTM/LTO	long-term monitoring/long-term operation
MB	method blank
MDL	method detection limit

LIST OFACRONYMS AND ABBREVIATIONS (continued)

MEK	methyl ethyl ketone
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
MQL	method quantitation limit
MQO	measurement quality objective
MS/MSD	matrix spike/matrix spike duplicate
MTBE	methyl *tert*-butyl ether
NAS	Naval Air Station
$Na_2S_2O_3$	sodium thiosulfate
NCP	National Contingency Plan
NDI	nondestructive inspection
NFA	no further action
NIST	National Institute of Standards and Technology
NO_2^-	nitrite
NO_3^-	nitrate
NTV	nephelometric turbidity units
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
OVM	organic vapor monitor
O/W	oil/water
P	polyethylene
PAH	polynuclear aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, comparability, completeness
PA/SI	Preliminary Assessment/Site Investigation
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-*p*-dioxin
PCDF	polychlorinated dibenzofuran
PE	performance evaluation
%R	percent recovery
PID	photoionization detector
PM	project manager
PO_4^{-3}	phosphate
ppb	parts per billion
PPE	personal protective equipment

LIST OFACRONYMS AND ABBREVIATIONS (continued)

ppmv	parts per million (volume)
PQL	practical quantitation limit
PVC	polyvinyl chloride
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
r	correlation coefficient
RCA	Recommendation for Corrective Action
RCRA	Resource Conservation and Recovery Act
RD/RA	remedial design/remedial action
RF	response factor
RFI/CMS	RCRA facility investigation/corrective measures study
RI/FS	remedial investigation/feasibility study
RPD	relative percent difference
RPM	remedial project manager
RSD	relative standard deviation
SAC	Strategic Air Command
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SO_4^{-2}	sulfate
SOP	standard operating procedure
SOW	statement of work
SP	spontaneous potential
SPLP	synthetic precipitation leaching procedure
SQL	sample quantitation limit
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
T	California brass
TCDD	tetrachlorodibenzo-*p*-dioxin
TCE	trichloroethene
TCDF	tetrachlorodibenzofuran
TCLP	Toxicity Characteristic Leaching Procedure
TIC	tentatively-identified compound
TNRCC	Texas Natural Resource Conservation Commission
TOC	total organic carbon
TPH	total petroleum hydrocarbons

LIST OFACRONYMS AND ABBREVIATIONS (continued)

UHP	ultra-high purity
UV	ultraviolet
VOC	volatile organic compound
WP	Work Plan
WSA	Weapons Storage Area

TAB

Section 1

FINAL
2000 BASEWIDE
QUALITY ASSURANCE PROJECT PLAN
NAS FORT WORTH JRB, TEXAS

1.0 INTRODUCTION

This quality assurance project plan (QAPP) presents, in specific terms, the policies, organization, functions, and specific quality assurance (QA) and quality control (QC) requirements associated with analytical data generation and assessment. The requirements of this QAPP are designed to achieve the data quality goals for the following activities to be performed at Naval Air Station (NAS) Fort Worth Joint Reserve Base (JRB): Resource Conservation and Recovery Act (RCRA) facility investigations/corrective measures studies (RFI/CMS), remedial design/remedial action (RD/RA) projects, and long-term monitoring/long-term operations (LTM/LTO). Sampling and analysis protocols and other associated field activities (i.e., standard operating procedures [SOPs] and detailed instructions) will be presented in the site-specific Field Sampling Plans (FSPs) or Sampling and Analysis Plans (SAPs) for each field effort. The United States Environmental Protection Agency (EPA) QA policy requires a written and approved 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 preparing this plan are set out in several EPA and U.S. Air Force guidance documents.

This Basewide QAPP supports the ongoing efforts of the Installation Restoration Program (IRP). The IRP was developed by the U.S. Department of Defense (DOD) in 1981 to investigate hazardous material disposal sites on DOD facilities. NAS Fort Worth JRB integrated the ongoing IRP with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986 SARA); the National Oil and Hazardous Substances Pollution Contingency Plan (NCP); pertinent provisions of the RCRA statutes; Executive Order 12580; the Defense Environmental Restoration Program (DERP); Texas Solid Waste Disposal Act, including the Texas Risk Reduction Rules; and all other applicable or relevant and appropriate federal and state laws and regulations. This Basewide QAPP is based on and supersedes the previous Basewide QAPP (HydroGeoLogic, 1998).

1.1 QAPP OBJECTIVES

This QAPP provides a comprehensive framework for obtaining analytical data of known quality during RFI/CMS, RD/RA and LTO/LTM activities at NAS Fort Worth JRB. The framework provided is necessarily broad and encompassing, due to the wide variety of assessment, design, construction, operation, and monitoring activities to be undertaken.

The objective of this QAPP is to provide guidance for collecting and analyzing environmental samples in a way that produces defensible and technically accurate data, economically. Flexibility is necessary within the QAPP, as procedures appropriate for a large task, such as basewide groundwater monitoring, may not be appropriate or economical for a small task, such as a one-time determination of a single design parameter for a groundwater extraction system. To facilitate remedial actions within the IRP, this QAPP must be flexible to accommodate many different contractors and laboratories while providing for acceptable data quality. This QAPP therefore provides guidance relevant to a "typical" RFI/CMS, RD/RA, or LTO/LTM task, while also providing for modification to this guidance through task-specific Work Plans, FSPs, or SAPs. Where modifications are proposed to this QAPP, they must be submitted, approved by the regulatory agencies, and incorporated separately from any FSP or SAP prior to implementation.

This QAPP is required reading for all staff participating in RFI/CMS, RD/RA, and LTO/LTM projects. It must be referenced in all task-specific plans written to support these projects, and if modifications to the guidance contained in this QAPP are proposed, specific justification for the modifications must be provided.

1.2 ADMINISTRATIVE PROCEDURES

Since this QAPP will cover multiple tasks and be used by multiple contractors, it is imperative that proper communication and documentation procedures be followed. The following discussion addresses procedures that will be followed by all contractors to ensure that appropriate communication and documentation procedures are completed at each step of the RFI/CMS, RD/RA, and LTO/LTM tasks.

1.2.1 Document Control

This QAPP may be revised as necessary when guidelines and regulatory documents are changed, or when additional sampling or methods of analysis are required for RFI/CMS, RD/RA or LTO/LTM tasks. Revisions to the QAPP will be addressed as follows:

- For specific project-required versions, an amendment to this QAPP will be prepared for the project-specific FSP.
- For permanent changes to the QAPP that apply to basewide activities, revisions will be incorporated as an addendum to this QAPP after agency consensus.

All contractors who might be affected by such revisions will be included in the review process. This inter-contractor coordination will ensure continued comparability of data produced. On completion of the review process, it is the responsibility of each contractor to ensure that all its subcontracted laboratories receive and understand the requirements of this QAPP and any subsequent final revisions.

Table 1.1 lists stakeholders in the project who must be kept apprised of the future revisions and addenda to the QAPP. At the direction of the stakeholders, the contractors to whom the requirements of this QAPP are relevant will be provided with a controlled copy. Initial

assignments and future distribution of the approved revisions or addenda will be noted on the table to ensure that all QAPP holders receive the distributed materials.

Table 1.1
Points of Contact NAS Fort Worth, JRB

Name	Affiliation
Don Ficklen	AFCEE/ERD
Michael Dodyk	AFCEE/ERD
Charles Pringle	AFCEE/ERB
Rafael Vazquez	AFBCA
Alvin Brown	AFBCA
Ray Risner	TNRCC
Tim Sewell	TNRCC, Region 4
Gary Miller	EPA, Region VI

1.2.2 Communications

It is the responsibility of the contractor in charge of a task to ensure that appropriate documentation of internal communications takes place. Methods of documenting internal communications may include phone logs, e-mail, or memoranda.

Because multiple contractors will be working at NAS Fort Worth JRB, there may be interdependency among various tasks. Any issues that could potentially affect other tasks, and therefore, the work of other contractors, must be communicated to all contractors. The primary method of communication will be written, either through memoranda or confirmation notices. All phone conversations resulting in the resolution of issues will be documented with either a memorandum or a confirmation notice.

1.3 QAPP ORGANIZATION

Section 2.0 of the QAPP provides a description of the site and a site history. The program organization and responsibilities are summarized in Section 3.0. Data quality objectives and measurement quality objectives are discussed in Section 4.0. Sampling procedures are summarized in Section 5.0 and screening analytical methods are presented in Section 6.0. Section 7.0 discusses definitive analytical methods. Section 8.0 describes data reduction, verification, and reporting. System and performance audits are addressed in Section 9.0. Preventive maintenance activities are summarized in Section 10.0. Section 11.0 provides a description of the corrective actions. Quality assurance reports are described in Section 12.0. The document references applicable to this QAPP are provided in Section 13.0.

The final version of the current NAS Fort Worth JRB Basewide QAPP and any addenda will be followed for all data quality objectives (DQOs), measurement quality objectives (MQOs), and QC requirements for sampling and analytical activities related to site closure during RFI/CMS, RD/RA and LTO/LTM activities at NAS Fort Worth JRB.

TAB

Section-2

2.0 SITE DESCRIPTION AND HISTORY

As part of a continuation of environmental investigation work initiated at NAS Fort Worth JRB in 1983, the United States Air Force will be conducting RFI/CMS and RD/RA efforts and LTO/LTM of the actions taken. This QAPP describes data quality processes to be used as part of these programs being conducted at NAS Fort Worth JRB. The RFI/CMS and RD/RA efforts include detailed definition of the area for which remedial action is being taken and the evaluation of bench/pilot scale treatment technologies for remediation. Demonstration of compliance with action-specific applicable or relevant and appropriate requirements (ARARs), demonstration of progress toward remediation, and the LTM/LTO efforts provide data for maintaining regulatory compliance at NAS Fort Worth JRB.

2.1 SITE HISTORY

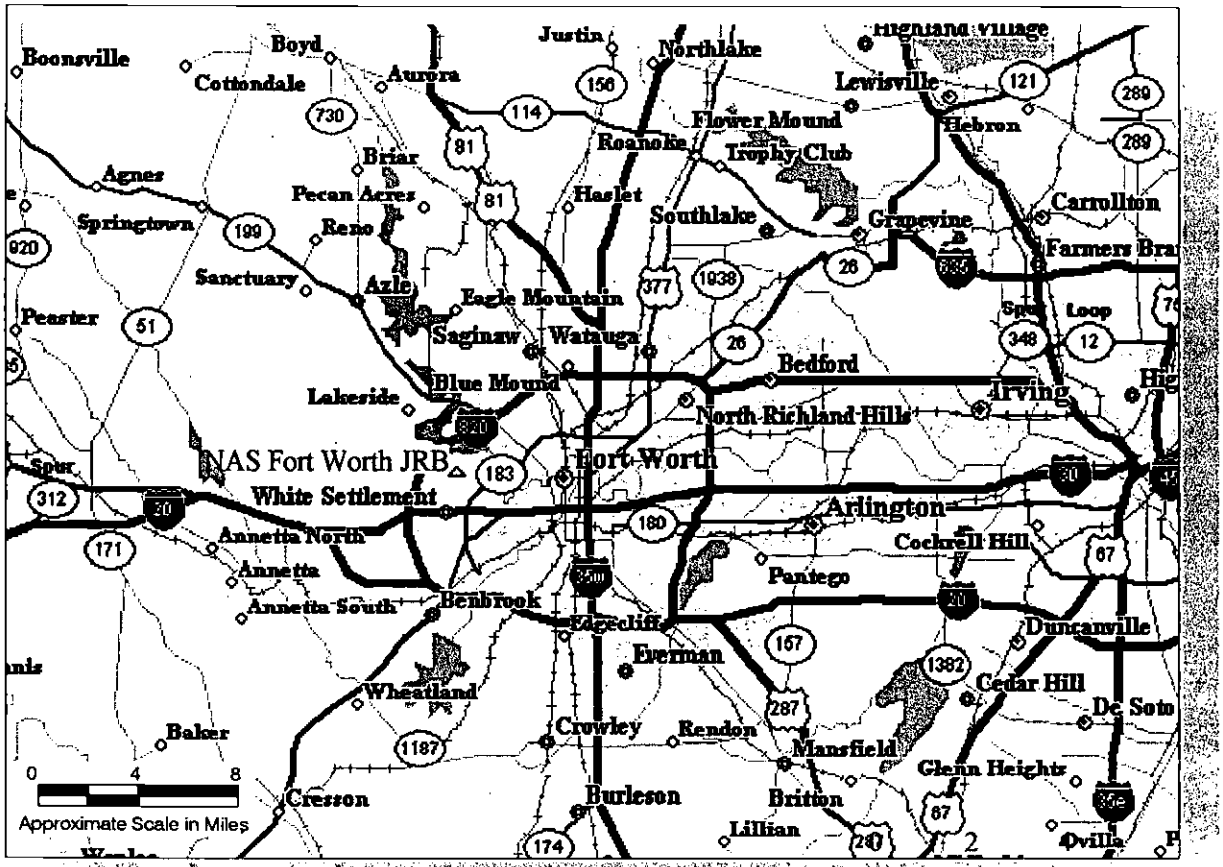
NAS Forth Worth JRB is located on 2,555 acres of land in Tarrant County, Texas, 8 miles west of Fort Worth (Figure 2.1). It lies between the communities of White Settlement and River Oaks, within a bend of the West Fork of the Trinity River that flows along the northern part of the eastern boundary of the base. The river is dammed to form Lake Worth, a drinking water supply and recreation reservoir bordering NAS Forth Worth JRB to the north. To the west, NAS Forth Worth JRB is neighbored by Air Force Plant 4 (AFP-4) and by the community of White Settlement. Lockheed Martin operates AFP-4 for the Air Force. It is an aircraft production plant that shares the runway and several facilities. The base is bordered on the east by the communities of River Oaks, Westworth Village, and other urban areas.

Two offsite facilities are part of the base: the Instrument Landing System Marker Beacon and the Weapons Storage Area (WSA), both located west of the town of White Settlement.

Prior to 1941, the area that is now occupied by NAS Fort Worth JRB consisted of woods and pasture in an area called White Settlement. In August 1942, the base was opened as Tarrant Field Airdrome. The original mission was to train pilots to fly the new B-24 Liberator, which was being constructed across the runway by the Consolidated Aircraft Corporation.

Construction at the airfield continued into 1943, extending the runway and taxiways, and erecting hangars and additional facilities. In May 1943, the field was redesignated as Fort Worth Army Air Field. The training mission continued, and in January, 1945, the Forth Worth Army Air Field began to operate a transition school for the B-32 aircraft, which, like the B-24, was manufactured across the runway. The 7th Bombardment Group and associated B-29 aircraft were assigned to the Fort Worth Army Air Field in October 1946.

The facility was taken under the command of the Strategic Air Command (SAC) in 1946 and named Carswell Air Force Base (AFB) in 1948. The SAC mission remained at Carswell AFB until 1992 when the Air Combat Command assumed control of the base. In October, 1994, the U.S. Navy assumed responsibility for the facility and the name was changed from Carswell AFB to NAS Fort Worth JRB. With the transfer of property at NAS Fort Worth JRB from the U.S. Air Force to the U.S. Navy, many of the street names were changed. Under present operations, training to execute directed tactical fighter missions is provided by the 301st Fighter Wing.



Filename: X:\AFC001\26\26jc\Report\Fig2-1.apr
Project: AFC001-26JC
Created: 07/19/98 cfarmer
Revised: 02/29/00 cf
Map Source: ProCD

HYDRO GeoLogic

N

Figure 2.1

Site Location Map
NAS Fort Worth JRB, Texas

The principal activities on the base have been maintaining and servicing bombers, fuel tankers, and fighter jet aircraft. Many of the activities have been in conjunction with AFP-4 that has been successively operated by Consolidated Aircraft Corporation, Consolidated Vultec Corporation, General Dynamics Corporation, and, most recently, Lockheed Martin. Servicing and maintenance of the engines and equipment of the multi-engine B-52 (eight engines) and the KC-135 (four engines) aircraft generated the majority of waste liquids at former Carswell AFB.

2.2 SUMMARY OF WASTE HANDLED

On February 7, 1991, the former Carswell AFB (NAS Fort Worth JRB), was issued a RCRA hazardous waste permit (HW-50289) by the TNRCC. This permit requires an RFI of all Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) listed in Permit Provision VIII, as well as those SWMUs and AOCs subsequently added to the list, in order to determine whether any of the hazardous constituents listed in 40 Code of Federal Regulation (CFR) Part 264, Appendix IX, have been released into the environment. Sixty-eight SWMUs and 19 AOCs have been identified at NAS Fort Worth JRB. A list of SWMUs is presented in Table 2.1; Table 2.2 lists the AOCs. Those SWMUs and AOCs which have been closed under RCRA are designated for no further action (NFA). The locations of these SWMUs and AOCs are shown on Figure 2.2. Since 1942, most hazardous wastes generated through operations and activities at former Carswell AFB have been disposed of in landfills, reused on base, or processed through the Defense Property Disposal Office (DPDO) for off-base recycling or disposal.

Most of the liquid waste generated by the industrial operations can be categorized as waste oils, recoverable fuels, and spent solvents and cleaners. Waste oils generally refer to lubricating fluids, such as crankcase oils and synthetic turbine oils. Hydraulic fluids have also been included in this category. Recoverable fuels refer to fuels drained from aircraft tanks and vehicles, such as JP-4 and MOGAS (unleaded gasoline). Spent solvents and cleaners refer to liquids used for degreasing and general cleaning of aircraft, aircraft systems, electronic components, and vehicles. This category includes PD-680 (a petroleum naphtha product) and various chlorinated organic compounds, such as carbon tetrachloride, trichloroethene (TCE), and 1,1,1-trichloroethane.

Specific types of solvents in use by the Air Force have changed over the years. In the 1950s, carbon tetrachloride was in common use; its was replaced by TCE in about 1960. Since then, TCE and 1,1,1-trichloroethane have been commonly used; however, TCE usage has decreased in favor of 1,1,1-trichloroethane. Today, PD-680 Type II, 1,1,1-trichloroethane, and, to a limited extent, TCE are in common use.

Waste paint solvents or thinners and strippers are generated by corrosion control activities. Typical thinners include isobutyl acetate, toluene, methyl ethyl ketone (MEK), isopropanol, naphtha, and xylenes. Paint strippers generally contain such compounds as methylene chloride, toluene, ammonium hydroxide, and phenolics.

This page was intentionally left blank

Areas of Concern (AOC)

1 Former Base Service Station/ Former Base Gas Station
2 Airfield Groundwater (Basewide Coverage)
4 Fuel Hydrant System
5 Grounds Maintenance Yard
6 RV Storage Area
7 Former Base Refueling Area
8 Aerospace Museum
9 Golf Course Maintenance Yard
10 O/W Separator
11 O/W Separator
12 O/W Separator
13 O/W Separator
14 Unnamed Stream
15 Storage Shed
16 Family Camp
17 Suspected Former Landfill
18 Suspected Former Fire Training Area A
19 Suspected Former Fire Training Area B

Solid Waste Management Units (SWMU)

5 Building 1626 Waste Accumulation Area
6 Building 1628 Wash Rack and Drain
7 Building 1628 Oil/Water Separator
8 Building 1628 Sludge Collection Tank
11 Building 1617 Waste Accumulation Area
12 Building 1619 Waste Accumulation Area
13 Building 1710 Visual Information Center Work Station Waste Accumulation Areas
16 Building 1060 Waste Accumulation Area
17 Landfill No.7
19 Fire Training Area No.2
20 Waste Fuel Storage Tank
21 Waste Oil Tank
22 Landfill No.4
23 Landfill No.5
24 Waste Burial Area
25 Landfill No.8
26 Landfill No.3
27 Landfill No.10
28 Landfill No.1
29 Landfill No.2
30 Landfill No.9
31 Building 1050 Waste Accumulation Area
32 Building 1410 Waste Accumulation Area
33 Building 1420 Waste Accumulation Area
34 Building 1194 Waste Accumulation Area
35 Vehicle Refueling Shop (Building 1194) Oil/Water Separation System
36 Building 1191 Waste Accumulation Area
37 Vehicle Maintenance Shop (Building 1191) Oil/Water Separation System
39 Building 1643 Waste Accumulation Area
40 Building 1643 Oil/Water Separation System
41 Building 1414 Oil/Water Separation System, Field Maintenance Squadron Aerospace Ground Equipment
42 Building 1414 Waste Accumulation Area
44 Building 1027 Oil/Water Separation System at the Aircraft Washing Hangar
45 Building 1027 Waste Oil Tank Vault at the Aircraft Washing Hangar
47 Building 1015 Jet Engine Test Cell Oil/Water Separator
49 Aircraft Washing Area No.1
50 Aircraft Washing Area No.2
51 Building 1190 Central Waste Holding Area
52 Building 1190 Oil/Water Separation System
53 Storm Water Drainage System
54 Storm Water Interceptors
55 East Gate Oil/Water Separator
61 Building 1320 Power Production Maintenance Facility Waste Accumulation Area
62 Landfill No.6
64 French Underdrain System
66 Sanitary Sewer System (Basewide Coverage)
67 Building 1340 Oil/Water Separator
68 POL Tank Farm

Figure 2.2

SWMU/AOC Location Map

U.S. Air Force Center
for Environmental Excellence
Brooks AFB, Texas

Legend

- - - - NAS Fort Worth JRB (Carswell Field)

——— Former Carswell Air Force Base

1 Area of Concern (AOC)

68 Solid Waste Management Unit (SWMU)

N

500 0 500 1000 1500

SCALE IN FEET

Filename: X:\AFC001\26\26jc\Report\ SWMU_AOC_loc(2.2).apr
Project: AFC001-26JC
Revised: 02/29/00 cf
Map Source: Jacobs, 1996

HYDRO GeoLogic INC.

Table 2.1
Solid Waste Management Units at NAS Fort Worth JRB, Texas

SWMU	Description	OPR
1	Pathological Waste Incinerator (NFA)	BRAC
2	Pathological Waste Storage Shed (NFA)	BRAC
3	Metal Cans (NFA)	BRAC
4	Facility Dumpsters (NFA)	BRAC
5	Building 1627 Waste Accumulation Area for Building 1628	ERA
6	Building 1628 Wash Rack and Drain	ERA
7	Building 1628 Oil/Water Separator	ERA
8	Building 1628 Sludge Collection Tank	ERA
9	Building 1628 Work Station Waste Accumulation Area (NFA)	ERA
10	Building 1617 Work Station Waste Accumulation Area (NFA)	ERA
11	Building 1618 Waste Accumulation Area for Buildings 1617 and 1619	ERA
12	Building 1602 Former Waste Accumulation Area	ERA
13	Building 1710 Visual Information Center Work Station Former Waste Accumulation Areas (NFA)	ERA
14	Building 1060 Bead Blaster Collection Tray (NFA)	ERA
15	Building 1060 Paint Booth Vault (NFA)	ERA
16	Building 1059 Waste Accumulation Area	ERA
17	Landfill No.7	ERA
18	Fire Training Area No.1 (NFA)	BRAC
19	Fire Training Area No.2	BRAC/ERA
20	Waste Fuel Storage Tank	BRAC/ERA
21	Waste Oil Tank	BRAC/ERA
22	Landfill No.4	BRAC
23	Landfill No.5	BRAC
24	Waste Burial Area	BRAC
25	Landfill No.8	BRAC/ERA
26	Landfill No.3	ERA
27	Landfill No.10	ERA
28	Landfill No.1	ERA
29	Landfill No.2	ERA
30	Landfill No.9	ERA
31	Building 1050 Former Waste Accumulation Area	ERA
32	Building 1415 Waste Accumulation Area for Building 1410	ERA
33	Building 1436 Waste Accumulation Area for Building 1420	ERA
34	Building 1194 Former Waste Accumulation Area	ERA
35	Vehicle Refueling Shop (Building 1194) Oil/Water Separation System	ERA
36	Building 1191 Former Waste Accumulation Area	ERA
37	Vehicle Maintenance Shop (Building 1191) Oil/Water Separation System	ERA
38	Building 1269 Polychlorinated Biphenyl Transformers Building (NFA)	BRAC

Table 2.1 (continued)
Solid Waste Management Units at NAS Fort Worth JRB

SWMU	Description	OPR
39	Building 1643 Former Waste Accumulation Area	ERA
40	Building 1643 Oil/Water Separation System	ERA
41	Building 1414 Oil/Water Separation System, Field Maintenance Squadron Aerospace Ground Equipment	ERA
42	Building 1414 Former Waste Accumulation Area	ERA
43	Building 1414 Non Destructive Inspection Waste Accumulation Point (NFA)	ERA
44	Building 1027 Oil/Water Separation System at the Aircraft Washing Hangar	ERA
45	Building 1027 Waste Oil Tank Vault at the Aircraft Washing Hangar	ERA
46	Building 1027 Waste Accumulation Area (NFA)	ERA
47	Building 1015 Jet Engine Test Cell Oil/Water Separator	ERA
48	Building 1048 Fuel Systems Shop Floor Drains (NFA)	ERA
49	Aircraft Washing Area No.1	ERA
50	Aircraft Washing Area No.2	ERA
51	Central Waste Holding Area/Waste Accumulation Areas 1187 and 1189	ERA
52	Building 1190 Oil/Water Separation System	ERA
53	Storm Water Drainage System	ERA
54	Storm Water Interceptors	ERA
55	East Gate Oil/Water Separator	ERA
56	Building 1405 Waste Accumulation Area (NFA)	ERA
57	Buildings 1432/1434 Waste Accumulation Area (NFA)	ERA
58	Pesticide Rinse Area	BRAC
59	Building 8503 Weapons Storage Area Waste Accumulation Area	BRAC
60	Building 8503 Radioactive Waste Burial Site	BRAC
61	Building 1319 Waste Accumulation Area for Building 1320	ERA
62	Landfill No.6	ERA
63	Entomology Dry Well (NFA)	ERA
64	French Underdrain System	ERA
65	Weapons Storage Area Disposal Site (NFA)	BRAC
66	Sanitary Sewer System	BRAC/ERA
67	Building 1340 Oil/Water Separator	ERA
68	POL Tank Farm	ERA

Notes:
OPR - Office of Primary Responsibility
BRAC - Base Realignment and Closure
ERA - Environmental Restoration Account
NFA - No further action
POL - Petroleum, oil, and lubricant

Table 2.2
Areas of Concern at NAS Fort Worth JRB

AOC	Description	OPR
1	Former Base Service Station/ former Base Gas Station	BRAC/ERA
2	Airfield Groundwater	ERA
3	Waste Oil Dump (NFA)	ERA
4	Fuel Hydrant System	ERA
5	Grounds Maintenance Yard	BRAC
6	RV Storage Area	ERA
7	Former Base Refueling Area	ERA
8	Aerospace Museum	BRAC
9	Golf Course Maintenance Yard	BRAC
10	Oil/Water Separator	ERA
11	Oil/Water Separator	ERA
12	Oil/Water Separator	ERA
13	Oil/Water Separator	ERA
14	Unnamed Stream	BRAC
15	Storage Shed Building 1190	ERA
16	Family Camp	BRAC
17	Suspected Former Landfill	ERA
18	Suspected Former Fire Training Area A	ERA
19	Suspected Former Fire Training Area B	ERA

Notes:
OPR - Office of Primary Responsibility
BRAC - Base Realignment and Closure
ERA - Environmental Restoration Account
NFA - No further action

TAB

Section 3

3.0 PROGRAM ORGANIZATION AND RESPONSIBILITIES

This basewide QAPP defines the program responsibilities for the signatory agencies. These agencies will work cooperatively to direct the NAS Fort Worth JRB IRP. This includes decisions related to priorities for site investigations and cleanup, as well as procedures and standards to be followed in accomplishing program activities and establishing project milestones and goals.

The efforts required to implement the IRP at NAS Fort Worth JRB are directed and funded by the Air Force. The Air Force is assisted in this effort by several contractors, subcontractors, and consultants. In this section, responsibilities are defined for each of the key personnel or functional areas of the agencies signing this QAPP.

3.1 AIR FORCE, U.S. ENVIRONMENTAL PROTECTION AGENCY, AND TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Each of the following agencies working with or under the QAPP have assigned a remedial project manager (RPM) to serve as the spokesperson for their respective organizations in managing or overseeing environmental restoration work at NAS Fort Worth JRB:

- AFCEE/ERD
- EPA, Region VI
- TNRCC

3.2 CONTRACTOR PROJECT ORGANIZATION

A contractor's RFI/CMS, RD/RA, or LTO/LTM project team generally will include technical professionals with experience in project management, quality assurance, analytical chemistry, field investigations, data management, and other technical and engineering disciplines. Contractors may use different organizational structures and titles for particular positions. The following examples of personnel and associated responsibilities will generally be used, but the project team should be selected based on the effort. The assignment of tasks to specific roles or titles within a contractors' organization should be detailed within the scoping documents prepared for the specific sites or activities.

- A project manager will be responsible for the contractual aspects of the project work and ensuring that appropriate staff and resources are assigned to the project. In this role, a project manager will ensure that technical activities and reports receive appropriate planning and oversight to meet or exceed the quality and timeliness of data required by the project. A project manager will also have primary responsibility for decision-making and communication with the AFCEE contracting officer's representative (COR).

- A Program Manager, along with a project manager, may be responsible for the technical and financial management of a specific project.

- A Field Investigation Task Manager will be responsible for directing field work; ensuring the field staff has adequate training in both field sampling and measurement procedures and in health and safety procedures; reporting the status of field activity to project management and the Air Force; and directing subcontractors. A field coordinator will have overall responsibility for implementing the field sampling plan and communicating any difficulties encountered. Field coordinators will also have the authority to stop work if safety or data quality will be significantly affected by site operations.

- An Analytical Chemistry Task Manager will have overall responsibility for ensuring that the planning, implementation, and reporting for the analytical program fulfill the objectives for data use. Duties of this position include laboratory selection and management; QAPP development; data evaluation/qualification; audit performance; corrective action implementation; database information flow; and identification and communication of problems that affect data quality and project schedule to the NAS Fort Worth JRB Quality Assurance Officer.

- A Database Manager will be responsible for maintaining the project-specific database, reporting results in required formats to the Air Force and data users, and ensuring the integrity of the project-specific database. This position also will be responsible for establishing and testing electronic formats to ensure that these formats are compatible with the project database.

- A Contractor Performance Assurance Manager will have overall responsibility to independently ensure that the planning, implementation, and reporting for RFI/CMS, RD/RA, or LTO/LTM activities fulfill the objectives for data use. The Performance Assurance Manager will have reporting responsibility outside the project organization to ensure independence in decision-making and the recommendations for corrective actions. The Performance Assurance Manager will be responsible for ensuring that needed corrective actions are implemented.

- A Health and Safety (H&S) Coordinator will be responsible for writing and enforcing the H&S plan for each specific project.

The other primary project staff members include technical professionals with expertise in risk assessment, chemistry, geology, hydrology, treatability studies, and remedial engineering. These individuals will be responsible for internal communication and task planning to ensure that all data obtained will be used for the intended purpose, and to provide the direction and supervision needed to ensure that technically sound decisions will be made within their area of expertise.

3.3 LABORATORIES

The laboratories used for individual projects will be chosen by the contractor tasked with that investigation. All laboratories used will meet audit requirements and frequencies as described in Section 9.0.

Notice to QAPP Users and Reviewers: As described in the QAPP objectives (Section 1.1), this QAPP is designed to be flexible. An attempt is made to identify the most commonly used laboratory methods and associated QA/QC procedures, acceptance limits, and corrective actions. However, during the life of the project, there may be a need to perform specialized tests that may not be covered under the basic QAPP. It is also possible that an analytical laboratory's internal procedures may be somewhat different from those specified in this QAPP. For these reasons, variances in the procedures and criteria may be necessary from time to time, depending on the objectives of the specific projects or the laboratory's procedures. Note that the data quality objectives for the specific projects still must be met; therefore, variances would, in no circumstance, produce data of a quality less than that desired. When the field investigations are defined and the FSP are prepared, the basic QAPP will be evaluated for adequacy for the proposed investigation. Any gaps and variances will be documented in an approved addendum to the QAPP.

TAB

Section 4

4.0 QUALITY PROGRAM AND 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 each project are specified in the FSP.

4.1 DATA CATEGORIES

The two general categories of data used by the AFCEE are defined as: (1) screening data and (2) 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, conductance) have been designated by definition as screening methods (see Section 6).

Screening methods shall be confirmed, as required in the FSP, by analyses that generate definitive data. Confirmation samples shall be selected to include both detected and nondetected results from the screening method.

Definitive data are generated using rigorous analytical methods (see Section 7), such as approved EPA reference methods. The data can be generated in a mobile or offsite laboratory. Data are analyte-specific, and both identification and quantitation are confirmed. These methods have standardized QC and documentation requirements (see Sections 7 and 8). 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 and 7.

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 laboratory control samples (LCS) to determine the precision of an analytical method. If the recoveries of analytes in an 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. It 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 duplicate matrix spiked samples shall be analyzed to assess field and analytical precision, and the precision measurement is determined using the relative percent difference (RPD) between duplicate sample results. The formula for the calculation of precision is provided in Table 4.1 as RPD. For replicate analyses, the relative standard deviation (RSD) is determined. The formula for the calculation of RSD is provided in Table 4.1.

4.2.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and system 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 organic compounds analyzed by gas chromatography (GC), surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed. Analysis of performance evaluation (PE) samples shall 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 4.1 as percent recovery (%R) from pure and sample matrices.

4.2.3 Representativeness

Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Representativeness shall be achieved through use of standardized 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 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 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 results that could not be reported for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, etc.), the number of desired results not reported is included in the number of all possible results.

The formula for calculation of completeness is presented below:

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

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 standardized 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 shall support the assessment of comparability. Analysis of PE samples and reports from audits shall also be used to provide additional information for assessing the comparability of analytical data produced among subcontracting laboratories. Historical comparability shall be achieved through consistent use of methods and documentation procedures throughout the project.

Table 4.1
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	$(s/\bar{x})$ x 100	Relative standard deviation, adjusts for magnitude of observations	Used to assess precision for replicate results
Percent Difference	%D	$\frac{x_1 - x_2}{x_1}$ x 100	Measure of the difference of 2 observations	Used to assess accuracy

Table 4.1 (continued)
Statistical Calculations

Statistic	Symbol	Formula	Definition	Uses
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	$\left(\frac{x_{meas}}{x_{true}}\right) \times 100$	Recovery of spiked compound in pure matrix	Used to assess accuracy
Percent Recovery	%R	$\left(\frac{\text{value of spiked sample} - \text{value of unspiked sample}}{\text{value of added spike}}\right) \times 100$	Recovery of spiked compound in sample matrix	Used to assess matrix effects and total precision
Correlation Coefficient	r	see SW8000B Section 7.5.2	see SW8000B Section 7.5.2	Evaluation of "goodness of fit" of a regression line
Coefficient of Determination	COD	see SW8000B Section 7.5.3	see SW8000B Section 7.5.3	Evaluation of "goodness of fit" of a polynomial equation

x = Observation (concentration)
n = Number of observations

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 shall establish method- and matrix-specific MDLs for each analyte the laboratory plans to report for the project. The laboratory shall re-establish these MDLs at least once per twelve month basis. The laboratory shall 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. The laboratory will submit the applicable MDLs for each instrument to be used on the project. For each method, matrix, and analyte, only the least sensitive instrument MDL will be used for reporting purposes. MDLs are adjusted on a sample-specific basis to account for such factors as percent moisture, subsample size, and dilution. Analyte results less than the sample-specific MDL shall be reported at the sample-specific practical quantitation limit (PQL) value and flagged with a "U" (see Section 8).

Laboratories participating in this work effort shall 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) Estimate the MDL using one of the following:

a) the concentration value that corresponds to an instrument signal/noise ratio within the range of 2.5 to 5.0, or

b) the concentration equivalent three times the standard deviation of replicate measurement of the analyte in reagent water, or

c) 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 containing the analyte of interest at a concentration three to five times the estimated MDL. The water matrix MDLs will be determined using ASTM Type II water. Ottawa sand will be used for soil methods (Teflon® boiling chips or glass beads may be substituted for Ottawa sand for metals analyses). Perform the following statistical manipulations on the result to determine analyte MDLs:

(a) Determine the variance (S^2) for each analyte as follows:

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

where x_i = the ith measurement of the variable x and $\bar{x}$ = the average value of x

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

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

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

(c) 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 PQL is the lowest reasonably achievable level of an analyte that can be quantified within specified limits of precision and accuracy during routine laboratory operating conditions. The laboratories participating in this work effort shall compare the results of the MDL demonstrations to the PQLs for each method that is listed in Section 7. All MDLs shall be lower than the relevant PQLs. The laboratories shall also verify PQLs by including a standard at or below the PQL as the lowest point on the calibration curve. PQLs are modified for sample-specific factors in the same manner as MDLs. All analyte detections at or above sample-specific MDL values will be reported; however, for those results falling between the sample-specific MDL and the sample-specific PQL, an F-qualifier shall be applied to the results indicating the variability associated with the result (see Section 8).

4.3.3 TNRCC Guidance on Detection and Quantitation Limits

In July 1998, the TNRCC issued an Interoffice Consistency Memorandum (TNRCC, 1998a), followed in September 1998 by an Erratum Sheet (TNRCC, 1998b). The Consistency Memorandum defined a method quantitation limit (MQL) as the demonstrated lower limit of the linear range for an analyte. As defined, an analyte's MQL is analogous to an analyte PQL reported by the laboratory without adjustment for sample-specific conditions. The Erratum Sheet also defined an analyte sample quantitation limit (SQL) as an analyte MDL adjusted for sample-specific conditions.

4.3.4 Instrument Calibration

Analytical instruments shall be calibrated in accordance with the analytical methods. All analytes reported shall be present in the initial and continuing calibration standards and these calibrations must meet the acceptance criteria specified in Section 7. Records of standard preparation and instrument calibration shall be maintained. Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards shall be traceable to standard materials.

Instrument calibration shall be checked using all of the analytes listed in the QC acceptance criteria table in Section 7 for the method. This applies equally to multi-component analytes (except as specified in Section 7). All calibration criteria shall satisfy SW-846 requirements at a minimum. Initial calibrations shall be checked at the frequency specified in each method using materials prepared independently of the calibration standards. Multipoint calibrations shall contain the minimum number of calibration points specified in the method with all points used for the calibration being contiguous. If more than the minimum number of standards is analyzed for the initial calibration, all the standards analyzed shall be included in the initial calibration. The only exception to this rule is that a standard that has been statistically determined as being an outlier can be dropped from the calibration, providing the requirement for the minimum number of standards is met. Acceptance criteria for method calibration checks are presented in Section 7.

Analyte concentrations are determined with either calibration curves or response factors (RFs). When using RFs to determine analyte concentrations for GC and gas chromatography/mass spectroscopy (GC/MS) methods, the average RF from an initial five point calibration shall be used. Continuing calibration verification results shall not be used to update the RFs from the initial five point calibration.

4.4 ELEMENTS OF QUALITY CONTROL

This section presents QC elements relevant to analysis of environmental samples that shall be followed during all analytical activities for fixed-base, mobile, and field laboratories producing definitive data. Some of these elements are also applicable to screening analytical methods (see Section 6). 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) shall 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 spike (MS) samples and matrix spike duplicate (MSD) samples 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) and analyzed sequentially. The identity of each AFCEE analytical batch shall 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.

4.4.1 Laboratory Control Samples

LCSs are composed of ASTM Type II analyte-free water (for aqueous analyses) or Ottawa sand (for soil analyses) spiked with known concentrations of all analytes listed in the QC acceptance criteria table for each method in (see Section 7). Teflon® boiling chips or glass beads may be substituted for Ottawa sand for metals LCS tests. Each LCS shall be carried through the complete sample preparation and analysis procedure.

LCSs are used to evaluate each AFCEE analytical batch and to determine if the method is in control.

One LCS shall be included in every AFCEE analytical batch.

The performance of an LCS is evaluated against the method QC acceptance limits listed in the tables in Section 7.

Whenever an analyte in an LCS is outside the acceptance limit, corrective action shall be performed. After the system problems have been resolved and system control has been reestablished, all samples in the AFCEE analytical batch shall 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 and 8, shall be applied to all associated results. In cases where errors in the analysis, such as improper sample injection, are observed by the analyst or are supported by instrument data, the LCS, not the analytical batch, shall be reanalyzed.

4.4.2 Matrix Spike/Matrix Spike Duplicate

An MS/MSD pair consists of duplicate aliquots of an environmental sample spiked with known concentrations of all analytes listed in the QC acceptance criteria table in Section 7 for each method. The spiking occurs prior to sample preparation and analysis. Only AFCEE samples shall be used for spiking. MS/MSDs shall be designated on the chains-of-custody.

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

The frequency of collection for MS/MSDs will be specified in project-specific FSPs. A minimum of one MS and one MSD sample shall be analyzed for each 20 samples from each site and matrix.

The performance of MSs and MSDs is evaluated against the QC acceptance limits given in the tables in Section 7. If either an MS or MSD is outside the QC acceptance limits, the analytes in the unspiked sample aliquot (the "parent" sample) shall be qualified according to the data flagging criteria in Sections 7 and 8. Following the data validation process, the results of all MS/MSDs from a sampling event will be evaluated to determine whether any MS/MSD discrepancies are simple outliers or are indicative of more pervasive matrix effects.

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 shall be added to environmental samples, controls, and blanks, in accordance with method requirements.

Whenever a surrogate recovery is outside the acceptance limit, corrective action must be performed. After system problems have been resolved and system control has been reestablished, The affected sample will be reprepared and reanalyzed. The sample is reanalyzed once, and if the failed surrogate(s) is in control, the original failure will be attributed to a faulty analysis, and the reanalyzed results for the sample will be accepted. If corrective actions are not performed or are

ineffective, the appropriate validation qualifier, as described in Sections 7 and 8, shall be applied to the sample results. In situations where there is objective evidence of matrix interference (e.g., earlier analyses, co-eluting compounds shown on chromatograms, or evidence of interfering compounds indicated in other method results), a Non-conformance Memo will be initiated by the laboratory to document the situation, and a decision will be made in consultation with the laboratory, the prime contractor, and, if needed, AFCEE.

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 IS quantitation methods to correct sample results affected by column injection losses, purging losses, or viscosity effects. ISs shall be added to environmental samples, controls, and blanks, in accordance with method requirements.

When IS results are outside of the acceptance limits, corrective actions shall be performed. After system problems have been resolved and system control has been reestablished, all samples with IS results out of control shall be reanalyzed. If corrective actions are not performed or are ineffective, the appropriate validation qualifier, as described in Sections 7 and 8, shall be applied to the associated 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 8000B.

When a compound retention time is outside of the acceptance limits, corrective action shall be performed. After system problems have been resolved and system control has been reestablished, all samples analyzed since the last acceptable retention time check should be reanalyzed. If corrective actions are not performed, the appropriate validation qualifier, as described in Sections 7 and 8, shall be applied to the sample results.

4.4.6 Interference Check Sample

Interference check samples (ICSs), used in inductively coupled plasma (ICP) metals analyses only, contain both interfering and analyte elements of known concentrations. ICSs are used to verify instrument background and interelement correction factors. An ICS is run at the beginning and end of each run sequence.

When ICS results are outside of the acceptance limits stated in the method, corrective action shall be performed. After system problems have been resolved and system control has been reestablished, reanalyze the ICS. If the ICS result is acceptable, all affected samples should be reanalyzed. If corrective action is not performed or the corrective action was ineffective, the appropriate validation qualifier, as described in Sections 7 and 8, shall be applied to all associated results.

4.4.7 Method Blank

A method blank is an analyte-free matrix (the same material used for method LCSs) to which all reagents are added in the same volumes or proportions as are used in sample processing. Method blanks shall be carried through the complete sample preparation and analytical procedure. Method blanks are used to document potential contamination resulting from the laboratory preparation and analysis process and shall 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 shall 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 shall be reprepared and reanalyzed. No analytical data shall be corrected for the presence of analytes in blanks. When an analyte is detected in a method blank and in associated samples, and corrective actions are not performed or are ineffective, the appropriate validation qualifier, as described in Sections 7 and 8, shall be applied to the sample results.

4.4.8 Ambient Blank

Ambient blanks consist of ASTM Type II reagent grade water poured into volatile organic compound (VOC) sample vials at a sampling site (in the same vicinity as the associated samples). They are handled like environmental samples and transported to the laboratory for analysis. Ambient blanks are prepared only when VOC samples are collected and are 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, etc.) to the samples during sample collection.

The frequency of collection for ambient blanks is specified in the FSP. Ambient blanks shall 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 or over, or pumped through, a 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 the FSP. Equipment blanks shall be collected immediately after the equipment has been decontaminated. Each blank shall be analyzed for all laboratory analyses requested for the associated environmental samples collected.

When an analyte is detected in an equipment blank the appropriate validation qualifier, as described in Section 8, shall be applied to all associated sample results.

4.4.10 Material Blank

A material blank consists of a sample of the source water used for decontaminating sample collection devices. A material blank is collected into the appropriate sample bottles directly from the water dispenser; the blank is then transported to the laboratory for analysis. Material blanks are used to evaluate the potential for decontamination materials to contaminate environmental samples.

The frequency of collection for material blanks is specified in the FSP. Material blanks shall be collected prior to the beginning of project field sampling activities. Each blank shall be analyzed for all laboratory analyses requested for the associated environmental samples collected for that project.

Data are not qualified based on the results of material blanks alone; these results are used to supplement the information obtained from equipment blanks. When an analyte is detected in the material blank, the potential effect on the sampling effort should be determined, and a decision should be made to determine whether to continue using a particular lot of water or to discard it and replace it.

4.4.11 Trip Blank

A 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 collected and are analyzed only for VOC analytes.

Trip blanks are used to assess the potential introduction of contaminants from sample containers or during transportation and storage procedures. When an analyte is detected in a trip blank the appropriate validation qualifier, as described in Section 8, shall be applied to all sample results from samples in the cooler with the affected trip blank.

One trip blank shall accompany each cooler of samples sent to the laboratory for analysis of VOCs.

4.4.12 Field Duplicates

A field duplicate sample is a second sample collected at the same location as the original sample (the 'parent' 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 the FSP. A minimum of one field duplicate pair must be collected for every site and matrix.

4.4.13 Field Replicates

A field replicate sample, also called a split sample, 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. The frequency of collection for field replicates is specified in the FSP.

4.5 QUALITY CONTROL PROCEDURES

4.5.1 Holding Time Compliance

All sample preparation and analysis shall be completed within the method-required holding times. Holding times begin at the time of sample collection. Some methods have more than one holding time requirement (e.g., methods SW8081A, SW8270C, etc.). 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. 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 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.

If holding times are exceeded and the analyses are performed, the results shall be qualified according to the procedures as described in Section 8.

4.5.2 Confirmation

Quantitative confirmation of results at or above the PQL for samples analyzed by GC or HPLC methods shall be required and shall be completed within the method-required holding times. For GC methods, a second-column is used for confirmation. For HPLC methods, a second column, a different detector, or a diode array detector (DAD) is used. The result of the first column/detector shall be the result reported, although the confirmation results will be required to meet the same QC criteria as the primary results. If holding times are exceeded and the confirmatory analyses are performed, the results shall be qualified according to the procedures as described in Section 8.

4.5.3 Standard Materials

Standard materials used in calibration and to prepare samples shall be traceable to National Institute of Standards and Technology (NIST), EPA, American Association of Laboratory Accreditation (A2LA) or other equivalent AFCEE-approved source, if available. If a NIST, EPA, or A2LA standard material is not available, the standard material proposed for use shall be included in an addendum to the SAP and approved before use. The standard materials shall be current, and the following expiration policy shall be followed: The expiration dates for ampulated solutions shall not exceed the manufacturer's expiration date or one year from the date of receipt, whichever comes first. Expiration dates for laboratory-prepared stock and diluted standards shall be no later than 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 shall be established by the laboratory and be based on chemical stability, possibility of contamination, and environmental and storage conditions. Expired standard materials shall be either 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 shall label standard and QC materials with expiration dates.

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.

4.5.4 Supplies and Consumables

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

TAB

Section 5

5.0 SAMPLING PROCEDURES

5.1 FIELD SAMPLING

The field sampling procedures for collecting samples and sampling methods shall be included in 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. The required sample volumes, container types, and preservation requirements for analytical methods proposed for project work not listed in Table 5.1 shall be included in an addendum to the FSP and approved by AFCEE before use.

Table 5.1
Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

Name	Analytical Methods	Container[a]	Preservation[b,c]	Minimum Sample Volume or Weight	Maximum Holding Time
Particle size	ASTM D422	P, G	None required	8 ounces	14 days
Oxidation-reduction potential	ASTM D1498	P, G	None required	N/A	Analyze immediately
Methane in soil gas	ASTM D3416	Varies	Varies	Varies	Varies
Ferrous iron	Per test kit instructions	G	N/A	N/A	Analyze immediately (field measurement)
VOCs in soil gas	Varies	Varies	Varies	Varies	Varies
Filterable residue	E160.1	P, G	4°C	100 mL	7 days
Nonfilterable residue	E160.2	P, G	4°C	100 mL	7 days
Temperature	E170.1	P, G	None required	N/A	Analyze immediately
Turbidity	E180.1	P, G	4°C	N/A	48 hours
Alkalinity	E310.1	P, G	4°C	50 mL	14 days
Nitrate and nitrite	E353.1	P, G	4°C, H_2SO_4 to pH<2	500 mL	28 days

Table 5.1 (continued)
Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

Name	Analytical Methods	Container[a]	Preservation[b,c]	Minimum Sample Volume or Weight	Maximum Holding Time
Dissolved oxygen	E360.1	G	None required	500 mL	Analyze immediately
Methane, ethane, and ethene	RSK-175	G (Teflon®-lined septum), T	4°C, HCl or H_2SO_4 to pH<2	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid
Moisture (soil)	(SW-846)	G, T	4°C	4 ounces	7 days
Reactivity	(SW-846)	P, G, T	4°C	500 mL or 4 ounces	7 days
Ignitability	SW1020A	G, T	4°C	500 mL or 4 ounces	7 days
Corrosivity to steel	SW1110	G, T	4°C	500 mL or 4 ounces	7 days
Toxicity characteristic leaching procedure (TCLP)	SW1311	G, T	4°C	1 liter or 8 ounces	14 days to TCLP extraction and 14 days after extraction (volatiles); 14 days to TCLP extraction, 7 days to prep extraction and 40 days after extraction (semivolatiles); 28 days to TCLP extraction and 28 days after extraction (mercury); 180 days to TCLP extraction and 180 days after extraction (metals)
Synthetic precipitation leaching procedure (SPLP)	SW1312	G, T	4°C	1 liter or 8 ounces	14 days to SPLP extraction and 14 days after extraction (volatiles); 14 days to SPLP extraction, 7 days to prep extraction and 40 days after extraction (semivolatiles); 28 days to SPLP extraction and 28 days after extraction (mercury); 180 days to SPLP extraction and 180 days after extraction (metals)
PCBs by immunoassay	SW4020	G, T	4°C	varies by test kit	varies by test kit
TPH by immunoassay	SW4030	G, T	4°C	varies by test kit	varies by test kit

Table 5.1 (continued)
Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

Name	Analytical Methods	Container[a]	Preservation[b,c]	Minimum Sample Volume or Weight	Maximum Holding Time
Metals (except chromium (VI) and mercury)	SW6010B/ SW6020 (ICP) and SW7000A series (AA methods)	P, G, T	HNO_3 to pH < 2, 4°C	500 mL or 8 ounces	180 days (water and soil)
Chromium (VI)	SW7196A	P, G, T	4°C	500 mL or 8 ounces	24 hours (water and soil)[e]
Mercury	SW7470A, SW7471A	P, G, T	HNO_3 to ph < 2, 4°C	500 mL or 8 ounces	28 days (water and soil)
Ethylene dibromide (EDB)	SW8011	G (Teflon®-lined septum), T	4°C, 0.008% $Na_2S_2O_3$ required	2 x 40 mL	28 days (water)
BTEX and MTBE (water)	SW8021A or SW8260B	G, Teflon®-lined septum	4°C; 0.008% $Na_2S_2O_3$; HCl to pH < 2	2 x 40 mL	14 days; 7 days if unpreserved by acid
BTEX and MTBE (soil)	SW8021A or SW8260B (collect by SW5035)	a) G, Teflon®-lined septum b) G, Teflon®-lined septum c) Syringe-type corer	a) 4°C, $NaHSO_4$ to pH < 2 b) 4°C, methanol c) 4°C	a) 2 x 5 g b) 5 g c) 3 x 5 g	a) 14 days b) 14 days c) 2 days; 14 days if frozen within 2 days of collection
Nitrosamines	SW8070A	G, 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)
Organochlorine pesticides and polychlorinated biphenyls (PCBs)	SW8080A or SW8081A and SW8082	G, 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)
Organophosphorus pesticides	SW8141A	G, 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)

Table 5.1 (continued)
Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

Name	Analytical Methods	Container[a]	Preservation[b,c]	Minimum Sample Volume or Weight	Maximum Holding Time
Chlorinated herbicides	SW8150B or SW8151A	G, 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 organics (water)	SW8260B	G (Teflon®-lined septum)	4°C; 0.008% $Na_2S_2O_3$; HCl to pH<2	2 x 40 mL	14 days; 7 days if unpreserved by acid
Volatile organics (soil)	SW8260B (collect by SW5035)	a) G (Teflon®-lined septum) b) G (Teflon®-lined septum) c) Syringe-type corer	a) 4°C, $NaHSO_4$ to pH <2 b) 4°C, methanol c) 4°C	a) 2 x 5 g b) 5 g c) 3 x 5 g	a) 14 days b) 14 days c) 2 days; 14 days if frozen within 2 days of collection
Semivolatile organics	SW8270C	G, T	4°C, 0.008% $Na_2S_2O_3$	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)
Dioxins and furans	SW8280A, SW8290	G, Teflon-lined cap, T	4°C, 0.008% $Na_2S_2O_3$	1 liter or 8 ounces	30 days until extraction and 45 days after extraction (water and soil)
Polynuclear aromatic hydrocarbons (PAHs)	SW8310	G, T	4°C, store in dark, 0.008% $Na_2S_2O_3$	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)
Explosive residues	SW8330	P, G, T	4°C	1 liter or 8 ounces	7 days to extraction (water); 14 days to extraction (soil); analyze within 40 days after extraction
Cyanide, total and amenable to chlorination	SW9012A	P, G, T	4°C; NaOH to pH>12, 0.6 g ascorbic acid	500 mL or 4 ounces	14 days (water and soil)

Table 5.1 (continued)
Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

Name	Analytical Methods	Container[a]	Preservation[b,c]	Minimum Sample Volume or Weight	Maximum Holding Time
Sulfide	SW9030A	P, G, T	4°C NaOH to pH>9, 2 mL zinc acetate	500 mL or 4 ounces	7 days
Hydrogen ion (pH)	SW9040B, SW9045C	P, G	None required	N/A	Analyze immediately
Conductance	SW9050A	P, G	None required	N/A	Analyze immediately
Common anions	SW9056 (or E300.0)	P, G	None required	50 mL	28 days for Br^-, F^-, Cl^-, and SO_4^{-2}; 48 hours for NO_3^-, NO_2^-, and PO_4^{-3}
Total organic carbon	SW9060, SW9060M	P, G, T	4°C, HCl or H_2SO_4 to pH <2	500 mL or 4 ounces	28 days (water and soil)
Volatile organics in air	TO-14	SUMMA® canister	none	1 canister	none in method
Total recoverable petroleum hydrocarbons (TRPH)	TX1005	G (Teflon®-lined septum), T	4°C, HCl to pH <2	2 x 40 mL (collect only 30 mL of sample in each vial) or 4 ounces	7 days (water); 14 days (soil)

[a] Polyethylene (P), glass (G) with Teflon®- lined cap (amber glass for water samples), unless otherwise noted; brass sleeves in the sample barrel, sometimes called California brass (T).
[b] No pH adjustment for soil.
[c] Preservation with 0.008 percent $Na_2S_2O_3$ or 0.6 g ascorbic acid is only required when residual chlorine is present (*exception* - preservation with 0.008 percent $Na_2S_2O_3$ is always required for method SW8011).
[d] Soil gas samples can be collected using a variety of technologies and analyzed using a variety of methods. Holding time will depend on the container used and analytical method chosen. Shonld soil gas samples be required for a project, the details of collection and analysis chosen will be provided in project-specific addenda to the FSP and QAPP.
[e] The maximum recommended holding time for completion of extraction into water is 48 hours. The extract shall be analyzed within 24 hours of completion of extraction.

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 shall maintain COC records for all field and field 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 shall be documented on each COC form (as illustrated in Section 8):

- Unique COC identification number
- 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, etc.)
- 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
- Bill of lading or transporter tracking number (if applicable)

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

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

Once a shipment of samples reaches the laboratory, each sample container shall be checked against information on the COC form for anomalies. The condition, temperature, and appropriate preservation of samples shall 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 shall be documented in laboratory records. All sample information shall then be entered into a tracking system, and unique analytical sample identifiers shall be assigned. A copy of this information shall 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. Samples not preserved or analyzed in accordance with these requirements shall be resampled and analyzed, at no additional cost to AFCEE. Subcontracted analyses shall be documented with the AFCEE COC form. Procedures ensuring internal laboratory COC shall also be implemented and documented by the laboratory. Specific instructions concerning the analysis specified for each sample shall be communicated to the analysts. Analytical batches shall be created, and laboratory QC samples shall be introduced into each batch.

While in the laboratory, samples shall be stored in limited-access, temperature-controlled areas. Refrigerators, coolers, and freezers shall be monitored for temperature seven days a week. Acceptance criteria for the temperatures of the refrigerators and coolers is 4°C ± 2°C (note that samples which arrive at the laboratory below 2°C but not frozen will be considered usable and resampling will not be required). Acceptance criteria for the temperatures of the freezers shall be less than 0°C . All of the cold storage areas shall be monitored by thermometers that have been calibrated with a NIST-traceable thermometer. As indicated by the findings of the calibration, correction factors shall be applied to each thermometer. Records that include acceptance criteria shall be maintained. Samples for volatile organics determination shall be stored separately from other samples, standards, and sample extracts. Samples shall be stored after analysis until disposed of in accordance with applicable local, state, and federal regulations. Disposal records shall be maintained by the laboratory.

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

TAB

Section 6

6.0 SCREENING ANALYTICAL METHODS

The screening analytical 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 (SW-846) (EPA 1997), Methods for Chemical Analysis of Water and Waste (EPA 1979), ASTM Annual Book of Standards (ASTM 1993), and from manufacturers' literature.

Table 6.1
Screening Analytical Methods

Method	Parameter
SW9040B	pH (water)
SW9045C	pH (soil)
SW-846 (SW3550)	Moisture
SW-846, Section 7.3	Reactivity (cyanide and sulfide)
SW1020A	Ignitability (Setaflash closed cup)
SW1110	Corrosivity toward steel
SW9030A	Sulfide
SW9050A	Conductance
SW9060	Total organic carbon in water
E160.1	Filterable residue
E160.2	Nonfilterable residue
E170.1	Temperature
E180.1	Turbidity
E310.1	Alkalinity
E360.1	Dissolved oxygen
Hach® Test Kit	Ferrous iron
ASTM D422	Particle size
Real-time Portable Organic Vapor Analyzer	Organic vapors in air
ASTM D1498	Oxidation-reduction potential
ASTM D3416	Methane
Varies	Soil gas screening-halogenated, aromatic, and petroleum hydrocarbons
SW4020	PCBs by immunoassay
SW4030	TPH by immunoassay

6.1 ANALYTICAL SCREENING METHOD DESCRIPTIONS

Section 6.1 contains subsections for each analytical procedure. Each subsection contains the following information:

- a brief method description
- the PQL (if applicable)

6.1.1 EPA Method SW9040B (water)/SW9045A (soil)–pH

pH measurements shall be performed for water samples using method SW9040B. pH measurements of soil samples are performed using method SW9045A. Measurements are determined electrometrically using either a glass electrode in combination with a reference potential, or a combination electrode.

6.1.2 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 samples 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 shall be reported on a dry weight basis.

6.1.3 SW-846 (Section 7.3) - Reactivity (Cyanide and Sulfide)

Reactive cyanide is measured by acidifying a sample aliquot and collecting the evolved gases in a scrubber under a nitrogen purge. The hydrogen cyanide released is measured by Method SW9014. Reactive sulfide is measured by acidifying a sample aliquot and collecting the evolved gases in a scrubber under a nitrogen purge. The hydrogen sulfide released is measured by Method SW9034.

6.1.4 EPA Method SW1020A - Ignitability

Method 1020A makes use of the Setaflash Closed Tester to determine the flash point of liquids that have flash points between 0° and 110°C and viscosities lower than 150 stokes at 25°C.

6.1.5 EPA Method SW1110–Corrosivity

This test exposes steel to liquid waste to determine the corrosivity of the waste.

6.1.6 EPA Method SW9030A–Sulfide

Method SW9030A is used to analyze for sulfide. This titration method uses an excess of iodine added to a sample which has been treated with zinc acetate to produce zinc sulfide. The iodine

oxidizes the sulfide to sulfur under acidic conditions. The excess iodine is back-titrated with sodium thiosulfate. The amount of sulfide is then calculated from the amount of titrant added.

Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
SW9030A	Sulfide	0.05	mg/L	30	mg/kg

6.1.7 EPA Method SW9050A–Conductance

Standard conductivity meters are used. Temperature is also reported.

6.1.8 EPA Method SW9060 (SW9060M)–Total Organic Carbon

Organic carbon is measured using a carbonaceous analyzer. This instrument converts the organic carbon in a sample to carbon dioxide by either catalytic combustion or wet chemical oxidation. The carbon dioxide formed is then either measured directly by an infrared detector or converted to methane and measured by a flame ionization detector. The amount of carbon dioxide or methane in a sample is directly proportional to the concentration of carbonaceous material in the sample. This method is designed for water samples but can be modified for soil analysis.

Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
SW9060	Total organic carbon	1	mg/L	750	mg/kg

6.1.9 EPA Method 160.1–Filterable Residue

A well-mixed sample is filtered through a standard glass fiber filter. The filtrate is evaporated and dried to constant weight at 180°C.

Method	Analyte	Water	
		PQL	Unit
E160.1	Total dissolved solids	10	mg/L

6.1.10 EPA Method 160.2–Nonfilterable Residue

A well-mixed sample is filtered through a glass fiber filter, and the residue retained on the filter is dried to constant weight at 103-105°C.

Method	Analyte	Water	
		PQL	Unit
E160.2	Total suspended solids	5	mg/L

6.1.11 EPA Method 170.1–Temperature

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

6.1.12 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 0–40 NTU. Higher levels of turbidity can be measured by diluting the sample with turbidity-free deionized water.

6.1.13 EPA Method 310.1–Alkalinity

In this method, an unaltered sample is titrated to an end point of pH 4.5 using hydrochloric or sulfuric acid.

Method	Analyte	Water	
		PQL	Unit
E310.1	Alkalinity[1]	10	mg/L

[1] alkalinity measured as calcium carbonate equivalents

6.1.14 EPA Method 360.1–Dissolved Oxygen

An instrumental probe, usually dependent upon an electrochemical reaction, is used for determination of dissolved oxygen in water. Under steady-state conditions, the current or potential can be correlated with dissolved oxygen concentrations.

6.1.15 Hach® Test Kit–Ferrous Iron

An aliquot of water is placed in a test tube and a developing agent is added. The concentration of ferrous iron is determined using a spectrophotometer.

6.1.16 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 mm (retained on the No. 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 75 mm is determined by a sedimentation process using a hydrometer.

6.1.17 Real-Time Portable Organic Vapor Analyzer

Two types of portable analyzers shall be used to perform real-time nonspecific analyses of hydrocarbon vapors. The instruments include a flame ionization detector (FID) (e.g., Foxboro Century organic vapor analyzer (OVA)) and a photoionization detector (PID) (e.g., HNu® Systems [HNu®] trace gas analyzer) organic vapor monitor (OVM). One or more of these instruments may be used at a specific site, depending on the contaminant species of interest. When used together, the instruments provide complementary information because they are sensitive to different types of hydrocarbon vapors.

Portable analyzers shall 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 comparability of results obtained from the PID and FID instruments can be considered only to be within the variability of this type of screening instrument. Comparability is greatest when the instruments are calibrated with the same standards and operated within similar concentration ranges.

The FID uses the principle of hydrogen flame ionization to detect and measure total hydrocarbon vapors. The FID has a dynamic operating range from 1 ppmv to 10 ppmv or 1 ppmv to 100,000 ppmv, depending on the instrument, and provides a nonspecific response to total hydrocarbons. If concentrations exceed the range of the instrument, a dilution probe shall be attached to the FID to allow elevated vapor concentrations to be measured. The instrument is highly sensitive to compounds such as methane, benzene, and acetone, but is less sensitive to alcohols and halogenated compounds.

During operation, a sample is drawn into the probe and transmitted to the detection chamber by an internal pumping system. Inside the chamber, the sample is exposed to a hydrogen flame that ionizes the organic vapors. As the organic vapors burn, the ions produced are collected on an electrode in the chamber, and a current proportional to the hydrocarbon concentration is generated. This current is measured and displayed on the meter.

The PID uses a photoionization detector to detect and measure total hydrocarbon vapors. The instrument has an operating range of 0-2,000 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, producing 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 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.

6.1.18 ASTM D1498–Oxidation-Reduction Potential

This method is designed to measure the oxidation-reduction potential (ORP) in water, which is defined as the electromotive force between a noble metal electrode and a reference electrode when immersed in a solution.

6.1.19 ASTM D3416–Methane in Soil Gas

An aliquot of the soil gas sample is introduced into a prechromatographic or stripper column which removes hydrocarbons other than methane and carbon monoxide. Methane and carbon monoxide are passed through a chromatographic column where they are separated. The methane is measured by a FID. Quantitation is performed by comparing the sample response to the response of a known concentration of methane.

6.1.20 Variable Methods–Organic Vapors in Soil Gas

There are several methods of sampling soil gas and introducing the sampled material into an analytical system. Sampling media include Tedlar® bags, glass vials with butyl-Teflon® septa, activated charcoal traps, and Summa® canisters; samples can be collected by active or passive methods. Analysis for BTEX, VOCs, or petroleum hydrocarbons is performed by a gas chromatograph equipped with an FID or MS. Analysis is generally not subject to the same level of QC as are definitive analyses for these compounds, and often shorter chromatographic columns are used to increase sample throughput.

6.1.21 Draft Method SW4020–Screening for Polychlorinated Biphenyls by Immunoassay

Soil samples are screened for total PCBs using immunoassay test kits. A mini methanol extraction of the soil sample is performed, and the extract and an enzyme conjugate reagent are added to immobilized antibodies. The enzyme conjugate competes with the PCBs in the sample for binding to immobilized anti-PCB antibodies. The test is interpreted by comparing the response produced by the sample to the response produced by a standard.

6.1.22 Draft Method SW4030–Screening for Petroleum Hydrocarbons by Immunoassay

Soil samples are screened for levels of TPH using immunoassay test kits. A mini extraction of the soil sample is performed, and the extract and an enzyme conjugate reagent are added to immobilized antibodies. The enzyme conjugate competes with hydrocarbons for binding to immobilized anti-hydrocarbon antibodies. The test is interpreted by comparing the response produced by the sample to the response produced by a standard.

6.2 CALIBRATION AND QC PROCEDURES FOR SCREENING METHODS

All screening data shall be flagged with an "S" data qualifier to show the reported data are screening data (see Section 8). The other data qualifiers that shall be used with screening data are also shown in Table 6.2 and Section 8. 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 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
Summary of Calibration and QC Procedures for Screening Methods

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Data Qualification[b]
SW9040B	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[d]	At each sample location	±0.1 pH units	Correct problem, recalibrate	R
		Field duplicate[d]	10% of field samples	±0.1 pH units	Correct problem, repeat measurement	J
SW9045C	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
		Laboratory duplicate sample[d]	10% of field samples	±0.1 pH unit	Correct problem, repeat measurement. If still out, repeat calibration and reanalyze samples	J
SW-846 (SW3550)	Moisture	Laboratory duplicate	1 per 20 samples	RPD > 15% RPD > 30%	Correct problem, repeat measurement. If still out, flag data	J R
SW-826, Section 7.3	Reactivity	Reference check solution	1 per analytical batch	%D from true value <20%	Correct problem, repeat measurement. If still out, flag data	J
		Field duplicate	10% of field samples	RPD <20%	None	J
SW1020A	Ignitability	Laboratory duplicate	1 per 20 samples	RPD <20%	Correct problem, repeat measurement	J
		Field duplicate	10% of field samples	RPD <20%	None	J

Table 6.2 (continued)
Summary of Calibration and QC Procedures for Screening Methods

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Data Qualification[b]
SW1110	Corrosivity	Laboratory duplicate	1 per 20 samples	RPD <20%	Correct problem, repeat measurement	J
		Field duplicate	10% of field samples	RPD <20%	None	J
SW9030	Sulfide	Method Blank	Daily or one per batch, whichever is more frequent	<PQL	Clean system; rerun blank and all samples associated with unacceptable blank	Flagging conventions, Table 8.4
		LCS	After method blank	%R between 70-130%	Correct problem then reprepare and analyze the LCS and all associated data with an unacceptable %R	If %R> UT, qualify all associated sample results J or UJ; if %R< LT, qualify all positive results J and reject all non-detects
		Field duplicate	10% of field samples	RPD <20%	None	J
		MS/MSD	5% of field samples	%R between 70-130% RPD <20%	None	Qualify all samples associated with that site J or UJ
SW9050A	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[d]	10% of field samples	±5%	Correct problem, repeat measurement	J
SW9060	Total organic carbon	Method blank	Daily or one per batch, whichever is more frequent	<PQL	Clean system; rerun blank and all samples associated with unacceptable blank	Flagging conventions, Table 8.4
		Replicate analysis	Each sample	RPD <20%	Correct problem, repeat measurement	J
		Field duplicate	10% of field samples	RPD <20%	None	J
E160.1	Filterable residue	Laboratory duplicate	1 per 20 samples	RPD <20%	Correct problem, repeat measurement	J
		Field duplicate	10% of field samples	RPD <20%	None	J
E160.2	Nonfilterable residue	Laboratory duplicate	1 per 20 samples	RPD <20%	Correct problem, repeat measurement	J
		Field duplicate	10% of field samples	RPD <20%	None	J
E170.1	Temperature	Daily check	Once per day at beginning of testing	± 1.0°C	Correct problem, repeat measurement	J
		Field duplicate[d]	10% of field samples	±1.0°C	Correct problem, repeat measurement	J

Table 6.2 (continued)
Summary of Calibration and QC Procedures for Screening Methods

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Data Qualification[b]
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, 0–20 range; ±0.2 units, 0–1 range	If calibration is not achieved, check meter; replace if necessary, recalibrate	R
		Zero drift check[d]	10% of field samples	Verify instrument reads 0 NTU ±0.2 units	Recalibrate instrument	J
E310.1	Alkalinity	Laboratory duplicate	1 per 20 samples	RPD <20%	Correct problem, repeat measurement	J
		Field duplicate	10% of field samples	RPD <20%	None	J
E360.1	Dissolved oxygen	Function check	Daily, prior to use	Meter reads 8% ±2%	Replace instrument	R
		Field duplicate[d]	10% of field samples	RPD <20%	Correct problem, repeat measurement	J
Hach® Test Kit	Ferrous iron	Field duplicate	10% of field samples	RPD <25%	Recollect samples, repeat measurement	J
ASTM D422	Particle size	Field duplicate	10% of field samples	Qualitative comparison by a geologist	None	J
None	Organic vapor concentrations (FID and PID)	3 point calibration	Monthly	Correlation coefficient ≥0.995	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
ASTM D1498	Oxidation-reduction potential	Sensitivity verification	Daily	ORP should decrease when pH is increased	If ORP increases, correct the polarity of electrodes. If ORP still does not decrease, clean electrodes and repeat procedure	R
		Calibration with one standard	Once per day	Two successive readings ±10 millivolts	Correct problem, recalibrate	R
		Field duplicate[d]	10% of field samples	±10 millivolts	Correct problem, repeat measurement	J

Table 6.2 (continued)
Summary of Calibration and QC Procedures for Screening Methods

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Data Qualification[b]
ASTM D3416	Methane	Single point calibration	Daily, prior to sample analysis	Delineation from database average within ±20%	Recalibrate	R
		Method blank	Daily or one per batch, whichever is more frequent	<PQL	Clean system; rerun blank and all samples associated with unacceptable blank	Flagging conventions, Table 8.4
		Laboratory duplicate	1 per 20 samples	RPD <20%	Correct problem, repeat measurement	J
		Field duplicate	10% of field samples	RPD <20%	None	J
Varies	Soil gas	Three point calibration	Daily, prior to sample analysis	RSD <20%	Recalibrate	R
		Method blank	Daily or one per batch, whichever is more frequent	<PQL	Clean system; rerun blank and all samples associated with unacceptable blank	Flagging conventions, Table 8.4
		LCS	After method blank	%D <25%	Correct problem, repeat measurement	J
		Field duplicate	10% of field samples	RPD <20%	None	J
SW4020	PCBs by Immunoassay	Field duplicate	10% of field samples	RPD <20%	Correct problem, repeat measurement	J
SW4030	Petroleum hydrocarbons by immunoassay	Field duplicate	10% of field samples	RPD <20%	Correct problem, repeat measurement	J

[a] All corrective actions shall be documented, and the records shall be maintained by the prime contractor.
[b] All screening results shall first be flagged with an "S" and also any other appropriate validation flags identified in the Data Flagging Criteria column of the table. For example "SJ", "SB", "SR".
[c] Field duplicates are not required if this parameter is being measured using a flow-through cell.

TAB

Section 7

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
- 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, SW-846, Third Edition, including Updates I, II, and III (EPA 1997); Handbook for IRP RI/FSs (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 (EPA 1994a); 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 (EPA 1994b). Definitions of terms are given in Section 4.0, and data validation guidelines are presented in Section 8.0.

If additional or alternative methods are needed or used, they will be outlined in a site-specific QAPP addendum. Any methods added due to project-specific needs will be described in detail equivalent to the methods in this QAPP, including all necessary QA/QC criteria and procedures. Tables will be supplied that complement those in Section 7 of this QAPP.

7.1 PREPARATION METHODS

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

Table 7.1
Extraction and Digestion Procedures

Method	Parameter
SW1311	Toxicity Characteristic Leaching Procedure (TCLP)
SW1312	Synthetic Precipitation Leaching Procedure (SPLP)
SW3005A	Acid digestion of water samples for metals analysis
SW3010A	Acid digestion of aqueous samples and extracts for metals analysis
SW3015	Microwave assisted acid digestion of aqueous samples and extracts for metals analysis
SW3020A	Acid digestion of aqueous samples and extracts for metals analysis
SW3050B	Acid digestion for solids, sediments, and sludges for metals analysis
SW3051	Microwave assisted acid digestion of solids, sediments, and sludges for metals analysis
SW3060A	Alkaline extraction
SW3510C	Separatory funnel liquid-liquid extraction

Table 7.1 (continued)
Extraction and Digestion Procedures

Method	Parameter
SW3520C	Continuous liquid-liquid extraction
SW3540C/SW3541	Soxhlet extraction
SW3550B	Ultrasonic extraction
SW5030B	Purge and trap
SW5035	Closed-system purge and trap
ASTM D3987	Neutral leachate

7.1.1 Method SW1311–Toxicity Characteristic Leaching Procedure

Method SW1311 is used to prepare samples for determination of the concentration of organic (semivolatile and volatile) and inorganic constituents that are leachable from waste. The method uses an acidic leaching solution of dilute acetic acid (partially neutralized with sodium hydroxide); this solution mimics the activity of organic acids present in landfills. Liquid wastes containing less than 0.5% solids are considered to be a TCLP extract after filtration, and no leaching procedure is required.

QC is accomplished by preparing one TCLP blank for every 20 extractions conducted in the extraction vessel. Additional extract is prepared so one MS can be performed for each waste type (samples of similar waste types shall be batched together). One MS must be analyzed in each AFCEE analytical batch. These QA measures are in accordance with the requirements of EPA method SW1311, Section 8.0.

7.1.2 Method SW1312–Synthetic Precipitation Leaching Procedure

Method SW1312 is used to prepare samples for determination of the concentration of organic (semivolatile and volatile) and inorganic constituents that are leachable from waste or other material. The method uses an acidic leaching solution of dilute nitric and sulfuric acids (VOCs and cyanide are extracted with reagent-grade water); this solution mimics the activity of acidic rainfall and runoff. Liquid wastes containing less than 0.5% solids are considered to be a SPLP extract after filtration, and no leaching procedure is required.

QC is accomplished by preparing one SPLP blank for every 20 extractions conducted in the extraction vessel. Additional extract is prepared so one MS can be performed for each waste type (samples of similar waste types shall be batched together). One MS must be analyzed in each AFCEE analytical batch. These QA measures are in accordance with the requirements of EPA method SW1312, Section 8.0.

7.1.3 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 ICP emission spectroscopy.

Note on metals preparation methods: For analysis of total recoverable metals, the entire sample is acidified at collection time. For analysis of dissolved metals, the samples are filtered after collection, then acidified.

7.1.4 Method SW3010A–Acid Digestion of Aqueous Samples and Extracts for Metals Analysis

Method SW3010A prepares aqueous or waste samples for total metals determination by ICP. The samples are vigorously digested with acid and then diluted.

7.1.5 Method SW3015–Microwave Assisted Acid Digestion of Aqueous Samples and Extracts for Metals Analysis

This method is used to prepare aqueous or waste samples, that contain suspended solids, for total metals determination by graphite furnace atomic absorption (GFAA) spectroscopy or ICP. The samples are digested with acid and heated in a microwave.

7.1.6 Method SW3020A–Acid Digestion of Aqueous Samples and Extracts for Metals Analysis

Method SW3020A prepares aqueous or waste samples for total metals determination by GFAA or ICP. The samples are vigorously digested with acid and then diluted.

7.1.7 Method SW3050B–Acid Digestion for Solids, Sediments, and Sludges for Metals Analysis

Method SW3050B is applicable to the preparation of sediment, sludge, and soil samples for metals analysis by ICP or, for some metals, ICP. The samples are digested, then refluxed with acid. A separate aliquot of the sample is dried for a total solids or percent moisture determination.

7.1.8 Method SW3051–Microwave Assisted Acid Digestion of Solids, Sediments, and Sludges for Metals Analysis

Method SW3051 is applicable to the preparation of sediment, sludge, and soil samples for metals analysis by GFAA or ICP. The samples are digested with acid and heated in a microwave. A separate aliquot of sample is dried for a total solids or percent moisture determination.

7.1.9 Method SW3060A–Alkaline Extraction

Method SW3060A is a procedure for extracting soluble and non-soluble hexavalent chromium from environmental samples. An aliquot of sample is digested in an alkaline solution at 95°C for one hour. The digestate is then filtered.

7.1.10 Method SW3510C–Separatory Funnel Liquid-Liquid Extraction

Method SW3510C is designed to quantitatively extract nonvolatile and semivolatile organic compounds (SVOCs) 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.

7.1.11 Method SW3520C–Continuous Liquid-Liquid Extraction

Method SW3520C is a procedure for isolating organic compounds from aqueous samples and is designed for extraction solvents with greater density than the sample.

7.1.12 Method SW3540C/SW3541–Soxhlet Extraction

Method SW3540C 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.

7.1.13 Method SW3550B–Ultrasonic Extraction

Method SW3550B 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.

7.1.14 Method SW5030B–Purge and Trap Method

Method SW5030B 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. This method is not recommended for solids except when comparability to historical data is an important consideration. Otherwise, solid matrix samples should be prepared by Method 5035 described below.

An inert gas is bubbled through an aliquot (usually either 5 mL or 25 mL) of each sample at ambient temperature to transfer the volatile components to the vapor phase. Soil samples are first suspended in analyte-free water. 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.

7.1.15 Method SW5035–Closed System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples

Method SW5035 is a method designed to minimize analyte loss during collection and analysis of solid matrix VOC samples. Approximately 5 g of sample are collected, weighed in the field, and sealed in a pre-weighed vial containing a stir bar and a sodium bisulfate preservative solution. The vials are not opened during analysis; appropriate reagents are introduced through the vial septa. Purge gas is introduced and removed through the septa. Alternative methods of sample collection involve using a syringe-like mini corer, or collecting the sample into a pre-weighed jar containing methanol as a preservative.

7.1.16 Method ASTM D3987–Neutral Leach

Method D3987 is a procedure for extracting soluble hexavalent chromium from environmental samples. An aliquot of sample is extracted into deionized water for 18 hours at ambient temperature. The extract is then filtered.

7.2 ANALYTICAL PROCEDURES

The analytical procedures presented in this section are outlined in Table 7.2.

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 spike duplicate, field duplicate, 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. *All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.* The last column designates the data flagging criteria that shall be applied in the event that the method-required calibration and QC acceptance criteria are not met. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

Table 7.2
Analytical Procedures

Methods	Parameter
SW-846 Organic Methods	
8011	Ethylene dibromide (EDB) (water and soil)
8021B	Aromatic volatile organics (water and soil)
8070A	Nitrosamines (water and soil)
8080A	Organochlorine pesticides and PCBs (water and soil)
8081A	Organochlorine pesticides (water and soil)
8082	PCBs (water and soil)
8141A	Organophosphorus compounds (water and soil)
8150B	Chlorinated herbicides (water and soil)
8151A	Chlorinated herbicides (water and soil)
8260B	Volatile organics (water and soil)
8270C	Semivolatile organics (water and soil)
8280A	Dioxins and furans (water and soil)
8290	Dioxins and furans - high resolution (water and soil)
8310	Polynuclear aromatic hydrocarbons (PAHs) (water and soil)
8330	Explosive residues (water and soil)
SW-846 Inorganic Methods	
6010B	Trace metals by ICP (water and soil)
6020	Trace metals by ICP-MS (water and soil)
7000A Series	Trace metals (antimony, arsenic, cadmium, chromium, lead, nickel, selenium, thallium, and vanadium) by GFAA (water and soil)
7196A	Hexavalent chromium (water and soil)
7470A/7471A	Mercury (water/soil)
9012A	Total and amenable cyanide (water and soil)
9056 (or E300.0)	Common anions (water)
Other Methods	
RSK-175	Methane, ethane, and ethene (water)
TO-14	Volatile organics (air)
TX 1005	Total petroleum hydrocarbons (water and soil)

7.2.1 Method SW8011-Ethylene Dibromide

Ethylene dibromide (EDB) in water is analyzed using method SW8011. The sample is extracted with hexane. The extract is injected into a GC with a linearized electron capture detector for separation and analysis. The PQL is presented in Table 7.3.

This method provides for the use of a second GC column of dissimilar phase to resolve compounds of interest from interferences that may occur. When second-column analysis is performed, retention times for the analyte must match those established for each column. Otherwise, the chromatographic peaks are considered interferences, and the analyte is not considered to be present in the sample. Requirements for confirmation of the analyte are described in Section 4.5.2. The calibration, QC, corrective action, and data qualification requirements are given in Tables 7.4 and 7.5.

Table 7.3
PQL for Method SW8011

Parameter/Method	Analyte	Water	
		PQL	Unit
SW8011	Ethylene dibromide	0.1	µg/L

Table 7.4
QC Acceptance Criteria for Method SW8011

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)
SW8011	Ethylene dibromide	85-115	≤15

Table 7.5
Summary of Calibration and QC Procedures for Method SW8011

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8011	Ethylene dibromide	Five-point initial calibration or calibration by regression	Initial calibration prior to sample analysis	%RSD < 20%; or r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	Correct problem then repeat initial calibration	Apply R to the result for EDB for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within 15% of expected value	Correct problem then repeat initial calibration	Apply R to the result for EDB 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 the result for EDB in the sample
		Initial calibration verification	Daily, before sample analysis	All analytes within 15% of expected value	Correct problem then repeat initial calibration	Apply R to the result for EDB 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	Flagging conventions, Table 8.2
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within 15% of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to the result for EDB in all samples since the last acceptable calibration verification
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.4	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to the EDB result for all samples analyzed by the analyst

Table 7.5 (continued)
Summary of Calibration and QC Procedures for Method SW8011

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8011 (cont)	Ethylene dibromide (cont)	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.4	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.4	Correct problem then reextract and analyze sample	Flagging conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.4	none	Flagging conventions, Table 8.2
		Second-column confirmation	100% for all positive results above the PQL	<25% difference between the primary and secondary column result	none	Flagging conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.3	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

7.2.2 Method SW8021B–Aromatic Volatile Organics

Aromatic volatile organics in water and soil samples are prepared using method SW5030A and analyzed using method SW8021B. This method 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 SW5035. This method is also known as the BTEX method since the compounds of interest include benzene, toluene, ethylbenzene, and xylene. PQLs for method SW8021B are presented in Table 7.6. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.7 and 7.8. It should be noted that this method is usable for more chlorinated organics than are listed in Table 7.7; however, it is recommended that larger suites of VOCs be analyzed using method SW8260B (see Section 7.2.10).

Table 7.6
PQLs for Method SW8021B

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Aromatic Volatile Organics SW5030A/SW8021B (water) or SW5035/SW8021B (soil)	1,2-Dichlorobenzene	4	µg/L	0.004	mg/kg
	1,3-Dichlorobenzene	4	µg/L	0.004	mg/kg
	1,4-Dichlorobenzene	3	µg/L	0.003	mg/kg
	Benzene	2	µg/L	0.002	mg/kg
	Chlorobenzene	2	µg/L	0.002	mg/kg
	Ethylbenzene	2	µg/L	0.002	mg/kg
	Methyl *tert*-butyl ether	2	µg/L	0.005	mg/kg
	Toluene	2	µg/L	0.002	mg/kg
	Xylenes, total	2	µg/L	0.002	mg/kg

Table 7.7
QC Acceptance Criteria for Method SW8021B

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8021B	1,2-Dichlorobenzene	61–134	20	51–144	30
	1,3-Dichlorobenzene	70–131	20	60–141	30
	1,4-Dichlorobenzene	75–126	20	66–136	30
	Benzene	75–125	20	66–135	30
	Chlorobenzene	75–129	20	66–139	30
	Ethylbenzene	71–129	20	61–139	30
	Methyl *tert*-butyl ether	65-135	20	55-145	30
	Toluene	70–125	20	60–135	30
	Xylenes, total	71–133	20	61–143	30
	Surrogates (choose at least two):				
	Bromochlorobenzene	46–136		36–146	
	Bromofluorobenzene	48–138		38–148	
	Difluorobenzene	48–138		38–148	
	Fluorobenzene	44–165		34–175	
	1,1,1-Trifluorotoluene	44–165		34–175	

Table 7.8
Summary of Calibration and QC Procedures for Method SW8021B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8021B	Aromatic volatile organics	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte >30%; *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 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 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 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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.7	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 7.8 (continued)
Summary of Calibration and QC Procedures for Method SW8021B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8021B (cont)	Aromatic volatile organics (cont)	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.7	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging conventions, Table 8.2
		Second-column confirmation	100% for all positive results above the PQL	<25% difference between the primary and secondary column result	none	Flagging conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.6	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.7	Correct problem then reextract and analyze sample	Flagging conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.7	none	Flagging conventions, Table 8.2
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

514 82

7.2.3 Method SW8070A–Nitrosamines

Select nitrosamines in water and soil samples are analyzed using method SW8070A. The sample is extracted and analyzed by gas chromatography. PQLs for method SW8070A are presented in Table 7.9. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.10 and 7.11.

Table 7.9
PQLs for Method SW8070A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Nitrosamines SW8070A	N-Nitrosodi-n-propylamine	2	µg/L	4	mg/kg
	N-Nitrosodimethylamine	0.5	µg/L	1	mg/kg
	N-Nitrosodiphenylamine	3	µg/L	6	mg/kg

Table 7.10
QC Acceptance Criteria for Method SW8070A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8070A	N-Nitrosodi-n-propylamine	45–146	30	35–146	50
	N-Nitrosodimethylamine	25–125	30	25–135	50
	N-Nitrosodiphenylamine	25–139	30	25–149	50
	Surrogates[a]				

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

Table 7.11
Summary of Calibration and QC Procedures for Method SW8070A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8070A	Nitrosamines	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte >30%; *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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 ±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 ±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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.10	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 7.11 (continued)
Summary of Calibration and QC Procedures for Method SW8070A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8070A (cont)	Nitrosamines (cont)	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.10	Reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.10	Correct problem then reextract and analyze sample	Flagging conventions, Table 8.2
		MS/MSD	One MS/MSD per site; or as required by the project specific FSP	QC acceptance criteria, Table 7.10	none	Flagging conventions, Table 8.2
		Second-column confirmation	100% for all positive results above the PQL	<25% difference between the primary and secondary column result	none	Flagging conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.9	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

7.2.4 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). 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 7.12. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.13 and 7.14.

For the analysis of PCBs and toxaphene, the initial five-point calibration and second source calibration verification shall contain a representative Aroclor mixture (AR 1016/1260). A single-point calibration will be analyzed for the remaining PCBs and toxaphene, and the concentration of these single calibration points will correspond to the AFCEE PQLs. Continuing calibration verification (CCV), MS, and LCS spiking solutions will contain the representative Aroclor 1016/1260 mixture. If toxaphene or any PCBs are detected, a calibration curve for those compounds will be generated, and the sample(s) reanalyzed. If reanalysis is performed, spiking solutions will contain the full suite of multicomponent analytes.

The laboratory will analyze and report alpha- and gamma-chlordane instead of technical chlordane. In the event of alpha- or gamma-chlordane detection, each sample will be assessed for the multi-response pattern of technical chlordane. If the pattern is observed, the system will be calibrated for technical chlordane and quantitated accordingly.

A second-column confirmation is not required for the analysis of toxaphene, chlordane (technical), or PCBs.

Table 7.12
PQLs for Method SW8080A

Parameter/Method	Analyte	PQL	Unit	PQL	Unit
Organochlorine Pesticides and PCBs SW3510B/SW8080A (W) SW3550A/SW8080A (S)	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
	α-Chlordane	0.8	µg/L	0.015	mg/kg
	γ-Chlordane	0.37	µg/L	0.015	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	0.010	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 7.13
QC Acceptance Criteria for Method SW8080A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8080A	Aldrin	47–125	≤ 30	37–135	≤ 50
	α-BHC	60–125	≤ 30	50–135	≤ 50
	β-BHC	51–125	≤ 30	41–133	≤ 50
	δ-BHC	60–126	≤ 30	50–136	≤ 50
	γ-BHC (lindane)	60–125	≤ 30	50–135	≤ 50
	α-Chlordane	41–125	≤ 30	31–135	≤ 50
	γ-Chlordane	41-125	≤ 30	31-133	≤ 50
	Chlordane (technical)	45–125	≤ 30	35–135	≤ 50
	4,4'-DDD	48–136	≤ 30	38–146	≤ 50
	4,4'-DDE	45–139	≤ 30	35–149	≤ 50
	4,4'-DDT	34–143	≤ 30	25–153	≤ 50
	Dieldrin	42–132	≤ 30	32–142	≤ 50
	Endosulfan I	49–143	≤ 30	39–153	≤ 50
	Endosulfan II	60–159	≤ 30	50–169	≤ 50
	Endosulfan sulfate	46–141	≤ 30	36–151	≤ 50
	Endrin	43–134	≤ 30	33–144	≤ 50
	Endrin aldehyde	60–150	≤ 30	50–160	≤ 50
	Heptachlor	45–128	≤ 30	35–138	≤ 50
	Heptachlor epoxide	53–134	≤ 30	43–144	≤ 50
	Methoxychlor	60–142	≤ 30	50–152	≤ 50
	Toxaphene	41–126	≤ 30	31–136	≤ 50
	PCB-1016	54–125	≤ 30	44–135	≤ 50
	PCB-1221	30–175	≤ 30	25–175	≤ 50
	PCB-1232	39–150	≤ 30	29–160	≤ 50
	PCB-1242	39–150	≤ 30	29–160	≤ 50
	PCB-1248	38–158	≤ 30	28–168	≤ 50
	PCB-1254	29–131	≤ 30	25–141	≤ 50
	PCB-1260	41–126	≤ 30	31–136	≤ 50
	Surrogates (only one needs to be within control limits):				
	Decachlorobiphenyl (DCBP)	34–133		34–133	
	Tetrachloro-*m*-xylene (TCMX)	45–120		45–120	

Table 7.14
Summary of Calibration and QC Procedures for Method SW8080A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8080A	Organochlorine pesticides and PCBs	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30%; *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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 ±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 20 samples and at the end of the analysis sequence	All analytes within ±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
		Breakdown check (Endrin and DDT - pesticide analysis only)	Daily prior to analysis of samples	Degradation ≤20% (total Endrin + DDT)	Repeat breakdown check	Apply J to all positive DDT, DDE, DDD, endrin, endrin ketone and endrin aldehyde results; apply J to positive results for the analytes listed above if minimum frequency is not met

Table 7.14 (continued)
Summary of Calibration and QC Procedures for Method SW8080A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8080A (cont)	Organochlorine pesticides and PCBs (cont)	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.13	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; reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.2
		LCS for all analytes (the Aroclor 1016/1260 mixture will represent the multi-response analytes (i.e., PCBs and toxaphene)	One LCS per analytical batch	QC acceptance criteria, Table 7.13	Reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.13	Correct problem then reextract and analyze sample	Flagging conventions, Table 8.2
		MS/MSD for all analytes (the Aroclor 1016/1260 mixture will represent the multi-response analytes (i.e., PCBs and toxaphene)	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.13	none	Flagging conventions, Table 8.2
		Second-column confirmation	100% for all positive results above the PQL	<25% difference between the primary and secondary column result	none	Flagging conventions, Table 8.2

Table 7.14 (continued)
Summary of Calibration and QC Procedures for Method SW8080A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8080A (cont.)	Organochlorine pesticides and PCBs (cont)	MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.12	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

7.2.5 Method SW8081A–Organochlorine Pesticides

Organochlorine pesticides in water and soil samples are analyzed using method SW8081A. This analytical method involves extraction of water samples using a separatory funnel (method SW3510B) or continuous liquid-liquid extraction (method SW3520B). Extraction of solid samples is accomplished with ultrasonic extraction (method SW3550A) procedures. The pesticides are separated and quantified by GC using electron capture detection. PQLs for this method are presented in Table 7.15. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.16 and 7.17.

A second-column confirmation is not required for the analysis of toxaphene or chlordane.

Table 7.15
PQLs for Method SW8081A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Organochlorine Pesticides SW3510B/SW3520B/SW8081A (W) SW3550A/SW8081 (S)	α-BHC	0.35	μg/L	0.019	mg/kg
	β-BHC	0.23	μg/L	0.033	mg/kg
	δ-BHC	0.24	μg/L	0.011	mg/kg
	γ-BHC (lindane)	0.25	μg/L	0.02	mg/kg
	α-Chlordane	0.8	μg/L	0.015	mg/kg
	γ-Chlordane	0.37	μg/L	0.015	mg/kg
	4,4'-DDD	0.5	μg/L	0.042	mg/kg
	4,4'-DDE	0.58	μg/L	0.025	mg/kg
	4,4'-DDT	0.81	μg/L	0.036	mg/kg
	Aldrin	0.34	μg/L	0.022	mg/kg
	Dieldrin	0.44	μg/L	0.035	mg/kg
	Endosulfan I	0.3	μg/L	0.021	mg/kg
	Endosulfan II	0.4	μg/L	0.024	mg/kg
	Endosulfan sulfate	0.35	μg/L	0.036	mg/kg
	Endrin	0.39	μg/L	0.036	mg/kg
	Endrin aldehyde	0.5	μg/L	0.016	mg/kg
	Heptachlor	0.4	μg/L	0.02	mg/kg
	Heptachlor epoxide	0.32	μg/L	0.021	mg/kg
	Methoxychlor	0.86	μg/L	0.057	mg/kg
	Toxaphene	0.5	μg/L	0.57	mg/kg

Table 7.16
QC Acceptance Criteria for Method SW8081A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8081A	α-BHC	75–125	≤ 30	65–135	≤ 50
	β-BHC	51–125	≤ 30	41–133	≤ 50
	δ-BHC	75–126	≤ 30	65–136	≤ 50
	γ-BHC (lindane)	73–125	≤ 30	63–130	≤ 50
	α-Chlordane	41–125	≤ 30	31–135	≤ 50
	γ-Chlordane	41–125	≤ 30	31–133	≤ 50
	4,4-DDD	48–136	≤ 30	38–146	≤ 50
	4,4-DDE	45–139	≤ 30	35–149	≤ 50
	4,4-DDT	34–143	≤ 30	25–153	≤ 50
	Aldrin	47–125	≤ 30	37–126	≤ 50
	Dieldrin	42–132	≤ 30	32–142	≤ 50
	Endosulfan I	49–143	≤ 30	39–153	≤ 50
	Endosulfan II	75–159	≤ 30	65–169	≤ 50
	Endosulfan sulfate	46–141	≤ 30	36–151	≤ 50
	Endrin	43–134	≤ 30	33–144	≤ 50
	Endrin aldehyde	75–150	≤ 30	65–160	≤ 50
	Heptachlor	45–128	≤ 30	35–138	≤ 50
	Heptachlor epoxide	53–134	≤ 30	43–144	≤ 50
	Methoxychlor	73–142	≤ 30	63–152	≤ 50
	Toxaphene	41–126	≤ 30	31–136	≤ 50
	Surrogates:				
	DCBP	34–133		25–143	
	TCMX	45–125		35–135	

Table 7.17
Summary of Calibration and QC Procedures for Method SW8081A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8081A	Organochlorine pesticides	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30%; *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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 ±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 20 samples and at the end of the analysis sequence	All analytes within ±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
		Breakdown check (Endrin and DDT - pesticide analysis only)	Daily prior to analysis of samples	Degradation ≤15%	Repeat breakdown check	Apply J to all positive DDT, DDE, DDD, endrin, endrin ketone and endrin aldehyde results; apply J to positive results for the analytes listed above if minimum frequency is not met
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.16	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 7.17 (continued)
Summary of Calibration and QC Procedures for Method SW8081

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8081 (cont)	Organochlorine pesticides	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.16	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.16	Correct problem then reextract and analyze sample	Flagging conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.16	none	Flagging conventions, Table 8.2
		Second-column confirmation	100% for all positive results above the PQL	<25% difference between the primary and secondary column result	none	Flagging conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.15	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

7.2.6 Method SW8082–Polychlorinated Biphenyls (PCBs)

PCBs in water and soil samples are analyzed using method SW8082. This analytical method involves extraction of water samples using a separatory funnel (method SW3510B) or continuous liquid-liquid extraction (method SW3520B). Extraction of solid samples is accomplished with ultrasonic extraction (method SW3550A) procedures. The PCBs are separated and quantified by GC using electron capture detection or electrolytic conductivity detection. PQLs for this method are presented in Table 7.18. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.19 and 7.20.

For the analysis of PCBs, the initial five-point calibration and second source calibration verification shall contain all PCBs. Retention times shall be verified for all analytes during the initial five-point calibration. A single-point calibration will be analyzed for the remaining PCBs and toxaphene, and the concentration of these single calibration points will correspond to the AFCEE PQLs. ICV, CCV, MS, and LCS spiking solutions will contain a representative Aroclor 1016/1260 mixture. If any PCBs are detected, the result is reported quantified using the original calibration. Second-column confirmation is not required.

Table 7.18
PQLs for Method SW8082

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
PCBs SW3510B/SW3520B/SW8082 (W) SW3550A/SW8082 (S)	PCB-1016	1.00	µg/L	0.70	mg/kg
	PCB-1221	1.00	µg/L	0.70	mg/kg
	PCB-1232	1.00	µg/L	0.70	mg/kg
	PCB-1242	1.00	µg/L	0.70	mg/kg
	PCB-1248	1.00	µg/L	0.70	mg/kg
	PCB-1254	1.00	µg/L	0.70	mg/kg
	PCB-1260	1.00	µg/L	0.70	mg/kg

Table 7.19
QC Acceptance Criteria for Method SW8082

Method	Analyte	Accuracy Water (%R)	Precision Water (%RPD)	Accuracy Soil (%R)	Precision Soil (%RPD)
SW8082	PCB-1016	54–125	≤ 30	44–127	≤ 50
	PCB-1221	41–126	≤ 30	31–136	≤ 50
	PCB-1232	41–126	≤ 30	31–136	≤ 50
	PCB-1242	39–150	≤ 30	29–160	≤ 50
	PCB-1248	41–126	≤ 30	31–136	≤ 50
	PCB-1254	29–131	≤ 30	25–141	≤ 50
	PCB-1260	41–126	≤ 30	31–136	≤ 50
	Surrogates:				
	DCBP	34–133		25–143	

Table 7.20
Summary of Calibration and QC Procedures for Method SW8082

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8082	PCBs	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30%; *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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 ±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 20 samples and at the end of the analysis sequence	All analytes within ±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
		Breakdown check (Endrin and DDT - pesticide analysis only)	Daily prior to analysis of samples	Degradation ≤15%	Repeat breakdown check	Apply J to all positive DDT, DDE, DDD, endrin, endrin ketone and endrin aldehyde results; apply J to positive results for the analytes listed above if minimum frequency is not met
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.19	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 7.20 (continued)
Summary of Calibration and QC Procedures for Method SW8082

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8082 (cont)	PCBs (cont)	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.19	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.19	Correct problem then reextract and analyze sample	Flagging conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.19	none	Flagging conventions, Table 8.2
		Second-column confirmation	100% for all positive results above the PQL	<25% difference between the primary and secondary column result	none	Flagging conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.18	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

7.2.7 Method SW8141A–Organophosphorus Pesticides

Method SW8141A is a GC method used to determine the concentrations of various organophosphorus pesticides. This analytical method involves extraction of water samples using a separatory funnel (method SW3510C). Extraction of solid samples is accomplished using one of the Soxhlet extraction (method SW3540C or SW3541) procedures. An aliquot of the extract is injected into a GC, and compounds in the GC effluent are detected with a flame photometric or nitrogen-phosphorus detector. Any compounds identified tentatively in the primary analysis are confirmed on a second GC column. PQLs for these pesticides are presented in Table 7.21. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.22 and 7.23.

Table 7.21
PQLs for Method SW8141A

Parameter/Method	Analyte[a]	Water		Soil	
		PQL	Unit	PQL	Unit
Organophosphorus Pesticides SW3510C/SW8141A (Water) SW3540C/SW8141A (Soil) or SW3541/SW8141A (Soil)	Disulfoton	0.7	µg/L	0.04	mg/kg
	Parathion methyl	1.2	µg/L	0.06	mg/kg
	Phorate	0.4	µg/L	0.02	mg/kg

[a] Additional analytes are referenced in Appendix A

Table 7.22
QC Acceptance Criteria for Method SW8141A

Method	Analyte[a]	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8141A	Disulfoton	50–150	≤ 30	40–160	≤ 50
	Parathion methyl	45–130	≤ 30	35–140	≤ 50
	Phorate	50–150	≤ 30	40–160	≤ 50
	Surrogates:				
	Tributyl phosphate	67-136	≤ 30	67-136	≤ 50
	Triphenyl phosphate	65-134	≤ 30	65-134	≤ 50

[a] Additional analytes are listed in Appendix A

514 101

Table 7.23
Summary of Calibration and QC Procedures for Method SW8141A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8141A	Organophosphorus pesticides	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30%; *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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 ±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 ±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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.22	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 7.23 (continued)
Summary of Calibration and QC Procedures for Method SW8141A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8141A (cont)	Organophosphorus pesticides (cont)	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.22	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.22	Correct problem then reextract and analyze sample	Flagging Conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.22	none	Flagging Conventions, Table 8.2
		Second-column confirmation	100% for all positive results above the PQL	<25% difference between the primary and secondary column result	none	Flagging Conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.21	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

514 102

7.2.8 Method SW8150B–Chlorinated Herbicides

Method SW8150B is a GC method for determining selected chlorinated acid herbicides. The esters are hydrolyzed and extraneous organic material is removed by a solvent wash. After acidification, the acids are extracted with solvent and converted to esters. The esters are determined by GC employing an electron capture detector. The results are reported as the acid equivalents. Any compounds identified tentatively in the primary analysis are confirmed on a second GC column. PQLs for herbicides are presented in Table 7.24. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.25 and 7.26.

Table 7.24
PQLs for Method SW8150B

Parameter/Method	Analyte[a]	Water		Soil	
		PQL	Unit	PQL	Unit
Chlorinated Phenoxy Acid Herbicides SW8150B	2,4-D	12.0	µg/L	0.8	mg/kg
	2,4,5-T	2.0	µg/L	0.1	mg/kg
	2,4,5-TP	1.7	µg/L	0.1	mg/kg
	Dinoseb[b]	1	µg/L	0.05	mg/kg

[a] Additional analytes are listed in Appendix A
[b] May also be analyzed by method SW8270C (see Appendix A)

Table 7.25
QC Acceptance Criteria for Method SW8150B

Method	Analyte[a]	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8150B	2,4-D	65–125	≤ 30	55–135	≤ 50
	2,4,5-T	71–125	≤ 30	61–135	≤ 50
	2,4,5-TP	75–125	≤ 30	65–135	≤ 50
	Dinoseb [b]	72–125	≤ 30	62–135	≤ 50
	Surrogate:				
	2,4-Dichlorophenylacetic acid	61-136	≤ 30	51-146	≤ 50

[a] Additional analytes are listed in Appendix A
[b] May also be analyzed by method SW8270C (see Appendix A)

Table 7.26
Summary of Calibration and QC Procedures for Method SW8150B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8150B	Chlorinated Herbicides	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30%; *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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 ±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 ±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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.25	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

514 104

Table 7.26 (continued)
Summary of Calibration and QC Procedures for Method SW8150B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8150B (cont)	Chlorinated Herbicides (cont)	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.25	Reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.25	Correct problem then reextract and analyze sample	Flagging Conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.25	none	Flagging Conventions, Table 8.2
		Second-column confirmation	100% for all positive results above the PQL	<25% difference between the primary and secondary column result	none	Flagging conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.24	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

7.2.9 Method SW8151A–Chlorinated Herbicides

Method SW8151A is a capillary GC method for determining selected chlorinated acid herbicides and related compounds. Samples are extracted then esterified. The esters are determined by GC employing an electron capture detector. Any compounds identified tentatively in the primary analysis are confirmed on a second GC column. PQLs for herbicides are presented in Table 7.27. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.28 and 7.29.

Table 7.27
PQLs for Method SW8151A

Parameter/Method	Analyte[a]	Water		Soil	
		PQL	Unit	PQL	Unit
Chlorinated Phenoxy Acid Herbicides SW8151A	2,4-D	2.0	µg/L	0.001	mg/kg
	2,4,5-T	0.80	µg/L	0.5	mg/kg
	2,4,5-TP	0.75	µg/L	0.003	mg/kg
	Dinoseb[b]	1.9	µg/L	2.7	mg/kg

[a] Additional analytes are listed in Appendix A
[b] May also be analyzed by method SW8270C (see Appendix A)

Note the reporting limits listed for method SW8150B may be used in place of the reporting limits listed above as long as the reporting limits for method SW8150B meet the ARARs for the project.

Table 7.28
QC Acceptance Criteria for Method SW8151A

Method	Analyte[a]	Accuracy Water (% R)	Precision Water(% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8151A	2,4-D	50–125	≤ 30	50–135	≤ 50
	2,4,5-T	71–125	≤ 30	61–135	≤ 50
	2,4,5-TP	75–125	≤ 30	65–135	≤ 50
	Dinoseb[b]	25–125	≤ 30	25–135	≤ 50
	Surrogate:				
	2,4-Dichlorophenylacetic acid	61-136	≤ 30	51-146	≤ 50

[a] Additional analytes are listed in Appendix A
[b] May also be analyzed by method SW8270C (see Appendix A)

Table 7.29
Summary of Calibration and QC Procedures for Method SW8151A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8151A	Chlorinated Herbicides	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30%; *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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 ±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 ±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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.28	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

514 107

Table 7.29 (continued)
Summary of Calibration and QC Procedures for Method SW8151

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8151A (cont)	Chlorinated Herbicides (cont)	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.28	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.28	Correct problem then reextract and analyze sample	Flagging Conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.28	none	Flagging Conventions, Table 8.2
		Second-column confirmation	100% for all positive results above the PQL	<25% difference between the primary and secondary column result	none	Flagging conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.27	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

7.2.10 Method SW8260B–Volatile Organics

Volatile (or purgeable) organics in water and soil samples are analyzed using method SW8260B. This method uses a capillary column GC/mass spectrometry technique. Volatile compounds are introduced into the GC by purge and trap, either utilizing method SW5030B for aqueous samples or method 5035 for soil samples. 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 7.30.

Tuning–The mass spectrometer is tuned daily to give an acceptable spectrum for bromoflourobenzene (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

Calibration–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 added to each calibration standard, blank, QC sample, and sample. Since the response of IS chlorobenzene-d5 (m/z 117) is too strong to properly use for bromoform, a secondary ion (m/z 119) will be used when quantifying associated compounds. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.31 and 7.32.

Table 7.30
PQLs for Method SW8260B

Parameter/Method	Analyte[a]	Water		Soil	
		PQL	Unit	PQL	Unit
VOCs SW5030B/SW8260B (Water) SW5035/SW8260B (Soil)	1,1,1,2-Tetrachloroethane	0.5	µg/L	0.003	mg/kg
	1,1,1-Trichloroethane	0.8	µg/L	0.004	mg/kg
	1,1,2,2-Tetrachloroethane	1.0	µg/L	0.002	mg/kg
	1,1,2-Trichloroethane	1.0	µg/L	0.005	mg/kg
	1,1-Dichloroethane	0.4	µg/L	0.002	mg/kg
	1,1-Dichloroethene	1.2	µg/L	0.006	mg/kg
	1,1-Dichloropropene	1.0	µg/L	0.005	mg/kg
	1,2,3-Trichlorobenzene	2.0	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-Dichloroethane	0.6	µg/L	0.003	mg/kg
	1,2-Dichlorobenzene	0.3	µg/L	0.002	mg/kg
	1,2-Dibromo-3-chloropropane	2.6	µg/L	0.010	mg/kg
	1,2-Dichloropropane	0.4	µg/L	0.002	mg/kg
	1,3,5-Trimethylbenzene	0.5	µg/L	0.003	mg/kg
	1,3-Dichlorobenzene	1.2	µg/L	0.006	mg/kg
	1,3-Dichloropropane	0.4	µg/L	0.002	mg/kg
	1,4-Dichlorobenzene	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
	Bromomethane	1.1	µg/L	0.005	mg/kg
	Carbon tetrachloride	2.1	µg/L	0.010	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-Dichloroethene	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

Table 7.30 (continued)
PQLs for Method SW8260B

Parameter/Method	Analyte[a]	Water		Soil	
		PQL	Unit	PQL	Unit
VOCs SW5030B/SW8260B (Water) SW5035/SW8260B (Soil) (cont)	Dichlorodifluoromethane	1.0	µg/L	0.005	mg/kg
	Ethylbenzene	0.6	µg/L	0.003	mg/kg
	Ethylene dibromide	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– and *p*-Xylene	1.3	µg/L	0.007	mg/kg
	Methylene chloride	5.0	µg/L	0.002	mg/kg
	Methyl *tert*-butyl ether	2.0	µg/L	0.005	mg/kg
	n-Butylbenzene	1.1	µg/L	0.005	mg/kg
	n-Propylbenzene	0.4	µg/L	0.002	mg/kg
	Naphthalene	2.0	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
	sec-Butylbenzene	1.3	µg/L	0.007	mg/kg
	Styrene	0.4	µg/L	0.002	mg/kg
	Trichloroethene	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-Dichloroethene	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

[a] Additional analytes are listed in Appendix A

Table 7.31
QC Acceptance Criteria for Method SW8260B

Method	Analyte[a]	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8260B	1,1,1,2-Tetrachloroethane	72–125	≤ 20	62–108	≤ 30
	1,1,1-Trichloroethane	75–125	≤ 20	65–135	≤ 30
	1,1,2,2-Tetrachloroethane	74–125	≤ 20	64–135	≤ 30
	1,1,2-Trichloroethane	75–127	≤ 20	65–135	≤ 30
	1,1-Dichloroethane	72–125	≤ 20	62–135	≤ 30
	1,1-Dichloroethene	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-Trimethylbenzene	75-125	≤ 20	65–135	≤ 30
	1,2-Dichloroethane	68–127	≤ 20	58–137	≤ 30
	1,2-Dichlorobenzene	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
	1,3,5-Trimethylbenzene	72–112	≤ 20	62–135	≤ 30
	1,3-Dichlorobenzene	75-125	≤ 20	65–135	≤ 30
	1,3-Dichloropropane	75-125	≤ 20	65–135	≤ 30
	1,4-Dichlorobenzene	75-125	≤ 20	65–135	≤ 30
	1-Chlorohexane	75-125	≤ 20	65–135	≤ 30
	2,2-Dichloropropane	50-125	≤ 20	50–135	≤ 30
	2-Chlorotoluene	73–125	≤ 20	63–135	≤ 30
	4-Chlorotoluene	74–125	≤ 20	64–135	≤ 30
	Benzene	75–125	≤ 20	65–135	≤ 30
	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	50–125	≤ 20	50–135	≤ 30
	Carbon tetrachloride	62–125	≤ 20	52–135	≤ 30
	Chlorobenzene	75–125	≤ 20	65–135	≤ 30
	Chloroethane	50–125	≤ 20	50–135	≤ 30
	Chloroform	74–125	≤ 20	64–135	≤ 30
	Chloromethane	50-125	≤ 20	50–135	≤ 30
	cis-1,2-Dichloroethene	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	50-125	≤ 20	50–135	≤ 30
	Ethylbenzene	75–125	≤ 20	65–135	≤ 30
	Ethylene dibromide	75-125	≤ 20	65–135	≤ 30
	Hexachlorobutadiene	75–125	≤ 20	65–135	≤ 30
	Isopropylbenzene	75–125	≤ 20	65–135	≤ 30
	m– and *p*-Xylene	75–125	≤ 20	65–135	≤ 30

Table 7.31 (continued)
QC Acceptance Criteria for Method SW8260B

Method	Analyte[a]	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8260B	Methylene chloride	75–125	≤ 20	65–135	≤ 30
	Methyl *tert*-butyl ether	65-135	≤ 20	55-145	≤ 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
	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
	trans-1,2-Dichloroethene	75–125	≤ 20	65–135	≤ 30
	trans-1,3-Dichloropropene	66–125	≤ 20	56–135	≤ 30
	Trichlorofluoromethane	50–125	≤ 20	50–135	≤ 30
	Vinyl chloride	46–134	≤ 20	36–144	≤ 30
	Surrogates:				
	Dibromofluoromethane	75–125		65–135	
	Toluene-*d8*	75–125		65–135	
	4-Bromofluorobenzene	75–125		65–135	
	1,2-Dichloroethane-*d4*	62–139		52–149	

[a] Additional analytes are listed in Appendix A

Table 7.32
Summary of Calibration and QC Procedures for Method SW8260A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8260B	Volatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Each SPCC average RRF ≥ 0.30[a]; and %RSD for each CCC ≤ 30%, and *either* mean %RSD for all analytes ≤15% with no single analyte >30% *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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
		Calibration verification	Daily, before sample analysis, every 12 hours of analysis time	Each SPCC RF ≥ 0.30[a]; and each CCC < 20% drift; and all calibration analytes within ±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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.31	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
		Check of mass spectral ion intensities using bromofluorobenzene	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (Section 7.2.10)	Retune instrument and verify	Apply R to all results for all samples associated with the tune
		Internal standards	Every sample, spiked sample, standard, and method blank	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	Apply J to all detects and UJ to all non-detects for specific analytes associates with the IS in the affected sample

Table 7.32 (continued)
Summary of Calibration and QC Procedures for Method SW8260A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8260B (cont)	Volatile Organics (cont)	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.31	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.31	Correct problem then reextract and analyze sample	Flagging Conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.31	none	Flagging Conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.30	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] Except > 0.10 for bromoform, and > 0.01 for chloromethane and 1,1-dichloroethane.

7.2.11 Method SW8270C–Semivolatile Organics

Semivolatile organics (also known as base/neutral and acid extractables) in water and soil samples are analyzed using method SW8270C. This technique determines quantitatively the concentration of a number of SVOCs. Aqueous samples are prepared using method SW3510C or SW3520C; solid samples are prepared by method SW3550B. 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 7.33.

Tuning–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

Calibration–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 7.34 and 7.35.

Table 7.33
PQLs for Method SW8270C

Parameter/Method	Analyte*	Water		Soil	
		PQL	Unit	PQL	Unit
Semivolatile organics Base/Neutral Extractables SW3510C/SW3520C/ SW8270C (Water) SW3550B/SW8270C (Soil)	1,2,4-Trichlorobenzene	10.0	µg/L	0.7	mg/kg
	1,2-Dichlorobenzene	10.0	µg/L	0.7	mg/kg
	1,3-Dichlorobenzene	10.0	µg/L	0.7	mg/kg
	1,4-Dichlorobenzene	10.0	µg/L	0.7	mg/kg
	2,4-Dinitrotoluene	10.0	µg/L	0.7	mg/kg
	2,6-Dintrotoluene	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
	Benzo(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-Chloroethyl) 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 benzyl phthalate	10.0	µg/L	0.7	mg/kg
	Chrysene	10.0	µg/L	0.7	mg/kg
	Di-n-butyl phthalate	10.0	µg/L	0.7	mg/kg
	Di-n-octyl phthalate	10.0	µg/L	0.7	mg/kg
	Dibenzo(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

Table 7.33 (continued)
PQLs for Method SW8270C

Parameter/Method	Analyte[a]	Water		Soil	
		PQL	Unit	PQL	Unit
Base/Neutral Extractables SW3510C/SW3520C/ SW8270C (Water) SW3550A/SW8270C (Soil) (cont)	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 SW3510C/SW3520C/ SW8270C (Water) SW3550B/SW8270C (Soil)	2,4,5-Trichlorophenol	50.0	µg/L	3.3	mg/kg
	2,4,6-Trichlorophenol	10.0	µg/L	0.33	mg/kg
	2,4-Dichlorophenol	10.0	µg/L	0.33	mg/kg
	2,4-Dimethylphenol	10.0	µg/L	0.33	mg/kg
	2,4-Dinitrophenol	50.0	µg/L	3.3	mg/kg
	2-Chlorophenol	10.0	µg/L	0.33	mg/kg
	2-Methylphenol	10.0	µg/L	0.33	mg/kg
	2-Nitrophenol	10.0	µg/L	0.33	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
	3- and 4-Methylphenol	10.0	µg/L	1	mg/kg
	4-Nitrophenol	50.0	µg/L	1.7	mg/kg
	Benzoic acid	50.0	µg/L	1.7	mg/kg
	Pentachlorophenol	50.0	µg/L	3.3	mg/kg
	Phenol	10.0	µg/L	0.33	mg/kg

[a] Additional analytes are listed in Appendix A

Table 7.34
QC Acceptance Criteria for Method SW8270C

Method	Analyte*	Accuracy Water (%R)	Precision Water (%RPD)	Accuracy Soil (%R)	Precision Soil (%RPD)
SW8270C Base/Neutral Extractables	1,2,4-Trichlorobenzene	44–142	≤ 20	34–152	≤ 30
	1,2-Dichlorobenzene	42–155	≤ 20	32–135	≤ 30
	1,3-Dichlorobenzene	36–125	≤ 20	26–135	≤ 30
	1,4-Dichlorobenzene	30–125	≤ 20	25–135	≤ 30
	2,4-Dinitrotoluene	39–139	≤ 20	29–149	≤ 30
	2,6-Dinitrotoluene	51–125	≤ 20	41–135	≤ 30
	2-Chloronaphthalene	60–125	≤ 20	50–135	≤ 30
	2-Methylnaphthalene	41–125	≤ 20	31–135	≤ 30
	2-Nitroaniline	10–125	≤ 20	10–135	≤ 30
	3,3'-Dichlorobenzidine	10–175	≤ 20	10–175	≤ 30
	3-Nitroaniline	10–125	≤ 20	10–135	≤ 30
	4-Bromophenyl phenyl ether	53–127	≤ 20	43–137	≤ 30
	4-Chloroaniline	10-136	≤ 20	10-146	≤ 30
	4-Chlorophenyl phenyl ether	51–132	≤ 20	41–142	≤ 30
	4-Nitroaniline	10–143	≤ 20	10–153	≤ 30
	Acenaphthylene	47–125	≤ 20	37–135	≤ 30
	Acenaphthene	49–125	≤ 20	39–135	≤ 30
	Anthracene	45–165	≤ 20	35–175	≤ 30
	Benzo[*a*]anthracene	51–133	≤ 20	41–143	≤ 30
	Benzo[*a*]pyrene	41–125	≤ 20	31–135	≤ 30
	Benzo[*b*]fluoranthene	37–125	≤ 20	27–1 35	≤ 30
	Benzo[*g,h,i*]perylene	34–149	≤ 20	25–159	≤ 30
	Benzyl alcohol	10–125	≤ 20	10–135	≤ 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
	Dibenzo[*a,h*]anthracene	50–125	≤ 20	40–135	≤ 30
	Dibenzofuran	52–125	≤ 20	42–135	≤ 30
	Diethyl phthalate	10–125	≤ 20	10–135	≤ 30
	Dimethyl phthalate	10–175	≤ 20	10–175	≤ 30
	Fluoranthene	47–125	≤ 20	37–135	≤ 30
	Fluorene	48–139	≤ 20	38–149	≤ 30
	Hexachlorobenzene	46–133	≤ 20	36–143	≤ 30
	Hexachlorobutadiene	25–125	≤ 20	25–135	≤ 30

Table 7.34 (continued)
QC Acceptance Criteria for Method SW8270C

Method	Analyte[a]	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8270C Base/Neutral Extractables (cont)	Hexachlorocyclopentadiene	10–125	≤ 20	10–135	≤ 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
SW8270C Acid Extractables	2,4,5-Trichlorophenol	25–175	≤ 20	25–175	≤ 30
	2,4,6-Trichlorophenol	39–128	≤ 20	29–138	≤ 30
	2,4-Dichlorophenol	46–125	≤ 20	36–135	≤ 30
	2,4-Dimethylphenol	45–139	≤ 20	35–149	≤ 30
	2,4-Dinitrophenol	10–151	≤ 20	10–161	≤ 30
	2-Chlorophenol	41–125	≤ 20	31–135	≤ 30
	2-Methylphenol	25–125	≤ 20	25–135	≤ 30
	2-Nitrophenol	44–125	≤ 20	34–135	≤ 30
	4,6-Dinitro-2-methylphenol	26–134	≤ 20	25–144	≤ 30
	4-Chloro-3-methylphenol	44–125	≤ 20	34–135	≤ 30
	4-Methylphenol	33–125	≤ 20	25–135	≤ 30
	4-Nitrophenol	10–131	≤ 20	10–141	≤ 30
	Benzoic Acid	10–162	≤ 20	10–172	≤ 30
	Pentachlorophenol	28–136	≤ 20	38–146	≤ 30
	Phenol	25–125	≤ 20	25–135	≤ 30
SW8270C	***Surrogates:***				
	2,4,6-Tribromophenol (Acid)	25–134		25–144	
	2-Fluorobiphenyl (Base/Neutral)	43–125		34–135	
	2-Fluorophenol (Acid)	25–125		25–135	
	Nitrobenzene-*d5* (Base/Neutral)	32–125		25–135	
	Phenol-*d5* (Acid)	25–125		25–135	
	Terphenyl-*d14* (Base/Neutral)	42–126		32–136	

[a] Additional analytes are listed in Appendix A

Table 7.35
Summary of Calibration and QC Procedures for Method SW8270C

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8270C	Semivolatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Each SPCC average RRF ≥ 0.05; and %RSD for each CCC ≤ 30%, and *either* mean %RSD for all analytes ≤15% with no single analyte >30% *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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
		Calibration verification	Daily, before sample analysis, every 12 hours of analysis time	Each SPCC RRF ≥ 0.05; and each CCC < 20% drift; and all calibration analytes within ±25% of expected value[a]	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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.34	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
		Check of mass spectral ion intensities using DFTPP	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (Section 7.2.11)	Retune instrument and verify	Apply R to all results for all samples associated with the tune

Table 7.35 (continued)
Summary of Calibration and QC Procedures for Method SW8270C

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8270C (cont)	Semivolatile Organics (cont)	Internal standards	Every sample, spiked sample, standard, and method blank	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	Apply J to all detects and UJ to all non-detects for specific analytes associated with the IS in the affected sample
		Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.34	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.34	Correct problem then reextract and analyze sample	Flagging Conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.34	none	Flagging Conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.33	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] within ±30% of expected value for benzyl alcohol; hexachlorocyclopentadiene; 2,4-dinitrophenol; 4-nitrophenol; 4,6-dinitro-2-methylphenol; 2-nitroaniline; 3-nitroaniline; and 4-chloroaniline

7.2.12 Method SW8280A–Polychlorinated Dibenzo-*p*-Dioxins and Polychlorinated Dibenzofurans

Method SW8280A is used to analyze for polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in water, soil, and waste. This GC/MS method uses matrix-specific extraction, analyte-specific cleanup, and high-resolution capillary column GC/low resolution mass spectrometry techniques to separate and identify the analytes of interest. The sensitivity of the method is dependent on the level of matrix interference. Selected cleanup methods may be used to reduce or eliminate interferences. Target analytes include all congener classes, tetra- through octa-dioxins and furans. Achieved detection limits vary according to matrix and analyte. Because of the extreme toxicity of these compounds, the analyst must take appropriate precautions during preparation and analysis to prevent accidental exposure. PQLs are presented in Table 7.36.

A tetrachlorinated dibenzo-*p*-dioxin (TCDD) chromatographic test mixture is analyzed daily to verify that there is at least 25 percent valley resolution between 2,3,7,8 TCDD and 1,2,3,4-TCDD. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.37 and 7.38.

Table 7.36
PQLs for Method SW8280A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Dioxins and Furans SW8280A	2,3,7,8-TCDD	4.4	ng/L	1.7	µg/kg
	2,3,7,8-TCDF	1.0	ng/L	1.1	µg/kg

Table 7.37
QC Acceptance Criteria for Method SW8280A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8280A	2,3,7,8-TCDD	50–140	≤ 30	56–140	≤ 50
	2,3,7,8-TCDF	50–140	≤ 30	50–140	≤ 50
	Surrogates:				
	C^{13}-2,3,7,8-TCDF	40–125		30–135	
	C^{13}-2,3,7,8-TCDD	40–125		30–135	

Table 7.38
Summary of Calibration and QC Procedures for Method SW8280A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8280A	Dioxins/Furans	Check mass spectral ion intensity	Prior to each initial calibration		Retune instrument; verify	Apply R to all results associated with the tune
		Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	RSD ≤15% for CFs or RFs; *or* correlation coefficient (r) > 0.995 using 5 data points (first order) or 6 or 7 data points (second or third order)	Correct problem then repeat initial calibration	Apply R to the result for the 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 the result for the specific analyte(s) in the sample
		Column performance check	Prior to sample analysis, at the beginning of every 12-hour period, and at the end of the final run period	A ≤ 25% valley between 1,2,3,4-TCDD and 2,3,7,8-TCDD	Correct problem then repeat until criteria are met	Apply R to all tetra isomers if valley is > 25%
		Calibration verification (500 ng/mL standard)	As part of initial calibration and at the beginning of each 12-hour period	RF within 30% (RPD) of average initial multipoint RF; isotope ratios in agreement with footnote c	Correct problem then repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Apply R to the result for the specific analyte(s) for all samples associated with the calibration
		Sensitivity check (200 ng/mL standard)	As part of initial calibration and at the beginning of each 12-hour period	Signal to noise ratio for 2,3,7,8-TCDD standard ≥ 50:1	Correct problem then repeat initial calibration and reanalyze all samples analyzed since the last successful sensitivity check	Qualify as estimated (J, UJ) for all analytes if signal to noise ratio is ≤ 50:1
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.37	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to the specific analyte(s) result for all samples analyzed by the analyst

Table 7.38 (continued)
Summary of Calibration and QC Procedures for Method SW8280A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8280A (cont)	Dioxins/Furans (cont)	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.37	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.37	Correct problem then reextract and analyze sample	Flagging Conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.37	none	Flagging Conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.36	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] The acceptance criteria for spectral ion intensities are given below:

PCDDs	Selected Ions (m/z)	Relative Intensity	PCDFs	Selected Ions (m/z)	Relative Intensity
Tetra	320/322	0.65-0.89	Tetra	304/306	0.65-0.89
Penta	358/356	0.55-0.75	Penta	342/340	0.55-0.75
Hexa	392/390	0.69-0.93	Hexa	376/374	0.69-0.93
Hepta	426/424	0.83-1.12	Hepta	410/408	0.83-1.12
Octa	458/460	0.75-1.01	Octa	442/444	0.75-1.01

7.2.13 Method SW8290–Polychlorinated Dibenzo-*p*-Dioxins and Polychlorinated Dibenzo-furans

Method SW8290 is used to analyze for PCDDs and PCDFs in water, soil, and waste. This GC/MS method uses matrix-specific extraction, analyte-specific cleanup, and high-resolution capillary column GC/high resolution mass spectrometry techniques to separate and identify the analytes of interest. The sensitivity of the method is dependent on the level of matrix interference. Selected cleanup methods may be used to reduce or eliminate interferences. Target analytes may include all congener classes, tetra- through octa-dioxins and furans. Achieved detection limits vary according to matrix and analyte. Because of the extreme toxicity of these compounds, the analyst must take appropriate precautions during preparation and analysis to prevent accidental exposure. PQLs are presented in Table 7.39. The calibration, QC, corrective action, and data flagging requirements are given in Table 7.40.

Table 7.39
PQLs for Method SW8290

Parameter/ Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Dioxins and Furans SW8290	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.01	ng/L	1	ng/kg
	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.01	ng/L	1	ng/kg
	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.03	ng/L	2.5	ng/kg
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.03	ng/L	2.5	ng/kg
	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.03	ng/L	2.5	ng/kg
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.03	ng/L	2.5	ng/kg
	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.05	ng/L	5	ng/kg
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.01	ng/L	1	ng/kg
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.01	ng/L	1	ng/kg
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.05	ng/L	1	ng/kg
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.03	ng/L	2.5	ng/kg
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.03	ng/L	2.5	ng/kg
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.03	ng/L	2.5	ng/kg
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.03	ng/L	2.5	ng/kg
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.03	ng/L	2.5	ng/kg
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.03	ng/L	2.5	ng/kg
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.05	ng/L	5	ng/kg

Table 7.40
Summary of Calibration and QC Procedures for Method SW8290

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8290	Dioxins/ Furans	Mass spectrometer tune	As per method SW8290, Section 7.6.2	As per method SW8290, Section 7.6.2	Retune instrument; verify	Apply R to the result for the specific analyte(s) for all samples associated with the tune
		Initial and continuing calibration	As per method SW8290, Section 7.7	As per method SW8290, Section 7.7	Correct problem then repeat calibration	Apply R to the result for the specific analyte(s) for all samples associated with the calibration
		Identification/retention times/ion ratios/ signal to noise/ interferences	As per method SW8290, Section 7.8.4	As per method SW8290, Section 7.8.4	Correct problem and rerun	Apply R to the result for the specific analyte(s) for all samples associated with the condition
		System performance check	As per method SW8290, Section 8.2	As per method SW8290, Section 8.2	Correct problem and rerun	Apply R to all results for specific analyte(s) for all samples associated with the check
		Quality control checks	As per method SW8290, Section 8.3	As per method SW8290, Section 8.3	Correct problem and rerun	Apply R to all results for specific analyte(s) for all samples associated with the QC check
		Internal standard	As per method SW8290, Section 8.4	As per method SW8290, Section 8.4	Correct problem and rerun	Apply J to all detects and UJ to all non-detects for specific analytes associated with the IS in the affected sample
		MDL study	Once per 12 month period	Detection limits established shall be < the PQLs in Table 7.39	none	Apply R to all results for the specific analyte(s) in all samples analyzed

7.2.14 Method SW8310–Polynuclear Aromatic Hydrocarbons

Method SW8310 is used to determine the concentration of ppb levels of selected PAHs in groundwater and soils by HPLC. Aqueous samples are prepared using method SW3510C, solid samples are prepared by method SW3550B. Samples are analyzed by direct injection. Detection is by ultraviolet and fluorescent detectors.

This method provides for the use of a second GC column of a dissimilar polarity to resolve compounds of interest from interferences that may occur. Alternatively, sample analysis and confirmation may be accomplished in one analytical run with a diode array detector (DAD). When second-column analysis is performed, retention times for the analyte must match those established for each column. Otherwise, the chromatographic peaks are considered interferences, and the analyte is not considered to be present in the sample. Requirements for confirmation of analytes are described in Section 4.5.2. PQLs are listed in Table 7.41. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.42 and 7.43.

Table 7.41
PQLs for Method SW8310

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Polynuclear Aromatic Hydrocarbons SW3510C/SW8310 (Water) SW3550B/SW8310 (Soil)	Acenaphthene	18	µg/L	1.2	mg/kg
	Acenaphthylene	23	µg/L	1.54	mg/kg
	Anthracene	6.6	µg/L	0.44	mg/kg
	Benzo(a)anthracene	0.13	µg/L	0.009	mg/kg
	Benzo(a)pyrene	0.23	µg/L	0.015	mg/kg
	Benzo(b)fluoranthene	0.18	µg/L	0.012	mg/kg
	Benzo(g,h,i)perylene	0.76	µg/L	0.05	mg/kg
	Benzo(k)fluoranthene	0.17	µg/L	0.011	mg/kg
	Chrysene	1.5	µg/L	0.1	mg/kg
	Dibenzo(a,h)anthracene	0.3	µg/L	0.02	mg/kg
	Fluoranthene	2.1	µg/L	0.14	mg/kg
	Fluorene	2.1	µg/L	0.14	mg/kg
	Indeno(1,2,3-c,d)pyrene	0.43	µg/L	0.03	mg/kg
	Naphthalene	18	µg/L	1.2	mg/kg
	Phenanthrene	6.4	µg/L	0.42	mg/kg
	Pyrene	2.7	µg/L	0.18	mg/kg

Table 7.42
QC Acceptance Criteria for Method SW8310

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Polynuclear Aromatic Hydrocarbons SW3510C/SW8310 (Water) SW3550B/SW8310 (Soil)	Acenaphthylene	49–125	≤ 30	39–135	≤ 50
	Acenaphthene	43–130	≤ 30	33–140	≤ 50
	Anthracene	54–125	≤ 30	44–135	≤ 50
	Benzo(a)anthracene	39–135	≤ 30	29–145	≤ 50
	Benzo(a)pyrene	52–125	≤ 30	42–135	≤ 50
	Benzo(b)fluoranthene	31–137	≤ 30	25–147	≤ 50
	Benzo(g,h,i)perylene	53–125	≤ 30	43–135	≤ 50
	Benzo(k)fluoranthene	60–129	≤ 30	50–139	≤ 50
	Chrysene	59–134	≤ 30	49–144	≤ 50
	Dibenzo(a,h)anthracene	51–125	≤ 30	41–135	≤ 50
	Fluoranthene	42–125	≤ 30	32–135	≤ 50
	Fluorene	53–125	≤ 30	43–135	≤ 50
	Indeno(1,2,3-c,d)pyrene	55–125	≤ 30	45–135	≤ 50
	Naphthalene	43–125	≤ 30	33–135	≤ 50
	Phenanthrene	52–129	≤ 30	42–139	≤ 50
	Pyrene	55–125	≤ 30	45–135	≤ 50
	Surrogates (choose one):				
	Carbazole	30-130		30-130	
	Terphenyl-*d14*	25–157		22–167	

Table 7.43
Summary of Calibration and QC Procedures for Method SW8310

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8310	Polynuclear Aromatic Hydrocarbons	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30%; *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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
		Initial calibration verification	Daily, before sample analysis	All analytes within ±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 ±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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.42	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 reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2

Table 7.43 (continued)
Summary of Calibration and QC Procedures for Method SW8310

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8310 (cont)	Polynuclear Aromatic Hydrocarbons (cont)	LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.42	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.42	Correct problem then reextract and analyze sample	Flagging Conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.42	none	Flagging Conventions, Table 8.2
		Confirmation[a]	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 shall be < the PQLs in Table 7.41	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] Use a second column or different detector.

7.2.15 Method SW8330–Explosive Residues

Method SW8330 provides HPLC conditions for the detection of ppb levels of certain explosive residues in water, soil, and sediment matrices. 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 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 7.44. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.45 and 7.46.

Table 7.44
PQLs for Method SW8330

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Explosive Residues SW8330	1,3,5-Trinitrobenzene	7.3	µg/L	0.25	mg/kg
	1,3-Dinitrobenzene	4	µg/L	0.25	mg/kg
	2,4,6-Trinitrotoluene	6.9	µg/L	0.25	mg/kg
	2,4-Dinitrotoluene	5.7	µg/L	0.25	mg/kg
	2,6-Dinitrotoluene	9.4	µg/L	0.26	mg/kg
	HMX	13	µg/L	2.2	mg/kg
	m-Nitrotoluene	7.9	µg/L	0.25	mg/kg
	Methyl-2,4,6-trinitrophenylnitramine	44	µg/L	0.65	mg/kg
	Nitrobenzene	7	µg/L	0.26	mg/kg
	o-Nitrotoluene	12	µg/L	0.25	mg/kg
	p-Nitrotoluene	8.5	µg/L	0.25	mg/kg
	RDX	14	µg/L	1	mg/kg

Table 7.45
QC Acceptance Criteria for Method SW8330

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Explosive Residues SW8330	1,3,5-Trinitrobenzene	75–128	≤ 30	65–138	≤ 50
	2,4-Dinitrotoluene	75–125	≤ 30	65–135	≤ 50
	2,6-Dinitrotoluene	75–129	≤ 30	65–139	≤ 50
	HMX	74–137	≤ 30	64–147	≤ 50
	m-Nitrotoluene	60–134	≤ 30	50–144	≤ 50
	Methyl-2,4,6-trinitrophenylnitramine	44–142	≤ 30	34–152	≤ 50
	Nitrobenzene	29–134	≤ 30	25–144	≤ 50
	o-Nitrotoluene	75–129	≤ 30	65–139	≤ 50
	p-Nitrotoluene	42–150	≤ 30	32–160	≤ 50
	RDX	75–132	≤ 30	65–142	≤ 50
	Surrogates[a]				

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

Table 7.46
Summary of Calibration and QC Procedures for Method SW8330

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8330	Explosives	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30%; *or* r > 0.995 using 5 data points (first order) or COD > 0.990 using 6 or 7 data points (second or third order)	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 ±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
		Initial calibration verification	Daily, before sample analysis	All analytes within ±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 ±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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.45	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 reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2

514 134

Table 7.46 (continued)
Summary of Calibration and QC Procedures for Method SW8330

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8330 (cont)	Explosives (cont)	LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.45	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.2
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.45	Correct problem then reextract and analyze sample	Flagging Conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.45	none	Flagging Conventions, Table 8.2
		Confirmation[a]	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 shall be < the PQLs in Table 7.44	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] Use a second column or different detector.

7.2.16 Method SW6010B–Trace Elements (Metals) by Inductively Coupled Plasma Atomic Emission Spectroscopy for Water and Soil

Samples are analyzed for trace elements or metals using method SW6010B for water and soils. Analysis for most metals requires digestion of the sample. This digestion is performed by method SW3005A or SW3010A for water; method SW3050B will be used for soil. Following digestion, the trace elements are determined simultaneously or sequentially using ICP emission spectroscopy. The elements and corresponding PQLs for this method are listed in Table 7.47. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.48 and 7.49.

Table 7.47
PQLs for Method SW6010B

Parameter/Method	Analyte[a]	Water		Soil	
		PQL	Unit	PQL	Unit
ICP Screen for Metals SW3005A/SW3010A/ SW6010B (Water) SW3050B/SW6010B (Soil)	Aluminum	0.5	mg/L	50.0	mg/kg
	Antimony	0.002[b]	mg/L	0.56	mg/kg
	Arsenic	0.0049[b]	mg/L	5.85	mg/kg
	Barium	0.02	mg/L	2.0	mg/kg
	Beryllium	0.0003[b]	mg/L	0.3	mg/kg
	Cadmium	0.0005[b]	mg/L	0.556	mg/kg
	Calcium	1.0	mg/L	50.0	mg/kg
	Chromium	0.0053[b]	mg/L	7.0	mg/kg
	Cobalt	0.0089[b]	mg/L	6.19	mg/kg
	Copper	0.0008[b]	mg/L	6.0	mg/kg
	Iron	0.07	mg/L	7.0	mg/kg
	Lead	0.0016[b]	mg/L	12.66	mg/kg
	Magnesium	1.0	mg/L	50.0	mg/kg
	Manganese	0.02	mg/L	2.0	mg/kg
	Molybdenum	0.0144[b]	mg/L	1.46	mg/kg
	Nickel	0.0204	mg/L	14.6	mg/kg
	Potassium	5.0	mg/L	500	mg/kg
	Selenium	0.0077	mg/L	0.313	mg/kg
	Silver	0.0002[b]	mg/L	0.128	mg/kg
	Sodium	1.0	mg/L	50.0	mg/kg
	Thallium	0.002	mg/L	1.5	mg/kg
	Vanadium	0.012	mg/L	8.0	mg/kg
	Zinc	0.02	mg/L	2.0	mg/kg

[a] Additional analytes are listed in Appendix A
[b] An MDL below this value is sufficient to meet background values. (Jacobs 1998)

Table 7.48
QC Acceptance Criteria for Method SW6010B

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW6010B	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

[a] Additional analytes are listed in Appendix A

Table 7.49
Summary of Calibration QC Procedures for Method SW6010B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW6010B	ICP Metals	Initial multipoint calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis	none	none	Apply R to all results for s all samples analyzed without calibration
		Initial and continuing calibration blank	Before beginning a sample run, after every 10 samples and at end of the analysis sequence	No analytes detected > PQL; no negative signal < -PQL	Correct problem then analyze calibration blank and previous 10 samples	Flagging Conventions, Table 8.3
		Initial and continuing calibration verification	Before beginning a sample run, after every 10 samples and at end of the analysis sequence	All analyte(s) within ±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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.48	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; no negative signal < -PQL	Correct problem reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.3

Table 7.49 (continued)
Summary of Calibration QC Procedures for Method SW6010B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW6010B (cont)	ICP Metals (cont)	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 ±20% of expected value	Terminate analysis; correct problem; reanalyze ICS; reanalyze all affected samples	Flagging Conventions, Table 8.3
		LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.48	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.3
		Dilution test	Once per matrix per site (specified on chain of custody)	1:5 dilution must agree within 10% of the original determination	Perform post digestion spike addition	Apply J to detects and UJ to non-detects of specific analytes in associated samples if all of following exist: (1) post-digestion spike not run (2) %D > 10% (3) Original analyte concentration > 5 x PQL
		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 detects and UJ to all non-detects for specific analyte(s) for all samples associated with the post digestion spike addition
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.48	none	Flagging Conventions, Table 8.3
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.47	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

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

Samples are analyzed for trace elements or metals using method SW6020 for water and soils. Analysis for total (i.e., acid leachable) metals requires digestion of the sample by method SW3005A for water or method SW3050A for soil. Following digestion, the trace elements are determined simultaneously or sequentially using Inductively Coupled Plasma Mass Spectroscopy (ICP-MS). The elements and PQLs for this method are listed in Table 7.50. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.51 and 7.52.

Table 7.50
PQLs for Method SW6020

Parameter/Method	Analyte[a]	Water		Soil	
		PQL	Unit	PQL	Unit
ICP Screen for Metals SW3005A/SW6020 (Water) SW3050B/SW6020 (Soil)	Aluminum	0.5	mg/L	50.0	mg/kg
	Antimony	0.002[b]	mg/L	0.56	mg/kg
	Arsenic	0.0049[b]	mg/L	5.85	mg/kg
	Barium	0.02	mg/L	2.0	mg/kg
	Beryllium	0.0003[b]	mg/L	0.3	mg/kg
	Cadmium	0.0005[b]	mg/L	0.556	mg/kg
	Chromium	0.0053[b]	mg/L	7.0	mg/kg
	Cobalt	0.0089[b]	mg/L	6.19	mg/kg
	Copper	0.0008[b]	mg/L	6.0	mg/kg
	Lead	0.0016[b]	mg/L	12.66	mg/kg
	Manganese	0.02	mg/L	2.0	mg/kg
	Nickel	0.0204	mg/L	14.6	mg/kg
	Silver	0.0002[b]	mg/L	0.128	mg/kg
	Thallium	0.002	mg/L	1.5	mg/kg
	Zinc	0.02	mg/L	2.0	mg/kg

[a] Additional analytes are listed in Appendix A.
[b] An MDL below this value is sufficient to meet background values (Jacobs 1998)

Table 7.51
QC Acceptance Criteria for Method SW6020

Method	Analyte[a]	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW6020	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
	Chromium	80–120	≤ 15	80–120	≤ 25
	Cobalt	80–120	≤ 15	80–120	≤ 25
	Copper	80–120	≤ 15	80–120	≤ 25
	Lead	80–120	≤ 15	80–120	≤ 25
	Manganese	80–120	≤ 15	80–120	≤ 25
	Nickel	80–120	≤ 15	80–120	≤ 25
	Silver	80–120	≤ 15	80–120	≤ 25
	Thallium	80–120	≤ 15	80–120	≤ 25
	Zinc	80–120	≤ 15	80–120	≤ 25

[a] Additional analytes are listed in Appendix A

Table 7.52
Summary of Calibration and QC Procedures for Method SW6020

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW6020	ICP/MS Metals	MS tuning sample	Prior to initial calibration and calibration verification	Mass calibration and verification criteria of ±0.1 amu and mass resolution of ≤0.9 amu at 10% peak height	Retune instrument then reanalyze tuning solution	Apply R to all results for all analytes for all samples associated with the MS tuning
		Initial multipoint calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis	none	none	Apply R to all results samples run without daily calibration
		Initial and continuing calibration blank	Before beginning a sample run, after every 10 samples and at end of the analysis sequence	No analytes detected > PQL; no negative signal < -PQL	Correct problem then analyze calibration blank and previous 10 samples	Flagging Conventions, Table 8.3
		Initial and continuing calibration verification	Before beginning a sample run, after every 10 samples and at the end of the analysis sequence	All analyte(s) within ±10% 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(s) in all samples since the last acceptable calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.51	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; no negative signal < -PQL	Correct problem reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.3
		Interference check solution (ICS)	At the beginning and end of an analytical run or twice during an 12 hour period, whichever is more frequent	Within ±20% of expected value	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all affected samples	Flagging Conventions, Table 8.3
		LCS for each analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.51	Correct problem reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.3

Table 7.52 (continued)
Summary of Calibration and QC Procedures for Method SW6020

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW6020 (cont)	ICP/MS Metals (cont)	Dilution test	Once per matrix per site (specified on chain of custody)	1:4 dilution must agree within ±10% of the original determination	Perform post digestion spike addition	Apply J to detects and UJ non-detects of specific analytes in associated samples if both of following exist: (1) post-digestion spike not run (2) RPD > 10% (3) Original analyte concentration > 5 x PQL
		Post digestion spike addition	When dilution test fails	Recovery within 75-125% of expected results	Dilute the sample; reanalyze post digestion spike addition	Apply J to detects and UJ to non-detects for specific analyte(s) for all samples associated with the post digestion spike addition
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.51	none	Flagging Conventions, Table 8.3
		Internal Standards (ISs)	Every sample	IS intensity within 30-120% of intensity of the IS in the initial calibration	Perform corrective action as described in method SW6020	Apply R to specific analytes associated with IS in affected sample
		MDL study	Every three months	Detection limits established shall be < the PQLs in Table 7.50	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

7.2.18 Method Series SW7000A–Graphite Furnace Atomic Absorption

GFAA is used to measure low concentrations of metals in water and soil samples. GFAA analysis is an alternative when project-specific RLs cannot be met by ICP analysis (SW6010B). Those metals identified by AFCEE as having the potential for requiring GFAA analysis are antimony (SW7041), arsenic (SW7060A), cadmium (SW7131A), chromium (SW7191), lead (SW7421), nickel (SW7521), selenium (SW7740), thallium (SW7841), and vanadium (SW7911). GFAA samples are extracted and discrete aliquots of sample extract are deposited in a graphite tube furnace in microliter amounts. The graphite tube is heated resistively by an electrical current. The sample solution is dried and charred to remove sample matrix components and then atomized at temperatures sufficient to vaporize the analytes. Matrix modification is used to eliminate interference effects and may also enhance the vaporization efficiency and allow lower detection limits. RLs for this analysis are listed in Table 7.53. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.54 and 7.55.

Table 7.53
PQLs for Method Series SW7000A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
SW7041	Antimony	0.002*	mg/L	0.56	mg/kg
SW7060A	Arsenic	0.049*	mg/L	5.85	mg/kg
SW7131A	Cadmium	0.0005*	mg/L	0.556	mg/kg
SW7191	Chromium	0.0053	mg/L	7.0	mg/kg
SW7421	Lead	0.0016*	mg/L	12.66	mg/kg
SW7521	Nickel	0.0204	mg/L	14.6	mg/kg
SW7740	Selenium	0.0077	mg/L	0.313	mg/kg
SW7841	Thallium	0.002	mg/L	1.5	mg/kg
SW7911	Vanadium	0.012	mg/L	8.0	mg/kg

* An MDL below this value is sufficient to meet background values (Jacobs 1998).

Table 7.54
QC Acceptance Criteria for Method Series SW7000A

Method	Analyte	Accuracy Water (%R)	Precision Water (% RPD)	Accuracy Soil (%R)	Precision Soil (% RPD)
SW7041	Antimony	75–125	≤ 15	75–125	≤ 15
SW7060A	Arsenic	74-120	≤ 15	74-120	≤ 15
SW7131A	Cadmium	80-122	≤ 15	80-122	≤ 15
SW7191	Chromium	80-121	≤ 15	80-121	≤ 15
SW7421	Lead	74-124	≤ 15	74-124	≤ 15
SW7521	Nickel	75-125	≤ 15	75-125	≤ 15
SW7740	Selenium	73-122	≤ 15	73-122	≤ 15
SW7841	Thallium	78-123	≤ 15	78-123	≤ 15
SW6911	Vanadium	78-123	≤ 15	78-123	≤ 15

Table 7.55
Summary of Calibration and QC Procedures for Method Series SW7000A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
Series SW7000A	GFAA 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 for all samples associated with the calibration
		Second-source calibration check standard	Once per initial daily multipoint calibration	Analyte within ±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
		Initial and continuing calibration blank	Before beginning a sample run, after every 10 samples and at end of the analysis sequence	No analytes detected > PQL; no negative signal < -PQL	Correct problem then reanalyze calibration blank and all samples associated with blank	Apply B to all results for the specific analyte in all samples associated with the blank
		Initial and continuing calibration verification	Before beginning a sample run, after every 10 samples and at end of the analysis sequence	Each analyte within ±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 7.54	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; no negative signal < -PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte in all samples in the associated analytical batch

Table 7.55 (continued)
Summary of Calibration and QC Procedures for Method Series SW7000A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
Series SW7000A	GFAA Metals	LCS	One LCS per analytical batch	QC acceptance criteria, Table 7.54	Correct problem then reprepare 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 all non-detects
		Five-fold dilution test	Each preparatory batch	Five times dilution sample result must be ±10% of the undiluted sample result	Perform recovery test	If dilution test not run, apply J to all detects of affected analytes in associated samples If dilution test run, apply J to all detects of specific analytes in associated samples if all of the following exist: (1) dilution test RPD ≥ 10% (2) analyte concentration in dilution test parent sample > 25 x MDL (3) Recovery test not performed
		Recovery test	Once per sample	Recovery within 85-115% of expected results	Reprepare and reanalyze sample; or analyze sample by the method of standard addition (affected analytes only)	Apply J to detects of specific analyte(s) not quantified by the method of standard addition when recovery outside 85-115% range
		Method of standard addition	For specific analytes when recovery test fails, each sample in batch	Correlation coefficient (r) ≥ 0.995	none	Apply J to detection(s) of affected analyte(s) in sample with method of standard addition out of control

Table 7.55 (continued)
Summary of Calibration and QC Procedures for Method Series SW7000A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
Series SW7000A	GFAA Metals	MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.54	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 12 month period	Detection limits established shall be ≤ the PQLs in Table 7.53	none	Apply R to all results for the specific analyte in all samples analyzed
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

7.2.19 Method SW7196A–Hexavalent Chromium (Colorimetric)

Dissolved hexavalent chromium, in the absence of interfering amounts of substances such as molybdenum, vanadium, and mercury, may be determined colorimetrically. The samples are extracted by method SW3060A. PQLs for this method are listed in Table 7.56. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.57 and 7.58.

Table 7.56
PQLs for Method SW7196A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
SW7196A	Hexavalent Chromium	0.5	mg/L	1.0	mg/kg

Table 7.57
QC Acceptance Criteria for Method SW7196A

Method	Analyte	Accuracy Water (%R)	Precision Water (%RPD)	Accuracy Soil (%R)	Precision Soil (%RPD)
SW7196A	Hexavalent Chromium	86–117	≤ 15	86–117	≤ 25

Table 7.58
Summary of Calibration and QC Procedures for Method SW7196A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW7196A	Hexavalent Chromium	Multipoint calibration curve (minimum three standards and a blank)	Initial calibration prior to sample analysis	Correlation coefficient ≥0.995 for linear regression	Correct problem then repeat initial calibration	Apply R to the specific analyte result for all samples associated with the calibration
		Second-source calibration verification	After each new stock standard preparation	Analytes within ±10% of expected value	Correct problem then repeat initial calibration	Apply R to the specific analyte result for all samples associated with the calibration
		Continuing calibration verification	After every 15 samples and at the end of the analysis sequence	Chromium within ±20% of expected value	Correct problem then repeat initial calibration and reanalyze all samples since last successful calibration	Apply R to the specific analyte result in all samples since the last acceptable calibration verification
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.57	Recalculate results; locate and fix problem with system and then rerun demonstration	Apply R to the specific analyte result for all samples analyzed by the analyst
		Verification check to ensure lack of reducing condition and/or interference	Once for every sample matrix analyzed	Spike recovery between 85-115%	If check indicates interference, dilute and reanalyze sample. Persistent interference indicates the need to use and alternate method	Apply R to the specific analyte result for all samples analyzed since the last acceptable verification check
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.56	none	Apply R to all specific analyte results for all samples analyzed
		Method blank	One per analytical batch	No analyte detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.3

514 150

Table 7.58 (continued)
Summary of Calibration and QC Procedures for Method SW7196A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW7196A (cont)	Hexavalent Chromium	LCS	One LCS per analytical batch	QC acceptance criteria, Table 7:57	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.3
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.57	none	Flagging Conventions, Table 8.3
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

514 151

7.2.20 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 absorbence. The PQLs for these methods are listed in Table 7.59. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.60 and 7.61.

Table 7.59
PQLs for Methods SW7470A/SW7471A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
SW7470A (Water) SW7471A (Soil)	Mercury	0.0001*	mg/L	0.035[a]	mg/kg

[a] An MDL below this value is sufficient to meet background values. (Jacobs 1998)

Table 7.60
QC Acceptance Criteria for Methods SW7470A/SW7471A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW7470A/SW7471A	Mercury	77–120	≤ 15	77–120	≤ 25

Table 7.61
Summary of Calibration and QC Procedures for Methods SW7470A/SW7471A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW7470A SW7471A	Mercury	Initial multipoint calibration (minimum 5 standards and a blank)	Daily initial calibration prior to sample analysis	Correlation coefficient ≥0.995 for linear regression	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Second-source calibration check standard	Once per initial daily multipoint calibration	Analyte within ±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	Before beginning a sample run, after every 10 samples and at end of the analysis sequence	No analytes detected > PQL; no negative signal < -PQL	Correct problem then analyze calibration blank and previous 10 samples	Flagging Conventions, Table 8.3
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	The analyte within ±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 analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.60	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; no negative signal < -PQL	Correct problem reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.3
		LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.60	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.3

Table 7.61 (continued)
Summary of Calibration and QC Procedures for Methods SW7470A/SW7471A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW7470A SW7471A (cont)	Mercury (cont)	New matrix check; five-fold dilution test	Once per matrix per site (specified on chain of custody)	Five times dilution sample result must be ±10% of the undiluted sample result	Perform recovery test	Apply J/UJ to all associated sample results if all of following exist: (1) Recovery test of dilution test sample not 85-115%, and (2) RPD >10% (3) Analyte concentration >25 x MDL
		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
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.60	none	Flagging Conventions, Table 8.3
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.59	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

514 154

7.2.21 Method SW9012A–Total Cyanide and Cyanide Amenable to Chlorination

Water and waste samples are analyzed for total cyanide using method SW9012A. This method is used to determine the concentration of inorganic cyanide in aqueous wastes and leachates. The method detects inorganic cyanides that are present as either sample soluble salts or complex radicals. It is used to determine values for both total cyanide and cyanide amenable to chlorination. The cyanide is released by refluxing the sample with a strong acid and catalyst and distillation. Total cyanide in soils is determined after acidification of the soil and distillation. The cyanide ion in the absorbing solution is then determined by automated colorimetry. PQL for cyanide is listed in Table 7.62. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.63 and 7.64.

Table 7.62
PQL for Method SW9012A

Parameter/Method	Analyte	Water	
		PQL	Unit
SW9012A	Total cyanide	0.02	mg/L

Table 7.63
QC Acceptance Criteria for Method SW9012A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)
SW9012A	Total cyanide	79-114	≤ 20

Table 7.64
Summary of Calibration and QC Procedures for Method SW9012A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	lagging Criteria
SW9012A	Cyanide	Multipoint calibration curve (six standards and a calibration blank)	Initial daily calibration prior to sample analysis	Correlation coefficient 0.995 for linear regression	Correct problem then repeat initial calibration	Apply R to the result for cyanide for all samples associated with the calibration
		Distilled standards (one high and one low)	Once per multipoint calibration	Cyanide within ±15% of undistilled standard	Correct problem then repeat distilled standards	Apply R to all results for the specific analyte for all samples associated with the calibration
		Second-source calibration verification	Once per stock standard preparation	Cyanide within ±15% of expected value	Correct problem then repeat initial calibration	Apply R to the result for the specific analyte for all samples associated with the calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.63	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to the specific analyte result for all samples analyzed by the analyst
		Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.3
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.63	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Conventions, Table 8.3
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.63	none	Flagging Conventions, Table 8.3
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.62	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

7.2.22 Method SW9056 (E300.0)–Common Anions

This method addresses the sequential determination of the anions chloride, fluoride, bromide, nitrate, nitrite, phosphate, and sulfate in the collection solutions from the bomb combustion of solid waste samples, as well as water samples. A small volume of combustate collection solution or other water sample is injected into an ion chromatograph to flush and fill a constant volume sample loop. The sample is then injected into a stream of eluent.

The sample is pumped through three different ion exchange columns and into a conductivity detector. The first two columns, a precolumn (guard column) and a separator column, are packed with a low-capacity, strongly basic anion exchanger. Ions are separated into discrete bands based on their affinity for the exchange sites of the resin. The last column is a suppressor column that reduces the anions in the sample to their corresponding acids. The separated anions in their acid form are measured using an electrical-conductivity cell. Anions are identified based on their retention times compared to known standards. Quantitation is accomplished by measuring the peak height or area and comparing it to a calibration curve generated from known standards.

PQLs are listed in Table 7.65. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.66 and 7.67.

Table 7.65
PQLs for Method SW9056 (E300.0)

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Common Anions SW9056	Bromide	0.5	mg/L	0.5	mg/kg
	Chloride	1.0	mg/L	1.0	mg/kg
	Fluoride	1.0	mg/L	1.0	mg/kg
	Nitrate	1.0	mg/L	1.0	mg/kg
	Nitrite	1.0	mg/L	1.0	mg/kg
	Phosphate	1.0	mg/L	1.0	mg/kg
	Sulfate	1.0	mg/L	1.0	mg/kg

Table 7.66
QC Acceptance Criteria for Method SW9056 (E300.0)

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW9056	Bromide	86–112	≤ 20	86–112	≤ 30
	Chloride	91–111	≤ 20	91–111	≤ 30
	Fluoride	86–114	≤ 20	86–114	≤ 30
	Nitrate	90–110	≤ 20	90–110	≤ 30
	Nitrite	88–116	≤ 20	88–116	≤ 30
	Phosphate	87–110	≤ 20	87–110	≤ 30
	Sulfate	88–115	≤ 20	88–115	≤ 30

Table 7.67
Summary of Calibration and QC Procedures for Method SW9056 (E300.0)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW9056	Common anions	Multipoint calibration for all analytes (minimum 3 standards and one calibration blank)	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
		Second-source calibration verification	Once per multipoint calibration	All analytes within ±10% 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	The width of the retention time window used to make identifications should be based on measurements of actual retention time variations of standards over the course of a day. ± 3x the standard deviation of a retention time can be used to calculate a suggested window size for a compound.	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 or when eluent is changed	All analytes within ±10% 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	Instrument response within ±10% of expected response	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
			After every analytical batch	All analytes within ±10% 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

Table 7.67 (continued)
Summary of Calibration and QC Procedures for Method SW9056 (E300.0)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW9056 (cont)	Common anions (cont)	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.66	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 reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.4
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.66	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging conventions, Table 8.4
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.66	none	Flagging conventions, Table 8.4
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.65	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

7.2.23 Method RSK-175 - Methane, Ethane, and Ethene

Determination of methane, ethane, and ethene is performed by displacing a percentage of headspace in the sample vial with helium. The sample in the vial is shaken to equilibrate the hydrocarbons between the sample and helium headspace. A headspace aliquot is withdrawn and analyzed with a GC FID system to determine the concentration of gaseous hydrocarbon present in the headspace. The headspace concentration is related to the starting concentration through the use of Henry's law. PQLs are presented in Table 7.68. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.69 and 7.70.

Table 7.68
PQLs for Method RSK-175

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Dissolved aliphatic and olephinic gases in water RSK-175	Methane	0.5	µg/L	NA	NA
	Ethane	0.5	µg/L	NA	NA
	Ethene	0.5	µg/L	NA	NA

Table 7.69
QC Acceptance Criteria for Method RSK-175

Method	Analyte	Water		Soil	
		Accuracy (% R)	Precision (% RPD)	Accuracy (% R)	Precision (% RPD)
RSK-175	Methane	70-130	≤ 30	NA	NA
	Ethane	70-130	≤ 30	NA	NA
	Ethene	70-130	≤ 30	NA	NA

Table 7.70
Summary of Calibration and QC for Method RSK-175

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
RSK-175	Dissolved aliphatic and olephinic gases in water	Three-point initial calibration	Prior to sample analysis	Correlation coefficient 0.995	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 three-point initial calibration	All analytes within ±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	Upon installation of new column	Three times standard deviation for each analyte retention time from the 72-hour study	Correct problem then reanalyze all samples since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Continuing calibration verification	Daily, before any samples, after every 20 samples, and after the last sample	All analytes within ±15% of expected value	Reanalyze to verify. If still deficient, 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 7.69	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 reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Convention, Table 8.2

511 161

Table 7.70 (continued)
Summary of Calibration and QC for Method RSK-175

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
RSK-175 (cont)	Dissolved aliphatic and olephinic gases in water (cont)	LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.69	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Convention, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.69	none	Flagging Convention, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.68	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

7.2.24 Method SW9060M-Total Organic Carbon In Soil

Method SW9060M is used to analyze for total organic carbon (TOC) in soil. An aliquot of a solid sample is treated with excess potassium dichromate and concentrated sulfuric acid. After treatment, the solution is back-titrated with ferrous sulfate to determine the amount of dichromate reduced during digestion. PQLs are presented in Table 7.71. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.72 and 7.73.

Table 7.71
PQLs for Method SW9060M

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Total organic carbon SW9060M	TOC	NA	NA	300	mg/kg

Table 7.72
QC Acceptance Criteria for Method SW9060M

Method	Analyte	Water		Soil	
		Accuracy (% R)	Precision (% RPD)	Accuracy (% R)	Precision (% RPD)
SW9060M	TOC	NA	NA	70-130	≤ 20

Table 7.73
Summary of Calibration and QC Procedures for Method SW9060M

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW9060M	Total organic carbon in soil	Two-point calibration which includes an initial calibration blank	Daily, before any samples	none	none	none
		Initial calibration verification standard	Daily, after curve	± 10%	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 end of sequence	± 10%	Reanalyze to verify. If still deficient, 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 7.72	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 reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Convention, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.72	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging Convention, Table 8.2

Table 7.73 (continued)
Summary of Calibration and QC Procedures for Method SW9060M

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW9060M (cont)	Total organic carbon in soil (cont)	MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.72	none	Flagging Conventions, Table 8.2
		MDL Study	Once per year	Detection limits established shall be < the PQLs in Table 7.71	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

7.2.25 Method TO-14–Volatile Organics in Ambient Air

Volatile organics in air are sampled and analyzed using method TO-14. This method uses a high resolution GC coupled to one or more appropriate detectors (AFCEE requires the use of a mass-selective detector). The analytes detected and PQLs for this method are listed in Table 7.74. Calibration—The mass spectrometer is tuned daily to give an acceptable spectrum for BFB. The tuning acceptance criteria are given in the following list as an ion abundance for each specified mass:

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

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 added to each calibration standard, blank, QC sample, and sample. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.75 and 7.76.

Table 7.74
PQLs for Method TO-14

Parameter/Method	Analyte	Air	
		PQL	Unit
VOCs in air TO-14	1,1,1-Trichloroethane	0.8	µg/L
	1,2-Dichloroethane	0.6	µg/L
	1,2-Dibromoethane	0.6	µg/L
	Benzene	0.4	µg/L
	Carbon tetrachloride	2.1	µg/L
	Chloroform	0.3	µg/L
	m-Xylene	0.5	µg/L
	o-Xylene	1.1	µg/L
	p-Xylene	1.3	µg/L
	Styrene	0.4	µg/L
	Trichloroethene	1.0	µg/L

Table 7.75
QC Acceptance Criteria for Method TO-14

Method	Analyte	Accuracy Air (% R)	Precision Air (% RPD)
TO-14	1,1,1-Trichloroethane	72–125	20
	1,2-Dichloroethane	75–125	20
	1,2-Dibromoethane	74–125	20
	Benzene	75–127	20
	Carbon tetrachloride	72–125	20
	Chloroform	75–125	20
	m-Xylene	75–125	20
	o-Xylene	75–137	20
	p-Xylene	75–125	20
	Styrene	75–135	20
	Trichloroethene	75-125	20

Table 7.76
Summary of Calibration and QC Procedures for Method TO-14

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
TO-14	Volatile Organics	Initial multipoint calibration (minimum 3 standards and humid zero air)	Initial calibration prior to sample analysis	%RSD for all calibration analytes 30% Or correlation coefficient (r) >0.995 using five data points (first order) or eight data points (second or third order)	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 three-point initial calibration	All analytes within 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
		Calibration verification (one point)	Daily, before sample analysis and every 12 hours of analysis time	All calibration analytes within 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 7.75	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
		Check of mass spectral ion intensities using bromofluorobenzene	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (Section 7.2.25)	Retune instrument and verify	Apply R to all results for all samples associated with the tune
		Internal standards	Every sample, spiked sample, standard, and method blank	Retention time 30 seconds: EICP area within -50% to +100% of last calibration verification (12 hours) for each	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning	Apply J to all detects and UJ to all non-detects for specific analytes associated with the IS in the affected sample

Table 7.76 (continued)
Summary of Calibration and QC Procedures for Method TO-14

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
TO-14 (cont)	Volatile Organics (cont)	Method blank	One per analytical batch	No analytes detected PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.75	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch: If the LCS %R > UCL, apply J to all positive results If the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		MDL study	Once per 12 month period	Detection limits established shall be < the PQLs in Table 7.74	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

514 169

7.2.26 Method TX1005–Total Petroleum Hydrocarbons

This gas chromatographic method is designed to determine the total concentrations in soil or water of petroleum hydrocarbons from n-hexane (C_6) to n-octacosane (C_{28}). These hydrocarbons have an approximate boiling point range from 65°C to 450°C. This range includes gasoline, kerosene, diesel/fuel oil No. 2, some light lubricating oils, and some portions of other heavier fuel oils and lubricating oils.

The method uses a FID as the mode of detection. The response of the FID is generally equal for all hydrocarbons on a weight and effective carbon number basis. PQLs for this analysis are listed in Table 7.77. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.78 and 7.79.

Table 7.77
PQLs for Method TX1005

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Total Petroleum Hydrocarbons TX1005	C_6-C_{10}	5	mg/L	50	mg/kg
	>C_{10}-C_{28}	5	mg/L	50	mg/kg

Table 7.78
Acceptance Criteria for Method TX1005

Method	Analyte	Water		Soil	
		Accuracy (%R)	Precision (%RPD)	Accuracy (%R)	Precision (%RPD)
TX1005	C_6-C_{10}	70-130	30	70-130	30
	>C_{10}-C_{28}	70-130	30	70-130	30

Table 7.79
Summary of Calibration and QC Procedures for Method TX1005

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
TX1005	Total Petroleum Hydrocarbons	Five-point initial calibration for each component.	Initial calibration prior to sample analysis	% RSD<25% for RFs Or correlation coefficient (r) > 0.995 using five data points (first order) or eight data points (second or third order)	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) associated with the calibration
		Retention time window calculated for each component	Each initial calibration and calibration verifications	3 times standard deviation for each component 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	All components within 25% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific component(s) for all components associated with the calibration.
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All components within 25% 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 component(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 7.78	Recalculate results; locate and fix problems 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 reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.2

514 172

Table 7.79 (continued)
Summary of Calibration and QC Procedures for Method TX1005

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
TX1005 (cont)	Total Petroleum Hydrocarbons (Cont)	LCS for all components	One LCS per analytical batch	QC acceptance criteria, Table 7.78	Correct problem then reprepare and analyze the LCS and all samples in the affected AFCEE analytical batch	Flagging conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.78	none	Flagging conventions, Table 8.2
		MDL study	Once per 12 month period	Detection limits established shall be < the PQLs in Table 7.79	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

TAB

Section 8

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

The data reduction, review, reporting, and validation procedures described in this section will ensure: (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 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 shall perform a 100 percent review of the screening data. The screening data methods are identified in Table 6.1 of Section 6. All screening data shall be qualified with an "S" flag and shall 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 in Section 6. The flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed. "S" designator flags shall be maintained in the final data qualification. When the data are reviewed and qualified, the analyst shall apply a final qualifier to any data that have been affected by multiple qualifiers. This final qualifier shall 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, SUJ, SU, and SJ. Therefore, the allowable final data qualifiers for screening data are SR, SUJ, SU, SJ, and S.

The definition of the data qualifiers are shown in Table 8.1. A summary of the flagging conventions of field screening methods is given in Table 6.2.

Screening data report packages shall be prepared for all field analyses as described in Section 8.8. The screening data shall be reported on the AFCEE screening data report forms (AFCEE Forms S-1 through S-3), as illustrated in Section 8.8, or forms showing the equivalent information. The prime contractor's project manager shall review the entire screening data report package with the field records. The prime contractor (1) shall determine if project data quality objectives have been met, and (2) shall calculate the data completeness for the project. These results shall 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 shall review 100 percent of the definitive data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst or by the supervisor of the respective analytical section using the same criteria.

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, 8.3, and 8.4. The flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

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

Data qualifiers which indicate analyte concentrations between the MDL and PQL (F flags) shall 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 shall be added to the first page of the definitive data report packages to explain any nonconformance or other issues. Data qualifiers shall be added by the prime contractor's staff level chemist. Analytical batch comments shall be made on the data quality evaluation (DQE) SOP checklists to explain any nonconformance or other issues. When data are qualified, a senior level chemist shall apply a final qualifier to any data that have been affected by multiple qualifiers. This final qualifier shall reflect the most severe qualifier that was applied to the data, i.e., each data point 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, UJ, U, F, and J. The definitions of the data qualifiers are shown in Table 8.1.

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 TIC numerical results will always be qualified with one and only one flag for any reason, and that is the "T" flag.

The prime contractor's senior chemist shall coordinate the review of definitive data report packages, and with the field records, approve the final data qualifiers for the definitive data. The prime contractor shall review the field QC samples and field logs, and shall then appropriately flag any of the associated samples identified with the field QC sample, as explained in Tables 8.2, 8.3, and 8.4.

The prime contractor (1) shall determine if the data quality objectives have been met, and (2) shall calculate the data completeness for the project. These results shall be included in the data package deliverable as described in Section 8.8, or on forms providing the equivalent information.

Table 8.1
Data Qualifiers

Qualifier	Description
F	The analyte was positively identified but the associated numerical value is below the PQL.
J	The analyte was positively identified, the quantitation is an estimation.
R	The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
S	To be applied to all field screening data.
T	To be applied to all tentatatively identified compounds.
U	The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
UJ	The analyte was analyzed for but not detected. The associated numerical value is an MDL which is estimated due to deficiencies in the QC criteria.

Table 8.2
Flagging Conventions for NAS Fort Worth JRB—Minimum Data Evaluation Criteria Specific to Organic Methods

Quality Control Check	Evaluation	Flag	Samples Affected
Holding Time	Holding time exceeded for extraction or analysis	J positive results UJ nondetects	Sample
	Holding time exceeded by a factor of two	J positive results R nondetects	Sample
Sample Preservation (SW8021A, SW8260B)	Sample not preserved with HCl (and not analyzed within 7 days of collection)	J positive results UJ nondetects	Sample
Sample Integrity (SW8021A, SW8260B)	Bubbles in VOA vial used for analysis [d]	J positive results UJ nondetects [d]	Sample
Temperature blank (cooler temperature)	> 6°C	J positive results (except PCBs and dioxins will not be flagged) UJ nondetects (except PCBs and dioxins will not be flagged)	All samples in same cooler
	> 9°C	J positive results (except PCBs and dioxins will not be flagged) R nondetects (except PCBs and dioxins will not be flagged)	All samples in same cooler
Initial Calibration	%RSD outside range *or* r < 0.995 *or* COD < 0.990	R	Out-of-compliance analytes in all samples associated with analysis batch
	%RSD >30% for any CCC	R	All analytes in samples associated with analysis batch
	Average RRF criterion not met for any SPCC	R	All analytes in samples associated with analysis batch
Calibration Verification (ICV, CCV)	%D > method-specific control limit	R	Out-of-compliance analytes in all associated samples in analysis batch
	Any CCC %D > 20%	R	All analytes in samples associated with analysis batch
Second Column/Detector Confirmation	%D > 25	J positive results > PQL	Affected analytes in sample
	Detection not confirmed	Report result as "PQL U"	Affected analytes in sample
Laboratory Control Sample (LCS)	%R > UT	J positive results; no effect on non-detects	Out-of-compliance analytes in all associated samples in analysis batch
	%R < LT	R non-detects; J positive results	
Method Blank	Multiply value by 5; common lab contaminants by 10 [a]	U flag reported results < calculated value	Affected analytes in all samples in extraction batch and/or analytical batch, whichever is appropriate.

Table 8.2 (continued)
Flagging Conventions for NAS Fort Worth JRB—Minimum Data Evaluation Criteria Specific to Organic Methods

Quality Control Check	Evaluation	Flag	Samples Affected
Equipment Blank	Convert to soil units, if applicable; multiply by 5	U flag reported results < calculated value	Affected analytes in all samples, same site, matrix and date (water) or all samples, same site, matrix (soil)
Trip Blank	Convert to soil units, if applicable; multiply by 5	U flag reported results < calculated value	Affected analytes in all samples shipped in the same cooler
Matrix Spikes			
% Recoveries [b]	%R > UT [f]	J all positive results	Specific analytes in parent sample
	%R < LT [f]	J positive results UJ nondetects	Specific analytes in parent sample
RPDs	RPD > UT	J positive results	Specific analytes in parent sample
Surrogates			
SW8021A, SW8260B	If one or more surrogates: %R > UT and none < LT	J positive results [g]	Sample
	%R < LT and none < 10%	J positive results [h] UJ nondetects	Sample
	Any %R < 10%	J positive results [h] R nondetects	Sample
SW8270C (evaluate acid and base/neutral surrogates separately)	If 2 or more acid surrogates or 2 or more base/neutral surrogates: %R > UT and none < LT	J positive results	All associated analytes (acid or base/neutral fraction) in sample
	If 2 or more acid surrogates or 2 or more base/neutral surrogates: %R < LT and none < 10%	J positive results UJ nondetects	All associated analytes (acid or base/neutral fraction) in sample
	Any %R < 10% *and* < LT	J positive results R nondetects	All associated analytes (acid or base/neutral fraction) in sample
GC and HPLC Methods[c,e], and SW8280A, SW8290	%R > UT	J positive results [g]	All analytes in associated sample
	%R < LT and none < 10%	J positive results [h] UJ nondetects	All analytes in associated sample
	%R < 10%	J positive results [h] R nondetects	All analytes in associated sample

Table 8.2 (continued)
Flagging Conventions for NAS Fort Worth JRB—Minimum Data Evaluation Criteria Specific to Organic Methods

Quality Control Check	Evaluation	Flag	Samples Affected
Analytical duplicate	RPD > UT	J positive results	Specific analytes in duplicate pair
Field duplicates	Reported > PQL in both samples, RPD > UT	J positive results	Specific analytes in duplicate pair
	Reported > PQL in one sample of the pair, reported detected < PQL in the other	J flag positive result, F flag low level result	Specific analytes in duplicate pair
	Reported > PQL in only one sample of the pair, not detected in the other	J flag positive result, UJ flag non-detect	Specific analytes in duplicate pair
Presence of PCB, chlordane, or toxaphene analytes	PCB, chlordane, or toxaphene peaks coelute with some single-analyte organochlorine pesticides on either column	R affected single-analyte organochlorine pesticide results	Sample
Tentatively identified compounds (TICs) in samples for GC/MS only	Reported	T all TICs	All samples with TICs

[a] Common lab contaminants: methylene chloride, acetone, 2-butanone, toluene, and phthalate esters.
[b] Spike recovery limits do not apply when sample concentration exceeds the spike concentration by a factor of 4 or more.
[c] Number of surrogates varies with GC method.
[d] Professional judgment must be used in determining the effect of the bubbles on data usability; use SW-846, Update III, 12/97 for guidance.
[e] For GC and HPLC Methods, the qualification of nondetects applies to primary column tolerances (either of the two GC columns may be designated as the primary column).
[f] Where one MS recovery meets acceptance criteria and the other MS of the pair does not, professional judgment may be used to determine if the parent sample should be qualified for matrix effects by comparing the matrix spike recoveries to other quality control results within the batch or sample site.
[g] This qualifier may not apply in cases where a surrogate coelutes with a nontarget analyte.
[h] Data qualification may not apply in cases where low surrogate recoveries are due to sample dilution.

CCV = Continuing calibration verification.
LT = Lower tolerance.
MB = Method blank.
UT = Upper tolerance.
PQL = Practical quantitation limit.
ICV = Initial calibration verification.
RPD = Relative percent difference.
%R = percent recovery.
MDL = Method detection limit.

Table 8.3
Flagging Conventions for NAS Fort Worth JRB—Minimum Data Evaluation Criteria Specific to Inorganic Metals Methods

Quality Control Check	Evaluation	Flag	Samples Affected
Holding Time	Holding time exceeded for digestion or analysis	J positive results R flag mercury, cyanide, and hexavalent chromium nondetects UJ nondetects for all other methods	Sample only
	Holding time exceeded by a factor of 2	As above, but also R all nondetect results	Sample
Sample Preservation	Sample preservation requirements not met (sample preservation may be adjusted at the laboratory with no flagging required)	J positive results UJ nondetects for all methods except mercury and cyanide R mercury and cyanide nondetects	Sample
Temperature Blank	> 6°C	J mercury, cyanide, and hexavalent chromium positive results UJ mercury, cyanide, and hexavalent chromium nondetects	Samples in same cooler
Calibration Verification:	Calibration above UT or below LT	R	Specific analyte in all associated samples in analysis batch
Interference check sample	%R > UT	J positive results	All associated samples in analytical batch if interfering levels present in individual samples
	%R between 50-79	J positive results UJ nondetects	All associated samples in analytical batch if interfering levels present in individual samples
	%R < 50	J positive results R nondetects	All associated samples in analytical batch if interfering levels present in individual samples
Laboratory Control Sample	%R > UT	J detects	Out-of-compliance analytes in all samples in digestion batch
	%R < LT	J detects R nondetects	Out-of-compliance analytes in all samples in digestion batch
Blank Contamination: MB, ICB, CCB, Leachate Blank	Multiply value by 5, convert to soil units if applicable	U flag reported results < calculated values	Affected analytes in all samples in digestion batch (MB); All samples in analysis batch (ICB,CCB)
Negative blanks: MB, ICB, CCB, or leachate blank (LB) with absolute value < PQL	Multiply absolute value by 5, convert to soil units if applicable	J-flag detects < calculated value; UJ-flag non-detects	Affected analytes in all samples in digestion or leach batch (MB, LB); all samples in analysis batch (CCB, ICB)
Negative blanks: MB, ICB, CCB, LB with absolute value >PQL	Multiply absolute value by 5, convert to soil units if applicable	J-flag detects < calculated value; R-flag non-detects	Affected analytes in all samples in digestion or leach batch (MB, LB); all samples in analysis batch (CCB, ICB)

Table 8.3 (continued)
Flagging Conventions for NAS Fort Worth JRB—Minimum Data Evaluation Criteria Specific to Inorganic Metals Methods

Quality Control Check	Evaluation	Flag	Samples Affected
Equipment blank	Convert to soil units if applicable, multiply by 5	U flag reported results < calculated values	Affected analytes in all samples, same field team, matrix and date (water) or all samples, same field team, matrix (soil)
Matrix Spikes			
% Recoveries[a]	%R > UT	J positive results	Specific analytes in parent sample
	%R < LT	J positive results UJ nondetects	Specific analytes in parent sample
RPDs	RPD > UT	J positive results	Specific analytes in parent sample
Serial Dilution	If concentration is > 25 times MDL for GFAA analyses (> 5 times the PQL for ICP analyses) and % difference > UT	J positive results UJ nondetects	All samples from same site as parent sample if post-digest spike (recovery test) not performed
Recovery Test	Spike results do not meet criteria	J positive UJ nondetects	Specific analytes in affected sample if method of standard additions is not performed
	%R < 10%	R nondetects	
Method of standard additions (GFAA only) perform on samples when the recovery test fails	MSA not done	J positive results; UJ nondetects	Specific analytes in affected sample
	MSA spike levels inappropriate	J positive results; UJ nondetects	
	r < 0.995	J positive results; UJ nondetects	
Field or Laboratory Duplicates	Concentration of reported analytes are > 5 times PQL[b] in both samples and RPD > UT.	J positive results	Specific analytes in duplicate pair
	One or both sample results < 5 times the PQL[b] and a difference of ±2 times PQL[b] for water (±4 times for soil).	J positive results	Specific analytes in duplicate pair
	Reported > PQL in only one sample of the pair, not detected in the other	J positive UJ nondetect	Specific analytes in duplicate pair

[a] Spike recovery limits do not apply when sample concentration exceeds the spike concentration by a factor of 4 or more.
[b] The PQLs can be found in Section 7.0, Tables 7-16 through 7-19.

CCB = Continuing calibration blank.
ICB = Initial calibration blank.
LT = Lower tolerance.
MB = Method blank.
UT = Upper tolerance.
PQL = Practical quantitation limit.
CCV = Continuing calibration verification.
ICV = Initial calibration verification.
MSA = Method of standard additions.
RPD = Relative percent difference.
%R = percent recovery.
MDL = Method detection limit.

Table 8.4
Flagging Conventions for NAS Fort Worth JRB—Minimum Data Evaluation Criteria Specific to General Chemistry[a]

Quality Control Check[b]	Evaluation	Flag	Samples Affected
Holding Time	Holding time exceeded for preparation or analysis Holding time exceeded by a factor of 2	J positive results UJ nondetects R nondetect results	Sample only
Sample Preservation	Sample not preserved (preservation may be adjusted at the lab)	J positive results R nondetects	Sample
Temperature Blank	> 6°C	J positive results UJ nondetects	All samples in same cooler
Calibration check (E901.1, SW9310, SW9045)	Calibration above UT or below LT	R	Out-of-compliance analytes in all associated samples in analytical batch
Calibration Verification: ICV, CCV	Calibration above UT or below LT	R	Out-of-compliance analytes in all associated samples in analytical batch
Laboratory Control Sample	%R > UT	J detects	Out-of-compliance analytes in all samples in preparation or analytical batch
	%R < LT	J detects R nondetects	Out-of-compliance analytes in all samples in preparation or analytical batch
Method Blank	Multiply value by 5, convert to soil units if applicable	U flag reported results < calculated values	Affected analytes in all samples in preparation or analytical batch
Calibration Blank ICB, CCB	Multiply value by 5, convert to soil units if applicable	U flag results < calculated values	Affected analytes in all associated samples in analytical batch
Equipment Blank	Convert to soil units if applicable, multiply by 5	U flag reported results < calculated values	Affected analytes in all samples, same field team, matrix and date (w) or all samples, same field team, matrix (soil)
Matrix Spikes[c]	%R > UT	J positive results	All samples from same site
	%R < LT	J positive results UJ nondetects	All samples from same site
	RPD > UT	J positive results	All samples from same site
Laboratory Duplicates	RPD > UT	J positive results	All samples in preparation or analytical batch
Field Duplicates	RPD > UT	J positive results	Field duplicate pair

[a] General chemistry methods include: E160, SW9056 (E300), E310, E325, E340, E350, E351, E353, E365, E375, E901.1, SW9045, SW9060 modified, SW9310, ASTM D422, acid volatile sulfides/simultaneously extracted metals, SW846 percent moisture, E130.1, E218.6, SW9066.
[b] Where applicable; not all "Quality Control Checks" are associated with every general chemistry method.
[c] Spike recovery limits do not apply when sample concentration exceeds the spike concentration by a factor of 4 or more.

CCV = Continuing calibration verification.
ICV = Initial calibration verification.
LT = Lower tolerance.
RPD = Relative percent difference.
UT = Upper tolerance.
%R = Percent recovery.
ICB = Initial calibration blank.
CCB = Continuing calibration blank.
PQL = Practical quantitation limit.

8.3 QUALITY ASSURANCE REPORTS

The laboratory QA staff shall issue QA reports to the laboratory management, laboratory supervisors and task leaders. These reports shall describe the results of QC measurements, performance audits, and 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 shall be documented with the corrective actions that have been taken to correct the deficiencies identified.

8.4 ERPIMS ELECTRONIC DATA REPORTS

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

ERPIMS 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 shall be provided by the prime contractor via ASCII files in specified ERPIMS format on 3.5" floppy diskettes. The information transferred shall 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 ERPIMS Data Loading Handbook.

8.5 ARCHIVING

Hardcopy and electronic data shall be archived in project files and on electronic archive tapes for the duration of the project or a minimum of five 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 shall be sufficiently documented to ensure the data are properly tracked, reviewed, and validated for use.

8.7 RECORDKEEPING

The laboratory shall maintain electronic and hardcopy records sufficient to recreate each analytical event conducted pursuant to the SOW. The minimum records the laboratory shall keep include the following: (1) COC forms, (2) initial and continuing calibration records including standards preparation traceable to the original material and lot number, (3) instrument tuning records (as applicable), (4) method blank results, (5) internal standard results, (6) surrogate spiking records and results (as applicable), (7) spike and spike duplicate records and results, (8) laboratory records, (9) raw data, including instrument printouts, bench work sheets, and/or chromatograms with compound identification and quantitation reports, (10) corrective action reports, (11) other

method and project required QC samples and results, and (12) laboratory-specific written SOPs for each analytical method and QA/QC function in place at the time of analysis of project samples.

8.8 HARDCOPY DATA REPORTS FOR SCREENING AND DEFINITIVE DATA

The hardcopy data reports shall conform to the formats identified in this section. The software to generate hardcopy results in the AFCEE forms is not currently available. Therefore, the laboratory will work with the prime contractor to develop acceptable hardcopy and electronic data deliverables.

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

A definitive data inorganic report package shall 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 shall 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.

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)

AABNo. : enter the unique AFCEE analytical batch number (see Section 4.4 for a definition of a batch)

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

Contract No. : 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)
% 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., μg/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)

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 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, 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 No. 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 No. 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

%D: enter the percent 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., μg/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 No. 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 No. 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 No. 1 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., μg/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 percent 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., μg/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 percent recovery

Duplicate Spike Sample Result: enter the result of the MSD

%RPD: enter the relative percent 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

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)

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., μg/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 percent 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)

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 percent 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 No. 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 No. 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)

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 percent 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 No. 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 No. 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., SPCC960603-2)

SPCC No. 2 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., SPCC960603-3)

CCC **No. 2 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., CCC960603-2)

CCC **No. 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., CCC960603-3)

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 percent 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., μg/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., μg/L or mg/kg)

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 percent 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., μg/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 percent recovery

Duplicate Spike Sample Result: enter the result of the MSD

%RPD: enter the relative percent 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., μg/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 needed (see QAPP Sections 7 and 8)

Form S-3

Units: enter the appropriate units (i.e., μg/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 percent or difference relative percent 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 No. : 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 No. : 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"

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

No. 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°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

FORMS

AFCEE
INORGANIC ANALYSES DATA PACKAGE

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
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 I-1

AFCEE
INORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Field Sample ID: _____ Lab Sample ID: _____ Matrix: _____
% Solids: _____ Dilution: _____
Date Received: _____ Date extracted: _____ Date Analyzed: _____
Concentration Units (μg/L or mg/kg dry weight): _____

Analyte	MDL	PQL	Concentration	Qualifier

Comments:

_____
_____
_____
_____

AFCEE
INORGANIC ANALYSES DATA SHEET 3
INITIAL MULTIPOINT CALIBRATION

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Instrument ID: _____ Date of Calibration: _____

Analyte	RF Blank	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	r	Q

r = correlation coefficient

Comments:

_____

_____

_____

AFCEE FORM I-3

AFCEE
INORGANIC ANALYSES DATA SHEET 3
MERCURY INITIAL MULTIPOINT CALIBRATION

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
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:

_____
_____
_____

AFCEE FORM I-3A

AFCEE
INORGANIC ANALYSES DATA SHEET 3
CYANIDE INITIAL MULTIPOINT CALIBRATION

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
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

AFCEE
INORGANIC ANALYSES DATA SHEET 4
CALIBRATION VERIFICATION

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Instrument ID: _____ Date of Calibration: _____
Highest Std ID: _____ 2nd Source ID: _____
CCV No. 1 ID: _____ CCV No. 2 ID: _____

Analyte	Highest or 2nd Source Calibration			Continuing Calibration Verification					Q
	Expected	Found	%D	Expected 1	Found 1	%D	Found 2	%D	

Comments:
_____
_____
_____

AFCEE
INORGANIC ANALYSES DATA SHEET 5
BLANKS

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Units: _____
Calibration Blank ID: _____ Method Blank ID: _____
CCB No. 1 ID: _____ CCB No. 2 ID: _____ CCB No. 3 ID: _____

Analyte	Calibration Blank	Continuing Calibration Blank			Method Blank	PQL	Q
		1	2	3			

Comments:

_____
_____
_____

AFCEE FORM I-5

AFCEE
INORGANIC ANALYSES DATA SHEET 6
LABORATORY CONTROL SAMPLE

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
LCS ID: _____ Units: _____

Analyte	Expected	Found	%R	Control Limits	Q

Comments:

_____
_____
_____

AFCEE FORM I-6

AFCEE
INORGANIC ANALYSES DATA SHEET 7
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Parent Field Sample ID: _____ Units: _____ % Solids: _____
MS ID: _____ MSD ID: _____

Analyte	Parent Sample Result	Spike Added	Spiked Sample Result	%R	Duplicate Spike Sample Result	%R	%RPD	Control Limits %R	Control Limits %RPD	Q

Comments:

_____
_____
_____

AFCEE FORM I-7

AFCEE
INORGANIC ANALYSES DATA SHEET 8
HOLDING TIMES

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____

Field Sample ID	Date Collected	Date Received	Date Analyzed	Max. Holding Time (days)	Time Held (days)	Q

Comments:

AFCEE FORM I-8

AFCEE
INORGANIC ANALYSES DATA SHEET 9
INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Instrument ID No. : _____

Field Sample ID/Std ID/ Blank ID/QC Sample ID	Date Analysis Started	Time Analysis Started	Date Analysis Completed	Time Analysis Completed

Comments:

_____

_____

_____

AFCEE
ORGANIC ANALYSES DATA PACKAGE

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
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

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Field Sample ID: _____ Lab Sample ID: _____ Matrix: _____
% Solids: _____ Dilution: _____
Date Received: _____ Date extracted: _____ Date Analyzed: _____
Concentration Units (μg/L or mg/kg dry weight): _____

Analyte	MDL	PQL	Concentration	Qualifier

Comments:
_____
_____
_____

AFCEE
ORGANIC ANALYSES DATA SHEET 3
INSTRUMENT PERFORMANCE CHECK
(BFB or DFTPP)

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Instrument ID: _____ Compound: _____ Injection Date/Time: _____

Mass	Ion Abundance Criteria	% Relative Abundance	Q

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, STANDARDS, BLANKS AND SPIKES:

Field Sample No. /Std ID/ Blank ID/QC Sample ID	Date Analyzed	Time Analyzed

AFCEE
ORGANIC ANALYSES DATA SHEET 4
INITIAL MULTIPOINT CALIBRATION

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Instrument ID: _____ Date of Calibration: _____
Calibration ID: _____

Analyte	RF Blank	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	Std 4	RF 4	Std 5	RF 5	% RSD	Q

Comments:

_____
_____
_____

AFCEE
ORGANIC ANALYSES DATA SHEET 5
CALIBRATION VERIFICATION

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Instrument ID: _____ Date of Calibration: _____ Calibration ID: _____
2nd Source ID: _____ CCV No. 1 ID: _____ CCV No. 2 ID: _____

Analyte	2nd Source Calibration			Continuing Calibration Verification					Q
	Expected	Found	%D	Expected 1	Found 1	%D	Found 2	%D	

Comments:

_____
_____
_____

AFCEE
ORGANIC ANALYSES DATA SHEET 5A
SPCC AND CCC CALIBRATION

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Instrument ID: _____ Date of Calibration: _____
SPCC No. 1 ID: _____ SPCC No. 2 ID: _____ SPCC No. 3 ID: _____
CCC No. 1 ID: _____ CCC No. 2 ID: _____

Analyte	SPCC No. 1		SPCC No. 2		SPCC No. 3		CCC No. 1			CCC No. 2			Q
	RF	Min RF	RF	Min RF	RF	Min RF	Expected	Found	%D	Expected	Found	%D	

AFCEE
ORGANIC ANALYSES DATA SHEET 6
BLANKS

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Units: _____ Method Blank ID: _____

Analyte	Method Blank	PQL	Q

Comments:

_____

_____

_____

AFCEE
ORGANIC ANALYSES DATA SHEET 7
LABORATORY CONTROL SAMPLE

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
LCS ID: _____ Units: _____

Analyte	Expected	Found	%R	Control Limits	Q

Comments:

_____
_____
_____

AFCEE
ORGANIC ANALYSES DATA SHEET 8
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Analytical Method: _____ AAB No.: _____
Lab Name: _____ Contract No.: _____
Parent Field Sample ID: _____ Units: _____ % Solids: _____
MS ID: _____ MSD ID: _____

Analyte	Parent Sample Result	Spike Added	Spiked Sample Result	%R	Duplicate Spike Sample Result	%R	%RPD	Control Limits	Q

Comments:

_____
_____
_____

AFCEE
ORGANIC ANALYSES DATA SHEET 9
HOLDING TIMES

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____

Field Sample ID	Date Collected	Date Received	Date Extracted	Max. Holding Time E	Time Held Ext.	Date Analyzed	Max. Holding Time A	Time Held Anal.	Q

Comments:
_____
_____
_____

AFCEE
ORGANIC ANALYSES DATA SHEET 10
INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: _____ AAB No. : _____
Lab Name: _____ Contract No. : _____
Instrument ID No. : _____

Field Sample ID/Std ID/ Blank ID/QC Sample ID	Date Analysis Started	Time Analysis Started	Date Analysis Completed	Time Analysis Completed

Comments:

_____

_____

_____

AFCEE
SCREENING DATA PACKAGE

Analytical Method: _____ Contract No. : _____
Base/Command: _____ Prime Contractor: _____

Field Sample ID

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Comments:
_____
_____
_____

Signature:_____ Name:_____
Date:_____ Title:_____

AFCEE FORM S-1

AFCEE
SCREENING DATA SHEET 2
RESULTS

Analytical Method: _____
Contract No. : _____ Field Sample ID: _____
Matrix: _____ Date Analyzed: _____
Concentration Units (μg/L or mg/kg dry weight): _____

Analyte	MDL	PQL	Concentration	Qualifier

Comments:

_____
_____
_____
_____

AFCEE
SCREENING DATA SHEET 3
FIELD DUPLICATES

Analytical Method: _____ Contract No. : _____
Units: _____

Analyte	Sample Result	Duplicate Sample Result	%D or %RPD	Acceptance Criteria	Q

Comments:

_____
_____
_____

MDL STUDY REPORT FORM

Lab Name: _____ Analytical Method: _____ Matrix: _____
Analysis Date: _____ Instrument ID: _____

Analyte	Amt. Spiked	Replicate							Std. Dev.	MDL
		1	2	3	4	5	6	7		

AFCEE
CHAIN-OF-CUSTODY RECORD
COCNo. : _____

Ship to:	Project Name:	Send Results to:
	Sampler Name:	
Carrier: Airbill No. :	Sampler Signature:	

Field Sample ID	Date 19__	Time	Matrix	Pres	Filtered/ Unfilt.	No. of Containers	MS/ MSD	Analyses Requested											Comments

Sample Condition Upon Receipt at Laboratory: Cooler temperature:

Special Instructions/Comments:

No. 1 Released by: (Sig)	Date:	No. 2 Released by: (Sig)	Date:	No. 3 Released by: (Sig)	Date:
Company Name:	Time	Company Name:	Time	Company Name:	Time
No. 1 Received by: (Sig)	Date	No. 2 Received by: (Sig)	Date	No. 3 Received by: (Sig)	Date
Company Name:	Time:	Company Name:	Time:	Company Name:	Time:

514 226

TAB

Section 9

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

Technical systems and performance audits shall 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. Audit guidance can be found in the HQ AFCEE Technical Services Quality Assurance Program, current version. 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 shall be reviewed by the prime contractor to determine whether data produced by the analytical contractor shall fulfill the objectives of the program.

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

9.1.2 Technical Systems Audits

A technical systems audit is an onsite, qualitative review of the sampling or analytical system to ensure that the activity is being performed in compliance with the SAP specifications. Sampling and field procedures and the analytical laboratories shall be audited by the prime contractor at the beginning of the field work. In addition, a laboratory systems audit shall be performed by AFCEE if previous audit reports indicate that corrective actions are outstanding, a recent audit has not been conducted, or 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 ensure the technical procedures and documentation are in place and operating to provide data that fulfill the project objectives, and to ensure outstanding corrective actions have been addressed.

Critical items for a laboratory or field systems audit include: (1) sample custody procedures, (2) calibration procedures and documentation, (3) completeness of data forms, notebooks, and other reporting requirements, (4) data review and validation procedures, (5) data storage, filing, and recordkeeping procedures, (6) QC procedures, tolerances, and documentation, (7) operating

conditions of facilities and equipment, (8) documentation of training and maintenance activities, (9) systems and operations overview, and (10) security of laboratory automated systems.

Critical items for a sampling systems audit include: (1) calibration procedures and documentation for field equipment, (2) documentation in field logbooks and sampling data sheets, (3) organization and minimization of potential contamination sources while in the field, (4) proper sample collection, storage, and transportation procedures, and (5) compliance with established COC and transfer procedures.

After each onsite 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 shall 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 corrective actions have been taken.

9.1.3 Project-Specific Performance Evaluation Audits

Performance audits quantitatively assess the data produced by a measurement system. A performance audit involves submitting project-specific PE samples for analysis for each analytical method used in the project. The prime contractor shall submit project-specific PE samples once per quarter per project. The project-specific PE samples are selected to reflect the expected range of concentrations for the sampling program. The performance audit answers questions about whether the measurement system is operating within control limits and whether the data produced meet the analytical QA specifications.

The project-specific PE samples are made to look as similar to field samples as possible and are submitted as part of a field sample shipment so that the laboratory is unable to distinguish between them and project samples. This approach ensures unbiased sample analysis and reporting by the laboratory.

The critical elements for review of PE results include: (1) correct identification and quantitation of the PE sample analytes, within project specifications, (2) accurate and complete reporting of the results, and (3) measurement system operation within established control limits for precision and accuracy.

The concentrations reported for the PE samples shall be compared to the known or expected concentrations spiked in the samples. The percent recovery shall be calculated and the results assessed according to the accuracy criteria for the LCS presented in Section 7. If the accuracy criteria are not met, the cause of the discrepancy shall be investigated and a second PE sample shall be submitted. The prime contractor shall notify the project staff, AFCEE, and agencies of the situation at the earliest possible time and the prime contractor shall notify AFCEE regarding corrective actions and subsequent PE sample results.

9.1.4 Magnetic Tape Audits

Magnetic tape audits involve the examination of the electronic media used in the analytical laboratory and by the prime contractor to collect, analyze, report, and store data. These audits are used to assess the authenticity of the data generated, and assess the implementation of good automated laboratory practices. AFCEE shall perform magnetic tape audits of the laboratories or of the prime contractors when warranted by project PE results, onsite audit results, or by other state/federal investigations.

9.1.5 Performance Evaluation Sample Programs

All laboratories shall participate in the U.S. EPA 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 shall document the corrective actions undertaken to address unacceptable PE results in order to demonstrate resolution of the problems.

9.2 TRAINING

Training shall be provided to all project personnel to ensure compliance with the health and safety plan and technical competence in performing the work effort. Documentation of this training shall be maintained in the records of the contracted organizations.

TAB

Section 10

10.0 PREVENTIVE MAINTENANCE

A preventive maintenance program shall 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. Manufacturers' recommendations provide the primary basis for the established maintenance schedules, and manufacturers' 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 shall maintain an in-house source of backup equipment and instrumentation.

10.4 MAINTENANCE RECORDS

Maintenance and repair of major field and laboratory equipment shall be recorded in field or laboratory logbooks. These records shall 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.

TAB

Section 11

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 (CAR). The QA coordinator or any other laboratory member can initiate the corrective action request in the event QC results exceed acceptability limits, 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. Routine laboratory corrective actions (e.g., reanalyses, recalibrations) which involve no input from the prime contractor and are successfully carried out need only be noted in laboratory case narratives. The prime contractor will be notified in a CAR when a corrective action is not successful or a non-routine issue needs resolution. Timely communication with the prime contractor is essential to ensure that problem resolution can be achieved before holding times expire, or before resampling will require remobilization in the field.

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.

TAB

Section 12

12.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

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

TAB

Section 13

13.0 REFERENCES

American Society for Testing and Materials (ASTM), 1993. ASTM Annual Book of Standards.

ERPIMS Data Loading Handbook, most current version.

Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS), September, 1993.

HydroGeoLogic, Inc. (HydroGeoLogic), 1998. Final Basewide Quality Assurance Project Plan NAS Fort Worth JRB, Texas.

Jacobs Engineering Group Inc. (Jacobs), 1998. NAS Fort Worth JRB Final Basewide Background Study.

Texas Natural Resources Conservation Commission (TNRCC), 1998a. Interoffice Memorandum, Implementation of the Existing Risk Reduction Rule, July 23.

Texas Natural Resources Conservation Commission, 1998b. Erratum Sheet to the July 23, 1998 Memorandum, September 11.

U.S. Environmental Protection Agency (EPA), 1979. Methods for Chemical Analysis of Water and Waste.

U.S. Environmental Protection Agency (EPA), 1994a. U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9240.1-05-01, EPA-540/R-94-013, PB94-963502.

U.S. Environmental Protection Agency (EPA), 1994b. U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9240.1-05, EPA-540/R-94-012, PB94-963501.

U.S. Environmental Protection Agency (EPA), 1997. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, including updates I, II, and III.

APPENDIX A

SUPPLEMENTAL APPENDIX IX ANALYTES

APPENDIX A
SUPPLEMENTAL APPENDIX IX ANALYTES

Presented below is the current contract laboratory's approach to performing Appendix IX compounds not addressed in Section 7 of the Basewide QAPP.

A.1 Method SW8080A/SW8081A–Organochlorine Pesticides

Please refer to Sections 7.2.4 and 7.2.5 for detailed descriptions of the methods.

Table A.1
PQLs for Appendix IX Compounds of SW8080A/SW8081A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Organochlorine Pesticides SW8080A/SW8081A	Kepone	2.5	µg/L	NA	µg/kg

514 241

Table A.2
Summary of Calibration and QC Procedures for Method SW8080A/SW8081A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8080A/ SW8081A	Organo-chlorine pesticides and PCBs	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30% Or correlation coefficient (r) > 0.995 using five data points (first order) or eight data points (second or third order)	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	Not applied to those compounds listed above	None	None
		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	Within ±50% of expected value for those compounds listed above	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 20 samples and at the end of the analysis sequence	Within ±50% of expected value for those compounds listed above	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
		Breakdown check (Endrin and DDT - pesticide analysis only)	Daily prior to analysis of samples	Degradation ≤20% (total Endrin + DDT)	Repeat breakdown check	Apply J to all positive DDT, DDE, DDD, endrin, endrin ketone and endrin aldehyde results; apply J to the analytes listed above if minimum frequency is not met

514 242

Table A.2 (continued)
Summary of Calibration and QC Procedures for Method SW8080A/SW8081A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8080A SW8081A (cont)	Organo-chlorine pesticides and PCBs (cont)	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	Does not apply to those compounds listed above	None	None
		Method blank	One per analytical batch	No analytes detected > PQL	Correct problem; reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.2
		LCS	One LCS per analytical batch	Not performed for those compounds listed above	None	None
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.13 or 7.16	Correct problem then reextract and analyze sample	Flagging conventions, Table 8.2

Table A.2 (continued)
Summary of Calibration and QC Procedures for Method SW8080A/SW8081A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8080A/ SW8081A (cont)	Organo-chlorine pesticides and PCBs (cont)	MS/MSD for all analytes (the arochlor 1016/1260 mixture will represent the multi-response analytes (i.e., PCBs and toxaphene)	One MS/MSD per matrix per site; or as required by the project specific FSP	Not performed for those compounds listed above	None	None
		Second-column confirmation	100% for all positive results above the PQL	25% difference between the primary and secondary column result	None	Flagging conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.12 or 7.15	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.2 Method SW8150B/SW8151A - Chlorinated Herbicides

Please refer to Sections 7.2.8 and 7.2.9 for a detailed description of the methods.

Table A.3
PQLs for Appendix IX Compounds of SW8150B/SW8151A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Chlorinated Herbicides SW8150B/SW8151A	Hexachlorophene*	NA	µg/L	NA	µg/kg

* May also be analyzed by method SW8270C.

Table A.4
Summary of Calibration and QC Procedures for Method SW8150B/SW8151A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8150B/ SW8151A	Chlorinated Herbicides	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30% Or correlation coefficient (r) > 0.995 using five data points (first order) or eight data points (second or third order)	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	Not applied to those compounds listed above	None	None
		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	Not applied to those compounds listed above	None	None
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	Not applied to those compounds listed above	None	None
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	Not applied to those compounds listed above	None	None
		Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2

Table A.4 (continued)
Summary of Calibration and QC Procedures for Method SW8150B/SW8151A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8150B/ SW8151A (cont)	Chlorinated Herbicides (cont)	LCS for all analytes	One LCS per analytical batch	Not performed on those compounds listed above	None	None
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.25 or 7.28	Correct problem then reextract and analyze sample	Flagging Conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project specific FSP	Not performed on those compounds listed above	None	None
		Second-column confirmation	100% for all positive results above the PQL	25% difference between the primary and secondary column result	none	Flagging conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.24 or 7.27	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.3 Method SW8141A - Organophosphorus Pesticides

Please refer to Section 7.2.7 for a detailed description of the method.

Table A.5
PQLs for Appendix IX Compounds of SW8141A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Organophosphorus Pesticides SW8141A	Dimethoate*	20	µg/L	660	µg/kg
	Ethyl parathion	0.5	µg/L	8.3	µg/kg
	Famphur	1.0	µg/L	33	µg/kg
	O,O,O-Triethyl phosphorothioate*	50	µg/L	1600	µg/kg
	Sulfotep*	50	µg/L	1600	µg/kg
	Thionazin (zinophos)	0.5	µg/L	8.3	µg/kg

* May also be analyzed by Method SW8270C.

Table A.6
Summary of Calibration and QC Procedures for Method SW8141A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8141A	Organophos-phorus pesticides	Five-point initial calibration or calibration by regression for all analytes	Initial calibration prior to sample analysis	Mean %RSD < 20% for all analytes with no single analyte RSD > 30% Or correlation coefficient (r) > 0.995 using five data points (first order) or eight data points (second or third order)	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 - different lot number for those compounds listed above	Once per five-point initial calibration	All analytes listed above within ±45% 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	Within ±45% of expected value for those compounds listed above	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	Within ±45% of expected value for those compounds listed above	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 analyses of a QC check sample	Once per analyst	Does not apply to those compounds listed above	None	None

Table A.6 (continued)
Summary of Calibration and QC Procedures for Method SW8141A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8141A (cont)	Organophos-phorus pesticides (cont)	Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Flagging Conventions, Table 8.2
		LCS for all analytes	One LCS per analytical batch	Not performed for those compounds listed above	None	None
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.22	Correct problem then reextract and analyze sample	Flagging Conventions, Table 8.2
		MS/MSD	One MS/MSD per matrix per site; or as required by the project specific FSP	Not performed for those compounds listed above	None	None
		Second-column confirmation	100% for all positive results above the PQL	25% difference between the primary and secondary column result	None	Flagging conventions, Table 8.2
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.21	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.4 Method SW8260B - Volatile Organics

Please refer to Section 7.2.10 for a detailed description of the method.

Table A.7
PQLs for Appendix IX Compounds of SW8260B

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
VOCs SW8260B	Acetonitrile	100	µg/L	100	µg/kg
	Acetone	20	µg/L	20	µg/kg
	Acrolein	100	µg/L	100	µg/kg
	Acrylonitrile	100	µg/L	100	µg/kg
	Allyl chloride	10	µg/L	10	µg/kg
	2-Butanone (MEK)	20	µg/L	20	µg/kg
	Carbon Disulfide	5.0	µg/L	5.0	µg/kg
	Chloroprene	5.0	µg/L	5.0	µg/kg
	trans-1,4-Dichloro-2-butene	5.0	µg/L	5.0	µg/kg
	1,4-Dioxane	500	µg/L	500	µg/kg
	Ethyl methacrylate	5.0	µg/L	5.0	µg/kg
	2-Hexanone	20	µg/L	20	µg/kg
	Isobutyl alcohol	200	µg/L	200	µg/kg
	Methacrylonitrile	5.0	µg/L	5.0	µg/kg
	Methyl iodide	5.0	µg/L	5.0	µg/kg
	Methyl methacrylate	5.0	µg/L	5.0	µg/kg
	4-Methyl-2-pentanone	20	µg/L	20	µg/kg
	Propionitrile	20	µg/L	20	µg/kg
	Vinyl acetate	10	µg/L	10	µg/kg

Table A.8
Summary of Calibration and QC Procedures for Appendix IX Compounds of SW8260B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8260B	Volatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Each SPCC average RRF ≥ 0.30[a]; and %RSD for each CCC ≤ 30%, and *either* mean %RSD for all analytes ≤15% with no single analyte >30% *or* correlation coefficient (r) > 0.995 using five data points (first order) or eight data points (second or third order)	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) associated with the calibration
		Calibration verification	Not performed for those compounds listed above	No limits for the compounds listed above	None	None
		Daily Calibration verification	Daily, before sample analysis and every 12 hours of analysis time	SPCCs average RF ≥ 0.30; and %D for compounds listed above ≤ 50%	None	None
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	Within the laboratory established historical control limits at the time of the study	Recalculate results; locate and fix problems 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
		Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (section 7.2.10)	Retune instrument and verify	Apply R to all results for all samples associated with the tune.

Table A.8 (continued)
Summary of Calibration and QC Procedures for Appendix IX Compounds of SW8260B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8260B (Cont)	Volatile Organics	Internal standards	Every sample, spiked sample, standard, and method blank	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	Apply J to all detects and UJ to all non-detects for specific analytes associates with the IS in the affected sample
		Method Blank	One per analytical batch	No analytes detected ≥ RL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Apply U to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all routine SW8260 analytes	Not performed for those compounds listed above	None	None	None
		Surrogate spike	Spike every sample, blank, and QC sample with surrogate standard.	%R must be within the laboratory established historical control limits	Correct problem then reextract and analyze the sample	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 for all routine SW8260 analytes	Not performed for those compounds listed above	None	None	None
		MDL study	Once per 12 month period	Detection limits established shall be < the RLs	None	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and RL	None	None	None	Apply F to all results between MDL and RL

A.5 Method SW8270C–Semivolatile Organics

Please refer to Section 7.2.11 for a detailed description of the method.

Table A.9
PQLs for Appendix IX Compounds of SW8270C

Parameter/Method	Analyte	Water PQL	Water Unit	Soil PQL	Soil Unit
SVOCs	Acetophenone	10	µg/L	330	µg/kg
SW8270C	2-Acetylaminofluorene	100	µg/L	330	µg/kg
	4-Aminobiphenyl	50	µg/L	1600	µg/kg
	Aniline	10	µg/L	330	µg/kg
	Aramite	20	µg/L	660	µg/kg
	bis(2-Chloro-1-methylethyl)ether	10	µg/L	330	µg/kg
	Chlorobenzilate	10	µg/L	330	µg/kg
	Diallate	10	µg/L	1600	µg/kg
	2,6-Dichlorophenol	10	µg/L	330	µg/kg
	Dimethoate*	20	µg/L	660	µg/kg
	p-(Dimethylamino)azobenzene	20	µg/L	660	µg/kg
	7,12-Dimethylbenz(a)anthracene	20	µg/L	660	µg/kg
	3,3'-Dimethylbenzidine	50	µg/L	1600	µg/kg
	a,a-Dimethylphenethylamine	50	µg/L	1600	µg/kg
	1,3-Dinitrobenzene	10	µg/L	330	µg/kg
	Diphenylamine	10	µg/L	330	µg/kg
	Ethyl methanesulfonate	10	µg/L	330	µg/kg
	Hexachlorophene**	NA	µg/L	NA	µg/kg
	Hexachloropropene	100	µg/L	3300	µg/kg
	Isodrin	10	µg/L	330	µg/kg
	Isosafrole	20	µg/L	660	µg/kg
	Kepone	100	µg/L	3300	µg/kg
	Methapyrilene	50	µg/L	1600	µg/kg
	Methyl methanesulfonate	10	µg/L	330	µg/kg
	1,4-Naphthoquinone	50	µg/L	1600	µg/kg
	1-Naphthylamine	10	µg/L	330	µg/kg
	2-Naphthylamine	10	µg/L	330	µg/kg
	4-Nitroquinoline 1-oxide	100	µg/L	3300	µg/kg
	N-Nitrosodi-n-butylamine	10	µg/L	330	µg/kg
	N-Nitrosodiethylamine	10	µg/L	330	µg/kg
	N-Nitrosodimethylamine	10	µg/L	330	µg/kg
	N-Nitrosomethylethylamine	10	µg/L	330	µg/kg
	N-Nitrosomorpholine	10	µg/L	330	µg/kg
	N-Nitrosopiperidine	10	µg/L	330	µg/kg
	N-Nitrosopyrrolidine	10	µg/L	330	µg/kg
	5-Nitro-*o*-toluidine	20	µg/L	660	µg/kg
	Parathion	50	µg/L	1600	µg/kg
	Pentachlorobenzene	10	µg/L	330	µg/kg
	Pentachloroethane	50	µg/L	1600	µg/kg

Table A.9 (continued)
PQLs for Appendix IX Compounds of SW8270C

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
SVOCs SW8270C	Pentachloronitrobenzene	50	µg/L	1600	µg/kg
	Phenacetin	20	µg/L	660	µg/kg
	p-Phenylenediamine	100	µg/L	3300	µg/kg
	2-Picoline	20	µg/L	660	µg/kg
	Benzo(k)fluoranthene	10	µg/L	330	µg/kg
	3-Methylcholanthrene	20	µg/L	660	µg/kg
	Pronamide	20	µg/L	660	µg/kg
	Pyridine	20	µg/L	660	µg/kg
	Safrole	20	µg/L	660	µg/kg
	1,2,4,5-Tetrachlorobenzene	10	µg/L	330	µg/kg
	2,3,4,6-Tetrachlorophenol	50	µg/L	1600	µg/kg
	Sulfotep*	50	µg/L	1600	µg/kg
	o-Toluidine	10	µg/L	660	µg/kg
	O,O,O-Triethyl phosphorothioate*	50	µg/L	1600	µg/kg
	sym-Trinitrobenzene	50	µg/L	330	µg/kg

* May also be analyzed by Method SW8141A.
** May also be analyzed by Methods SW8150B/SW8151A.

Table A.10
Summary of Calibration and QC Procedures for Appendix IX Compounds of SW8270C

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8270C	Semivolatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Each SPCC average RRF ≥ 0.05; and %RSD for each CCC ≤ 30%, and *either* mean %RSD for all analytes ≤15% with no single analyte >30% *or* correlation coefficient (r) > 0.995 using five data points (first order) or eight data points (second or third order)	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) associated with the calibration
		Calibration verification	Not performed for those compounds listed above	No limits for those compounds listed above	None	None
		Daily Calibration verification	Daily, before sample analysis and every 12 hours of analysis time	SPCCs average RF ≥ 0.050; and %D for remaining compounds listed above ≤ 50%	None	None
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	Within the laboratory established historical control limits at the time of the study	Recalculate results; locate and fix problems 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
		Check of mass spectral ion intensities using DFTPP	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (section 7.2.11)	Retune instrument and verify	Apply R to all results for all samples associated with the tune.

Table A.10 (continued)
Summary of Calibration and QC Procedures for Appendix IX Compounds of SW8270C

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
SW8270C (cont)	Semivolatile Organics (cont)	Internal standards	Every sample, spiked sample, standard, and method blank	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	Apply J to all detects and UJ to all non-detects for specific analytes associates with the IS in the affected sample
		Method Blank	One per analytical batch	No analytes detected ≥ RL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Apply U to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all routine SW8270 analytes	Not performed for those compounds listed above	None	None	None
		Surrogate spike	Spike every sample, blank, and QC sample with surrogate standard.	%R must be within the laboratory established historical control limits	Correct problem then reextract and analyze the sample	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 for all routine SW8270 analytes	Not performed for those compounds listed above	None	None	None
		MDL study	Once per 12 month period	Detection limits established shall be < the RLs	None	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and RL	None	None	None	Apply F to all results between MDL and RL

A.6 Method SW6010B/SW6020 - Trace Metals by ICP

Please refer to Section 7.2.16 and 7.2.17 for a description of the methods and the Summaries of Calibration and QC Procedures.

Table A.11
PQLs for Appendix IX Analytes of SW6010B

Parameter/Method	Analyte	Water		Soil	
		PQL	Units	PQL	Units
Metals SW6010B/SW6020	Tin	0.10	mg/L	10.0	mg/kg

Table A.12
QC Acceptance Criteria for Appendix IX Analytes of SW6010B

Method	Analyte	Accuracy Water (%R)	Precision Water (%RPD)	Accuracy Soil (%R)	Precision Soil (%RPD)
Metals SW6010B/SW6020	Tin	86-114	15	80-118	25

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE