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NAS CECIL FIELD
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FINAL SAMPLING AND ANALYSIS PLAN FOR PETROLEUM SITES JET ENGINE TEST CELL, NORTH FUEL FARM, DAY TANK 1 AND BUILDINGS 46 AND 271 WITH TRANSMITTAL LETTER NAS CECIL FIELD FL
03/24/2011
TETRA TECH NUS

TETRA TECH

PITT-03-11-071

March 24, 2011

Project 112G02267

BRAC PMO SE
Attn: Mr. Art Sanford
4130 Faber Place Drive
North Charleston, South Carolina 29405

Reference: CLEAN Contract No. N62470-08-D-1001
Contract Task Order JM09

Subject: Final Sampling and Analysis Plan for Petroleum Sites: Jet Engine Test Cell; North Fuel Farm; Day Tank 1; Building 46 and Building 271
Naval Air Station Cecil Field
Jacksonville, Florida

Dear Mr. Sanford:

Enclosed please find one copy of the subject deliverable. Copies have been sent to the members of the NAS Cecil Field Partnering Team for their review and comment as noted below. This document has been reviewed by the Navy Chemist and FDEP, and all comments have been addressed. Regulatory review and corresponding approval or comment letter is requested. The Final version is to be signed by all persons named on the title page for the document to be considered final.

If you have any questions, please call me at 412-921-8163 or Megan Boerio at 412-921-7271.

Sincerely,

Robert F. Simcik, P.E.
Task Order Manager

RFS/clm

Enclosure

cc: D. Grabka, FDEP (1 copy)
D. Vaughn-Wright, U.S. EPA (electronic copy)
M. Davidson, BRAC PMO SE (electronic copy)
S. Martin, NAVFAC Atlantic (electronic copy)
J. Keener, Solutions-IES (electronic copy)
M. Halil, CH2MHill (electronic copy)
J. Trepanowski, Tetra Tech NUS
S. Currie/Tetra Tech NUS File JM09 (1 copy unbound)

Tetra Tech NUS, Inc.
661 Andersen Drive, Pittsburgh, PA 15220-2745
Tel 412.921.7090 Fax 412.921.4040 www.ttnus.com

Comprehensive **L**ong-term **E**nvironmental **A**ction **N**avy

CONTRACT NUMBER N62470-08-D-1001

Sampling and Analysis Plan
for
Petroleum Sites: Jet Engine Test Cell, North Fuel Farm; Day Tank 1; Building 46; and Building 271

Naval Air Station Cecil Field
Jacksonville, Florida

Contract Task Order JM09

March 2011

BRAC Program Management Office Southeast
4130 Faber Place Drive, Suite 202
North Charleston, South Carolina 29405

TETRA TECH NUS, Inc.

SAP Worksheet #1 -- Title and Approval Page

(UFP-QAPP Manual Section 2.1)

FINAL
SAMPLING AND ANALYSIS PLAN
MARCH 2011

PETROLEUM SITES: JET ENGINE TEST CELL; NORTH FUEL FARM; DAY TANK 1; BUILDING 46; AND BUILDING 271
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Prepared for:
BRAC Program Management Office Southeast
4130 Faber Place Drive
North Charleston, South Carolina 29405

Prepared by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406

Prepared under:
Contract N62470-08-D-1001
CONTRACT TASK ORDER JM09

Review Signatures:

T.E. Johnston 3/22/2011
Tom Johnston, PhD/CLEAN Quality Assurance Manager/Date, Tetra Tech

3/22/11
Rob Simcik/Project Manager/Date
Tetra Tech

M. Tony Lieberman
M. Tony Lieberman/Quality Assurance Manager/Date Solutions-IES

Jessica Keener 5/11/11
Jessica Keener/Project Manager/Date
Solutions-IES

Approval Signatures:

Arthur Sanford 5/11/11
Art Sanford/RPM/Date
BRAC PMO SE

See attached
Government Chemist/Date
NAVFAC QAO

David J. Grabka 5/11/11
David Grabka/RPM/Date
FDEP, Bureau of Waste Cleanup, Fed Section

SAP Worksheet #1 -- Title and Approval Page

(UFP-QAPP Manual Section 2.1)

DRAFT
SAMPLING AND ANALYSIS PLAN
AUGUST 2010

PETROLEUM SITES: JET ENGINE TEST CELL; NORTH FUEL FARM; DAY TANK 1; BUILDING 46; AND BUILDING 271
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Prepared for:
BRAC Program Management Office Southeast
4130 Faber Place Drive
North Charleston, South Carolina 29405

Prepared by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406

Prepared under:
Contract N62470-08-D-1001
CONTRACT TASK ORDER JM09

Review Signatures:

Kelly A Cooper for
Tom Johnston/PhD/CLEAN Quality Assurance Manager/Date, Tetra Tech

Rob Simcik/Project Manager/Date
Tetra Tech

M. Tony Lieberman/Quality Assurance Manager/Date Solutions-IES

Jessica Keener/Project Manager/Date
Solutions-IES

Approval Signatures:

Art Sanford/RPM/Date
BRAC PMO SE

TUCKER.JONATHAN.P.1239524180 Digitally signed by TUCKER.JONATHAN.P.1239524180 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=TUCKER.JONATHAN.P.1239524180 Date: 2010.10.06 15:28:30 -04'00'

Government Chemist/Date
NAVFAC QAO

David Grabka/RPM/Date
FDEP, Bureau of Waste Cleanup, Fed Section

EXECUTIVE SUMMARY

Tetra Tech, Inc. (Tetra Tech) has prepared this Sampling and Analysis Plan (SAP) for Long-term Monitoring of the following Petroleum Sites at the former Naval Air Station (NAS) Cecil Field in Jacksonville, Florida: Jet Engine Test Cell (JETC), North Fuel Farm (NFF), Day Tank 1, Building 46, and Building 271. This work was done under Comprehensive Long-term Environmental Action-Navy Contract Number N62470-08-D-1001, Contract Task Order Number JM09. This SAP follows the format of the Uniform Federal Policy (UFP) for Quality Assurance Project Plans (QAPPs) and was prepared to address several ongoing long-term monitoring investigations at the former NAS Cecil Field. The sites addressed in this SAP are already part of long-term monitoring programs and all are under the Petroleum Program based on the contaminants of concern (COCs) at the sites.

The JETC is located on the east side of the intersection of Flightline Road (formerly Jet Road) and Cecil Pines Street (formerly 9th Street) at NAS Cecil Field in the vicinity of Buildings 328, 334, 339, and 811. Reported leaks and overfilling spills led to the first environmental investigations at this site in 1989. Petroleum-impacted soil was identified in 1990 as part of a preliminary Contamination Assessment. Free product, soil and groundwater contamination associated with the two underground storage tanks (USTs) on site were identified and delineated during a comprehensive Contamination Assessment between 1991 and 1994. Soil removal and air sparging were selected as remedies for the site, along with groundwater monitoring. The air sparge system was operated from November 24, 2003 through April 2007. Groundwater sampling is currently conducted quarterly, with samples from five wells being analyzed for total recoverable petroleum hydrocarbons (TRPH) and polycyclic aromatic hydrocarbons (PAHs). Quarterly monitoring is conducted to verify that contaminants do not migrate off site.

The NFF is located at the northeast corner of Aviation Avenue and Loop Road at NAS Cecil Field. The site previously contained six 595,000-gallon jet propellant 5 aviation fuel (JP-5) storage tanks, one of which was removed after leaks were recorded in 1991, and the other five of which were removed from 2000 to 2001. Volatile organic compounds (VOCs) were the COCs that were found in groundwater at the site from approximately 5 feet below ground surface (bgs) to 100 feet bgs. Air sparge, biosparge, and soil vapor extraction systems were installed at the site to treat contamination, and began operating between May and July 2005. Quarterly monitoring of 16 wells is conducted to verify that contaminants do not migrate off site.

Day Tank 1 is located approximately 1/8 miles south of the “A” Avenue gate on Jet Road. The Day Tank 1 site is the former location of an earth-mounded, 200,000-gallon above ground storage tank (AST) containing JP-5 which was piped from the tank to the flightline area via an underground fuel distribution line. The AST was removed in 1999, along with approximately 24,000 tons of impacted soil, and a

biosparge/soil vapor extraction (BS/SVE) system was installed in 2000 and operated for 3 years. Semi-annual monitoring is currently being conducted at 12 wells with groundwater samples being analyzed for VOCs and PAHs.

Building 46, the former base gas station, was located on the east side of "D" Avenue across from the Bachelor Officers' Quarters, and after being demolished in 1987, was turned into a parking area between Buildings 903 and 904. Two Phoster ® biological treatment systems were installed and operated at the site from 2001 to 2004, with chemical injections stopping in 2004 and oxygen injections being discontinued in January 2008. Benzene, toluene, ethylbenzene, and xylenes (BTEX), methyl-tert-butyl-ether (MTBE), napththalene, 1-methylnaphthalene, 2-methylnaphthalene, sulfate, and TRPH are the COCs at this site. Semi-Annual monitoring is conducted at varying depths at nine wells to verify that contaminants do not migrate off site.

Building 271 is located at the corner of Cecil Pines Street (formerly 9th Avenue) and Pool Site Avenue (formerly "B" Avenue) at NAS Cecil Field. Building 271 was a former retail gasoline facility that had four underground storage tanks (USTs), identified as 271-D, 271-R, 271-UL and 271-SUL, along with two oil water separators. All of the USTs, Oil Water Separators (OWSs), and associated piping have been removed from the site, and petroleum-impacted soil and groundwater were identified in several investigations from 1999 to 2003. An AS system was installed and began operation in November 2003. The system was shut down in December 2009. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene are the COCs at this site. Quarterly monitoring is conducted at varying depths at eight wells to verify that contaminants do not migrate off site.

The SAP contained herein was generated for and complies with applicable UFP-QAPP, Florida Department of Environmental Protection (FDEP), and United States Environmental Protection Agency (USEPA) Region 4 requirements, regulations, guidance, and technical standards as appropriate. This SAP outlines the organization, project management, objectives, planned activities, measurement, data acquisition, assessment, oversight, and data review procedures associated with the planned investigations at Petroleum Sites at the former NAS Cecil Field. The scope of work includes but is not limited to groundwater sampling for analysis of select VOCs, PAHs, and petroleum-related compounds at the JETC, NFF, Day Tank 1, Building 46, and Building 271. The data will be used by the NAS Cecil Field Partnering Team to determine whether continued groundwater monitoring is appropriate or if other actions must be taken to be protective of human health and the environment. Protocols for sample collection, handling, storage, chain of custody, laboratory and field analyses, and reporting are also addressed in this SAP. The investigation procedures utilized will comply with FDEP and Tetra Tech Standard Operating Procedures (SOPs). The field work and sampling are already ongoing on a regular basis. A complete schedule is detailed in SAP Worksheet #16.

Field activities conducted under this SAP shall meet the requirements of the Solutions-IES Field Site-Specific Health and Safety Plan (HASP).

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Appendices

Appendix A Field Documentation Forms and Standard Operating Procedures
Appendix B DQO Meeting Minutes
Appendix C Laboratory Standard Operating Procedures
Appendix D Laboratory DoD ELAP Certification

ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc.
APR	Alternate Procedures Request
AS	Air Sparging
AST	Aboveground Storage Tank
BCT	BRAC Cleanup Team
BEC	Base Environmental Coordinator
BEI	Bechtel Environmental, Inc.
BFB	Bromofluorobenzene
bgs	Below ground surface
bls	Below land surface
BNA	Base-Neutral and Acid
BOA	Basic Ordering Agreement
BRAC	Base Realignment and Closure
BS/SVE	Biosparge/Soil Vapor Extraction
BTEX	Benzene, toluene, ethylbenzene, and xylenes
°C	Degree Celsius
CA	Corrective Action
CAR	Contamination Assessment Report
CARA	Contamination Assessment Report Addendum
CAS	Chemical Abstract Service
CCB	Continuing Calibration Blank
CCC	Calibration Check Compound
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
CH2MHill	CH2MHill Constructors, Inc.
CLEAN	Comprehensive Long-term Environmental Action Navy
COC	Contaminant of concern
CSM	Conceptual site model
CSR	Confirmatory Sampling Report
CTO	Contract Task Order
%D	Percent Difference
DCA	1,2-Dichloroethane
DFTPP	Decafluorotriphenyl-phosphine
DL	Detection Limit
DO	Dissolved Oxygen

DoD	Department of Defense
DPT	Direct push technology
DQI	Data Quality Indicator
DQO	Data Quality Objective
DQR	Data Quality Review
EDD	Electronic Data Deliverables
EGIS	Environmental Geographic Information System
EICP	Extracted Ion Current Profile
FAC	Florida Administrative Code
ELAP	Environmental Laboratory Accreditation Program
FDEP	Florida Department of Environmental Protection
FOL	Field Operations Leader
FTMR	Field Task Modification Request
GC/FID	Gas Chromatograph/Flame Ionization Detector
GC/MS	Gas Chromatograph/Mass Spectrometer
GCTL	Groundwater Cleanup Target Level
GWMR	Groundwater Monitoring Report
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HLA	Harding Lawson Associates
HPLC	High Pressure Liquid Chromatography
HSM	Health and Safety Manager
IC	Ion Chromatograph
ICAL	Initial Calibration
ICV	Initial Calibration Verification
IDW	Investigation-derived waste
IR	Installation Restoration
IS	Internal Standards
JEDC	Jacksonville Economic Development Commission
JETC	Jet Engine Test Cell
KAG	Kerosene Analytical Group
LCAR	Limited Closure Assessment Report
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory information management system
LOQ	Limit of Quantitation
LTM	Long-Term Monitoring

LTMP	Long-Term Monitoring Program
µg/L	Micrograms per liter
MIP	Membrane interface probe
mL	Milliliter
MNA	Monitored Natural Attenuation
MO	Monitoring Only
MPC	Measurement Performance Criterion
MS/MSD	Matrix spike/matrix spike duplicate
MTBE	Methyl-tert-butyl-ether
NA	Natural Attenuation
N/A	Not Applicable
NADC	Natural Attenuation Default Concentration
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
NELAP	National Environmental Laboratory Accreditation Program
NFA	No Further Action
NFF	North Fuel Farm
NTU	Nephelometric turbidity unit
O&M	Operations and Maintenance
ORP	Oxidation Reduction Potential
OSHA	Occupational Safety and Health Administration
OVA	Organic Vapor Analyzer
OWS	Oil Water Separator
PAH	Polycyclic Aromatic Hydrocarbon
PAL	Project Action Level
PARCCS	Precision, accuracy, representativeness, comparability, completeness, and sensitivity
PE	Professional Engineer
PG	Professional Geologist
PID	Photoionization Detector
PM	Project Manager
PMO	Project Management Office
PP	Poor performing
PQLG	Project Quantitation Limit Goal
PT	Proficiency Testing
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan

QC	Quality Control
RAC	Remedial Action Contractor
RAP	Remedial Action Plan
RAPA	Remedial Action Plan Addendum
RF	Response Factor
RI	Remedial Investigation
RMO	Risk Management Option
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative standard deviation
RT	Retention Time
SA	Site Assessment
SAP	Sampling and Analysis Plan
SAR	Site Assessment Report
SARA	Site Assessment Report Addendum
SCTL	Soil Cleanup Target Level
SDG	Sample Delivery Group
SE	Southeast
SMC	System Monitoring Compounds
SMP	Site Management Plan
Solutions-IES	Solutions – Industrial and Environmental Services, Inc.
SOP	Standard operating procedure
SPCC	System performance check compound
SQL	Structured query language
SRR	Source Removal Report
SVE	Soil Vapor Extraction
TBD	To be determined
TMB	Trimethylbenzene
TOC	Total Organic Carbon
TRPH	Total recoverable petroleum hydrocarbons
Tetra Tech	Tetra Tech, Inc.
TtNUS	Tetra Tech NUS, Inc.
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
UST	Underground storage tank
VOC	Volatile organic compound

SAP Worksheet #2 -- SAP Identifying Information

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number:	Petroleum Sites: Jet Engine Test Cell (JETC); North Fuel Farm (NFF); Day Tank 1; Building 46; and Building 271
Operable Unit:	Not applicable
Contractor Name:	Tetra Tech, Inc. (Tetra Tech)
Contract Number:	N62470-08-D-1001
Contract Title:	Comprehensive Long-term Environmental Action Navy (CLEAN)
Work Assignment Number:	Contract Task Order (CTO) JM09

1. This Sampling and Analysis Plan (SAP) was prepared for Petroleum Sites JETC; NFF; Day Tank 1; Building 46; and Building 271 in accordance with the requirements of the United States Environmental Protection Agency (USEPA) *Uniform Federal Policy (UFP) for Quality Assurance Project Plans (QAPPs)* (USEPA, 2005) and *Guidance for Quality Assurance Project Plans, EPA QA/G-5, Quality Assurance Management Staff* (USEPA 2002).

2. Identify regulatory program: Florida Department of Environmental Protection (FDEP) Petroleum Contamination Site Cleanup Criteria, Regulation Chapter 62-770, Florida Administrative Code.

3. This document is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
UFP-SAP Kick-off Meeting – Tetra Tech Internal	March 31, 2010
Data Quality Objective (DQO) Scoping Meeting with Base Realignment and Closure (BRAC) Cleanup Team (BCT)	May 6, 2010

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	Date
Base-Wide Generic Work Plan [Tetra Tech NUS, Inc. (TtNUS)]	October 1998
Work Plan Addendum for UST Investigations at South Fuel Farm and Other Sites (TtNUS, 2003a)	April 2003
Phase V Sampling and Analysis Work Plan, Day Tank 1 – (Former Basin Area Well) (TtNUS, 2005)	January 2005
Work Plan Revision, Troubleshooting and Repair of Air Sparging System at Building 271 (CH2MHill Constructors, Inc. [CH2MHill, 2008])	January 2008
Work Plan – Long Term Monitoring and O&M Operations At Building 46 and Day Tank 1 (TtNUS, 2008a)	February 2008
Long-Term Monitoring and Operating and Maintenance Work Plan (JETC, NFF, and Building 271) [Solutions – Industrial and Environmental Services, Inc. (Solutions-IES, 2008)]	September 2008

6. List organizational partners (stakeholders) and connection with lead organization:

BRAC Project Management Office (PMO) Southeast (SE) (former property owner), USEPA (regulatory), FDEP (regulatory), Jacksonville Aviation Authority(JETC, NFF, and Day Tank 1 property owner), City of Jacksonville (Building 46 and Building 271 property owner)

7. Lead organization (see Worksheet #7 for detailed list of data users)

BRAC PMO SE (former property owner)

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

Not applicable

SAP Worksheet #3 -- Distribution List

(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipients	Title	Organization	Telephone Number (Optional)	E-Mail Address
Mr. Art Sanford	Navy Remedial Project Manager (RPM)	BRAC PMO SE	(843) 743-2135	art.sanford@navy.mil
Ms. Deborah Vaughn-Wright	USEPA RPM	USEPA Region 4	(404) 562-8539	vaughn-wright.debbie@epa.gov
Mr. David Grabka	FDEP RPM	FDEP	(850) 245-8997	david.grabka@dep.state.fl.us
Mr. Mark Davidson	Base Environmental Coordinator (BEC)	BRAC PMO SE	(843) 743-2124	mark.davidson@navy.mil
Ms. Jessica Keener	Basic Ordering Agreement (BOA) Project Manager	Solutions-IES	(919) 873-1060 ext. 126	keenerj@solutions-ies.com
Mr. Robert Simcik	Tetra Tech Project Manager (PM) CLEAN Contractor	Tetra Tech	(412) 921-8163	robert.simcik@tetratech.com

Name of SAP Recipients	Title	Organization	Telephone Number (Optional)	E-Mail Address
Mr. Mike Halil	CH2M Hill PM Remedial Action Contactor (RAC)	CH2M Hill	(904) 777- 4812 ext. 233	michael.halil@CH2M.com
Mr. Walt Beckwith	Solutions-IES Health and Safety Program Manager (HSM)	Solutions-IES	(919) 873-1060 ext.127	wbeckwith@solutions-ies.com
Ms. Bonnie Capito	Librarian and Records Manager	Naval Facilities Engineering Command (NAVFAC) Atlantic	(757) 322-4785	bonnie.capito@navy.mil
Mr. Ronald Kotun	Tetra Tech Project Risk Assessor	Tetra Tech	(412) 921-8291	ronald.kotun@tetratech.com
Ms. Peggy Churchill	Tetra Tech DQO Facilitator	Tetra Tech	(321) 636-6470 ext 1300	peggy.churchill@tetratech.com
Dr. Tom Johnston	Tetra Tech QA Manager (QAM)	Tetra Tech	(412) 921-8615	tom.johnston@tetratech.com
Mr. M. Tony Lieberman	Solutions-IES QAM	Solutions-IES	(919) 873-1060 ext. 117	tlieberman@solutions-ies.com

Name of SAP Recipients	Title	Organization	Telephone Number (Optional)	E-Mail Address
Ms. Dawn Marshall	Field Operations Leader (FOL)	Solutions-IES	(919) 873-1060 ext.131	dmarshall@solutions-ies.com
Mr. Mark Jonnet	Tetra Tech Project Environmental Geographic Information System (EGIS) Specialist	Tetra Tech	(412) 921-8622	mark.jonnet@tetratech.com
Ms. Jean Dent-Smith	Laboratory PM	Accutest	(407) 425-6700	jeans@accutest.com

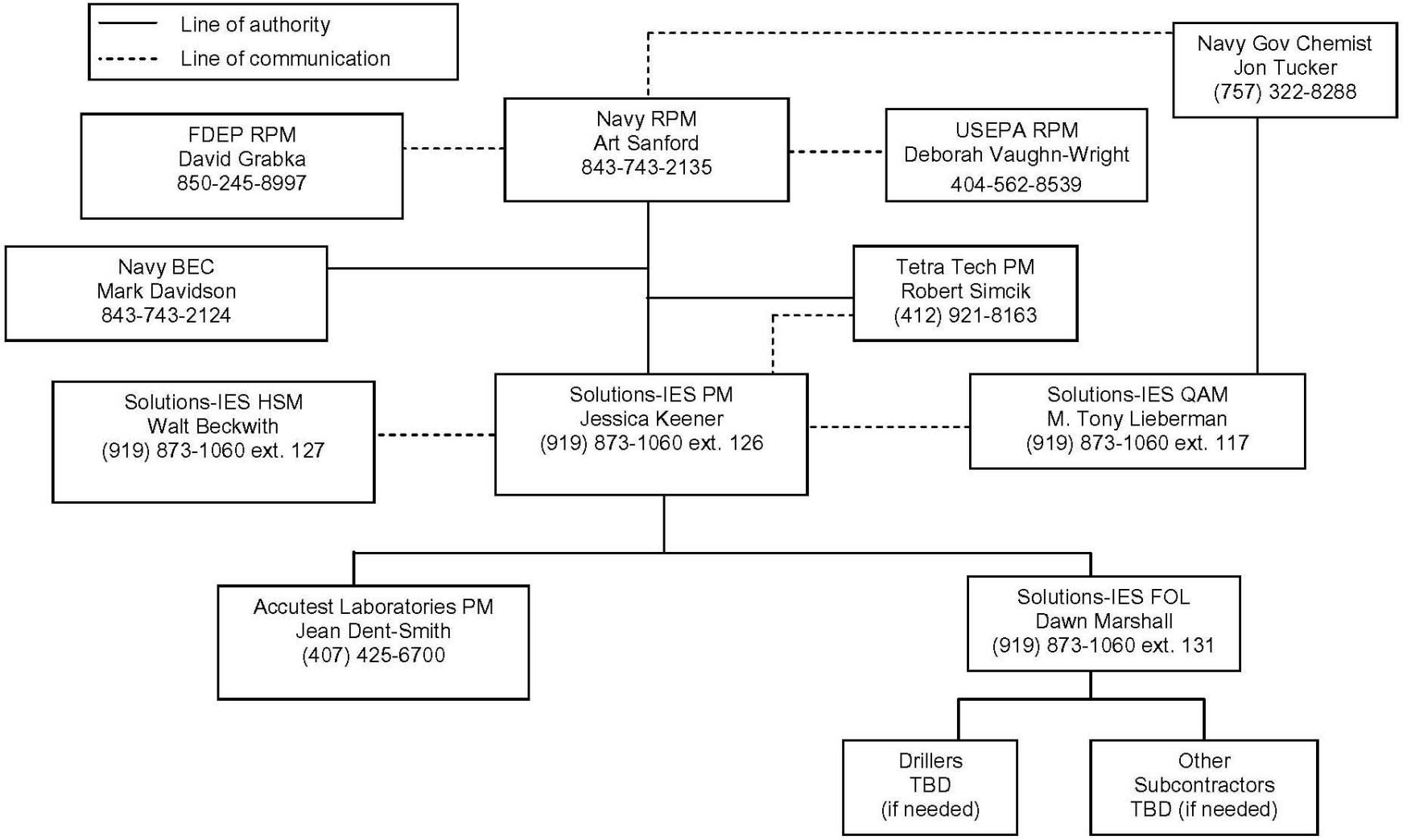
SAP Worksheet #4 -- Project Personnel Sign-Off Sheet

(UFP-QAPP Manual Section 2.3.2)

Name	Organization/Title/Role	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Jessica Keener, PG	Solutions-IES PM	See Worksheet #1 Title and Approval Page		
Robert Simcik, PE	Tetra Tech PM	See Worksheet # 1 Tetra Tech Title and Approval Page	All	
Dawn Marshall	FOL	NR	All	
Tom Johnston, PhD	Tetra Tech QAM	See Worksheet #1 Tetra Tech Title and Approval Page	All	
M. Tony Lieberman	Solutions-IES QAM	See Worksheet #1 Title and Approval Page		
Jean Dent-Smith	Laboratory PM (Accutest)	NR	Worksheets #12, #14, #15A-E, #19, #20, #23-28, #30, #34-37	
Ronald Kotun, PhD	DQO Facilitator and Human Health Risk Assessor		All	

SAP Worksheet #5 -- Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)



SAP Worksheet #6 -- Communication Pathways

(UFP-QAPP Manual Section 2.4.2)

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure
Changes in schedule	Solutions-IES PM Navy RPM	Jessica Keener Art Sanford	919-873-1060 ext. 126 843-743-2135	Solutions-IES PM informs the Navy RPM via email within one week and Navy RPM informs via email Regulatory RPMs within one week.
Issues in the field that result in minor modifications of field methodology or sampling protocol	Solutions-IES FOL Solutions-IES PM	Dawn Marshall Jessica Keener	919-873-1060 ext. 131 919-873-1060 ext. 126	Solutions-IES FOL informs the Solutions-IES PM via email or phone call within one business day, and Solutions-IES PM informs Navy RPM within one week. Solutions-IES FOL documents change in the field log book, and Navy RPM informs Regulatory RPMs.
Field conditions that result in changes in scope of field work or major modifications in field methodology or sampling protocol	Solutions-IES FOL Solutions-IES PM	Dawn Marshall Jessica Keener	919-873-1060 ext. 126 919-873-1060 ext. 126	Solutions-IES FOL informs Solutions-IES PM via email within one business day. The Solutions-IES PM informs the Navy RPM within the same business day. Solutions-IES FOL and PM prepare a field task modification request (FTMR), and Navy RPM provides request via e-mall within one week to Regulatory RPMs.
Recommendation to stop work and initiate work upon CA	Solutions-IES FOL Solutions-IES PM Solutions-IES QAM Solutions-IES HSM Navy RPM	Dawn Marshall Jessica Keener M. Tony Lieberman Walt Beckwith Art Sanford	919-873-1060 ext. 126 919-873-1060 ext. 126 919-873-1060 ext. 117 919-873-1060 ext. 127 843-743-2135	Responsible party immediately (within one hour) informs subcontractors, Navy, and Solutions-IES PM via email and phone call. Navy RPM informs Regulatory RPMs.
Analytical data quality issues	Analytical Laboratory Solutions-IES PM	Accutest (Jean Dent-Smith) Jessica Keener	407-425-6700 919-873-1060 ext. 126	Laboratory PM notifies Solutions-IES PM within one business day via email.

SAP Worksheet #7 – Personnel Responsibilities Table

(UFP-QAPP Manual Section 2.4.3)

Name	Title/ Role	Organizational Affiliation	Responsibilities
Art Sanford	Navy RPM	BRAC PMO SE	Functions as primary Navy interface with the Tetra Tech PM, Solutions-IES PM, and Regulatory RPMs. • Oversees Tetra Tech and Solutions-IES management of project. • Provides Navy input through participation in technical meetings, review of SAP and project documents, and regular discussion with Tetra Tech PM, Solutions-IES PM, and Regulatory RPMs.
Mark Davidson	Navy BEC	BRAC PMO SE	Functions to support elevated issues as identified by the Navy RPM.
Deborah Vaughn-Wright	Regulatory RPM	USEPA Region 4	Functions as BCT member providing input when requested. • Provides input through participation in technical meetings and regular discussion with Navy RPM, but does not have direct regulatory input in the Petroleum Program.
David Grabka	Regulatory RPM	FDEP	Functions as primary regulatory interface with the Navy RPM. • Provides regulatory input through participation in technical meetings, review of SAP and project documents, and regular discussion with Navy RPM. • Provides approval of documents in accordance with the requirements of the current Amended Site Management Plan (SMP) for former NAS Cecil Field.

Name	Title/ Role	Organizational Affiliation	Responsibilities
Jessica Keener	PM	Solutions-IES	Oversees project, manages financial, schedule, and technical day-to-day activities of the project. Ensures timely resolution of project-related technical, quality, and safety questions associated with Tetra Tech operations. • Certifies reports. • Functions as the primary Solutions-IES interface with the Navy RPM, Solutions-IES field and office personnel, laboratory points of contact, and Tetra Tech PM. • Ensures that Solutions-IES health and safety issues related to this project are communicated effectively to all personnel and offsite laboratories. • Monitors and evaluates all Solutions-IES subcontractor performance. • Coordinates and oversees work performed by Solutions-IES field and office technical staff (including data interpretation and report preparation). • Coordinates and oversees maintenance of all Solutions-IES project records. • Coordinates and oversees review of Solutions-IES project deliverables and issuance to the Navy and project team. Coordinates analyses with laboratory chemists, ensures that the laboratory scope of work is followed, and communicates with Solutions-IES staff. Performs data quality reviews (DQRs). • Monitors and evaluates subcontractor laboratory performance. • Ensures timely resolution of laboratory-related technical, quality, or other issues effecting project goals.
Robert Simcik	PM	Tetra Tech	• Functions as the primary Tetra Tech interface with the Navy RPM, Tetra Tech office personnel, laboratory points of contact, and Solutions-IES PM. • Maintains contact with Navy RPM and Solutions-IES PM regarding any field or laboratory work that may affect Tetra Tech responsibilities and projects.
Dawn Marshall	FOL	Solutions-IES	Supervises, coordinates, and performs field sampling activities.
Tom Johnston, PhD	QAM	Tetra Tech	Ensures quality aspects of the CLEAN program are implemented, documented, and maintained.

Name	Title/ Role	Organizational Affiliation	Responsibilities
M. Tony Lieberman	QAM	Solutions-IES	• Ensures that this SAP meets Solutions-IES, Navy, USEPA and FDEP requirements. • Approves SAP and ensures that quality aspects of the CLEAN program are implemented. • Develops, maintains, and monitors QA policies and procedures. • Provides training to Solutions-IES staff in QA/QC policies and procedures. • Conducts management and technical audits to monitor compliance with environmental regulations, contractual requirements, QAPP requirements, and corporate policies and procedures. • Audits project records. • Monitors subcontractor quality controls and records. • Assists in the development of corrective action (CA) plans and ensures correction of non-conformances reported in internal or external audits. • Oversees the responsibilities of the Tetra Tech Site QA/QC Advisor.
Ronald Kotun, Ph.D.	Human Health Risk Assessor	Tetra Tech	Performs human health risk assessment and oversees preparation of human health risk assessment and risk management decisions.
Peggy Churchill	DQO Facilitator	Tetra Tech	Coordinates the DQO process.
Walt Beckwith	HSM	Solutions-IES	Oversees CLEAN Program Health and Safety Program.
Jean Dent-Smith	Laboratory PM	Accutest	Coordinates analyses with laboratory chemists, ensures that scope of work is followed, provides QA of data packages, and communicates with Tt project staff.

SAP Worksheet #8 -- Special Personnel Training Requirements Table

(UFP-QAPP Manual Section 2.4.4)

All field personnel will have appropriate training to conduct the field activities to which they are assigned. Additionally, each site worker will be required to have completed a 40-hour course (and 8-hour refresher, if applicable) in Hazardous Waste Operations and Emergency Response (HAZWOPER) health and safety training as described under Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(b)(4) (OSHA, 2002).

SAP Worksheet #9 -- Project Scoping Session Participants Sheet

(UFP-QAPP Manual Section 2.5.1)

Project Name: Former NAS Cecil Field PM: Robert Simcik	Site Name: Petroleum Sites: JETC; NFF; Day Tank 1; Building 46; and Building 271 Site Location: Jacksonville, Florida

Date of Session: March 31, 2010
Scoping Session Purpose: Tetra Tech internal discussion to designate project roles, prepare timelines, and discuss project details.

Name	Title	Affiliation	Phone #	E-Mail Address	Project Role
Peggy Churchill	Environmental Scientist	Tetra Tech	(321) 636-6470 ext 1300	peggy.churchill@tetratech.com	DQO Facilitator
Robert Simcik, P.E.	PM	Tetra Tech	(412) 921-8361	robert.simcik@tetratech.com	PM
Megan Ritchie	Project Chemist	Tetra Tech	(610) 491-9688	megan.ritchie@tetratech.com	Project Chemist and Installation Restoration (IR) SAP writer
Megan Boerio	Project Engineer	Tetra Tech	(412)921-7271	megan.boerio@tetratech.com	Petroleum Program SAP writer

Comments/Decisions: Peggy advised on how to cut down Worksheet #10 so that all necessary information is there without it being too long or wordy. May 5, 2010 presented as the goal date for internal draft completion.

Action Items: Rob requested that Megan R. and Megan B. prepare mark-ups of aerial figures for each site to develop conceptual site models (CSMs), and that Megan R. and Megan B. get started on writing the DQOs and arrange to meet with Peggy to discuss. Megan R. to talk with Accutest about completing lab worksheets.

Consensus Decisions: Accutest will be used as the laboratory for the analysis of all IR and Petroleum sites, as it is the lab that is used for all analytical activities required by Solutions-IES currently. Megan R. will write IR Sites SAP and Megan B. will write Petroleum Sites SAP. Meeting minutes are provided in Appendix B.

Project Name: Former NAS Cecil Field PM: Rob Simcik	Site Name: Petroleum Sites: JETC; NFF; Day Tank 1; Building 46; and Building 271 Site Location: Jacksonville, Florida
Date of Session: **Scoping Session Purpose:** DQO meeting with Tetra Tech, Navy, and Regulatory Team.	

Name	Title	Affiliation	Phone #	E-Mail Address	Project Role
David Grabka	RPM	FDEP	(850) 245-8997	david.grabka@dep.state.fl.us	RPM
Art Sanford	RPM	Navy	(843) 743-2135	art.sanford@navy.mil	RPM
Robert Simcik	PM	Tetra Tech	(412) 921-8163	robert.simcik@tetratech.com	Tetra Tech PM
Mark Jonnet	EGIS/Engineer	Tetra Tech	(412) 921-8622	mark.jonnet@tetratech.com	EGIS/ Engineer
Peggy Churchill	Environmental Scientist III	Tetra Tech	(321) 636-6470 ext. 1300	peggy.churchill@tetratech.com	DQO Facilitator
Jessica Keener	PM	Solutions-IES	(919) 873-1060 ext. 126	keenerj@solutions-ies.com	Solutions-IES PM

Comments/Decisions: Peggy presented DQOs for the Petroleum Sites and IR Sites to be sampled by the BOA, including site histories. DQOs were revised and agreed upon by the time.

Action Items: Jessica will update the field sampling table to make sure all of the BOA sampling information is up-to-date. Tetra Tech SAP writers will update the SAPs to include Jessica's updates. Tetra Tech to determine if there are other names for the chemicals n-propylbenzene and p-isopropyltoluene, as Dave identified that these may not have FDEP guidance criteria. Peggy will update the presentations and decision rules and distribute to the SAP writers to be incorporated in the documents.

Consensus Decisions: It was decided that data from samples collected from well points would be compared to surface water criteria.

SAP Worksheet #10 -- Conceptual Site Model

(UFP-QAPP Manual Section 2.5.2)

The sites discussed in this SAP are all located within NAS Cecil Field. The majority of former NAS Cecil Field is located in southwestern Duval County, and the southernmost portion of NAS Cecil Field is located in Clay County, as shown on Figure 10A-1. The base was operated by the Navy from approximately 1943 to 1999. This SAP governs work to be conducted at five NAS Cecil Field sites where petroleum compounds are the primary contaminants of concern (COCs): JETC, NFF, Day Tank 1, Building 46, Building 271. These five sites are being investigated and acted upon under the FDEP Petroleum Program. Groundwater at all five of the sites is currently being monitored, and this SAP is being used to identify and refine the LTMP for each site. Figure 10A-1 provides a location map for all five petroleum sites. Additional details concerning CSMs for each site, including historical site activities, past investigations, current site conditions, and potential unacceptable ecological and human exposures are provided below.

10A. JET ENGINE TEST CELL

10A.1 SITE DESCRIPTION

The JETC is located on the east side of the intersection of Flightline Road (formerly Jet Road) and Cecil Pines Street (formerly 9th Street) at NAS Cecil Field in the vicinity of Buildings 328, 334, 339, and 811 (see Figure 10A-2). The site has been under the LTMP since July 1999. The JETC was used to test jet engines by mounting and operating them in three buildings (Buildings 334, 339, and 811) since 1953. Two 20,000-gallon underground storage tanks (USTs) provided the fuel required for the fuel systems that allowed the engines to operate, and two aboveground storage tanks (ASTs) and three oil-water separators (OWSs) were also located at the site. Leaks and overflowing of the JP-5 occurred at the site in 1989 and are the most likely cause of site contamination.

10A.2 HISTORY OF ENVIRONMENTAL INVESTIGATIONS AND ACTIONS

Environmental investigations began at JETC in 1989 after leaks and overfilling were reported at two USTs containing JP-5. A 1990 Preliminary Contamination Assessment identified petroleum-impacted soil, and a comprehensive Contamination Assessment conducted between 1991 and 1994 identified and delineated free product, soil, and groundwater contamination associated with the two USTs. Additional soil contamination was identified at Oil-Water Separator 334-OW, and the majority (although not all) of the impacted soil was excavated in 1999.

FDEP approved a Groundwater Only Monitoring Plan for Natural Attenuation for JETC in May 1999, and quarterly groundwater monitoring followed according to this plan from July 1997 through October 2000. After October 2000, it was determined that further investigation was required, and the groundwater contamination at the site was further delineated in 2001.

10A.3 RAP REMEDIAL ACTION

A Remedial Action Plan (RAP) for Jet Engine Test Cell and Oil-Water Separator 334-OW (TtNUS, 2002a) was signed in September 2002 to address soil and groundwater contaminated with petroleum hydrocarbons as a result of leaks and spills from ASTs and USTs at the site. A RAP Addendum (RAPA) followed in January 2003 (TtNUS, 2003a). The remedy selected in the RAPA was implementation of an air sparging (AS) system and monitoring to remediate groundwater contamination at the site, and excavation of the remaining contaminated soil associated with Tank 334-OW. Contaminants that were found at concentrations greater than FDEP Groundwater Cleanup Target Levels (GCTLs) were to be analyzed in groundwater monitoring samples and included benzene, toluene, ethylbenzene, and total xylenes (BTEX), naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and total recoverable petroleum hydrocarbons (TRPH). COCs that were present in the soil associated with Tank 334-OW at concentrations greater than FDEP Soil Cleanup Target Levels (SCTLs) included the same list of COCs as in groundwater, with the exception of TRPH.

10A.4 LTM SUMMARY

The AS system commenced operation on November 24, 2003, and the system was shut down in April 2007. Groundwater monitoring has been conducted at various intervals at the site for 9 years, including the July 1997 to October 2000 sampling events, and the long-term monitoring plan has been optimized through the years based on decisions at BCT meetings and recommendations made in the monitoring reports, which were accepted by FDEP.

As of the Second Quarter (June) 2009 Long-Term Monitoring Report at JETC, five wells were being sampled on a quarterly basis and analyzed for BTEX, methyl-tert-butyl-ether (MTBE), polycyclic aromatic hydrocarbons (PAHs), TRPH, and natural attenuation (NA) parameters (Solutions-IES, 2009a). During BCT meetings the elimination of all parameters other than TRPH was discussed. FDEP concurred with the elimination of BTEX and MTBE, but required that PAHs still be analyzed, in a letter dated July 13, 2009.

10A.5 CONCEPTUAL SITE MODEL

A summary of the CSM based on post-removal action site conditions at the JETC is shown on Figure 10A-3. The text below describes the CSM.

10A.5.1 Sources of Contamination

Based on the 1994 Contamination Assessment Report Addendum (CARA), leaks were detected during an October 1989 release detection program, which were caused by inadequate seals between manway covers and the walls of tanks holding JP-5. Spills also occurred at the tank as a result of overfilling (ABB-ES, 1994a). These releases most likely led to petroleum-impacted soil and groundwater at the site.

10A.5.2 Potential Contaminant Migration Mechanisms

Because the VOCs, PAHs, and TRPH contamination is located between 3.5 feet and 15 feet below land surface (bls) in the groundwater only, the contamination could migrate to the southwest in the shallow zones of the Surficial Aquifer based on the historical groundwater flow data. Soil leaching to groundwater under the influence of infiltrating precipitation is a potential contaminant migration mechanism. Upon entering the water column, contaminants are carried with the flow of groundwater to downgradient locations.

Vegetation at the site serves to minimize fugitive particulates; therefore, the airborne contaminant transport pathway is not a concern at the site.

10A.5.3 Summary of Risks and Receptors

Former NAS Cecil Field is supplied with public water; therefore, human exposure to contaminated site groundwater through ingestion, inhalation, or direct contact with potable water is not a consideration. Ecological receptors are not exposed to groundwater; however, contamination exceeding regulatory criteria remains.

JETC is located in a highly developed area consisting largely of paved areas and buildings, and does not allow for direct access for contact with groundwater. The resulting lack of ecological habitat and complete exposure pathways precludes potential unacceptable risks for ecological receptors. Direct exposure of potential human receptors to soil and groundwater is restricted based upon the current and future land use.

Because potential contaminant sources no longer exist at the site, and because the levels of contamination are low, additional contributions to the contaminant plume will not occur.

10B NORTH FUEL FARM

10B.1 SITE DESCRIPTION

The NFF is located at the northeast corner of Aviation Avenue and Loop Road at NAS Cecil Field. The NFF site formerly contained six 595,000-gallon JP-5 jet fuel storage tanks, one of which was removed in 1991, and the other five of which were removed in 2000 and 2001. The site is mostly paved, with one building present and grass- and tree-covered areas along the perimeter. The only structure remaining on-site is a remediation building associated with the active remedy for the site. Figure 10B-1 shows the layout of the NFF site.

10B.2 HISTORY OF ENVIRONMENTAL INVESTIGATIONS AND ACTIONS

A corrective action was completed in 1991 to address the petroleum impacts caused by a 1987 spill of approximately 23,000 gallons of JP-5 and a 1991 spill of approximately 913,000 gallons that occurred at the site (ABB-ES, 1994b). A supplemental investigation was completed in 1994 to assess impacts from a 1,800 gallon spill that occurred in November 1993, which included groundwater investigations for horizontal and vertical delineation of groundwater contamination. Based on 1994 groundwater analytical data from shallow, intermediate, and deep wells, a direct-push technology (DPT) investigation was conducted in October and November 1994. Several monitoring wells were installed following the DPT investigation, and based on all of the soil and groundwater sampling results collected, the BCT recommended a RAP be prepared for the site (ABB-ES, 1996).

The initial 1997 RAP proposed soil excavation activities, installation of a soil vapor extraction (SVE) system to treat the contaminated soil in the earth mound area, free product recovery using temporary well points, monitored natural attenuation (MNA), a bioslurping system, and a biosparging system to treat contaminated groundwater, and monitoring (ABB-ES, 1997a). A RAPA was submitted in August 1999 proposing the complete removal of tanks, soil (including the earth mound area), and free-product, along with the installation and operation of an AS system to treat groundwater contamination. The bioslurping and SVE systems were deleted from the original RAP in the RAPA, but the biosparging system, MNA, and LTM were unchanged (TtNUS, 1999a).

Three soil removal actions have taken place at the site since the 1996 CARA, resulting in a total of approximately 140,000 tons of fuel-impacted soil being removed from the site. The greatest amount of soil was removed as a result of the 1999 RAPA, and upon the removal of the soil from the site, the Navy

and FDEP agreed that a supplemental Site Assessment (SA) was necessary to evaluate the impact of the source removal. A Site Assessment Report Addendum (SARA) indentified that soil contamination at the site required no further action (NFA), and that a second RAPA was necessary to address the extent of the groundwater contamination on-site.

10B.3 RAP REMEDIAL ACTION

The second RAPA, which is still in place at the site, was completed in 2004 and recommended a combination of remediation techniques including AS, biosparging with nutrient addition, SVE, and MNA.

AS and biosparging wells and piping were installed at the site from June 1 to October 7, 2004. The AS system was installed in areas where benzene concentrations exceeded 1,000 micrograms per liter (µg/L). Eighty-two vertical AS wells were installed in these areas. The biosparging system was installed in areas where benzene concentrations ranged from 100 µg/L to 1,000 µg/L. One hundred twenty-five vertical biosparging wells were installed in these areas.

The SVE system piping was installed from June 24 to July 16, 2004. The SVE system was installed in the footprint of the AS system to capture vapor released as a result of the AS system operation. Ten horizontal SVE collection lines were installed at a depth of approximately 3 ft bgs in these areas.

Full-scale operation of the remediation systems began in mid-July 2005. FDEP approved the shutdowns of the SVE system on October 24, 2005 because of heavy entrainment of groundwater; the system was shut down in November 2005. CH2MHill conducted an optimization study of the system and provided their recommendations in a report submitted in June 2008. The report recommended redefining the target treatment areas based on updated groundwater data, reconfiguring the treatment system, and continued sampling of the existing monitoring well network on a quarterly basis for 1 year to determine the need for future use (CH2MHill, 2008b). The AS system was reconfigured and restarted in November 2008 but ran sporadically through March 2009 because of maintenance issues. The system operated continuously from March 19, 2009, through June 3, 2009, when it was shut down to let aquifer conditions equilibrate before the June 2009 quarterly groundwater sampling event was conducted.

10B.4 LTM SUMMARY

The MNA sampling program defined in the most recent RAPA recommended that eight wells were to be sampled quarterly while the system was active. Groundwater samples were to be analyzed for VOCs, PAHs, dissolved hydrogen, dissolved methane, and NA parameters [nitrate, nitrite, sulfate, sulfide, total organic carbon (TOC), inorganic carbon, and total phosphorus].

Currently, 16 monitoring wells are sampled quarterly at the site. Monitoring well CEF-076-104D was destroyed during construction activities and therefore, was not sampled in March 2009 or June 2009. Monitoring well CEF-076-117D was added to the monitoring program in June 2009 as a downgradient deep well to replace CEF-076-104D. The wells are screened at depths ranging between approximately 5 to 115 ft bgs. Groundwater samples from the 16 wells are analyzed for VOCs, PAHs, TRPH, dissolved oxygen (DO), and NA parameters (sulfide, sulfate, TOC, inorganic carbon) (Solutions-IES, 2009b).

10B.5 CONCEPTUAL SITE MODEL

A summary of the CSM based on post-removal action site conditions at NFF is shown on Figure 10B-2. The text below describes the CSM.

10B.5.1 Sources of Contamination

The 1996 CARA concluded that spills and leaks from fuel storage and overfill containment tanks are the source of soil and groundwater contamination. Petroleum-related groundwater exceeding Chapter 62-770 Florida Administrative Code (FAC) NFA and Monitoring Only (MO) target levels for Class G-11 groundwater migrated vertically downward into the surficial aquifer and downgradient from the areas of the leaks and spills (ABB-ES, 1996).

10B.5.2 Potential Contaminant Migration Mechanisms

The potential contaminant migration pathways from NFF include overland runoff toward a stream that is in the northern portion of the site and infiltration. Vegetation at the site serves to minimize fugitive particulates; therefore, the airborne contaminant transport pathway is not a concern at the site.

Infiltrating precipitation can cause contamination to leach from surface soil to subsurface soil to groundwater. Upon entering the water column, chemicals, particularly VOCs, are carried with the flow of groundwater downgradient in a southeasterly direction. Recent groundwater elevation measurements indicate that the direction of groundwater flow may be changing at NFF to be slightly more to the south, but groundwater flow has historically been to the southeast. The downgradient wells remain appropriate to verify that contamination is not migration off-site. Depth to groundwater at NFF, as measured in June 2009, ranged from approximately 3.2 to 15.9 feet bgs; therefore, any contaminant migration would occur in the shallow zone of the surficial aquifer.

Runoff of surface water from NFF is primarily to the north and northeast because if the drainage ditch stream located northeast of the site. This drainage ditch leads to Sal Taylor Creek.

10B.5.3 Summary of Site Risks and Receptors

Former NAS Cecil Field is supplied with public water; therefore, human exposure to contaminated site groundwater through ingestion, inhalation, or direct contact with potable water is not a consideration. Ecological receptors are not exposed to groundwater; however, contamination exceeding regulatory criteria remains.

NFF is located in a highly developed area consisting largely of paved areas and buildings, and does not allow for direct access for contact with groundwater. The resulting lack of ecological habitat and complete exposure pathways precludes potential unacceptable risks for ecological receptors. Direct exposure of potential human receptors to soil and groundwater is restricted based upon the current and future land use.

Because potential contaminant sources no longer exist at the site and because the levels of contamination are low, additional contributions to the contaminant plume will not occur.

10C DAY TANK 1

10C.1 SITE DESCRIPTION

Day Tank 1 was located on the former Main Base east of Flightline (formerly Jet) Road, north of Buildings 824 and 824A, and west of Building 846. Day Tank 1 was a 200,000-gallon earth-mounded AST that stored JP-5 jet fuel, which was installed in 1956 and demolished in 1999 (ABB-ES, 1997b). The area of the site is mostly paved and includes Buildings 824A and 1848. These buildings were used for aircraft maintenance and aircraft and aircraft parts storage. The Day Tank 1 area is contained within IR Site 57. A detailed site plan is shown on Figure 10C-1.

10C.2 HISTORY OF ENVIRONMENTAL INVESTIGATIONS AND ACTIONS

Numerous spills have occurred at the site, most notably a release of approximately 497,000 gallons of JP-5 in 1981 (ABB-ES, 1993). This release was followed by several investigations, beginning with a preliminary Contamination Assessment, conducted in 1981. This preliminary Contamination Assessment concluded that the spilled fuel was found only in the unsaturated zone, had not migrated to the groundwater, and would degrade naturally. From 1990 through 1992, a Contamination Assessment was conducted and identified groundwater contamination and free product associated with the fuel spills. No impacts to surface water or sediment were identified. In 1993, additional field work was performed to address FDEP comments on the Contamination Assessment Report (CAR), and a CARA was submitted.

In 1994, a RAP was submitted based on the CARA. Based on comments from FDEP, the Navy prepared an Alternate Procedures Request (APR) to address groundwater table depression that would be caused by a proposed free product remediation system. The APR for a vapor-enhanced free-product extraction system was submitted in 1995.

In 1996, vacuum-enhanced extraction and two bioslurping field tests were performed. Based on the results of the field tests, FDEP requested that a second RAP be submitted for the site.

10C.3 RAP REMEDIAL ACTION

In 1997, the second RAP was submitted (ABB-ES, 1997b). The remediation components of the second RAP included the removal of free product and contaminated soil by excavation, groundwater treatment near the source using biosparge/SVE (BS/SVE), and long-term monitoring of the plume for NA. In support of the RAP, contaminated soil was delineated. In 1999, the RAC implemented the excavation portion of the RAP, and in 2000, installed the BS/SVE system near the southwestern corner of Building 846. The limits of excavation defined in the RAP encompassed the limits of the free product that was identified in the CARA. Approximately 24,000 tons of soil was excavated to a depth of 11 feet, approximately 1 foot below the water table. The excavation included the demolition and removal of Day Tank 1. Post-excavation samples collected along the edges of the excavation were analyzed by a laboratory, and although TRPH, VOCs, and PAHs were detected, their concentrations did not require additional action based on the RAP protocol. These results were reported in the Source Removal Report (SRR) (CH2MHill, 2000).

In 2000, free product was identified in two of the vapor extraction wells. The free product was routinely removed from the wells but returned in one well (VEW-01) after removal. The free product thickness observed in VEW-1 has varied from 1 to 4 feet. Less than 20 gallons of free product were removed over a period of two years. In 1999 to 2000, groundwater monitoring for NA indicated that the plume extended much farther than identified in the RAP. In 2001, a Remedial Investigation (RI) was performed at Site 57, which is adjacent to the Day Tank 1 groundwater plume. The extent of free product associated with VEW-01 under Building 846 was evaluated during this RI. In 2002, the results of the confirmatory samples from the 1999 excavation were re-evaluated and compared to the FDEP SCTLs. This comparison showed that contaminated soil remained at the Day Tank 1 site and that the extent of soil contamination in exceedance of SCTLs was uncertain. Free product continued to be observed in two monitoring wells. Additional assessment of the site was required to delineate the extent of contamination in the soil and to confirm the extent of free product under Building 846. In 2003, a SARA investigation was performed to delineate contaminated soil that did not meet residential and leachability criteria, and to delineate the extent of free product beneath Building 846. The presence of water in the basin prevented

sampling within the basin. The SARA included an excavation plan for 3,300 cubic yards of contaminated soil, including the free product (TtNUS, 2003b).

A soil removal action followed in accordance with the 2003 SARA. The excavation activities included soil excavation and off-site disposal, basin draining, and the delineation and excavation of contaminated soil beneath the basin. One monitoring well was installed within the footprint of the basin excavation. A second SARA was completed in 2006 after the completion of the soil removal activities. The SARA No. 2 concluded that the site met the conditions for NFA for soil, based on 62-770.680 (1) FAC Risk Management Options (RMO) Level 1. FDEP concurred that NFA was required for soil at the site.

In August 2003, the BS/SVE system was taken out of service based on the groundwater monitoring data. The groundwater monitoring program was continued.

10C.4 LTM SUMMARY

The LTMP for the Day Tank 1 area as identified in the RAP included sampling five monitoring wells on a quarterly basis for the first year in order to evaluate the performance, progress, and effectiveness of NA at reducing the contamination and retarding plume migration at the site. After 1 year, sampling frequency was to change to semi-annual, and eventually to annual. Samples were to be analyzed for BTEX, total naphthalenes, MTBE, and NA parameters (temperature, DO, pH, conductivity, alkalinity, ferrous iron, nitrate, sulfate, oxidation reduction potential (ORP), dissolved sulfide, TOC, carbon dioxide, and methane) (ABB-ES, 1997b).

Changes have been made to the LTMP over time to optimize the sampling and to monitor groundwater contamination at other areas of the site. Currently, 12 wells are being sampled semi-annually for VOCs and PAHs (Solutions-IES, 2010).

10C.5 CONCEPTUAL SITE MODEL

A summary of the CSM based on post-removal action site conditions at the Day Tank 1 site is shown on Figure 10C-2. The text below describes the CSM.

10C.5.1 Sources of Contamination

The JP-5 leaks and spills from Day Tank 1 caused the soil surrounding the tank and the containment basin to become contaminated, and this soil contamination was the source of the groundwater contamination still present at the site. The tank was removed from the site during soil removal activities, and all free product has also been removed.

10C.5.2 Potential Contaminant Migration Mechanisms

The site is almost completely paved, which serves to minimize fugitive particulates; therefore, the airborne contaminant transport pathway is not a concern at the site. The possibility of overland runoff or infiltration is also limited by the fact that the site is almost completely paved or covered with buildings.

Depth to groundwater at the Day Tank 1 site, as measured in March 2009, ranged from approximately 6.5 to 9.9 feet bgs. Current groundwater elevation data indicate that groundwater flow from the area of highest isopropylbenzene concentrations (in the vicinity of well VEW-07) is to the southeast (Solutions-IES, 2009c).

10C.5.3 Summary of Site Risks and Receptors

Former NAS Cecil Field is supplied with public water; therefore, human exposure to potentially contaminated site groundwater through ingestion, inhalation, or direct contact is not a consideration. Ecological receptors are not exposed to groundwater; however, contamination exceeding regulatory criteria remains.

The Day Tank 1 site is located in a highly developed area, consisting largely of paved areas and buildings, and not allowing for direct access for contact with groundwater. The resulting lack of ecological habitat and complete exposure pathways precludes potential unacceptable risks for ecological receptors. Direct exposure of potential human receptors to soil and groundwater is restricted based upon the current and future land use.

Because potential contaminant sources no longer exist at the site and because the levels of contamination are low, additional contributions to the contaminant plume will not occur.

10D BUILDING 46

10D.1 SITE DESCRIPTION

The Building 46 site formerly served as a gasoline station at former NAS Cecil Field. The former base gas station was located on the east side of “D” Avenue across from the Bachelor Officers’ Quarters, and after being demolished in 1987, was turned into a parking area between Buildings 903 and 904. Eight USTs were located at the site, four of which were operational prior to 1970, and were used to store regular, unleaded, and super unleaded gasoline, and diesel fuel. Currently, approximately half of the site is covered in grass and half of the site is paved, and the only facilities associated with the site are

remediation treatment facilities. All of the USTs at the site were removed in June 1988. A site plan is included as Figure 10D-1.

10D.2 HISTORY OF ENVIRONMENTAL INVESTIGATIONS AND ACTIONS

A Contamination Assessment investigation was conducted in June 1997, involving the collection and analysis of several soil and groundwater samples. The Confirmatory Sampling Report (CSR) recommended that an SA be performed to determine the extent of soil and groundwater contamination at the site (ABB-ES, 1998). An SA was conducted by Harding Lawson Associates (HLA) in 1998 to assess the vertical and horizontal extent of petroleum-contaminated soil and groundwater at the Building 46 area. The Site Assessment Report (SAR) concluded that operation of the USTs had resulted in contamination of soil and groundwater with fuel-related compounds, including BTEX, MTBE, naphthalene, and TRPH. The SAR determined that a soil area of approximately 5,500 square feet at the location of the former USTs was highly contaminated to a depth of 7 feet bgs and acted as a source of groundwater contamination. The SAR also established that the areal extent of the groundwater contaminant plume in the shallow (7 to 25 feet bgs), intermediate (25 to 50 feet bgs), and deep (50 to 92 feet bgs) zones of the surficial aquifer was approximately 25,300 square feet, 95,700 square feet, and 31,000 square feet, respectively. The SAR recommended that a RAP be prepared for the site (HLA, 1998).

On April 11, 2002, after the remedy was in place, TtNUS conducted a supplemental investigation to determine the extent of the groundwater contamination downgradient of CEF-046-26I with DPT/Membrane interface probe (MIP) screening technology. Three downgradient points were drilled with DPT/MIP in the southeast direction at distances of 25, 50, and 80 ft, respectively, from CEF-046-26I. A fourth point was drilled sidegradient to the groundwater flow direction and approximately 50 feet due south of the monitoring well. The MIP data indicated detections of volatile organic compounds at depths of 6 ft bls, 30 ft bls and 46 ft bls at two locations. No VOCs were indicated at the sidegradient location and the data for the third downgradient point appeared to indicate little to no impact from VOCs at that location. Based on these results, a RAP Modification was suggested (TtNUS, 2003c).

10D.3 RAP REMEDIAL ACTION

An initial RAP for Building 46 was previously prepared and submitted by TtNUS in March 1999 (TtNUS, 1999b). The 1999 RAP described a remedial action that included installation and operation of an AS/VE system to treat the highly contaminated soil and groundwater in the source area, and MNA for the remediation of the remainder of the groundwater contaminant plume. In June 2000, TtNUS submitted a RAP Addendum which contained a recommendation to enhance the AS system with a nutrient injection system known as PHOSter®, which stimulates the growth of petrophilic microorganisms (TtNUS, 2000), to eliminate the need of a VE system component. The RAP Addendum also recommended the addition of

two intermediate and one deep monitoring well downgradient to monitor the plume and detect possible migration in that direction. The AS system and wells were installed between December 2000 and June 2001. The system was shut down in December 2009, and all of the equipment associated with the system was removed from the site.

10D.4 LTM SUMMARY

The 2000 RAPA identified the sampling program for the Building 46 site. Three soil borings were installed quarterly during the first year of operation of the PHOSter® Nutrient Injection System. The data from the soil borings were used to verify the cleanup of vadose zone soil. Soil borings were advanced to the water table. Soil samples were collected from each boring starting at a depth of 1 foot bgs and from every 2-foot interval thereafter. Samples were field-screened with an organic vapor analyzer (OVA) in accordance with FAC Chapter 62-770.200. For each boring, the sample from the interval with the highest OVA reading was to be analyzed for specific kerosene analytical group (KAG) fractions. After soil samples were obtained, the borings were backfilled with sand and the top of the borings sealed at grade with either a 6-inch layer of top soil in unpaved areas or with asphalt in paved areas.

Groundwater samples were to be collected from a total of 14 wells at the Building 46 site: two shallow wells, nine intermediate wells, and three deep wells. Samples were to be analyzed for BTEX and MTBE, PAHs, TRPH, and nutrients (nitrates, nitrites, and orthophosphates). NA parameters (temperature, dissolved oxygen, pH, conductivity, ORP, ferrous iron, hydrogen sulfide, carbon dioxide, and alkalinity) are also to be measured at the site. Sampling was to be quarterly for the first year while the AS systems were operational, semi-annual for the next 2 years, and one final post-remediation monitoring sampling event.

Soil sampling was discontinued after December 2006 sampling. There are currently nine groundwater monitoring wells being sampled quarterly at Building 46: two shallow wells, four intermediate wells, and three deep wells. The parameters being analyzed are BTEX, MTBE, TRPH, naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and sulfate (Solutions-IES, 2009d). At the May 2010 BCT meeting, well CEF-046-25I was removed from the sampling program and well CEF-046-27D was added to be sampled for sulfate analysis only.

10D.5 CONCEPTUAL SITE MODEL

A summary of the CSM based on current site conditions at the Building 46 area is shown on Figure 10D-2. The text below describes the CSM.

10D.5.1 Sources of Contamination

The source of Building 46 soil contamination was the operation and possible leaks, spills, and overflow associated with the gasoline station. The contaminated soil is the source of groundwater contamination. BTEX, MTBE, PAHs, TRPH, and sulfate have been detected in groundwater at Building 46 at concentrations exceeding their respective GCTLs.

10D.5.2 Potential Contaminant Migration Mechanisms

The potential contaminant migration pathways from Building 46 include overland runoff and infiltration. Vegetation at the site serves to minimize fugitive particulates; therefore, the airborne contaminant transport pathway is not a concern at the site.

Infiltrating precipitation can cause contamination to leach from surface soil to subsurface soil to groundwater. Upon entering the water column, chemicals, particularly sulfate and VOCs, are carried with the flow of groundwater downgradient in a southwesterly direction. Depth to groundwater at the Building 46 site, as measured in June 2009, ranged from approximately 5.8 to 10.3 feet bgs; therefore, any contaminant migration would occur in the shallow zone of the surficial aquifer (Solutions-IES, 2009d).

10D.5.3 Summary of Site Risks and Receptors

Former NAS Cecil Field is supplied with public water; therefore, human exposure to contaminated site groundwater through ingestion, inhalation, or direct contact with potable water is not a consideration. Ecological receptors are not exposed to groundwater; however, contamination exceeding regulatory criteria remains.

Building 46 is located in a highly developed area which is approximately half paved and half grass-covered, and does not allow for direct access for contact with groundwater. The resulting lack of ecological habitat and complete exposure pathways preclude potential unacceptable risks for ecological receptors. Direct exposure of potential human receptors to soil and groundwater is restricted based upon the current and future land use.

Because potential contaminant sources no longer exist at the site and because the levels of contamination are low, additional contributions to the contaminant plume will not occur.

10E BUILDING 271

10E.1 SITE DESCRIPTION

Building 271 is located southeast of the corner of Pool Side Avenue and Cecil Pines Street. Building 271 was a former retail gasoline facility that contained four USTs and two OWSs. Three of the USTs had a 10,000-gallon capacity, and the fourth UST had an approximate capacity of 6,000 gallons. Several buildings formerly surrounded Building 271: three former dormitories; Building 201, which was used by Tetra Tech to store investigation-derived waste (IDW); Building 81; Building 907, currently used as the local Jacksonville Economic Development Commission (JEDC) office; Facility 356, which was being used by the Jacksonville Electric Authority; and a water tower. Currently, the site is mostly grass and some areas of pavement, as all buildings have been removed. A site plan is included as Figure 10E-1.

10E.2 HISTORY OF ENVIRONMENTAL INVESTIGATIONS AND ACTIONS

According to UST closure records, Tank 271-D was the first of the USTs removed from the site, with the removal completed on March 5, 1996. The closure report indicates that no soil or groundwater contamination was detected relative to Tank 271-D. The report also indicates that the tank and associated piping were removed from the site.

In July 1999, HLA compiled the CSR for the tank site and the two OWSs also at the site. The CSR indicated that petroleum-impacted soil was encountered at two locations relative to the tank site. The CSR also reported that no KAG constituents (as defined by Chapter 62-770, FAC) were detected in the groundwater sample from the monitoring well CEF-271-3S installed for the tank investigation. HLA reported no soil or groundwater contamination relative to the OWSs. Based on their finding of soil contamination, an SA was recommended for the UST site (HLA, 1999).

Following completion of the planned investigation in the SA, the RAC removed the remaining three USTs and associated piping and distribution systems. The RAC's work on site addressed the soil contamination issues and indicated the existence of groundwater contamination (CH2MHill, 2001). TtNUS proceeded to plan and execute a second investigation in a SAP Addendum (TtNUS, 2001) to address the remaining site contamination in the groundwater. The RAC also removed both OWSs, and submitted separate Limited Closure Assessment Reports (LCAR) for each OWS site in April 2001 to the FDEP. Both LCARs for the OWSs indicated that no petroleum contamination of the soil or groundwater existed relative to the OWSs. On May 23, 2001, the FDEP issued separate letters agreeing with the RAC's findings.

Phase 1 of the 2002 SAR identified that excessively contaminated soil remained at the site, and thus a soil source removal was needed. There was no groundwater contamination detected at the time of the Phase I SA. Phase 2 of the SAR concluded that all of the petroleum-impacted soil had been removed during the RAC's removal of the three remaining tanks, OWSs, piping, and affected soil. No further actions were required at the site for soil. The Phase 2 groundwater investigation results suggested that the groundwater contamination was likely limited to the shallow groundwater zone (above 26 feet bgs). The Phase 3 groundwater results confirmed the Phase 2 conclusions. The SAR recommended a RAP to address the shallow groundwater contamination (TtNUS, 2002b).

10E.3 RAP REMEDIAL ACTION

The remedy recommended in the RAP included AS and groundwater monitoring (TtNUS, 2002c) and a RAPA followed, redefining the AS system design (TtNUS, 2003d). The AS system was installed at the site between September and November 2003 and began operation on November 17, 2003. The system is connected to seven air sparge wells that are screened from approximately 28 to 30 feet bgs. Minor troubleshooting and repairs were conducted on the system in February and March 2008. The system has not operated since late 2008.

10E.4 LTM SUMMARY

According to the RAP, four wells were to be sampled and the groundwater was to be analyzed for VOCs and PAHs. Nine other wells would be tested for water level only. Monitoring was to be performed quarterly, with results being reported in the AS system Operation and Maintenance (O&M) status reports.

The current routine monitoring program consists of measuring the water levels from four wells and collecting groundwater samples from two monitoring wells on a quarterly basis. The most recent (June 2009) sampling event had been modified to include measuring water levels in all 13 monitoring wells and sampling of 12 monitoring wells; however, based on analytical results obtained to date, it was recommended that the measuring of water levels continue at four wells, and sampling for groundwater analysis continue at only two monitoring wells (CEF-271-07S and CEF-271-10S) as specified at the May 2010 BCT Meeting (NASCF Partnering Team Meeting, May 06, 2010, Minute 2622). Sampling frequency remains as quarterly, and the COCs being analyzed at the site include naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.

10E.5 CONCEPTUAL SITE MODEL

A summary of the CSM based on post-removal action site conditions at the Building 271 area is shown on Figure 10E-2. The text below describes the CSM.

10E.5.1 Sources of Contamination

The source of Building 271 groundwater contamination is soil in the area of the former USTs and associated piping, which held and carried large volumes of petroleum-related compounds. Select PAHs (naphthalene, 1- and 2-methylnaphthalene) are the COCs at the site which have been recently detected at concentrations exceeding GCTLs. Samples have also been analyzed for BTEX, MTBE, and TRPH, but these chemicals have not recently been detected at concentrations exceeding their respective GCTLs.

10E.5.2 Potential Contaminant Migration Mechanisms

The groundwater elevations measured in June 2009 ranged from 3.5 to 5.5 feet bgs, in the shallow zone of the surficial aquifer. Groundwater flow in the surficial aquifer is generally to the southeast. The naphthalene contaminant plume is small and stable and confined to the shallow aquifer, and there is no evidence of ongoing contaminant migration.

10E.5.3 Summary of Site Risks and Receptors

Former NAS Cecil Field is supplied with public water; therefore, human exposure to contaminated site groundwater through ingestion, inhalation, or direct contact with potable water is not a consideration. Ecological receptors are not exposed to groundwater; however, contamination exceeding regulatory criteria remains.

Building 271 is located in a highly developed area consisting largely of paved areas, and does not allow for direct access for contact with groundwater. The resulting lack of ecological habitat and complete exposure pathways preclude potential unacceptable risks for ecological receptors. Direct exposure of potential human receptors to soil and groundwater is restricted based upon the current and future land use.

Because potential contaminant sources no longer exist at the site and because the levels of contamination are low, additional contributions to the contaminant plume will not occur.

SAP Worksheet #11 -- Project Quality Objectives/Systematic Planning Process Statements

(UFP-QAPP Manual Section 2.6.1)

11.1 PROBLEM DEFINITIONS

The general goals of the sampling program at each site are to determine if the contaminated groundwater plume is contained, if natural attenuation is occurring, if the monitoring program can be optimized, and if an alternative or additional action needs to be considered as a result of exceedances or contaminant migration. The ultimate goal of LTM at each of the sites is to verify that the groundwater COC concentrations are less than regulatory criteria. Remediation system performance monitoring is also necessary for NFF.

11.1.A Jet Engine Test Cell

TRPH and PAH groundwater contamination remains in the area of the JETC site. Concentrations of TRPH and PAHs have exceeded FDEP GCTLs in at least one monitoring well in the last 2 years. Long-term monitoring results indicate that no contaminant migration is occurring. The source of contamination is most likely the historical leaks and spills from the former JP-5 storage tanks at the JETC buildings, and the plume is contained. Groundwater is monitored quarterly. To confirm whether NA is occurring at the site, TRPH and PAH levels in the groundwater must be measured and evaluated. These data will be used to determine an appropriate path forward as described in Worksheet #11. The AS system is still present at the site but has not been in operation since April 2007.

11.1.B North Fuel Farm

Benzene, ethylbenzene, total xylenes, isopropyl benzene, methylene chloride, 1,2,4-trimethylbenzene (TMB), 1,3,5-TMB, and naphthalene are the COCs that continue to exceed their action levels [GCTLs and Natural Attenuation Default Concentrations [NADCs)] in groundwater. Contaminant concentrations are remaining relatively stable at the monitoring wells. The AS system is currently being operated, although certain wells seem to be unaffected. Groundwater monitoring is required to determine whether the AS system is effective in reducing COC concentrations to acceptable levels, and whether natural attenuation is occurring at the areas outside of the AS system. If groundwater monitoring proves these methods to be ineffective, other actions may be considered.

11.1.C Day Tank 1

Contaminant concentrations in several wells at the site exceeded their respective GCTLs, and naphthalene in plume well CEF-293-VEW-7 exceeded its NADC in the most recent sampling event.

Long-term monitoring results indicate that no contaminant migration is occurring. The source of contamination is the historical JP-5 leaks from the tank while it was in operation and the soil that was immediately affected; the plume is contained. Groundwater is monitored semi-annually. To confirm whether natural attenuation is occurring at the site, VOC and PAH concentrations in the groundwater must be measured and evaluated. These data will be used to determine an appropriate path forward as described in Section 11.4. The BS/SVE system is still present at the site but has been inactive since August 2003.

11.1.D Building 46

Monitoring wells CEF-046-01S and CEF-046-07I are the wells that have been impacted the most, and are located in the source area that is targeted by the AS system. The only other COC that had concentrations exceeding its GCTL in wells other than CEF-046-01S and CEF-046-07I during the past several sampling events is sulfate. LTM results indicate that no contaminant migration is occurring. The source of contamination is the past releases of petroleum-related compounds from the USTs onsite while the gasoline station was in operation and the soil that was immediately affected by these releases. The plume is contained. Groundwater is monitored quarterly. Groundwater monitoring is required to determine whether natural attenuation is occurring at the site and to verify that COC concentrations have not rebounded since the AS system is no longer in operation. These data will be used to determine an appropriate path forward as described in Section 11.4. The AS system was shut down in December 2009 and was been removed from the site.

11.1.E Building 271

PAH groundwater contamination remains in the area of the Building 271 site. Naphthalene in well CEF-271-07S is the only GCTL exceedance detected since July 2007. Long-term monitoring results indicate that no contaminant migration is occurring. The source of contamination is the past releases of petroleum-related compounds from the tanks and piping onsite while the gasoline station was in operation and the soil that was immediately affected by these releases. The plume is contained. Groundwater is monitored quarterly. To confirm whether natural attenuation is occurring at the site, PAH levels in the groundwater must be measured and evaluated. These data will be used to determine an appropriate path forward as described in Section 11.4. The AS system is still present at the site but has been inactive since 2008.

11.2 INFORMATION INPUTS

11.2.1 Previously Collected Data and COCs

The usable data from previous investigations and LTM events was used in conjunction with new LTM data to evaluate current site conditions, contaminant trends, and to determine the COCs for the media being monitored at all sites. The full list of analytes is listed by site in Worksheet #15. The required analyses as agreed upon by the BCT are presented below.

11.2.2 Required Analyses and Frequency of Monitoring by Site

Requirements for groundwater sampling and analysis for each site are described below. The locations and number of samples required are detailed in Worksheet #s 17 and 18. Additional detail (e.g., the methods and SOPs to be used) is provided in Worksheet #s 15, 19, and 21.

Jet Engine Test Cell		
Matrix	**COC**	**Frequency**
Groundwater	TRPH	Quarterly
	PAH	

Groundwater level will be measured at 14 wells.

North Fuel Farm		
Matrix	**COC**	**Frequency**
Groundwater	VOCs	Quarterly
	PAHs	
	Sulfide	
	Sulfate	
	Total organic carbon	
	Inorganic carbon	
	Dissolved oxygen	
	TRPH	

Groundwater level will be measured at 16 wells.

Day Tank 1		
Matrix	**COC**	**Frequency**
Groundwater	VOCs	Semi-Annually
	PAHs	

Groundwater level will be measured at 12 wells.

Building 46		
Matrix	**COC**	**Frequency**
Groundwater	BTEX	Quarterly
	MTBE	
	Naphthalene	
	1-methylnaphthalene	
	2-methylnaphthalene	
	Sulfate	
	TRPH	

Groundwater level will be measured at 15 wells.

Building 271		
Matrix	**COC**	**Frequency**
Groundwater	Naphthalene	Quarterly
	1-methylnaphthalene	
	2-methylnaphthalene	

Groundwater level will be measured at 4 wells.

11.2.3 Analytical Methods

Analytical methods were selected to be the same as those used previously or at least comparable to previously used analytical methods with respect to precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) parameters. See Worksheet #s 19 and 23 for a list of the analytical methods applicable to each site.

11.2.4 Sampling Methods

Sampling methods were selected to be the same as those used previously or to at least be able to produce data which are consistent with the representativeness and comparability of previous data for the medium being sampled at each site. See Worksheet # 21 for a list of sampling methods.

11.2.5 Project Action Levels

A full list of PALs is included within Worksheet #15. The BCT has ensured that the selected laboratory limits of quantitation (LOQs) are generally low enough to measure constituent concentrations in site media that are less than the PALs in order to conduct comparisons of site data to the PALs. In cases where the PAL is between than the LOQ and the detection limit (DL) for a particular analyte, results between the LOQ and DL for that particular analyte will be “J” flagged if the result is less than the LOQ. The BCT will accept these analytical results as usable (without additional qualification) unless quality evaluations indicate that the data quality has been compromised. Laboratory DLs change over time. If, for any analyte in any site medium, the PAL is less than the laboratory DL, the BCT accepts the

laboratory LOQ as the PAL for decision making purposes, as is suggested in "Guidance for the Selection of Analytical Methods and for the Evaluation of Practical Quantitation Limits" (FDEP, 2004).

The groundwater COC concentrations for individual samples and temporal concentration trends for individual wells (using new and previously collected data) will be compared with the FDEP GCTLs listed as PALs in Worksheet #15 to determine whether natural attenuation has caused COC concentrations to attain, or will lead to attainment, of the GCTLs within two consecutive sampling rounds.

11.3 STUDY BOUNDARIES

At each site, a monitoring well network is established, which determines the horizontal and vertical boundaries of the site. The terms "compliance well" and "source well" are used in defining study area boundaries and in the decision rules. Compliance wells are the category of wells that are downgradient monitoring wells at which the groundwater is analyzed to confirm that contamination is not migrating off site. Source wells are those wells which are located within the groundwater contaminant plume. The monitoring well network and thus the study area boundary at each site will expand if the plume is migrating and new compliance wells are added over time, so that the monitoring well network will include the contaminant plume and all downgradient wells. At each of the sites, the populations of interest are the groundwater contaminant plume, the upgradient and downgradient groundwater, and any other groundwater on the perimeter of the plume whose concentrations are needed for decision making. These populations of interest constitute the spatial decision unit. When determining whether an exceedance of a GCTL has occurred at each site, the temporal decision unit is each round of monitoring. When determining whether parameters or wells may be eliminated from the monitoring program, the temporal decision unit is two consecutive monitoring rounds.

11.3.A Jet Engine Test Cell

The JETC area covers approximately 25.2 acres, delineated from the northeast corner to the southwest corner by CEF-339-30S and NG-24S, respectively. This area is shown on Figure 10A-2. The vertical boundary is from the top of the water table to 80 feet bgs.

11.3.B North Fuel Farm

The NFF area covers approximately 917,000 square feet. This is delineated from the northwest corner to the southeast corner by upgradient well CEF-076-95S and downgradient wells CEF-076-117D, as shown on Figure 10B-1. The vertical boundary for the groundwater plume is from 5 ft to 110 ft bgs.

11.3.C Day Tank 1

The Day Tank 1 area covers approximately 169,000 square feet. This is delineated from the northwest corner to the southeast corner by upgradient well CEF-293-09 and downgradient well CEF-293-13, as shown on Figure 10C-1. The vertical boundary for the groundwater plume is from 1.5 ft to 17 ft bgs.

11.3.D Building 46

The Building 46 area covers approximately 140,000 square feet. This is delineated from the northeast corner to the southwest corner by upgradient well CEF-046-15I and downgradient well CEF-046-26I, as shown on Figure 10D-1. The vertical boundary for the groundwater plume is from 4 ft to 80 ft bgs.

11.3.E Building 271

The Building 271 area covers approximately 10,000 square feet. This is delineated from the northwest corner to the southeast corner by upgradient well CEF-271-07S and downgradient well CEF-271-12S, as shown on Figure 10E-1. The vertical boundary for the groundwater plume is from 3 ft to 13 ft bgs.

11.4 ANALYTIC APPROACH

At all of the sites, a direct comparison of measured concentrations within the groundwater will be made against the appropriate PAL. PALs are detailed for each COC in Worksheet # 15. Additionally, if none of the measured COC concentrations in groundwater exceed criteria after two consecutive rounds of monitoring, then the monitoring program will be discontinued after coordination with the BCT. The following decision rules are related to the specific monitoring programs at each site. Decision rules 1 through 4 will apply to all sites. JETC, Day Tank 1, and Building 271 all have remediation systems on-site that are not currently running, and will thus also have a fifth decision rule regarding post-active remediation monitoring. NFF has an active remediation system on-site and will follow the same five decision rules as the JETC, Day Tank 1, and Building 271 sites, along with the additional Decision Rule #6. Building 46 did have a remediation system on site, but it has since been removed.

11.4.A All Sites

These decision rules are related to long-term monitoring and optimization, and apply to all sites in the LTMP.

Decision Rule #1: If all measured concentrations of COCs in all wells are less than action levels for two consecutive quarters, then no further monitoring will be recommended.

Decision Rule #2: If any measured source well COC concentration is greater than or equal to the GCTL, then continue monitoring until source well COC concentrations are less than the GCTL for two consecutive monitoring rounds.

Decision Rule #3: If any compliance well COC concentration is greater than or equal to the GCTL, then a resample will be collected and analyzed to verify the exceedance. If the verification sample also has COC concentrations greater than the GCTL(s), then conduct additional delineation of groundwater contamination via additional groundwater sampling and installation of new monitoring wells. An FTMR will be issued to govern the delineation.

Decision Rule #4: Throughout the groundwater monitoring, if any particular measured COC concentration is less than GCTL for two consecutive sampling rounds, or all measured COC concentrations in any particular well are less than GCTLs for at least two consecutive sampling rounds, then the BCT will discuss the elimination of the well or COC from the monitoring program, in accordance with the Navy guidance on groundwater monitoring well optimization. The well (or COC) will be eliminated unless the well is a compliance well, or the BCT determines that the inclusion of the well (or COC) provides useful information on evaluating the overall program and should not be removed.

11.4.B JETC, Day Tank 1, Building 271, NFF

This decision rule is related to post-active remediation, and applies at all sites where remedial systems are present but not currently in operation.

Decision Rule #5: If post-active remediation monitoring concentrations rebound to levels greater than system action levels, then restarting the active remedial system will be discussed by the BCT. If post-active remediation monitoring concentrations are less than or equal to system action levels, monitor for NA.

The system action levels for these sites are as follows:

- JETC - Benzene (1 µg/L) and naphthalene (20 µg/L)
- Day Tank 1 - Benzene (1 µg/L) and xylenese (50 µg/L)
- Building 271 - Benzene (1 µg/L) and naphthalene (20 µg/L)
- NFF - Benzene (1,000 µg/L)

11.4.C North Fuel Farm

This decision rule is related to active remediation and applies to NFF, which is the only site that has a currently operating remediation system.

Decision Rule #6: If groundwater COC concentrations in the active remedial system area are greater than system action levels as specified in the RAP and Chapter 62.770.700 (19) (a-c) FAC, then continue operating the active remedial system. If groundwater COC concentrations are less than or equal to system action levels for two consecutive sampling events, turn off the system and conduct post-active remediation monitoring for 1 year. If post-active remediation monitoring COC concentrations in source area wells rebound to levels greater than system action levels, then restarting the active remedial system will be discussed by the BCT. If post-active remediation monitoring concentrations are less than or equal to system action levels, monitor for NA.

11.5 PERFORMANCE CRITERIA

Individual groundwater COCs concentrations and temporal COCs concentration trends within individual wells will be compared to the PAL. The BCT will use the measured results to determine whether the amount and type of data collected are sufficient to support the attainment of Remedial Action Objectives. If all data have been collected as planned and no data points are missing or rejected for quality reasons, the type and amount of data collected will be considered satisfactory. If any data gaps are identified, including missing or rejected data, the BCT will assess whether a claim of having obtained project objectives is reasonable. This assessment will depend on the number and type of identified data gaps; therefore, a more detailed strategy cannot be presented. All stakeholders will be involved in rendering the final conclusion regarding adequacy of the data.

11.6 PLAN FOR OBTAINING DATA

The plan for obtaining data at each site is described in detail on Worksheet #17 along with the sampling designs and rationales.

SAP Worksheet #12 -- Measurement Performance Criteria Table

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table – Field QC Samples –Groundwater

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Trip Blank	VOC	1 per cooler containing VOCs	Accuracy / Bias Contamination	No analytes ≥ ½ LOQ, except common lab contaminants, which must be < LOQ.	S & A
Rinsate Blank[1]	All fractions	1 per 20 samples per sampling equipment	Accuracy / Bias Contamination	No analytes ≥ ½ LOQ, except common lab contaminants, which must be < LOQ.	S & A
Field Duplicate	All fractions	1 per 10 environmental samples	Precision	Values >5X the LOQ: Relative percent difference (RPD) of ≤30% Values <5X LOQ: absolute difference of values must be <2xLOQ	S & A
Temperature Indicator	All fractions	1 per cooler	Representativeness	Temperature less than or equal to 6 degrees Celsius (°C)	S

1 – Equipment rinsate blanks will be collected if non-dedicated sampling equipment is used. For disposable equipment, one sample per batch of disposable equipment will be collected.

SAP Worksheet #13 -- Secondary Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)

Secondary Data	**Data Source** (originating organization, report title, and date)	**Data Generator(s)** (originating organization, data types, data generation / collection dates)	**How Data Will Be Used**	**Limitations on Data Use**
JETC LTM Data	Second Quarter 2009 Long-Term Monitoring Report, December 1, 2009	Solutions-IES Year 9 Groundwater data and historical LTM data (starting from 2000)	LTM of groundwater– compares current data to that observed during previous LTM events	None
NFF LTM Data	Second Quarter 2009 Long-Term Monitoring Report, December 1, 2009	Solutions-IES Year 5 Groundwater data and historical LTM data (starting from 2005)	LTM of groundwater– compares current data to that observed during previous LTM events	None
Day Tank 1 LTM Data	Second Semi-Annual Groundwater Monitoring Report, September 2009, March 5, 2010	Solutions-IES Year 3 Groundwater data and historical LTM data (starting from 2007)	LTM of groundwater– compares current data to that observed during previous LTM events	None
Building 46 LTM Data	Second Quarter 2009 Long-Term Monitoring and Operation & Maintenance Status Report, November 9, 2009	Solutions-IES Year 7 Groundwater data and historical LTM data (starting from 2003)	LTM of groundwater– compares current data to that observed during previous LTM events	None
Building 271 LTM Data	First Quarter, June 2009, Long Term Monitoring Report, November 9, 2009	Solutions-IES Year 11 Groundwater data and historical LTM data (starting from 1998)	LTM of groundwater– compares current data to that observed during previous LTM events	None

SAP Worksheet #14 -- Summary of Project Tasks

(UFP-QAPP Manual Section 2.8.1)

Long-term monitoring at the petroleum sites includes the following tasks:

- Mobilization/Demobilization
- Site-Specific Health and Safety Training
- Monitoring Well Installation and Development
- Monitoring Equipment Calibration
- Groundwater Sampling
- Water Level Measurements
- IDW Management
- Field Decontamination Procedures
- Field Documentation Procedures
- Long-Term Monitoring Reports

Additional project activities include the following tasks:

- Analytical Tasks
- Data Management
- Data Review

Mobilization/Demobilization

Mobilization shall consist of the delivery of all equipment, materials, and supplies to the site; the complete assembly in satisfactory working order of all such equipment at the site; and the satisfactory storage of all such materials and supplies at the site. Solutions-IES will coordinate with the Base to identify locations for the storage of equipment and supplies. Site-specific Health and Safety Training will be provided to all Solutions-IES subcontractors as part of the site mobilization.

Demobilization shall consist of the prompt and timely removal of all equipment, materials, and supplies from the site following completion of the work. Demobilization includes the cleanup and removal of IDW generated during the conduct of the investigation.

Site-Specific Health and Safety Training

Site-specific health and safety training to all Solutions-IES field staff and subcontractors will be provided as part of the site mobilization and is also addressed in Worksheet #8. A photoionization detector (PID) will be used as field instrumentation for health and safety purposes.

Monitoring Well Installation and Development: If it is determined that the contaminant plume has migrated at a specific site and that additional downgradient wells must be installed, then this step will be completed. An FTMR will be prepared and submitted to identify the location(s) of the new well (s). Soil borings will be completed at the locations specified in the FTMR, and the bore holes will be converted into permanent monitoring wells in accordance with Tetra Tech SOP GH-2.8. Prior to sampling, the new wells will be developed to remove fine-grained materials. Well development procedures are described in Tetra Tech SOP GH-2.8.

Monitoring Equipment Calibration

These procedures are described in Worksheet #22.

Water Level Measurements

One synoptic round of water-level measurements will be conducted at the site as part of each groundwater sampling event to provide information regarding groundwater flow patterns and gradients. Water-level measurements will be completed within the shortest time possible on the same day, and no sooner than 24 hours after a significant precipitation event to minimize the precipitation effects on the data sets. Water level measurements will be recorded to the nearest 0.01 foot and referenced to a top of casing notch, or if a notch is absent, to the north side of the top of the well casing. The measurement instrument will be decontaminated prior to conducting the measurement event and between each monitoring well.

Groundwater Sampling

Groundwater samples will be collected using low-flow purging techniques (discharge rate of less than 1 liter per minute) with a peristaltic pump using Teflon tubing dedicated to each well. When a well is developed for sampling, a water quality meter will be used to monitor pH, ORP, dissolved oxygen, turbidity, and conductivity. All groundwater samples will be collected using the procedures specified in FS 2200, Groundwater Sampling. Worksheet #s 17 and 18 specify the groundwater sample locations and analytes for this investigation, and Worksheet #23 specifies the analytical methods to be used.

Prior to groundwater sample collection, the monitoring wells will be purged. Both purging and sampling operations will be conducted at a flow rate that results in a groundwater turbidity measurement of 20 Nephelometric turbidity units (NTUs) or less (inherent turbidity will be minimized to the greatest extent possible using low flow techniques; individual well conditions and local geology may preclude meeting the 20 NTU criteria).

The sample aliquot for VOC analysis will be the last one collected. The Teflon™ tubing will be slowly pulled out of the well to minimize agitation of the water in the monitoring well and then the contents of the tubing will be transferred to a VOC vial. After collection, the samples will be placed in a cooler, chilled with ice, and shipped under chain of custody protocol to the off-site laboratory for analysis.

IDW Management

IDW generated during the activities will be managed in accordance with the NAS Cecil Field IDW Plan and will be conducted in an environmentally responsible manner consistent with NAS Cecil Field requirements (e.g., designation of staging areas). The objectives of the IDW management are:

- Management of IDW in a manner that prevents contamination of uncontaminated areas (by IDW) and that is protective of human health and the environment.

- Minimization of IDW, thereby reducing costs and the potential for human or ecological exposure to contaminated materials.

- Compliance with federal and state requirements that are Applicable or Relevant and Appropriate Requirements.

- Bagging and disposal of used personal protective equipment, such as gloves, as regular trash in an appropriate facility waste container.

Field Decontamination Procedures

Decontamination of major equipment and sampling equipment will be in general accordance with FDEP SOP FC 1000, Cleaning / Decontamination Procedures.

Field Documentation Procedures

Pre-preserved, certified-clean bottleware will be supplied by the subcontracted laboratory. Matrix-specific sample logsheets will be maintained for each sample collected. In addition, sample collection information

will be recorded in bound field notebooks or specific field forms. Samples will be packaged and shipped according to FDEP SOP FT1000, General Sampling Procedures.

Field documentation will include a summary of all field activities, and will be properly recorded in a bound logbook with consecutively numbered pages that cannot be removed. Logbooks will be assigned to field personnel and will be stored in a secured area when not in use.

At a minimum, the following information will be recorded in the site logbook:

- Name of the person to whom the logbook is assigned.
- Project name.
- Project start date.
- Names and responsibilities of on-site project personnel including subcontractor personnel.
- Arrival/departure of site visitors.
- Arrival/departure of equipment.
- Sampling activities and sample log sheet references.
- Description of subcontractor activities.
- Sample pick-up information, including chain of custody numbers, air bill numbers, carrier, time, and date.
- Description of borehole or monitoring well installation activities and operations.
- Health and safety issues.
- Description of photographs including date, time, photographer, roll and picture number, location, and compass direction of photograph.

All entries will be written in ink and no erasures will be made. If an incorrect entry is made, striking a single line through the incorrect information will make the correction; the person making the correction will initial and date the change.

Long-term Monitoring Reports

Long-term monitoring reports will be issued following each sampling event. The reports will include appropriate sections concerning site background, investigation activities, physical characteristics, nature and extent of contamination, and conclusions and recommendations.

Each long-term monitoring report will be issued in draft to BRAC PMO SE for initial review. BRAC PMO SE comments will be addressed, and the draft final report will be issued for regulatory review.

Analytical Tasks

Accutest is a current Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) accredited laboratory. A copy of the laboratory certification for Accutest can be found in Appendix C. Analyses will be performed in accordance with the analytical methods identified in Worksheet #19. Accutest is expected to meet the PALs to the extent identified in Worksheet #15. Empirical will perform chemical analysis following laboratory-specific SOPs (Worksheets #19 and #23) developed based on the analytical methods listed in Worksheets #19 and #30. Copies of the Laboratory SOPs are included in Appendix C.

Data Management

Data Handling and Management - After the field investigation is completed, the field sampling log sheets will be organized by date and media and filed in the project files. The field logbooks for this project will be used only for these sites, and will also be categorized and maintained in the project files after the completion of the field program. Project personnel completing concurrent field sampling activities may maintain multiple field logbooks. When possible, logbooks will be segregated by sampling activity. The field logbooks will be titled based on date and activity. The data handling procedures to be followed by the laboratories will meet the requirements of the technical specification. The electronic data results will be automatically downloaded into the Tetra Tech database in accordance with proprietary Tetra Tech processes.

Data Tracking and Control. The Tetra Tech PM (or designee) is responsible for the overall tracking and control of data generated for the project.

- Data Tracking: Data is tracked from its generation to its archiving in the Tetra Tech project-specific files. The Tetra Tech Project Chemist (or designee) is responsible for tracking the samples collected and shipped to the subcontracted laboratory. Upon receipt of the data packages from the analytical laboratory, the Tetra Tech Project Chemist will oversee the data validation effort, which includes verifying that the data packages are complete and results for all samples have been delivered by the analytical laboratory.

- Data Storage, Archiving, and Retrieval: The data packages received from the subcontracted laboratory are tracked in the data validation logbook. After the data are validated, the data packages are entered into the Tetra Tech CLEAN file system and archived in secure files. The field records including field logbooks, sample logs, chain-of-custody records, and field calibration logs will be submitted by the Tetra Tech FOL to be entered into the CLEAN file system prior to archiving in secure project files. The project files are audited for accuracy and completeness. At the completion

of the Navy contract the records will be stored by Tetra Tech and eventually handed over to NAVFAC.

- Data Security: The Tetra Tech project files are restricted to designated personnel only. Records can only be borrowed temporarily from the project file using a sign-out system. The Tetra Tech Data Manager maintains the electronic data files. Access to the data files is restricted to qualified personnel only. File and data backup procedures are routinely performed.

Assessment and Oversight – Refer to Worksheet #32 for assessment findings and corrective actions and Worksheet #33 for QA management reports.

Data Review

Data verification is described in Worksheet #34. Data validation is described in Worksheets #35 and #36. Usability assessment is described in Worksheet #37.

SAP Worksheet #15 -- Reference Limits for Groundwater

(UFP-QAPP Manual Section 2.8.1)

SAP Worksheet #15A -- Reference Limits for Groundwater – Jet Engine Test Cell

Matrix: Groundwater
Analytical Group: Naphthalenes

Analyte	CAS Number	PAL [1] (mg/L)	PAL Reference	Project Quantitation Limit Goal (PQLG) (mg/L)	Accutest[2]		
					LOQ (mg/L)	LOD[3] (mg/L)	DL[3] (mg/L)
Naphthalene	91-20-3	14	FDEP GCTL	4.7	2	1	0.038
1-Methylnaphthalene	90-12-0	28	FDEP GCTL	9.3	2	0.5	0.058
2-Methylnaphthalene	91-57-6	28	FDEP GCTL	9.3	2	0.5	0.044

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

Matrix: Groundwater
Analytical Group: TRPH

Analyte	CAS Number	PAL [1] (mg/L)	PAL Reference	Project Quantitation Limit Goal (PQLG) (mg/L)	Accutest[2]		
					LOQ (mg/L)	LOD[3] (mg/L)	DL[3] (mg/L)
TRPH	No CAS	5	FDEP GCTL	1.67	0.25	0.17	0.046

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

SAP Worksheet #15B -- Reference Limits for Groundwater – North Fuel Farm

Matrix: Groundwater
Analytical Group: VOCs

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	PQLG (µg/L)	Accutest[(2)]		
					LOQs (µg/L)	LODs[(3)] (µg/L)	DLs[(3)] (µg/L)
Benzene	71-43-2	1.0	FDEP GCTL	0.3	1.0	0.21	0.21
cis-1,2-Dichloroethene	156-59-2	70	FDEP GCTL	23.3	1.0	0.32	0.32
1,2-Dichloroethane	107-06-2	3	FDEP GCTL	1.0	1.0	0.33	0.33
Ethylbenzene	100-41-4	30	FDEP GCTL	10.0	1.0	0.2	0.2
Isopropylbenzene	**98-82-8**	**0.8**	**FDEP GCTL**	**0.27**	**1.0**	**0.2**	**0.20**
p-Isopropyltoluene	99-87-6	NC	N/A	NC	1.0	0.21	0.21
Methylene chloride	75-09-2	5	FDEP GCTL	1.7	5.0	2.0	2.0
Methyl ethyl ketone	78-93-3	4200	FDEP GCTL	1400	5.0	2.0	2.0
1,2,4-Trimethylbenzene	95-63-6	10	FDEP GCTL	3.3	2.0	0.22	0.22
1,3,5-Trimethylbenzene	108-67-8	10	FDEP GCTL	3.3	2.0	0.21	0.21
Trichloroethene	79-01-6	3	FDEP GCTL	1.0	1.0	0.24	0.24
Total Xylenes	1330-20-7	20	FDEP GCTL	6.7	3	0.54	0.54
Toluene	108-88-3	1000	FDEP GCTL	330	1	0.2	0.2

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

NC = No Criteria
N/A = Not Applicable

Bolded rows indicate that the PAL is between the laboratory LOQ and DL. The Project Team has agreed to accept this data for decision making if results below the LOQ are "J" qualified and the results are discussed in the uncertainties section of the Risk Assessment.

Shaded and Bolded rows indicate the PAL is less than the DL; therefore, the Project Team has agreed to replace the PALs with the laboratory LOQs for decision making purposes, as suggested in "Guidance for the Selection of Analytical Methods for the Evaluation of Practical Quantitation Limits" (FDEP, 2004). The LOD is provided to satisfy DOD reporting requirements.

Matrix: Groundwater
Analytical Group: PAHs

Analyte	CAS Number	PAL [1] (µg/L)	PAL Reference	PQLG (µg/L)	Accutest[2]		
					LOQ (µg/L)	LOD[3] (µg/L)	DL[3] (µg/L)
Naphthalene	91-20-3	14	FDEP GCTL	4.7	2	1	0.038
1-Methylnaphthalene	90-12-0	28	FDEP GCTL	9.3	2	0.5	0.058
2-Methylnaphthalene	91-57-6	28	FDEP GCTL	9.3	2	0.5	0.044
Chrysene	218-01-9	4.8	FDEP GCTL	1.6	2	0.5	0.014
Phenanthrene	85-01-8	210	FDEP GCTL	70	2	1	0.035
Pyrene	129-00-0	210	FDEP GCTL	70	2	0.5	0.032

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

Bolded rows indicate that the PAL is between the laboratory LOQ and DL. The Project Team has agreed to accept this data for decision making if results below the LOQ are "J" qualified and the results are discussed in the uncertainties section of the Risk Assessment.

Shaded and Bolded rows indicate the PAL is less than the DL; therefore, the Project Team has agreed to replace the PALs with the laboratory LOQs for decision making purposes, as suggested in "Guidance for the Selection of Analytical Methods for the Evaluation of Practical Quantitation Limits" (FDEP, 2004). The LOD is provided to satisfy DOD reporting requirements.

Matrix: Groundwater
Analytical Group: TRPH

Analyte	CAS Number	PAL [1] (mg/L)	PAL Reference	PQLG (mg/L)	Accutest[2]		
					LOQ (mg/L)	LOD[3] (mg/L)	DL[3] (mg/L)
TRPH	No CAS	5	FDEP GCTL	1.67	0.25	0.17	0.046

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

Matrix: Groundwater
Analytical Group: NA Parameters

Analyte	CAS Number	PAL [1] (mg/L)	PAL Reference	Project Quantitation Limit Goal (PQLG) (mg/L)	Accutest[2]		
					LOQ (mg/L)	LOD[3] (mg/L)	DL[3] (mg/L)
Sulfate	14808-79-8	250	FDEP GCTL	83.3	2	1	0.467
Sulfide	No CAS	N/A	N/A	2	1	0.6	0.54
TOC	No CAS	N/A	N/A	1	1	0.5	0.076
Inorganic Carbon	No CAS	N/A	N/A	1	1	0.5	0.076

1 PALs are not required for MNA; however, PQLG have been set comparable to historical data and achievable laboratory limits.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

SAP Worksheet #15C -- Reference Limits for Groundwater – Day Tank 1

Matrix: Groundwater
Analytical Group: VOCs

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	PQLG (µg/L)	Accutest[(2)]		
					LOQs (µg/L)	LODs[(3)] (µg/L)	DLs[(3)] (µg/L)
Benzene	71-43-2	1.0	FDEP GCTL	0.3	1.0	0.21	0.21
Ethylbenzene	100-41-4	30	FDEP GCTL	10.0	1.0	0.2	0.2
Isopropylbenzene	**98-82-8**	**0.8**	**FDEP GCTL**	**0.27**	**1.0**	**0.2**	**0.20**
1,2,4-Trimethylbenzene	95-63-6	10	FDEP GCTL	3.3	2.0	0.22	0.22
1,3,5-Trimethylbenzene	108-67-8	10	FDEP GCTL	3.3	2.0	0.21	0.21
Total Xylenes	1330-20-7	20	FDEP GCTL	6.7	3	0.54	0.54
Toluene	108-88-3	40	FDEP GCTL	330	1	0.2	0.2

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.
NC = No Criteria
N/A = Not Applicable

Bolded rows indicate that the PAL is between the laboratory LOQ and DL. The Project Team has agreed to accept this data for decision making if results below the LOQ are "J" qualified and the results are discussed in the uncertainties section of the Risk Assessment.

Shaded and Bolded rows indicate the PAL is less than the DL; therefore, the Project Team has agreed to replace the PALs with the laboratory LOQs for decision making purposes, as suggested in "Guidance for the Selection of Analytical Methods for the Evaluation of Practical Quantitation Limits" (FDEP, 2004). The LOD is provided to satisfy DOD reporting requirements.

Matrix: Groundwater
Analytical Group: PAHs

Analyte	CAS Number	PAL [1] (µg/L)	PAL Reference	PQLG (µg/L)	Accutest[2]		
					LOQ (µg/L)	LOD[3] (µg/L)	DL[3] (µg/L)
Naphthalene	91-20-3	14	FDEP GCTL	4.7	5	1	0.72
1-Methylnaphthalene	90-12-0	28	FDEP GCTL	9.3	5	1	0.78
2-Methylnaphthalene	91-57-6	28	FDEP GCTL	9.3	5	1	0.66

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

Bolded rows indicate that the PAL is between the laboratory LOQ and DL. The Project Team has agreed to accept this data for decision making if results below the LOQ are "J" qualified and the results are discussed in the uncertainties section of the Risk Assessment.

Shaded and Bolded rows indicate the PAL is less than the DL; therefore, the Project Team has agreed to replace the PALs with the laboratory LOQs for decision making purposes, as suggested in "Guidance for the Selection of Analytical Methods for the Evaluation of Practical Quantitation Limits" (FDEP, 2004). The LOD is provided to satisfy DOD reporting requirements

SAP Worksheet #15D -- Reference Limits for Groundwater – Building 46

Matrix: Groundwater
Analytical Group: VOCs

Analyte	CAS Number	PAL [1] (µg/L)	PAL Reference	PQLG (µg/L)	Accutest[2]		
					LOQ (µg/L)	LOD[3] (µg/L)	DL[3] (µg/L)
Benzene	71-43-2	1.0	FDEP GCTL	0.3	1	0.21	0.21
Ethylbenzene	100-14-4	30	FDEP GCTL	10	1	0.2	0.2
Toluene	108-88-3	40	FDEP GCTL	13.3	1	0.2	0.2
Total Xylenes	1330-20-7	20	FDEP GCTL	6.7	3	0.54	0.54
MTBE	1634-04-4	20	FDEPGCTL	6.7	1	0.25	0.25

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

Matrix: Groundwater
Analytical Group: Naphthalenes

Analyte	CAS Number	PAL [1] (µg/L)	PAL Reference	PQLG (µg/L)	Accutest[2]		
					LOQ (µg/L)	LOD[3] (µg/L)	DL[3] (µg/L)
Naphthalene	91-20-3	14	FDEP GCTL	4.7	5	1	0.72
1-Methylnaphthalene	90-12-0	28	FDEP GCTL	9.3	5	1	0.78
2-Methylnaphthalene	91-57-6	28	FDEP GCTL	9.3	5	1	0.63

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

Matrix: Groundwater
Analytical Group: TRPH

Analyte	CAS Number	PAL [1] (mg/L)	PAL Reference	PQLG (mg/L)	Accutest[2]		
					LOQ (mg/L)	LOD[3] (mg/L)	DL[3] (µg/L)
TRPH	No CAS	5	FDEP GCTL	1.67	0.25	0.17	0.046

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

Matrix: Groundwater
Analytical Group: Inorganics

Analyte	CAS Number	PAL [1] (mg/L)	PAL Reference	PQLG (mg/L)	Accutest[2]		
					LOQ (mg/L)	LOD[3] (mg/L)	DL[3] (µg/L)
Sulfate	14808-79-8	250	FDEP GCTL	83.3	2	1	0.467

1 PALs are not required for MNA; however, PQLG have been set comparable to historical data and achievable laboratory limits.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

SAP Worksheet #15E -- Reference Limits for Groundwater – Building 271

Matrix: Groundwater
Analytical Group: Naphthalenes

Analyte	CAS Number	PAL [1] (µg/L)	PAL Reference	PQLG (µg/L)	Accutest[2]		
					LOQ (µg/L)	LOD[3] (µg/L)	DL[3] (µg/L)
Naphthalene	91-20-3	14	FDEP GCTL	4.7	5	1	0.72
1-Methylnaphthalene	90-12-0	28	FDEP GCTL	9.3	5	1	0.78
2-Methylnaphthalene	91-57-6	28	FDEP GCTL	9.3	5	1	0.63

1 FDEP GCTLs. Groundwater Cleanup Target Levels F.A.C. 62-777 Table I, April 2005.
2 Accutest reporting limits are current as of June 2010.
3 Results will be reported to the DL and LOQ, as FDEP requires. Currently, the Accutest LIMs system only accommodates two values for reporting, the LOQ and LOD. The statistically-derived DL is included to satisfy the requirements of the DoD QSM Version 4.1.

SAP Worksheet #16 -- Project Schedule/Timeline Table

(UFP-QAPP Manual Section 2.8.2)

Activities	Organization	Dates (MM/DD/YYYY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
JETC, 2nd Quarter 2011 Sampling Event	Solutions-IES	06/13/2011	06/13/2011	Groundwater Monitoring Report (GWMR) Presentation	08/10/2011
NFF, 2nd Quarter 2011 Sampling Event	Solutions-IES	06/16/2011	06/16/2011	GWMR Presentation	08/10/2011
Day Tank 1, 2nd Semi-Annual 2011 Sampling Event	Solutions-IES	09/16/2011	09/16/2011	GWMR Presentation	11/09/2011
Building 46 2nd Semi-Annual 2011 Sampling Event	Solutions-IES	09/16/2011	09/16/2011	GWMR Presentation	11/09/2011
Building 271 1st Quarter 2011 Sampling Event	Solutions-IES	06/14/2011	06/14/2011	GWMR Presentation	08/10/2011

This schedule shows the project schedule for the first sampling event for each site under this UFP-SAP as an example. However, LTM will continue at each site under this UFP-SAP until the BCT agrees that NFA is required at a specific site.

SAP Worksheet #17 -- Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

The sampling design and rationale for each site is presented below for each site. The objective of the sampling designs is to obtain data that fulfills the Project Quality Objectives presented in Worksheet # 11. The BCT has selected a biased sampling approach appropriate for LTM at each site. The numbers of selected sampling points for each site are based on the available wells and a need to obtain comprehensive spatial coverage over the area of interest. Upgradient and downgradient sampling locations at each site have been selected to monitor the source areas or contaminated groundwater plumes at each site, and to execute the decision rules presented in Worksheet # 11. The samples will be collected according to field sampling procedures presented in Worksheet # 21.

At all of the sites, if it is determined that the contaminant plume migrated and that additional downgradient wells are required, delineation of the plume in order to determine the placement of new wells will take place by stepping out 40 to 50 feet from the contaminated downgradient well in the direction of groundwater flow, installing and sampling a new well, and continuing to step out and repeat the process if the new well has COC exceedances.

17A Jet Engine Test Cell

The JETC sampling strategy consists of quarterly sampling of five shallow monitoring wells. The wells were chosen based on historical groundwater flow data, detections of TRPH and PAHs in the wells, and whether they are downgradient or upgradient from the contamination plume. Wells CEF-334-34S, CEF-811-17S, and CEF-811-18S are source area wells; and CEF-334-02SA and CEF-334-01S are considered downgradient wells. The intent was to include wells that indicate whether contaminant concentrations are naturally attenuating and to verify that contamination is not migrating from the JETC site. The sampling locations are detailed in Worksheet #18. A map of the monitoring wells is provided on Figure 10A-2.

17B North Fuel Farm

The 16 shallow, intermediate, and deep wells were chosen based on historical groundwater flow data, detections of the COCs in the wells, and whether they are downgradient or upgradient from the contamination plume. Monitoring well CEF-076-95S is to be sampled as the upgradient well, and monitoring well CEF-076-117D is the downgradient well. The other 14 wells to be sampled are source areas wells in the area of influence of the shallow and/or deep AS system wells. The intent was to include wells that indicate whether contaminant concentrations are decreasing as a result of the operation

of the AS system, or whether they are naturally attenuating. The sampling locations are detailed in Worksheet #18. A map of the monitoring wells is provided on Figure 10B-1.

17C Day Tank 1

Twelve shallow wells were chosen based on historical groundwater flow data, detections of the COC in the wells, and whether they are downgradient or upgradient from the contamination plume. Monitoring wells CEF-293-02, CEF-293-09, CEF-293-VEW-01, CEF-293-VEW-02, CEF-293-VEW-04, CEF-293-VEW-07, and CEF-293- VEW-08 are within the plume at the Day Tank 1 site, and wells CEF-293-13, CEF-293-22, CEF-293-VEW-03, CEF-293-VEW-05, and CEF-293-VEW-06 are perimeter wells which will be monitored to verify that contamination is not migrating offsite. The intent was to include wells that indicate whether contaminant concentrations are naturally attenuating. The sampling locations are detailed in Worksheet #18. A map of the monitoring wells is provided on Figure 10C-1.

17D Building 46

Nine wells of varying depths were chosen based on historical groundwater flow data, detections of the COC in the wells, and whether they are downgradient or upgradient from the contamination plume. Monitoring wells CEF-046-01S, CEF-046-02S, CEF-046-05I, CEF-046-06D, and CEF-046-07I are the source area wells, and CEF-046-21I, CEF-046-24D, CEF-046-26I, and CEF-046-27D are perimeter wells. Upgradient wells were removed from the monitoring program after at least three years with no detections of COCs. The intent was to include wells that indicate whether contaminant concentrations are naturally attenuating and to verify that contamination is not migrating offsite. The sampling locations are detailed in Worksheet #18. A map of the monitoring wells is provided on Figure 10D-1.

17E Building 271

Two wells of varying depths were chosen based on historical groundwater flow data, detections of the COCs in the wells, and whether they are downgradient or upgradient from the contamination plume. Monitoring well CEF-271-07S is the source area well, with well CEF-271-10S being monitored as a downgradient well to verify that contamination is not rebounding since the shutdown of the AS system, and that contamination is not migrating offsite. The intent was to include wells that indicate whether contaminant concentrations are naturally attenuating. The sampling locations are detailed in Worksheet #18. A map of the monitoring wells is provided on Figure 10E-1.

SAP Worksheet #18 -- Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

SAP Worksheet #18A -- Sampling Locations and Methods/SOP Requirements Table – Jet Engine Test Cell

Sampling Location / Identification Number	Matrix	Screen Interval	Analytical Group	Number of Samples (identify field duplicates)[1]	Sampling SOP Reference[(2)]
CEF-811-17S, CEF-811-18S, CEF-334-34S, CEF-334-01S, CEF-334-02SA	Groundwater	3.5 to 13.5 feet bgs or 5 to15 feet bgs	TRPH, PAHs	5 plus 1 field duplicate	FT1000 and FS2200

1 Field duplicates may be consolidated across sites at FOL's discretion so as to yield one field duplicate per 10 environmental samples.
2 SOP that describes the sample collection procedures.

Groundwater elevation will be measured at 14 wells. See Figure 10A-2 for well locations.

SAP Worksheet #18B -- Sampling Locations and Methods/SOP Requirements Table – North Fuel Farm

Sampling Location / Identification Number	Matrix	Screen Interval	Analytical Group	Number of Samples (identify field duplicates)[1]	Sampling SOP Reference[(2)]
CEF-372-13R, CEF-076-94S, CEF-076-95S	Groundwater	1.5 to 11.5 feet bgs or 5 to 15 feet bgs	VOCs, PAHs, TRPH, NA parameters[(3)]	16 plus 2 field duplicates	FT1000 and FS2200
CEF-076-49S, CEF-076-57S, CEF-076-93S, CEF-076-113S		45 to 50 feet bgs 30 to 35 feet bgs 25 to 30 feet bgs 35 to 40 feet bgs			
CEF-076-50I, CEF-076-61I, CEF-076-70I		75 to 80 feet bgs or 65 to 70 feet bgs			
CEF-076-98D, CEF-076-99D, CEF-076-100D, CEF-076-110D, CEF-076-116D, CEF-076-117D		105 to 110 or 95 to 100 or 110 to 115 feet bgs			

1 Field duplicates may be consolidated across sites at FOL's discretion so as to yield one field duplicate per 10 environmental samples.
2 SOP that describes the sample collection procedures.
3 NA Parameters for the NFF include: Sulfide, TOC, and Inorganic Carbon.

Groundwater elevation will be measured at all 16 wells. See Figure 10B-1 for well locations.

SAP Worksheet #18C -- Sampling Locations and Methods/SOP Requirements Table – Day Tank 1

Sampling Location / Identification Number	Matrix	Screen Interval	Analytical Group	Number of Samples (identify field duplicates)[1]	Sampling SOP Reference[(2)]
CEF-293-02, CEF-293-09, CEF-293-13, CEF-293-22, CEF-293-VEW-01, CEF-293-VEW-02, CEF-293-VEW-03, CEF-293-VEW-04, CEF-293-VEW-05, CEF-293-VEW-06, CEF-293-VEW-07, CEF-293-VEW-08	Groundwater	1.5 to 11.5 feet bgs 4 to 14 feet bgs or 5 to 15 feet bgs or 6 to 16 feet bgs, or 7 to 17 feet bgs	VOCs, PAHs	12 plus 2 field duplicates	FT1000 and FS2200

1 Field duplicates may be consolidated across sites at FOL's discretion so as to yield one field duplicate per 10 environmental samples.
2 SOP that describes the sample collection procedures.

Groundwater elevation will be measured at all 12 wells. See Figure 10C-1 for well locations.

SAP Worksheet #18D -- Sampling Locations and Methods/SOP Requirements Table – Building 46

Sampling Location / Identification Number	Matrix	Screen Interval	Analytical Group	Number of Samples (identify field duplicates)[1]	Sampling SOP Reference[(2)]
CEF-046-01S, CEF-046-02S	Groundwater	4 to 14 feet bgs	BTEX, MTBE, Naphthalenes, TRPH, sulfate[3]	9 plus 1 field duplicates	FT1000 and FS2200
CEF-046-05I, CEF-046-07I, CEF-046-21I, CEF-046-26I		45 to 50 feet bgs or 25 to 30 feet bgs			
CEF-046-06D, CEF-046-24D, CEF-046-27D		85 to 90 feet bgs			

1 Field duplicates may be consolidated across sites at FOL's discretion so as to yield one field duplicate per 10 environmental samples.
2 SOP that describes the sample collection procedures.
3 CEF-046-06D and CEF-046-27D are to be sampled for sulfate only.

Groundwater elevation will be measured at 15 wells. See Figure 10D-1 for well locations.

SAP Worksheet #18E -- Sampling Locations and Methods/SOP Requirements Table – Building 271

Sampling Location / Identification Number	Matrix	Screen Interval	Analytical Group	Number of Samples (identify field duplicates)[1]	Sampling SOP Reference[(2)]
CEF-271-07S, CEF-271-10S	Groundwater	3 to 13 feet bgs	Naphthalenes	2 plus 1 field duplicate	FT1000 and FS2200

1 Field duplicates may be consolidated across sites at FOL's discretion so as to yield one field duplicate per 10 environmental samples.
2 SOP that describes the sample collection procedures.

Groundwater elevation will be measured at 4 wells. See Figure 10E-1 for well locations.

SAP Worksheet #19 -- Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers (number, size, and type)	Sample volume (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Groundwater	VOC	SW-846 8260B Accutest MS 005.6	3x40-milliliter (mL) clear glass vials with septum	120 mL	Hydrochloric Acid (HCl) to pH < 2; Cool to ≤ 6 degrees °C	14 days to analysis
Groundwater	PAHs	SW-846 8270C Accutest MS 006.7	2x1L-Amber glass with Teflon-lined cap	2 L	Cool to ≤ 6 degrees °C	7 days to extraction, analysis within 40 days
Groundwater	PAH (NFF only)	SW-846 8310 Accutest GC 018.6	2x1L-Amber glass with Teflon-lined cap	2 L	Cool to ≤ 6 degrees °C	7 days to extraction, analysis within 40 days
Groundwater	TRPH	FL-PRO Accutest GC 008.6	2x1L-Amber glass with Teflon-lined cap	2 L	HCl or Sulfuric Acid (H_2SO_4) to pH < 2; Cool to ≤ 6 degrees °C	7 days to extraction, analysis within 40 days
Groundwater	Sulfate	SW-846 9056A/EPA 300.0 Accutest GNSOP: 228.2	1 L-Polyethylene bottle with plastic cap and liner	1 L	Cool to ≤ 6 degrees °C	28 days to analysis
Groundwater	Sulfide	SM 4500S=F Accutest GN 140.7	3x250-mL Nalgene bottle	750 mL	Zinc acetate to pH > 11; Cool to 4(±2)°C	7 days to analysis
Groundwater	TOC/Inorganic Carbon	SM 5310B Accutest GN 215.4	3x40-mL amber glass vials with septum	120 mL	HCl to pH < 2; Cool to 4(±2)°C	28 days to analysis

SAP Worksheet #20 -- Field Quality Control Sample Summary Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of Matrix Spike (MS)/Matrix Spike Duplicates (MSDs)[1]	No. of Field Blanks	No. of Equip. Blanks	No. of VOC Trip Blanks	No. of Proficiency Testing (PT) Samples	Total No. of Samples to Lab
JET ENGINE TEST CELL									
Groundwater	PAHs	5	1	1/1	N/A	N/A	N/A	N/A	8
	TRPH	5	1	1/1	N/A	N/A	N/A	N/A	8
NORTH FUEL FARM									
Groundwater	VOCs	16	2	1/1	N/A	N/A	1	N/A	22
	PAHs	16	2	1/1	N/A	N/A	N/A	N/A	21
	TRPH	16	2	1/1	N/A	N/A	N/A	N/A	21
	Sulfide	16	2	1/1	N/A	N/A	N/A	N/A	21
	Sulfate	16	2	1/1	N/A	N/A	N/A	N/A	21
	TOC	16	2	1/1	N/A	N/A	N/A	N/A	21
	Inorganic Carbon	16	2	1/1	N/A	N/A	N/A	N/A	21
DAY TANK 1									
Groundwater	VOCs	12	2	1/1	N/A	N/A	1	N/A	18
	PAHs	12	2	1/1	N/A	N/A	N/A	N/A	17
BUILDING 46									
Groundwater	VOCs	7	1	1/1	N/A	N/A	1	N/A	12
	Naphthalenes	7	1	1/1	N/A	N/A	N/A	N/A	11
	TRPH	7	1	1/1	N/A	N/A	N/A	N/A	11
	Sulfate	9	1	1/1	N/A	N/A	N/A	N/A	13
BUILDING 271									
Groundwater	Naphthalenes	2	1	1/1	N/A	N/A	N/A	N/A	6

1 Although the MS/MSD is not typically considered a field QC it is included here because location determination is often established in the field.

SAP Worksheet #21 -- Project Sampling SOP References Table

(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date and/or Number[1]	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
FS2200	Groundwater Sampling	FDEP	Peristaltic pump	Y	
FT1000 (plus series)	Field Testing General and Series including pH, Specific Conductance, Salinity, Temperature, Dissolved Oxygen, and Turbidity	FDEP	Multi-parameter water quality meter	Y	
FC1000	Field Decontamination	FDEP	Decontamination Equipment (scrub brushes, phosphate free detergent, de-ionized water)	Y	
GH-2.8	Groundwater Monitoring Well Installation Rev. 3, September 2003	Tetra Tech	DPT and HSA combination drill rig	N	

1 FDEP SOPs can be downloaded from http://www.dep.state.fl.us/labs/bars/sas/qa/sops.htm.

SAP Worksheet #22 -- Field Equipment Calibration, Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference	Comments
PID	Calibration and Visual Inspection	Daily	Manufacturer's Guidance	Replace	FOL or designee	Manufacturer's Guidance	
Depth to Water Meter	Visual Inspection	Daily	Manufacturer's Guidance	Replace	FOL or designee	Manufacturer's Guidance	
Multi-Parameter Water Quality Meter	Visual Inspection, Calibration	Daily	Manufacturer's Guidance	Replace	FOL or designee	FDEP FT 1000 through 1500 and Manufacturer's Guidance	
LaMotte Model 2008 (or similar) Turbidity Meter	Visual Inspection, Calibration	Daily	RPD of ±10% (6 measurements of 2 successive samples of a 20 NTU standard) Accuracy of ±10% at 20 NTU (Mean of the measured values must be 18 to 22 NTU)	Replace	FOL or designee	FT 1600, Field Measurement of Turbidity (FDEP) and Manufacturer's Guidance	If an acceptable turbidity meter model is not used, submittal of an Alternate Test Procedure application is required

SAP Worksheet #23 -- Analytical SOP References Table

(UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?[1] (Y/N)
OP 021.7	Standard Operating Procedure for the Introduction of Volatile Organics Analytes Using Purge-and-Trap, July 2009	Definitive	VOC Preparation Groundwater	N/A	Accutest	N
MS 005.6	Analysis of Volatile Organics by GC/MS, July 2009	Definitive	VOC Analysis Groundwater	Gas Chromatograph / Mass Spectrometer (GC/MS)	Accutest	N
OP 006.7	Standard Operating Procedure for the Extraction of Base-Neutral and Acid (BNAs) Extractables from Water Samples, June 2009	Definitive	PAH Preparation Groundwater	N/A	Accutest	N
MS 006.7	Analysis of Semivolatile Organics by GC/MS, July 2009	Definitive	PAH Analysis Groundwater	GC/MS	Accutest	N

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?[1] (Y/N)
OP 014.5	Standard Operating Procedure for the Extraction of Polynuclear Aromatic Hydrocarbons (PAHs) from Water Samples for High Pressure Liquid Chromatography (HPLC) Analysis, June 2009	Definitive	PAH Preparation Groundwater	N/A	Accutest	N
GC 018.6	Analysis of PAHs by HPLC, July 2009	Definitive	PAH Analysis Groundwater	HPLC	Accutest	N
OP 012.7	Standard Operating Procedure for the Extraction of Total Petroleum Hydrocarbons from Water Samples (FL-PRO), June 2009	Definitive	TRPH Preparation Groundwater	N/A	Accutest	N
GC 008.6	Analysis of Petroleum Range Organics by Gas Chromatography Using Flame Ionization Detector, July 2009	Definitive	TRPH Analysis Groundwater	Gas Chromatograph / Flame Ionization Detector (GC/FID)	Accutest	N

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?[1] (Y/N)
GN 228.2	Standard Operating Procedure for the Determination of Inorganic Anions by Ion Chromatography Using the IC 2000, January 2009	Definitive	Sulfate Groundwater	Ion Chromatograph (IC)	Accutest	N
GN 140.7	Sulfide, July 2007	Definitive	Dissolved Sulfide Groundwater	N/A	Accutest	N
GN 215.4	Total Organic Carbon in Aqueous Samples, July 2007	Definitive	TOC/Inorganic Carbon Groundwater	FID	Accutest	N

Laboratory SOPs are included as Appendix C.

SAP Worksheet #24 -- Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/MS VOCs	Tuning	Prior to analysis and at the beginning of each 12 hour shift.	See table in SOP and/or method. Must meet the ion abundance criteria required by the method. No samples may be accepted without a valid tune.	Determine source of problem by re-tuning using auto or manual tune, clean source, rerun tune.	Analyst/ Supervisor	Accutest MS 005.6
	Initial Calibration (ICAL) – A minimum of a 5-point calibration curve is analyzed	Calibrate the instrument when it is received and after a major change or if the daily calibration fails. A minimum 5 point calibration is required.	The percent relative standard deviation (RSD) for each Calibration Check Compound (CCC) must be ≤ 30%. The minimum mean response factor (RF) for each System Performance Check Compound (SPCC) must meet the criteria stated in 8260B. If the RSD for an analyte is > 15%, use a linear curve (linear regression correlation coefficient (r) ≥ 0.995) or quadratic curve (coefficient of determination (r^2) ≥0.99, (minimum 6 points) for quantitation.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	
	Initial Calibration Verification (ICV) - 2nd source	Once after each initial calibration.	Percent difference (%D) for all normal analytes of interest should be ≤25%, the %D for all poor performing (PP) analytes of interest should be ≤40%. (These analytes are identified in Table 1 of SOP).	A second standard should be prepared. If the ICV still does not meet criteria, analyze an ICV prepared from a third source. If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
	Continuing Calibration Verification (CCV)	Analyze a standard at the beginning of each 12 hour shift after a bromofluorobenzene (BFB) tune.	The minimum RF for all analytes must meet the criteria stated in 8260B. All analytes must be ≤ 20 %D.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	
GC/MS PAHs (Day Tank 1, Building 271, Building 46)	Tuning	Prior to analysis and at the beginning of each 12 hour shift.	See table in SOP and/or method. Must meet the ion abundance criteria required by the method. No samples may be accepted without a valid tune.	Determine source of problem by re-tuning using auto or manual tune, clean source, rerun tune.	Analyst/ Supervisor	MS 006.7
	ICAL – A minimum of a 5-point calibration curve is analyzed	Calibrate the instrument when it is received and after a major change or if the daily calibration fails. A minimum 5 point calibration is required.	The %RSD for each CCC must be ≤ 30%. The minimum mean RF for each SPCC must meet the criteria stated in 8270C. If the RSD for an analyte is > 15%, use a linear curve (r > 0.995) or quadratic curve (r^2 >0.99, minimum 6 points) for quantitation.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
	ICV - 2nd source	Once after each initial calibration.	%D for all analytes of interest should be ≤25%.	If the %D > 25%, the analysis of samples may still proceed if the analyte failed high and the analyte is not expected to be present in the samples. However, if a reportable analyte is detected in a sample and the %D for that analyte was greater than 25% in the ICV, the sample will need to be reanalyzed on a system with a passing ICV for that analyte. If the ICV does not meet this criterion, a second standard should be prepared. If the ICV still does not meet criteria, analyze an ICV prepared from a third source. If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.	Analyst/ Supervisor	
	CCV	Analyze a standard at the beginning of each 12 hour shift after a Decafluorotriphenyl-phosphine (DFTPP) tune.	The minimum RF for SPCCs must meet the criteria stated in 8270C. All analytes must be ≤ 20 %D.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	
HPLC PAHs (NFF only)	ICAL – A minimum 5-point calibration curve is analyzed	Calibrate the instrument when it is received and after a major change or if the daily calibration fails. A minimum 5 point calibration is required.	The %RSD must be ≤ 20%. If the RSD for an analyte is > 20%, use a linear curve (r > 0.995) or quadratic curve (r^2 >0.99, minimum 6 points) for quantitation.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	GC 018.6

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
	ICV – 2nd Source	Once after each initial calibration.	%D for all analytes of interest should be ≤15%.	If the ICV does not meet this criterion, a second standard should be prepared. If the ICV still does not meet criteria, analyze an ICV prepared from a third source. If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.	Analyst/ Supervisor	
	CCV	Beginning and end of each run and after every 10 samples.	%D should be ≤ 15% for each analyte.	If the first continuing calibration verification does not meet criteria, a second standard may be injected. If the second standard does not meet criteria, the system must be recalibrated.	Analyst/ Supervisor	
GC/FID TRPH	ICAL – A minimum of a 5-point calibration curve is analyzed	Prior to sample analysis.	Must be ≤20% RSD, or r ≥0.995, or r^2 ≥0.99 with a minimum of 5 points.	Perform instrument maintenance as needed. Reanalyze or re-prepare calibration standards.	Analyst/ Supervisor	GC 008.6
	ICV - 2nd source	Once after each ICAL.	%D for all analytes of interest should be ≤25%.	If the ICV does not meet this criterion, a second standard should be prepared. If the ICV still does not meet criteria, analyze an ICV prepared from a third source. If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
	Solvent Blank	Beginning of each 24 hour shift.	< ½ LOQ for the initial solvent blank	Solvent blanks should also be analyzed after samples with high concentrations to ensure that there is no carryover.	Analyst/ Supervisor	
	CCV	Analyze a standard at the beginning and end of the sequence and after every 10 samples.	%D for individual compounds must be ≤25%.	If %D>25% and sample results are <LOQ, narrate. If %D >25% and is likely the result of matrix interference, narrate. All samples must be reanalyzed that fall within the standard that exceeded criteria and the last standard that was acceptable.	Analyst/ Supervisor	
IC Anions	ICAL	ICAL performed at a minimum of once per month or when Retention times (RTs) shift more than 10%.	The correlation coefficient, r, must be ≥0.995.	Correct problem, then repeat ICAL.	Analyst/ Supervisor	GN 228.2
	ICV	Once after each ICAL, prior to beginning a sample run.	All analytes must be within ± 10% of true value and retention times within appropriate windows.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL	Analyst/ Supervisor	
	CCV	After every 10 field samples and at the end of the analysis sequence.	All project analytes within established retention time windows. Within ± 10% of true value	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Analyst/ Supervisor	
	Continuing Calibration Blank (CCB)	Immediately following CCV.	No analyte ≥LOQ.	Investigate source of contamination. Report all sample results <LOQ. Report sample results >10X the blank result and flag results with a "B". Reanalyze all other samples associated with the CCB.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
FID TOC/Inorganic Carbon	ICAL- six point calibration	Calibrate the instrument when it is received and after a major change or if the daily calibration fails, or at a minimum every 3 months.	The correlation coefficient, r, must be ≥0.995.	Instrument is check for any obvious problems and maintenance is performed. Samples injected after the last CCV to meet QC criteria must be re-analyzed.	Analyst/ Supervisor	GN 215.4
	ICV – Second source	After the calibration and at the beginning of each run.	Within ± 10% of the expected value.	The problem must be resolved before any samples can be analyzed.	Analyst/ Supervisor	
	CCV	Every 10 samples and after all samples are run.	Within ± 10% of the expected value.	Correct the problem. Re-analyze any samples that were bracketed by a failing CCV.	Analyst/ Supervisor	
	CCB	After every CCV	Absolute value < LOQ.	No samples can be reported in the area bracketed by a CCB that does not meet acceptance criteria. Reanalyze.	Analyst/ Supervisor	

1 Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).
2 Name or title of responsible person may be used.

SAP Worksheet #25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person [2]	SOP Reference [1]
GC/MS	Injector port, column maintenance, source cleaning.	VOCs PAHs (Day Tank 1, Building 46, Building 271)	Leak test, column and injector port inspection, source insulator integrity.	Need for maintenance determined by passing calibration and BFB and DFTPP tunes.	Passing BFB and DFTPP tunes and CCV, passing Internal Standard response.	Column clipping and/or reconditioning, seal and liners replacement, filaments and insulators as needed	Analyst	MS 005.6 MS 006.7
GC/FID	Replace septa, replace inlet liner, clip column, clean or replace FID jet, bake out detector, recondition column.	TRPH Dissolved Gases	Check connections, replace disposables, bake out instrument, recondition column and perform leak checks.	Replace liner, septa, and clip column as indicated by instrument change in response and chromatography. If signal is suppressed, clean or replace FID jet. Bake out detectors and columns if signal elevated.	Per instrument manufacturer's instructions.	Inspect system; correct problem; perform new initial calibration and affected samples.	Analyst	GC 008.6 GC 019.5
HPLC	Replace disposables, check LC pump tubing, inspect mobile phase degasser, autosampler and temperature control column compartment	PAHs (NFF only)	Check LC pump tubing, inspect eluent degasser, autosampler and temperature control column compartment, replace disposables	Frequency determined by instrument remaining in calibration and free of interference.	Per instrument manufacturer's instructions.	Inspect system; correct problem; perform new initial calibration and affected samples.	Analyst	GC 018.6
IC	Pump maintenance, guard column cleaning.	Anions	Clean or replace tubing and check connections.	Frequency determined by instrument remaining in calibration and free of interference.	Passing Calibration.	Reconnect tubes, check pump rate. Rerun calibration and samples.	Analyst	GN 228.2

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person [2]	SOP Reference [1]
FID	Cleaning and maintenance of heating modules.	TOC	Tubing inspection for build-up and catalyst inspection.	As needed.	Passing Calibration.	Clean or replace tubing, replace Pt catalyst, and replace Air/Oxygen tanks.	Analyst	GN 215.4

1 Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet No.23).
2 Name or title of responsible person may be used.

SAP Worksheet #26 -- Sample Handling System

(UFP-QAPP Manual Appendix A)

Sample Handling System
SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): FOL, Solutions-IES, Jacksonville, Florida
Sample Packaging (Personnel/Organization): FOL, Solutions-IES, Jacksonville, Florida
COORDINATION OF SHIPMENT (PERSONNEL/ORGANIZATION): FOL, TETRA TECH, JACKSONVILLE, FLORIDA
TYPE OF SHIPMENT/CARRIER: FEDEX
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodians, Accutest Laboratories
Sample Custody and Storage (Personnel/Organization): Sample Custodians, Accutest Laboratories
Sample Preparation (Personnel/Organization): Preparation Laboratory Staff (organic / inorganic), Accutest Laboratories
Sample Determinative Analysis (Personnel/Organization): GC/MS, GC, VOC Laboratory Staff, Accutest Laboratories
SAMPLE ARCHIVING
Field Sample Storage (Number of days from sample collection): 60 days from submittal of final data report.
Sample Extract/Digestate Storage (Number of days from extraction/digestion): 6 months from submittal of final data report
Biological Sample Storage (Number of days from sample collection): Not applicable
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodians, Accutest Laboratories

SAP Worksheet #27 – Sample Custody Requirements Table

(UFP-QAPP Manual Section 3.3.3)

SAMPLE CUSTODY REQUIREMENTS

Field Chain of Custody

To ensure the integrity of a sample from collection through analysis, an accurate, written record that traces the possession and handling of the sample is necessary. This documentation is referred to as the chain of custody form. Chain of custody begins at the time of sample collection. A sample is under custody if any of the following conditions apply:

- It is in the owner's actual possession.
- It is in the owner's view, after being in his/her physical possession,.
- It was in the owner's possession and was locked or sealed it up to prevent tampering.
- It is in a secure area.

Custody documentation is designed to provide documentation of preparation, handling, storage, and shipping of all samples collected. A multi-part chain of custody form is used with each page of the form signed and dated by the recipient of a sample or portion of sample. The person releasing the sample and the person receiving the sample each will retain a copy of the chain of custody form each time a sample transfer occurs.

Preservation of the integrity of the samples collected during the site investigation will be the responsibility of identified persons from the time the samples are collected until the samples, or their derived data, are incorporated into the final report. Sample custody is described above.

The FOL is responsible for the care and custody of the samples collected until they are delivered to the laboratory or are entrusted to a carrier. When transferring samples, the individuals relinquishing and receiving them will sign, date, and note the time on the chain of custody form. This form documents the sample custody transfer from the sampler to the laboratory, often through another person or agency (common carrier). Field chain of custody requirements are provided in Tetra Tech SOP SA-6.3. Upon arrival at the laboratory, internal sample custody procedures will be followed as defined in the Accutest SOPs included in Appendix C.

Laboratory Chain of Custody

The laboratory sample custody procedures (receipt of samples, archiving, and disposal) documented in Accutest SOPs SAM 101.14 and QA 048.00 will be followed. Coolers will be received and checked for proper temperature. A sample cooler receipt form will be filled out to note conditions and any discrepancies. The chain-of-custody will be checked against the sample containers for correctness. Samples will be logged into the Laboratory Information Management System (LIMS) and given a unique log number which can be tracked through processing. The client will be notified of any problems.

SAP Worksheet #28 -- Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)

Matrix	Groundwater
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260B Accutest MS 005.6

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less.	No target compounds >½ the LOQ, except common lab contaminants, which must be < LOQ.	Re-prepare and reanalyze all samples with positive results. If insufficient amount of sample is available, apply B flag to all affected sample results	Analyst and Laboratory Supervisor	Bias / Contamination	Same as Method/SOP QC Acceptance Limits.
System Monitoring Compounds (SMC)/ Surrogates	4 per sample: Dibromofluoromethane 1,2-Dichloroethane-d4 Toluene-d8 4-Bromofluorobenzene	Laboratory-specific limits provided in Appendix C.	Check for possible matrix effects. If none found, reanalyze affected sample if sufficient sample is available. Qualify data as needed.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
Laboratory Control Sample (LCS)	One per batch of 20 samples or less.	Laboratory-specific limits provided in Appendix C.	Re-prepare and reanalyze all samples with positive results. If insufficient amount of sample is available, apply qualifier to all affected sample results.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
Internal Standards (IS)	4 per sample: Fluorobenzene Chlorobenzene-d5 1,4-Dichlorobenene-d4 Tert Butyl Alcohol-d10	Retention time +/- 30 seconds from RT of the ICAL midpoint standard, and the Extracted Ion Current Profile (EICP) area within -50% to +100 % of ICAL midpoint standard.	Inspect instrument for malfunctions. Check for possible matrix effects. If none found, reanalyze affected sample if sufficient sample is available. Qualify data as needed.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Matrix	Groundwater
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260B Accutest MS 005.6

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
MS/MSD	One per batch of 20 samples or less.	Laboratory specific limits provided in Appendix C. MS/MSD RPD should be ≤ 30%.	Check for errors in calculations and spike preparation. Check un-spiked sample results and surrogate recoveries for possible matrix effects. If no errors are found and the associated LCS in control, matrix effects are the likely cause. Qualify failing analytes as estimated.	Analyst and Laboratory Supervisor	Precision / Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Please note that limits are updated periodically and may change from the issuance of the final SAP to the time data validation is performed. The limits used for validation will be the limits that are current at the time of analysis.

Matrix	Groundwater
Analytical Group	PAHs (all but NFF)
Analytical Method/ SOP Reference	SW-846 8270C Accutest MS 006.7

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less.	No target compounds > ½ the LOQ.	Re-prepare and reanalyze all samples with positive results. If insufficient amount of sample is available, apply B flag to all affected sample results.	Analyst and Laboratory Supervisor	Bias / Contamination	Same as Method/SOP QC Acceptance Limits.
SMCs	6 per sample: Nitrobenzene-d5 2-Fluorobiphenyl p-Terphenyl Phenol-d5 2-Fluorophenol 2,4,6-Tribromophenol	Laboratory specific limits are provided in Appendix C.	Check for possible matrix effects. If none found, reanalyze affected sample if sufficient sample is available. Qualify data as needed.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per batch of 20 samples or less.	Laboratory specific limits are provided in Appendix C.	Re-prepare and reanalyze all samples with positive results. If insufficient amount of sample is available, apply qualifier to all affected sample results.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
IS	6 per sample: 1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	Retention time +/- 30 seconds from RT of the ICAL midpoint standard, and the Extracted Ion Current Profile (EICP) area within -50% to +100 % of ICAL midpoint standard.	Inspect instrument for malfunctions. Check for possible matrix effects. If none found, reanalyze affected sample if sufficient sample is available. Qualify data as needed.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	One per SDG or every 20 samples.	Laboratory specific limits are provided in Appendix C. MS/MSD RPD should be ≤ 30%.	Check for errors in calculations and spike preparation. Check un-spiked sample results and surrogate recoveries for possible matrix effects. If no errors are found and the associated LCS in control, matrix effects are the likely cause. Qualify failing analytes as estimated.	Analyst and Laboratory Supervisor	Precision / Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Please note that limits are updated periodically and may change from the issuance of the final SAP to the time data validation is performed. The limits used for validation will be the limits that are current at the time of analysis.

Matrix	Groundwater
Analytical Group	PAHs
Analytical Method/ SOP Reference	SW-846 8310 Accutest GC 018.6

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less.	No target compounds > ½ LOQ.	The samples should be re-extracted and reanalyzed for confirmation. If there is insufficient sample to re-extract, or if the sample is re-extracted beyond hold time, the appropriate footnote and qualifiers should be added to the results.	Analyst and Laboratory Supervisor	Bias / Contamination	Same as Method/SOP QC Acceptance Limits.
SMCs	2 per sample: o-Terphenyl p-Terphenyl	Laboratory specific limits are provided in Appendix C.	Check to be sure that there are no errors in calculations, integrations, surrogate solutions or internal standards. If errors are found, recalculate the data accordingly. Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per batch of 20 samples or less.	Laboratory specific limits are provided in Appendix C.	Check to be sure that there are no errors in calculations, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly. Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Matrix	Groundwater
Analytical Group	PAHs
Analytical Method/ SOP Reference	SW-846 8310 Accutest GC 018.6

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
MS/MSD	One per SDG or every 20 samples.	Laboratory specific limits are provided in Appendix C. MS/MSD RPD should be ≤ 30%.	Check to be sure that there are no errors in calculations, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly. Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type. If no problem is found, compare the recoveries to those of the blank spike. If the blank spike recoveries indicate that the problem is sample related, document this on the run narrative. Matrix spike recovery failures are not grounds for re-extract but are indications of the sample matrix effects.	Analyst and Laboratory Supervisor	Precision / Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Please note that limits are updated periodically and may change from the issuance of the final SAP to the time data validation is performed. The limits used for validation will be the limits that are current at the time of analysis.

Matrix	Groundwater
Analytical Group	TRPH
Analytical Method/ SOP Reference	FL-PRO Accutest GC 008.6

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less.	No TRPH > MDL.	Re-prepare and reanalyze all samples with positive results. If insufficient amount of sample is available, apply B flag to all affected sample results.	Analyst and Laboratory Supervisor	Bias / Contamination	Same as Method/SOP QC Acceptance Limits.
Surrogates	1 per sample: o-Terphenyl	Laboratory specific limits provided in Appendix C.	Check for possible matrix effects. If none found, reanalyze affected sample if sufficient sample is available. Qualify data as needed.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per batch of 20 samples or less.	Laboratory specific limits provided in Appendix C.	Re-prepare and reanalyze all samples with positive results. If insufficient amount of sample is available, apply qualifier to all affected sample results.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less.	Use laboratory-specific %R criteria. RPD < 28%	Evaluate data for matrix interference homogeneity of sample.	Analyst and Laboratory Supervisor	Precision / Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Please note that limits are updated periodically and may change from the issuance of the final SAP to the time data validation is performed. The limits used for validation will be the limits that are current at the time of analysis.

Matrix	Groundwater
Analytical Group	Sulfate
Analytical Method/ SOP Reference	SW-846 9056A GN 228.2

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 or less.	Result must be <½ the LOQ.	If the blank contains more than the reporting level, then all samples must be reanalyzed. If no sample volume remains to be reanalyzed, then the data must be flagged.	Analyst and Laboratory Supervisor	Bias / Contamination	Same as Method/SOP QC Acceptance Limits.
LCS	One per batch of 20 or less.	%R must be within 90-110%.	If the recoveries are outside of this range, then all associated samples must be reanalyzed. If no sample volume remains to be reanalyzed, then the data must be flagged.	Analyst and Laboratory Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
MS (MSD may replace laboratory duplicate)	One per batch of 10 or less.	%R should be within 90-110%. RPD should be ≤ 10%	If the recoveries are outside of this range, and all other method quality control is within limits, then matrix interference should be suspected. If the RPD values are outside of this range, and all other method quality control is within limits, then sample non-homogeneity should be suspected.	Analyst and Laboratory Supervisor	Precision / Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
Laboratory Duplicate	One per batch of 10 or less.	RPD should be ≤ 10%	If the RPD values are outside of this range, and all other method quality control is within limits, then sample non-homogeneity should be suspected.	Analyst and Laboratory Supervisor	Precision	Same as Method/SOP QC Acceptance Limits.

Please note that limits are updated periodically and may change from the issuance of the final SAP to the time data validation is performed. The limits used for validation will be the limits that are current at the time of analysis.

Matrix	Groundwater
Analytical Group	Dissolved Sulfide
Analytical Method/ SOP Reference	SM 4500S=F Accutest GN 140.7

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 or less.	Result must be < ½ LOQ.	Re-prepare and reanalyze all samples with positive results. If insufficient amount of sample is available, apply B flag to all affected sample results	Analyst, Laboratory Supervisor and Data Reviewer	Bias / Contamination	Result must be < ½ LOQ.
LCS	One per batch of 20 or less.	%R must be within 80-120%.	Re-prepare and reanalyze all samples with positive results. If insufficient amount of sample is available, apply qualifier to all affected sample results.	Analyst, Laboratory Supervisor and Data Reviewer	Accuracy / Bias	%R must be within 80-120%.
MS (MSD may replace laboratory duplicate)	One per batch of 20 or less.	%R should be within 75-125%. RPD should be ≤ 20%.	Check for errors in calculations and spike preparation. Check un-spiked sample results and surrogate recoveries for possible matrix effects. If no errors are found and the associated LCS in control, matrix effects are the likely cause. Qualify failing analytes as estimated.	Analyst, Laboratory Supervisor and Data Reviewer	Precision / Accuracy / Bias	%R should be within 75-125%. RPD should be ≤ 20%.
Laboratory Duplicate	One per batch of 20 or less.	RPD ≤ 20.	If the RPD is > 20 and the sample and the duplicate are less than 5x the LOQ, then the duplicate is considered in control and appropriately footnoted.	Analyst, Laboratory Supervisor and Data Reviewer	Precision	RPD ≤ 20.

Please note that limits are updated periodically and may change from the issuance of the final SAP to the time data validation is performed. The limits used for validation will be the limits that are current at the time of analysis.

Matrix	Groundwater
Analytical Group	TOC/Inorganic Carbon
Analytical Method/ SOP Reference	SM 5310B Accutest GN 215.4

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 or less.	Result must be < ½ LOQ.	Samples must reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10x the method blank level.	Analyst, Laboratory Supervisor and Data Reviewer	Bias / Contamination	Result must be < ½ LOQ.
LCS	One per batch of 20 or less.	%R must be within 90-110%.	If the LCS recovery is high and the results of the samples to be reported are <LOQ, then the sample results can be reported with no flag. In all other situations, all samples associated with a LCS outside of recovery limits must be reanalyzed.	Analyst, Laboratory Supervisor and Data Reviewer	Accuracy / Bias	%R must be within 90-110%.
MS (MSD may replace laboratory duplicate)	One per batch of 20 or less.	%R must be within 90-110%. RPD must be ≤ 20%.	Results should be flagged with the appropriate footnote. If the matrix spike amount is < ¼ of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect.	Analyst, Laboratory Supervisor and Data Reviewer	Accuracy / Bias	%R must be within 90-110%. RPD must be ≤ 20%.
Laboratory Duplicate	One per batch of 20 or less.	RPD must be ≤ 20%.	If a duplicate is out of control, then the results should be flagged with the appropriate footnote. If the sample and the duplicate are less than 5x the LOQ and are within a range of ± the LOQ, then the duplicate is considered to be in control.	Analyst, Laboratory Supervisor and Data Reviewer	Precision	RPD must be ≤ 20%.

Please note that limits are updated periodically and may change from the issuance of the final SAP to the time data validation is performed. The limits used for validation will be the limits that are current at the time of analysis.

SAP Worksheet #29 -- Project Documents and Records Table

(UFP-QAPP Manual Section 3.5.1)

Document	Where Maintained
Field Documents Field Logbook (and sampling notes) Field Sample Forms (e.g., boring logs, sample log sheets, drilling logs, etc.) Chain of custody Records Sample Shipment Air Bills Equipment Calibration Logs Photographs FTMR Forms This SAP HASP	Field documents will be maintained in the Solutions-IES project file, results will be discussed in the project report.
Laboratory Documents Sample receipt, custody, and tracking record Equipment calibration logs Sample preparation logs Analysis Run logs CA forms Reported field sample results Reported results for standards, QC checks, and QC samples Extraction/clean-up records Raw data	Laboratory documents will be included in the hardcopy and PDF deliverables from the laboratory. Laboratory data deliverables will be maintained in the Solutions-IES project file and in long-term data package storage at a third-party professional document storage firm. Electronic data results will be maintained in a database on a password protected Structured Query Language (SQL) server.
Assessment Findings Field Sampling Audit Checklist (if conducted) Analytical Audit Checklist (if conducted)	All assessment documents will be maintained in the Solutions-IES project file.
Reports Regular Long-term Monitoring Reports	All versions of the reports and all support documents (e.g., figures) will be stored in hardcopy in the Solutions-IES project file and electronically in the server library.

SAP Worksheet #30 -- Analytical Services Table

(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization[1] (name and address, contact person and telephone number)	Backup Laboratory / Organization[1] (name and address, contact person and telephone number)
Groundwater	VOC	See Worksheet # 18	SW-846 8260B SOP MS 500.6	21 days	Ms. Jean Dent-Smith jeans@accutest.com Accutest SE 4405 Vineland Road Suite C-15 Orlando, FL 32811 407-425-6700 407-425-0707	N/A
Groundwater	PAHs (Day Tank 1, Building 46, Building 271)		SW-846 8270C SOP MS 006.7			
Groundwater	PAH (NFF only)		SW-846 8310 SOP GC 018.6			
Groundwater	TRPH		FL-PRO SOP GC 008.6			
Groundwater	Sulfate		SW-846 9056A/EPA 300.0 GNSOP : 228.2			
Groundwater	Sulfide		SM 4500S=F SOP GN 140.7			
Groundwater	TOC/Inorganic Carbon		SM 5310B SOP GN 215.4			

SAP Worksheet #31 -- Planned Project Assessments Table

(UFP-QAPP Manual Section 4.1.1)

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment** (title and organizational affiliation)	**Person(s) Responsible for Responding to Assessment Findings** (title and organizational affiliation)	**Person(s) Responsible for Identifying and Implementing Corrective Actions** (title and organizational affiliation)	**Person(s) Responsible for Monitoring Effectiveness of Corrective Action** (title and organizational affiliation)
Laboratory Systems Audit[1]	Every 3 years	External	DoD Environmental Laboratory Accreditation Program (ELAP) Accrediting Body and FDEP and National Environmental Laboratory Accreditation Program (NELAP)	DoD ELAP Accrediting Body Auditor and FDEP and NELAP Auditors	QAM, Accutest	QAM, Accutest	QAM, Accutest
Field Sampling Systems Audit	One per contract year	Internal	Solutions-IES	Auditor, Solutions-IES	PM, Solutions-IES	Auditor and QAM, Solutions-IES	QAM, Solutions-IES

1 Accutest has successfully completed the laboratory assessment process required as part of the DoD QSM Version 4.1 under the DoD ELAP by a recognized Accrediting Body. Accutest is also Florida-certified NELAP accredited laboratory. Copies of the Accutest's certifications are included in Appendix D.

SAP Worksheet #32 -- Assessment Findings and Corrective Action Responses

(UFP-QAPP Manual Section 4.1.2)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Field Sampling Systems Audit	Audit checklist (as per Navy Installation Restoration Chemical Data Quality Manual [IRCDQM]) and written audit report	Jessica Keener, PM, Solutions-IES; Dawn Marshall, FOL, Solutions-IES; and M. Tony Lieberman, QAM, Solutions-IES	Dependent on findings; if major, a stop work maybe issued immediately; however, if minor, within one week of audit	Written memo	M. Tony Lieberman, QAM, Solutions-IES, or QAM Designee/Auditor Solutions-IES	Within 48 days of notification
Laboratory System Audit	Written audit report	Svetlana Izosimova, Laboratory QAM, Accutest	Specified by DOD ELAP Accrediting Body	Letter	DOD ELAP Accrediting Body	Specified by DOD ELAP Accrediting Body

SAP Worksheet #33 -- QA Management Reports Table

(UFP QAPP Manual Section 4.2)

Type of Report	**Frequency** (Daily, weekly monthly, quarterly, annually, etc.)	**Projected Delivery Date(s)**	**Person(s) Responsible for Report Preparation** (title and organizational affiliation)	**Report Recipient(s)** (title and organizational affiliation)
Major Analysis Problem Identification (Internal Memorandum)	When persistent analysis problems are detected	Immediately	QAM, Solutions-IES	PM, Solutions-IES; project file
Project Monthly Progress Report	Monthly for duration of the project	Monthly	PM, Solutions-IES	PM, Solutions-IES; QAM, Solutions-IES; Program Manager, Solutions-IES; project file
Laboratory QA Report	When significant plan deviations result from unanticipated circumstances	Immediately	Laboratory PM, Accutest	PM, Solutions-IES; project file

SAP Worksheet #34 -- Verification (Step I) Process Table

(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Chain-of-custody Forms	The Solutions-IES FOL or designee will review and sign each chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and the sample information is accurate. The chain-of-custody forms will be signed by the Sampler and a copy will be retained for the project file and the Solutions-IES PM.	Internal	FOL and Field Crew, Solutions-IES
SAP Sample Tables	Verify that all proposed samples listed in the SAP tables have been collected.	Internal	FOL and Field Crew, Solutions-IES
Sample Log Sheets	Verify that information recorded in the log sheets is accurate and complete.	Internal	PM, FOL, or designee, Solutions-IES
Sample Coordinates	Verify that sample locations are correct and in accordance with the SAP proposed locations.	Internal	PM, FOL, or designee, Solutions-IES
Field SOPs/Field logs/Sample collection	Ensure that all sampling SOPs were followed. Verify that deviations have been documented and MPCs have been achieved. Particular attention should be given to verify that samples were correctly identified, that sampling location coordinates are accurate, and that documentation establishes an unbroken trail of documented chain-of-custody from sample collection to report generation. Verify that the correct sampling and analytical methods/SOPs were applied. Verify that the sampling plan was implemented and carried out as written and that any deviations are documented.	Internal	Solutions-IES, PM or designee
Analytical SOPs	Ensure that all laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied.	Internal	Accutest QAM
Documentation of method QC results	Establish that all method QC samples were analyzed and in control as listed in the analytical SOPs. If method QA is not in control, the laboratory will contact Solutions-IES for guidance prior to report preparation.	Internal	Accutest QAM
Field QC Samples	Check that field QC samples listed in Worksheet # 20 were collected as required.	Internal	Solutions-IES, FOL or designee

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Chain-of-Custody Forms	The laboratory sample custodian will review the sample shipment for completeness, integrity, and sign accepting the shipment. The Solutions-IES PM or designee will check that the Chain-of-Custody Form was signed/dated by the Solutions-IES FOL or designee relinquishing the samples and also by the laboratory sample custodian receiving the samples for analyses.	Internal/ External	Laboratory sample custodian/ Solutions-IES PM or designee
Analytical Data Package	All analytical data packages will be verified internally for completeness by the laboratory performing the work. The laboratory QAM will sign the case narrative for each data package.	Internal	Accutest QAM
Analytical Data Package	The data package will be verified for completeness by Solutions-IES PM or designee. Missing information will be requested Solutions-IES from the laboratory.	External	Solutions-IES, PM or designee
Electronic Data Deliverables (EDDs)	The electronic data will be verified against the chain-of-custody and hard copy data package for accuracy and completeness. Laboratory analytical results will be verified and compared to the electronic analytical results for accuracy. Positive results reported between the method detection limit and the reporting limit will be qualified as estimated.	Internal/ External	Laboratory sample custodian/ Solutions-IES PM or designee

1 IIa=compliance with methods, procedures, and contracts (see Table 10, page 117, UFP-QAPP manual, V.1, March 2005).
IIb=comparison with measurement performance criteria in the SAP (see Table 11, page 118, UFP-QAPP manual, V.1, March 2005).

SAP Worksheet #35 -- Validation (Steps IIa and IIb) Process Table

(UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Step IIa/IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Chain-of-custody	Ensure that the custody and integrity of the samples was maintained from collection to analysis and the custody records are complete and any deviations are recorded.	Solutions-IES PM or designee
IIa	Holding times	Review that the samples were shipped and store at the required temperature and sample pH for chemically-preserved samples meet the requirements listed in Worksheet # 19. Ensure that the analyses were performed within the holding times listed in Worksheet # 19.	Accutest QAM
IIa/IIb	Laboratory data results for accuracy	Ensure that the laboratory QC samples listed in Worksheet # 28 were analyzed and that the measurement performance criteria listed in Worksheet # 12 were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed and that the analytical QC criteria set up for this project were met.	Accutest QAM and Solutions-IES PM or designee
IIa/IIb	Laboratory Duplicate Analyses for Precision	Check the laboratory precision by reviewing the RPD or percent difference values from laboratory duplicate analyses; MS/MSDs; and LCS/Laboratory Control Sample Duplicates (LCSDs). Ensure compliance with the methods and project MPC accuracy goals listed in Worksheet # 12.	Accutest QAM
IIa/IIb	Sample results for representativeness	Check that the laboratory recorded the temperature at sample receipt and the pH of the chemically preserved samples to ensure sample integrity from sample collection to analysis.	Accutest QAM
IIa/IIb	PALs	Discuss the impact on matrix interferences or sample dilutions performed because of the high concentration of one or more contaminant, on the other target compounds reported as non-detected. Document this usability issue and inform the Solutions-IES PM.	Solutions-IES PM or designee

Step IIa/IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa/IIb	Laboratory Report Narrative	Summarize deviations from methods, procedures, or contracts. Qualify data results based on method or QC deviation and explain all the data qualifications. Print a copy of the project database qualified data depicting data qualifiers and data qualifier codes that summarize the reason for data qualifications. Determine if the data met the MPC and determine the impact of any deviations on the technical usability of the data.	Accutest QAM Solutions-IES PM or designee
IIb	LOQs for sensitivity	Ensure that the project LOQs listed in Worksheet # 15 were achieved.	Solutions-IES PM or designee

1 IIa=compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.]
IIb=comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005]

SAP Worksheet #36 –Analytical Data Validation (Steps IIa and IIb) Summary Table

(UFP-QAPP Manual Section 5.2.2.1)

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	Groundwater	VOCs PAHs TRPH	Data review will be performed using criteria for SW-846 8260B,8270C, 8310, and FL-PRO and Accutest SOPs listed in Worksheet#s12, 15, 24, 25, and 28.	Data Reviewer, Accutest
IIa and IIb	Groundwater	Sulfate, Sulfide, TOC, and Inorganic Carbon	Data review will be performed using criteria for SW-846 9056A/EPA 300.0, SM 4500S=F, and SM 5310B and the Accutest SOP listed in Worksheet #s 12, 15, 24, 25, and 28.	Data Reviewer, Accutest

1 IIa=compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.]
IIb=comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005]

SAP Worksheet #37 -- Usability Assessment

(UFP-QAPP Manual Section 5.2.3)

Data Usability Assessment
The usability of the data directly affects whether project objectives can be achieved. The following characteristics will be evaluated at a minimum. The results of these evaluations will be included in the project report. The characteristics will be evaluated for multiple concentration levels if the evaluator determines that this is necessary. To the extent required by the type of data being reviewed, the assessors will consult with other technically competent individuals to render sound technical assessments of these data characteristics: **Completeness** For each matrix that was scheduled to be sampled, the FOL, acting on behalf of the Project Team, will prepare a table listing planned samples/analyses to collected samples/analyses. If deviations from the scheduled sample collection or analyses are identified the Tetra Tech PM and Project Risk Assessor will determine whether the deviations compromise the ability to meet project objectives. If they do, the Tetra Tech PM will consult with the Navy RPM and other Project Team members, as necessary (determined by the Navy RPM), to develop appropriate CAs. **Precision** The Solutions-IES PM, acting on behalf of the Project Team, will determine whether precision goals for field duplicates and laboratory duplicates were met. This will be accomplished by comparing duplicate results to precision goals identified in Worksheet #s 12 and 28. This will also include a comparison of field and laboratory precision with the expectation that field duplicate results will be no less precise than laboratory duplicate results. If the goals are not met, or data have been flagged as estimated (J qualifier), limitations on the use of the data will be described in the project report. **Accuracy** The Solutions-IES PM, acting on behalf of the Project Team, will determine whether the accuracy/bias goals were met for project data. This will be accomplished by comparing percent recoveries of LCS, LCSD, MS, MSD, and surrogate compounds to accuracy goals identified in Worksheet #28. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, matrix spike, and laboratory control samples. If the goals are not met, limitations on the use of the data will be described in the project report. Bias of the qualified results and a description of the impact of identified non-compliances on a specific data package or on the overall project data will be described in the project report. **Representativeness** A Solutions-IES PM, acting on behalf of the Project Team, will determine whether the data are adequately representative of intended populations, both spatially and temporally. This will be accomplished by verifying that samples were collected and processed for analysis in accordance with the SAP, by reviewing spatial and temporal data variations, and by comparing these characteristics to expectations. The usability report will describe the representativeness of the data for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the project scientist indicates that a quantitative analysis is required.

Comparability

The Solutions-IES PM, acting on behalf of the Project Team, will determine whether the data generated under this project are sufficiently comparable to historical site data generated by different methods and for samples collected using different procedures and under different site conditions. This will be accomplished by comparing overall precision and bias among data sets for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the Solutions-IES PM indicates that such quantitative analysis is required.

Sensitivity

The Solutions-IES PM, acting on behalf of the Project Team, will determine whether project sensitivity goals listed in Worksheet #15 are achieved. The overall sensitivity and quantitation limits (LOQs and MDLs) from multiple data sets for each matrix and analysis will be compared. If sensitivity goals are not achieved, the limitations on the data will be described. The Solutions-IES PM will enlist the help of the Project Risk Assessor to evaluate deviations from planned sensitivity goals.

Project Assumptions and Data Outliers

The Solutions-IES PM and designated team members will evaluate whether project assumptions are valid. This will typically be a qualitative evaluation but may be supported by quantitative evaluations. The type of evaluation depends on the assumption being tested. Potential outliers will be removed if a review of the associated indicates that the results have an assignable cause that renders them inconsistent with the rest of the data. During this evaluation, the team will consider whether outliers could be indications of unanticipated site conditions. Consideration will be given to whether outliers represent an unanticipated site condition.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

Upon receipt of the data from the laboratory, the data and data quality will be reviewed to determine whether sufficient data of acceptable quality are available for decision making. In addition to the evaluations described above, a series of inspections and statistical analyses will be performed to estimate these characteristics. Statistical evaluations will include simple summary statistics for target analytes, such as maximum concentration, minimum concentration, number of samples exhibiting non-detected results, number of samples exhibiting positive results, and the proportion of samples with detected and non-detected results. Trend lines will be generated to show concentrations over time, including data collected prior to this investigation. The Project Team members identified by the Solutions-IES PM will assess whether the data collectively support the attainment of project objectives. This will be accomplished in part by comparing concentrations to GCTLs, but also by inspecting temporal trend lines to determine whether there are any anomalies present that indicate a deviation from expected trends. They will consider whether any missing or rejected data have compromised the ability to make decisions or to make the decisions with the desired level of confidence. The data will be evaluated to determine whether missing or rejected data can be compensated by other data. Although rejected data will generally not be used, there may be reason to use them in a weight of evidence argument, especially when they supplement data that have not been rejected. If rejected data are used, their use will be supported by technically defensible rationales.

For statistical comparisons and mathematical manipulations, non-detected values will be represented by a concentration equal to the sample-specific detection limit. Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations. However, the average of the original and duplicate samples will be used to represent the concentration at a particular sampled location.

Identify the personnel responsible for performing the usability assessment: The Solutions-IES PM and FOL will be responsible for conducting the listed data usability assessments. The data usability assessment will be reviewed with the Navy RPM, the EPA RPM, and the FDEP RPM. If deficiencies affecting the attainment of project objectives are identified, the review will take place either in a face-to-face meeting or a teleconference depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the project report and reviewed during the normal document review cycle.
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: The data will be presented in tabular format, including data qualifications such as estimation (J, UJ) or rejection (R). Written documentation will support the non-compliance estimated or rejected data results. The project report will identify and describe the data usability limitations and suggest re-sampling or other CAs, if necessary.

REFERENCES

ABB-ES (ABB Environmental Services, Inc.), 1993. Contamination Assessment Report Addendum – Day Tank 1, Facility 293, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command. December.

ABB-ES, 1994a. Contamination Assessment Report Addendum, Jet Engine Test Cell, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command. November.

ABB-ES, 1994b. Contamination Assessment Report – North Fuel Farm, Area Sites, NAS Cecil Field, Jacksonville, Florida. Florida. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command. July.

ABB-ES, 1996. Contamination Assessment Report Addendum – North Fuel Farm Site, North Fuel Farm Area, NAS Cecil Field, Jacksonville, Florida. Florida. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command. April.

ABB-ES, 1997a. Remedial Action Plan – Revision 1, North Fuel Farm Area, NAS Cecil Field, Jacksonville, Florida. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command. November.

ABB-ES, 1997b. Remedial Action Plan – Day Tank 1, Facility 293, NAS Cecil Field, Jacksonville, Florida. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command. January.

ABB-ES, 1998. Confirmatory Sampling Report, Building 46, Tanks 46R, 46D, 46SUL, and 46UL, Base Realignment and Closure, Miscellaneous Tank Sites. Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command. May.

CH2MHill (CH2MHill Constructors, Inc.), 2000. Source Removal Report, Aboveground Storage Tank Removal at Facility 293, Naval Air Station Cecil Field, Jacksonville, Florida. March.

CH2MHill, 2001. Source Removal Report, Underground Storage Tank Closure at Building 271, Tank Numbers 271R, 271UL, and 271SUL, Naval Air Station Cecil Field, Jacksonville, Florida. March.

CH2MHill, 2008a. Work Plan Addendum No. 18 – Installation of Air Sparging Systems at the Jet Engine Test Cell (JETC) and Building 271. Former Naval Air Station Cecil Field, Jacksonville, Florida. January.

CH2MHill, 2008b. Optimization Report for Air Sparging/Biosparging Treatment System, North Fuel Farm Site, Former Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for NAS Cecil Field Base Cleanup Team. June.

FDEP (Florida Department of Environmental Protection), 1999. F.A.C. Chapter 62-777. Table was updated in April 2005. http://www.dep.state.fl.us/waste/quick_topics/rules/documents/62-777/TableIGroundwaterCTLs4-17-05.pdf

FDEP, 2005. Technical Memorandum, Recommendation to Discontinue Operation of SVE System, North Fuel Farm Site, Former Naval Air Station Cecil Field, Jacksonville, Florida. October.

FDEP, 2006. "Guidance for the Selection of Analytical Methods for the Evaluation of Practical Quantitation Limits, " FAC Chapter 62-4.246(4), Prepared by the Division of Resource Assessment and Management for the Division of Water Resources Management Wastewater Programs. April.

HLA (Harding Lawson Associates), 1998. Site Assessment Report, Building 46, Tanks 46R, 46D, 46SUL, and 46UL, Base Realignment and Closure, Miscellaneous Tank Sites, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command. December.

HLA, 1999. Confirmatory Sampling Report, Base Exchange Gas Station, Building 271, Base Realignment and Closure, Underground Storage Tank and Aboveground Storage Tank Grey Sites, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command. July.

OSHA (Occupation Safety and Health Administration), 2002. HAZWOPER safety and health plan requirements for Phase I and Phase II environmental assessments. 29 Code of Federal Regulations (CFR) 1910.120(b)(4). September.

Solutions- Industrial and Environmental Services (Solutions-IES), 2008. Work Plan, Long Term Monitoring and Operation & Maintenance, Former Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Naval Facilities Engineering Command Southeast, Charleston, South Carolina. September.

Solutions-IES, 2009a. Second Quarter 2009 Long-Term Monitoring Report, JETC, NAS Cecil Field, Jacksonville, FL, Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. December.

Solutions-IES, 2009b. Second Quarter 2009, Long-Term Monitoring Report, North Fuel Farm, Former NAS Cecil Field, Jacksonville, FL. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. December.

Solutions-IES, 2009c. First Semi-Annual Natural Attenuation Monitoring Report, Day Tank 1, Former NAS Cecil Field, Jacksonville, FL, Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. July.

Solutions-IES, 2009d. Second Quarter 2009 Long-Term Monitoring and Operation & Maintenance Status Report, Building 46, Former NAS Cecil Field, Jacksonville, FL, Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. November.

Solutions-IES, 2010. Second Semi-Annual Groundwater Monitoring Report, September 2009, Day Tank 1, Former NAS Cecil Field, Jacksonville, FL. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. March.

TtNUS (Tetra Tech NUS, Inc.), 1998. Base-Wide Generic Work-Plan, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command. October.

TtNUS, 1999a. Remedial Action Plan Addendum – North Fuel Farm, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. August.

TtNUS, 1999b. Remedial Action Plan – Building 46, Former Tanks 46R, 46D, 46SUL and 46UL for Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. March.

TtNUS, 2000. Remedial Action Plan Addendum– Building 46, Former Tanks 46R, 46D, 46SUL and 46UL for Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. March.

TtNUS, 2001. Remedial Action Plan Addendum– Building 46, Former Tanks 46R, 46D, 46SUL and 46UL for Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. March.

TtNUS, 2002a. Remedial Action Plan for Jet Engine Test Cell and Oil-Water Separator 334-OW, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. September.

TtNUS, 2002b. Site Assessment Report for Building 271, Tanks 271 UL, 271R, 271 SUL and 271D, Base Realignment and Closure, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. May.

TtNUS, 2002c. Remedial Action Plan for Building 271 Tanks UL/R/SUL/D, FDEP Facility ID No. 168507293 at Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. September.

TtNUS, 2003a. Work Plan Addendum for UST Investigations at South Fuel Farm and Other Sites, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. April.

TtNUS, 2003b. Remedial Action Plan Addendum, Jet Engine Test Cell and Oil-Water Separator 334-OW, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. January.

TtNUS, 2003c. Site Assessment Report Addendum for Day Tank 1, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. November.

TtNUS, 2003d. Letter Report, Supplemental Assessment, Building 46, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. May.

TtNUS, 2003e. Remedial Action Plan Addendum, Building 271, Tanks UL/SUL/D, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. January.

TtNUS, 2004. Remedial Action Plan Addendum for North Fuel Farm, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. March

TtNUS, 2005. Phase V Sampling and Analysis Work Plan, Day Tank 1 – (Former Basin Area Well), Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. January.

TtNUS, 2006. Site Assessment Report Addendum No. 2 for Day Tank 1 with No FurtherAction Proposal for Soils, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. January.

TtNUS, 2008. Work Plan – Long Term Monitoring and O&M Operations at Building 46 and Day Tank 1, Former Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for the Naval Facilities Engineering Command Southeast, Charleston South Carolina. February.

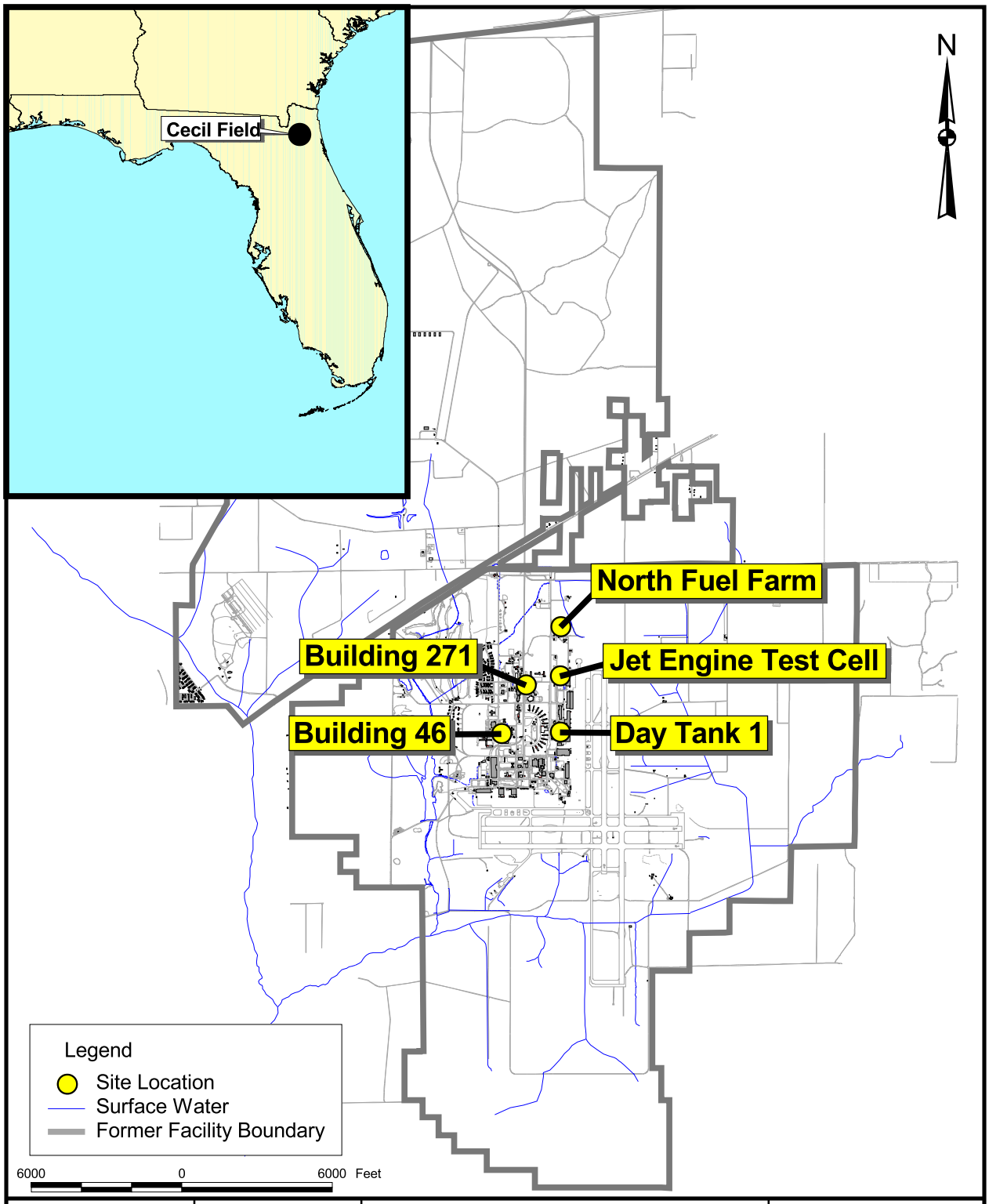
TetraTech, 2010 NASCF Partnering Team Meeting, May 06, 2010, Minute 2622

USEPA (United States Environmental Protection Agency), 2002. Guidance for Developing Quality Systems for Environmental Programs. EPA QA/G-1. Washington, D.C. November.

USEPA, 2005. Uniform Federal Policy (UFP) for Quality Assurance Project Plans (QAPPs). March.

USEPA, 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA QA/G-4. Washington, D.C. February.

FIGURES



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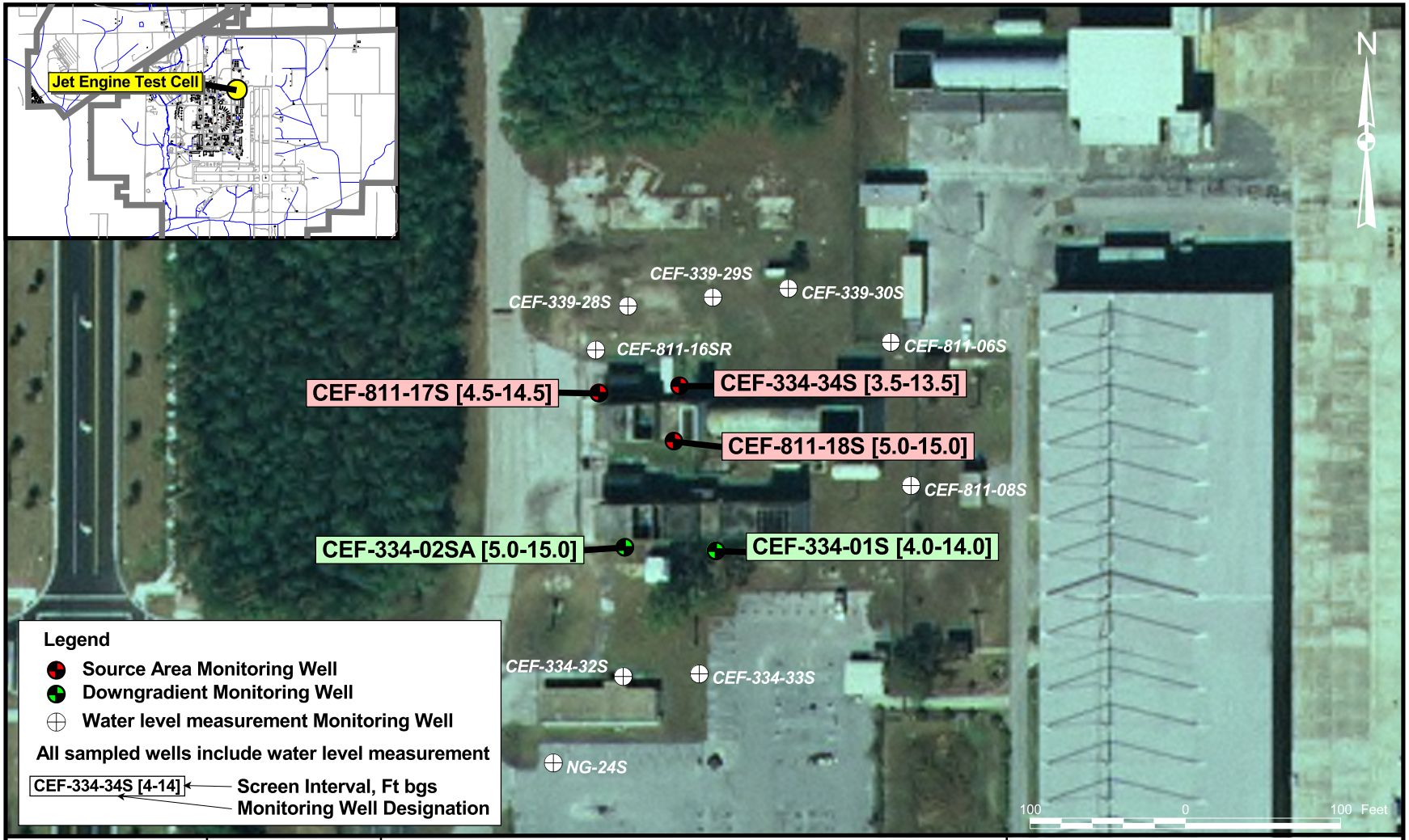

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MJJ	07Apr10
CHECKED BY	DATE
COST/SCHEDULE-AREA	
SCALE	AS NOTED

NAVFAC

MONITORING WELL LOCATION MAP
JET ENGINE TEST CELL (JETC)
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

CONTRACT NUMBER	
2267	
APPROVED BY	DATE
APPROVED BY	DATE
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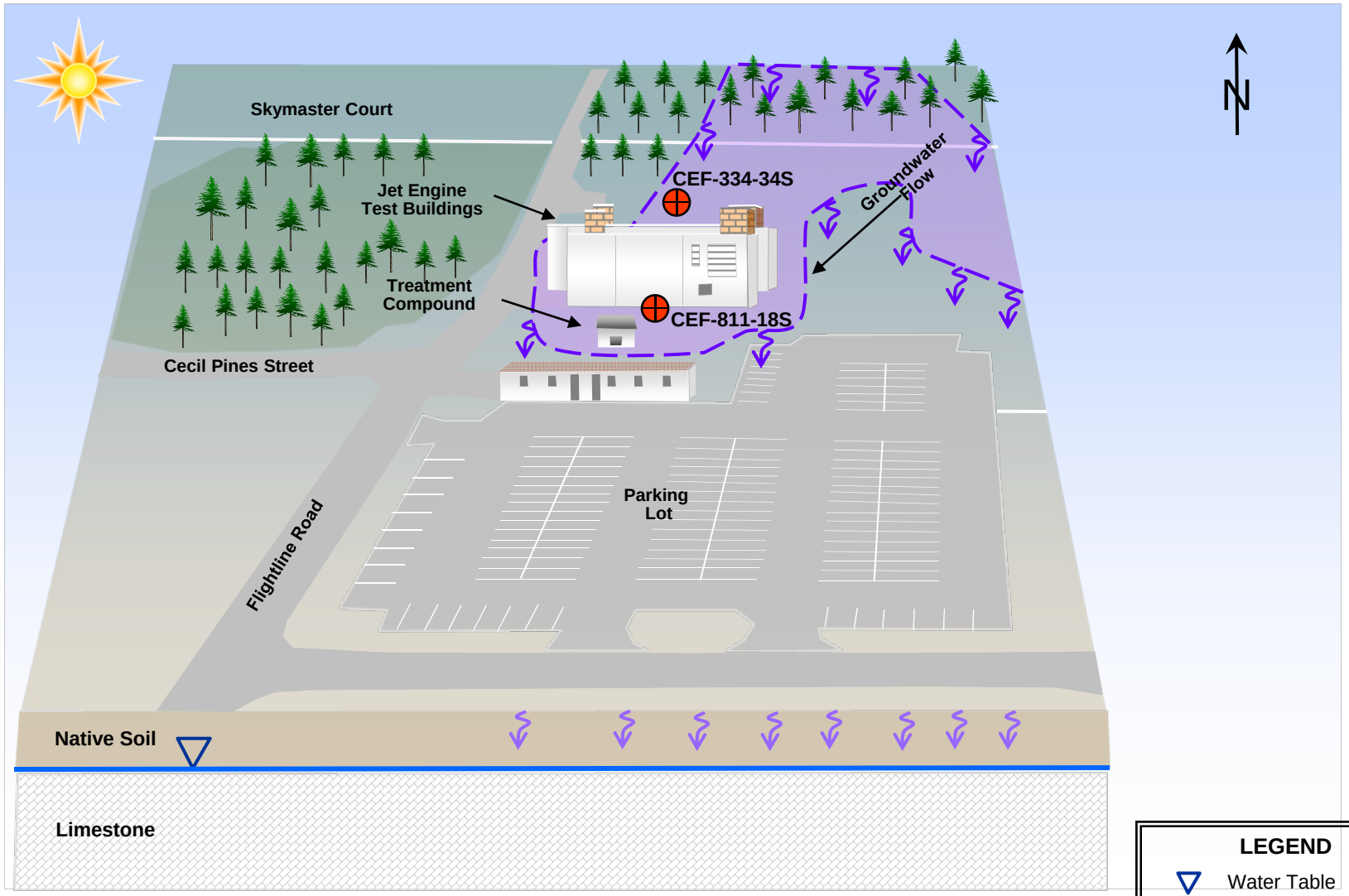

LEGEND

- Water Table
- Plume (depth = 3.5' to 15' bgs)
- Infiltration
- Source Area Monitoring Well
- Groundwater Flow
- Limestone

DRAWN BY / DATE	NAVFAC	CONCEPTUAL SITE MODEL JET ENGINE TEST CELL NAVEL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NO. 2267
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REVISED BY / DATE			APPROVED BY / DATE
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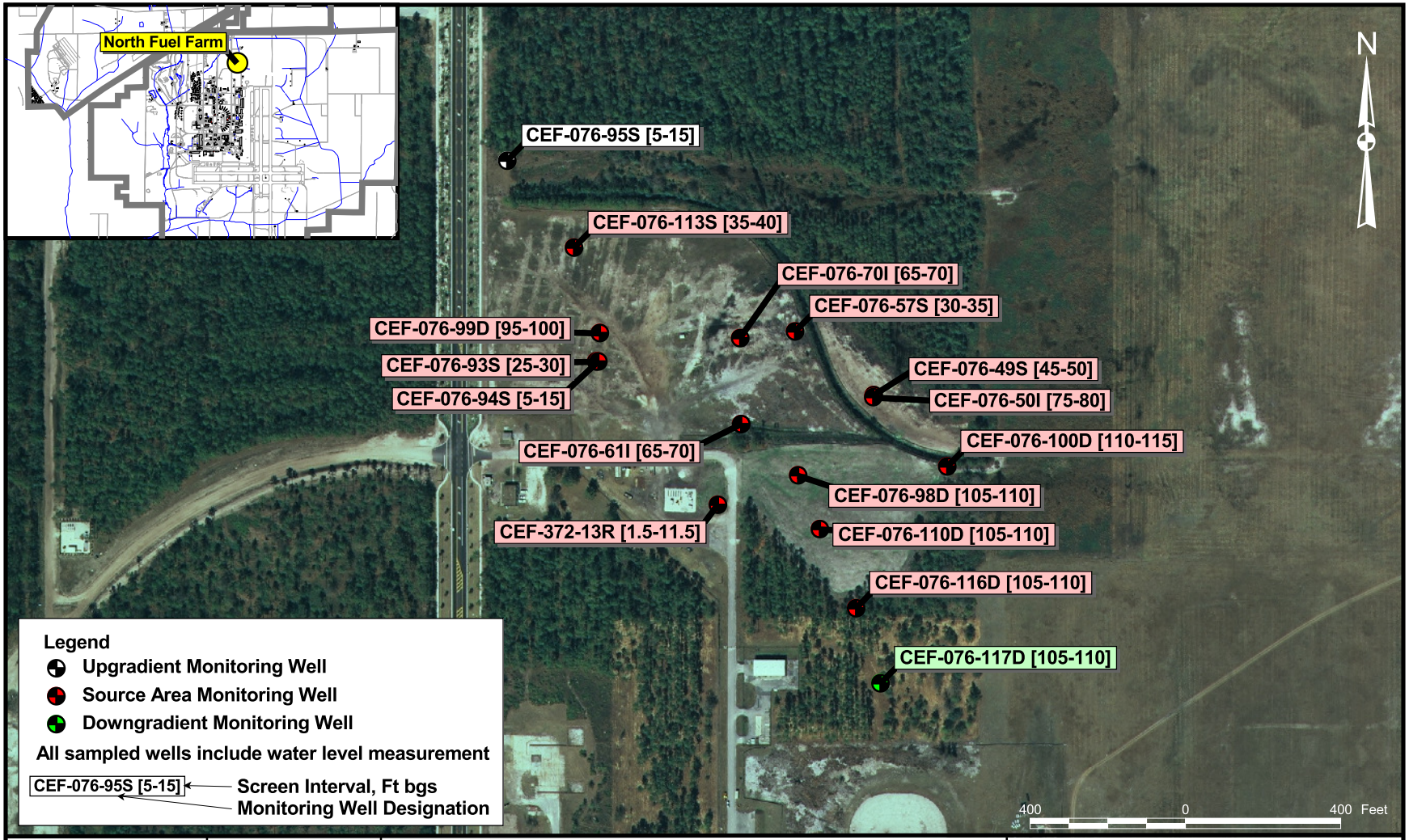

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CHECKED BY	DATE		APPROVED BY DATE
COST/SCHEDULE-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 10B-1 / REV 0

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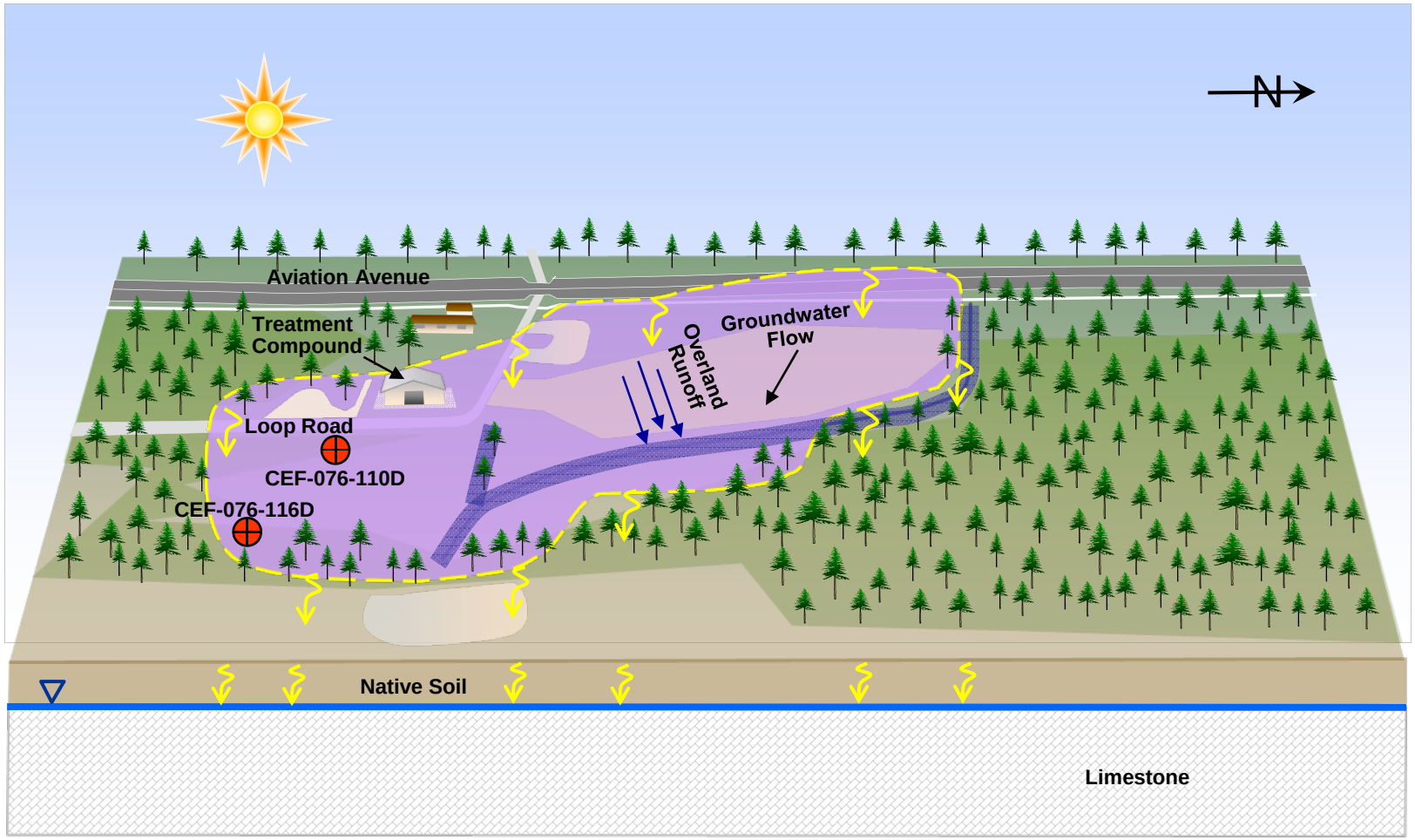

LEGEND

- Water Table
- Plume (depth= 25' to 110' bgs)
- Infiltration
- Stream
- Source Area Monitoring Well
- Groundwater Flow
- Overland Runoff
- Limestone

DRAWN BY / DATE	NAVFAC	CONCEPTUAL SITE MODEL NORTH FUEL FARM (NFF) NAVEL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NO. 2267
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REVISED BY / DATE			APPROVED BY / DATE
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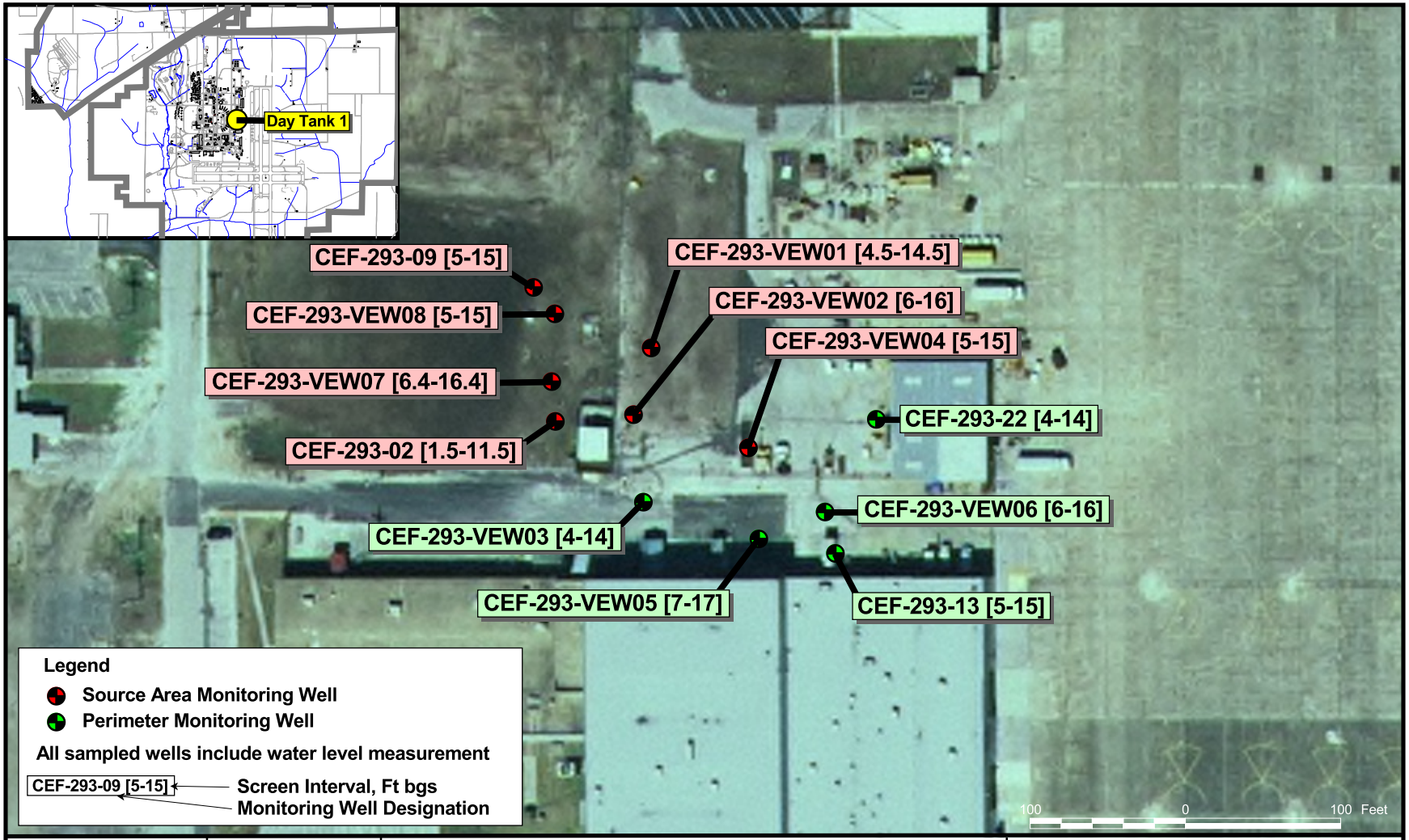

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COST/SCHEDULE-AREA			APPROVED BY DATE
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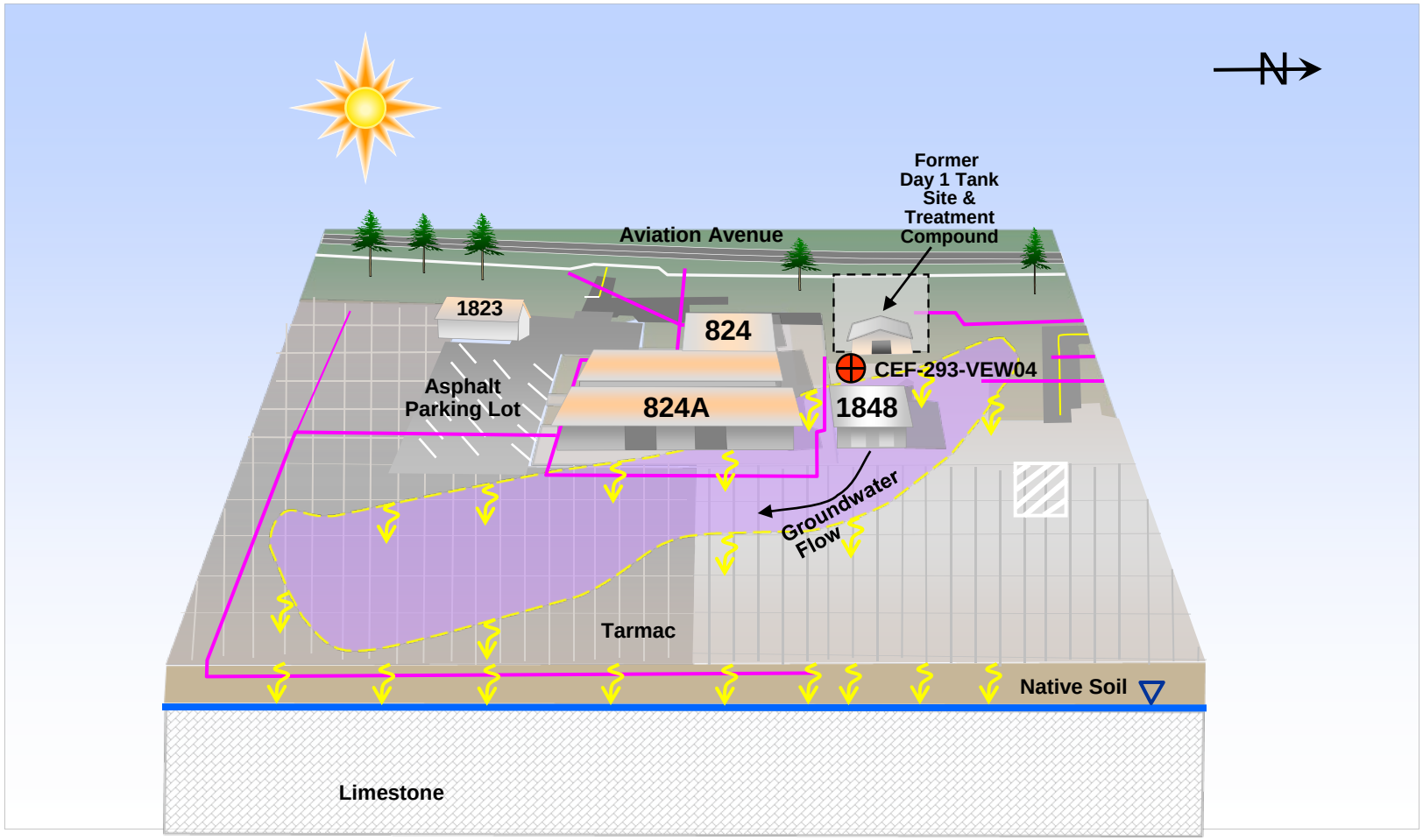

LEGEND

- Water Table
- Plume (depth = 1.5' to 16' bgs)
- Infiltration
- Sewer Lines
- Source Area Monitoring Well
- Groundwater Flow
- Limestone

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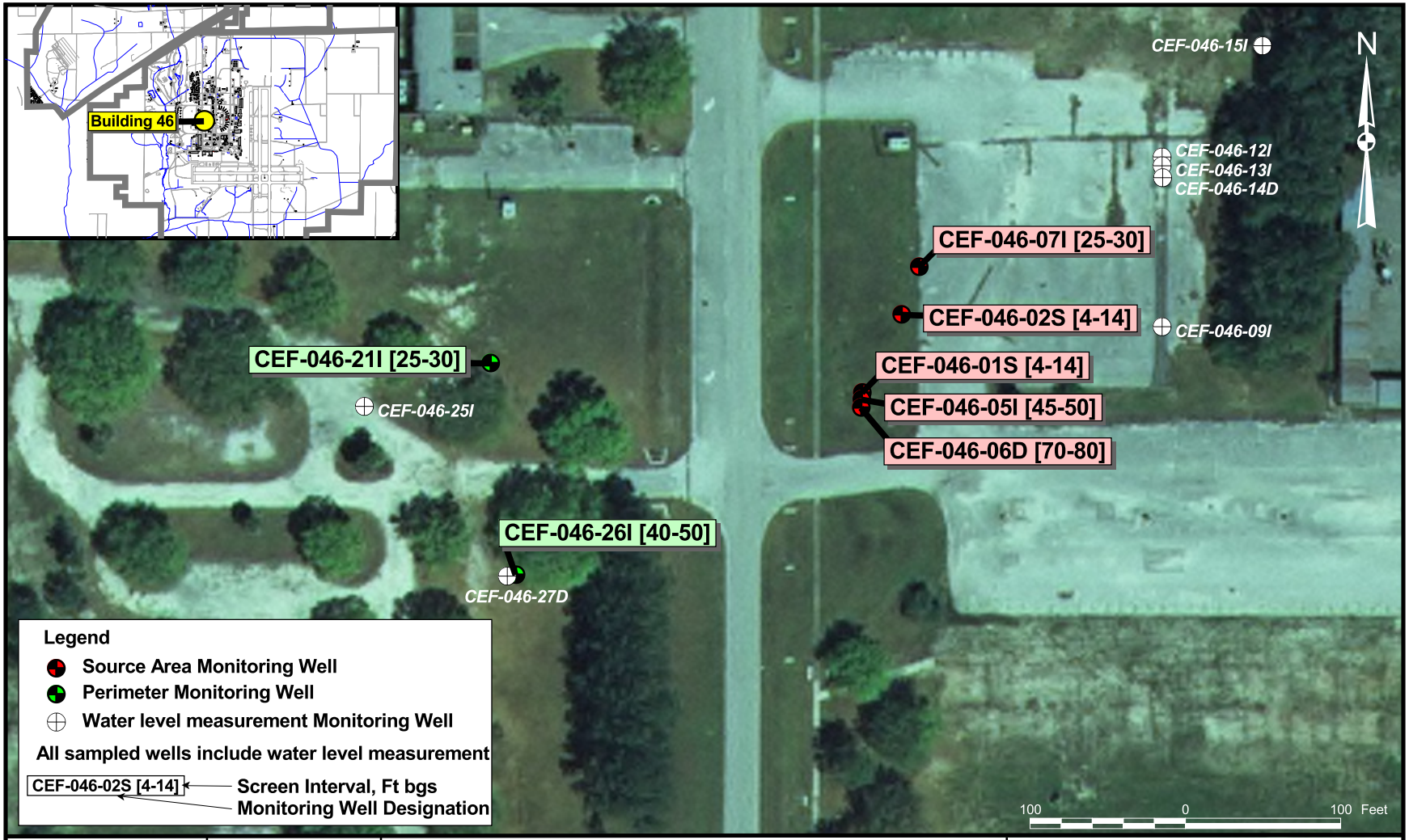

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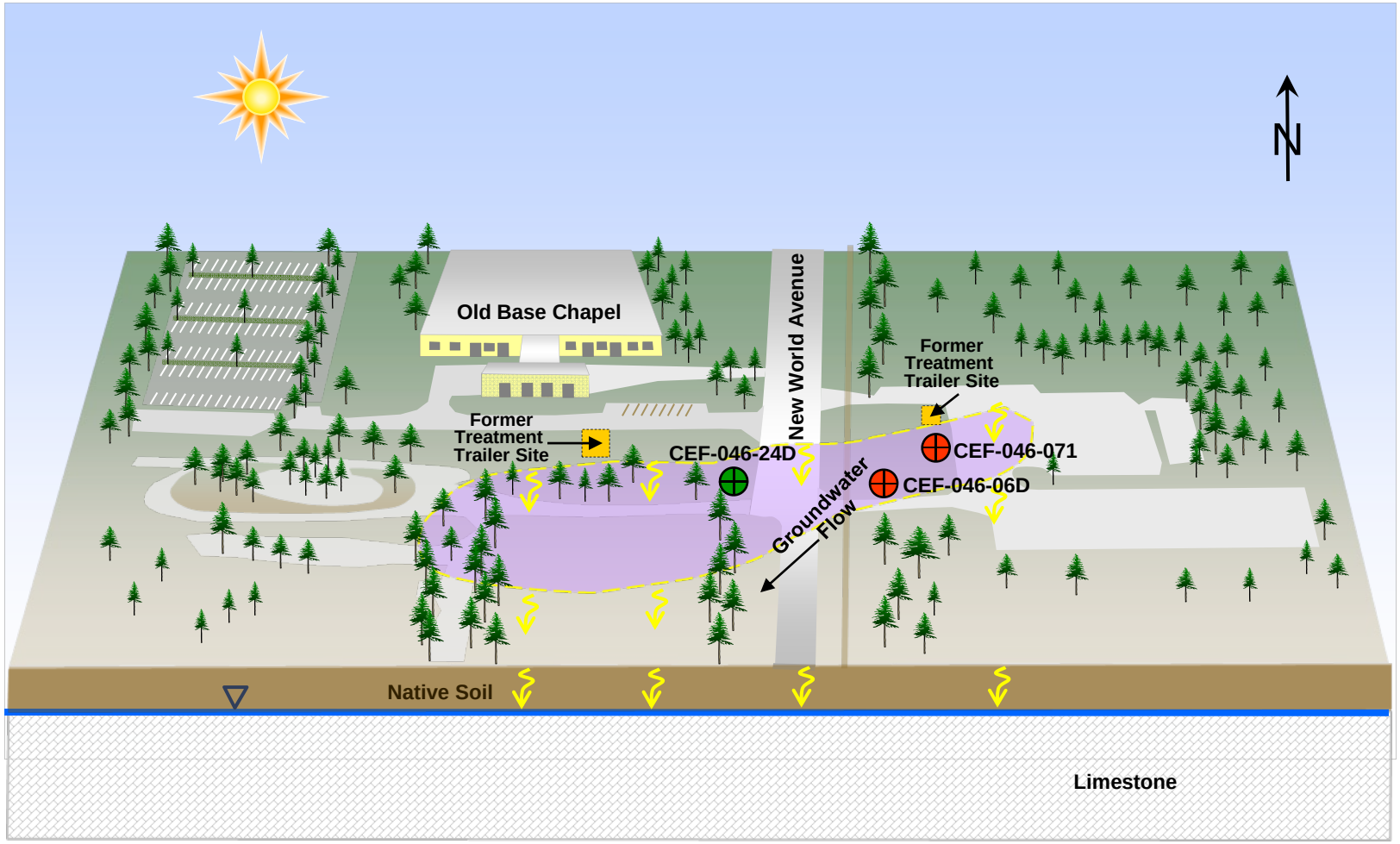

CEF-046-071

LEGEND

- Water Table
- Plume (depth= 4' to 90' bgs)
- Infiltration
- Former Treatment Trailer Site
- Source Area Monitoring Well
- Perimeter Monitoring Well
- Groundwater Flow
- Limestone

DRAWN BY / DATE	NAVFAC	CONCEPTUAL SITE MODEL BUILDING 46 NAVEL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NO. 2267
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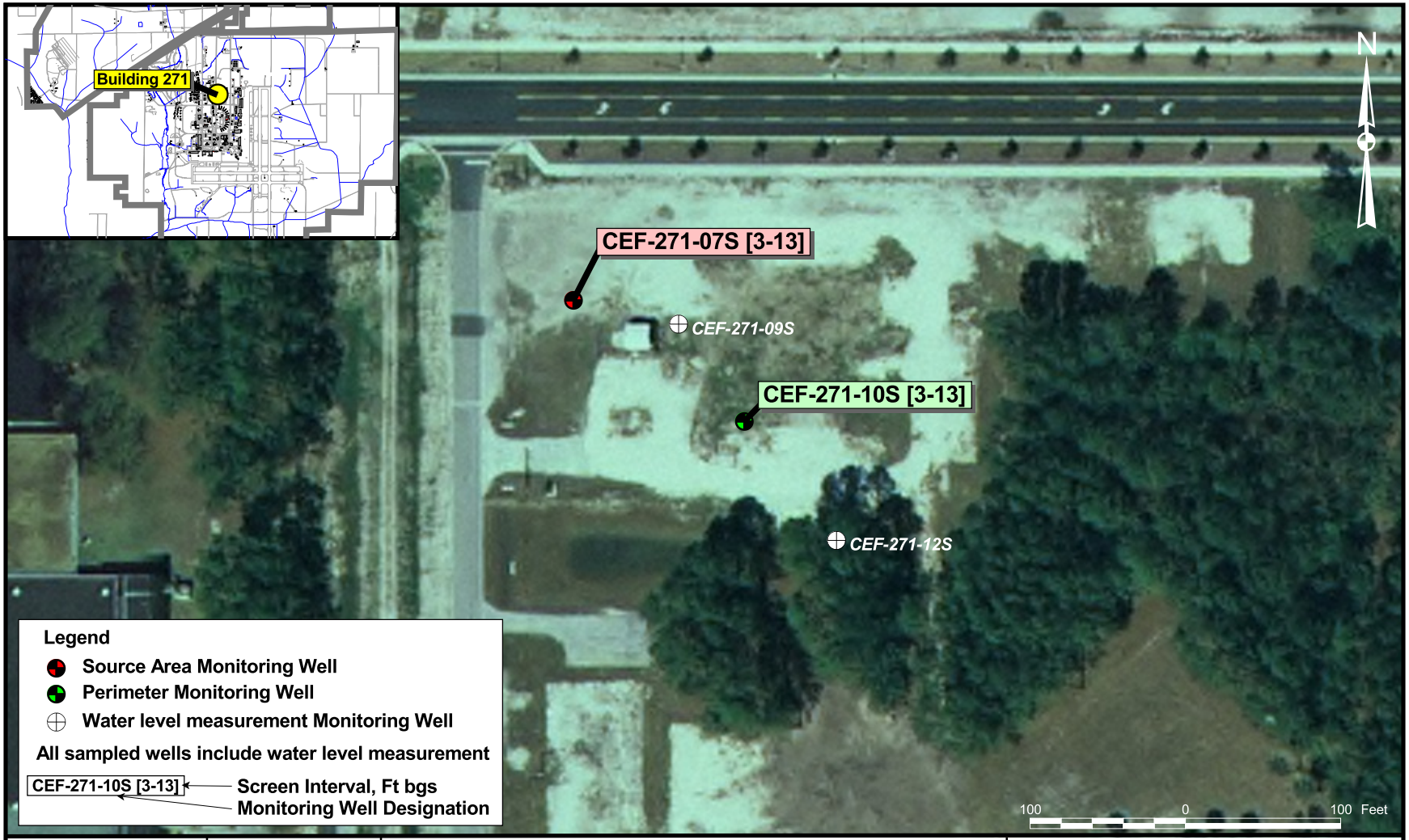

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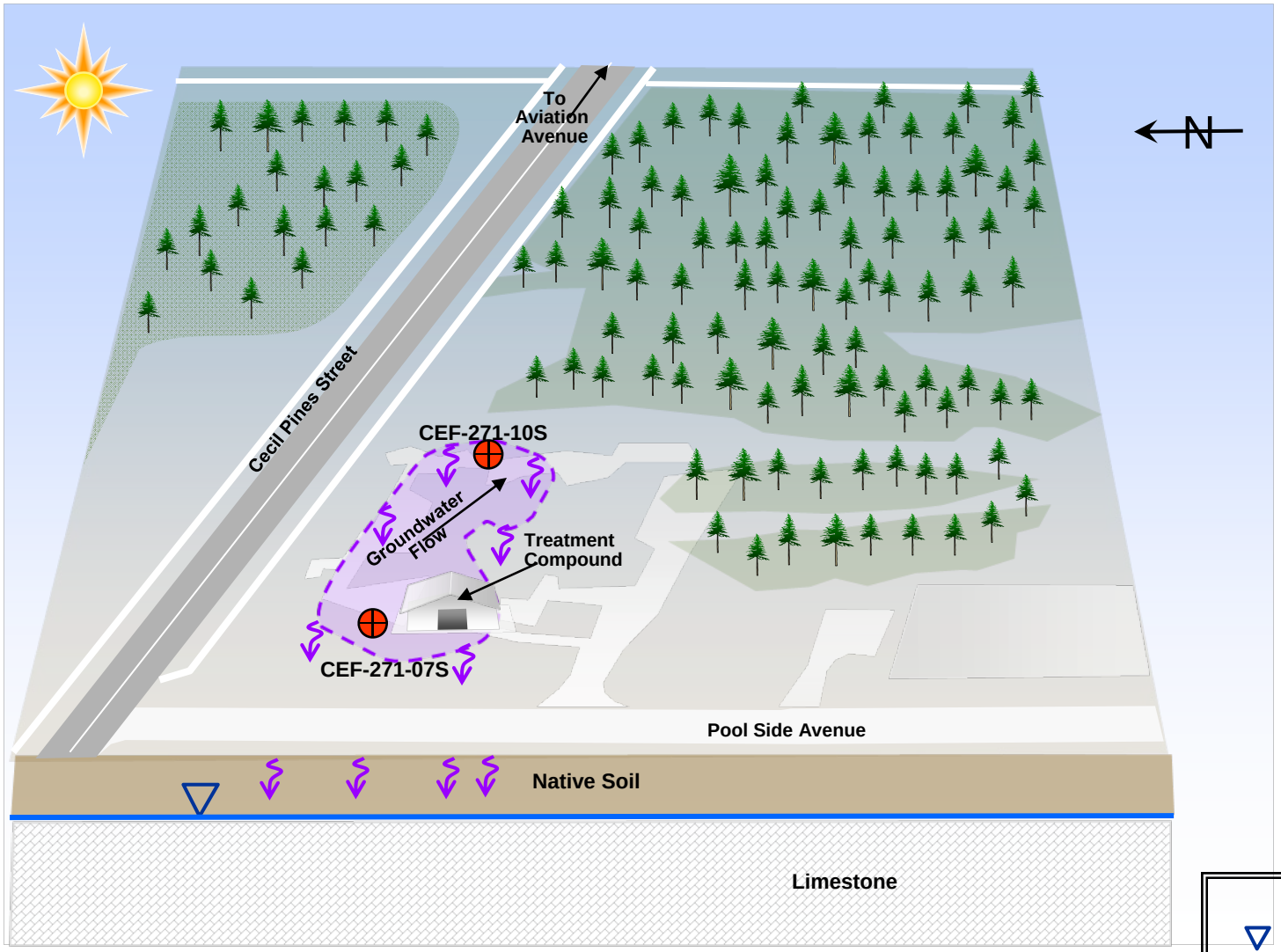


LEGEND

- Water Table
- Plume (depth = 3' to 13' bgs)
- Infiltration
- Source Area Monitoring Well
- Groundwater Flow
- Limestone

DRAWN BY / DATE	NAVFAC	CONCEPTUAL SITE MODEL BUILDING 271 NAVEL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NO. 2267
CHECKED BY / DATE			OWNER NO.
REVISED BY / DATE			APPROVED BY / DATE
SCALE NOT TO SCALE			DRAWING NO. FIGURE 10E-2 / REV.

APPENDIX A

FIELD DOCUMENTATION FORMS and STANDARD OPERATING PROCEDURES

FC 1000. CLEANING / DECONTAMINATION PROCEDURES

1. PERFORMANCE CRITERIA

1.1. The cleaning/decontamination procedures must ensure that all equipment that contacts a sample during sample collection is free from the analytes of interest and constituents that would interfere with the analytes of interest.

1.2. The detergents and other cleaning supplies cannot contribute analytes of interest or interfering constituents unless these are effectively removed during a subsequent step in the cleaning procedure.

1.3. The effectiveness of any cleaning procedure (including all cleaning reagents) must be supported by equipment blanks with reported non-detected values.

The cleaning procedures outlined in this SOP are designed to meet the above-mentioned performance criteria. Alternative cleaning reagents or procedures may be used. However, the organization must be prepared to demonstrate through documentation (i.e., company-written protocols and analytical records) and historical data (i.e., absence of analytes of interest in equipment blanks) that it consistently meets these performance criteria. Field quality control measures (see FQ 1210) must support the use of alternative reagents or procedures.

FC 1001. *Cleaning Reagents*

Recommendations for the types and grades of various cleaning supplies are outlined below. The recommended reagent types or grades were selected to ensure that the cleaned equipment is free from any detectable contamination.

1. DETERGENTS: Use Luminox (or a non-phosphate solvent based equivalent), Liqui-Nox (or a non-phosphate equivalent) or Alconox (or equivalent). EPA recommends Luminox (or equivalent) since solvent rinses can be eliminated from the cleaning process. Liquinox (or equivalent) may be substituted (solvent rinses, when applicable, must be performed), and Alconox (or equivalent) may be substituted if the sampling equipment will not be used to collect phosphorus or phosphorus-containing compounds.

2. SOLVENTS

Note: If the detergent Luminox (or equivalent) is used, solvent rinses are not required.

2.1. Use pesticide grade isopropanol as the rinse solvent in routine equipment cleaning procedures. This grade of alcohol must be purchased from a laboratory supply vendor.

2.2. Other solvents, such as acetone or methanol, may be used as the final rinse solvent if they are pesticide grade. However, methanol is more toxic to the environment and acetone may be an analyte of interest for volatile organics.

2.2.1. **Do not use** acetone if volatile organics are of interest.

2.3. Properly dispose of all wastes according to applicable regulations. Containerize all solvents (including rinsates) for on-site remediation or off-site disposal, as required.

2.4. Pre-clean equipment that is heavily contaminated (see FC 1120, section 3) with organic analytes with reagent grade acetone and hexane or other suitable solvents.

2.5. Use pesticide grade methylene chloride when cleaning sample containers.

2.6. Store all solvents away from potential sources of contamination (gas, copier supplies, etc.).

3. ANALYTE-FREE WATER SOURCES

3.1. Analyte-free water is water in which all analytes of interest and all interferences are below method detection limits.

3.2. Maintain documentation (such as results from equipment blanks) to demonstrate the reliability and purity of analyte-free water source(s).

3.3. The source of the water must meet the requirements of the analytical method and must be free from the analytes of interest. In general, the following water types are associated with specific analyte groups:

- Milli-Q (or equivalent polished water): suitable for all analyses.
- Organic-free: suitable for volatile and extractable organics.
- Deionized water: not suitable for volatile and extractable organics if the analytes of interest are present in concentrations that affect the result.
- Distilled water: not suitable for volatile and extractable organics, metals or ultra-trace metals.

3.4. Use analyte-free water for blank preparation and the final decontamination water rinse.

3.5. In order to minimize long-term storage and potential leaching problems, obtain or purchase analyte-free water just prior to the sampling event. If obtained from a source (such as a laboratory), fill the transport containers and use the contents for a single sampling event. Empty the transport container(s) at the end of the sampling event.

3.6. Discard any analyte-free water that is transferred to a dispensing container (such as a wash bottle) at the end of each sampling day.

4. ACIDS

4.1. Reagent Grade Nitric Acid: 10 - 15% (one volume concentrated nitric acid and five volumes deionized water).

4.1.1. Use for the acid rinse unless nitrogen components (e.g., nitrate, nitrite, etc.) are to be sampled.

4.1.2. If sampling for ultra-trace levels of metals, use an ultra-pure grade acid.

4.2. Reagent Grade Hydrochloric Acid: 10% hydrochloric acid (one volume concentrated hydrochloric and three volumes deionized water).

4.2.1. Use when nitrogen components are to be sampled.

4.3. If samples for both metals and the nitrogen-containing components (see FC 1001, section 4.1.1 above) are collected with the equipment, use the hydrochloric acid rinse, or thoroughly rinse with hydrochloric acid after a nitric acid rinse.

4.4. If sampling for ultra trace levels of metals, use an ultra-pure grade acid.

4.5. Freshly prepared acid solutions may be recycled during the sampling event or cleaning process. Dispose appropriately at the end of the sampling event, cleaning process or if acid is discolored or appears otherwise contaminated (e.g., floating particulates).

4.5.1. Transport only the quantity necessary to complete the sampling event.

4.6. Dispose of any unused acids according to FDEP and local ordinances.

FC 1002. *Reagent Storage Containers*

The contents of all containers must be clearly marked.

1. DETERGENTS: Store in the original container or in a high density polyethylene (HDPE) or polypropylene (PP) container.

2. SOLVENTS

2.1. Store solvents to be used for cleaning or decontamination in the original container until use in the field. If transferred to another container for field use, the container must be either glass or Teflon.

2.2. Use dispensing containers constructed of glass, Teflon, or stainless steel. Note: if stainless steel sprayers are used, any components (including gaskets and transfer lines) that contact the solvents must be constructed of inert materials.

3. ANALYTE-FREE WATER: Transport in containers appropriate to the type of water to be stored. If the water is commercially purchased (e.g., grocery store), use the original containers when transporting the water to the field. Containers made of glass, Teflon, polypropylene, or Polyethylene (PE) are acceptable.

3.1. Use glass, Teflon, polypropylene or PE to transport organic-free sources of water on-site.

3.2. Dispense water from containers made of glass, Teflon, PE or polypropylene.

3.3. Do not store water in transport containers for more than three days before beginning a sampling event.

3.4. Store and dispense acids using containers made of glass, Teflon, PE or polypropylene.

FC 1003. *General Requirements*

1. Before using any equipment, clean/decontaminate all sampling equipment (pumps, tubing, lanyards, split spoons, etc.) that are exposed to the sample.

1.1. Before installing, clean (or obtain as certified precleaned) all equipment that is dedicated to a single sampling point and remains in contact with the sample medium (e.g., permanently installed groundwater pump (see FS 2220, section 3.3.4).

1.2. Clean this equipment any time it is removed for maintenance or repair.

1.3. Replace dedicated tubing if discolored or damaged.

2. Clean all equipment in a designated area having a controlled environment (house, laboratory, or base of field operations) and transport to the field precleaned and ready to use, unless otherwise justified.

3. Rinse all equipment with water after use, even if it is to be field-cleaned for other sites. Rinse equipment used at contaminated sites or used to collect in-process (e.g., untreated or partially treated wastewater) samples immediately with water.

4. Whenever possible, transport sufficient clean equipment to the field so that an entire sampling event can be conducted without the need for cleaning equipment in the field.

5. Segregate equipment that is only used once (i.e., not cleaned in the field) from clean equipment and return to the in-house cleaning facility to be cleaned in a controlled environment.

6. Protect decontaminated field equipment (including well sounders) from environmental contamination by securely wrapping and sealing with one of the following:

6.1. Aluminum foil (commercial grade is acceptable);

6.2. Untreated butcher paper; or

6.3. Clean, untreated, disposable plastic bags. Plastic bags may be used:

- For all analyte groups except volatile and extractable organics;
- For volatile and extractable organics, if the equipment is first wrapped in foil or butcher paper or if the equipment is completely dry.

7. Containerize all solvent rinsing wastes, detergent wastes and other chemical wastes requiring off-site or regulated disposal. Dispose of all wastes in conformance with applicable regulations.

FC 1100. Cleaning Sample Collection Equipment

FC 1110. ON-SITE/IN-FIELD CLEANING

1. Cleaning equipment on-site is not recommended because:

1.1. Environmental conditions cannot be controlled.

1.2. Wastes (solvents and acids) must be containerized for proper disposal.

2. If performed, follow the appropriate cleaning procedure as outlined in FC 1130. Ambient temperature water may be substituted in the hot, sudsy water bath, and hot water rinses.

Note: Properly dispose of all solvents and acids.

3. Rinse all equipment with water after use, even if it is to be field-cleaned for other sites. Rinse equipment used at contaminated sites or used to collect in-process (e.g., untreated or partially treated wastewater) samples immediately with water.

FC 1120. HEAVILY CONTAMINATED EQUIPMENT

In order to avoid contaminating other samples, isolate heavily contaminated equipment from other equipment and thoroughly decontaminate the equipment before further use. Equipment is considered heavily contaminated if it:

- Has been used to collect samples from a source known to contain significantly higher levels than background;
- Has been used to collect free product; or
- Has been used to collect industrial products (e.g., pesticides or solvents) or their by-products.

1. Cleaning heavily contaminated equipment in the field is not recommended.

2. ON-SITE PROCEDURES

2.1. Protect all other equipment, personnel and samples from exposure by isolating the equipment immediately after use.

2.2. At a minimum, place the equipment in a tightly sealed untreated plastic bag.

2.3. Do not store or ship the contaminated equipment next to clean, decontaminated equipment, unused sample containers, or filled sample containers.

2.4. Transport the equipment back to the base of operations for thorough decontamination.

2.5. If cleaning must occur in the field, and in order to document the effectiveness of the procedure, collect and analyze blanks on the cleaned equipment (see FQ 1000).

3. CLEANING PROCEDURES

3.1. If organic contamination cannot be readily removed with scrubbing and a detergent solution, prerinse equipment by thoroughly rinsing or soaking the equipment in acetone.

3.1.1. Do not use solvent soaks or rinses if the material is clear acrylic.

3.1.2. Use hexane only if preceded and followed by acetone.

3.2. In extreme cases, it may be necessary to steam clean the field equipment before proceeding with routine cleaning procedures.

3.3. After the solvent rinses (and/or steam cleaning), use the appropriate cleaning procedure (see FC 1130).

3.3.1. Scrub, rather than soak all equipment with sudsy water.

3.3.2. If high levels of metals are suspected and the equipment cannot be cleaned without acid rinsing, soak the equipment in the appropriate acid. Do not use stainless steel equipment when heavy metal contamination is suspected or present, since stainless steel cannot be exposed to prolonged acid soaks.

3.4. If the field equipment cannot be cleaned utilizing these procedures, discard unless further cleaning with stronger solvents and/or oxidizing solutions is effective as evidenced by visual observation and blanks.

3.5. Clearly mark or disable all discarded equipment to discourage use.

FC 1130. GENERAL CLEANING

Follow these procedures when cleaning equipment under controlled conditions. See FC 1110 for modifications if cleaning is performed on-site. Check manufacturer's instructions for cleaning restrictions and/or recommendations.

FC 1131. *Procedure for Teflon, Stainless Steel and Glass Sampling Equipment*

This procedure must be used when sampling for **ALL** analyte groups: extractable organics, metals, nutrients, etc. or if a single decontamination protocol is desired to clean all Teflon, stainless steel and glass equipment.

1. Rinse equipment with hot tap water.

2. Soak equipment in a hot, sudsy water solution (Liqui-Nox or equivalent - see FC 1001, section 1).

3. If necessary, use a brush to remove particulate matter or surface film.

4. Rinse thoroughly with hot tap water.

5. If samples for trace metals or inorganic analytes will be collected with the equipment and the equipment **is not** stainless steel, thoroughly rinse (wet all surfaces) with the appropriate acid solution (see FC 1001, section 4).

6. Rinse thoroughly with analyte-free water. Use enough water to ensure that all equipment surfaces are thoroughly flushed with water.

7. If samples for volatile or extractable organics will be collected, rinse with isopropanol. Wet equipment surfaces thoroughly with free-flowing solvent. Rinse thoroughly with analyte-free water (see FC 1001, section 3).

8. Allow to air dry. Wrap and seal according to FC 1003, section 6 as soon as the equipment is air-dried.

9. If isopropanol is used, the equipment may be air-dried without the final analyte-free water rinse (see FC 1131, section 8 above); however, **the equipment must be completely dry before wrapping or use**.

10. Wrap clean sampling equipment according to the procedure described in FC 1003, section 6.

FC 1132. *General Cleaning Procedure for Plastic Sampling Equipment*

1. Rinse equipment with hot tap water.

2. Soak equipment in a hot, sudsy water solution (Liqui-Nox or equivalent - see FC 1001, section 1).

3. If necessary, use a brush to remove particulate matter or surface film.

4. Rinse thoroughly with hot tap water.

5. Thoroughly rinse (wet all surfaces) with the appropriate acid solution (see FC 1001, section 4). Check manufacturer's instructions for cleaning restrictions and/or recommendations.

6. Rinse thoroughly with analyte-free water. Use enough water to ensure that all equipment surfaces are thoroughly flushed with water. Allow to air dry as long as possible.

7. Wrap clean sampling equipment according to the procedure described in FC 1003, section 6.

FC 1133. *Cleaning Procedure by Analyte Group*

See Table FC 1000-1 for the procedures to be used to decontaminate equipment based on construction of sampling equipment, and analyte groups to be sampled.

FC 1140. AUTOMATIC SAMPLERS, SAMPLING TRAINS AND BOTTLES

1. When automatic samplers are deployed for extended time periods, clean the sampler using the following procedures when routine maintenance is performed. Inspect deployed samplers prior to each use. At a minimum, change the tubing if it has become discolored or has lost elasticity (FC 1140, section 2.3 below).

2. Clean all automatic samplers (such as ISCO) as follows:

   2.1. Wash the exterior and accessible interior portions of the automatic samplers (excluding the waterproof timing mechanisms) with laboratory detergent (see FC 1001, section 1) and rinse with tap water.

2.2. Clean the face of the timing case mechanisms with a clean, damp cloth.

2.3. Check all tubing (sample intake and pump tubing). Change the tubing every six months (if used frequently) or if it has become discolored (i.e., affected by mold and algae) or if it has lost its elasticity.

2.4. See FC 1160, section 4 for the procedures associated with cleaning the tubing in the pump head.

3. AUTOMATIC SAMPLER ROTARY FUNNEL AND DISTRIBUTOR

3.1. Clean with hot sudsy water and a brush (see FC 1001, section 1 for appropriate detergent type).

3.2. Rinse thoroughly with analyte-free water.

3.3. Air dry.

3.4. Replace in sampler.

4. SAMPLER METAL TUBE: Clean as outlined in FC 1160, section 5.

5. REUSABLE GLASS COMPOSITE SAMPLE CONTAINERS

5.1. If containers are used to collect samples that contain oil, grease or other hard to remove materials, it may be necessary to rinse the container several times with reagent-grade acetone before the detergent wash. If material cannot be removed with acetone, discard the container.

5.2. Wash containers following the procedure outlined in FC 1131 above. End with a final solvent rinse if organics are to be sampled.

5.3. Invert containers to drain and air dry for at least 24 hours.

5.4. Cap with aluminum foil, Teflon film or the decontaminated Teflon-lined lid.

5.5. After use, rinse with water in the field, seal with aluminum foil to keep the interior of the container wet, and return to the laboratory or base of operations.

5.6. **Do not recycle or reuse containers if**:

5.6.1. They were used to collect in-process (i.e., untreated or partially treated) wastewater samples at industrial facilities;

5.6.2. A visible film, scale or discoloration remains in the container after the cleaning procedures have been used; or

5.6.3. The containers were used to collect samples at pesticide, herbicide or other chemical manufacturing facilities that produce toxic or noxious compounds. Such containers must be properly disposed of (preferably at the facility) at the conclusion of the sampling activities.

5.6.4. If the containers described above are reused, check no less than 10% of the cleaned containers for the analytes of interest **before** use. If found to be contaminated, (i.e., constituents of interest are found at method detection levels or higher), then **discard the containers**.

6. REUSABLE PLASTIC COMPOSITE SAMPLE CONTAINERS

6.1. Follow FC 1132.

6.2. Inspect the containers. Determine if the containers can be reused by the criteria in FC 1140, section 5 above.

7. GLASS SEQUENTIAL SAMPLE BOTTLES FOR AUTOMATIC SAMPLER BASED FOR SEQUENTIAL MODE

7.1. Clean glass sequential sample bottles to be used for collecting inorganic samples by using a laboratory dishwasher (see FC 1140, sections 7.1.1 through 7.1.3 below) or manually following the procedures in FC 1131.

7.1.1. Rinse with appropriate acid solution (see FC 1001, section 4).

7.1.2. Rinse thoroughly with tap water.

7.1.3. Wash in dishwasher at wash cycle, using laboratory detergent cycle, followed by tap and analyte-free water rinse cycles.

7.2. Replace bottles in covered, automatic sampler base; cover with aluminum foil for storage.

7.3. Rinse bottles in the field with water as soon as possible after sampling event.

8. Glass Sequential Sample Bottles (Automatic Sampler based for Sequential Mode) to be used for Collecting Samples for Organic Compounds

8.1. Use cleaning procedures outlined in FC 1131. Allow containers to thoroughly air dry before use.

8.2. Replace bottles in covered, automatic sampler base; cover with aluminum foil for storage.

9. BOTTLE SIPHONS USED TO TRANSFER SAMPLES FROM COMPOSITE CONTAINERS

9.1. Rinse tubing with solvent and dry overnight in a drying oven.

9.2. Cap ends with aluminum foil and/or Teflon film for storage.

9.3. Seal in plastic for storage and transport.

9.4. Flush siphon thoroughly with sample before use.

10. REUSABLE TEFLON COMPOSITE MIXER RODS

10.1. Follow procedures outlined in FC 1131.

10.2. Wrap in aluminum foil for storage.

FC 1150. FILTRATION EQUIPMENT

1. Dissolved Constituents using in-line, Molded and Disposable Filter Units

1.1. <u>Peristaltic Pump</u>

1.1.1. Clean the pump following procedures in FC 1170, section 2.2.

1.1.2. Clean the pump head tubing following FC 1160, section 4.

1.1.3. If Teflon tubing is used, clean following the procedures in FC 1160, section 3.

1.1.4. Clean other tubing types such as polyethylene according to the appropriate procedures listed in FC 1160, section 7.

1.2. <u>Other Equipment Types (e.g., pressurized Teflon bailer)</u>

1.2.1. Follow the appropriate cleaning regimen specified in FC 1131 through FC 1132 for other types of equipment that utilize in-line, molded and disposable filters.

2. Dissolved Constituents using Non-disposable Filtration Units (e.g., syringes, "tripod assembly")

2.1. Stainless Steel or Glass Units

2.1.1. Follow FC 1131, assembling and applying pressure to the apparatus after each rinse step (water and acid) to drive rinsing solution through the porous filter holder in the bottom of the apparatus.

2.1.2. Remove and clean any transfer tubing according to the appropriate cleaning procedures (see FC 1160).

2.1.3. Assemble the unit and cap both the pressure inlet and sample discharge lines (or whole unit if a syringe) with aluminum foil to prevent contamination during storage.

2.1.4. If the unit will **not** be used to filter volatile or extractable organics, seal the unit in an untreated plastic bag to prevent contamination.

2.2. Reusable In-Line Filter Holders

2.2.1. Clean, using FC 1131, (if Teflon, glass or stainless steel) or FC 1132 (if plastic) assembling and applying pressure to the apparatus after each rinse step (water and acid) to drive rinsing solution through the porous filter holder in the bottom of the apparatus.

2.2.2. Assemble the unit and wrap with aluminum foil to prevent contamination during storage.

2.2.3. If the unit will **not** be used to filter volatile or extractable organics, seal the unit in an untreated plastic bag to prevent contamination.

3. FILTERS

3.1. Do not clean filters. Instructions for rinsing the filters prior to use are discussed in the applicable sampling SOPs (FS 2000 - FS 8000).

FC 1160. SAMPLE TUBING DECONTAMINATION

1. Check tubing:

1.1. For discoloration: Remove discolored tubing from use until it can be cleaned. If the discoloration cannot be removed, discard the tubing.

1.2. For elasticity (if used in a peristaltic-type pump): Discard any tubing that has lost its elasticity.

2. Transport all tubing to the field in precut, **precleaned** sections.

3. TEFLON, POLYETHYLENE AND POLYPROPYLENE TUBING

3.1. New Tubing: Follow this procedure unless the manufacturer/supplier provides certification that the tubing is clean.

3.1.1. Teflon

3.1.1.1. Rinse outside of tubing with pesticide-grade solvent (see FC 1001, section 2).

3.1.1.2. Flush inside of tubing with pesticide-grade solvent.

3.1.1.3. Dry overnight in drying oven or equivalent (zero air, nitrogen, etc.).

3.1.2. Polyethylene and Polypropylene

3.1.2.1. Clean the exterior and interior of the tubing by soaking in hot, sudsy water.

3.1.2.2. Thoroughly rinse the exterior and interior of the tubing with tap water, followed by analyte-free water.

3.2. Reused Tubing

Use the following procedure for in-lab cleaning. **Field cleaning is not recommended**:

3.2.1. Clean the exterior of the tubing by soaking in hot, sudsy water (see FC 1001, section 1) in a stainless steel sink (or equivalent non-contaminating material). Use a brush to remove any particulates, if necessary.

3.2.2. Use a small bottle brush and clean the inside of the tubing ends where the barbs are to be inserted or cut 1-2 inches from the ends of the tubing after cleaning.

3.2.3. Rinse tubing exterior and ends liberally with tap water.

3.2.4. Rinse tubing surfaces and ends with the appropriate acid solution (see FC 1001, section 4), tap water, isopropanol (see FC 1001, section 2), and finally analyte-free water.

3.2.4.1. Note: Eliminate the isopropanol rinse for polyethylene or polypropylene tubing.

3.2.5. Place tubing on fresh aluminum foil or clean polyethylene sheeting. Connect all of the precut lengths of tubing with Teflon inserts or barbs.

3.2.6. Cleaning configuration:

3.2.6.1. Place cleaning reagents: [sudsy water (see FC 1001, section 1); acid (see FC 1001, section 4); isopropanol (see FC 1001, section 2)] in an appropriately cleaned container (2-liter glass jar is recommended).

3.2.6.2. Place one end of the Teflon tubing into the cleaning solution.

3.2.6.3. Attach the other end of the Teflon tubing set to the influent end of a pump.

3.2.6.4. Recycle the effluent from the pump by connecting a length of Teflon tubing from the effluent to the glass jar with the cleaning reagents.

3.2.6.5. Recycling as described above may be done for all reagents listed in FC 1160, section 3.2.6.1 above, **except** the final isopropanol rinse and the final analyte-free water rinse. Disconnect the tubing between the effluent end of the pump and the jar of cleaning reagents.

3.2.6.6. Containerize isopropanol in a waste container for proper disposal.

3.2.6.7. Analyte-free water may be discarded down the drain.

3.2.7. Using the above configuration described in FS 1160, section 3.2.6 above:

3.2.7.1. Pump hot, sudsy water through the connected lengths. Allow the pump to run long enough to pump at least three complete tubing volumes through the tubing set.

3.2.7.2. Using the same procedure, successively pump tap water, the acid solution(s), tap water, isopropanol, and finally analyte-free water through the system.

3.2.7.3. Leave the Teflon inserts or barbs between the precut lengths and cap or connect the remaining ends.

3.2.8. After the interior has been cleaned as described in FC 1160, section 3.2.7 above, rinse the exterior of the tubing with analyte-free water.

3.2.9. Wrap the connected lengths in aluminum foil or untreated butcher paper and store in a clean, dry area until use.

4. Flexible Tubing used in Pump Heads of Automatic Samplers and other Peristaltic Pumps

Replace tubing after each sampling point if samples are collected through the tubing. Unless the pump is deployed to collect samples from the same location over a long period of time, remove and wash the tubing after each sampling event (see FC 1140, section 1).

4.1. Flush tubing with hot tap water then sudsy water (see FC 1001, section 1).

4.2. Rinse thoroughly with hot tap water.

4.3. Rinse thoroughly with analyte-free water.

4.4. If used to collect metals samples, flush the tubing with an appropriate acid solution (see FC 1001, section 4), followed by thorough rinsing with analyte-free water. If used to collect both metals and nitrogen components use hydrochloric acid (see FC 1001, section 4.1.1).

4.5. Install tubing in peristaltic pump or automatic sampler.

4.6. Cap both ends with aluminum foil or equivalent.

Note: Change tubing at specified frequencies as part of routine preventative maintenance.

5. STAINLESS STEEL TUBING

Clean the exterior and interior of stainless steel tubing as follows:

5.1. Using sudsy water (see FC 1001, section 1), scrub the interior and exterior surfaces.

5.2. Rinse with hot tap water.

5.3. Rinse with analyte-free water.

5.4. If volatile or extractable organics are to be sampled, rinse all surfaces with isopropanol (see FC 1001, section 2). Use enough solvent to wet all surfaces with free flowing solvent.

5.5. Allow to air dry or thoroughly rinse with analyte-free water.

6. GLASS TUBING

6.1. Use new glass tubing.

6.2. If volatile or extractable organics are to be sampled, rinse with isopropanol (see FC 1001, section 2).

6.3. Air dry for at least 24 hours.

6.4. Wrap in aluminum foil or untreated butcher paper to prevent contamination during storage.

6.5. Discard tubing after use.

7. MISCELLANEOUS NON-INERT TUBING TYPES (TYGON, RUBBER, PVC, ETC.)

7.1. New Tubing

7.1.1. As a general rule, new tubing may be used without preliminary cleaning.

7.1.2. Protect new tubing from potential environmental contamination by wrapping in aluminum foil and sealing in untreated plastic bags or keep in the original sealed packaging until use.

7.1.3. If new tubing is exposed to potential contamination, rinse the exterior and interior tubing surfaces with hot tap water followed by a thorough rinse with analyte-free water.

7.1.4. If new tubing is to be used to collect samples, thoroughly rinse the tubing with sample water (i.e., pump sample water through the tubing) before collecting samples.

7.2. Reused Tubing

7.2.1. Flush tubing with sudsy solution of hot tap water and laboratory detergent (see FC 1001, section 1).

7.2.2. Rinse exterior and interior thoroughly with hot tap water.

7.2.3. Rinse exterior and interior thoroughly with analyte-free water.

7.2.4. If used to collect only metals samples, flush the tubing with nitric acid (see FC 1001, section 4.1), followed by a thorough rinse with analyte-free water.

7.2.5. If used to collect metals and nitrogen-containing compounds, see FC 1001, section 4.3.

7.2.6. Cap ends in aluminum foil and store in clean, untreated plastic bags to prevent contamination during storage and transport.

FC 1170. PUMPS

1. SUBMERSIBLE PUMPS

1.1. Pumps used for Purging and Sampling Metals and/or Volatile and Extractable Organics

1.1.1. Construction of pump body and internal mechanisms (bladders, impellers, etc.), including seals and connections, must follow Tables FS 1000-1, FS 1000-2 and FS 1000-3.

1.1.2. Tubing material must follow Tables FS 1000-1, FS 1000-2 and FS 1000-3.

1.1.3. Clean pump exterior following FC 1132. Note: omit the solvent rinse if the pump body is constructed of plastic (e.g., ABS, PVC, etc.).

1.1.4. Clean the pump internal cavity and mechanism as follows:

1.1.4.1. If used only for purging, thoroughly flush the pump with water before purging the next well.

1.1.4.2. When used for purging and sampling, completely disassemble the pump (if practical) and decontaminate between each well.

1.1.4.3. When used for purging and sampling and the pump cannot be (practicably) disassembled, then clean the internal cavity/mechanism by pumping

several gallons of sudsy water (see FC 1001, section 1), followed by several gallons of tap water, and finally, several gallons of analyte-free water.

1.1.4.4. If multiple sampling points are located in an area that is not accessible by a vehicle, and it is difficult to return to the vehicle for cleaning or to transport all cleaning materials to the staging location, at a minimum thoroughly rinse the pump with water.

1.1.5. Refer to FC 1160, section 3 to clean Teflon tubing.

1.1.6. Refer to FC 1160, section 5 for stainless steel tubing.

1.1.7. Clean other types of tubing according to FC 1160, sections 6 and 7.

1.2. Pumps used for Purging and Sampling all Analytes except Metals, Volatile and Extractable Organics

1.2.1. Pump construction: no restrictions.

1.2.2. Pump tubing material: no restrictions.

1.2.3. Scrub the exterior of the pump with appropriate metal-free, phosphate-free or ammonia-free detergent solution.

1.2.4. Rinse the exterior with tap water and analyte-free water.

1.2.5. Rinse the interior of the pump and tubing by pumping tap or analyte-free water through the system using a clean bucket or drum.

2. ABOVE-GROUND PUMPS USED FOR PURGING AND SAMPLING

2.1. Pumps used only for Purging

2.1.1. The exterior of the pump must be free of oil and grease.

2.1.2. Select tubing according to Tables FS 1000-1, FS 1000-2 and FS 1000-3.

2.1.3. Clean the tubing that contacts the formation water according to the appropriate protocol for construction materials specified in FC 1160.

2.2. Pumps used for Sampling

2.2.1. Clean the exterior of the pump with a detergent solution followed by a tap water rinse. Use clean cloths or unbleached paper towels that have been moistened with the appropriate solution to wipe down the pump.

2.2.2. Select tubing according to Tables FS 1000-1, FS 1000-2 and FS 1000-3.

2.2.3. Clean the tubing that contacts the formation water according to the appropriate protocol for construction materials specified in FC 1160.

FC 1180. ANALYTE-FREE WATER CONTAINERS

This section pertains to containers that are purchased to transport, store and dispense analyte-free water. It does not apply to water that has been purchased in containers. See FC 1002, section 3 for appropriate construction materials.

1. NEW CONTAINERS

1.1. Wash containers and caps according to FC 1131, omitting the solvent rinse if plastic (polyethylene or polypropylene) containers are being cleaned.

1.2. Cap with Teflon film or the bottle cap. The bottle cap must be composed of the same material as the container and cannot be lined.

2. REUSED CONTAINERS

2.1. Immediately after emptying, cap with aluminum foil, Teflon film or the container cap.

2.2. Wash the exterior of the container with lab-grade detergent solution (see FC 1001, section 1) and rinse with analyte-free water.

2.3. Rinse the interior thoroughly with analyte-free water.

2.4. Invert and allow to drain and dry.

FC 1190. ICE CHESTS AND SHIPPING CONTAINERS

1. Wash the exterior and interior of all ice chests with laboratory detergent (see FC 1001, section 1) after each use.

2. Rinse with tap water and air dry before storing.

3. If the ice chest becomes severely contaminated with concentrated waste or other toxic or hazardous materials clean as thoroughly as possible, render unusable, and properly dispose.

FC 1200. Field Instruments and Drilling Equipment

FC 1210. FIELD INSTRUMENTS (TAPES, METERS, ETC.)

Follow manufacturer's recommendations for cleaning instruments. At a minimum:

1. Wipe down equipment body, probes, and cables with lab-grade detergent solution (see FC 1001, section 1). Check manufacturer's instructions for recommendations and/or restrictions on cleaning.

2. Rinse thoroughly with tap water.

3. Rinse thoroughly with analyte-free water.

4. Store equipment according to the manufacturer's recommendation or wrap equipment in aluminum foil, untreated butcher paper or untreated plastic bags to eliminate potential environmental contamination.

FC 1220. SOIL BORING EQUIPMENT

This section pertains only to equipment that is not used to collect samples. Clean split spoons, bucket augers and other sampling devices according to FC 1131.

1. Remove oil, grease, and hydraulic fluid from the exterior of the engine and power head, auger stems, bits and other associated equipment with a power washer or steam jenny or wash by hand with a brush and sudsy waster (no degreasers).

2. Rinse thoroughly with tap water.

FC 1230. WELL CASING CLEANING

These are recommended procedures for cleaning well casing and riser pipes. Use procedures specified by a FDEP contract, order, permit, or rule, if different or more stringent than the procedures outlined below.

1. FDEP recommends only using casing that is designed for subsurface environmental groundwater monitoring.

2. Casing that has been contaminated with grease, hydraulic fluid, petroleum fuel, etc. may require additional cleaning or deemed unusable.

3. All casings and riser pipes should be cleaned before installation, unless the casing is received wrapped and ready for installation:

3.1. Steam clean all casings and riser pipes except PVC. Steam cleaning criteria shall meet the following: water pressure - 2500 psi; water temperature - 200°F.

3.2. Rinse thoroughly with tap (potable) water. This tap water must be free of the analytes of interest.

FC 1300. Sample Containers

FC 1310. OBTAINING CLEAN CONTAINERS

1. Obtain clean sample containers in one of three ways:

1.1. From commercial vendors as precleaned containers. The cleaning grades must meet EPA analyte specific requirements. Keep all records for these containers (lot numbers, certification statements, date of receipt, etc.) and document the container's intended uses;

1.2. From internal groups within the organization that are responsible for cleaning and maintaining containers according to the procedures outlined in FC 1320; or

1.3. From a subcontracted laboratory that is accredited under the National Environmental Laboratory Accreditation Program (NELAP).

1.3.1. The contractor must verify that the laboratory follows the container cleaning procedures outlined in FC 1320.

1.3.2. If the laboratory cleaning procedures are different, the contractor must require that the laboratory use the following cleaning procedures or provide documentation and historical records to show that their in-house procedure produces containers that are free from the analytes of interest.

FC 1320. CONTAINER CLEANING PROCEDURES

1. Refer to Table FC 1000-2. Follow the cleaning steps in the order specified in the chart.

2. Cleaning procedures that are different from those outlined in FC 1320 may be used as long as blanks collected in the containers are free from the analytes of interest and any analytical interferences and the cleaning procedures are supported by historical and continuing documentation.

3. Inspect all containers before cleaning.

3.1. **Do not recycle or reuse containers if**:

3.1.1. Containers were used to collect in-process (i.e., untreated or partially treated) wastewater samples at industrial facilities;

3.1.2. A visible film, scale or discoloration remains in the container after the cleaning procedures have been used; or

3.1.3. Containers were used to collect samples at pesticide, herbicide or other chemical manufacturing facilities that produce toxic or noxious compounds. Such containers shall be properly disposed of (preferably at the facility) at the conclusion of the sampling activities.

3.1.4. If the containers described above are reused, check no less than 10% of the cleaned containers for the analytes of interest before use. If found to be contaminated (i.e., analytes of interest are found at MDL levels or higher), discard the containers.

FC 1400. Documentation

Document cleaning procedures described below for the indicated activities. See FD 1000 for additional information about required records and retention of documents.

FC 1410. FIELD EQUIPMENT

1. IN-FIELD CLEANING

   1.1. Initially identify the procedures that are used to clean equipment in the field by SOP numbers and dates of usage.

   1.2. Record the date and time that equipment was cleaned.

2. IN-HOUSE CLEANING

   2.1. Retain any cleaning certificates, whether from a laboratory or commercial vendor.

   2.2. Identify the procedure(s) that are used to clean equipment by the SOP number and dates of usage.

   2.3. Record the date that the equipment was cleaned.

FC 1420. SAMPLE CONTAINERS

1. Organizations that order precleaned containers must retain the packing slips, and lot numbers of each shipment, any certification statements provided by the vendor and the vendor cleaning procedures.

2. Organizations that clean containers must maintain permanent records of the following:

   2.1. Procedure(s) used to clean containers by SOP number and dates of usage.

   2.2. If containers are certified clean by the laboratory the laboratory must record:

   - Type of container;
   - Date cleaned;
   - SOP used;
   - Person responsible for cleaning;
   - Lot number (date of cleaning may be used) of the batch of containers that were cleaned using the same reagent lots and the same procedure;
   - The results of quality control tests that were run on lot numbers; and
   - Any additional cleaning or problems that were encountered with a specific lot.

FC 1430. REAGENTS AND OTHER CLEANING SUPPLIES

Maintain a record of the lot number with the inclusive dates of use for all acids, solvents, and other cleaning supplies.

Appendix FC 1000
Tables, Figures and Forms

Table FC 1000-1 Procedures for Decontamination at the Base of Operations or On-site

Table FC 1000-2 Container Cleaning Procedures

Table FC 1000-1
Procedures for Decontamination at the Base of Operations or On-Site

Construction Material	Analyte Group Sampled	SOP Reference	Base of Operations	On-Site
Teflon or Glass	All	FC 1131	Follow as written	May substitute ambient temperature water for the hot water rinses and hot detergent solution
	Extractable & Volatile Organics Petroleum Hydrocarbons		May omit acid rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution May omit acid rinse
	Metals[1] Radionuclides For ultra trace metals, refer to FS 8200		May omit solvent rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution May omit solvent rinse
	Inorganic Nonmetallics Physical & Aggregate Properties Aggregate Organics Biologicals Volatile Inorganics		May omit solvent rinse	Rinse several times with water Rinse several times with sample water from the next sampling location
	Microbiological – Viruses Microbiological - Bacteria		Omit solvent and acid rinses	Rinse several times with water Rinse several times with sample water from the next sampling location
Metallic (stainless steel, brass, etc.)	All Extractable & Volatile Organics Petroleum Hydrocarbons	FC 1131	Omit the acid rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution Omit the acid rinse
	Metals Radionuclides		Omit the acid rinse May omit the solvent rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution Omit the acid rinse May omit the solvent rinse
	Inorganic Nonmetallics Physical & Aggregate Properties Aggregate Organics Biologicals Volatile Inorganics		Omit solvent rinse May omit the acid rinse	Rinse several times with water Rinse several times with sample water from the next sampling location

Table FC 1000-1
Procedures for Decontamination at the Base of Operations or On-Site

Construction Material	Analyte Group Sampled	SOP Reference	Base of Operations	On-Site
	Microbiological – Viruses Microbiological - Bacteria		Omit solvent and acid rinses	Rinse several times with water Rinse several times with sample water from the next sampling location
Plastic (Polyethylene, polypropylene, PVC, silicone, acrylic	Volatile and Extractable Organics;	FC 1132	Follow as written.	May substitute ambient temperature water for the hot water rinses and hot detergent solution
	Inorganic Nonmetallics Physical & Aggregate Properties Aggregate Organics Biologicals Volatile Inorganics		May omit the acid rinse	Rinse several times with water Rinse several times with sample water from the next sampling location
	Microbiological – Viruses Microbiological - Bacteria		Omit acid rinse	Rinse several times with water Rinse several times with sample water from the next sampling location

[i] Do not use glass if collecting samples for boron or silica.

Table FC 1000-2
Container Cleaning Procedures

ANALYSIS / ANALYTE GROUP	CLEANING STEPS See Description Below
Extractable Organics	1, 2, 4, 6 (not required if Luminox (or equivalent is used), (5 and 7 optional), 11
Volatile Organics	1, 2, 4, (6 optional, methanol only), 7
Metals	1, 2, 3, 4, 8, 11 ** **Procedures to clean containers for ultra-trace metals are found in FS 8200
Inorganic Nonmetallics, Radionuclides, Physical and Aggregate Properties, Aggregate Inorganics, and Volatile Inorganics	1, 2, 3*, 4, 8, 11 * For nutrients, replace nitric acid with hydrochloric acid, or use a hydrochloric acid rinse after the nitric acid rinse. See FC 1001, section 4
Petroleum Hydrocarbons, and Oil and Grease	1, 2, 3, 4, (5, 6, 7 optional), 11
Microbiological (all)	1, 2, 4, 8, 9, 11
Toxicity Tests (Includes Bioassays)	1, 2, 10, 2, 4, 6.1, (10 optional), 11

NOTE: Steps 1 and 2 may be omitted when cleaning new, uncertified containers.

1. Wash with hot tap water and a brush using a suitable laboratory-grade detergent:

   1.1. Volatile and Extractable Organics, Petroleum Hydrocarbon, Oil and Grease: Luminox, Liqui-Nox, Alconox or equivalent;

   1.2. Inorganic nonmetallics: Liqui-Nox or equivalent;

   1.3. Metals: Liqui-Nox, Acationox, Micro or equivalents:

   1.4. Microbiologicals (all): Must pass an inhibitory residue test.

2. Rinse thoroughly with hot tap water.
3. Rinse with 10% nitric acid solution.
4. Rinse thoroughly with analyte-free water (deionized or better).
5. Rinse thoroughly with pesticide-grade methylene chloride.
6. Rinse thoroughly with pesticide-grade isopropanol, acetone or methanol.

   6.1. For bioassays, use only acetone, and only when containers are glass.

7. Oven dry at 103°C to 125°C for at least 1 hour.

Table FC 1000-2
Container Cleaning Procedures

7.1. VOC vials and containers must remain in the oven in a contaminant-free environment until needed. They should be capped in a contaminant-free environment just prior to dispatch to the field.

8. Invert and air-dry in a contaminant-free environment.

9. Sterilize containers:

9.1. Plastic: 60 min at 170°C, loosen caps to prevent distortion.

9.2. Glass: 15 min at 121°C.

10. Rinse with 10% hydrochloric acid followed by a sodium bicarbonate solution.

11. Cap tightly and store in a contaminant-free environment until use. Do not use glass if collecting samples for boron or silica.

FS 2200. Groundwater Sampling

1. INTRODUCTION AND SCOPE

1.1 Use these Standard Operating Procedures to collect groundwater samples. They are designed to ensure that the collected samples will be representative of water in the aquifer or target formation and that the samples have not been altered or contaminated by the sampling and handling procedures. These procedures apply to permanently and temporarily installed monitoring wells, wells constructed using "direct-push" techniques, wells with installed plumbing, remedial groundwater treatment systems and excavations where groundwater is present. Use of alternative, DEP-approved and properly documented procedures (e.g., Corporate SOP, ASTM Standards, alternative equipment, etc.) is acceptable if they meet the intent (e.g., sample representativeness and integrity) of this standard (see FA 1000).

1.2 The topics in this SOP include equipment and supply selection, equipment construction materials, and purging and sampling techniques.

1.3 Use the following DEP SOPs in conjunction with FS 2200:

- FA 1000 Regulatory Scope and Administrative Procedures for Use of DEP SOPs
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000 Documentation Procedures
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FS 2000 General Aqueous Sampling
- FT 1000 Field Testing and Measurement
- FT 1100 Field pH
- FT 1200 Field Specific Conductance
- FT 1400 Field Temperature
- FT 1500 Field Dissolved Oxygen
- FT 1600 Field Turbidity

2. Groundwater samples may be collected from a number of different configurations. Each configuration is associated with a unique set of sampling equipment requirements and techniques:

3. Wells without Plumbing: These wells require that equipment be brought to the well to purge and sample unless dedicated equipment is placed in the well.

4. Wells with In-Place Plumbing: Wells with in-place plumbing do not require that equipment be brought to the well to purge and sample. In-place plumbing is generally considered permanent equipment routinely used for purposes other than purging and sampling, such as for water supply. They are generally found at wellfields, industrial facilities, and private residences. See FS 2300 for procedures to sample potable water wells. Air Strippers or Remedial Systems: These types of systems are installed as remediation devices. Sample these wells like drinking water wells (see FS 2300).

FS 2201 *Equipment and Supplies*

Use groundwater purging and sampling equipment constructed of only non-reactive, non-leachable materials that are compatible with the environment and the selected analytes. In selecting groundwater purging and sampling equipment, give consideration to the depth of the well, the depth to groundwater, the volume of water to be evacuated, the sampling and purging technique, and the analytes of interest. Refer to Tables FS 1000-1, FS 1000-2, FS 1000-3 and FS 2200-1 for selection of appropriate equipment.

Additional supplies such as reagents, preservatives, and field measurement equipment are often necessary.

1. FLOW CONTAINER: DEP recommends using a flow-through cell or container when collecting measurements for purging stabilization. The design must ensure that fresh formation water continuously contacts the measuring devices and does not aerate the sample or otherwise affect the groundwater properties.

2. PUMPS: All pumps or pump tubing must be lowered and retrieved from the well slowly and carefully to minimize disturbance to the formation water. This is especially critical at the air/water interface. Avoid the resuspension of sediment particles (turbidity) at the bottom of the well or adhered to the well casing during positioning of the pump or tubing.

2.1 Above-Ground Pumps

2.1.1 Variable Speed Peristaltic Pump: Use a variable speed peristaltic pump to purge groundwater from wells when the static water level in the well is no greater than 20-25 feet below land surface (BLS). If the water levels are deeper than 18-20 feet BLS, the pumping velocity will decrease.

2.1.1.1 A variable speed peristaltic pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.1.1.2 Most analyte groups can be sampled with a peristaltic pump if the tubing and pump configurations are appropriate. See Table FS 1000-3 for proper tubing selection and pump configurations.

2.1.2 Variable Speed Centrifugal Pump: A variable speed centrifugal pump can be used to purge groundwater from 2-inch and larger internal diameter wells. Do not use this type of pump to collect groundwater samples.

2.1.2.1 When purging is complete, do not allow the water that remains in the tubing to fall back into the well. Install a check valve at the end of the purge tubing, and withdraw the tubing slowly from the well while the pump is still running.

2.1.2.2 See Table FS 1000-3 for proper tubing selection and allowable analyte groups.

2.2 Submersible Pumps

2.2.1 Variable Speed Electric Submersible Pump: A variable speed submersible pump can be used to purge and sample groundwater from 2-inch and larger internal diameter wells.

2.2.1.1 A variable speed submersible pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or

formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.2.1.2 Make sure that the pump housing, fittings, check valves and associated hardware are constructed of stainless steel. Make sure that any other materials are compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

2.2.1.3 Install a check valve at the output side of the pump to prevent backflow.

2.2.1.4 If purging and sampling for organics:

- The entire length of the delivery tube must be Teflon, Polyethylene or Polypropylene (PP) tubing.
- The electrical cord must be sealed in Teflon, Polyethylene or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or be constructed of stainless steel.
- All interior components that contact the sample water (impeller, seals, gaskets, etc.) must be constructed of stainless steel or Teflon.

2.2.2 Variable Speed Bladder Pump: A variable speed positive displacement bladder pump (no-gas contact) can be used to purge and sample groundwater from 3/4-inch and larger internal diameter wells.

2.2.2.1 A variable speed bladder pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.2.2.2 The bladder pump system is composed of the pump, the compressed air tubing, the water discharge tubing, the controller and a compressor or compressed gas supply.

2.2.2.3 The pump consists of a bladder and an exterior casing or pump body that surrounds the bladder and two (2) check valves. These parts can be composed of various materials, usually combinations of polyvinyl chloride (PVC), Teflon, Polyethylene, PP and stainless steel. Other materials must be compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

2.2.2.4 If purging and sampling for organics:

- The pump body must be constructed of stainless steel and the valves and bladder must be Teflon, Polyethylene or PP
- The entire length of the delivery tube must be Teflon, Polyethylene or PP.
- Any cabling must be sealed in Teflon Polyethylene or PP, or be constructed of stainless steel.
- Permanently installed pumps may have a PVC pump body as long as the pump remains in contact with the water in the well.

3. BAILERS:

3.1 Purging: DEP does not recommend using bailers for purging unless no other equipment can be used or purging with a bailer has been specifically authorized by a DEP program, permit, contract or order (see Table FS 2200-3). Use a bailer if there is non-aqueous phase liquid (free product) in the well or non-aqueous phase liquid is suspected to

be in the well. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager. If a bailer is used, follow FS 2213, section 4, with no deviations.

3.2 Sampling: Bailers may be used to routinely collect some analyte groups or under specific circumstances for other analyte groups (see Table FS 2200-3).

3.3 Construction and Type:

3.3.1 Bailers must be constructed of materials compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

3.3.2 Stainless steel, Teflon, Polyethylene and PP bailers may be used to sample all analytes.

3.3.3 Use disposable bailers when sampling grossly contaminated sample sources.

3.3.4 DEP recommends using dual check valve bailers when collecting samples.

3.3.5 Use bailers with a controlled flow bottom when collecting volatile organic samples.

3.3.6 Use bailers that can be pressurized when collecting filtered samples for metals.

3.4 Contamination Prevention:

3.4.1 Keep the bailer wrapped (foil, butcher paper, etc.) until just before use.

3.4.2 Use protective gloves to handle the bailer once it is removed from its wrapping.

3.4.3 Handle the bailer by the lanyard to minimize contact with the bailer surface.

4. LANYARDS

4.1 Lanyards must be made of non-reactive, non-leachable material such as cotton twine, nylon, or stainless steel; or, coated with Teflon, Polyethylene or PP.

4.1.1 Evaluate the appropriateness of the lanyard material with analyses of equipment blanks for the analytes of interest, as necessary.

4.2 Discard cotton twine, nylon, and non-stainless steel braided lanyards after sampling each monitoring well.

4.3 Decontaminate stainless steel, coated Teflon, Polyethylene and PP lanyards between monitoring wells (see FC 1003). They do not need to be decontaminated between purging and sampling operations.

4.4 Securely fasten lanyards to downhole equipment (bailers, pumps, etc.).

4.5 Do not allow lanyards used for downhole equipment to touch the ground surface.

FS 2210. GROUNDWATER PURGING

Perform procedures in the following sections to calculate purging parameters and to purge groundwater from monitoring wells, wells with installed plumbing, high-volume wells, air stripper systems and other remedial treatment systems.

FS 2211 *Water Level and Purge Volume Determination*

Collect representative groundwater samples from the aquifer. The amount of water that must be purged from a well is determined by the volume of water and/or field parameter stabilization.

1. GENERAL EQUIPMENT CONSIDERATIONS

1.1 Selection of appropriate purging equipment depends on the analytes of interest, the well diameter, transmissivity of the aquifer, the depth to groundwater and other site conditions.

1.2 Use a pump to purge the well.

1.3 Use a bailer if there is non-aqueous phase liquid in the well or non-aqueous phase liquid is suspected to be in the well.

1.4 Bailers may be used if approved by a DEP program, or if bailer use is specified in a permit, contract or DEP order (see Table FS 2200-3). If used, bailers must be of appropriate type and construction, and the user must follow the procedure outlined in FS 2213, section 4, with no deviations. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager. DEP does not recommend using bailers because improper bailing:

1.4.1 Introduces atmospheric oxygen which precipitates metals (i.e., iron) or causes other changes in the chemistry of the water in the sample (i.e., pH)

1.4.2 Agitates groundwater which biases volatile and semi-volatile organic analyses due to volatilization

1.4.3 Agitates the water in the aquifer and resuspends fine particulate matter

1.4.4 Surges the well, loosening particulate matter in the annular space around the well screen

1.4.5 Introduces dirt into the water column if the sides of the casing wall are scraped

2. INITIAL INSPECTION

2.1 Verify the identification of the monitoring well by examining markings, sign plates, placards or other designations.

2.2 Remove the well cover and remove all standing water around the top of the well casing (manhole) before opening the well cap.

2.3 Inspect the exterior protective casing of the monitoring well for damage and document the results of the inspection if there is a problem.

2.4 It is recommended that you place a protective covering around the well head. Replace the covering if it becomes soiled or ripped.

2.5 Inspect the well lock and determine whether the cap fits tightly. Replace the cap if necessary.

3. WATER LEVEL MEASUREMENTS: Use an electronic probe or chalked tape to determine the water level.

3.1 General Procedures

Perform these steps using either the electronic probe or chalked tape method.

3.1.1 Decontaminate all equipment that will contact the groundwater in the well before use.

3.1.2 Measure the depth to groundwater from the top of well casing to the nearest 0.01 foot and always measure from the same reference point or survey mark on the well casing. If there is no reference mark, measure from the north side of the casing.

3.1.3 Record the measurement and the reference point.

3.2 Electronic Probe

3.2.1 Follow the manufacturer's instructions for use.

3.2.2 Record the measurement.

3.3 Chalked Line Method: This method is not recommended if collecting samples for organic or inorganic parameters.

3.3.1 Lower chalked tape into the well until the lower end is in the water (usually determined by the sound of the weight hitting the water).

3.3.2 Record the length of the tape relative to the reference point (see section 3.2 above).

3.3.3 Quickly remove the tape from the well.

3.3.4 Record the length of the wetted portion to the nearest 0.01 foot.

3.3.5 Determine the depth to water by subtracting the length of the wetted portion (see section 3.5.3 above) from the total length (see section 3.5.2 above). Record the result.

4. WATER COLUMN DETERMINATION

4.1 Do not determine the total depth of the well by lowering the probe to the bottom of the well immediately before purging and sampling. If the well must be sounded, delay purging and sampling activities for at least 24 hours after the well was sounded or for a time sufficient to meet the purge stabilization criterion for turbidity. Alternatively, collect samples before sounding the well.

4.2 Subtract the depth to the top of the water column from the total well depth to determine the length of the water column.

4.3 The total well depth depends on the well construction. Some wells may be drilled in areas of sinkhole or karst formations or rock leaving an open borehole. Attempt to find the total borehole depth in cases where there is an open borehole below the cased portion.

5. WELL WATER VOLUME

5.1 Calculate the total volume of water in gallons in the well using the following equation:

V = (0.041)d x d x h

Where: V = volume in gallons

d = well diameter in inches

h = height of the water column in feet

5.2 The total volume of water in the well may also be determined with the following equation by using a casing volume per foot factor (Gallons per Foot of Water) for the appropriate diameter well:

V = [Gallons per Foot of Water] x h

Where: V = volume in gallons

h = height of the water column in feet

Casing Internal Diameter	Approximate Gallons per Foot of Water
0.75”	0.02
1”	0.04
1.25”	0.06
2”	0.16
3”	0.37
4”	0.65
5”	1.02
6”	1.47
12”	5.88

5.3 Record all measurements and calculations in the field records.

6. Purging Equipment Volume

Calculate the total volume of the pump, associated tubing and container that is used for in situ measurements (flow container), if used, using the following equation:

V = p + ((0.041)d x d x l) + fc

Where: V = volume in gallons

p = volume of pump in gallons

d = tubing diameter in inches

l = length of tubing in feet

fc = volume of flow cell in gallons

7. When collecting samples from multiple wells on a site, if the groundwater elevation data are to be used to construct groundwater elevation contour maps, all water level measurements must be taken within the same 24-hour time interval unless a shorter time period is required by a DEP program. If the site is tidally influenced, complete the water level measurements within the time frame of an incoming or outgoing tide.

FS 2212 *Well Purging Techniques*

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. The intent of proper purging is to stabilize the water level in the well and minimize the hydraulic stress to the hydrogeologic formation.

Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging completion criteria.

A flowchart which summarizes purging procedure options is presented in Figure FS 2200-2.

Select equipment using the construction and configuration requirements specified in Table FS 2200-1. See the discussions in FS 2201.

1. MEASURING THE PURGE VOLUME: The volume of water that is removed during purging must be recorded. Measure the volume during the purging operation.

1.1 Collect the water in a graduated container and multiply the number of times the container was emptied by the volume of the container, or

1.2 Estimate the volume based on pumping rate. Use this technique only if the pumping rate is constant. Determine the pumping rate by measuring the amount of water that is pumped for a fixed period of time or use a flow meter.

1.2.1 Calculate the amount of water that is discharged per minute:

$$D = \frac{\text{Measured amount}}{\text{Total time in minutes}}$$

1.2.2 Calculate the time needed to purge one (1) well volume or one (1) purging equipment volume:

$$\text{Time} = \frac{V}{D}$$

Where: V = well volume determined from FS 2211, section 5, or purging equipment volume

D = discharge rate calculated in section 1.2.1. above

1.2.3 Make new measurements (see section 1.2.1 above) each time the pumping rate is changed, or

1.3 Use a totalizing flow meter.

1.3.1 Record the reading on the totalizer prior to purging.

1.3.2 Record the reading on the totalizer at the end of purging.

1.3.3 Subtract the reading on the totalizer prior to purging from the reading on the totalizer at the end of purging to obtain the volume purged.

1.4 Record in the field records the times that purging begins and ends.

2. Stabilization Measurement Frequency

2.1 Begin to record stabilization measurements after pumping the minimum volume as prescribed in options 2.3 – 2.5 below. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging criteria.

2.2 If the well screened interval is not known, use option 2.3, below.

2.3 <u>Wells with Fully Submerged Screen and Pump or Intake Tubing Placed at the Top of the Water Column (conventional purge):</u> Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) well volume prior to collecting measurements of the stabilization parameters. Allow at least one quarter (1/4) well volume to purge between subsequent measurements.

2.4 <u>Wells with Fully Submerged Screen and Pump or Intake Tubing Placed Within the Screened Interval (minimizing purge volume):</u> Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) volume of the pump, associated tubing and flow container (if used) prior to collecting measurements of the stabilization parameters. Take measurements of the stabilization parameters no sooner

than two (2) minutes apart. Purge at least three (3) volumes of the pump, associated tubing and flow container, if used, prior to collecting a sample.

If the water level drops into the screened interval during purging, lower the pump or tubing intake as in FS 2213, section 1.3 below and follow purging procedures for partially submerged well screens (2.5 below).

2.5 Wells with a Partially Submerged Well Screen: Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) well volume prior to collecting measurements of the stabilization parameters. Take measurements of the stabilization parameters no sooner than two (2) minutes apart.

3. PURGING COMPLETION: DEP recommends the use of a flow-through container to measure the stabilization parameters discussed below. Alternatively, measure all parameters *in situ* by inserting measurement probes into the well at the depth appropriate for the purging option. Purging is considered complete if the criteria in section 3.1, 3.2 or 3.3 below are satisfied. Make every attempt to satisfy the criteria in section 3.1. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging criteria.

3.1 Three (3) consecutive measurements of the five (5) parameters listed below must be within the stated limits. The measurements evaluated must be the last three consecutive measurements taken before purging is stopped. The range between the highest and the lowest values for the last three measurements of temperature, pH and specific conductance cannot exceed the stated limits. The last three consecutive measurements of dissolved oxygen and turbidity must all be at or below the listed thresholds.

- Temperature: ± 0.2° C
- pH: ± 0.2 Standard Units
- Specific Conductance: ± 5.0% of reading
- Dissolved Oxygen: ≤20% Saturation
- Turbidity: ≤20 NTU

3.2 Naturally occurring conditions may prevent attaining the ≤20% saturation criterion for dissolved oxygen, typically in surficial aquifers. See section 3.5, below.

3.3 Naturally occurring conditions may prevent attaining the ≤20 NTU criterion for turbidity. However, when collecting groundwater samples for metals or certain inorganic (e.g., phosphorus forms) or extractable organic (e.g. polynuclear aromatic hydrocarbons) chemicals, make every attempt to reduce turbidity to ≤20 NTU to avoid a potential turbidity-associated bias for these analytes. See section 3.5, below.

3.4 Document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.

- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.5 If the criteria in section 3.1 above for dissolved oxygen and/or turbidity cannot be met, then three (3) consecutive measurements of the five (5) parameters listed below must be within the stated limits.

3.5.1 The measurements evaluated must be the last three consecutive measurements taken before purging is stopped. The range between the highest and the lowest values for the last three measurements cannot exceed the stated limits.

- Temperature: ± 0.2° C
- pH: ± 0.2 Standard Units
- Specific Conductance: ± 5.0% of reading
- Dissolved Oxygen: ± 0.2 mg/L or 10%, whichever is greater
- Turbidity: ± 5 NTUs or 10%, whichever is greater

3.5.2 Additionally, document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- A description of conditions at the site that cause the dissolved oxygen to be high and/or dissolved oxygen measurements made within the screened or open borehole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that cause the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.5.3 If from review of the submitted data the Department determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first four (4) items are required to be submitted in future reports. However, if the Department cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first four (4) items, a description of the conditions at the site that caused the affected parameter(s) to be high is required to be submitted in future reports.

3.6 If the stabilization parameters in either section 3.1 or 3.2 cannot be met, and all attempts have been made to minimize the drawdown, check the instrument condition and calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. All measurements that were made during the attempt must be documented. The sampling team leader may decide whether or

not to collect a sample or to continue purging after five (5) well volumes (conventional purge section 2.1 or 2.3 above) or five (5) volumes of the screened interval (minimizing purge volumes in section 2.2 above).

Further, the report in which the data are submitted must include the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- Drawdown in the well, if any.
- A description of conditions at the site that caused the dissolved oxygen to be high and/or dissolved oxygen measurements made within the screened or open borehole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that caused the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If from review of the submitted data the DEP determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first four (4) items are required to be submitted in future reports. However, if the DEP cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first four (4) items, a description of the conditions at the site that caused the affected parameter(s) to be high is required to be submitted in future reports.

3.7 One fully dry purge (not recommended). This criterion applies only if purging was attempted per FS 2212, FS 2213, and section 3.4.1 below, and if it is impossible to balance the pumping rate with the rate of recharge at very low pumping rates (< 100 mL/minute).

3.7.1 If wells have previously and consistently purged dry, when purged according to FS 2212 and FS 2213, and the current depth to groundwater indicates that the well will purge dry during the current sampling event, minimize the amount of water removed from the well by using the same pump to purge and collect the sample:

3.7.1.1 Place the pump or tubing intake within the well screened interval.

3.7.1.2 Use very small diameter Teflon, Polyethylene or PP tubing and the smallest possible pump chamber volume to minimize the total volume of water pumped from the well and to reduce drawdown.

3.7.1.3 Select tubing that is thick enough to minimize oxygen transfer through the tubing walls while pumping.

3.7.1.4 Pump at the lowest possible rate (100 mL/minute or less) to reduce drawdown to a minimum.

3.7.1.5 Purge at least two (2) volumes of the pumping system (pump, tubing and flow cell, if used).

3.7.1.6 Measure pH, Specific Conductance, Temperature, Dissolved Oxygen and Turbidity and begin to collect the samples (see FS 2222).

4. Collect samples immediately after purging is complete.

4.1 The time period between completing the purge and sampling cannot exceed six (6) hours.

4.2 If sample collection does not occur within one (1) hour of purging completion, re-measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity just prior to collecting the sample.

4.2.1 If the measured values are not within 10 percent of the previous measurements, re-purge the well.

4.2.2 See section 3.4 above when collecting samples from wells that have purged dry.

FS 2213 *Purging Wells Without Plumbing (Monitoring Wells)*

1. TUBING/PUMP PLACEMENT

1.1 Do not lower the pump or intake hose (tubing) to the bottom of the well. Pump or tubing placement procedures will be determined by the purging option selected in FS 2212, section 2 above or FS 2214 below.

1.1.1 Minimizing Purge Volume: If the following conditions can be met, position the intake hose (tubing) or pump in the screened or open borehole interval.

- The same pump must be used for both purging and sampling,
- The well screen or borehole interval must be less than or equal to 10 feet, and
- The well screen or borehole must be fully submerged.

1.1.2 If the position or length of the screened interval or open borehole is unknown or estimated, place the intake hose (tubing) or pump to perform conventional purging in 1.2 below.

1.1.3 Position the pump or intake hose when purging large-diameter deep wells with open boreholes using the procedure in FS 2214 below.

1.2 Conventional Purging: Position the pump or intake tubing in the top one foot of the water column or no deeper than necessary for the type of pump.

1.2.1 If purging with a bailer, see section 4 below.

1.3 Partially Submerged Screened Interval: If the well screen or open borehole is partially submerged, and the pump will be used for both purging and sampling, position the pump or intake hose (tubing) in the portion of the water column within the submerged screened or open borehole interval.

1.3.1 If the position or length of the screened interval or open borehole is unknown or estimated, place the intake hose (tubing) or pump to perform conventional purging in 1.2 above.

1.3.2 Purge large-volume, high-recharge wells as in FS 2214 below.

1.3.3 If purging with a bailer, see section 4 below.

2. NON-DEDICATED (PORTABLE) PUMPS

2.1 Variable Speed Peristaltic Pump

2.1.1 Install a new, 1-foot maximum length of silicone tubing in the peristaltic pump head.

2.1.2 Attach a short section of tubing to the discharge side of the pump-head silicone tubing and into a graduated container.

2.1.3 Attach one end of a length of new or precleaned transport tubing to the intake side of the pump head silicone tubing.

2.1.4 Place the transport tubing in the monitoring well per one of the options in FS 2213, section 1 above.

2.1.5 Measure the depth to groundwater at frequent intervals.

2.1.6 Record these measurements.

2.1.7 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.1.8 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.1.9 If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.1.10 Record the purging rate each time the rate changes.

2.1.11 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.1.12 Record this measurement.

2.1.13 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.2 Variable Speed Centrifugal Pump

2.2.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.2.2 Place the decontaminated suction hose so that water is always pumped from the top of the water column.

2.2.3 Equip the suction hose with a foot valve to prevent purge water from re-entering the well.

2.2.4 Measure the depth to groundwater at frequent intervals.

2.2.5 Record these measurements.

2.2.6 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.2.7 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.2.8 If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.2.9 Record the purging rate each time the rate changes.

2.2.10 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.2.11 Record this measurement.

2.2.12 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.3 Variable Speed Electric Submersible Pump

2.3.1 Position fuel powered equipment downwind and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.3.2 Carefully position the decontaminated pump per one of the options in FS 2213, section 1 above.

2.3.3 Measure the depth to groundwater at frequent intervals.

2.3.4 Record these measurements.

2.3.5 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.3.6 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.3.7 If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.3.8 Record the purging rate each time the rate changes.

2.3.9 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.3.10 Record this measurement.

2.3.11 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.4 Variable Speed Bladder Pump

2.4.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.4.2 Attach the tubing and carefully position the pump per one of the options in FS 2213, section 1 above.

2.4.3 Measure the depth to groundwater at frequent intervals.

2.4.4 Record these measurements.

2.4.5 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.4.6 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.4.7 If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.4.8 Record the purging rate each time the rate changes.

2.4.9 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.4.10 Record this measurement.

2.4.11 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

3. DEDICATED PORTABLE PUMPS: Place dedicated pumps per one of the options in FS 2213, section 1 above.

3.1 Variable Speed Electric Submersible Pump

3.1.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.1.2 Measure the depth to groundwater at frequent intervals.

3.1.3 Record these measurements.

3.1.4 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.1.5 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal with the recharge rate.

3.1.6 Record the purging rate each time the rate changes.

3.1.7 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.1.8 Record this measurement.

3.2 Variable Speed Bladder Pump

3.2.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.2.2 Measure the depth to groundwater at frequent intervals.

3.2.3 Record these measurements.

3.2.4 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.2.5 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal with the recharge rate.

3.2.6 Record the purging rate each time the rate changes.

3.2.7 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.2.8 Record this measurement.

4. BAILERS: DEP recommends against using bailers for purging except as a last contingency, or if free product is present in the well or suspected to be in the well. However, they may be used if approved by a DEP program, or specified in a permit, contract or DEP order (see Table FS 2200-3 and FS 2211, section 1.3). If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager.

4.1 Minimize handling the bailer as much as possible.

4.1.1 Remove the bailer from its protective wrapping just before use.

4.1.2 Attach a lanyard of appropriate material (see FS 2201, section 4).

4.1.3 Use the lanyard to move and position the bailer.

4.2 Lower and retrieve the bailer slowly and smoothly.

4.3 Lower the bailer carefully into the well to a depth approximately a foot above the water column.

4.3.1 Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column. Ensure that the length of the bailer does not exceed the length of the water column.

4.3.2 Allow time for the bailer to fill with aquifer water as it descends into the water column.

4.4 Carefully raise the bailer.

4.4.1 Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.

4.5 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

4.5.1 Record the volume of the bailer.

4.6 Continue to carefully lower and retrieve the bailer as described above until the purging completion conditions specified in FS 2212, section 3, have been satisfied.

4.6.1 Remove at least one (1) well volume before collecting measurements of the field parameters. Take each subsequent set of measurements after removing at least one quarter (1/4) well volume between measurements.

FS 2214 *Purging Large-Volume, High-Recharge Wells With Portable Pumps*

If a well originally constructed for high-flow-rate pumping will be sampled as a monitoring well, use these guidelines to develop a purging procedure applicable to the specific details of the well construction. Typical wells constructed for this purpose may be deep, large-diameter wells with a section of open borehole. Evaluate each well on a case-by-case basis and consider any available information on the construction and hydraulic performance of the well.

1. PURGING PROCEDURE

1.1 Place the pump at the top of the open borehole segment of the well.

1.2 Start purging while monitoring stabilization parameters as in FS 2212, section 3 above.

1.3 Purge at least one equipment volume before measuring stabilization parameters.

1.4 If the well is being purged for the first time using these guidelines, monitor stabilization parameters for an extended period until confident that sufficient volume has been pumped from the open borehole to draw fresh formation water into the pump tubing and flow-through container. Use the information obtained from the first-time purging of the well to determine the pumping rate and duration of purging required for future sampling events at the well.

1.5 Purge at least three equipment volumes before evaluating purging completion.

2. PURGING COMPLETION

2.1 Complete the purging of the well when the last three consecutive measurements of the purge stabilization parameters have met the applicable criteria specified in FS 2212, section 3 above.

3. Collect samples from the well using the procedures in FS 2221, section 1 below.

FS 2215. *Purging Wells With Plumbing (production wells or permanently installed pumps equipped with sampling ports or sampling spigots)*

Wells with in-place plumbing are commonly found at municipal water treatment plants, industrial water supplies, private residences, etc. Depending on the sampling objective for collecting samples using installed plumbing, purge the system and collect samples closest to the point of consumption, or, as close to the source well as possible. When purging is required and the purge volume of the plumbing system is not known, purge the system until the purging completion criteria in FS 2212, section 3, have been met.

1. CONTINUOUSLY RUNNING PUMPS

1.1 Select the spigot that is closest to the pump and before any storage tanks (if possible).

1.2 Remove all hoses, aerators and filters (if possible).

1.3 Open the spigot and purge at maximum flow.

1.4 If a storage tank is located between the pump and the spigot, purge the volume of the tank, lines and spigot.

1.5 If the spigot is before any storage tank, purge until sufficient volume is removed to flush the stagnant water from the spigot and the tap line to the spigot.

1.6 Reduce the flow rate to ≤ 500 mL/minute (a 1/8” stream) or approximately 0.1 gal/minute before collecting samples. When sampling for volatile organic compounds, reduce the flow to ≤100 mL/minute before collecting the samples.

2. INTERMITTENTLY RUNNING PUMPS

2.1 Select the spigot that is closest to the pump and before any storage tanks (if possible).

2.2 Remove all hoses, aerators and filters (if possible).

2.3 Open the spigot and purge sufficient volume at a maximum, practical flow rate to flush the spigot and lines and until the purging completion criteria in FS 2212, section 3, have been met.

2.4 If a storage tank is located between the pump and the spigot, purge the volume of the tank, lines and spigot.

2.5 Ensure that the purge stabilization measurement of dissolved oxygen is not biased with aeration of the sample by a high flow rate in the flow-through container.

2.6 Reduce the flow rate to ≤ 500 mL/minute (a 1/8” stream) or approximately 0.1 gal/minute before collecting samples. When sampling for volatile organic compounds, reduce the flow to ≤ 100 mL/minute before collecting the samples.

FS 2216. *Purging Airstrippers and Remedial Treatment Systems*

If collecting samples for groundwater contamination monitoring, follow FS 2215above.

FS 2220. GROUNDWATER SAMPLING TECHNIQUES

1. Purge wells using the techniques outlined in FS 2210.

2. Replace the protective covering around the well if it is soiled or torn after completing the purging operations.

3. EQUIPMENT CONSIDERATIONS

Follow all notes and restrictions as indicated in Table FS 2200-1 and as discussed in FS 2201.

NOTE: The only pumps that are currently approved for use in collecting volatile organic samples through the pump are stainless steel and Teflon variable speed submersible pumps, stainless steel and Teflon or Polyethylene variable speed bladder pumps, and permanently installed PVC bodied pumps (variable speed bladder or submersible pumps) as long as the pump remains in contact with the water in the well at all times.

3.1 Collect the sample into the sample container from the sampling device. **Do not** use intermediate containers.

3.2 In order to avoid contaminating the sample or loss of analytes from the sample:

3.3 Handle the sampling equipment as little as possible.

3.3.1 Minimize the equipment that is exposed to the sample.

3.3.2 Minimize aeration of samples collected for VOC analysis.

3.3.3 Reduce sampling pump flow rates to $\leq$ 100 mL/minute when collecting VOC samples.

3.4 Dedicated Sampling Equipment

3.4.1 Whenever possible, use dedicated equipment because it significantly reduces the chance of cross-contamination.

3.4.2 Dedicated is defined as equipment that is to be used solely for one location for the life of that equipment (e.g., permanently mounted pump).

3.4.3 All material construction and restrictions from Table FS 2200-1 also apply to dedicated equipment. Purchase equipment with the most sensitive analyte of interest in mind.

3.5 Cleaning/Decontamination

3.5.1 Clean or ensure dedicated pumps are clean before installation. They do not need to be cleaned prior to each use but must be cleaned if they are withdrawn for repair or servicing.

3.5.2 Clean or make sure any permanently mounted tubing is clean before installation.

3.5.3 Change or clean tubing when the pump is withdrawn for servicing.

3.5.4 Clean any replaceable or temporary parts as specified in FC 1000.

3.5.5 Collect equipment blanks on dedicated pumping systems when the tubing is cleaned or replaced.

3.5.6 Clean or ensure dedicated bailers are clean before placing them into the well.

3.5.7 Collect an equipment blank on dedicated bailers before introducing them into the water column.

3.5.8 Suspend dedicated bailers above the water column if they are stored in the well.

FS 2221. *Sampling Wells Without Plumbing*

1. SAMPLING WITH PUMPS: Variable speed stainless steel and Teflon submersible pumps and stainless steel, Teflon or Polyethylene bladder pumps, and permanently installed PVC-bodied variable speed submersible or bladder pumps, as long as the pump remains in contact with the water in the well at all times, may be used to sample for all organics. The delivery tubing must be Teflon, Polyethylene or PP. **Extractable organics** may be collected through a peristaltic pump if ≤ 1 foot of silicone tubing is used in the pump head or a vacuum trap is used (see Figure FS 2200-1 for specific configuration). Follow all notes and restrictions as defined in Table FS 2200-1 and discussed in Equipment and Supplies (FS 2201) when using pumps to collect samples.

Do not lower the pump or tubing to the bottom of the well.

1.1 Peristaltic Pump

1.1.1 Volatile Organics Using Manual Fill and Drain Method: Collect volatile organics last. If the pump tubing is placed within the screened interval, the tubing cannot be reinserted into the well, and steps 1.1.1.3 through 1.1.1.6 below are prohibited.

1.1.1.1 Ensure that there is sufficient tubing volume to fill the requisite number of VOC vials.

1.1.1.2 Remove the drop tubing from the inlet side of the pump.

1.1.1.3 Submerse the drop tubing into the water column and allow it fill.

1.1.1.4 Remove the drop tubing from the well.

1.1.1.5 Prevent the water in the tubing from flowing back into the well.

1.1.1.6 Carefully allow the groundwater to drain by gravity into the sample vials. Avoid turbulence. Do not aerate the sample. The flow rate must be ≤ 100 mL/minute.

1.1.1.7 Repeat steps 1.1.1.3 - 1.1.1.6 until enough vials are filled.

1.1.2 Volatile Organics Using the Pump to Fill and Drain the Tubing: Collect volatile organics last. If the pump tubing is placed within the screened interval, the tubing cannot be reinserted into the well, and steps 1.1.2.2 through 1.1.2.8 below are prohibited.

1.1.2.1 Ensure that there is sufficient tubing volume to fill the requisite number of VOC vials.

1.1.2.2 Submerse the drop tubing into the water column.

1.1.2.3 Use the pump to fill the drop tubing.

1.1.2.4 Quickly remove the tubing from the pump.

1.1.2.5 Prevent the water in the tubing from flowing back into the well.

1.1.2.6 Remove the drop tubing from the well and fill the vials using the pump or gravity-drain methods in steps 1.1.2.7 or 1.1.2.8 below.

1.1.2.7 Reverse the flow on the peristaltic pump to deliver the sample into the vials at a slow, steady rate. The flow rate must be ≤ 100 mL/minute.

1.1.2.8 Or, remove the drop tubing from the inlet side of the pump and carefully allow the groundwater to drain into the sample vials. Avoid turbulence. Do not aerate the sample. The flow rate must be ≤ 100 mL/minute.

1.1.2.9 Repeat steps 1.1.2.2 through 1.1.2.8 until enough vials are filled.

1.1.3 Extractable Organics Collected Through Silicone Pump-Head Tubing:

1.1.3.1 Ensure that a 1-foot maximum length of new silicone tubing was installed in the peristaltic pump head assembly before the well was purged if the same pump is being used to purge and sample the well. Otherwise, install a new length of tubing as described above.

1.1.3.2 Collect extractable organic samples directly from the effluent delivery tubing (attached to discharge side of the silicone pump head tubing) into the sample container.

1.1.3.3 If there is a concern that sample analytes are absorbed, adsorbed, leached or otherwise affected or lost by pumping through the silicone pump-head tubing, sample the well using the organic trap assembly in 1.1.4 below.

1.1.4 Extractable Organics Using an Optional Organic Trap Assembly

1.1.4.1 Assemble the components of the pump and trap according to Figure FS 2200-1.

1.1.4.2 The sample container should be the trap bottle.

1.1.4.3 All equipment that contacts the groundwater **before** the sample container must be constructed of Teflon, Polyethylene, PP, stainless steel or glass, including the transport tubing to and from the sample container, the interior liner of the container cap and all fittings. **Do not use a rubber stopper as a cap.**

1.1.4.4 Connect the outflow tubing from the container to the influent side of the peristaltic pump.

1.1.4.5 Prevent the water in the down-hole delivery tubing from flowing back into the well while performing this connection.

1.1.4.6 Turn the pump on and reduce the flow rate to a smooth and even flow.

1.1.4.7 Discard a small portion of the sample to allow an air space.

1.1.4.8 Preserve (if required), label and complete the field notes.

1.1.5 Inorganics

1.1.5.1 Inorganic samples may be collected from the effluent tubing.

1.1.5.2 If samples are collected from the pump, decontaminate all tubing (including the tubing in the head) or change it between wells.

1.1.5.3 Preserve (if required), label and complete field notes.

1.2 Variable Speed Bladder Pump

1.2.1 If sampling for organics the pump body must be constructed of stainless steel and the valves and bladder must be Teflon. All tubing must be Teflon, Polyethylene, or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or made of stainless steel.

1.2.2 After purging to a smooth even flow, reduce the flow rate.

1.2.3 When sampling for volatile organic compounds, reduce the flow rate to 100 mL/minute or less, if possible.

1.3 Variable Speed Submersible Pump

1.3.1 The housing must be stainless steel.

1.3.2 If sampling for organics, the internal impellers, seals and gaskets must be constructed of stainless steel, Teflon, Polyethylene or PP. The delivery tubing must be Teflon, Polyethylene or PP and the electrical cord must be sealed in Teflon and any cabling must be sealed in Teflon or constructed of stainless steel.

1.3.3 After purging to a smooth even flow, reduce the flow rate.

1.3.4 When sampling for volatile organic compounds, reduce the flow rate to 100 mL/minute or less, if possible.

2. SAMPLING WITH BAILERS: A high degree of skill and coordination are necessary to collect representative samples with a bailer. When properly used, bailers may be used to collect samples for certain analyte groups and under specific conditions (see Table FS 2200-3). They must be of an appropriate type and construction (see FS 2201, section 3), and must be used as outlined below. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager.

2.1 General Considerations

2.1.1 Minimize handling the bailer as much as possible.

2.1.1.1 Wear sampling gloves.

2.1.1.2 Remove the bailer from its protective wrapping just before use.

2.1.1.3 Attach a lanyard of appropriate material (see FS 2201, section 4).

2.1.1.4 Use the lanyard to move and position the bailers.

2.1.2 Do not allow the bailer or lanyard to touch the ground.

2.1.3 Rinsing

2.1.3.1 If the bailer is certified precleaned, no rinsing is necessary.

2.1.3.2 If both a pump and a bailer are to be used to collect samples, rinse the exterior and interior of the bailer with sample water from the pump before removing the pump.

2.1.3.3 If the purge pump is not appropriate for collecting samples (e.g., non-inert components), rinse the bailer with by collecting a single bailer of the groundwater to be sampled. Use the technique described in section 2.2, Bailing Technique, below.

2.1.3.4 Discard the water appropriately.

2.1.3.5 **Do not** rinse the bailer if Oil & Grease, TRPHs, etc., (see FS 2006) are to be collected.

2.2 Bailing Technique

2.2.1 Collect all samples that are required to be collected with a pump before collecting samples with the bailer.

2.2.2 Raise and lower the bailer gently to minimize stirring up particulate matter in the well and the water column which can increase sample turbidity.

2.2.3 Lower the bailer carefully into the well to a depth approximately a foot above the water column. Ensure that the length of the bailer does not exceed the length of the water column.

2.2.3.1 When the bailer is in position, lower the bailer into the water column at a rate of 2 cm/sec until the desired depth is reached (see section 2.2.3 above).

2.2.4 Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column.

2.2.5 Allow time for the bailer to fill with aquifer water as it descends into the water column.

2.2.6 Do not allow the bailer to touch the bottom of the well or particulate matter will be incorporated into the sample.

2.2.6.1 Carefully raise the bailer (see section 2.2.2 above). Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.

2.2.7 Lower the bailer to approximately the same depth each time.

2.2.8 Collect the sample.

2.2.8.1 Install a device to control the flow from the bottom of the bailer and discard the first few inches of water. Reduce the flow to $\leq$ 100 mL/minute when collecting VOC samples.

2.2.8.2 Fill the appropriate sample containers by allowing the sample to slowly flow down the side of the container. Minimize aeration of VOC samples.

2.2.8.3 Discard the last few inches of water in the bailer.

2.2.9 Repeat steps 2.2.1 through 2.2.8.3 for additional samples.

2.2.10 Measure the DO, pH, temperature, turbidity and specific conductance after the final sample has been collected.

2.2.10.1 Record all measurements and note the time that sampling was completed.

3. SAMPLING WELLS WITH FLOATING NON-AQUEOUS PHASE LIQUID: DEP does not recommend the sampling of wells with floating non-aqueous phase liquid for trace contaminants. This concerns primarily petroleum related sites, but includes any chemical product (e.g., solvent) that floats on the water table. Sampling is acceptable if the information is to be used for the purpose of remedial design.

Sample data from such wells cannot provide useful information regarding the level of contamination. Furthermore, these wells typically do not provide legitimate data because of permanent chemical contamination from product contact with the well casing for an extended period of time.

DEP does reserve the right to require sampling of these wells, not for levels of trace contaminants, but for confirmation of an appropriate remediation technique. This type of sampling is performed **below** the non-aqueous phase layer (see section 3.2 below).

3.1 Non-Aqueous Phase Liquid Sampling: Non-aqueous phase liquid may be evident in a cased monitoring well or in an open excavation.

3.1.1 Non-aqueous phase liquid is normally sampled for two reasons:

- Documentation for its existence and thickness; and
- Determination of the type of product so that the proper analyses can be performed to determine extent. This is only feasible for relatively recent releases as it may not be possible to identify weathered product.

3.1.2 Disposable plastic (acrylic, clear PVC) bailers are recommended for sampling. Disposable Polyethylene and PP bailers are also acceptable. Other wide mouth vessels may be used for sampling non-aqueous phase liquid in an excavation.

3.1.3 Monitoring Well

3.1.3.1 If a non-aqueous phase liquid is identified in a monitoring well during the water level measurement, measure its thickness in the well. If the thickness of the non-aqueous phase liquid is greater than 0.01 foot or product globules are present, collect a sample using a precleaned disposable bailer.

3.1.3.2 Measure the product thickness to the nearest 0.01 foot after withdrawing the bailer.

3.1.3.3 Pour a portion of the product into a glass sample container.

3.1.3.4 This sample is considered a concentrated waste. Therefore, package the container in protective wrapping to prevent breakage, isolate from other samples, and ice to 4°C.

3.1.4 Excavation

3.1.4.1 If non-aqueous phase liquid is observed in an open excavation, a glass sample container or a precleaned intermediate vessel may be used to collect the sample.

3.1.4.2 Securely tie a lanyard to the container and lower it into the excavation.

3.1.4.3 Gently lower and retrieve the container so that no solid material is released or collected.

3.1.4.4 If sufficient water is available, a bailer can be used.

3.1.4.5 Although not recommended, screened casing can be placed (or augered and placed) in the bottom of the excavation and the product sampled with a bailer.

3.1.4.6 Avoid dangerous situations, such as standing too close to the edge of an excavation, riding in the backhoe bucket, or entering a trench or excavation that may collapse.

3.1.4.7 Follow all applicable OSHA regulations.

3.2 Sampling Below Product

3.2.1 This type of depth-specific sampling to attempt to sample the dissolved constituents in the water column below the product layer is performed only at the request of DEP or its designee.

3.2.2 These data provide information that helps define adequate groundwater treatment. Without these data, incorrect (and sometimes unnecessarily expensive) remediation techniques may be designed for a situation where they are not required.

3.2.3 There are some substantial logistical problems involved with sending a sampler through non-aqueous phase liquid to sample the groundwater below. Although there are some products designed specifically for this type of sampling, they are expensive and the results may not be commensurate with their cost. The use of "self-engineered" equipment or coverings may be the best option.

3.2.4 These data are only to be used for qualitative use and will aid in deciding on an appropriate remediation technique.

3.2.5 Wrapping bailers and tubing in plastic seems to be the most popular technique in getting past the product layer.

3.2.6 Although not recommended, some have wrapped submersible pumps in several layers of plastic and retrieved each layer by a separate lanyard. One suggestion would be to use a rigid piece of stainless steel tubing wrapped in plastic.

3.2.6.1 Once the covered tubing is past the layer, pull up on the plastic, piercing the plastic and exposing the (somewhat) clean tubing inlet.

3.2.6.2 Introduce the wrapped hose slowly to not entrain any more product into the dissolved layer located below.

3.2.6.3 Also, perform this procedure with a peristaltic pump or a vacuum pump linked to a trap bottle. To use this setup, the water table must be no deeper than 15-20 feet, realizing that actual sampling may be occurring several feet below the product layer.

FS 2222. *Sampling Low Permeability Aquifers or Wells That Have Purged Dry*

1. Collect the sample(s) after the well has been purged according to FS 2212, section 3.4. Minimize the amount of water removed from the well by using the same pump to purge and collect the sample. If the well has purged dry, collect samples as soon as sufficient sample water is available.

2. Measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity at the time of sample collection.

3. Advise the analytical laboratory and the client that the usual amount of sample for analysis may not be available.

FS 2223. *Sampling Wells With In-Place Plumbing*

1. If a storage tank is present, locate a cold water spigot, valve or other sampling point close to the well head between the pump and the storage tank. If there is no sampling location between the pump and the storage tank, locate the spigot, valve or other sampling point closest to the tank.

1.1 Depending on the sampling objective for collecting samples using installed plumbing, purge the system and collect samples closest to the point of consumption, or, as close to the source well as possible.

2. Remove all screens or aerators and reduce the flow rate to no more than 500 mL/minute. If collecting samples for volatile organic compounds, reduce the flow rate to 100 mL/minute or less. Collect the samples directly into the appropriate containers.

FS 2224. *Sampling Airstripper and Remedial Treatment System Sampling*

1. Reduce the flow rate to less than 500 mL/minute and begin sample collection.

2. If collecting samples for volatile organic compounds, reduce the flow rate to 100 mL/minute or less.

3. Collect the samples directly into the appropriate containers.

FS 2225. *Filtering Groundwater Samples*

Filtered groundwater samples can only be collected after approval from the DEP program or project manager. If filtering is approved, the DEP program or permit condition may require both filtered and unfiltered samples to be collected, analyzed and reported.

1. FILTERING GROUNDWATER FOR METALS:

1.1 Unless specified otherwise by the DEP program, use a new, disposable, high capacity, 1-µm in-line filter.

1.2 Use a variable speed peristaltic, bladder or submersible pump with the in-line filter fitted on the outlet end.

1.2.1 Peristaltic pumps, bladder pumps or submersible pumps can be used when water levels are no greater than 20 to 25 feet deep.

1.2.2 Bladder pumps or submersible pumps must be used when water levels are greater than 20 to 25 feet deep.

1.3 Ensure that a 1-foot maximum length of new, silicone tubing was installed in the peristaltic pump head assembly before the well was purged if the same pump is being used to purge and sample the well. Otherwise, install a new length of tubing as described above.

1.4 Ensure that new or precleaned delivery tubing was assembled with the peristaltic pump before the well was purged if the same pump is being used to purge and sample the well. Otherwise, assemble the pump with new or precleaned delivery tubing and the new filter.

1.5 Insert the filter on the high pressure side (i.e., on the delivery side) of the pump.

1.5.1 Flush the filter before attaching to the pump tubing assembly with 30-50 mL of analyte free water or an inert gas (nitrogen) to remove atmospheric oxygen;

1.5.2 Or, with the filter attached to the pump tubing assembly, hold the filter upright with the inlet and outlet in the vertical position and pump water from the aquifer through the filter until all atmospheric oxygen has been removed.

1.6 Collect the filtered samples directly into the sample container from the high-pressure (delivery) side of the pump tubing assembly.

1.6.1 Collect filtered samples by either of the methods in 1.6.1.3 or 1.6.1.4 below if the static water level in the well is too deep for a variable speed peristaltic pump and a variable speed electric submersible pump or variable speed bladder pump is not available.

1.6.1.1 Do not agitate the sample or expose it to atmospheric oxygen.

1.6.1.2 **Do not** pour the sample into any intermediate vessel for subsequent filtration.

1.6.1.3 Collect the sample in a Polyethylene, Teflon or PP bailer that can be pressurized. When the bailer has been retrieved, immediately connect the filter and begin to pressurize the bailer;

1.6.1.4 Or, collect the sample with a bailer and immediately place the intake tube of the peristaltic pump into the full bailer and begin pumping the water through the filter as described in section 1.2 above.

1.7 **Do not** use the following equipment for filtering groundwater samples for metals:

1.7.1 Any pump and apparatus combination in which the filter is on the vacuum (suction) side of the pump.

1.7.2 Any type of syringe or barrel filtration apparatus.

1.7.3 Any filter that is not encased in a one-piece, molded unit.

2. Filtering groundwater for non-metallic analytes

2.1 The following analytes cannot be filtered:

- Oil and Grease
- Total Recoverable Petroleum Hydrocarbons (TRPH)
- FL-PRO
- Volatile Organic Compounds (VOC)
- Microbiological Analytes
- Volatile Inorganic Compounds (e.g., Hydrogen Sulfide)

2.2 Unless specified otherwise by the regulatory program, use a new, disposable, high capacity, 0.45 µm in-line filter.

2.3 Assemble the pump, tubing and filter as in 1.2 – 1.5 above.

2.4 Flush the filter as in 1.5.1 or 1.5.2 above.

2.5 Collect the samples as in 1.6 – 1.6.1.4 above.

Appendix FS 2200

Tables, Figures and Forms

Table FS 2200-1 Equipment for Collecting Groundwater Samples
Table FS 2200-2 Dissolved Oxygen Saturation
Table FS 2200-3 Allowable Uses for Bailers
Figure FS 2200-1 Pump and Trap for Extractable Organics
Figure FS 2200-2 Groundwater Purging Procedure
Form FD 9000-24 Groundwater Sampling Log

Table FS 2200-1
Equipment for Collecting Groundwater Samples

Activity	Equipment Type
Well Purging	Variable speed centrifugal pump Variable speed submersible pump Variable speed bladder pump Variable speed peristaltic pump Bailer with lanyard: Not Recommended
Well Stabilization	pH meter DO meter Conductivity meter Thermometer/Thermistor Turbidimeter Flow-through cell Multi-function meters
Sample Collection	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Bailer with lanyard (See Table FS 2200-3)
Filtration	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Pressurized bailer 1.0 µm high capacity molded filter 0.45 µm high capacity molded filter
Groundwater Level	Electronic sensor Chalked tape

Table FS 2200-2
Dissolved Oxygen Saturation

TEMP	D.O.	mg/L	TEMP	D.O.	mg/L	TEMP	D.O.	mg/L	TEMP	D.O.	mg/L
deg C	SAT.	20%	deg C	SAT.	20%	deg C	SAT.	20%	deg C	SAT.	20%
15.0	10.084	2.017	19.0	9.276	1.855	23.0	8.578	1.716	27.0	7.968	1.594
15.1	10.062	2.012	19.1	9.258	1.852	23.1	8.562	1.712	27.1	7.954	1.591
15.2	10.040	2.008	19.2	9.239	1.848	23.2	8.546	1.709	27.2	7.940	1.588
15.3	10.019	2.004	19.3	9.220	1.844	23.3	8.530	1.706	27.3	7.926	1.585
15.4	9.997	1.999	19.4	9.202	1.840	23.4	8.514	1.703	27.4	7.912	1.582
15.5	9.976	1.995	19.5	9.184	1.837	23.5	8.498	1.700	27.5	7.898	1.580
15.6	9.955	1.991	19.6	9.165	1.833	23.6	8.482	1.696	27.6	7.884	1.577
15.7	9.934	1.987	19.7	9.147	1.829	23.7	8.466	1.693	27.7	7.870	1.574
15.8	9.912	1.982	19.8	9.129	1.826	23.8	8.450	1.690	27.8	7.856	1.571
15.9	9.891	1.978	19.9	9.111	1.822	23.9	8.434	1.687	27.9	7.842	1.568
16.0	9.870	1.974	20.0	9.092	1.818	24.0	8.418	1.684	28.0	7.828	1.566
16.1	9.849	1.970	20.1	9.074	1.815	24.1	8.403	1.681	28.1	7.814	1.563
16.2	9.829	1.966	20.2	9.056	1.811	24.2	8.387	1.677	28.2	7.800	1.560
16.3	9.808	1.962	20.3	9.039	1.808	24.3	8.371	1.674	28.3	7.786	1.557
16.4	9.787	1.957	20.4	9.021	1.804	24.4	8.356	1.671	28.4	7.773	1.555
16.5	9.767	1.953	20.5	9.003	1.801	24.5	8.340	1.668	28.5	7.759	1.552
16.6	9.746	1.949	20.6	8.985	1.797	24.6	8.325	1.665	28.6	7.745	1.549
16.7	9.726	1.945	20.7	8.968	1.794	24.7	8.309	1.662	28.7	7.732	1.546
16.8	9.705	1.941	20.8	8.950	1.790	24.8	8.294	1.659	28.8	7.718	1.544
16.9	9.685	1.937	20.9	8.932	1.786	24.9	8.279	1.656	28.9	7.705	1.541
17.0	9.665	1.933	21.0	8.915	1.783	25.0	8.263	1.653	29.0	7.691	1.538
17.1	9.645	1.929	21.1	8.898	1.780	25.1	8.248	1.650	29.1	7.678	1.536
17.2	9.625	1.925	21.2	8.880	1.776	25.2	8.233	1.647	29.2	7.664	1.533
17.3	9.605	1.921	21.3	8.863	1.773	25.3	8.218	1.644	29.3	7.651	1.530
17.4	9.585	1.917	21.4	8.846	1.769	25.4	8.203	1.641	29.4	7.638	1.528
17.5	9.565	1.913	21.5	8.829	1.766	25.5	8.188	1.638	29.5	7.625	1.525
17.6	9.545	1.909	21.6	8.812	1.762	25.6	8.173	1.635	29.6	7.611	1.522
17.7	9.526	1.905	21.7	8.794	1.759	25.7	8.158	1.632	29.7	7.598	1.520
17.8	9.506	1.901	21.8	8.777	1.755	25.8	8.143	1.629	29.8	7.585	1.517
17.9	9.486	1.897	21.9	8.761	1.752	25.9	8.128	1.626	29.9	7.572	1.514
18.0	9.467	1.893	22.0	8.744	1.749	26.0	8.114	1.623	30.0	7.559	1.512
18.1	9.448	1.890	22.1	8.727	1.745	26.1	8.099	1.620	30.1	7.546	1.509
18.2	9.428	1.886	22.2	8.710	1.742	26.2	8.084	1.617	30.2	7.533	1.507
18.3	9.409	1.882	22.3	8.693	1.739	26.3	8.070	1.614	30.3	7.520	1.504
18.4	9.390	1.878	22.4	8.677	1.735	26.4	8.055	1.611	30.4	7.507	1.501
18.5	9.371	1.874	22.5	8.660	1.732	26.5	8.040	1.608	30.5	7.494	1.499
18.6	9.352	1.870	22.6	8.644	1.729	26.6	8.026	1.605	30.6	7.481	1.496
18.7	9.333	1.867	22.7	8.627	1.725	26.7	8.012	1.602	30.7	7.468	1.494
18.8	9.314	1.863	22.8	8.611	1.722	26.8	7.997	1.599	30.8	7.456	1.491
18.9	9.295	1.859	22.9	8.595	1.719	26.9	7.983	1.597	30.9	7.443	1.489

Derived using the formula in Standard Methods for the Examination of Water and Wastewater, Page 4-101, 18th Edition, 1992

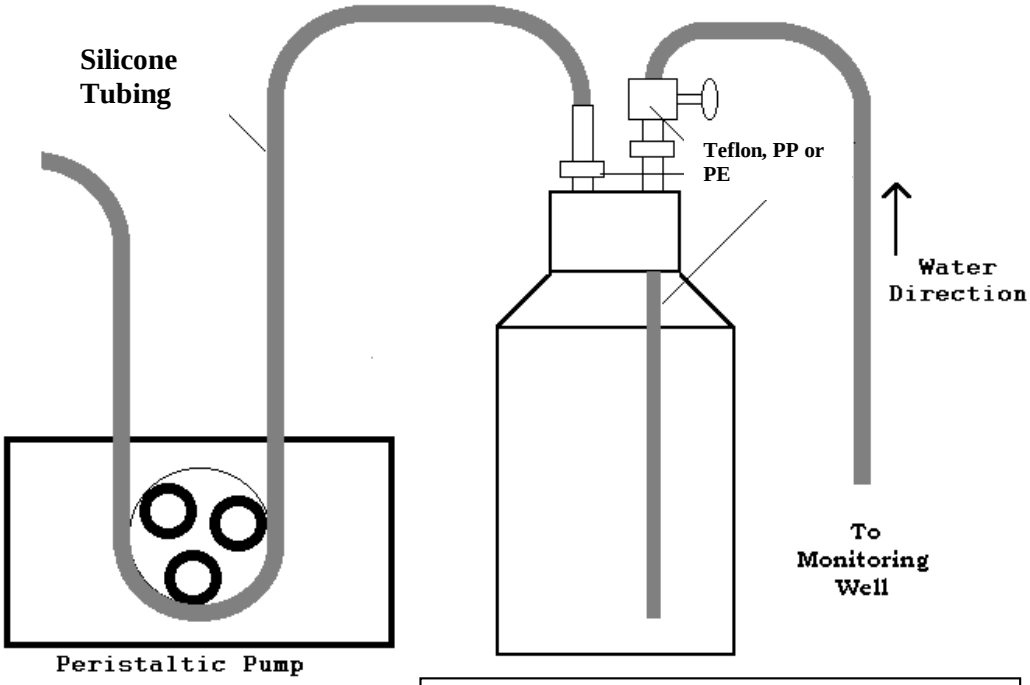
Table FS 2200-3
Allowable Uses for Bailers

• **ANALYTE GROUP(S)**	• **PURGING** (Not Recommended)	• **SAMPLING**	
	Use:	Use:	Not Recommended:
Volatile Organics Extractable Organics Radionuclides, including Radon Metals Volatile Sulfides	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	If concentrations exceed action levels, the purpose is to monitor effective treatment, and the DEP program allows the use of bailers; or If specified by DEP permit, program, contract or order. or If operated by a skilled individual with documented training in proper techniques and using appropriate equipment. Field documentation must demonstrate that the procedure in FS 2221, section 2 was followed without deviation.	If concentrations are near or below the stated action levels; or If a critical decision (e.g., clean closure) will be made based on the data; or If data are to demonstrate compliance with a permit or order.
Petroleum Hydrocarbons (TRPH) & Oil & Grease	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	Only if allowed by permit, program, contract or order as samples should be collected into the container without intermediate devices.	Unless allowed by permit, program, contract or order.

• **ANALYTE GROUP(S)**	• **PURGING** (Not Recommended)	• **SAMPLING**	
	Use:	Use:	Not Recommended:
Biologicals Inorganic Non-Metallics Aggregate Organics Microbiological Physical and Aggregate Properties	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	If all analytes collected from the well can be collected with a bailer; or If collected <u>after</u> collecting all analytes that require the use of a pump.	Before collecting any analytes that must be collected with a pump.
Ultra-Trace Metals	Never	Never	

Figure 2200-1

Pump and Trap for Extractable Organics



The glass sample bottle must be threaded to use a reusable sampling cap lined and installed with fittings made of Teflon, polypropylene or polyethylene, similar to the design shown.

Scenario 1: WELL SCREEN COMPLETELY SUBMERGED

Option 1a: Minimal Purge Volume: Pump or tubing is placed within the middle of the screen interval. The following conditions must be met to use this option:

1. The well screen interval is ≤ 10 feet.
2. Although drawdown may occur in the well when purging is initiated, the drawdown has to stabilize (Aquifer Recovery Rate = Purge Rate).
3. The samples will be obtained with the same equipment that was used to purge the well. Therefore, centrifugal pumps and bailers are not suitable for use in Option 1a.

If one or more of these conditions do not apply, use Option 1b.

Option 1b: Conventional Purge: Pump, tubing, or bailer [1] is placed above the screen at the top of the water column.

[1] DEP does not recommend the use of a bailer for purging; however, if a bailer is used it shall be lowered and raised at the rate of 2 cm/sec in the top of the water column.

Scenario 2: WELL SCREEN PARTIALLY SUBMERGED

Option 2a: A bailer [1] is placed at the top of the water column and is used to purge and sample the well.

Option 2b: Pump or tubing is placed within the middle of the saturated portion of the screen interval.

If the pump or tubing that was used for purging will not be used to obtain the sample, then position the pump or tubing at the top of the water column for purging.

Purging Procedure #1

1. After the drawdown in the well stabilizes, purge at least one equipment volume then collect the first set of stabilization parameters.
2. Thereafter, collect stabilization parameters ≥ 2 to 3 minutes apart.
3. Purge at least three equipment volumes before sampling.

Purging Procedure #2

1. Purge at least one well volume then collect first set of stabilization parameters.
2. Thereafter, collect stabilization parameters ≥ every 1/4 well volume.

Purging Procedure #3

1. Purge at least one well volume then collect first set of stabilization parameters.
2. Thereafter, collect stabilization parameters ≥ 2 to 3 minutes apart.

Purging Completion

If Dissolved Oxygen is ≤ 20% of saturation for the measured temperature and Turbidity is ≤ 20 NTUs, then purging is complete when three consecutive readings of the parameters listed below are within the following ranges:

Temperature ± 0.2 °C
pH ± 0.2 Standard Units
Specific Conductance ± 5.0% of reading

If Dissolved Oxygen (DO) is > 20% of saturation for the measured temperature and/or Turbidity is > 20 NTUs after every attempt has been made to reduce DO and/or turbidity, then purging is complete when three consecutive readings of the parameters listed below are within the following ranges:

Temperature ± 0.2 °C
pH ± 0.2 Standard Units
Specific Conductance ± 5.0% of reading
Dissolved Oxygen ± 0.2 mg/L or readings are within 10% (whichever is greater).
Turbidity ± 5 NTUs or readings are within 10% (whichever is greater).

If the well is expected to purge dry, position the pump or tubing within the screened interval and purge at ≤ 100 mL/minute until two equipment volumes are removed. Use the same pump for purging and sampling.

If the well purges dry at the lowest achievable flow rate (pumping at 100 mL/minute or less), then after a sufficient amount of water recharges in the well, collect the samples.

In either case listed above, before samples are collected, measure (once) pH, temperature, specific conductance, dissolved oxygen, and turbidity.

If one or more parameters do not stabilize after 5 volumes of the screened interval (purging procedure #1) or 5 well volumes (purging procedure #s 2 & 3) are removed, purging may be discontinued at the discretion of the sampling team leader.

FT 1000. GENERAL FIELD TESTING AND MEASUREMENT

Use the following SOPs in conjunction with FT 1000:

- FD 1000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FS 1000 General Sampling Procedures
- FT 1100 through FT 3000 Specific Field Testing Procedures

1. INTRODUCTION

1.1. Scope and Applicability: SOPs FT 1100 to FT 3000 outline procedures to conduct field testing measurements and observations. They include the parameters that are measured *in-situ* or in a field-collected sample. Additionally some samples with allowable extended holding times may be collected for laboratory measurement, as described in the specific FT-series SOPs. Included in SOPs FT 1100 to FT 3000 are:

- FT 1100 Field Measurement of Hydrogen Ion Activity (pH)
- FT 1200 Field Measurement of Specific Conductance (Conductivity)
- FT 1300 Field Measurement of Salinity
- FT 1400 Field Measurement of Temperature
- FT 1500 Field Measurement of Dissolved Oxygen (DO)
- FT 1600 Field Measurement of Turbidity
- FT 1700 Field Measurement of Light Penetration (Secchi Depth and Transparency)
- FT 1800 Field Measurement of Water Flow and Velocity
- FT 1900 Continuous Monitoring with Installed Meters
- FT 2000 Field Measurement of Residual Chlorine
- FT 3000 Aquatic Habitat Characterization

1.2. Exclusions: **If proposed for experimental purposes, field-screening procedures employing techniques not addressed in these SOPs** must be submitted to the DEP site or project manager. Such procedures must be addressed for each program or project dealing specifically with the planning and design of sampling events. Data quality objectives for quantitative assessment preclude the use of field-screening procedures for regulatory purposes.

1.3. Expectations and Requirements:

1.3.1. In some cases, specific instruments are identified in the SOP, with detailed instruction provided on their use. If you are using a different instrument from that identified in the SOP, follow the manufacturer's instructions for assembly, operation, and maintenance.

1.3.2. When required, the FT-series SOPs outline the instrument specifications. A field instrument must meet the stated requirements.

1.3.3. The FT-Series SOPs specify the calibration requirements for each method. Although instruments may vary in configuration or operation, the specified calibration requirements must be met.

1.3.3.1. Where applicable to the FT-series SOP, use the minimum number of calibration standards specified.

1.3.3.2. Do not establish the lower limit of the quantitative calibration bracket with "zero" solutions, quality control blanks or reagent dilution water.

1.3.4. Ensure that all equipment is in proper working condition, calibrated, and that batteries are properly charged before using the equipment for field testing measurements.

1.3.5. If reagents or standards are prepared from stock chemicals, they must be analytical reagent grade or better. Some procedures may specify a higher grade or assay of reagent or standard.

1.4. Recommendations for Use of Grab Samples or *in situ* Field Testing Measurements:

1.4.1. Use *in situ* readings where practical for field measurements in surface water and wastewater.

1.4.2. Use *in situ* readings or flow-through containers for field measurements for groundwater stabilization during purging and for other applications where groundwater monitoring measurements are required.

1.4.3. If grab samples are collected for measurement where allowed in the individual FT-series SOP, measure samples within fifteen (15) minutes of collection when immediate analysis is specified per Table FS 1000-4 and FS 1000-5. Otherwise, analyze grab samples within the applicable holding times specified in Table FS 1000-4 and FS 1000-5.

2. MINIMUM CALIBRATION REQUIREMENTS:

2.1. Calibration Definitions: This section outlines the essential calibration concepts that must be applied to each field test. Specific requirements for calibration are addressed in the individual SOPs.

2.1.1. Initial Calibration (IC): The instrument or meter electronics are adjusted (manually or automatically) to a theoretical value (e.g., dissolved oxygen saturation) or a known value of a calibration standard.

2.1.2. Initial Calibration Verification (ICV): The instrument or meter calibration is checked or verified directly following initial calibration by measuring a calibration standard of known value as if it were a sample and comparing the measured result to the calibration acceptance criteria listed in the SOP.

2.1.3. Continuing Calibration Verification (CCV): The instrument or meter calibration is checked or verified by measuring a calibration standard of known value as if it were a sample and comparing the measured result to the calibration acceptance criteria listed in the SOP.

2.1.4. Chronological Calibration Bracket: The interval of time between verifications within which environmental sample measurements must occur. The instrument or meter

is calibrated or verified before and verified after the time of environmental sample measurement(s).

2.1.5. Quantitative Calibration Bracket: The instrument or meter is calibrated or verified at two known values that encompass the range of observed environmental sample measurement(s).

2.1.6. Acceptance Criteria: The numerical limits within which calibration verifications are acceptable.

2.2. Calibration Activities: Specific calibration procedures are given in the individual SOPs.

2.2.1. Chronological Calibration Bracket:

2.2.1.1. Ensure that the field test result is preceded by an acceptable ICV or CCV and followed by an acceptable CCV.

2.2.1.2. Specific requirements for chronological bracketing are addressed in the individual FT-series SOPs.

2.2.2. Quantitative Calibration Bracket:

2.2.2.1. Choose two standards that bracket the range of sample measurements. These standards may be used for initial calibrations or for verifications.

2.2.2.2. Specific requirements for quantitative bracketing are addressed in the individual FT-series SOPs.

2.2.3. Initial Calibration: Calibrate if no initial calibration has been performed or if a calibration verification does not meet acceptance criteria. Do not reuse standards for initial calibrations.

Table FT 1000-1: Field Testing Acceptance Criteria

Parameter	Acceptance Criteria
pH (FT 1100)	**± 0.2 Standard pH Units of buffer or more stringent program criteria**
Specific Conductance (FT 1200)	**± 5% of standard value**
Temperature (FT 1400)	**± 0.2°C of NIST-traceable value (with correction factors) Verification over range of applicable values**
Dissolved Oxygen (FT 1500)	**± 0.3 mg/L of theoretical value (see Table FT 1500-1)**
Turbidity (FT 1600)	**0.1-10 NTU: ± 10% of standard value 11-40 NTU: ± 8% of standard value 41-100 NTU: ± 6.5% of standard value > 100 NTU: ± 5% of standard value**
Total Residual Chlorine (FT 2000)	**0.995 calibration curve correlation coefficient ± 10% of primary standard value ± 10% of secondary standard value Color comparator acceptance criterion: ± 10% of primary standard value**

2.2.4. Initial Calibration Verification:

2.2.4.1. Perform an ICV immediately after calibration. All ICVs must meet the calibration acceptance criteria specified in the applicable FT-series SOP. See Table FT 1000-1 for a list of acceptance criteria for the most common field testing procedures.

2.2.4.2. If an ICV fails to meet acceptance criteria, immediately recalibrate the instrument using the applicable initial calibration procedure or remove it from service.

2.2.5. Continuing Calibration Verification: Perform a CCV at no more than 24-hour intervals from previous verification, except where noted for individual FT-series SOPs.

2.2.5.1. If historically generated data demonstrate that a specific instrument remains stable for longer periods of time, the time interval between calibration verifications may be increased.

2.2.5.2. Base the selected time interval on the shortest interval that the instrument maintains stability. If CCVs consistently fail, shorten the time period between verifications or replace/repair the instrument.

2.2.5.3. All CCVs must meet the calibration acceptance criteria specified in the applicable FT-series SOP. See Table FT 1000-1 for a list of acceptance criteria for the most common field testing procedures.

2.2.5.4. If a CCV fails to meet acceptance criteria perform one or more of the following procedures as necessary:

- Reattempt the CCV again within the chronological bracket time interval without changing the instrument calibration. Do not perform maintenance, repair, or cleaning of the instrument or probe. Probes may be rinsed with analyte-free water or fresh verification standard. The CCV may be reattempted with a fresh aliquot of verification standard.
- Perform the initial calibration, perform an ICV, re-analyze the sample(s), and perform a CCV.
- Report all results between the last acceptable calibration verification and the failed calibration verification as estimated (report the value with a "J"). Include a narrative description of the problem in the field notes.

2.2.5.5. For installed instruments that are deployed for extended periods of time or used for continuous monitoring, see FT 1900.

2.2.5.6. Shorten the time period between verification checks or replace/repair the instrument.

2.2.6. Determining the Values of Secondary Standards: Use only those standards recommended by the manufacturer for a specific instrument. Only use secondary standards for continuing calibration verifications. See the individual FT-series SOPs for specific procedures for use of secondary standards. At documented intervals, determine or verify the values of secondary standards immediately after performing an initial calibration or after verifying the calibration with primary standards. Read each secondary standard as a sample. This result must be within the manufacturer's stated tolerance range and +/- 10% of the stated standard value. If the +/- 10% criterion is not

met, assign this reading as the value of the standard. If the reading is outside the manufacturer's stated tolerance range, discard the secondary standard.

2.2.7. **More frequent calibration verifications may be required for discharge permit compliance measurements or other regulatory requirements.**

3. PREVENTIVE MAINTENANCE: Record all maintenance and repair notes in the maintenance logbook for each meter (see FS 1007). If rental equipment is used, a log is not required. However, the origin (i.e., rental company), rental date, equipment type, model number, and identification number (if applicable) must be entered into the field notes or a rental equipment notebook.

4. DOCUMENTATION

4.1. Standard and Reagent Documentation: Document information about standards and reagents used for calibrations, verifications, and sample measurements.

4.1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.

4.1.1.1. Document acceptable verification of any standard used after its expiration date.

4.1.2. Record the concentration or other value for the standard in the appropriate measurement units.

4.1.2.1. Note vendor catalog number and description for pre-formulated solutions as well as for neat liquids and powdered standards.

4.1.2.2. Retain vendor assay specifications for standards as part of the calibration record.

4.1.3. Record the grade of standard or reagent used.

4.1.4. When formulated in-house, document all calculations used to formulate calibration standards.

4.1.4.1. Record the date of preparation for all in-house formulations.

4.1.5. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).

4.2. <u>Field Instrument Calibration Documentation</u>: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

4.2.1. Retain vendor certifications of all factory-calibrated instrumentation.

4.2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

4.2.2.1. Record the manufacturer name, model number, and identifying number such as a serial number for each instrument unit.

4.2.3. Record the time and date of all initial calibrations and all calibration verifications.

4.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.

4.2.5. Record the name of the analyst(s) performing the calibration.

4.2.6. Document the specific standards used to calibrate or verify the instrument or field test with the following information:

- Type of standard or standard name (e.g., pH buffer)
- Value of standard, including correct units (e.g., pH = 7.0 SU)
- Manufacturer's tolerance range for secondary standards
- Link to information recorded according to section 4.1 above

4.2.7. Retain manufacturers' instrument specifications.

4.2.8. Document whether successful initial calibration occurred.

4.2.9. Document whether each calibration verification passed or failed.

4.2.10. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.

4.2.10.1. Document the date and time of any corrective actions.

4.2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

4.2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).

4.3. Record all field-testing measurement data, to include the following:

- Project name
- Date and time of measurement or test (including time zone, if applicable)
- Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
- Latitude and longitude of sampling source location (if required)
- Analyte or parameter measured
- Measurement or test sample value
- Reporting units
- Initials or name of analyst performing the measurement
- Unique identification of the specific instrument unit(s) used for the test(s)

Appendix FT 1000
Tables, Figures and Forms

Table FT 1000-1 Field Testing Acceptance Criteria

Table FT 1000-1: Field Testing Acceptance Criteria	
Parameter	**Acceptance Criteria**
pH (FT 1100)	**± 0.2 Standard pH Units of buffer or more stringent program criteria**
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Dissolved Oxygen (FT 1500)	**± 0.3 mg/L of theoretical value (see Table FT 1500-1)**
Turbidity (FT 1600)	**0.1-10 NTU: ± 10% of standard value 11-40 NTU: ± 8% of standard value 41-100 NTU: ± 6.5% of standard value > 100 NTU: ± 5% of standard value**
Total Residual Chlorine (FT 2000)	**0.995 calibration curve correlation coefficient ± 10% of primary standard value ± 10% of secondary standard value Color comparator acceptance criterion: ± 10% of primary standard value**

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1.0 PURPOSE

This procedure provides general guidance and information pertaining to proper monitoring well design, installation, and development.

2.0 SCOPE

This procedure is applicable to the construction of monitoring wells. The methods described herein may be modified by project-specific requirements for monitoring well construction. In addition, many regulatory agencies have specific regulations pertaining to monitoring well construction and permitting. These requirements must be determined during the project planning phases of the investigation, and any required permits must be obtained before field work begins. Innovative monitoring well installation techniques, which typically are not used, will be discussed only generally in this procedure.

3.0 GLOSSARY

Monitoring Well - A well which is screened, cased, and sealed which is capable of providing a groundwater level and groundwater sample representative of the zone being monitored. Some monitoring wells may be constructed as open boreholes.

Piezometer - A pipe or tube inserted into the water bearing zone, typically open to water flow at the bottom and to the atmosphere at the top, and used to measure water level elevations. Piezometers may range in size from 1/2-inch-diameter plastic tubes to well points or monitoring wells.

Potentiometric Surface - The surface representative of the level to which water will rise in a well cased to the screened aquifer.

Well Point (Drive Point) - A screened or perforated tube (Typically 1-1/4 or 2 inches in diameter) with a solid, conical, hardened point at one end, which is attached to a riser pipe and driven into the ground with a sledge hammer, drop weight, or mechanical vibrator. Well points may be used for groundwater injection and recovery, as piezometers (i.e., to measure water levels) or to provide groundwater samples for water quality data.

4.0 RESPONSIBILITIES

Driller - The driller provides adequate and operable equipment, sufficient quantities of materials, and an experienced and efficient labor force capable of performing all phases of proper monitoring well installation and construction. The driller may also be responsible for obtaining, in advance, any required permits for monitoring well installation and construction.

Field Geologist - The field geologist supervises and documents well installation and construction performed by the driller, and insures that well construction is adequate to provide representative groundwater data from the monitored interval. Geotechnical engineers, field technicians, or other suitable trained personnel may also serve in this capacity.

5.0 PROCEDURES

5.1 Equipment/Items Needed

Below is a list of items that may be needed when installing a monitoring well or piezometer:

- Health and safety equipment (hard hats, safety glasses, etc.) as required by the Site Safety Officer.
- Well drilling and installation equipment with associated materials (typically supplied by the driller).
- Hydrogeologic equipment (weighted engineer's tape, water level indicator, retractable engineers rule, electronic calculator, clipboard, mirror and flashlight - for observing downhole activities, paint and ink marker for marking monitoring wells, sample jars, well installation forms, and a field notebook).
- Drive point installation tools (sledge hammer, drop hammer, or mechanical vibrator; tripod, pipe wrenches, drive points, riser pipe, and end caps).

5.2 Well Design

The objectives and intended use for each monitoring well must be clearly defined before the monitoring system is designed. Within the monitoring system, different monitoring wells may serve different purposes and, therefore, require different types of construction. During all phases of the well design, attention must be given to clearly documenting the basis for design decisions, the details of well construction, and the materials used. The objectives for installing the monitoring wells may include:

- Determining groundwater flow directions and velocities.
- Sampling or monitoring for trace contaminants.
- Determining aquifer characteristics (e.g., hydraulic conductivity).

Siting of monitoring wells shall be performed after a preliminary estimation of the groundwater flow direction. In most cases, groundwater flow directions and potential well locations can be determined by an experienced hydrogeologist through the review of geologic data and the site terrain. In addition, data from production wells or other monitoring wells in the area may be used to determine the groundwater flow direction. If these methods cannot be used, piezometers, which are relatively inexpensive to install, may have to be installed in a preliminary investigative phase to determine groundwater flow direction.

5.2.1 Well Depth, Diameter, and Monitored Interval

The well depth, diameter, and monitored interval must be tailored to the specific monitoring needs of each investigation. Specification of these items generally depends on the purpose of the monitoring system and the characteristics of the hydrogeologic system being monitored. Wells of different depth, diameter, and monitored interval can be employed in the same groundwater monitoring system. For instance, varying the monitored interval in several wells, at the same location (cluster wells) can help to determine the vertical gradient and the depths at which contaminants are present. Conversely, a fully penetrating well is usually not used to quantify or vertically locate a contaminant plume, since groundwater samples collected in wells that are screened over the full thickness of the water-bearing zone will be representative of average conditions across the entire monitored interval. However, fully penetrating wells can be used to establish the existence of contamination in the water-bearing zone. The well diameter desired depends upon the hydraulic characteristics of the water-bearing zone, sampling requirements, drilling method and cost.

The decision concerning the monitored interval and well depth is based on the following (and possibly other) information:

- The vertical location of the contaminant source in relation to the water-bearing zone.
- The depth, thickness and uniformity of the water-bearing zone.
- The anticipated depth, thickness, and characteristics (e.g., density relative to water) of the contaminant plume.
- Fluctuation in groundwater levels (due to pumping, tidal influences, or natural recharge/discharge events).
- The presence and location of contaminants encountered during drilling.
- Whether the purpose of the installation is for determining existence or non-existence of contamination or if a particular stratigraphic zone is being investigated.
- The analysis of borehole geophysical logs.

In most situations where groundwater flow lines are horizontal, depending on the purpose of the well and the site conditions, monitored intervals are 20 feet or less. Shorter screen lengths (5 feet or less) are usually required where flow lines are not horizontal, (i.e., if the wells are to be used for accurate measurement of the potentiometric head at a specific point).

Many factors influence the diameter of a monitoring well. The diameter of the monitoring well depends on the application. In determining well diameter, the following needs must be considered:

- Adequate water volume for sampling.
- Drilling methodology.
- Type of sampling device to be used.
- Costs.

Standard monitoring well diameters are 2, 4, 6, or 8 inches. Drive points are typically 1-1/4 or 2 inches in diameter. For monitoring programs which require screened monitoring wells, either a 2-inch or 4-inch-diameter well is preferred. Typically, well diameters greater than 4 inches are used in monitoring programs in which open-hole bedrock monitoring wells are used. With smaller diameter wells, the volume of stagnant water in the well is minimized, and well construction costs are reduced; however, the sampling devices that can be used are limited.

In specifying well diameter, sampling requirements must be considered (up to a total of 4 gallons of water may be required for a single sample to account for full organic and inorganic analyses, and split samples), particularly if the monitored formation is known to be a low-yielding formation. The unit volume of water contained within a monitoring well is dependent on the well diameter as follows:

Casing Inside Diameter (Inch)	Standing Water Length to Obtain 1 Gallon Water (Feet)
2	6.13
4	1.53
6	0.68

If a well recharges quickly after purging, then well diameter may not be an important factor regarding sample volume requirements.

Pumping tests for determining aquifer characteristics may require larger diameter wells (for installation of high capacity pumps); however, in small-diameter wells in-situ permeability tests can be performed during drilling or after well installation is completed.

5.2.2 Riser Pipe and Screen Materials

Well materials are specified by diameter, type of material, and thickness of pipe. Well screens require an additional specification of slot size. Thickness of pipe is referred to as "Schedule" for polyvinyl chloride (PVC) casing and is usually Schedule 40 (thinner wall) or 80 (thicker wall). Steel pipe thickness is often referred to as "Strength". Standard Strength is usually adequate for monitoring well purposes. With larger diameter pipe, the wall thickness must be greater to maintain adequate strength. The required thickness is also dependent on the method of installation; risers for drive points require greater strength than wells installed inside drilled borings.

The selection of well screen and riser materials depends on the method of drilling, the type of subsurface materials the well penetrates, the type of contamination expected, and natural water quality and depth. Cost and the level of accuracy required are also important. The materials generally available are Teflon, stainless steel, PVC galvanized steel, and carbon steel. Each has advantages and limitations (see Attachment A of this guideline for an extensive presentation on this topic). The two most commonly used materials are PVC and stainless steel. Properties of these two materials are compared in Attachment B. Stainless steel is a good choice where trace metals or organic sampling is required; however, costs are high. Teflon materials are extremely expensive, but are relatively inert and provide the least opportunity for water contamination due to well materials. PVC has many advantages, including low cost, excellent availability, light weight, ease of manipulation, and widespread acceptance. The crushing strength of PVC may limit the depth of installation, but the use of Schedule 80 materials may overcome some of the problems associated with depth. However, the smaller inside diameter of Schedule 80 pipe may be an important factor when considering the size of bailers or pumps required for sampling or testing. Due to this problem, the minimum well pipe size recommended for Schedule 80 wells is 4-inch I.D.

Screens and risers may have to be decontaminated before use because oil-based preservatives and oil used during thread cutting and screen manufacturing may contaminate samples. Metal pipe may corrode and release metal ions or chemically react with organic constituents, but this is considered a minor issue. Galvanized steel is not recommended where samples may be collected for metals analyses, as zinc and cadmium levels in groundwater samples may become elevated from leaching of the zinc coating.

Threaded, flush-joint casing is most often preferred for monitoring well applications. PVC, Teflon, and steel can all be obtained with threaded joints. Welded-joint steel casing is also acceptable. Glued PVC may release organic contaminants into the well, and therefore, should not be used if the well is to be sampled for organic constituents.

When the water-bearing zone is in consolidated bedrock, such as limestone or fractured granite, a well screen is often not necessary (the well is simply an open hole in bedrock). Unconsolidated materials, such as sands, clay, and silts require a screen. A screen slot size of 0.010 or 0.020 inch is generally used when a screen is necessary, and the annular borehole space around the screened interval is artificially packed with an appropriately sized sand, selected based on formation grain size. The slot size controls the quantity of water entering the well and prevents entry of natural materials or sand pack. The screen shall pass no more than 10 percent of the pack material, or in-situ aquifer material. The site geologist shall specify the combination of screen slot size and sand pack which will be compatible with the water-bearing zone, to maximize groundwater inflow and minimize head losses and movement of fines into the wells. For example, as a standard procedure, a Morie No. 1 or No. 10 to No. 20 U.S. Standard Sieve size filter pack is typically appropriate for a 0.020-inch slot screen; however, a No. 20 to No. 40 U.S. Standard Sieve size filter pack is typically appropriate for a 0.010-inch slot screen.

5.2.3 Annular Materials

Materials placed in the annular space between the borehole and riser pipe and screen include a sand pack when necessary, a bentonite seal, and cement-bentonite grout. The sand pack is usually a medium- to coarse-grained poorly graded, silica sand and should relate to the grain size of the aquifer sediments. The quantity of sand placed in the annular space is dependent upon the length of the screened interval, but should always extend at least 1 foot above the top of the screen. At least 1 to 3 feet of bentonite pellets or equivalent shall be placed above the sand pack. Cement-bentonite grout (or equivalent) is then placed to extent from the top of the bentonite pellets to the ground surface.

On occasion, and with the concurrence of the involved regulatory agencies, monitoring wells may be packed naturally (i.e., no artificial sand pack installed). In this case, the natural formation material is allowed to collapse around the well screen after the well is installed. This method has been used where the formation material itself is a relatively uniform grain size, or when artificial sand packing is not possible due to borehole collapse.

Bentonite expands by absorbing water and provides a seal between the screened interval and the overlying portion of the annular space and formation. Cement-bentonite grout is placed on top of the bentonite pellets, extending to the surface. The grout effectively seals the remaining borehole annulus and eliminates the possibility for surface infiltration reaching the screened interval. Grouting also replaces material removed during drilling and prevents hole collapse and subsidence around the well. A tremie pipe should be used to introduce grout from the bottom upward, to prevent bridging, and to provide a better seal. In shallow boreholes that don't collapse, it may be more practical to pour the grout from the surface without a tremie pipe.

Grout is a general term which has several different connotations. For all practical purposes within the monitoring well installation industry, grout refers to the solidified material which is installed and occupies the annular space above the bentonite pellet seal. Grout, most of the time, is made up of one or two assemblages of material, (e.g., cement and/or bentonite). A cement-bentonite grout, which is the most common type of grout used in monitoring well completions, normally is a mixture of cement, bentonite, and water at a ratio of one 90-pound bag of Portland Type I cement, plus 3 to 5 pounds of granular or flake-type bentonite, and 6-7 gallons of water. A neat cement consists of one ninety-pound bag of Portland Type I cement and 6-7 gallons of water. A bentonite slurry (bentonite and water mixed to a thick but pumpable mixture) is sometimes used instead of grout for deep well installations where placement of bentonite pellets is difficult. Bentonite chips are also occasionally used for annular backfill in place of grout.

In certain cases, the borehole may be drilled to a depth greater than the anticipated well installation depth. For these cases, the well shall be backfilled to the desired depth with bentonite pellets/chips or sand. A short (1- to 2-foot) section of capped riser pipe sump is sometimes installed immediately below the screen, as a silt reservoir, when significant post-development silting is anticipated. This will ensure that the entire screen surface remains unobstructed.

5.2.4 Protective Casing

When the well is completed and grouted to the surface, a protective steel casing is typically placed over the top of the well. This casing generally has a hinged cap and can be locked to prevent vandalism. The protective casing has a larger diameter than the well and is set into the wet cement grout over the well upon completion. In addition, one hole is drilled just above the cement collar through the protective casing which acts as a weep hole for the flow of water which may enter the annulus during well development, purging, or sampling.

A protective casing which is level with the ground surface (flush-mounted) is used in roadway or parking lot applications where the top of a monitoring well must be below the pavement. The top of the riser pipe is placed 4 to 5 inches below the pavement, and a locking protective casing is cemented in place to 3 inches below the pavement. A large diameter, manhole-type protective collar is set into the wet cement around the well with the top set level with or slightly above the pavement. An appropriately-sized id is placed over the protective sleeve. The cement should be slightly mounded to direct pooled water away from the well head.

5.3 Monitoring Well Installation

Pertinent data regarding monitoring well installation shall be recorded on log sheets as depicted and discussed in SOP SA-6.3. Attachments to this referenced SOP illustrate terms and physical construction of various types of monitoring wells.

5.3.1 Monitoring Wells in Unconsolidated Sediments

After the borehole is drilled to the desired depth, well installation can begin. The procedure for well installation will partially be dictated by the stability of the formation in which the well is being placed. If the borehole collapses immediately after the drilling tools are withdrawn, then a temporary casing must be installed and well installation will proceed through the center of the temporary casing, and continue as the temporary casing is withdrawn from the borehole. In the case of hollow-stem auger drilling, the augers will act to stabilize the borehole during well installation.

Before the screen and riser pipe are lowered into the borehole, all pipe and screen sections should be measured with an engineer's rule to ensure proper placement. When measuring sections, the threads on one end of the pipe or screen must be excluded while measuring, since the pipe and screen sections are screwed flush together.

After the screen and riser pipe are lowered through the temporary casing, the sand pack can be installed. A weighted tape measure must be used during the installation procedure to carefully monitor installation progress. The sand is slowly poured into the annulus between the riser pipe and temporary casing, as the casing is withdrawn. Sand should always be kept within the temporary casing during withdrawal in order to ensure an adequate sand pack. However, if too much sand is within the temporary casing (greater than 1 foot above the bottom of the casing) bridging between the temporary casing and riser pipe may occur. Centralizers may be used at the geologist's discretion, one above and one below the screen, to assure enough annular space for sand pack placement.

After the sand pack is installed to the desired depth (at least 1 foot above the top of the screen), then the bentonite pellet seal (or equivalent), can be installed in the same manner as the sand pack. At least 1 to 3 feet of bentonite pellets should be installed above the sand pack. Pellets should be added slowly and their fall monitored closely to ensure that bridging does not occur.

The cement-bentonite grout is then mixed and tremied into the annulus as the temporary casing or augers are withdrawn. Finally, the protective casing can be installed as detailed in Section 5.2.4.

5.3.2 Confining Layer Monitoring Wells

When drilling and installing a well in a confined aquifer, proper well installation techniques must be applied to avoid cross contamination between aquifers. Under most conditions, this can be accomplished by installing double-cased wells. This is accomplished by drilling a large-diameter boring through the upper aquifer, 1 to 5 feet into the underlying confining layer, and setting and pressure grouting or tremie grouting a large-diameter casing into the confining layer. The grout material must fill the space between the native material and the outer casing. A smaller diameter boring is then continued through the confining layer for

installation of the monitoring well as detailed for overburden monitoring wells. Sufficient time (determined by the field geologist), must be allowed for setting of the grout prior to drilling through the confined layer.

5.3.3 Bedrock Monitoring Wells

When installing bedrock monitoring wells, a large diameter boring is drilled through the overburden and approximately 5 –10 feet into bedrock. A casing (typically steel) is installed and either pressure grouted or tremie grouted in place. After the grout has cured, a smaller diameter boring is continued into bedrock to the desired depth. If the boring does not collapse, the well can be left open, and a screen is not necessary. If the boring collapses, then a screen is required and can be installed as detailed for overburden monitoring wells. If a screen is to be used, then the casing which is installed through the overburden and into the bedrock does not require grouting and can be removed when the final well installation is completed.

5.3.4 Drive Points

Drive points can be installed with either a sledge hammer, drop hammer, or a mechanical vibrator. The screen section is threaded and tightened onto the riser pipe with pipe wrenches. The drive point is simply pounded into the subsurface to the desired depth. If a heavy drop hammer is used, then a tripod and pulley setup is required to lift the hammer. Drive points typically cannot be manually driven to depths exceeding 10 feet.

Direct push sampling/monitoring point installation methods, using a direct push rig or drilling rig, are described in SOP SA-2.5.

5.3.5 Innovative Monitoring Well Installation Techniques

Certain innovative sampling devices have proven advantageous. These devices are essentially screened samplers installed in a borehole with only small-diameter tubes extending to the surface. This reduces drilling costs, decreases the volume of stagnant water, and provides a sampling system that minimizes cross-contamination from sampling equipment. Four manufacturers of these samplers include Timco Manufacturing Company, Inc., of Prairie du Sac, Wisconsin, BARCAD Systems, Inc., of Concord, Massachusetts, Westbay Instruments Ltd. of Vancouver, British Columbia, Canada and the University of Waterloo at Waterloo, Ontario, Canada.. Each manufacturer offers various construction materials.

5.4 Well Development Methods

The purpose of well development is to stabilize and increase the permeability of the gravel pack around the well screen, and to restore the permeability of the formation which may have been reduced by drilling operations. Wells are typically developed until all fine material and drilling water is removed from the well. Sequential measurements of pH, conductivity, turbidity, and temperature taken during development may yield information (stabilized values) regarding whether sufficient development has been performed. The selection of the well development method shall be made by the field geologist and is based on the drilling methods, well construction and installation details, and the characteristics of the formation that the well is screened in. The primary methods of well development are summarized below. A more detailed discussion may be found in Driscoll (1986).

5.4.1 Overpumping and Backwashing

Wells may be developed by alternatively drawing the water level down at a high rate (by pumping or bailing) and then reversing the flow direction (backwashing) so that water is passing from the well into the formation. This back and forth movement of water through the well screen and gravel pack serves to

remove fines from the formation immediately adjacent to the well, while preventing bridging (wedging) of sand grains. Backwashing can be accomplished by several methods, including pouring water into the well and then bailing, starting and stopping a pump intermittently to change water levels, or forcing water into the well under pressure through a water-tight fitting ("rawhiding"). Care should be taken when backwashing not to apply too much pressure, which could damage or destroy the well screen.

5.4.2 Surging with a Surge Plunger

A surge plunger (also called a surge block) is approximately the same diameter as the well casing and is aggressively moved up and down within the well to agitate the water, causing it to move in and out of the screens. This movement of water pulls fine materials into the well, where they may be removed by any of several methods, and prevents bridging of sand particles in the gravel pack. There are two basic types of surge plungers; solid and valved surge plungers. In formations with low yields, a valved surge plunger may be preferred, as solid plungers tend to force water out of the well at a greater rate than it will flow back in. Valved plungers are designed to produce a greater inflow than outflow of water during surging.

5.4.3 Compressed Air

Compressed air can be used to develop a well by either of two methods: backwashing or surging. Backwashing is done by forcing water out through the screens, using increasing air pressure inside a sealed well, then releasing the pressurized air to allow the water to flow back into the well. Care should be taken when using this method so that the water level does not drop below the top of the screen, thus introducing air into the formation and reducing well yield. Surging, or the "open well" method, consists of alternately releasing large volumes of air suddenly into an open well below the water level to produce a strong surge by virtue of the resistance of water head, friction, and inertia. Pumping of the well is subsequently done using the air lift method.

5.4.4 High Velocity Jetting

In the high velocity jetting method, water is forced at high velocities from a plunger-type device and through the well screen to loosen fine particles from the sand pack and surrounding formation. The jetting tool is slowly rotated and raised and lowered along the length of the well screen to develop the entire screened area. Jetting using a hose lowered into the well may also be effective. The fines washed into the screen during this process can then be bailed or pumped from the well.

6.0 RECORDS

A critical part of monitoring well installation is recording of all significant details and events in the site logbook or field notebook. The geologist must record the exact depths of significant hydrogeological features, screen placement, gravel pack placement, and bentonite placement.

A Monitoring Well Sheet (see Attachments to SOP SA-6.3) shall be completed, ensuring the uniform recording of data for each installation and rapid identification of missing information. Well depth, length, materials of construction, length and openings of screen, length and type of riser, and depth and type of all backfill materials shall be recorded. Additional information shall include location, installation date, problems encountered, water levels before and after well installation, cross-reference to the geologic boring log, and methods used during the installation and development process. Documentation is very important to prevent problems involving questionable sample validity. Somewhat different information will need to be recorded, depending on whether the well is completed in overburden (single- or double-cased), as a cased well in bedrock, or as an open hole in bedrock.

The quantities of sand, bentonite, and grout placed in the well are also important. The geologist shall calculate the annular space volume and have an idea of the quantity of material needed to fill the annular

space. Volumes of backfill significantly higher than the calculated volume may indicate a problem such as a large cavity, while a smaller backfill volume may indicate a cave-in or bridging of the backfill materials. Any problems with rig operation or down-time shall be recorded and may affect the driller's final fee.

7.0 REFERENCES

Scalf, M. R., J. F. McNabb, W. J. Dunlap, R. L. Cosby, and J. Fryberger, 1981. Manual of Groundwater Sampling Procedures. R. S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. EPA, Ada, Oklahoma.

Barcelona, M. J., P. P. Gibb and R. A. Miller, 1983. A Guide to the selection of Materials for Monitoring Well Construction and Groundwater Sampling. ISWS Contract Report 327, Illinois State Water Survey, Champaign, Illinois.

U.S. EPA, 1980. Procedures Manual for Groundwater Monitoring of Solid Waste Disposal Facilities. Publication SW-611, Office of Solid Waste, U.S. EPA, Washington, D.C.

Driscoll, Fletcher G., 1986. Groundwater and Wells. Johnson Division, St. Paul, Minnesota, 1989.

ATTACHMENT A

RELATIVE COMPATIBILITY OF RIGID WELL CASING MATERIAL (PERCENT)

Potentially-Deteriorating Substance	Type of Casing Material						
	PVC 1	Galvanized Steel	Carbon Steel	Lo-carbon Steel	Stainless Steel 304	Stainless Steel 316	Teflon*
Buffered Weak Acid	100	56	51	59	97	100	100
Weak Acid	98	59	43	47	96	100	100
Mineral Acid/ High Solids Content	100	48	57	60	80	82	100
Aqueous/Organic Mixtures	64	69	73	73	98	100	100
Percent Overall Rating	91	58	56	59	93	96	100

Preliminary Ranking of Rigid Materials:

1 Teflon®
2 Stainless Steel 316
3. Stainless Steel 304
4 PVC 1
5 Lo-Carbon Steel
6 Galvanized Steel
7 Carbon Steel

* Trademark of DuPont

RELATIVE COMPATIBILITY OF SEMI-RIGID OR ELASTOMERIC MATERIALS (PERCENT)

Potentially-Deteriorating Substance	Type of Casing Material								
	PVC Flexible	PP	PE Conv.	PE Linear	PMM	Viton®*	Silicone	Neoprene	Teflon®*
Buffered Weak Acid	97	97	100	97	90	92	87	85	100
Weak Acid	92	90	94	96	78	78	75	75	100
Mineral Acid/ High Solids Content	100	100	100	100	95	100	78	82	100
Aqueous/Organic Mixtures	62	71	40	60	49	78	49	44	100
Percent Overall Rating	88	90	84	88	78	87	72	72	100

Preliminary Ranking of Semi-Rigid or Elastomeric Materials:

1 Teflon®
2 Polypropylene (PP)
3. PVC Flexible/PE Linear
4 Viton®
5 PE Conventional
6 Plexiglas/Lucite (PMM)
7 Silicone/Neoprene

* Trademark of DuPont

Source: Barcelona et al., 1983

ATTACHMENT B

COMPARISON OF STAINLESS STEEL AND PVC FOR MONITORING WELL CONSTRUCTION

Characteristic	Stainless Steel	PVC
Strength	Use in deep wells to prevent compression and closing of screen/riser.	Use when shear and compressive strength are not critical.
Weight	Relatively heavier.	Light-weight; floats in water.
Cost	Relatively expensive.	Relatively inexpensive.
Corrosivity	Deteriorates more rapidly in corrosive water.	Non-corrosive -- may deteriorate in presence of ketones, aromatics, alkyl sulfides, or some chlorinated hydrocarbons.
Ease of Use	Difficult to adjust size or length in the field.	Easy to handle and work with in the field.
Preparation for Use	Should be steam cleaned if organics will be subsequently sampled.	Never use glue fittings -- pipes should be threaded or pressure fitted. Should be steam cleaned when used for monitoring wells.
Interaction with Contaminants*	May sorb organic or inorganic substances when oxidized.	May sorb or release organic substances.

* See also Attachment A.

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1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs, and reports generally initiated and maintained for documenting Tetra Tech NUS, Inc. (TtNUS) field activities.

2.0 SCOPE

Documents presented within this SOP (or equivalents) shall be used for all TtNUS field activities, as applicable. Other or additional documents may be required by specific client contracts or project planning documents.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

Project Manager (PM) - The PM is responsible for obtaining hardbound controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all field documentation used in site activities (i.e., records, field reports, sample data sheets, field notebooks, and the site logbook) in the project's central file upon the completion of field work.

Field Operations Leader (FOL) - The FOL is responsible for ensuring that the site logbook, notebooks, and all appropriate and current forms and field reports included in this SOP (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time frame.

General personnel qualifications for field documentation activities include the following:

- Occupational Safety and Health Administration (OSHA) 40-hour and applicable refresher training.
- Capability of performing field work under the expected physical and environmental (i.e., weather) conditions.
- Familiarity with appropriate procedures for documentation, handling, packaging, and shipping.

5.0 PROCEDURES

5.1 SITE LOGBOOK

5.1.1 General

The site logbook is a hard-bound, paginated, controlled-distribution record book in which all major on-site activities are documented. At a minimum, record or reference the following activities/events (daily) in the site logbook:

- All field personnel present
- Arrival/departure times and names of site visitors
- Times and dates of health and safety training
- Arrival/departure times of equipment
- Times and dates of equipment calibration

- Start and/or completion of borehole, trench, monitoring well installation activities, etc.
- Daily on-site activities
- Sample pickup information
- Health and safety issues (level of protection, personal protective equipment [PPE], etc.)
- Weather conditions

Maintain a site logbook for each project and initiate it at the start of the first on-site activity (e.g., site visit or initial reconnaissance survey). Make entries every day that on-site activities take place involving TtNUS or subcontractor personnel. Upon completion of the fieldwork, provide the site logbook to the PM or designee for inclusion in the project's central file.

Record the following information on the cover of each site logbook:

- Project name
- TtNUS project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2) but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). An example of a typical site logbook entry is shown in Attachment A.

If measurements are made at any location, either record the measurements and equipment used in the site logbook or reference the field notebook in which the measurements are recorded (see Attachment A).

Make all logbook, notebook, and log sheet entries in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, cross out the entry with a single strike mark, initial, and date it. At the completion of entries by any individual, the logbook pages used must be signed and dated by the person making the entries. The site logbook must also be signed by the FOL at the end of each day.

5.1.2 Photographs

Sequentially number movies, slides, or photographs taken of a site or any monitoring location to correspond to logbook/notebook entries. Enter the name of the photographer, date, time, site location, site description, and weather conditions in the logbook/notebook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook/notebook. If possible, such techniques shall be avoided because they can adversely affect the accuracy of photographs. Chain-of-custody procedures depend on the subject matter, type of camera (digital or film), and the processing it requires. Follow chain-of-custody procedures for film used for aerial photography, confidential information, or criminal investigation. After processed, consecutively number the slides of photographic prints and label them according to the logbook/notebook descriptions. Docket the site photographs and associated negatives and/or digitally saved images to compact disks into the project's central file.

5.2 FIELD NOTEBOOKS

Key field team personnel may maintain a separate dedicated field notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a

separate field notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a field notebook.

5.3 FIELD FORMS

All TtNUS field forms (see list in Section 6.0 of this SOP) can be found on the company's intranet site (http://intranet.ttnus.com) under Field Log Sheets. Forms may be altered or revised for project-specific needs, subject to client approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOPs.

5.3.1 Sample Collection, Labeling, Shipment, Request for Analysis, and Field Test Results

5.3.1.1 Sample Log Sheet

Sample log sheets are used to record specified types of data while sampling. The data recorded on these sheets are useful in describing the sample as well as pointing out any problems, difficulties, or irregularities encountered during sampling. Complete a sample log sheet for each sample obtained, including field quality control (QC) samples.

5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B. Complete the required information on the adhesive labels and apply them to every sample container. Obtain sample labels from the appropriate program/project source, request that they be electronically generated in house, or request them the laboratory subcontractor.

5.3.1.3 Chain-of-Custody Record

The chain-of-custody record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used as follows for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site:

- Retain one carbonless copy of the completed chain-of custody form in the field.
- Send one copy is sent to the PM (or designee)
- Send the original to the laboratory with the associated samples. Place the original (top, signed copy) of the chain-of custody form inside a large Ziploc®-type bag taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one chain-of custody form, send the form with the cooler containing vials for volatile organic compound (VOC) analysis or the cooler with the air bill attached. Indicate on the air bill how many coolers are included with that shipment.

An example of a chain-of-custody form is provided as Attachment C. After the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed chain-of custody form (any discrepancies between the sample labels and chain-of custody form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the TtNUS PM). The chain-of custody form is signed and copied. The laboratory will retain the copy, and the original becomes part of the samples' corresponding analytical data package.

5.3.1.4 Chain-of-Custody Seal

Attachment D is an example of a custody seal. The custody seal is an adhesive-backed label that is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transport to the laboratory. Sign and date custody seals

and affix them across the lid and body of each cooler (front and back) containing environmental samples (see SOP SA-6.1). Obtain custody seals from the laboratory (if available) or purchase them from a supplier.

5.3.1.5 Geochemical Parameters Log Sheets

Complete Field Analytical Log Sheets to record geochemical and/or natural attenuation field test results.

5.3.2 Hydrogeological and Geotechnical Forms

5.3.2.1 Groundwater Level Measurement Sheet

Complete a Groundwater Level Measurement Sheet for each round of water level measurements made at a site.

5.3.2.2 Data Sheet for Pumping Test

During the performance of a pumping test (or an in-situ hydraulic conductivity test), a large amount of data must be recorded, often within a short time period. Use a Pumping Test Data Sheet to facilitate this task by standardizing the data collection format for the pumping well and observation wells, and allowing the time interval for collection to be established in advance.

5.3.2.3 Packer Test Report Form

Complete a Packer Test Report Form for each well at which a packer test is conducted.

5.3.2.4 Boring Log

Complete a Summary Log of Boring, or Boring Log for each soil boring performed to document the materials encountered, operation and driving of casing, and locations/depths of samples collected. In addition, if volatile organics are monitored on cores, samples, cuttings from the borehole, or breathing zone, (using a photoionization detector [PID] or flame ionization detector [FID]), enter these readings on the boring log at the appropriate depth. When they become available, enter the laboratory sample number, concentrations of key contaminants, or other pertinent information in the "Remarks" column. This feature allows direct comparison of contaminant concentrations with soil characteristics.

5.3.2.5 Monitoring Well Construction Details Form

Complete a Monitoring Well Construction Details Form for every monitoring well, piezometer, or temporary well point installed. This form contains specific information on length and type of well riser pipe and screen, backfill, filter pack, annular seal and grout characteristics, and surface seal characteristics. This information is important in evaluating the performance of the monitoring well, particularly in areas where water levels show temporal variation or where there are multiple (immiscible) phases of contaminants. Depending on the type of monitoring well (in overburden or bedrock, stick-up or flush mount), different forms are used.

5.3.2.6 Test Pit Log

When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log must be filled out by the responsible field geologist or sampling technician.

5.3.2.7 Miscellaneous Monitoring Well Forms

Miscellaneous monitoring well forms that may be required on a project-specific basis include the Monitoring Well Materials Certificate of Conformance and Monitoring Well Development Record. Use a Monitoring Well Materials Certificate of Conformance to document all materials utilized during each monitoring well installation. Use a Monitoring Well Development Record to document all well development activities.

5.3.2.8 Miscellaneous Field Forms – Quality Assurance and Checklists

Miscellaneous field forms/checklists forms that may be required on a project-specific basis include the following:

- Container Sample and Inspection Sheet – use this form when a container (drum, tank, etc.) is sampled and/or inspected.
- QA Sample Log Sheet – use this form when a QA sample such as an equipment rinsate blank, source blank, etc. is collected.
- Field Task Modification Request (FTMR) – use this form to document deviations from the project planning documents. The FOL is responsible for initiating the FTMRs. Maintain copies of all FTMRs with the on-site planning documents, and place originals in the final evidence file.
- Field Project Daily Activities Checklist and Field Project Pre-Mobilization Checklist – used these during both the planning and field effort to ensure that all necessary tasks are planned for and completed. These two forms are not requirements but are useful tools for most field work.

5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring, or test equipment is necessary to ensure the proper operation and response of the equipment, to document the accuracy, precision, or sensitivity of the measurements, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log, which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. Maintain an Equipment Calibration Log for each electronic measuring device used in the field; make entries for each day the equipment is used or in accordance with manufacturer recommendations.

5.4 FIELD REPORTS

The primary means of recording on-site activities is the site logbook. Other field notebooks may also be maintained. These logbooks and notebooks (and supporting forms) contain detailed information required for data interpretation or documentation but are not easily used for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain on site for extended periods of time and are thus not accessible for timely review by project management. Other reports useful for tracking and reporting the progress of field activities are described below.

5.4.1 Daily Activities Report

To provide timely oversight of on-site contractors, complete and submit Daily Activities Reports (DARs) as described below.

5.4.1.1 Description

The DAR documents the activities and progress for each day's field work. Complete this report on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring that involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors. The DAR form can be found on the TtNUS intranet site.

5.4.1.2 Responsibilities

It is the responsibility of the rig geologist to complete the DAR and obtain the driller's signature acknowledging that the times and quantities of material entered are correct.

5.4.1.3 Submittal and Approval

At the end of the shift, the rig geologist must submit the DAR to the FOL for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DARs are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the PM.

5.4.2 Weekly Status Reports

To facilitate timely review by project management, photocopies of logbook/notebook entries may be made for internal use.

In addition to those described herein, other summary reports may also be contractually required.

All TtNUS field forms can be found on the company's intranet site at http://intranet.ttnus.com under Field Log Sheets.

6.0 LISTING OF FIELD FORMS ON THE TtNUS INTRANET SITE

- Boring Log
- Container Sample and Inspection Sheet
- Daily Activities Checklist
- Daily Activities Record
- Equipment Calibration Log
- Field Task Modification Request
- Field Analytical Log sheet - Geochemical Parameters
- Groundwater Level Measurement Sheet
- Groundwater Sample Log Sheet
- Hydraulic Conductivity Test Data Sheet
- Low Flow Purge Data Sheet
- Bedrock Monitoring Well Construction (Stick Up)
- Bedrock Monitoring Well Construction Flush Mount
- Bedrock Monitoring Well Construction Open Hole
- Confining Layer Monitoring Well Construction
- Monitoring Well Development Record

- Monitoring Well Materials Certificate of Conformance
- Overburden Monitoring Well Construction Flush Mount
- Overburden Monitoring Well Construction Stick Up
- Packer Test Report Form
- Pumping Test Data Sheet
- QA Sample Log Sheet
- Soil/Sediment Sample Log Sheet
- Surface Water Sample Log Sheet
- Test Pit Log
- Field Project Pre-Mobilization Checklist

ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY

START TIME: _____ DATE: _____

SITE LEADER: _____
PERSONNEL:

TtNUS	DRILLER	SITE VISITORS
_____	_____	_____
_____	_____	_____
_____	_____	_____

WEATHER: Clear, 68°F, 2-5 mph wind from SE

ACTIVITIES:

1. Steam jenney and fire hoses were set up.
2. Drilling activities at well ____ resumes. Rig geologist was _____. See Geologist's Notebook, No. 1, page 29-30, for details of drilling activity. Sample No. 123-21-S4 collected; see sample logbook, page 42. Drilling activities completed at 11:50 and a 4-inch stainless steel well installed. See Geologist's Notebook, No. 1, page 31, and well construction details for well _____.
3. Drilling rig No. 2 steam-cleaned at decontamination pit. Then set up at location of well _____.
4. Well _____ drilled. Rig geologist was _____. See Geologist's Notebook, No. 2, page ____ for details of drilling activities. Sample numbers 123-22-S1, 123-22-S2, and 123-22-S3 collected; see sample logbook, pages 43, 44, and 45.
5. Well _____ was developed. Seven 55-gallon drums were filled in the flushing stage. The well was then pumped using the pitcher pump for 1 hour. At the end of the hour, water pumped from well was "sand free."
6. EPA remedial project manger arrives on site at 14:25 hours.
7. Large dump truck arrives at 14:45 and is steam-cleaned. Backhoe and dump truck set up over test pit _____.
8. Test pit _____ dug with cuttings placed in dump truck. Rig geologist was _____. See Geologist's Notebook, No. 1, page 32, for details of test pit activities. Test pit subsequently filled. No samples taken for chemical analysis. Due to shallow groundwater table, filling in of test pit ___ resulted in a very soft and wet area. A mound was developed and the area roped off.
9. Express carrier picked up samples (see Sample Logbook, pages 42 through 45) at 17:50 hours. Site activities terminated at 18:22 hours. All personnel off site, gate locked.

_____

Field Operations Leader

ATTACHMENT B
SAMPLE LABEL

Tetra Tech NUS, Inc. 661 Andersen Drive Pittsburgh, 15220 (412)921-7090	Project: Site: Location:		
Sample No:			Matrix:
Date:	Time:	Preserve:	
Analysis:			
Sampled by:	Laboratory:		

ATTACHMENT C
CHAIN-OF-CUSTODY RECORD FORM

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER 3413 | PAGE ____ OF _____

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
		CARRIER/WAYBILL NUMBER		CITY, STATE

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)
PRESERVATIVE USED
TYPE OF ANALYSIS

DATE YEAR	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS										COMMENTS

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

ATTACHMENT D
CHAIN-OF-CUSTODY SEAL

CUSTODY SEAL	**CUSTODY SEAL**
Date	**Date**
Signature	**Signature**

APPENDIX B

DQO MEETING MINUTES

NASCF Partnering Team Meeting Attendence Record 05-May-10 BCT

05-May-10	BCT-FDEP	Grabka	7:51
	CH2MHill	Halil	7:58
	SDIV	Sanford	8:01
	Solution-IES	Keener	7:54
	TtNUS	Jonnet	7:51
		Simcik	7:51
		Wimble	13:00
06-May-10	BCT-FDEP	Grabka	7:56
	BCT-SDIV	Sanford	7:55
	Solution-IES	Keener	7:55
	TtNUS	Churchill	7:54
		Jonnet	7:54
		Klink	7:54
		Simcik	7:53
		Wimble	7:54

NASCF Partnering Team Minutes

MeetingDate: 05-May-10 **MeetingType:** BCT

Minute No. 2614
05-May-1
Topic: General
Program GENERAL
Site: Basewide
Presentor: FACILITA Team
Actions/Decisions:
1598

Check-in. What's new with everyone. Greg Fraley unable to attend this meeting due to a health issue.

Read mission, vision, and ground rules.

Validated agenda. Removed Tier II Update because there is no representitive at this meeting. Dave G. will provide team an update that Eric put together on the last Tier II meeting.

Developed parking lot items.

Action Items.
Item: 1576 - Art will prepare a quick letter addressed to Greg and Dave indicating that the four outstanding groundwater report drafts are OK as submitted based on discussions at this May BCT meeting.
Item 1594 - Discussed if GCTLs, as identified in the ROD, need to be met to achieve Ready for Reuse. Will keep item open to discuss later with Greg.

Minute No. 2615
05-May-1
Topic: General
Program GENERAL
Site: Basewide
Presentor: TtNUS Simcik
Actions/Decisions:

Schedule review:
Provided Cecil Field Document Tracking Table and field schedule update and LTM program tracking table to team. Table revised based on comments.
No CERCLIS / SCAPS update this meeting.
Exit Strategy due on May 14, 2010, and Mark Jonnet will update and submit to Tier II.

Dave G. asked about schedule for Building 502 and 290A. Mike H. will provide update later today. Sheet pile design currently being reviewed, and dig will be conducted once it is approved.

Minute No. 2616
05-May-1
Topic: Reporting
Program BRAC
Site: S. Fuel Farm
Presentor: TtNUS
Jonnet
Actions/Decisions:
780

South Fuel Farm

The biovent/biosparge system was installed by Bechtel in 1998 and was operated by Bechtel from 1998 to 2001. The system was then operated by CH2MHill from 2001 to 2007. A RAPA was submitted by Tetra Tech in 2004. In 2006/2007, CH2MHill prepared a Treatment Evaluation Report that recommended shutdown based on soil and groundwater levels less than system cleanup goals. One year of Post-Active Remediation Monitoring (PARM) was conducted. The results of PARM identified isopropylbenzene and TRPH exceedences in CEF-043-7N.

Soil results identified no surface soil concentrations greater than direct exposure industrial SCTLs. TRPH exceedances in subsurface soil samples were attributed to contamination in the smear zone. The 2009 PARM Report by CH2MHill identified that residual soil contamination is not a direct exposure threat at this site.

Groundwater sampled annually from 2000 to 2005. The 2006 and 2007 investigation concluded that the biosparge system had remediated groundwater successfully. Five wells were sampled from 2008 to 2009, and a rebound was observed. Benzene, ethylbenzene, xylenes, isopropylbenzene and TRPH concentrations in CEF-043-7N exceeded NADCs.

The last sampling effort was conducted in February 2009. FDEP identified interest in knowing what the concentration is now in the two wells exceeding NADCs and upgradient of the rebounded wells. An action is needed based on exceedences of system action levels. Dave identified that an additional investigation should be conducted to determine the next appropriate actions.

Tetra Tech is to conduct O&M sampling using the current PARM plan prepared by CH2MHill to support this additional investigation. The results are to be presented at the next BCT meeting.

Minute No. 2617
05-May-1
Topic: Reporting
Program CERCLA
Site: Site 45
Presentor: TtNUS
Jonnet
Actions/Decisions:
1599 781

Site 45

Vanadium LTM program. Based on June 2009 groundwater sampling results, the source area has higher levels of vanadium than what were observed in 2001, and two downgradient groundwater wells (-02Sb and -06S) had detections of vanadium exceeding the GCTL (180 ppb and 142 ppb, respectively). Plume concentrations were predicted to decrease to less than the GCTL via dilution in 900 to 1,300 years.

Analytical modeling was conducted and presented. The conservative modeling identified the plume is not expected to migrate more the 450 feet from the source area.

It was proposed that new downgradient wells be installed at the edge of the anticipated extent of migration, and based on results (assuming they will be less than GCTL of 49 ppb for vanadium), land use restrictions will be proposed to extend onto the City of Jacksonville property via Restrictive Covenent.

The locations of the two new wells were proposed approximately 500 feet from the source area. Dave questioned the true direction of groundwater flow in the area. The location of the southwestern well might not be downgradient. Dave wants another round of groundwater level measurements and preparation of a revised contour map. Tetra Tech directed to do another round of groundwater elevations and present results to the team.

Minute No. 2618
05-May-1
Topic: Reporting
Program CERCLA
Site: Site 1&2
Presentor: TtNUS
Jonnet
Actions/Decisions:

Site 1 and 2 Annual Monitoring Presentation.

The Year 13 annual groundwater event, was conducted in April 2010. Three sediment and three surface water samples were collected.
Sediment results were relatively unchanged and all below criteria. The surface water results were also unchanged and were less than criteria.

The next sampling effort will be conducted in April 2011.

Minute No. 2619
05-May-1
Topic: Reporting
Program CERCLA
Site: Site 59
Presentor: TtNUS
Jonnet
Actions/Decisions:
1600 782

Site 59, OU9, Year 2 fourth quarter groundwater monitoring event.

This is the annual sampling event, and an annual report will be prepared and submitted.

The sampling event was conducted during the week of April 2, 2010. Groundwater level measurements were collected from 58 wells, and samples were collected at 32 wells for analysis. Groundwater flow direction remained relatively unchanged.

Upgradient wells (well cluster 001) were all non-detect. Downgradient well cluster 019 concentrations were also all non-detect. Sidegradient well clusters 009, 027, 011,029,014, and 026 were all non-detect, except CEF-026-035 had TCE at 3.4 ppb. Vertical well CEF-004-112 was non-detect. The source area wells in the area of the systems were reduced to less than the system action levels, and the systems were shut off. The expanded system in the Hot Spot #2A area around CEF-013-053 had a significant decrease in TCE from 1,400 ppb, and cis-1,2-DCF increased from 2 to 534 mg/L, showing a reduction via biodegradation is occuring.

There is about 2 months of funding remaining to run the expanded system. The original systems do not need to be turned on, but the expanded system should continue to be operated to reduce the cis-1,2-DCE via biodegradation.

Minute No. 2620
05-May-1
Topic: Reporting
Program GENERAL
Site: Basewide
Presentor: CH2MHill
Halil
Actions/Decisions:

RAC Status Update

Site 59: RAC February sampling event results presented during Tetra Tech Site 59 update.

Site 15: Tetra Tech completing RI field work. Approximately 75,000 lbs of Munitions Debris from the previous RAC efforts are still on site (119 55-gal drums). A subcontractor is in process of processing and transporting drums for offsite disposal.

Building 365/Hangar 860 MRAs: Final Explosives Safety Submission (ESS) submitted to NOSSA during the week of April 26, 2010. Mobilization scheduled for May 31, 2010. NOSSA provided verbal communication that they would provide interim site approval to start work. Field work is scheduled to be completed in 8 to 12 weeks for both sites. The ESQD for MEC removal was revised to 61 feet based on HFD causes no impacts to inhabited building or operations.

Building 502 and 290A: June 7th is the new proposed excavation date. One week for the excavation activities.

Site 36/37 system operation has been turned over to the BOA (Solutions-IES). No issues, and system is operating fine.

Minute No. 2621
05-May-1
Topic: Reporting
Program BRAC
Site: Basewide
Presentor: TtNUS
Wimble
Actions/Decisions:

Petroleum Update

815 Wash Rack: 1st Semi-Annual, 2nd Year. Sampling was conducted January 2010 in accordance with the 2008 NAMPAO. Four wells being evaluated. Groundwater flow is consistent with previous sampling events. Naphthalene concentrations remain above the GCTL but now less than the NADC. The report was submitted April 16, 2010, and the next sampling event is scheduled for July 2010.

North-South Apron Plume: Sampling occured on January 21, 2010. 1st Semi-annual, Year 5 event. Groundwater flow is consistent with previous efforts. The report was submitted on April 5, 2010, and the next sampling event is scheduled for July 2010. Benzene concentrations decreased slightly from previous sampling events.

BP Wells: Seven wells are being sampled on a semi-annual basis. Second Semi-Annual Year 2 report was submitted today. There is contamination in the downgradient wells so, additonal monitoring wells will be installed and a soil investigation will be conducted. An FTMR will be prepared and submitted to do this investigation and well installation activity.

Ocala Crash Site: Annual groundwater monitoring. Year 5 annual groundwater sampling was conducted in February 2010. No exceedances were detected this sampling round. Tetra Tech will resample CEF-CS1AR and CEF-CS10 to confirm the lack of detection. Results will be presented at the August BCT meeting.

Building 82, Tank 82: Year 2, 2nd semi-annual sampling was conducted on April 19, 2010, and results will be disussed during the next BCT meeting.

81 A, B and C: A UFP-SAP was submitted and is currently in FDEP review. The next sampling event will be conducted after the SAP is approved.

Building 502 and 290A digs: A work plan was submtited by CH2MHill.
Field activity is scheduled to be conducted during the week of June 7, 2010.

Minute No. 2622
05-May-1
Topic: Reporting
Program CERCLA
Site: Basewide
Presentor: Solution-IE
Jessica
Actions/Decisions:
1601 783
1602

BOA LTM Presentations.

The LTM reports for the March 2010 and December 2009 sampling events were being held pending discussions at this meeting prior to formal submission.

IR Site Summary for LTM sampling conducted in March 2010:

Site 57: Annual sampling effort. Year 7. Water level data suggest flow toward the southeast. Twenty-three wells are being evaluated. Generally, concentrations decreased in the source area but were generally consistent in downgradient wells. Petroleum Plume: six wells with concentrations in excess of GCTLs. Chlorinated plume: two wells with concentrations in excess of the GCTLs. Continue with the monitoring program; next event will be in March 2011.

Site 58: Annual sampling effort. Year 7. Groundwater flow toward sewer system located in the middle of the site. Nine wells being analyzed. Select VOCs, naphthalene, and TRPH for select wells. Naphthalene was detected above the GCTL in CEF-312-01 and -01S. No other constituents were detected above GCTLs. The last time TRPH was detected was in January 2008. MW-01S had two rounds below GCTL, but will do one more round for TRPH for this well only. Note that in January 2009, three wells had anomalous results so resampling was conducted in April 2009. Review optimization of the sampling plan to eliminate wells and/or analyses.

Site 36 and 37: Year 10. Quarterly monitoring while system is operational. Sampling was conducted March 15, 2010. Hot Spot 1: Source area well (-03I) had no detections above GCTLs. Downgradient wells in intermediate zone and deep zone (-07I and -08D) had benzene and TCE above GCTLs but well below system action levels. Sidegradient wells also had some detections above the GCTLs. Hot Spot #2 had concentrations above GCTL but still below the system action levels. Hot Spot #3: System currently operational. Benzene concentrations above the system action level in CEF-037-29S (less than December sampling event) and CEF-037-40. Outside the influence of the system is CEF-037-26S, which has a detection above the system action level. Groundwater divide well CEF-233-01S had detections and will continue to be monitored. No exceedances in any of the sentinel wells. Tetra Tech will conduct the next quarterly sampling event in June 2010 for source area wells only.

Petroleum Site Summaries for LTM sampling conducted in March 2010:

JETC: Quaterly groundwater sampling effort. Year 10, 1st quarter. Five wells being sampled for select VOC, PAHs, and TRPH. Groundwater flow remains to the southwest. TRPH exceededits GCTL in well CEF-334-34S, this is only well with GCTL exceedances during last four quarterly events. All other parameters were not dectected above the GCTLs. It appears the system was successful in remediating this site. The monitoring report will recommend the elimination of all analysis except TRPH and elimination of monitoring wells -17S, -02SA, -01S, and -02S.

Building 271: Quarterly sampling program. Groundwater being evaluated at four monitoring wells and analysis of two wells. Concentrations still exceed the GCTL in source well -07S, and are non-detect in downgradient well -10S. Continue with the monitoring program.

Building 46: Quarterly sampling program. The system was turned off in December 2009. 14 wells are being used to determine groundwater flow, which is to the south/southwest. Naphthalene and sulfate are the only constituents detected above the GCTLs. Benzene and MTBE were not detected above GCTLs in any of the wells. Might want to consider eliminating a few of the intermediate wells in the upgradient area (-15I, -12I, and -13I). Dave suggested that the report recommend the elimination

of -25I for analysis but continuation for water level measurement. Add -27D for sulfate. Need to review groundwater flows to confirm applicability of removing these. These eliminations are to be recommended in the formal submission of the report and are not to be implemented until a formal letter from FDEP on the recommendation is obtained. The next sampling effort is scheduled for June 8, 2010. The field MNA parameters, now that the system is off, might be considered for removal from the program. FDEP identified it is really only concerned with sulfate and sulfide. We are now in post-active remedial system monitoring for the next quarters.

Day Tank 1: Semi-annual sampling effort. Water flows toward the southeast. Naphthalene, isopropylbenzene, and 1,2,4-trimethylebenzene were detected above the GCTLs. Isopropylbenzene was detected above the NADC in VEW-8. Nine of the 12 wells had concentrations in excess of GCTLs. Naphthalene was only detected in VEW-7. In general, concentrations increased slightly compared to September 2009 results. The next sampling effort is in September 2010.

North Fuel Farm: Quarterly monitoring. System is on. Benzene concentrations in CEF-076-113S have not decreased since system startup in July 2005. Thirteen of the 16 wells sampled had exceedances of GCTLs. Seven of these above the NADCs. The system was modified to increase air flow toward impacted wells (-113S and -110D), but it did not seem to have an impact. Monitoring well -113S was evaluated by Solutions-IES and Hill, and there was observed bubbling (area flooded due to rain, and ground surface was bubbling). Discuss if the system needs to be modified or another remedial alternative is needed. The sparge well is 48' to 50' bgs, and the -113S well is 35' - 40' bgs. It is recommended that two new air sparge wells be installed near -113S and the existing air lines be used to provide the air. Dave will need a short plan on this proposed modification to the system.

The modification of the sparge system will include two sparge wells installed to a depth of 50' bgs with a 2-foot screen located at approximately 5 feet in each direction from -113S. The air will be supplied by using an existing well to supply these newly installed wells.

Minute No. 2623
05-May-1
Topic: Reporting
Program CERCLA
Site: Site 15
Presentor: TtNUS
Jonnet
Actions/Decisions:
1603

Site 15 groundwater status update.

Summarized previous groundwater sampling results since the remedial action was completed. Monitori ng well CEF-015-17S was installed and sampled. During the first event on 6/5/09, the arsenic concentration slightly exceeded the GCTL of 10 ppb.
6/5/09 at 11.9 ppb
6/19/09 at 14.5 ppb
6/29/09 at 19.3 ppb
10/7/09 at 20.0 ppb
1/14/10 at 10.4 ppb
2/4/10 at 7.5 ppb

Dave G. will prepare a writeup for his management to review requesting No Further Action for groundwater.
The writeup to his management will be requesting they agree that arsenic is not a concern in groundwater at Site 15.

Minute No. 2624 05-May-1 **Topic:** Reporting **Program** GENERAL **Site:** Basewide **Presentor:** FACILITA Team **Actions/Decisions:**	Parking Lot items: Well abandonment: Mark Jonnet provided an update on well abandoment status. Right now tracking 869 monitoring wells in GIS. There are about nine background wells that could possibly be abandonded. Site 25 is NFA but close to 81ABC so none of these wells should be abandoned. Wells at active sites cannot be abandoned, so that limits what can be abandoned. Site 8 waiting on final report approval. There are 20 wells associated with this site. There are 13 NG wells that could be abandoded. A decision was made to wait for Site 8 to go NFA, and a maximum of about 50 wells could be abandoned this year. There are a significant number of wells at the NFF. NORM Data Transfer to NIRIS impact: Mark reviewed the table for NIRIS with Art. Mark will provide the table so Art can review it with Mark Davidson. Status of JAA FOST: Navy is working on the deed. Mike H. identified that the system expansion as-builts will be submitted tomorrow and that information will get to Dave. Dave can then approve the CH2MHill Construction Completion Report for the Site 59 system. The Site 59 OPS, RC, LUC RD, and IRACR all submitted final (just need a couple of approval letters saying finals have been received and approved). IDW Building Training: The annual IDW building training is scheduled for June 8, 2010, at 8:00 am. Solution-IES identified they will have a crew attend the meeting.
Minute No. 2625 06-May-1 **Topic:** Check In **Program** GENERAL **Site:** Basewide **Presentor:** FACILITA Team **Actions/Decisions:**	Check in. How is everyone this morning. Review days agenda.

Minute No. 2626
06-May-1
Topic: Reporting
Program CERCLA
Site: Site 15
Presentor: TtNUS
Klink
Actions/Decisions:
1604

Site 15 MEC update.

Field effort for the investigation started last week. There are three parts to the process. The transects are laid out, the vegetation is cleared, and then the sweep for MEC is conducted.

The transects are about 5' wide and 100' long. If a specific area is identified as having a significant number of anomalies, then additional stepouts can be completed as needed. The field team consists of six personnel, and daily logs are completed and a weekly summary is prepared.

There have been some issues with the brush clearing equipment breaking down. We are bringing in a bush hog to assist in the clearing effort. Even with the down time, the crew is still on schedule. The temperature has been very warm, with most days in the low 90 degrees.

The crew has identified four MEC items on the surface that appear to be Munitions Debris consisting of propellant containers and slap flare casings. One of the items was identified outside the LUC for soil and in the NAS Jacksonville property. This location is to be confirmed. Art will let Adrian (his point of contact at NAS Jacksonville) know about this discovery.

The investigation appears to be following what was expected, with the outter edge being relatively clear and the middle section having much more "noise" or anomalies. The line segments will be color coded based on the number of anomalies. Blue would be no anomalies and then various colors for low, medium, or high number of anomalies.

The MRP website is uploaded on a daily basis to track progress on a daily basis. Linda logged on to provide live demonstration.

There is funding in place for the next effort.

Minute No. 2627
06-May-1
Topic: Reporting
Program GENERAL
Site: Basewide
Presentor: TtNUS Churchhill
Actions/Decisions:
1605

UFP SAP for BOA Sites

Peggy Churchill is the acting DQO facilitator.
Peggy discussed with Jessica the BOA chain of command and current validation efforts. Jessica will markup the appropriate worksheets.

Two UFP SAPs for BOA sites are being prepared: IR Sites and Petroleum Sites.
Petroleum Sites LTM Program DQO Presentation.
The sites in the SAP include:
Jet Engine Test Cell (JETC)
Ocala Crash Site *
Norh Fuel Farm (NFF)
Day Tank 1
Building 46
Building 271
South Fuel Farm (SFF) *

*It was identified that the Ocala Crash Site and South Fuel Farm (SFF) sampling will be conducted by Tetra Tech and that the Final Petroleum SAP will be modified to include these two site. All the other sites are being sampled by Solutions-IES and will be included in the UFP SAP for BOA sites.

Each site was reviewed with regard to monitoring wells on site and which wells are being currently sampled.

For the Ocala Crash Site, more information is needed on the excavation conducted and included as the active remediation.

For JETC, the figure needs to be revised to show the current LTM sampling being conducted. Jessica will update the Site Tracking Table with the current wells and analyses being conducted. Jessica will update the field table for all the BOA sites, and the UFP SAP will be revised to reflect this update.

For NFF, n-propylbenzene and p-isopropyltoluene were listed as COCs, and Dave identified there might not be standards for these. Do they have other chemical names? This needs to be checked.

When was the Day Tank 1 system actually operated? Beyond August 2003 as identified in the presentation. The system was completely removed from the site in 2009. Mark Jonnet reviewed the CH2MHill report, which verified that the system was deactivated in 2003, so precertification is correct.

Building 46. The active remedial systems have all been removed. The nutrient injection system was replaced by air sparging, and as of December 1, 2009, all systems have been completly removed. The site is currently in PARM consisting of quarterly monitioring for 1 year. Figure is missing -25I.

Building 271. The oil water separators are not part of the site so do not need to discussed in the history. Analysis for TRPH was removed. There is still an AS system on site, but it is not operational.

South Fuel Farm. This site was discussed yesterday. The five PARM wells will be sampled and analyzed for select VOCs, naphthalene, and TRPH.

DQO Step #1: Problem Statement:
The sites were catagorized according to whether or not a remedial system is on site and if so is it operational. The sites with systems include NFF, SFF, Bldg 271, and JETC.

There are no systems at Ocala, Day Tank 1, and Building 46.

DQO Step #3: Information Inputs.
Lab and field inputs discussed.

DQO #4: Study Boundaries.
Horizontal and vertical boundaries as well as population of interest discussed.

DQO #5: Analytical Approach.
- If all measured concentrations of COCs in all wells are less than GCTLs for two consecutive events, then no further monitoring is recommended.
- If any measured source well COC concentration is greater than or equal to the GCTL, then continue monitoring until all COC concentrations are less than the GCTL for two consecutive monitoring rounds.
- If any compliance well COC concentration is greater than or equal to the GCTL, then conduct additonal delineation of groundwater contamination via additional groundwater sampling and installaiton of new monitoring wells. An FTMR will be issued to govern the delineation.
- This decision rule assumes that the source area wells include COC concentrations that exceed GCTLs; however, the plume is stable in that no exceedances have been detected in the compliance wells for a minimum of two rounds.
- This decision rule applies to the NFF. As long as COC concentrations in the active remedial system area are greater than action levels, then operation of the remedial system will continue.
- If groundwater COC concentrations are less than or equal to system action levels (NADCs or level off as identified in Chaptor 62-770.690) for two consecutive sampling events, then the BCT will evaluate turning the system off and conducting PARM for 1 year. If PARM COC concentrations in source area wells rebound to levels greater than GCTLs, then the BCT will evaluate turning the active remedial system back on. If PARM concentrations are less than or equal to GCTLs, monitor for NA.

The NFF has a RAP approved so might want to include Section 7.7 of the RAP regarding system operation in the SAP.

The decision statements were revised and recorded by Peggy based on team input.

IR Sites LTM Program DQO Presentation

This SAP will include the following sites.
Site 3 - Oil and Sludge Disposal Pit
Site 5 - Oil Disposal Area Northwest
Site 17 - Sludge Disposal Pit Southwest
Site 21 - Golf Course Maintenance Area
Site 16 - AIMD Seepage Pit
Site 57
Site 58

Site 3 has a well point. The well point results should be compared to both the surface water and groundwater criteria, but it is the surface water criteria that will be considered in the decision statements.

Some of the sites have inorganics so need to make sure the Cecil Field Inorganic Background Data Set (IBDS) are included in the report.

For Site 16, need to verify the deep 5-year compliance well and the new sidegradient well added to the program are included. Jessica is providing the updated table for

	sampling, which will show these. The action level for Site 3 is 1,255 ppb TCE. The decision rules were discussed and agreed upon. The presentation text was revised with new language. Note that the decision rules are to be revised to remove specific reference to sampling frequency. Also note the language to be revised to identify BCT will determine next step. Peggy to delete Slide 40. The UFP SAPs will be updated and sent to Navy Chemist for review prior to submission to the team.
Minute No. 2628 06-May-1 **Topic:** Close-out **Program** GENERAL **Site:** Basewide **Presentor:** FACILITA Team **Actions/Decisions:** 1606	Check out conducted. The next meetings: August 10 through 12 in Jacksonville November 2 through 4 in Jacksonville Built preliminary agenda for next meeting Filled out facilitation report for Tier II. Discuss plusses/minuses.

NASCF Partnering Team Decisions 05-May-10

Decision No. - 780 **Site:** S. Fuel Farm **Minute Ref. No. -** 2616 05-May-10

Tetra Tech to sample monitoring wells in the PARM event (CEF-043-7N, CEF-043-6N, CEF-043-09N, CEF-043-02N, CEF-043-04N) for VOCs and TRPH. Also sample monitoring wells CEF-043-17, CEF-043-23, CEF-043-8N, CEF-043-5N, CEF-043-18, and CEF-043-40A for the same parameters. Include naphthalene as the only SVOC needed. Lead is not required.

Decision No. - 781 **Site:** Site 45 **Minute Ref. No. -** 2617 05-May-10

Collect a round of groundwater level measurements from the 16 wells at Site 45 and prepare a new groundwater flow contour map for discussion prior to selection of new downgradient monitoring wells.

Decision No. - 782 **Site:** Site 59 **Minute Ref. No. -** 2619 05-May-10

Expanded system to continue to be operated. CH2MHill will not conduct the last sampling event and will use the savings to operate the expanded system potentially until the next sampling event to be conducted by Tetra Tech in August 2010.

Decision No. - 783 **Site:** Basewide **Minute Ref. No. -** 2622 05-May-10

Eliminate analysis for TRPH in monitoring wells CEF-B312-01 and CEF-B312-3S. TRPH will be analyzed in CEF-B312-01S for the next round, and if ND again, it will be eliminated also. If not the other wells might be added back into the program.
Eliminate sampling and analysis of monitoring well CEF-B312-7S.

NASCF Outstanding Action Items

As of: 14-May-10

Action Item No.- 696 **Assigned to:** CONTRACTOR **on** 29-Jun-98 **Required by:** **Minute Ref. No.** 583
All inorganics must be compared to Cecil Field Screening Values (inorganic bckground data sets) for all future sampling events for any submittals.

Action Item No.- 1371 **Assigned to:** Sanford **on** 17-Mar-04 **Required by:** 8/31/2007 **Minute Ref. No.** 2085
Navy to have all BOAs and EMACs provide report dates to TtNUS for schedule tracking.

Action Item No.- 1465 **Assigned to:** Simcik **on** 07-Jun-06 **Required by:** **Minute Ref. No.** 2338
Send Team PDF of Meeting Minutes.

Action Item No.- 1587 **Assigned to:** Fraley **on** 02-Feb-10 **Required by:** **Minute Ref. No.** 2600
Greg and Art are to determine who the Draft 5-Year report will go to for review and signatures.

Action Item No.- 1593 **Assigned to:** Frayley **on** 02-Feb-10 **Required by:** **Minute Ref. No.** 2608
Greg is to look at what would be needed if the groundwater at Site 15 does not go below 10 ppb arsenic (ie: need ESD, ROD, other documentation?).

Action Item No.- 1594 **Assigned to:** Team **on** 02-Feb-10 **Required by:** **Minute Ref. No.** 2609
Provide team definition of what "Ready for Reuse" is as defined by CERCLA standards.

Action Item No.- 1595 **Assigned to:** Klink **on** 03-Feb-10 **Required by:** **Minute Ref. No.** 2611
Linda is to determine if the Cecil BCT will be able to access the Tt MRP web site and/or identify the procedure to request information on the ongoing progress of effort or highlights.

Action Item No.- 1598 **Assigned to:** Sanford **on** 05-May-10 **Required by:** **Minute Ref. No.** 2614
Art to send letter regarding four outstanding draft reports from Apex LLC to indicate draft accepted as final based on May BCT meeting discussions.

Action Item No.- 1599 **Assigned to:** Simcik **on** 05-May-10 **Required by:** **Minute Ref. No.** 2617
Provide both the old and new groundwater flow contour map to Dave for review so he can determine if the southwestern proposed well is in the correct location.

Action Item No.- 1600 **Assigned to:** Jonnet **on** 05-May-10 **Required by:** **Minute Ref. No.** 2619
Mark to follow up with Rusty to determine if the monitoring wells in the nothern area of Site 59 under construction were properly abandoned.

Action Item No.- 1601 **Assigned to:** Jessica **on** 05-May-10 **Required by:** **Minute Ref. No.** 2622
Jessica will see if the lab has results for 1,1,2,2-tetrachloroethane for CEF-B312-08S.

Action Item No.- 1602 **Assigned to:** Halil **on** 05-May-10 **Required by:** **Minute Ref. No.** 2622
Tetra Tech to prepare a short work plan for the installation of two air sparge wells for the NFF system modification. Plan needs to be stamped by a PE in Florida. Dave will provide the report to his engineer for approval before the system modification can be conducted.

Action Item No.- 1603 **Assigned to:** Grabka **on** 05-May-10 **Required by:** **Minute Ref. No.** 2623
Dave to prepare a write up summary of actions at Site 15 to present to his management in attempt to determine if NFA is appropriate for Site 15.

Action Item No.- 1604 **Assigned to:** Klink **on** 06-May-10 **Required by:** **Minute Ref. No.** 2626

Art to touch base with Adrien regarding the discovery of MEC on NAS Jacksonville proprety and possibly discuss future reuse in that area (because might be different than low-intensity recreational).

APPENDIX C

LABORATORY STANDARD OPERATING PROCEDURES

Charlie Crist
Governor

Ana M. Viamonte Ros. M.D., M.P.H.
State Surgeon General

Laboratory Scope of Accreditation

Attachment to Certificate #: E83510-21, expiration date June 30, 2010. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E83510** **EPA Lab Code:** **FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1	Synthetic Organic Contaminants	NELAP	9/6/2002
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1	Synthetic Organic Contaminants	NELAP	9/6/2002
Arsenic	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/2003
Barium	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/2003
Cadmium	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/2003
Chromium	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/2003
Copper	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/2003
Mercury	EPA 245.1	Primary Inorganic Contaminants	NELAP	4/1/2003
Nickel	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/2003
Perchlorate	EPA 314.0	Secondary Inorganic Contaminants	NELAP	2/3/2003

Laboratory Scope of Accreditation

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State Laboratory ID: **E83510** **EPA Lab Code:** **FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	4/10/2002
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	4/10/2002
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,2-Trichloro-1,2,2-trifluoroethane	ALS MS 005.2	Volatile Organics	NELAP	7/23/2004
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	4/10/2002
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	4/10/2002
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	4/10/2002
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/1/2008
1,2,4-Trichlorobenzene	EPA 625	Extractable Organics	NELAP	4/10/2002
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1	Volatile Organics	NELAP	6/20/2007
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8011	Volatile Organics	NELAP	7/1/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1	Volatile Organics	NELAP	6/20/2007
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8011	Volatile Organics	NELAP	7/1/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 602	Volatile Organics	NELAP	4/10/2002
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	4/10/2002
1,2-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	4/10/2002
1,2-Dichlorobenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	4/10/2002
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	4/10/2002
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E83510-21, expiration date June 30, 2010. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E83510 **EPA Lab Code: FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	3/25/2010
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 602	Volatile Organics	NELAP	4/10/2002
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	4/10/2002
1,3-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	4/10/2002
1,3-Dichlorobenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	3/25/2010
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 602	Volatile Organics	NELAP	4/10/2002
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	4/10/2002
1,4-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	4/10/2002
1,4-Dichlorobenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,4-Dioxane (1,4-Diethyleneoxide)	ALS MS 006	Extractable Organics	NELAP	8/25/2005
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	8/1/2008
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
1-Chlorohexane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	8/1/2008
1-Methylnaphthalene	EPA 610	Extractable Organics	NELAP	6/20/2007
1-Methylnaphthalene	EPA 625	Extractable Organics	NELAP	6/20/2007
1-Methylnaphthalene	EPA 8310	Extractable Organics	NELAP	6/20/2007
1-Methylnaphthalene (added to method at FDEP request)	EPA 8270	Extractable Organics	NELAP	6/20/2007
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	2/5/2009
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trichlorophenol	EPA 625	Extractable Organics	NELAP	4/10/2002
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003

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State Laboratory ID: E83510 **EPA Lab Code: FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
2,4-Dichlorophenol	EPA 625	Extractable Organics	NELAP	4/10/2002
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dimethylphenol	EPA 625	Extractable Organics	NELAP	4/10/2002
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrophenol	EPA 625	Extractable Organics	NELAP	4/10/2002
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 625	Extractable Organics	NELAP	4/10/2002
2,4-Dinitrotoluene (2,4-DNT)	EPA 8091	Extractable Organics	NELAP	3/1/2005
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	3/1/2005
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	8/1/2008
2,6-Dinitrotoluene (2,6-DNT)	EPA 625	Extractable Organics	NELAP	4/10/2002
2,6-Dinitrotoluene (2,6-DNT)	EPA 8091	Extractable Organics	NELAP	3/1/2005
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	3/1/2005
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	8/1/2008
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	4/10/2002
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chloronaphthalene	EPA 625	Extractable Organics	NELAP	4/10/2002
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Chlorophenol	EPA 625	Extractable Organics	NELAP	4/10/2002
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Hexanone	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Methyl-4,6-dinitrophenol	EPA 625	Extractable Organics	NELAP	4/10/2002
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylnaphthalene	EPA 610	Extractable Organics	NELAP	6/20/2007
2-Methylnaphthalene	EPA 625	Extractable Organics	NELAP	6/20/2007
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylnaphthalene	EPA 8310	Extractable Organics	NELAP	6/20/2007
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Naphthylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008

Laboratory Scope of Accreditation

Attachment to Certificate #: E83510-21, expiration date June 30, 2010. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E83510** **EPA Lab Code:** **FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrophenol	EPA 625	Extractable Organics	NELAP	4/10/2002
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	8/1/2008
3,3'-Dichlorobenzidine	EPA 625	Extractable Organics	NELAP	4/10/2002
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	8/1/2008
3,5-Dinitroaniline	EPA 8330	Extractable Organics	NELAP	8/1/2008
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	8/1/2008
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	2/5/2009
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
4,4'-DDD	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDE	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDT	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	7/1/2003
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	8/1/2008
4-Bromophenyl phenyl ether	EPA 625	Extractable Organics	NELAP	4/10/2002
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloro-3-methylphenol	EPA 625	Extractable Organics	NELAP	4/10/2002
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorophenyl phenylether	EPA 625	Extractable Organics	NELAP	4/10/2002
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	8/1/2008
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitrophenol	EPA 625	Extractable Organics	NELAP	4/10/2002
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E83510-21, expiration date June 30, 2010. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E83510 **EPA Lab Code: FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	8/1/2008
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	8/1/2008
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
Acenaphthene	EPA 610	Extractable Organics	NELAP	4/10/2002
Acenaphthene	EPA 625	Extractable Organics	NELAP	4/10/2002
Acenaphthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Acenaphthylene	EPA 610	Extractable Organics	NELAP	4/10/2002
Acenaphthylene	EPA 625	Extractable Organics	NELAP	4/10/2002
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Acetone	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetonitrile	EPA 8260	Volatile Organics	NELAP	4/1/2005
Acetophenone	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acetylene	RSK-175	Volatile Organics	NELAP	4/7/2010
Acrolein (Propenal)	EPA 624	Volatile Organics	NELAP	2/3/2003
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acrylonitrile	EPA 624	Volatile Organics	NELAP	2/3/2003
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Aldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	11/19/2009
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	4/1/2005
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/1/2005
Aluminum	EPA 200.7	Metals	NELAP	4/10/2002
Aluminum	EPA 6010	Metals	NELAP	7/1/2003
Ammonia as N	EPA 350.1	General Chemistry	NELAP	6/20/2007
Aniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
Anthracene	EPA 610	Extractable Organics	NELAP	4/10/2002
Anthracene	EPA 625	Extractable Organics	NELAP	4/10/2002
Anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Anthracene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Antimony	EPA 200.7	Metals	NELAP	4/10/2002

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E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Antimony	EPA 6010	Metals	NELAP	7/1/2003
Aramite	EPA 8270	Extractable Organics	NELAP	8/1/2008
Aroclor-1016 (PCB-1016)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1221 (PCB-1221)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1232 (PCB-1232)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1242 (PCB-1242)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1248 (PCB-1248)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1254 (PCB-1254)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1260 (PCB-1260)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Arsenic	EPA 200.7	Metals	NELAP	4/10/2002
Arsenic	EPA 6010	Metals	NELAP	4/10/2002
Atrazine	ALS MS 006.5 (Rev. 07/08)/GC-MS	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Barium	EPA 200.7	Metals	NELAP	4/10/2002
Barium	EPA 6010	Metals	NELAP	7/1/2003
Benzaldehyde	ALS MS 006.5 (Rev. 07/08)/GC-MS	Extractable Organics	NELAP	8/1/2008
Benzene	EPA 602	Volatile Organics	NELAP	4/10/2002
Benzene	EPA 624	Volatile Organics	NELAP	4/10/2002
Benzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Benzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Benzidine	EPA 625	Extractable Organics	NELAP	4/10/2002
Benzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)anthracene	EPA 610	Extractable Organics	NELAP	4/10/2002
Benzo(a)anthracene	EPA 625	Extractable Organics	NELAP	4/10/2002
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(a)pyrene	EPA 610	Extractable Organics	NELAP	4/10/2002
Benzo(a)pyrene	EPA 625	Extractable Organics	NELAP	4/10/2002

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E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(b)fluoranthene	EPA 610	Extractable Organics	NELAP	4/10/2002
Benzo(b)fluoranthene	EPA 625	Extractable Organics	NELAP	4/10/2002
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(g,h,i)perylene	EPA 610	Extractable Organics	NELAP	4/10/2002
Benzo(g,h,i)perylene	EPA 625	Extractable Organics	NELAP	4/10/2002
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(k)fluoranthene	EPA 610	Extractable Organics	NELAP	4/10/2002
Benzo(k)fluoranthene	EPA 625	Extractable Organics	NELAP	4/10/2002
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzoic acid	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Beryllium	EPA 200.7	Metals	NELAP	4/10/2002
Beryllium	EPA 6010	Metals	NELAP	7/1/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Biochemical oxygen demand	SM 5210 B	General Chemistry	NELAP	6/20/2007
Biphenyl	ALS MS 006.5 (Rev. 07/08)/GC-MS	Extractable Organics	NELAP	8/1/2008
bis(2-Chloroethoxy)methane	EPA 625	Extractable Organics	NELAP	4/10/2002
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroethyl) ether	EPA 625	Extractable Organics	NELAP	4/10/2002
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 625	Extractable Organics	NELAP	4/10/2002
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 625	Extractable Organics	NELAP	4/10/2002
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Bolstar (Sulprofos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Bromide	EPA 300.0	General Chemistry	NELAP	4/10/2002
Bromide	EPA 9056	General Chemistry	NELAP	7/1/2003
Bromobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003

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State Laboratory ID: E83510 **EPA Lab Code: FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	4/10/2002
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromoform	EPA 624	Volatile Organics	NELAP	4/10/2002
Bromoform	EPA 8260	Volatile Organics	NELAP	7/1/2003
Butyl benzyl phthalate	EPA 625	Extractable Organics	NELAP	4/10/2002
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Cadmium	EPA 200.7	Metals	NELAP	4/10/2002
Cadmium	EPA 6010	Metals	NELAP	4/10/2002
Calcium	EPA 200.7	Metals	NELAP	4/10/2002
Calcium	EPA 6010	Metals	NELAP	7/1/2003
Caprolactam	ALS MS 006.5 (Rev. 07/08)/GC-MS	Extractable Organics	NELAP	8/1/2008
Carbazole	EPA 8270	Extractable Organics	NELAP	7/1/2003
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	7/1/2003
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	4/10/2002
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Carbonaceous BOD (CBOD)	SM 5210 B	General Chemistry	NELAP	4/10/2002
Carbophenothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Chemical oxygen demand	SM 5220 C	General Chemistry	NELAP	6/20/2007
Chlordane (tech.)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Chloride	EPA 300.0	General Chemistry	NELAP	4/10/2002
Chloride	EPA 9056	General Chemistry	NELAP	7/1/2003
Chloride	SM 4500 Cl- C	General Chemistry	NELAP	4/7/2010
Chlorobenzene	EPA 602	Volatile Organics	NELAP	4/10/2002
Chlorobenzene	EPA 624	Volatile Organics	NELAP	4/10/2002
Chlorobenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Chloroethane	EPA 624	Volatile Organics	NELAP	4/10/2002
Chloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroform	EPA 624	Volatile Organics	NELAP	4/10/2002
Chloroform	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroprene	EPA 8260	Volatile Organics	NELAP	4/1/2005
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Chromium	EPA 200.7	Metals	NELAP	4/10/2002
Chromium	EPA 6010	Metals	NELAP	4/10/2002

Laboratory Scope of Accreditation

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E83510
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4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chromium VI	EPA 7196	Metals	NELAP	7/1/2003
Chrysene	EPA 610	Extractable Organics	NELAP	4/10/2002
Chrysene	EPA 625	Extractable Organics	NELAP	4/10/2002
Chrysene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Chrysene	EPA 8310	Extractable Organics	NELAP	7/1/2003
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	4/10/2002
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	4/3/2009
Cobalt	EPA 200.7	Metals	NELAP	4/10/2002
Cobalt	EPA 6010	Metals	NELAP	7/1/2003
Color	SM 2120 B	General Chemistry	NELAP	6/20/2007
Conductivity	EPA 120.1	General Chemistry	NELAP	5/2/2005
Copper	EPA 200.7	Metals	NELAP	4/10/2002
Copper	EPA 6010	Metals	NELAP	4/10/2002
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
delta-BHC	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Demeton-o	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Demeton-s	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dibenz(a,h)anthracene	EPA 610	Extractable Organics	NELAP	4/10/2002
Dibenz(a,h)anthracene	EPA 625	Extractable Organics	NELAP	4/10/2002
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibenz(a,h)anthracene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Dibenz(a,j)acridine	EPA 8270	Extractable Organics	NELAP	8/1/2008
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	4/10/2002
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dibromomethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Dieldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	7/1/2003
Diesel range organics (DRO)	MA-EPH	Extractable Organics	NELAP	7/1/2003
Diesel range organics (DRO)	OA-2	Extractable Organics	NELAP	4/1/2005
Diesel range organics (DRO)	TN-EPH	Extractable Organics	NELAP	6/20/2007
Diesel range organics (DRO)	WI-DRO	Extractable Organics	NELAP	4/1/2005
Diethyl ether	EPA 8260	Volatile Organics	NELAP	6/20/2007
Diethyl phthalate	EPA 625	Extractable Organics	NELAP	4/10/2002
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-isopropylether (DIPE)	EPA 8260	Volatile Organics	NELAP	6/20/2007
Dimethoate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Dimethyl phthalate	EPA 625	Extractable Organics	NELAP	4/10/2002
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-butyl phthalate	EPA 625	Extractable Organics	NELAP	4/10/2002
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-octyl phthalate	EPA 625	Extractable Organics	NELAP	4/10/2002
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/25/2010
Endosulfan I	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan II	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan sulfate	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin aldehyde	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
EPN	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Ethane	RSK-175	Volatile Organics	NELAP	4/1/2005
Ethanol	EPA 8015	Volatile Organics	NELAP	4/1/2005

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Ethanol	EPA 8260	Volatile Organics	NELAP	6/20/2007
Ethion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Ethoprop	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Ethyl acetate	EPA 8260	Volatile Organics	NELAP	6/20/2007
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	4/1/2005
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	8/1/2008
Ethyl tert-butyl alcohol	ALS MS 005	Volatile Organics	NELAP	4/3/2009
Ethylbenzene	EPA 602	Volatile Organics	NELAP	4/10/2002
Ethylbenzene	EPA 624	Volatile Organics	NELAP	4/10/2002
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ethylene	RSK-175	Volatile Organics	NELAP	4/1/2005
Ethyl-t-butylether (ETBE)	EPA 8260	Volatile Organics	NELAP	6/20/2007
Famphur	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Fensulfothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Fluoranthene	EPA 610	Extractable Organics	NELAP	4/10/2002
Fluoranthene	EPA 625	Extractable Organics	NELAP	4/10/2002
Fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fluoranthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Fluorene	EPA 610	Extractable Organics	NELAP	4/10/2002
Fluorene	EPA 625	Extractable Organics	NELAP	4/10/2002
Fluorene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fluorene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Fluoride	EPA 300.0	General Chemistry	NELAP	4/10/2002
Fluoride	EPA 9056	General Chemistry	NELAP	7/1/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/1/2005
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	7/1/2003
Gasoline range organics (GRO)	MA-VPH	Extractable Organics	NELAP	7/1/2003
Gasoline range organics (GRO)	OA-1	Extractable Organics	NELAP	4/1/2005
Gasoline range organics (GRO)	TN-GRO	Extractable Organics	NELAP	4/1/2005
Generic Analyte for SOP	Generic Method for SOP	Extractable Organics	NELAP	4/7/2010

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Hardness	SM 2340 B	Metals	NELAP	1/24/2003
Heptachlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Heptachlor epoxide	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Hexachlorobenzene	EPA 625	Extractable Organics	NELAP	4/10/2002
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 625	Extractable Organics	NELAP	4/10/2002
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorocyclopentadiene	EPA 625	Extractable Organics	NELAP	4/10/2002
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachloroethane	EPA 625	Extractable Organics	NELAP	4/10/2002
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	8/1/2008
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	8/1/2008
Ignitability	EPA 1010	General Chemistry	NELAP	7/1/2003
Indene	ALS MS 006	Extractable Organics	NELAP	4/7/2010
Indeno(1,2,3-cd)pyrene	EPA 610	Extractable Organics	NELAP	4/10/2002
Indeno(1,2,3-cd)pyrene	EPA 625	Extractable Organics	NELAP	4/10/2002
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Iron	EPA 200.7	Metals	NELAP	4/10/2002
Iron	EPA 6010	Metals	NELAP	7/1/2003
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8015	Volatile Organics	NELAP	4/1/2005
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	4/1/2005
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Isophorone	EPA 625	Extractable Organics	NELAP	4/10/2002
Isophorone	EPA 8270	Extractable Organics	NELAP	7/1/2003
Isopropyl alcohol (2-Propanol)	EPA 8015	Volatile Organics	NELAP	4/1/2005
Isopropyl ether	ALS MS 005	Volatile Organics	NELAP	8/25/2005
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Isosafrole	EPA 8270	Extractable Organics	NELAP	8/1/2008
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Kjeldahl nitrogen - total	EPA 351.2	General Chemistry	NELAP	6/20/2007

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Lead	EPA 200.7	Metals	NELAP	4/10/2002
Lead	EPA 6010	Metals	NELAP	4/10/2002
Magnesium	EPA 200.7	Metals	NELAP	4/10/2002
Magnesium	EPA 6010	Metals	NELAP	7/1/2003
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Manganese	EPA 200.7	Metals	NELAP	4/10/2002
Manganese	EPA 6010	Metals	NELAP	5/21/2007
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Mercury	EPA 245.1	Metals	NELAP	4/10/2002
Mercury	EPA 7470	Metals	NELAP	4/10/2002
Merphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	4/1/2005
Methane	RSK-175	Volatile Organics	NELAP	4/1/2005
Methanol	EPA 8015	Volatile Organics	NELAP	4/1/2005
Methapyrilene	EPA 8270	Extractable Organics	NELAP	8/1/2008
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	4/10/2002
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl chloride (Chloromethane)	EPA 624	Volatile Organics	NELAP	4/10/2002
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	4/1/2005
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	8/1/2008
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Methyl tert-butyl ether (MTBE)	EPA 602	Volatile Organics	NELAP	6/20/2007
Methyl tert-butyl ether (MTBE)	EPA 624	Volatile Organics	NELAP	6/20/2007
Methyl tert-butyl ether (MTBE)	EPA 8021	Volatile Organics	NELAP	7/1/2003
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methylene chloride	EPA 624	Volatile Organics	NELAP	4/10/2002
Methylene chloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Molybdenum	EPA 200.7	Metals	NELAP	4/10/2002
Molybdenum	EPA 6010	Metals	NELAP	4/10/2002
Monocrotophos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Naled	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Naphthalene	EPA 610	Extractable Organics	NELAP	4/10/2002
Naphthalene	EPA 625	Extractable Organics	NELAP	4/10/2002
Naphthalene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Naphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Naphthalene	EPA 8310	Extractable Organics	NELAP	7/1/2003
n-Butyl alcohol	EPA 8015	Volatile Organics	NELAP	4/1/2005
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Nickel	EPA 200.7	Metals	NELAP	4/10/2002
Nickel	EPA 6010	Metals	NELAP	4/10/2002
Nitrate	EPA 9056	General Chemistry	NELAP	7/1/2003
Nitrate (calc.)	SM 4500-NO3 E minus SM 4500-NO2 B	General Chemistry	NELAP	4/7/2010
Nitrate as N	EPA 300.0	General Chemistry	NELAP	4/10/2002
Nitrate as N	SM 4500-NO3 E	General Chemistry	NELAP	4/7/2010
Nitrate-nitrite	EPA 300.0	General Chemistry	NELAP	4/10/2002
Nitrate-nitrite	SM 4500-NO3 E	General Chemistry	NELAP	4/7/2010
Nitrite	EPA 9056	General Chemistry	NELAP	7/1/2003
Nitrite as N	EPA 300.0	General Chemistry	NELAP	4/10/2002
Nitrite as N	SM 4500-NO2-B	General Chemistry	NELAP	4/7/2010
Nitrobenzene	EPA 625	Extractable Organics	NELAP	4/10/2002
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	7/1/2003
Nitroglycerin	EPA 8330	Extractable Organics	NELAP	8/1/2008
Nitroglycerin	EPA 8332	Extractable Organics	NELAP	7/1/2003
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosodimethylamine	EPA 625	Extractable Organics	NELAP	4/10/2002
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosodi-n-propylamine	EPA 625	Extractable Organics	NELAP	4/10/2002
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiphenylamine	EPA 625	Extractable Organics	NELAP	4/10/2002
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiphenylamine/Diphenylamine (analyte pair)	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	8/1/2008

Attachment to Certificate #: E83510-21, expiration date June 30, 2010. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E83510 **EPA Lab Code: FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Propanol	EPA 8015	Volatile Organics	NELAP	4/1/2005
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
o,o,o-Triethyl phosphorothioate	ALS GC 032.2 (Rev. 07/08)	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Oil & Grease	EPA 1664A	General Chemistry	NELAP	9/8/2003
Oil & Grease	EPA 9070	General Chemistry	NELAP	7/1/2003
Organic nitrogen	EPA 351.2 - EPA 350.1	General Chemistry	NELAP	6/20/2007
Orthophosphate as P	EPA 365.3	General Chemistry	NELAP	4/10/2002
o-Toluidine	EPA 8270	Extractable Organics	NELAP	8/1/2008
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/25/2010
p-Dioxane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/1/2008
Pentachloroethane	ALS MS 006.5 (Rev. 07/08)/GC-MS	Extractable Organics	NELAP	8/1/2008
Pentachloroethane	EPA 8260	Volatile Organics	NELAP	4/1/2005
Pentachloronitrobenzene (Quintozene)	EPA 8270	Extractable Organics	NELAP	8/1/2008
Pentachlorophenol	EPA 625	Extractable Organics	NELAP	4/10/2002
Pentachlorophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pentaerythritoltetranitrate (PETN)	ALS GC-020	Extractable Organics	NELAP	8/25/2005
Pentaerythritoltetranitrate (PETN)	EPA 8330	Extractable Organics	NELAP	8/1/2008
Perchlorate	EPA 314.0	General Chemistry	NELAP	4/9/2003
pH	EPA 9040	General Chemistry	NELAP	7/1/2003
pH	SM 4500-H+-B	General Chemistry	NELAP	6/20/2007
Phenacetin	EPA 8270	Extractable Organics	NELAP	8/1/2008
Phenanthrene	EPA 610	Extractable Organics	NELAP	4/10/2002
Phenanthrene	EPA 625	Extractable Organics	NELAP	4/10/2002
Phenanthrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenanthrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Phenol	EPA 625	Extractable Organics	NELAP	4/10/2002
Phenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Phosphorus, total	EPA 365.3	General Chemistry	NELAP	5/21/2007
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Potassium	EPA 200.7	Metals	NELAP	4/10/2002
Potassium	EPA 6010	Metals	NELAP	7/1/2003
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	8/1/2008
Propane	RSK-175	Volatile Organics	NELAP	4/7/2010
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	4/1/2005
Pyrene	EPA 610	Extractable Organics	NELAP	4/10/2002
Pyrene	EPA 625	Extractable Organics	NELAP	4/10/2002
Pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pyrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Pyridine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Quinoline	ALS MS 006	Extractable Organics	NELAP	4/7/2010
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Reactive cyanide	Sec. 7.3 SW-846	General Chemistry	NELAP	7/1/2003
Reactive sulfide	Sec. 7.3 SW-846	General Chemistry	NELAP	7/1/2003
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	6/20/2007
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	6/20/2007
Residue-total	SM 2540 B	General Chemistry	NELAP	6/20/2007
Ronnel	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Safrole	EPA 8270	Extractable Organics	NELAP	8/1/2008
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Selenium	EPA 200.7	Metals	NELAP	4/10/2002
Selenium	EPA 6010	Metals	NELAP	4/10/2002
Silver	EPA 200.7	Metals	NELAP	4/10/2002
Silver	EPA 6010	Metals	NELAP	7/1/2003
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Simazine	ALS MS 006.5 (Rev. 07/08)/GC-MS	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Sodium	EPA 200.7	Metals	NELAP	4/10/2002
Sodium	EPA 6010	Metals	NELAP	7/1/2003
Stirofos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Styrene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Sulfate	EPA 300.0	General Chemistry	NELAP	4/10/2002
Sulfate	EPA 9056	General Chemistry	NELAP	7/1/2003

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Sulfide	SM 4500-S F (20th/21st Ed.)	General Chemistry	NELAP	6/20/2007
Sulfotepp	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Sulfotepp	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Surfactants - MBAS	SM 5540 C	General Chemistry	NELAP	6/20/2007
T-amylmethylether (TAME)	EPA 8260	Volatile Organics	NELAP	6/20/2007
tert-Amyl alcohol	ALS MS 005	Volatile Organics	NELAP	4/3/2009
tert-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	6/20/2007
tert-Butyl formate	ALS MS 005	Volatile Organics	NELAP	4/3/2009
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	4/10/2002
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetraethyl pyrophosphate (TEPP)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Thallium	EPA 200.7	Metals	NELAP	4/10/2002
Thallium	EPA 6010	Metals	NELAP	7/1/2003
Thionazin (Zinophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Thiophenol (Benzenethiol)	EPA 8270	Extractable Organics	NELAP	4/7/2010
Tin	EPA 200.7	Metals	NELAP	4/1/2005
Tin	EPA 6010	Metals	NELAP	7/1/2003
Tokuthion (Prothiophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Toluene	EPA 602	Volatile Organics	NELAP	4/10/2002
Toluene	EPA 624	Volatile Organics	NELAP	4/10/2002
Toluene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Toluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Total cyanide	EPA 335.4	General Chemistry	NELAP	6/20/2007
Total cyanide	EPA 9012	General Chemistry	NELAP	6/20/2007
Total nitrate-nitrite	EPA 9056	General Chemistry	NELAP	7/1/2003
Total organic carbon	EPA 9060	General Chemistry	NELAP	6/20/2007
Total organic carbon	SM 5310 B	General Chemistry	NELAP	6/20/2007
Total organic carbon	SM 5310 C	General Chemistry	NELAP	9/11/2002
Total Petroleum Hydrocarbons (TPH)	FL-PRO	Extractable Organics	NELAP	7/1/2003
Total phenolics	EPA 420.4	General Chemistry	NELAP	6/20/2007
Toxaphene (Chlorinated camphene)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
trans-1,2-Dichloroethylene	EPA 624	Volatile Organics	NELAP	4/10/2002

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,3-Dichloropropylene	EPA 624	Volatile Organics	NELAP	4/10/2002
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	4/1/2005
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	4/10/2002
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	4/10/2002
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichloronate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Turbidity	EPA 180.1	General Chemistry	NELAP	4/10/2002
Un-ionized Ammonia	DEP SOP 10/03/83	General Chemistry	NELAP	2/3/2003
Vanadium	EPA 200.7	Metals	NELAP	4/10/2002
Vanadium	EPA 6010	Metals	NELAP	7/1/2003
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Vinyl chloride	EPA 624	Volatile Organics	NELAP	4/10/2002
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Xylene (total)	EPA 602	Volatile Organics	NELAP	2/3/2003
Xylene (total)	EPA 624	Volatile Organics	NELAP	9/8/2003
Xylene (total)	EPA 8021	Volatile Organics	NELAP	7/1/2003
Xylene (total)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Zinc	EPA 200.7	Metals	NELAP	4/10/2002
Zinc	EPA 6010	Metals	NELAP	4/10/2002

Laboratory Scope of Accreditation

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E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/1/2008
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/10/2002
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/10/2002
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	4/10/2002
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	4/10/2002
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/10/2002
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	4/10/2002
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/10/2002
1,4-Dioxane (1,4-Diethyleneoxide)	ALS MS 006	Extractable Organics	NELAP	8/25/2005
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	8/1/2008
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
1-Chlorohexane	EPA 8260	Volatile Organics	NELAP	4/10/2002
1-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	8/1/2008
1-Methylnaphthalene	EPA 8310	Extractable Organics	NELAP	6/20/2007
1-Methylnaphthalene (added to method at FDEP request)	EPA 8270	Extractable Organics	NELAP	6/20/2007

Laboratory Scope of Accreditation

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E83510
Accutest Laboratories Southeast, Inc.
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Orlando, FL 32811

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	4/10/2002
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	2/5/2009
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	4/10/2002
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	4/10/2002
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	3/7/2005
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	8/1/2008
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	4/10/2002
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	3/7/2005
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	8/1/2008
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	4/10/2002
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	4/10/2002
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	4/10/2002
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	4/10/2002
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	4/10/2002
2-Hexanone	EPA 8260	Volatile Organics	NELAP	4/10/2002
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	4/10/2002
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	4/10/2002
2-Naphthylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	4/10/2002
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
2-Nitropropane	EPA 8260	Volatile Organics	NELAP	4/10/2002
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	4/10/2002
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	8/1/2008
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	4/10/2002
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	8/1/2008

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
3,5-Dinitroaniline	EPA 8330	Extractable Organics	NELAP	8/1/2008
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	8/1/2008
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	2/5/2009
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	4/10/2002
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	4/10/2002
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	4/10/2002
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	8/1/2008
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	4/10/2002
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	4/10/2002
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	4/10/2002
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	4/10/2002
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	8/1/2008
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	4/10/2002
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	4/10/2002
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	4/10/2002
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	4/10/2002
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	8/1/2008
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	8/1/2008
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
Acenaphthene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Acenaphthene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Acetone	EPA 8260	Volatile Organics	NELAP	4/10/2002
Acetonitrile	EPA 8260	Volatile Organics	NELAP	4/1/2005
Acetophenone	EPA 8270	Extractable Organics	NELAP	2/3/2003
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	4/10/2002
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	4/10/2002
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	4/1/2005
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002

Laboratory Scope of Accreditation

Attachment to Certificate #: E83510-21, expiration date June 30, 2010. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E83510 **EPA Lab Code: FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aluminum	EPA 6010	Metals	NELAP	4/10/2002
Ammonia as N	EPA 350.1	General Chemistry	NELAP	6/20/2007
Aniline	EPA 8270	Extractable Organics	NELAP	4/10/2002
Anthracene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Anthracene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Antimony	EPA 6010	Metals	NELAP	4/10/2002
Aramite	EPA 8270	Extractable Organics	NELAP	8/1/2008
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Arsenic	EPA 6010	Metals	NELAP	4/10/2002
Atrazine	ALS MS 006.5 (Rev. 07/08)/GC-MS	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Barium	EPA 6010	Metals	NELAP	4/10/2002
Benzaldehyde	ALS MS 006.5 (Rev. 07/08)/GC-MS	Extractable Organics	NELAP	8/1/2008
Benzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Benzidine	EPA 8270	Extractable Organics	NELAP	4/10/2002
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Benzoic acid	EPA 8270	Extractable Organics	NELAP	4/10/2002
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	4/10/2002
Beryllium	EPA 6010	Metals	NELAP	4/10/2002

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Biphenyl	ALS MS 006.5 (Rev. 07/08)/GC-MS	Extractable Organics	NELAP	8/1/2008
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	4/10/2002
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	4/10/2002
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	4/10/2002
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	4/10/2002
Bolstar (Sulprofos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Bromide	EPA 9056	General Chemistry	NELAP	4/10/2002
Bromobenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
Bromoform	EPA 8260	Volatile Organics	NELAP	4/10/2002
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	4/10/2002
Cadmium	EPA 6010	Metals	NELAP	4/10/2002
Calcium	EPA 6010	Metals	NELAP	4/10/2002
Caprolactam	ALS MS 006.5 (Rev. 07/08)/GC-MS	Extractable Organics	NELAP	8/1/2008
Carbazole	EPA 8270	Extractable Organics	NELAP	4/10/2002
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	4/10/2002
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	4/10/2002
Carbophenothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Chloride	EPA 9056	General Chemistry	NELAP	4/10/2002
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Chloroethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
Chloroform	EPA 8260	Volatile Organics	NELAP	4/10/2002
Chloroprene	EPA 8260	Volatile Organics	NELAP	4/1/2005
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Chromium	EPA 6010	Metals	NELAP	4/10/2002
Chromium VI	EPA 7196	General Chemistry	NELAP	1/24/2003
Chrysene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Chrysene	EPA 8310	Extractable Organics	NELAP	4/10/2002
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	4/10/2002
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	4/10/2002
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	4/3/2009

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Cobalt	EPA 6010	Metals	NELAP	4/10/2002
Copper	EPA 6010	Metals	NELAP	4/10/2002
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Demeton-o	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Demeton-s	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Dibenz(a,h)anthracene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Dibenz(a,j)acridine	EPA 8270	Extractable Organics	NELAP	8/1/2008
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	4/10/2002
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
Dibromomethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	4/10/2002
Diesel range organics (DRO)	MA-EPH	Extractable Organics	NELAP	2/3/2003
Diesel range organics (DRO)	OA-2	Extractable Organics	NELAP	4/1/2005
Diesel range organics (DRO)	TN-EPH	Extractable Organics	NELAP	6/20/2007
Diethyl ether	EPA 8260	Volatile Organics	NELAP	6/20/2007
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	4/10/2002
Dimethoate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	4/10/2002
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	4/10/2002
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	4/10/2002
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002

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Orlando, FL 32811

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
EPN	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Ethanol	EPA 8015	Volatile Organics	NELAP	4/1/2005
Ethion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Ethoprop	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Ethyl acetate	EPA 8260	Volatile Organics	NELAP	6/20/2007
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	4/1/2005
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	8/1/2008
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Ethyl-t-butylether (ETBE)	EPA 8260	Volatile Organics	NELAP	6/20/2007
Famphur	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Fensulfothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Fluoranthene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Fluoranthene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Fluorene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Fluorene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Fluoride	EPA 9056	General Chemistry	NELAP	4/10/2002
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	4/10/2002
Gasoline range organics (GRO)	MA-VPH	Extractable Organics	NELAP	2/3/2003
Gasoline range organics (GRO)	OA-1	Extractable Organics	NELAP	4/1/2005
Gasoline range organics (GRO)	TN-GRO	Extractable Organics	NELAP	4/1/2005
Generic Analyte for SOP	Generic Method for SOP	Extractable Organics	NELAP	4/7/2010
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	4/10/2002
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	8/1/2008

Laboratory Scope of Accreditation

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E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	8/1/2008
Ignitability	EPA 1010	General Chemistry	NELAP	4/10/2002
Indene	ALS MS 006	Extractable Organics	NELAP	4/7/2010
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	2/3/2003
Iron	EPA 6010	Metals	NELAP	4/10/2002
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8015	Volatile Organics	NELAP	4/1/2005
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	4/1/2005
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Isophorone	EPA 8270	Extractable Organics	NELAP	4/10/2002
Isopropyl alcohol (2-Propanol)	EPA 8015	Volatile Organics	NELAP	4/1/2005
Isopropyl ether	EPA 8260	Volatile Organics	NELAP	4/10/2002
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Isosafrole	EPA 8270	Extractable Organics	NELAP	8/1/2008
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Kjeldahl nitrogen - total	EPA 351.2	General Chemistry	NELAP	6/20/2007
Lead	EPA 6010	Metals	NELAP	4/10/2002
Magnesium	EPA 6010	Metals	NELAP	4/10/2002
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Manganese	EPA 6010	Metals	NELAP	4/10/2002
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Mercury	EPA 7471	Metals	NELAP	4/10/2002
Merphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	4/1/2005
Methanol	EPA 8015	Volatile Organics	NELAP	4/1/2005
Methapyrilene	EPA 8270	Extractable Organics	NELAP	8/1/2008
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	4/10/2002
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	4/10/2002
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	4/1/2005
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	8/1/2008
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	4/10/2002

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Methylene chloride	EPA 8260	Volatile Organics	NELAP	4/10/2002
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Molybdenum	EPA 6010	Metals	NELAP	4/10/2002
Monocrotophos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Naled	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Naphthalene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Naphthalene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Naphthalene	EPA 8310	Extractable Organics	NELAP	4/10/2002
n-Butyl alcohol	EPA 8015	Volatile Organics	NELAP	4/1/2005
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Nickel	EPA 6010	Metals	NELAP	4/10/2002
Nitrate	EPA 9056	General Chemistry	NELAP	4/10/2002
Nitrite	EPA 9056	General Chemistry	NELAP	4/10/2002
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	2/3/2003
Nitroglycerin	EPA 8330	Extractable Organics	NELAP	8/1/2008
Nitroglycerin	EPA 8332	Extractable Organics	NELAP	2/3/2003
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	4/10/2002
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	4/10/2002
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	4/10/2002
n-Nitrosodiphenylamine/Diphenylamine (analyte pair)	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	8/1/2008
n-Propanol	EPA 8015	Volatile Organics	NELAP	4/1/2005
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
o,o,o-Triethyl phosphorothioate	ALS GC 032.2 (Rev. 07/08)	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	4/10/2002
Oil & Grease	EPA 9071	General Chemistry	NELAP	4/10/2002
o-Toluidine	EPA 8270	Extractable Organics	NELAP	8/1/2008

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
p-Dioxane	EPA 8260	Volatile Organics	NELAP	4/10/2002
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/1/2008
Pentachloroethane	ALS MS 006.5 (Rev. 07/08)/GC-MS	Extractable Organics	NELAP	8/1/2008
Pentachloroethane	EPA 8260	Volatile Organics	NELAP	4/1/2005
Pentachloronitrobenzene (Quintozene)	EPA 8270	Extractable Organics	NELAP	8/1/2008
Pentachlorophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
Pentaerythritoltetranitrate (PETN)	ALS GC-020	Extractable Organics	NELAP	8/25/2005
Pentaerythritoltetranitrate (PETN)	EPA 8330	Extractable Organics	NELAP	8/1/2008
pH	EPA 9045	General Chemistry	NELAP	4/10/2002
Phenacetin	EPA 8270	Extractable Organics	NELAP	8/1/2008
Phenanthrene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Phenanthrene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Phenol	EPA 8270	Extractable Organics	NELAP	4/10/2002
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Phosphorus, total	EPA 365.3	General Chemistry	NELAP	6/20/2007
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Potassium	EPA 6010	Metals	NELAP	4/10/2002
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	8/1/2008
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	4/1/2005
Pyrene	EPA 8270	Extractable Organics	NELAP	4/10/2002
Pyrene	EPA 8310	Extractable Organics	NELAP	4/10/2002
Pyridine	EPA 8270	Extractable Organics	NELAP	4/10/2002
Quinoline	ALS MS 006	Extractable Organics	NELAP	4/7/2010
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	4/10/2002
Reactive cyanide	Sec. 7.3 SW-846	General Chemistry	NELAP	4/10/2002
Reactive sulfide	Sec. 7.3 SW-846	General Chemistry	NELAP	4/10/2002
Ronnel	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Safrole	EPA 8270	Extractable Organics	NELAP	8/1/2008
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Selenium	EPA 6010	Metals	NELAP	4/10/2002
Silver	EPA 6010	Metals	NELAP	4/10/2002
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Simazine	ALS MS 006.5 (Rev. 07/08)/GC-MS	Pesticides-Herbicides-PCB's	NELAP	8/1/2008

Laboratory Scope of Accreditation

Attachment to Certificate #: E83510-21, expiration date June 30, 2010. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E83510 **EPA Lab Code: FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Sodium	EPA 6010	Metals	NELAP	5/21/2007
Stirofos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Styrene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Sulfate	EPA 9056	General Chemistry	NELAP	4/10/2002
Sulfotepp	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Sulfotepp	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Synthetic Precipitation Leaching Procedure	EPA 1312	General Chemistry	NELAP	4/10/2002
T-amylmethylether (TAME)	EPA 8260	Volatile Organics	NELAP	6/20/2007
tert-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	6/20/2007
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	4/10/2002
Tetraethyl pyrophosphate (TEPP)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	4/10/2002
Thallium	EPA 6010	Metals	NELAP	4/10/2002
Thionazin (Zinophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/1/2008
Thiophenol (Benzenethiol)	EPA 8270	Extractable Organics	NELAP	4/7/2010
Tin	EPA 6010	Metals	NELAP	1/24/2003
Tokuthion (Prothiophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Toluene	EPA 8260	Volatile Organics	NELAP	4/10/2002
Total cyanide	EPA 9012	General Chemistry	NELAP	6/20/2007
Total nitrate-nitrite	EPA 9056	General Chemistry	NELAP	4/10/2002
Total organic carbon	EPA 9060	General Chemistry	NELAP	6/20/2007
Total Petroleum Hydrocarbons (TPH)	FL-PRO	Extractable Organics	NELAP	4/10/2002
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/10/2002
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	4/10/2002
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	4/10/2002
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	4/10/2002
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	4/1/2005
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	4/10/2002
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	4/10/2002
Trichloronate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	6/20/2007
Vanadium	EPA 6010	Metals	NELAP	4/10/2002
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	4/10/2002
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	4/10/2002
Xylene (total)	EPA 8260	Volatile Organics	NELAP	4/10/2002

Laboratory Scope of Accreditation

Attachment to Certificate #: E83510-21, expiration date June 30, 2010. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E83510** **EPA Lab Code:** **FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Zinc	EPA 6010	Metals	NELAP	4/10/2002

Laboratory Scope of Accreditation

Attachment to Certificate #: E83510-21, expiration date June 30, 2010. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E83510** **EPA Lab Code:** **FL00946** **(407) 425-6700**

E83510
Accutest Laboratories Southeast, Inc.
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Matrix: **Air and Emissions**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Benzene	EPA TO-3	Volatile Organics	NELAP	7/1/2007
Ethylbenzene	EPA TO-3	Volatile Organics	NELAP	7/1/2007
Gasoline range organics (GRO)	EPA TO-3	Volatile Organics	NELAP	7/1/2007
Isopropylbenzene	EPA TO-3	Volatile Organics	NELAP	7/1/2007
Methyl tert-butyl ether (MTBE)	EPA TO-3	Volatile Organics	NELAP	7/1/2007
Toluene	EPA TO-3	Volatile Organics	NELAP	7/1/2007
Xylene (total)	EPA TO-3	Volatile Organics	NELAP	7/1/2007

ANALYSIS OF PETROLEUM RANGE ORGANICS BY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTOR

Prepared by:	Norm Farmer	Date:	07/20/09
Reviewed by:	Mark Erstling	Date:	07/20/09

Annual Review

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Reviewed by:	Date:
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Issued to:		Date:	

Effective 7 days after "*" date

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TEST NAME: ANALYSIS OF PETROLEUM RANGE ORGANICS BY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTOR

METHOD REFERENCE: FLDEP FL-PRO

DEPT: GC

Revised Sections: 6.1, 6.4, 7.5.2, 9.3.2.3, and 12.0 Added 1.2.5 and 7.5.4

1.0 SCOPE AND APPLICATION, SUMMARY

1.1 Scope and Application

1.1.1 This method is used to determine the total petroleum hydrocarbon (TPH) concentration in water, solid, and waste matrices utilizing a gas chromatograph equipped with a flame ionization detector.

1.1.2 TPH for this method is defined as any peaks, including any unresolved hydrocarbon mixtures eluting between Octane (nC8) and Tetracontane (nC40). Quantitation is based on a 17 component Alkane standard.

1.1.3 Reporting limits (RL) are based on the extraction procedure and the lowest calibration standard. Reporting limits may vary depending on matrix complications and volumes. Reporting limits for this method are in the range of 0.25 mg/l for aqueous samples and 8.3 mg/kg for solid samples. Solid matrices are reported on a dry weight basis.

1.1.4 The Method Detection Limit (MDL) for each analyte is evaluated on an annual basis for each matrix and instrument. MDLs are pooled for each matrix, and the final pooled MDLs are verified. The verified MDLs are stored in the LIMS and should be at least 2 to 3 times lower than the RL. Exceptions may be made on a case by case basis; however, at no point shall the MDL be higher than the reported RL.

1.1.5 Compounds detected at concentrations between the RL and MDL are quantitated and qualified as estimated values and reported with an “I” qualifier. Some program or project specifications may require that no values below the RL be reported.

1.2 Summary

1.2.1 This method is adapted from FLDEP FL-PRO.

1.2.2 Samples are received, stored and extracted within the appropriate holding times.

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1.2.3 Sample preparation is performed in accordance with Accutest SOP OP012 and OP013.

1.2.4 The extracts are analyzed on a gas chromatograph equipped with a flame ionization detector.

1.2.5 Manual integrations are performed in accordance with SOP QA029.

2.0 PRESERVATION AND HOLDING TIME

2.1 Preservation

2.1.1 Samples shall be collected in amber glass bottles with Teflon lined caps. One-liter bottles are recommended for aqueous samples and 300ml jars are recommended for solid samples.

2.1.2 Aqueous samples must be preserved with hydrochloric or sulfuric acid to minimize biological degradation.

2.1.3 The samples must be protected from light and refrigerated at 4°C from the time of collection until extraction. The extracts must be stored at 4°C until analysis.

2.2 Holding Time

2.2.1 Aqueous samples must be extracted within 7 days of collection.

2.2.2 Solid and waste samples must be extracted within 14 days of collection.

2.2.3 Extracts must be analyzed within 40 days of extraction.

3.0 INTERFERENCES

3.1 Data from all blanks, samples, and spikes must be evaluated for interferences.

3.2 Method interferences may be caused by contaminants in solvents, reagents, or glassware. Interferences from phthalate esters can be eliminated by using plastic-free solvent containers and solvent rinsed glassware.

3.3 Other organic compounds, including chlorinated hydrocarbons, phenols, and phthalate esters may be coextracted by this method. By definition, these compounds are included as TPH.

3.4 Animal and vegetable oils and fats are removed by silica cleanup.

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4.0 DEFINITIONS

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. For all GC and HPLC methods, a CCV must be analyzed at the beginning of the analytical run, after every 10 samples, and at the end of the run.

4.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.5 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

4.6 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

4.7 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.8 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.9 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.10 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

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4.11 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

4.12 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the extraction efficiency.

5.0 REAGENTS

5.1 Methylene chloride – Pesticide grade or equivalent

5.2 TPHS Standard – 17 component even number alkane mix from nC8 to nC40

5.3 Surrogate standard – O-terphenyl

6.0 APPARATUS

6.1 Gas Chromatograph – HP 5890 with 7673 Autosampler or Agilent Technologies 6890 with 7683 Autosampler

Suitable gas chromatograph equipped with a split-splitless injection port and flame ionization detector.

Autosampler allows for unattended sample and standard injection throughout the analytical run.

6.2 Data System – Agilent Technologies MS Chemstation rev. BA 02.00 and DA 00.01

6.2.1 A computer system interfaced to the gas chromatograph that allows for the continuous acquisition and storage of all data obtained throughout the duration of the chromatographic program.

6.2.2 A data collection and processing system. System must be capable of forced baseline integrations and quantitations using multipoint calibrations.

6.2.3 Data is archived to magnetic tape for long term storage.

6.3 DB-5 Column or equivalent: 30m X 0.32mm X 0.25um

6.4 Gas-tight syringes and class “A” volumetric glassware for dilutions of standards and extracts.

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7.0 PROCEDURE

7.1 Standards Preparation

Standards are prepared from commercially available certified reference standards. All standards must be logged in the Semivolatile Standards Logbook. All standards shall be traceable to their original source. The standards should be stored at 4 °C, or as recommended by the manufacturer.

7.1.1 Stock Standard Solutions

Stock standards are available from several commercial vendors. All vendors must supply a "Certificate of Analysis" with the standard. The certificate will be retained by the lab. Hold time for unopened stock standards is until the vendor's expiration date. Once opened, the hold time is reduced to one year or the vendor's expiration date (whichever is shorter). Note C36, C38, and C40 will readily precipitate when the standard is refrigerated. The standard should be warmed to room temperature prior to using. Gentle sonication may aid in dissolving any residue.

7.1.2 Intermediate Standard Solutions

Intermediate standards are prepared by quantitative dilution of the stock standard with methylene chloride. The hold time for intermediate standards is six months or the vendor's expiration date (whichever is shorter). Intermediate standards may need to be remade if comparison to other standards indicate analyte degradation or concentration changes.

7.1.3 Calibration Standards

Calibration standards for TPH are prepared at a minimum of five concentration levels through quantitative dilutions of the intermediate standard. The low standard is at a concentration at or below the RL and the remaining standards define the working range of the detector.

Calibration standard concentrations are verified by the analysis of an initial calibration verification (ICV) standard.

7.2 Gas Chromatograph Conditions (GC Racer Equipped Instrument)

1-2ul autosampler injection

Carrier gas – UHP Helium

Detector gas – UHP Air (~300 ml/min)

Detector gas – UHP Hydrogen (~30 ml/min)

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Injection port temperature – 275 to 300 °C

Detector temperature – 320 °C

Oven program – 50 °C for 2 minutes
60 °C/min to 310 °C for 6.5 minutes

Pressure program – 17.5 psi for 2 minutes
6 psi/min to 50 psi for 0 minutes

GC conditions are optimized for each instrument. Actual conditions may vary slightly from those listed above.

7.3 Gas Chromatograph Conditions

1-2ul autosampler injection

Carrier gas – UHP Helium

Detector gas – UHP Air (~300 ml/min)

Detector gas – UHP Hydrogen (~30 ml/min)

Injection port temperature – 275 to 300 °C

Detector temperature – 320 °C

Oven program – 40 °C for 2 minutes
45 °C/min to 160 °C for 0 minutes
35 °C/min to 260 °C for 0 minutes
28 °C/min to 310 °C for 5 minutes

Pressure program – 2.0 ml/min for 2 minutes
1 ml/min to 10 ml/min for 0 minutes

GC conditions are optimized for each instrument. Actual conditions may vary slightly from those listed above.

7.4 Sample Preparation

7.4.1 Water Samples

A 1000ml aliquot of sample is extracted with methylene chloride utilizing separatory funnel extraction. The extract is cleaned with silica gel and then concentrated to 1.0ml.

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7.4.2 Solid Samples

A 30-gram aliquot of sample is extracted with methylene chloride utilizing pulse sonication. The extract is cleaned with silica gel and then concentrated to 1.0ml.

7.4.3 Waste Samples

A one-gram aliquot of sample is diluted in methylene chloride to 10ml. The extract is then cleaned with silica gel.

7.5 Gas Chromatographic Analysis

Instrument calibration consists of two major sections:

Initial Calibration Procedures
Continuing Calibration Verification

7.5.1 Initial Calibration Procedures

Before samples can be run, the chromatographic system must be calibrated and retention time ranges and windows must be determined.

7.5.1.1 Retention Time Range

The nC8 to nC40 even numbered alkane standard is used to establish the retention time range. The TPH range is defined by the start of nC8 and the end of nC40. This range is used for all samples and standards. The range must be verified every 10 samples.

7.5.1.2 External Standard Calibration

Quantitation for this method is based on the response of a 17 component even number alkane standard from nC8 to nC40. A 50 ug/ml each alkane standard is equivalent to 850 ug/ml total petroleum hydrocarbon standard (TPHS).

A minimum 5-point calibration curve is created for the TPHS and o-terphenyl (surrogate).

The area of the TPHS is determined by integrating (baseline to baseline) from the time where nC8 starts to the time where nC40 ends. The MS Chemstation software will automatically correct for the area of the surrogate.

Calibration factors (CF) for TPHS are determined at each concentration by dividing the total area of the TPH standard

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(corrected for the surrogate) by the concentration of the standard. Calibration factors for the surrogate are determined at each concentration by dividing the area of the peak by the concentration of the standard.

The mean CF and standard deviation of the CF are determined for each analyte. The percent relative standard deviation (%RSD) of the calibration factors is calculated for each analyte as follows:

%RSD = (Standard Deviation of CF X 100) / Mean CF

If the %RSD $\leq$ 20%, linearity through the origin can be assumed and the mean CF can be used to quantitate target analytes in the samples. Alternatively if the %RSD > 20% a calibration curve of response vs. amount can be plotted. If the correlation coefficient (r) is $\geq$0.995 ($r^2 \geq$0.990) then the curve can be used to quantitate target analytes in the samples.

7.5.1.3 Initial Calibration Verification (ICV)

The validity of the initial calibration curve must be verified through the analysis of an initial calibration verification (ICV) standard. The ICV should be prepared from a second source at a mid-range concentration.

The %D for all analytes of interest should be $\leq$ 25%. If the ICV does not meet this criteria, a second standard should be prepared. If the ICV still does not meet criteria, analyze an ICV prepared from a third source. If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.

7.5.1.4 Solvent Blank

A solvent blank must be analyzed at the beginning of each 24hr shift to determine the normal baseline rise during a GC run. This amount must be less than the one half the RL for the initial solvent blank. Solvent blanks should also be analyzed after samples with high TPH concentrations to ensure that there is no carryover.

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7.5.1.5 Retention Time Windows

Retention time windows must be established whenever a new column is installed in an instrument or whenever a major change has been made to an instrument.

Individual nC8, nC40, and surrogate peaks must fall within the appropriate retention time windows; however, The TPH range is defined as any peaks, including any unresolved hydrocarbon mixtures eluting between the start of nC8 and the end of nC40.

Retention time windows are crucial to the identification of target compounds. Absolute retention times are used for compound identification in all GC and HPLC methods that do not employ internal standard calibration. Retention time windows are established to compensate for minor shifts in absolute retention times that result from normal chromatographic variability. The width of the retention time window should be carefully established to minimize the occurrence of both false positive and false negative results.

Retention time windows are established by injecting all standard mixes three times over the course of 72 hours. For this method, the retention time windows must be calculated for nC8, nC40, and o-terphenyl. The width of the retention time window for each analyte, surrogate, and major constituent in multi-component analytes is defined as ± 3 times the standard deviation of the mean absolute retention time or 0.03 minutes, whichever is greater.

Establish the center of the retention time window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

Peak identification is based on the retention time of a peak falling within the retention time window for a given analyte. Time reference peaks (surrogates) are used to correct for run-to-run variations in retention times due to temperature, flow, or injector fluctuations.

The retention time windows should be used as a guide for identifying compounds; however, the experience of the analyst should weigh heavily in the interpretation of the

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chromatograms. The analyst should monitor the retention times of known peaks (standards and surrogates) throughout an instrument run as an indication of instrument performance.

Because calculated retention time windows are generally very tight (less than ± 0.03 minutes), the retention time windows for the data processing method are generally set wider than the calculated window. This is done to ensure that the software does not miss any potential "hits". The analyst will then review these "hits" and determine if the retention times are close enough to the retention time of the target analyte to positively identify the peak or to require confirmation.

7.5.2 Continuing Calibration Verification (CCV)

Continuing calibration verification standards for TPH are prepared at various concentrations. At least one low-level standard must be analyzed during a 24hr period to confirm instrument sensitivity. A continuing calibration standard must be analyzed at the beginning and end of each run to verify that the initial calibration is still valid. Additionally a CCV must be analyzed after every 10 samples.

The percent difference (%D) for each analyte of interest will be monitored. The |%D| should be ≤ 25% for each analyte. If the first continuing calibration verification does not meet criteria, a second standard may be injected. If the second standard does not meet criteria, the system must be recalibrated.

If the |%D| is greater than 25%, then documented corrective action is necessary. This may include recalibrating the instrument and reanalyzing the samples, performing instrument maintenance to correct the problem and reanalyzing the samples, or qualifying the data. Under certain circumstances, the data may be reported. i.e. The CCV failed high, the associated QC passed, and the samples were ND.

NOTE: Any target analytes that are detected in the samples must be bracketed by an acceptable initial calibration curve and acceptable CCV standards; otherwise, the samples must be reanalyzed or the data must be qualified.

7.5.3 Sample Extract Analysis

7.5.3.1 Samples are analyzed in a set referred to as an analysis sequence or batch. A batch consists of the following:

Initial Calibration Standards
Second Source Verification
Solvent Blank

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QC Extracts
Sample Extracts
CCV Standards

OR

Continuing Calibration Standard
Low Level Standard
Solvent Blank
QC Extracts
Sample Extracts
CCV Standards

7.5.3.2 One or two microliters (same amount as standards) of extract is injected into the GC by the autosampler. A splitless injection technique is used. The data system then records the resultant peak responses and retention times.

7.5.3.3 As defined by the method, any peaks (including any unresolved petroleum hump) falling within the retention time range are defined as TPH and must be quantitated. Confirmations are not required for this method.

7.5.3.4 If the petroleum response exceeds the linear range of the system, the extract must be diluted and reanalyzed. It is recommended that extracts be diluted so that the response falls into the middle of the calibration curve.

7.5.3.5 Some petroleum products (gasoline, JP4, etc) may not fall completely within the TPHS range. If a significant amount of the product falls outside the range, it should be noted on the report.

7.5.4 Instrument Maintenance

Routine maintenance of the instruments will help keep them in optimum working condition. Because of the variability in work load and sample matrix, it is not feasible to set up an exact maintenance schedule for each instrument. See SOP QA032 for maintenance recommendations.

8.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

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Blank spike, matrix spike, and matrix spike duplicate samples are compared to statistically generated control limits. These control limits are reviewed and updated annually. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

9.0 QUALITY ASSURANCE / QUALITY CONTROL

Accuracy and matrix bias are monitored by the use of surrogates and by the analysis of a QC set that is prepared with each batch (maximum of 20 samples) of samples. The QC set consists of a method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD).

9.1 Surrogates

9.1.1 O-terphenyl is used as the surrogate standard to monitor the efficiency of the extraction and clean-up procedures.

A known amount of surrogate standard is added to each sample including the QC set prior to extraction. The percent recovery for each surrogate is calculated as follows:

% Recovery = (Sample Amount / Amount Spiked) X 100

The percent recovery must fall within the established control limits for the results to be acceptable.

9.1.2 If the surrogate recoveries are not within the established control limits, the following are required.

9.1.2.1 Check to be sure that there are no errors in calculations, integrations, surrogate solutions or internal standards. If errors are found, recalculate the data accordingly.

9.1.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.1.2.3 If no problem is found, re-extract and reanalyze the sample. **NOTE:** If the recoveries are high and the sample is non-detect, then re-extraction may not be necessary. If there is insufficient sample for re-extraction, reanalyze the sample and footnote this on the report.

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9.1.2.4 If upon reanalysis, the recovery is still not within control limits, the problem is considered matrix interference. Surrogates from both sets of analysis should be reported on the final report.

9.2 Method Blank

9.2.1 The method blank is either de-ionized water or sodium sulfate (depending upon sample matrix) to which the surrogate standard has been added. The method blank is then extracted and taken through all cleanup procedures along with the other samples to determine any contamination from reagents, glassware, or high level samples. The method blank must be free of any analytes of interest or interferences at the required MDL to be acceptable. If the method blank is not acceptable, corrective action must be taken to determine the source of the contamination. Samples associated with a contaminated method blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples, re-extracting and reanalyzing the samples or qualifying the results with a “V” qualifier.

9.2.2 If the MB is contaminated but the samples are non-detect, then the source of contamination should be investigated and documented. The sample results can be reported without qualification.

9.2.3 If the MB is contaminated but the samples results are > 10 times the contamination level, the source of the contamination should be investigated and documented. The samples results may be reported with the appropriate “V” qualifier. This must be approved by the department supervisor.

9.2.4 If the MB is contaminated but the samples results are < 10 times the contamination level, the source of the contamination should be investigated and documented. The samples should be re-extracted and reanalyzed for confirmation. If there is insufficient sample to re-extract, or if the sample is re-extracted beyond hold time, the appropriate footnote and qualifiers should be added to the results. This must be approved by the department supervisor.

9.3 Blank Spike

9.3.1 The blank spike is either de-ionized water or sodium sulfate (depending upon sample matrix) to which the surrogate standard and spike standard have been added. The blank spike is then extracted and taken through all cleanup procedures along with the other samples to monitor the efficiency of the extraction procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = (Blank Spike Amount / Amount Spiked) X 100

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The percent recovery for each analyte of interest should fall within the established control limits for the results to be acceptable.

9.3.2 If the blank spike recoveries are not within the established control limits, the following are required.

9.3.2.1 Check to be sure that there are no errors in calculations, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly.

9.3.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.

9.3.2.3 If the recovery of an analyte in the BS is high and the associated sample is non-detect, the data may be reportable.

9.3.2.4 If no problem is found, the department supervisor shall review the data and determine what further corrective action is best for each particular sample. That may include reanalyzing the samples, re-extracting and reanalyzing the samples, or qualifying the results as estimated.

9.3.2.5 If there is insufficient sample to re-extract, or if the sample is re-extracted beyond hold time, the appropriate footnote and qualifiers should be added to the results. This must be approved by the department supervisor.

9.4 Matrix Spike and Matrix Spike Duplicate

9.4.1 Matrix spike and spike duplicates are replicate sample aliquots to which the surrogate standard and spike standard have been added. The matrix spike and spike duplicate are then extracted and taken through all cleanup procedures along with the other samples to monitor the precision and accuracy of the extraction procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = [(Spike Amount – Sample Amount) / Amount Spiked] X 100

The percent recovery for each analyte of interest must fall within the established control limits for the results to be acceptable.

9.4.2 If the matrix spike recoveries are not within the established control limits, the following are required.

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9.4.2.1 Check to be sure that there are no errors in calculations, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly.

9.4.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.4.2.3 If no problem is found, compare the recoveries to those of the blank spike. If the blank spike recoveries indicate that the problem is sample related, document this on the run narrative. Matrix spike recovery failures are not grounds for re-extract but are an indication of the sample matrix effects.

9.4.3 Precision

Matrix spike and spike duplicate recoveries for each analyte are used to calculate the relative percent difference (RPD) for each compound.

RPD = [| MS Result – MSD Result | / Average Result] X 100

The RPD for each analyte should fall within the established control limits. If the RPDs fall outside of the established control limits, the MS and MSD should be reanalyzed to ensure that there was no injection problem. If upon reanalysis the RPDs are still outside of the control limits, the department supervisor shall review the data and determine if any further action is necessary. RPD failures are generally not grounds for re-extraction.

10.0 CALCULATIONS

The area of the TPH in the samples is determined by integrating (baseline to baseline) from the time where nC8 starts to the time where nC40 ends. This integration must include any unresolved petroleum “hump”. The MS Chemstation software will automatically correct for the area of the surrogate.

The concentration of the analyte in the original sample is calculated as follows:

TPH Water (mg/l) = $(CONC_{inst}) \times (V_F / V_I) \times DF$

TPH Soil (mg/kg) = $[(CONC_{inst}) \times (V_F / W_I) \times DF] / \%solids$

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$CONC_{inst}$	=	Instrument concentration calculated from the initial calibration using mean RF, linear curve, or quadratic curve
DF	=	Dilution Factor
V_F	=	Volume of final extract (ml)
V_I	=	Volume of sample extracted (ml)
W_I	=	Weight of sample extracted (g)
%solids	=	Dry weight determination in decimal form

All soils are reported on a dry weight basis.

11.0 SAFETY AND POLLUTION PREVENTION

11.1 Safety

The analyst should follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which includes the use of safety glasses and lab coats.

The toxicity of each reagent and target analyte has not been precisely defined; however, each reagent and sample should be treated as a potential health hazard. Material Safety Data Sheets (MSDS) are available for all reagents and many of the target analytes. Exposure must be reduced to the lowest possible level. Personal protective equipment should be used by all analysts.

11.2 Pollution Prevention

Waste solvents from the sample analysis and standards preparation are collected in waste storage bottles and are eventually transferred to the chlorinated waste drum.

Sample Extracts are archived and stored for 60 days after analysis. Old extracts and standards are disposed of in the waste vial drum.

12.0 REFERENCES

Florida DEP Method FL-PRO, REV. 1, 11/95

SW846 Method 8000C Revision 3, March 2003

SW846 Method 8015B Revision 2, December 1996

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ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS BY HPLC

Prepared by:	Norm Farmer	Date:	07/15/09
Reviewed by:	Mike Eger	Date:	07/15/09

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TEST NAME: ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS BY HPLC

METHOD REFERENCE: SW846 8310

DEPT: HPLC

Revised Sections: 6.2, 6.3, 6.4, 7.1, 7.2, 7.4.2, 9.3.2.4, and 12.0 Added 1.2.5 and 7.4.4

1.0 SCOPE AND APPLICATION, SUMMARY

1.1 Scope and Application

1.1.1 This method is used to determine the concentrations of specific polynuclear aromatic hydrocarbons (PAHs) in water and solid matrices utilizing an HPLC equipped with a diode array detector and fluorescence detector (optional).

1.1.2 The following compounds can be reported by this method:

Naphthalene
2-Methylnaphthalene
1-Methylnaphthalene
Acenaphthylene
Acenaphthene
Fluorene
Phenanthrene
Anthracene
Flouranthene
Pyrene
Benzo(a)anthracene
Chrysene
Benzo(b)fluoranthene
Benzo(k)flouranthene
Benzo(a)pyrene
Indeno(1,2,3-cd)pyrene
Dibenzo(a,h)anthracene
Benzo(ghi)perylene

1.1.3 The reporting limits (RL) are based on the extraction procedure and the lowest calibration standard. Reporting may vary depending on matrix complications and volumes. Reporting limits for this method are in the range of 0.2 to 2.0 ug/l for aqueous samples and 66 to 330 ug/kg for solid samples. Solid matrices are reported on a dry weight basis.

1.1.4 The Method Detection Limit (MDL) for each analyte is evaluated on an annual basis for each matrix and instrument. MDLs are pooled for each matrix, and the final pooled MDLs are verified. The verified MDLs are stored in the LIMS and should be at least 2 to 3 times lower than the RL.

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Exceptions may be made on a case by case basis; however, at no point shall the MDL be higher than the reported RL.

1.1.5 Compounds detected at concentrations between the RL and MDL are quantitated and qualified as estimated values and reported with either a "J" or "I" qualifier. Some program or project specifications may require that no values below the RL be reported.

1.2 Summary

1.2.1 This method is adapted from SW846 Method 8310.

1.2.2 Samples are received, stored and extracted within the appropriate holding times.

1.2.3 Sample preparation is performed in accordance with Accutest SOP OP014 and OP015.

1.2.4 The extracts are analyzed on an HPLC equipped with a diode array detector and fluorescence detector (optional).

1.2.5 Manual integrations are performed in accordance with SOP QA029.

2.0 PRESERVATION AND HOLDING TIME

2.1 Preservation

2.1.1 Samples shall be collected in amber glass bottles with Teflon lined caps. One-liter bottles are recommended for aqueous samples and 300ml jars are recommended for solid samples.

2.1.2 The samples must be protected from light and refrigerated at 4°C from the time of collection until extraction. The extracts must be stored at 4°C until analysis.

2.2 Holding Time

2.2.1 Aqueous samples must be extracted within 7 days of collection.

2.2.2 Solid and waste samples must be extracted within 14 days of collection.

2.2.3 Extracts must be analyzed within 40 days of extraction.

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3.0 INTERFERENCES

3.1 Data from all blanks, samples, and spikes must be evaluated for interferences.

3.2 Method interferences may be caused by contaminants in solvents, reagents, or glassware. Interferences from phthalate esters can be eliminated by using plastic-free solvent containers and solvent rinsed glassware.

3.3 Other organic compounds, including chlorinated hydrocarbons, petroleum hydrocarbons, and phthalate esters may be coextracted by this method.

3.4 High levels of sulfur may interfere with the analysis of chrysene. The interference can be removed by treating the extract with activated copper.

3.5 Poor solvent exchanges will result in rounded peaks and poor resolution. If this occurs, the extracts should be re-solvent exchanged.

4.0 DEFINITIONS

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. For all GC and HPLC methods, a CCV must be analyzed at the beginning of the analytical run, after every 10 samples, and at the end of the run.

4.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.5 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

4.6 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

4.7 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical

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procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.8 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.9 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.10 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.11 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

4.12 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the extraction efficiency.

5.0 REAGENTS

5.1 Water – HPLC grade or equivalent

5.2 Acetonitrile – HPLC grade or equivalent

5.3 PAH stock standards – Traceable to Certificate of Analysis

5.4 Surrogate standards – 0-Terphenyl and P-Terphenyl

6.0 APPARATUS

6.1 HPLC – Agilent Technologies 1100

Suitable HPLC equipped with an autosampler, pump, diode array detector, and fluorescence detector (optional).

Autosampler allows for unattended sample and standard injection throughout the analytical run.

6.2 Data System – Agilent Technologies LC Chemstation rev. A 08.00 or A 10.00
Agilent Technologies MS Chemstation rev. BA 02.00 or DA 00.01

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6.2.1 A computer system interfaced to the HPLC that allows for the continuous acquisition and storage of all data obtained throughout the duration of the chromatographic program.

6.2.2 The software should allow for the viewing of the entire UV Spectra acquired over the analytical run. Comparisons can then be made between spectra from standards and samples.

6.2.3 Data is archived to magnetic tape for long term storage.

6.3 Pinnacle II PAH column 4u – 3.2mm X150mm or equivalent

6.4 Gas-tight syringes and class "A" volumetric glassware for dilutions of standards and extracts.

7.0 PROCEDURE

7.1 Standards Preparation

Standards are prepared from commercially available certified reference standards. All standards must be logged in the HPLC Standards Logbook. All standards shall be traceable to their original source. The standards should be stored at 4 °C, or as recommended by the manufacturer.

7.1.1 Stock Standard Solutions

Stock standards are available from several commercial vendors. All vendors must supply a "Certificate of Analysis" with the standard. The certificate will be retained by the lab. Hold time for unopened stock standards is until the vendor's expiration date. Once opened, the hold time is reduced to one year or the vendor's expiration date (whichever is shorter).

7.1.2 Intermediate Standard Solutions

Intermediate standards are prepared by quantitative dilution of the stock standard with acetonitrile. The hold time for intermediate standards is six months or the vendor's expiration date (whichever is shorter). Intermediate standards may need to be remade if comparison to other standards indicate analyte degradation or concentration changes.

7.1.3 Calibration Standards

Calibration standards for the polynuclear aromatic hydrocarbons are prepared at a minimum of five concentration levels through quantitative dilutions of the intermediate standard. The low standard is at a

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concentration at or below the RL and the remaining standards define the working range of the detector.

Calibration standard concentrations are verified by the analysis of an initial calibration verification (ICV) standard.

7.2 HPLC Conditions – Pinnacle II PAH column

10ul autosampler injection

Mobile phase – HPLC grade water and acetonitrile

Column temperature – 21 °C

Gradient program –

Water (%)	Acetonitrile (%)	Flow (ml/min)	Time (min)
40	60	0.75	0.1
0	100	1.0	8.0
0	100	2.0	14
40	60	0.75	18

Diode Array Detector – Set to acquire and process data at 270-nm and 254-nm (switches to 300-nm after chrysene has eluted) wavelengths using a 10 to 20-nm bandwidth. All data from 200-nm to 450-nm wavelengths is stored for spectral evaluation.

HPLC conditions are optimized for each instrument. Actual conditions may vary slightly from those listed above.

7.3 Sample Preparation

7.3.1 Water Samples

A 1000ml aliquot of sample is extracted with methylene chloride utilizing separatory funnel extraction. The extract is solvent exchanged into acetonitrile and concentrated to 1.0ml.

7.3.2 Solid Samples

A 30-gram aliquot of sample is extracted with methylene chloride utilizing pulse sonication. The extract is solvent exchanged into acetonitrile and concentrated to 5.0ml. The extract is filtered through a .45um Teflon syringe filter to remove any particulate.

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7.4 HPLC Analysis

Instrument calibration consists of two major sections:

Initial Calibration Procedures
Continuing Calibration Verification

7.4.1 Initial Calibration Procedures

Before samples can be run, the HPLC system must be calibrated, and retention time windows must be determined.

7.4.1.1 External Standard Calibration

A minimum 5-point calibration curve is created for the PAHs and surrogates. Accutest Laboratories routinely performs a 7-point calibration to maximize the calibration range.

Calibration factors (CF) for the PAHs and surrogates are determined at each concentration by dividing the area of each compound by the concentration of the standard.

The low point may be omitted from the calibration table for any compound with an RL set at the level two standard. Additionally the high point may be omitted for any compound that exhibits poor linearity at the upper end of the calibration range.

The mean CF and standard deviation of the CF are determined for each analyte. The percent relative standard deviation (%RSD) of the response factors is calculated for each analyte as follows:

%RSD = (Standard Deviation of CF X 100) / Mean CF

If the %RSD $\leq$ 20%, linearity through the origin can be assumed and the mean CF can be used to quantitate target analytes in the samples. Alternatively if the %RSD > 20% a calibration curve of response vs. amount can be plotted. If the correlation coefficient (r) is $\geq$0.995 ($r^2 \geq$0.990) then the curve can be used to quantitate target analytes in the samples.

7.4.1.2 Initial Calibration Verification (ICV)

The validity of the initial calibration curve must be verified through the analysis of an initial calibration verification (ICV) standard. The ICV should be prepared from a second source at a mid-range concentration.

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The %D for all analytes of interest should be ≤ 15%. If the ICV does not meet this criteria, a second standard should be prepared. If the ICV still does not meet criteria, analyze an ICV prepared from a third source. If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.

7.4.1.3 Retention Time Windows

Retention time windows must be established whenever a new column is installed in an instrument or whenever a major change has been made to an instrument.

Retention time windows are crucial to the identification of target compounds. Absolute retention times are used for compound identification in all GC and HPLC methods that do not employ internal standard calibration. Retention time windows are established to compensate for minor shifts in absolute retention times that result from normal chromatographic variability. The width of the retention time window should be carefully established to minimize the occurrence of both false positive and false negative results.

Retention time windows are established by injecting all standard mixes three times over the course of 72 hours. The width of the retention time window for each analyte, surrogate, and major constituent in multi-component analytes is defined as ± 3 times the standard deviation of the mean absolute retention time or 0.03 minutes, whichever is greater.

Establish the center of the retention time window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

Peak identification is based on the retention time of a peak falling within the retention time window for a given analyte. Time reference peaks (surrogates) are used to correct for run-to-run variations in retention times due to temperature, flow, or injector fluctuations. HPLC retention times tend to shift more than GC retention times.

The retention time windows should be used as a guide for identifying compounds; however, the experience of the analyst

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should weigh heavily in the interpretation of the chromatograms. The analyst should monitor the retention times of known peaks (standards and surrogates) throughout an instrument run as an indication of instrument performance.

Because calculated retention time windows are generally very tight (less than ± 0.03 minutes), the retention time windows for the data processing method are generally set wider than the calculated window. This is done to ensure that the software does not miss any potential "hits". The analyst will then review these "hits" and determine if the retention times are close enough to the retention time of the target analyte to positively identify the peak or to require confirmation.

7.4.2 Continuing Calibration Verification (CCV)

Continuing calibration verification standards for the PAHs are prepared at various concentrations; at least one CCV must be below the mid-point of the calibration curve. A continuing calibration standard must be analyzed at the beginning and end of each run to verify that the initial calibration is still valid. Additionally a CCV must be analyzed after every 10 samples.

The percent difference (%D) for each analyte of interest will be monitored. The |%D| should be ≤ 15% for each analyte. If the first continuing calibration verification does not meet criteria, a second standard may be injected. If the second standard does not meet criteria, the system must be recalibrated.

If the |%D| is greater than 15%, then documented corrective action is necessary. This may include recalibrating the instrument and reanalyzing the samples, performing instrument maintenance to correct the problem and reanalyzing the samples, or qualifying the data. Under certain circumstances, the data may be reported. i.e. The CCV failed high, the associated QC passed, and the samples were ND.

NOTE: Any target analytes that are detected in the samples must be bracketed by an acceptable initial calibration curve and acceptable CCV standards; otherwise, the samples must be reanalyzed or the data must be qualified.

7.4.3 Sample Extract Analysis

7.4.3.1 Samples are analyzed in a set referred to as an analysis sequence or batch. A batch consists of the following:

Initial Calibration Standards (or Initial CCV)
QC Extracts
Sample Extracts
CCV Standards

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7.4.3.2 Ten microliters (same amount as standards) of extract is injected into the HPLC by the autosampler. The data system then records the resultant peak responses and retention times.

7.4.3.3 Tentative identification of an analyte occurs when the peaks from the sample extract fall within the established retention time windows for a calibrated compound.

7.4.3.4 The diode array detector is capable of spectral evaluation, second column confirmation is generally not necessary. Peak spectra can be compared to a spectral library that has been created for the target analytes. If the UV spectra of the peak match the UV spectra for the target analyte in the library, the hit is confirmed.

7.4.3.5 Additional confirmation data may be obtained from the fluorescence detector (if utilized) or the extract may be analyzed by GC/MS in either full scan or SIM mode. When the extract is analyzed by GC/MS, it must be diluted at least 2x with methylene chloride because the acetonitrile will cause peak splitting.

7.4.3.6 Quantitation of the analyte on the primary and secondary wavelength should agree within 40%. If the difference is greater than 40% and no obvious reason can be found, the higher result should be reported and flagged as “estimated”; otherwise, the result from the primary wavelength should be reported.

7.4.3.7 If the compound identification does not confirm, then the result should be reported as ND or “U”.

7.4.3.8 If the analyte response exceeds the linear range of the system, the extract must be diluted and reanalyzed. It is recommended that extracts be diluted so that the response falls into the middle of the calibration curve.

7.4.3.9 If peak identification is prevented by the presence of interferences, further cleanup may be required or the extract must be diluted so that the interference does not mask any analytes.

7.4.4 Instrument Maintenance

Routine maintenance of the instruments will help keep them in optimum working condition. Because of the variability in work load and sample matrix, it is not feasible to set up an exact maintenance schedule for each instrument. See SOP QA032 for maintenance recommendations.

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8.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix spike duplicate samples are compared to statistically generated control limits. These control limits are reviewed and updated annually. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

9.0 QUALITY ASSURANCE / QUALITY CONTROL

Accuracy and matrix bias are monitored by the use of surrogates and by the analysis of a QC set that is prepared with each batch (maximum of 20 samples) of samples. The QC set consists of a method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD).

9.1 Surrogates

9.1.1 O-Terphenyl and P-Terphenyl are used as the surrogate standards to monitor the efficiency of the extraction.

A known amount of surrogate standard is added to each sample including the QC set prior to extraction. The percent recovery for each surrogate is calculated as follows:

% Recovery = (Sample Amount / Amount Spiked) X 100

The percent recovery must fall within the established control limits for both surrogates for the results to be acceptable.

9.1.2 If either surrogate recovery is not within the established control limits, the following are required.

9.1.2.1 Check to be sure that there are no errors in calculations, integrations, surrogate solutions or internal standards. If errors are found, recalculate the data accordingly.

9.1.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

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9.1.2.3 If no problem is found, re-extract and reanalyze the sample. **NOTE:** If the recoveries are high and the sample is non-detect, then re-extraction may not be necessary. If there is insufficient sample for re-extraction, reanalyze the sample and footnote this on the report.

9.1.2.4 If upon reanalysis, the recovery is still not within control limits, the problem is considered matrix interference. Surrogates from both sets of analysis should be reported on the final report.

9.2 Method Blank

9.2.1 The method blank is either de-ionized water or sodium sulfate (depending upon sample matrix) to which the surrogate standard has been added. The method blank is then extracted and taken through all cleanup procedures along with the other samples to determine any contamination from reagents, glassware, or high level samples. The method blank must be free of any analytes of interest or interferences at ½ the required reporting level to be acceptable. If the method blank is not acceptable, corrective action must be taken to determine the source of the contamination. Samples associated with a contaminated method blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples, re-extracting and reanalyzing the samples or qualifying the results with a “B” or “V” qualifier.

9.2.2 If the MB is contaminated but the samples are non-detect, then the source of contamination should be investigated and documented. The sample results can be reported without qualification.

9.2.3 If the MB is contaminated but the samples results are > 10 times the contamination level, the source of the contamination should be investigated and documented. The samples results may be reported with the appropriate “B” or “V” qualifier. This must be approved by the department supervisor.

9.2.4 If the MB is contaminated but the samples results are < 10 times the contamination level, the source of the contamination should be investigated and documented. The samples should be re-extracted and reanalyzed for confirmation. If there is insufficient sample to re-extract, or if the sample is re-extracted beyond hold time, the appropriate footnote and qualifiers should be added to the results. This must be approved by the department supervisor.

9.3 Blank Spike

9.3.1 The blank spike is either de-ionized water or sodium sulfate (depending upon sample matrix) to which the surrogate standard and spike standard have been added. The blank spike is then extracted and taken through all

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cleanup procedures along with the other samples to monitor the efficiency of the extraction procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = (Blank Spike Amount / Amount Spiked) X 100

The percent recovery for each analyte of interest should fall within the established control limits for the results to be acceptable. The large number of analytes in this method presents a substantial probability that a few of the analytes will fall outside of the established control limits. This may not indicate that the system is out of control; therefore, corrective action may not be necessary.

Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. A marginal exceedance in the Blank Spike is defined as a recovery being outside of 3 standard deviations but within 4 standard deviations of the mean.

The number of allowable marginal exceedances is based on the number of analytes in the Blank Spike. Marginal Exceedances must be random. If the same analyte exceeds the BS control limits repeatedly, it is an indication of a systematic problem and corrective action must be taken.

The number of allowable marginal exceedances is as follows:

1) 11-30 analytes in BS, 1 analyte allowed in ME range;

2) < 11 analytes in BS, no analytes allowed in ME range

9.3.2 If the blank spike recoveries are not within the established control limits, the following are required.

9.3.2.1 Check to be sure that there are no errors in calculations, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly.

9.3.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.

9.3.2.3 Check to see if the recoveries that are outside of control limits are analytes of concern. If the analytes are not being reported, additional corrective action is not necessary and the sample results can be reported without qualification.

9.3.2.4 If the recovery of an analyte in the BS is high and the associated sample is non-detect, the data may be reportable.

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9.3.2.5 If no problem is found, the department supervisor shall review the data and determine what further corrective action is best for each particular sample. That may include reanalyzing the samples, re-extracting and reanalyzing the samples, or qualifying the results as estimated.

9.3.2.6 If there is insufficient sample to re-extract, or if the sample is re-extracted beyond hold time, the appropriate footnote and qualifiers should be added to the results. This must be approved by the department supervisor.

9.4 Matrix Spike and Matrix Spike Duplicate

9.4.1 Matrix spike and spike duplicates are replicate sample aliquots to which the surrogate standard and spike standard have been added. The matrix spike and spike duplicate are then extracted and taken through all cleanup procedures along with the other samples to monitor the precision and accuracy of the extraction procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = [(Spike Amount – Sample Amount) / Amount Spiked] X 100

The percent recovery for each analyte of interest must fall within the established control limits for the results to be acceptable.

9.4.2 If the matrix spike recoveries are not within the established control limits, the following are required.

9.4.2.1 Check to be sure that there are no errors in calculations, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly.

9.4.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.4.2.3 If no problem is found, compare the recoveries to those of the blank spike. If the blank spike recoveries indicate that the problem is sample related, document this on the run narrative. Matrix spike recovery failures are not grounds for re-extract but are an indication of the sample matrix effects.

9.4.3 Precision

Matrix spike and spike duplicate recoveries for each analyte are used to calculate the relative percent difference (RPD) for each compound.

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RPD = [| MS Result – MSD Result | / Average Result] X 100

The RPD for each analyte should fall within the established control limits. If more than 33% of the RPDs fall outside of the established control limits, the MS and MSD should be reanalyzed to ensure that there was no injection problem. If upon reanalysis the RPDs are still outside of the control limits, the department supervisor shall review the data and determine if any further action is necessary. RPD failures are generally not grounds for re-extraction.

10.0 CALCULATIONS

The concentration of each polynuclear aromatic hydrocarbon in the original sample is calculated as follows:

Water (ug/l) = $(CONC_{inst})$ X (V_F / V_I) X DF

Soil (ug/kg) = $[(CONC_{inst})$ X (V_F / W_I) X DF] / %solids

$CONC_{inst}$	=	Instrument concentration calculated from the initial calibration using mean CF, linear curve, or quadratic curve
DF	=	Dilution Factor
V_F	=	Volume of final extract (ul)
V_I	=	Volume of sample extracted (ml)
W_I	=	Weight of sample extracted (g)
%solids	=	Dry weight determination in decimal form

All soils are reported on a dry weight basis.

11.0 SAFETY AND POLLUTION PREVENTION

11.1 Safety

The analyst should follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which includes the use of safety glasses and lab coats.

The toxicity of each reagent and target analyte has not been precisely defined; however, each reagent and sample should be treated as a potential health hazard. Material Safety Data Sheets (MSDS) are available for all reagents and many of the target analytes. Exposure must be reduced to the lowest possible level. Personal protective equipment should be used by all analysts.

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11.2 Pollution Prevention

Wastewater and acetonitrile from the instrument are collected in waste storage bottles and are eventually transferred to the non-chlorinated waste drum.

Sample Extracts are archived and stored for 60 days after analysis. Old extracts and standards are disposed of in the waste vial drum.

12.0 REFERENCES

SW846 Method 8000C Revision 3, March 2003

SW846 Method 8310 Revision 0, September 1986

SW846 Method 8100 Revision 0, September 1986

EPA 610, October 1984

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SULFIDE

Prepared by:	Svetlana Izosimova	Date:	07/25/2007
Reviewed by:	Kelliam Garcia	Date:	07/31/2007

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TEST NAME: SULFIDE

METHOD REFERENCE: Standard Method 4500S=F 20th revision; EPA 376.1/SW-846 9030

DEPARTMENT: GN

REPORTING LIMIT: 1.0 mg/l for waters and 20 mg/kg for soils.

Summary of Changes: Primary method is SM4500S=F; QC table references in-house criteria; removed Organics references in CCV (Sec. 15.3);

1.0 SCOPE AND APPLICATION, SUMMARY

1.1 This method is used as a measure of sulfides and is applicable to all water and wastewater. A modification of this method is used to determine water-soluble sulfides in soil samples. The iodometric titration is based on SM4500S=F.

1.2 Excess iodine is added to the sample, which may have been preserved with zinc acetate and sodium hydroxide to produce zinc sulfide. The iodine oxidizes the sulfide to sulfur when the sample is acidified with HCl. The excess iodine is back titrated with sodium thiosulfate.

2.0 PRESERVATION AND HOLDING TIME

2.1 Preservation

Water samples should be preserved with zinc acetate and sodium hydroxide to pH $\geq$ 9 and collected in three 250-ml bottles. Water and soil samples should be kept under refrigeration at 4°C until they are analyzed.

2.2 Holding Time

All samples should be analyzed as soon as possible, but definitely within 7 days of the date of collection.

3.0 REPORTING LIMITS AND METHOD DETECTION LIMITS

3.1 The reporting limit for sulfide in water has been established at 1.0 mg/l and 20 mg/kg for soils

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method

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qualitative identification criteria. Experimental MDLs must be determined annually for this method.

3.3 MDLs should be established for all appropriate methods, using a solution spiked at approximately 3 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of the replicate analyses by 3.14, which is the student's t value for a 99% confidence level.

4.0 INTERFERENCES

Reduced sulfur compounds, which decompose in acid, such as sulfite and thiosulfate, may yield erratic results. Volatile iodine consuming substances will give high results. Samples should be taken with a minimum of aeration as oxidation may affect results.

5.0 APPPARATUS

The following items are needed for the analysis of samples following the method outlined below:

5.1 25 ml buret

5.2 Graduated beakers or flasks

5.3 Stir bars

5.4 Stir plates

5.5 Volumetric pipets

5.6 Filtering apparatus with 934 AH Whatman glass fiber filters or equivalent

6.0 REAGENTS

All chemicals listed below are reagent grade unless otherwise specified. De-ionized water should be used whenever water is required. Commercially available certified solutions are preferred.

6.1 Hydrochloric acid, HCl, 6N. Add 50 ml of concentrated HCl to 50 ml of DI water and mix.

6.2 Standard iodine solution, 0.0250 N: Dissolve 20 to 25 g of KI in a little DI water in a 1 liter volumetric and add 3.2 g of iodine. Allow it to dissolve. Dilute to 1 liter and standardize against 0.025 N sodium thiosulfate.

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6.3 Sodium Thiosulfate solution, 0.025 N: This solution is commercially available.

6.4 Starch indicator solution: This solution is commercially available.

6.5 Zinc acetate solution: Dissolve 220 g of zinc acetate in 870 ml of DI water.

6.6 Sodium hydroxide, 6N: Weigh out 24 g of sodium hydroxide and dilute to a final volume of 100 ml with DI water.

6.7 Sodium hydroxide, 1N: Dissolve 40 g of NaOH in 500 ml of DI water. Dilute to 1 liter with DI.

6.8 Sulfide Stock Solution, 537 mg/l: Dissolve 4.02 g of $Na_2S \bullet 9H_2O$ in approximately 980 ml DI water. Adjust the pH to between 9 and 11 with 1N NaOH (6.7). Dilute to 1 liter with DI in a volumetric flask. **NOTE:** Sodium sulfite nonahydrate is extremely hydroscopic. This solution must be made weekly.

7.0 TITRATION PROCEDURE

7.1 Before starting on the samples, standardize the iodine solution using the following procedure.

7.1.1 Volumetrically pipette 5.0 ml of the iodine solution into the beaker. Then measure out 200 ml of DI water into the beaker. Place a stir bar in the solution and place the beaker on a stir plate. Add several drops of HCl, to bring the pH to less than 2 and then add several drops starch solution.
Note: The amount of HCl solution needed may vary with the strength of the solution. If you do not get a blue color with several drops of starch, first verify that the pH $\leq$ 2. If the pH is correct, then add addition starch solution until a blue color is obtained.

7.1.2 Fill a 25-ml buret with 0.025 N sodium thiosulfate solution. Titrate the iodine solution with the sodium thiosulfate until the last blue color disappears. Record the volume of sodium thiosulfate used. At a minimum, perform this titration in duplicate.

7.1.3 Calculate the normality of the iodine as shown below. The iodine normality used should be the average of the normality for the two titrations of the DI blanks.

$$\text{N of iodine solution} = \frac{(\text{ml of Na thiosulfate}) * (0.025\ \text{N})}{(5.00\ \text{ml of iodine})}$$

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7.2 For soil samples, weigh out 25.0 g and dilute to 250 ml with DI water. Mix well. Let settle and filter through Whatman 934 AH filters until clear. Measure out 200 ml to use for analysis. Prepare a duplicate sample, a matrix spike, a spike blank, and a method blank. For the method blank, use 200 ml of DI water. **NOTE:** The soil sample should be prepared immediately before titration.

7.3 For water samples that are **not preserved** with Zn acetate/ NaOH, mix the sample well and measure out 200 ml to use for analysis. Continue with step 7.5

7.4 For water samples that are **preserved** with Zn acetate/ NaOH, mark the side of the sample bottle at the level of the sample meniscus.

7.5 Volumetrically pipette 3.0 ml of the iodine solution (6.2) into a flask and add 2 ml of 6N HCl and swirl to mix. Gently transfer the contents of the sample bottle to the flask (or the 200 ml from step 7.3) with a minimum of aeration under the surface of the iodine. Rinse the preserved sample bottle with sufficient DI to ensure a quantitative transfer to the flask. Add a stir bar and stir slowly. The solution should be yellow. If not, add additional iodine. Add a small amount of starch solution and the solution should turn blue.
Note: The amount of HCl solution needed may vary with the strength of the solution. If you do not get a blue color with several drops of starch, first verify that the pH is less than 2. If the pH is correct, then add addition starch solution until a blue color is obtained.

7.6 Titrate the sample slowly with the 0.025N sodium thiosulfate solution until the last bluish tint disappears. The solution is normally clear at the end point. Note: The sample should be gently, but continuously stirred during the titration.

7.7 Each batch of samples, set up quality control samples, consisting of a method blank, a spike blank, a matrix spike and a duplicate. The spike blank and the matrix spike are spiked with 5.0 ml of sulfide Stock solution (6.8) when the sample is transferred to the flask. **NOTE:** For MS and SB, use 10.0 ml of iodine, instead of 3.0.

7.8 For water samples that are preserved with Zn acetate/ NaOH, measure the volume used by filling the original bottle with water to the line marked on the side of the bottle then pour the water into a graduated cylinder. Record the volume.

7.9 If interference is suspected, the samples may be taken through a pre-treatment step as described below.

7.9.1 If the sample was not preserved, measure out 200 ml of sample. Add 0.30 ml of zinc acetate solution and 4 to 5 drops of 6N NaOH solution

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to bring the pH above 9. Mix gently. Let the precipitate settle for approximately 30 minutes. Continue with step 7.9.3

7.9.2 If the sample was preserved, verify the pH > 9 and mark the level of the meniscus on the side of the bottle. Additional Zn acetate may be added to ensure complete precipitation. Continue with step 7.9.3.

7.9.3 Filter the sample through glass fiber filter paper and then place the filter paper in a beaker with approximately 200-ml of DI water. Proceed with the titration starting at step 7.5.

8.0 CALCULATIONS

The calculations for both soils and waters are outlined below.

For water samples, the following calculations should be used.

$$\text{Sulfide in mg/l} = \frac{((V_iN_i) - (V_tN_t)) \times 16000}{\text{sample volume in ml}}$$

Where:
V_i = volume of iodine solution in ml
N_i = normality of iodine solution in ml
V_t = volume of sodium thiosulfate solution in ml
N_t = normality of sodium thiosulfate solution

For soil sample, the following calculation should be used.

$$\text{Sulfide in mg/kg} = \frac{((V_iN_i) - (V_tN_t)) \times 16000 \times V_f}{V_s \times (\%\text{solids}/100) \times W_i}$$

Where:
V_i = volume of iodine solution in ml
N_i = normality of iodine solution in ml
V_t = volume of sodium thiosulfate solution in ml
N_t = normality of sodium thiosulfate solution
V_s = volume of sample titrated
V_f = final volume of sample after preparation
W_i = initial weight of sample prepared

9.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

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Blank spike, matrix spike, and matrix spike duplicate samples are compared to statistically generated control limits. These control limits are reviewed and updated annually. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

10.0 QUALITY CONTROL

10.1 A method blank is required at a minimum of one per batch. The concentration of sulfide in the MB must be < ½ RL.

10.2 A spike blank is required at a minimum of one per batch. Until in-house limits can be generated, use 80 - 120% recovery as the limits. See Table 1.

10.3 A matrix spike is analyzed for every batch. In-house recovery limits should be used to assess the data. Use 75 - 125% recovery until the limits can be generated. If there is insufficient sample for a matrix spike, a second spike blank must be analyzed.

10.4 A duplicate is analyzed for every batch. Until in-house limits can be generated, 20% RPD should be used as the limit. A spike blank duplicate may be used, if there is insufficient sample available for the duplicate. If the RPD is greater than 20 and the sample and the duplicate are less than 5 times the RL, then the duplicate is considered in control and appropriately footnoted.

10.5 For QC criteria calculations refer to SOP QA042.

11.0 GLASSWARE CLEANING

All glassware should be washed with soap and tap water and then well rinsed with de-ionized water.

12.0 DOCUMENTATION REQUIREMENTS

All data should be recorded in a sulfide analysis log. Any unusual characteristics of the samples should be noted in the comment section. In addition, all reagent information such as lot numbers, vendors, date made, etc. should be recorded in the reagent logbook. All sample ID's and dilutions should be clearly labeled on the data.

13.0 SAFETY

The analyst should follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual. Safety glasses and lab coats should be worn at all times in the lab. Gloves should be worn when handling samples.

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14.0 POLLUTION PREVENTION AND WASTE MANAGEMENT

14.1 Pollution Prevention

Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards reagents and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in Section 14.2.

14.2 Waste Management

Individuals performing this method must follow established waste management procedures as described in the Sample and Laboratory Waste Disposal SOP. This document describes the proper disposal of all waste materials generated during the testing of samples.

15.0 DEFINITIONS

15.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or 24 hours which ever comes first.

15.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

15.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run.

15.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

15.5 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

15.6 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

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15.7 Continuing Calibration Verification 2 (CCV2): A check standard used to verify instrument calibration. CCV2 is analyzed at the time of instrument calibration and is usually the same concentration as the lowest standard or the reporting limit.

15.8 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

15.9 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the precision and bias of a method in a given sample matrix.

15.10 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

15.11 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

15.12 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

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Table 1 QC Criteria

Quality Control	Acceptance Criteria	Corrective Action
Method blank (MB)	< 1/2RL	Reanalyze, and/or stop the run and determine the source of contamination, or document why the data are acceptable.
Blank Spike (BS or LSC)	In-house criteria	Determine and correct the problem, reanalyze samples, if necessary, or document why data are acceptable.
MS/MSD	In-house criteria	Determine and correct the problem, reanalyze samples and MS/MSD, or document why data are acceptable
Sample Duplicate	In-house criteria	Determine and correct cause of the poor reproducibility

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TOTAL ORGANIC CARBON IN AQUEOUS SAMPLES

Prepared by:	Svetlana Izosimova	Date:	07/31/2007
Reviewed by:	Kelliam Garcia	Date:	08/06/2007

Annual Review

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TITLE: TOTAL ORGANIC CARBON IN AQUEOUS SAMPLES

REFERENCES: SM 5310B; SW846 9060A, Rev. 1.0, November 2004; EPA Method 415.1

Summary of Changes: ***Method references revised. Revised Summary to reflect actual technology; streamlined Definitions; removed sparger check; removed DW references; Removed 10.10.2 – quadruplicate analysis required anyway. Removed Calibration Blanks. MB acceptance at 1/2RL, removed running batches everywhere.***

1.0 SCOPE AND APPLICATION

1.1 This method can be used to determine total organic carbon or dissolved organic carbon in any aqueous matrix. The total organic carbon is actually being determined as non-purgeable organic carbon. Volatile compounds are lost during the sparging process to remove inorganic carbon.

1.2 The product for total organic carbon is TOC and the product for dissolved organic carbon is DOC. Both of these products require prep and analytical work groups. Total carbon (TCAR) can also be analyzed following this method. However for total carbon, both total and inorganic carbon must be measured and no sparging of the sample is done.

1.3 The normal reporting limit for TOC and DOC in aqueous samples is 1.0 mg/l. The normal reporting limit for TCAR is also 1.0 mg/l. Inorganic carbon (ICAR) is calculated as the difference between TCAR and TOC and has a normal reporting limit of 2.0 mg/l.

1.4 Very high level water samples (normally > 500 mg/l) or samples containing high levels of particulates may need to be run using the boat sampler normally used for soil samples. When analyzing these samples using the boat sampler, all steps of the soil SOP, including acidification and heating to remove inorganic carbonates, must be followed. (Acidification and sparging may also be used to remove inorganic carbonates.) Refer to EGN233 for more information on this procedure.

2.0 SUMMARY

2.1 Total organic carbon is determined by combusting an acidified sample and converting the carbon dioxide CO2 into methane CH4, which is measured by FID. Amount of CH4 is directly proportionate to the amount of carbonaceous material in the sample The quantitation is done by comparison to a linear calibration curve. Dissolved organic carbon is determined following the same method, but the sample is filtered through a 0.45 µm filter before analysis. Total carbon is determined following the same method, but the sample is not sparged.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at the lowest concentration standard in the calibration curve. Detected concentrations below this concentration are not reported.

3.1.1 Establish reporting limits at the concentration of the low standard used to generate the calibration range. This concentration is defined as the lower limit for quantitative accuracy.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study.

4.0 DEFINITIONS

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or samples loaded on an instrument within the same 12-hour shift, which ever comes first.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. CCV must be analyzed at the beginning of the analytical run, after every 10 samples, and at the end of the run.

4.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.5 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

4.6 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

4.7 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical

procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.8 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.9 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.10 Method Detection Limits (MDLs) MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. This definition is qualitative in nature and does not evaluate an acceptable quantitative limit for method performance. MDLs should be determined annually for every matrix and method. Refer to SOP QA020, current revision.

4.11 Reagent Blank: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. For methods requiring no preparation step, the reagent blank is equivalent to the method blank.

4.12 Reagent Grade: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents, which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

4.13 Reagent Water: Water that has been generated by any method, which would achieve the performance specifications for ASTM Type II water.

4.14 Reference Material: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

4.15 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.16 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

5.0 HEALTH & SAFETY

5.1 The analyst should follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and should be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets should be made available to all personnel involved in these analyses.

5.3 The furnaces in the TOC analyzers are heated to high temperatures. Do not handle the furnaces or furnace glassware until they are cooled down.

6.0 COLLECTION, PRESERVATION, AND HOLDING TIME

6.1 Water samples for TOC or DOC should be preserved with HCl to a pH <2. Samples should be kept under refrigeration at 4^0 C until they are analyzed. (Sulfuric acid preservation is allowed by the method, but will quickly degrade the columns on the TOC analyzer.)

6.1.1 Total carbon preservation is not directly addressed in the methods. Normally an unpreserved sample is used to prevent the loss of CO2 formed from acidified inorganic carbon. If an acid preserved sample is used, it should be handled like a volatile sample to minimize the loss of this CO2.

6.1.2 For North Carolina samples, sulfuric acid or phosphoric acid preservation is required. These samples must generally be run at a 1:5 dilution to prevent degradation of the column on the TOC.

6.2 DOC samples should be filtered through a 0.45 um filter before analysis. It is recommended that this be done at the time of sampling. If it is done in the lab, a filter blank must also be prepared and analyzed.

6.3 All samples should be analyzed within 28 days of the date of collection per 40 CFR.

7.0 APPARATUS

The following items are needed for the analysis of samples following the method outlined below:

7.1 Shimadzu 5000 TOC analyzer or equivalent. An autosampler is desirable for this analysis. See instrument maintenance outlined below.

7.1.1 Every day, the humidifier should be checked to ensure that the water level is within the two white lines on the side of the humidifier.

7.1.2 Whenever calibration check recoveries are low or blank results are high, the flow and the condition of the catalyst should be checked. Refer to the instrument manual for additional information. Never change the catalyst without first checking with the area supervisor or manager.

7.2 Analytical balance, capable or weighing to 0.1 mg. The calibration of the analytical balance should be verified each day before use.

7.3 Volumetric glassware, class A. For standards and reagent preparation.

7.4 Filter paper, 0.45 um pore size. (For DOC only)

8.0 REAGENTS

All chemicals listed below are reagent grade unless otherwise specified. Deionized water taken from the DI taps in the organics lab should be used whenever water is required. Make sure to properly label all reagents and record the reagent preparation in the reagent logbook. Note: HCl is the preferred preservative for all of the work with the Shimadzu analyzer.

8.1 Potassium hydrogen phthalate (KHP), stock solution, 100 mg carbon/L. Dissolve .2125 g of potassium hydrogen phthalate (primary standard grade, dried to a constant weight, approximately 1 hour at 105^0 C) in approximately 800 ml of DI water. Add concentrated HCl to bring the pH to less than 2 and dilute to a final volume of 1000 ml with DI water. This standard may be stored under refrigeration for 3 months.

8.2 Potassium hydrogen phthalate (KHP) calibration solutions. All standards should be made up in volumetric flasks using volumetric pipettes. All standards should be brought to a final volume of 100 ml with DI water and be acidified to a pH of less than 2 with HCl. Note: the concentrations shown below are suggested levels. Alternate calibrations may be used as long as a minimum of a blank and 5 standards are analyzed. Calibration standards may be stored under refrigeration for up to 28 days.

Volume of Dilution Std	Conc. of Dilution Std	Final Conc. in mg/l
0.00	0.00	0.00
1.00	100	1.00
2.00	100	2.00
5.00	100	5.00
10.0	100	10.0
20.0	100	20.0
30.0	100	30.0

8.3 CCV Check solution. The CCV should be at a level at or near the mid-point of the curve. The CCV must be from a separate source than the calibration curve. For all other methods, the CCV may be either from the same source as the calibration curve or from a separate source. To make the CCV for the curve shown above, add 15.0 ml

of 100 mgC/l to a 100 ml volumetric flask and dilute to approximately 95 ml with DI water. Acidify to a pH of < 2 with HCl and dilute to the final volume of 100 ml with DI water. Mix well. The true value for this solution is 15.0 mg/l of TOC.

8.4 ICV Check solution. The ICV must be from a different source than the calibration curve. It may be purchased or made internally. Any concentration within the range of the curve may be used. If making this ICV internally, one acceptable preparation is use the sucrose solution made in Section 8.5. To make this ICV, add 15.0 ml of 100 mg C/l to a 100 ml volumetric flask and dilute to approximately 95 ml with DI water. Acidify to a pH of < 2 with HCl and dilute to the final volume of 100 ml with DI water. Mix well. The true value of this solution is 15 mg/l of TOC.

9.0 INTERFERENCES

9.1 High results may be obtained if the inorganic carbon is not completely removed from the sample before analysis. The sample must be acidified to a pH of less than 2 and sparged for at least 6 minutes to remove the inorganic carbon. Samples that are expected to contain high amounts of inorganic carbon may be logged into the LIMS with the product code TOCEP, which indicates that an extended purge (sparge) time is needed. A minimum of a 15-minute sparge time is required for these samples.

9.2 Large particulate in the sample may not be pulled into the needle during the sample injection and may result in a low bias.

9.3 Filtration can result in loss or gain of DOC, depending on the physical properties of the carbons containing compounds and the adsorption of carbonaceous material on the filter or its desorption from it.

10.0 PROCEDURE

10.1 Below is the procedure to be followed for the analysis of aqueous samples for total organic carbon using the Shimadzu TOC analyzer. All standards and samples must be analyzed using a minimum of duplicate injections.

10.2 Turn on the oxygen. The pressure in the water module should be set at 5 and the carrier gas should be set as marked on the dial (150 ml/min). The oxygen pressure at the tank must be at least 60 psi to maintain sufficient pressure at the instrument. Check to make sure that the humidifier contains sufficient water. It should be filled to within the two white lines on the side of the humidifier. (The humidifier is located inside the water analyzer at the right side of the instrument.)

10.3 If the power is off, then turn on the power at the side of the soil and water modules and for the computer.

10.4 Go into the TOC software on the TOC. Select measure and then connect. Wait for the software to connect with the TOC analyzer. Proceed to options and then conditions. Under TOC, there should be a check next to Furnace on. Under ASI,

there should be a check next to ASI used. Under SSM, the TOC furnace should not be turned on.

10.5 Go to view and click on the background monitor. A graph will appear on screen showing the position of the baseline and the status of the furnace temperature. Wait for the baseline to stabilize and for the furnace temperature to indicate that it is OK. If the baseline is not within several steps of zero, then the zero of the instrument may need to be adjusted. Check with the lab supervisor or manager for further instructions.

10.6 If the instrument has not been calibrated within the last month, then it is recommended that it be calibrated at this point. (A new calibration is required at least once per quarter.)

10.6.1 Select new file and insert standards. A minimum of 2 injections must be used for each standard. Five standards and a blank are required for the calibration. The lowest standard should be at 1.0 mg C/l or lower. A 100 ul injection size should be used for all standards. A 6-minute sparge time (or greater) should be used for all standards and samples.

10.6.2 After the standard file is created and inserted into the run file, then save the run file using the save as command. The file should be named with the instrument identifier (A or B), year (1 digit), the month (2 digits), the day, and a designation for the matrix and the run number for that matrix. For example, the first water run on instrument A from 3/12/02 would be named A20312w1.

10.6.3 Pour out the standards into the standard vials on the autosampler. Check to make sure that the pH is <2 for all standards. Cover the standard vials with a tight layer of foil and anchor it in place with a plastic ring.

10.6.4 Save the file under the proper name before starting the analysis. Open up the real-time monitor to view the peaks as the analysis is done. With the cursor positioned on the autosampler file, the start button should be highlighted. Use the mouse to click on the start button and the analysis should begin.

10.6.5 When all of the standards have been completed, then review the curve using the view, calibration option. If a correlation coefficient of greater than 0.995 is obtained and the intercept is less than the RDL, then save the curve using the “file save” option.

10.7 If a previous calibration is being used, then it must be verified with a low (1.0 mg/l) and a high (30 mg/l) standard and a blank before proceeding on each analysis day. The low standard must be within 30% of the true value. All other check standards must be within 10% of the true value. The blank must contain <1/2RL for TOC. Make sure to use duplicate injections for all analyses. Note: The method blank may be used as the calibration blank check.

10.8 After the calibration or calibration checks are completed, then analyze an external check standard made from a separate source than the calibration standards. This standard must agree within 10% of the true value. If it is not within this range, determine the source of the problem before proceeding. Note: The external calibration check may be used as the spike blank. For EPA 9060A analyze after every 15 samples. Acceptance criteria are the same as for CCV.

10.9 After every 10 samples and at the end of the run, a continuing calibration check sample and a continuing calibration blank should be analyzed. The continuing calibration check should be a standard near the mid-range of the curve. It is recommended that a check standard at 15 mgC/l be used as the continuing calibration check standard. The continuing calibration check should agree within 10% of the true value. The result for the continuing calibration blank must be less than the reporting level. If either the CCV or the CCB do not meet criteria, then all samples bracketed by this QC must be reanalyzed.

10.10 Begin analyzing the samples following the procedure outlined below.

10.10.1 Write out a run log, with the sample numbers and check standards recorded in the order in which they are to be run. All samples and check standards must be analyzed with duplicate injections.

10.10.2 Shake the samples well to make sure they are completely homogenized and pour out an aliquot into an autosampler tube.

10.10.2.1 If a sample contains a high level of particulates, check with the lab supervisor before proceeding. The sample may need to be analyzed using the soil module.

10.10.3 Check the pH of each sample. If the pH is not <2, then add HCl drop-wise to bring the pH to < 2. Check the final pH with pH paper and record it on the run log.

10.10.3.1 North Carolina samples must be preserved with sulfuric acid. Dilute all sulfuric acid preserved samples by a factor of 5 to prevent degradation of the column.

10.10.4 Method blank and spike blank must be analyzed with every batch. Matrix spikes are analyzed at the 10% matrix frequency. All of these quality control points must be analyzed using duplicate injections for SM5310B and in quadruplicate for EPA 9060A.

10.10.4.1 Prepare the matrix spike by adding 0.050 ml of 1000 mg C/l standard solution to 5.00 ml of acidified sample.

10.10.4.2 The spike blank may be prepared by adding 0.500 ml of 1000 mg C/l standard solution to 50 ml of acidified blank. Alternatively, the external check may be used as the spike blank.

10.10.4.3 For both the matrix spike and the spike blank, sample and standard amounts may be varied as necessary as long as the same final spike concentrations are used for each of these QC points.

10.10.5 Analyze continuing calibration checks as outlined in 10.9 above.

10.10.6 When all samples and quality control have been poured into the autosampler tray, enter the run log information into the sample file. Make sure that a 6 minute sparge time is used and the proper autosampler vials are indicated for each sample. Enter any dilution factors both in the dilution column and in the column to the right of the sample ID. Save the file using the save as option. The file should be named with the instrument designation (A or B), the year (last digit), the month (2 digits), the day, and a designation for the matrix and the run number for that matrix.

10.10.6.1 The software may not accept large dilution factors (>100). In that case, enter in the dilution in the column to the right of the sample ID and correct the final result in the LIMS system for the sample dilution.

10.10.7 Open up the real-time monitor to view the peaks as the analysis is done. With the cursor positioned on the autosampler file, the start button should be highlighted. Use the mouse to click on the start button and the analysis should begin.

10.10.8 After the analysis is complete, check through the data to make sure that all QC is within criteria, that samples are within the curve, and that good reproducibility is obtained for the duplicate injections.

10.10.8.1 If the duplicate sample injections have a coefficient of variation (CV) of greater than 15 percent, and the difference between the injections is greater than the reporting limit, then repeat the analysis with 2 additional duplicate injections.

$$CV = (\text{Std Dev}_{n-1} / \text{mean}) \times 100$$

10.10.8.1.1 If, on the repeated analysis, a high %RPD is still obtained, and there is no evidence of an analytical problem, then the sample results should be reported with a flag due to possible sample nonhomogeneity.

10.10.8.2 If there is carryover from a previous high analysis then the first of three injections may be excluded. If a bad injection is observed, then that injection may also be excluded as long as it is documented.

10.10.9 Add dilutions and reruns to the end of the file, along with the appropriate quality control. Make sure to save the file both before and after the additions. When restarting the analysis, make sure to select the append option. Never use the overwrite option.

10.10.10 Review the run for completeness and data and quality control problems. Then export the data file and copy it into the LIMS system. Make any necessary corrections in GNAPP and provide the supervisor with the data for additional review. See the area supervisor or manager for further details.

11.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix spike duplicate samples are compared to method defined control limits. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

12.0 QUALITY ASSURANCE

Below is a summary of the quality control requirements for this method. Make sure to check with the laboratory supervisor or manager for any additional client specific quality control requirements.

12.1 Method Detection Limits (MDLs). MDLs should be established using a blank sample spiked at approximately 3 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of the replicate analyses by 3.14, which is the student's t value for a 99% confidence level. MDLs should be determined approximately once per year.

12.2 Method Blank. The laboratory must prepare and analyze a method blank with each batch. The method blank must contain the analyte at <1/2RL. If the method blank contains over that limit, the samples must reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

12.3 Spike Blank. The laboratory must prepare and analyze a spike blank with each batch. The laboratory should assess laboratory performance of the spike blank against recovery limits of 90 to 110%. If the spike blank recovery is high and the results of the samples to be reported are <RL, then the sample results can be reported with no flag. In all other situations, all samples associated with a spike blank outside of recovery limits must be reanalyzed.

12.4 Matrix Spike. The laboratory must add a known amount of each analyte to a minimum of 10%matrix.

12.4.1 The spike recovery should be assessed using +/-10% acceptance criteria. If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect.

12.4.2 The matrix spike recovery should be calculated as shown below.

$$\frac{\text{(Spiked Sample Result - Sample Result)}}{\text{(Amount Spiked)}} \times 100 = \text{MS Recovery}$$

12.5 Matrix Duplicate. The laboratory should analyze a duplicate sample for a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. Matrix spike duplicates may be used in place of matrix duplicates. The duplicate RPD is calculated as shown below.

12.5.1 The duplicate RPD should be assessed using in house limits. Until these limits can be generated, then default limits of 20% RPD should be applied. If a duplicate is out of control, then the results should be flagged with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of $\pm$ the reporting limit, then the duplicate is considered to be in control.

12.5.2 The duplicate RPD should be calculated as shown below.

$$\frac{\text{(Sample Result - Duplicate Result)} \times 100}{\text{(Sample Result + Duplicate Result)} \times 0.5} = \text{\% RPD}$$

12.6 Quality Control Sample (also referred to as Initial Calibration Verification Standard, ICV). It is recommended that a standard from a separate source than the calibration should be run at the beginning of each run. (It is required that this be run with each new calibration curve.) This ICV should be within 10% of the true value. If it is not, the problem must be resolved before any samples can be analyzed. Note: The spike blank may be used in place of the ICV as long as a separate source standard is used and the 10% criterion is met.

12.7 Continuing Calibration Verification Sample (CCV). Analyze the continuing calibration verification solution after every tenth sample and at the end of the sample run. If the CCV solution is not within 10% of the true value, then no samples can be reported in the area bracketed by that CCV. (Note: the exception is if the CCV is biased high and the samples are less than the detection limit. In that case, the samples can be reported with no flag.) The CCV concentration should be at or near the mid-range of the calibration curve.

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12.8 For all analyses done following Standard Methods 5310B (normally drinking water samples), analyze the continuing calibration blank solution after every CCV check (every tenth sample and at the end of the sample run). The continuing calibration blank must be less than the reporting limit. If the CCB solution is not less than the reporting limit, then no samples can be reported in the area bracketed by that CCB. (Note: the exception is if the CCB is biased high and the samples are less than the detection limit. In that case, the samples can be reported with no flag.)

13.0 DOCUMENTATION

13.1 A run log, showing any dilutions and the sample pH values, should be recorded on a data sheet such as the example attached. Make sure to record any comments regarding unusual sample appearance or any other problems or observations. All reagent reference numbers should be recorded on the data sheet.

13.2 All reagent information should be recorded in reagent logs.

13.3 Balance checks and calibrations should be recorded on the balance logs provided with each balance. Each balance must be checked at least once per day before use. The balance checks should be within the criteria listed in the balance logbook.

14.0 DATA REVIEW AND REPORTING

14.1 All samples should be updated to both prep (GP) and analysis (GN) batches in the LIMS system. The analyst should calculate all matrix spike, duplicate, external, and CCV recoveries and review the results of all blanks.

14.2 All documentation must be completed, including reagent references and spike amounts and spiking solution references.

14.3 A final report should be printed out from the TOC software. Make sure to check that all samples meet replication requirements (< 15% CV) and that the samples are within the range of the calibration curve.

14.4 A data file should be exported to the LIMS system and the spike amounts should be entered into the file at the GNAPP process step.

14.5 A final data package, consisting of the raw data sheet (run log), QC summary sheet, TOC printout, and workgroup printout, should be turned into the area supervisor for review. The external standard should be plotted on the TOC control chart.

15.0 POLLUTION PREVENTION & WASTE MANAGEMENT

15.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or

solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 15.2.

15.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, SAM109. This document describes the proper disposal of all waste materials generated during the testing of samples.

16.0 ADDITIONAL REFERENCES

16.1 Shimadzu TOC 5000 Instrument Manual

STANDARD OPERATING PROCEDURE FOR THE DETERMINATION OF INORGANIC ANIONS BY ION CHROMATOGRAPHY USING THE IC 2000

Prepared by: Svetlana Izosimova Date: 01/21/09

Reviewed by: Steve Lee Date: 01/23/09

Annual Review

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Reviewed by: _____ Date: _____

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Effective 7 days after "*" date

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TITLE: DETERMINATION OF INORGANIC ANIONS BY ION CHROMATOGRAPHY using the IC2000

METHOD REFERENCES: EPA 300.0, Revision 2.1, 1993; SW846 9056A; 40CFR, part 136, Ap. B – MDL procedure.

***Revised Sections*: Method revision clarified in Method References; MDL study performed semiannually – Sec. 3.2.1, 4.10, 14.1; edited 14.2.1.1.**

1.0 SCOPE AND APPLICATION

1.1 This method is for the measurement of anions such as bromide, chloride, fluoride, nitrate, nitrite and sulfate by ion chromatography. The method is applicable to potable and non-potable water, solids after extractions, and neutral leachates.

2.0 SUMMARY OF METHOD

2.1 A small volume of sample is introduced into an ion chromatograph. The anions of interest are separated and measured, using a system comprised of a guard column, and analytical column, a suppressor column, and a conductivity detector.

2.2 Detection limits vary with the instrument conditions and calibration levels used.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The normal reporting limit for this method is normally established at or above the lowest non-zero concentration standard in the calibration curve. Detected concentrations below this concentration are not reported unless MDL reporting is being done. Reporting limits were set as follows:

ANALYTE	REPORTING LIMIT
Bromide	0.50 mg/l
Chloride	2.00 mg/l
Fluoride	0.10 mg/l
Nitrate	0.10 mg/l
Nitrite	0.10 mg/l
Sulfate	2.00 mg/l

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined semiannually for this method, as outlined in EPA 300.0. Refer to SOP QA020, current revision, for further details.

4.0 DEFINITIONS

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or samples loaded on an instrument within the same 12-hour shift, which ever comes first.

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4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. CCV must be analyzed at the beginning of the analytical run, after every 10 samples, and at the end of the run.

4.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.5 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

4.6 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

4.7 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.8 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.9 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.10 Method Detection Limits (MDLs) MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. This definition is qualitative in nature and does not evaluate an acceptable quantitative limit for method performance. MDLs should be determined semiannually for every matrix in this method. Refer to SOP QA020, current revision.

4.11 Reagent Blank: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. For methods requiring no preparation step, the reagent blank is equivalent to the method blank.

4.12 Reagent Grade: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents, which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

4.13 Reagent Water: Water that has been generated by any method, which would achieve the performance specifications for ASTM Type II water.

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4.14 Reference Material: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

4.15 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.16 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

5.0 HEALTH & SAFETY

5.1 The analyst should follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and should be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets should be made available to all personnel involved in these analyses.

6.0 COLLECTION, PRESERVATION, AND HOLDING TIME

6.1 For bromide, chloride, and fluoride, no special preservations are required. For nitrite, nitrate and sulfate, the sample must be cooled to 4 °C.

6.2 Bromide, chloride, fluoride, and sulfate must all be analyzed within 28 days. Nitrite and nitrate must be analyzed within 48 hours.

7.0 APPARATUS AND MATERIALS

7.1 Ion Chromatograph with a guard column, an analytical column, a suppressor column, and a conductivity conductor. This SOP is written for the use with the Dionex ICS-2000 instrument. The ICS-2000 is run using the external water mode with the suppressor and using internally generated eluent. No manual eluent preparation is required for the ICS-2000 instruments. The columns used are listed below. Alternate columns may be used if all method requirements can be met.

7.1.1 Suppressor column, ASRS Ultra 4 mm. Dionex part number 061561

7.1.2 Guard Column, IONPAC AG18 4 mm. Dionex part number 060551

7.1.3 Analytical Column, IONPAC AS18. Dionex part number 060549

7.2 Top loading balance, capable of weighing to 0.01 g.

7.3 Volumetric flasks, class A.

7.4 Volumetric pipets, class A or autopipeters. Note: If autopipeters are used, make sure that the calibration is checked before use as specified in the autopipeter SOP.

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7.5 Helium tank and regulator. On the IC-2000 instruments, helium is used only for head pressure on the water reservoirs. The pressure should be set at approximately 6 psi.

7.6 Magnetic stirrers and stirring bars (for solid samples)

7.7 Nylon 0.45 um membrane filters or equivalent, that can be attached to the end of the syringe.

8.0 REAGENTS

All chemicals listed below are reagent grade unless otherwise specified. Deionized water must be used whenever water is required.

8.1 Stock Standard Solution, 1000 mg/L: The stock standard solution for all the anions can be purchased commercially from various manufacturers.

Bromide: Absolute Standards #54107, 1000ppm, or equivalent
Chloride: LabChem #LC13000-7, 1000ppm, or equivalent
Fluoride: Acculon #IC-F-10X-1, 1000ppm, or equivalent
Nitrate: Acculon #IC-NO3-N-10X-1, 1000ppm, or equivalent
Nitrite: Acculon #IC-NO2-N-10X-1, 1000ppm, or equivalent
Sulfate: I-CAL #IC5041-5, 1000ppm, or equivalent

8.2 Calibration standard solutions: Solutions containing bromide, chloride, fluoride, nitrate, and sulfate must be made fresh weekly. Solutions containing nitrite should be made fresh daily. Note: Levels shown below are suggested levels and may be changed to meet different reporting limit requirements.

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8.2.1 The final concentrations of suggested standards are shown in the table below. All units are in mg/l.

Anion	STDA	STDB	STDC	STDD	STDE	STDF	STDG
F	.1	.5	1	2.5	3	4	5
CHL	2	10	30	50	100	200	400
NO2	.1	.5	1	2.5	3	4	5
BRO	.5	1	7.5	12.5	15	20	25
NO32	0.1	.5	1	2.5	3	4	5
SO4	2	10	30	50	100	200	400

8.2.2 The volume of 1000 mg/L added to 100 ml volumetric flask are shown in the table below. All units are in ml.

Anion	STDA	STDB	STDC	STDD	STDE	STDF	STDG
F	.01	.05	.1	.25	.3	.4	.5
CHL	.2	1	3	5	10	20	40
NO2	.01	.05	.1	.25	.3	.4	.5
BRO	.05	.1	.75	1.25	1.5	2.0	2.5
NO32	.01	.05	.1	.25	.3	.4	.5
SO4	.2	1	3	5	10	20	40

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8.7 CCV. Same concentration as standard D.

8.8 ICV (External Check Solution.) The ICV can be made in the same manner as the standard D from a separate source than the standards. It must be within the range of the curve. Alternatively, it can be purchased from a outside supplier.

8.9 0.2N H_2SO_4 for suppressor regeneration: Pipet 1.0 ml of concentrated H_2SO_4 into 100 ml DI and dilute to final volume of 200ml with DI.

8.10 0.1M Oxalic Acid for metals column clean-up: Dissolve 6.3 g of oxalic acid into approx. 300 mL of DI water. Bring to final volume of 500 mL with DI water.

8.11 10X eluent concentrate (300mM KOH) for hydrophilic ionic contamination clean-up.

8.12 Acetonitrile, reagent grade

8.13 1M HCl: Add 8.3 ml of concentrated hydrochloric acid to approximately 70 ml of deionized water. Dilute to a final volume of 100 ml and mix well.

9.0 INTERFERENCES

9.1 Interferences can be caused by substances with retention times that are similar to and overlap those of the anion of interest. This interference is especially important at low concentrations.

9.2 The acetate anion elutes early during the chromatographic run and can cause elution times of other anions to vary when large amounts of acetate are present. High levels of acetate also can cause interference with the fluoride peak. Therefore, this method is not recommended for leachates containing acetic acid.

9.3 Large amounts of an anion can interfere with the peak resolution of an adjacent anion. High concentrations of an anion can also cause the peak to be misidentified on the chromatograph due to the large width of the peak. Sample dilution and fortification can be used to correct most interference problems connected with peak resolution.

9.4 Samples that contain particles greater than 0.45 μm and reagents with particles larger than 0.2 μm must be filtered to prevent damage to instrument columns and flow systems.

10.0 SAMPLE PREPARATION PROCEDURE

10.1 For soil samples, follow the preparation outlined below.

10.1.1 Mix the sample well and remove any artifacts as discussed in SOP QA034, current revision. Weigh approximately 10 g of sample and add 100 ml of DI water. Mix the resulting slurry for 10 minutes using a magnetic stirring device. Filter the resulting slurry through a 0.45 um membrane filter before analysis. Record the weight to the nearest 0.01 g on preparation log.

10.1.2 For matrix spikes, make sure to spike the aliquot of the sample directly and then add the 100 ml of water and stir.

10.1.3 Prepare blank QC (Method Blank and Blank Spike) using clean sand, using

approximately 10 g aliquot and 100 ml of DI water. Record the weight to nearest 0.01 g.

10.1.4 Check with the lab supervisor if there is insufficient sample to use a 10 g aliquot. Smaller aliquots may be used if a homogeneous portion of the sample can be obtained. The sample must always be extracted with 10 times the sample weight of DI water.

10.2 For water samples, filter all samples through 0.45 um filters before analysis. Matrix spikes must be spiked before filtration.

11.0 ION CHROMATOGRAPHY ANALYSIS PROCEDURE FOR THE ICS-2000 INSTRUMENTS

11.1 Check to make sure that the helium tank pressure is > 100 PSI and the pressure gauge by the eluent bottles is set at 6 PSI.

11.2 Fill the eluent generation bottle(s) that are to be used with deionized water (resistance of 18.2 megaohms or greater), making sure that they are pressurized with helium. On the instrument panel (or in the software) set the water volume at the level in the bottles and adjust the flow rate up to 1.0 ml/min. Check the KOH is set at the proper molarity. Normally it should be set at 30 mM. Also fill the external water bottle(s) for the suppressor with deionized water.

11.3 Check the lines coming out of the suppressor for air bubbles. Bubbles should be present. If not, then check to make sure the current is on and the suppressor is working properly.

11.4 Check the pump waste line and see if bubbles are present. If they are present, then prime the pump using the procedure described below.

11.4.1 Hit the prime button on the front panel.

11.4.2 Open up the pressure transducer on the pump by turning it 3 turns to the left. Then enter OK on the front panel.

11.4.3 Put the syringe in the syringe prime knob and turn it 3 times to the left and begin to slowly pull back on the syringe to 10 ml. Check for air bubbles on the pump waste line. If not air bubbles are present, then close the syringe priming knob and shut the pump off. Then close the pressure transducer knob.

11.4.4 Allow the instrument conditions to settle and then check the pressure and check for air bubbles. If there is still a problem, the priming procedure may be repeated.

11.5 In the software, go to the browser and go to the correct instrument panel (1 or 2). Then connect the instrument. Monitor the baseline until it is stable.

11.6 Go to the template sequences and edit a sequence for the samples in the run. If a calibration is being using from an earlier run, make sure to copy the calibration into the front of the sequence. After the sequence is generated, then save it using the file name (instrument, date, run). Refer to the instrument manuals or help screens in the program for help in using the software. A summary of the instrument conditions required for the analysis of anions is shown below. Note: the retention time window for each anion must not exceed $\pm$ 10% of that anions retention time from the calibration. Refer to section 13.7 for more discussion of the proper application of retention time.

Column: IonPac AG18, AS18
Eluent: 30 mM KOH
Suppressor setting: approximately 38 mAmps. This setting will be autogenerated.
Flow Rate: 0.5 ml/min
Inj. Volume: 12.5 µl
Pump pressure – should be around 2000 psi
Detection: Suppressed conductivity, SRS Ultra II, external water mode

11.7 Load the autosampler and turn it on. The autosampler should then move to the first sample. A print-out of the autosampler table should be generated showing the order that the samples are loaded into the autosampler.

11.8 Start the run. Monitor the results as the run is going to make sure that problems are identified quickly. Note: the initial demonstration of capability, including instrument MDL's and linear calibration ranges, must be completed before samples can be run.

11.8.1 Data files should be saved using the naming scheme of instrument, year (last 2 digits), month, day, run number followed by the extension of .ic. For example, the first IC run on instrument 2 on May 20, 2005 would be named 205052001. This name should always be used in the workgroup description in the LIMS system.

11.8.2 It is recommended that a new calibration be run a minimum of once per month. (It is required that a calibration be run once per quarter.) Calibrations standards may be varied from the one stated in this SOP depending on the levels of each anion that are to be reported. A minimum of 5 standards and a blank are required and a low standard must be at or below the reporting limit for each anion. A correlation coefficient of 0.995 is required. If this correlation coefficient is not met, than the instrument must be recalibrated.

11.8.3 After the calibration, a low check at the reporting limit must be run. This low check must have the levels in standard B or at the reporting limit for the calibration outlined in this SOP and recoveries must be in the range of 90 –110%. On a daily basis, it is recommended that an external check is analyzed and recoveries must be within a range of 90 - 110 %. (This check must be analyzed at a minimum with each new calibration.) Continuing calibration checks and continuing calibration blanks must be run every 10 samples. The continuing calibration checks must have recoveries in the range of 90 -110 %. Refer to the quality control section of this SOP for more detail on these quality control samples.

11.9 After the run is completed, review all of the chromatograms and check for overlapping peaks, dilutions, etc.

11.9.1 If the retention time of any anion in the ICV or CCV check standards has shifted more than 10% from the original calibration curve retention time, then no results can be reported for that anion. The column should be reconditioned, if necessary, and the instrument recalibrated before any more samples are reported for that anion. Affected samples are reanalyzed after the problem has been corrected.

11.9.2 If a sample peak has shifted significantly from the original retention time (and the ICV and CCV check standards are within the 10% retention time window), then verify the reported result using post-digest spike on that sample. Do not report results from peaks where the retention time has shifted more than 10 percent unless the peak can be verified using a post-digest spike.

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11.9.3 For large or overlapping peaks, make dilutions. If at all possible, make dilutions and reruns on the same run as the original sample.

11.9.4 Refer to section 14.7 for information on how to determine the appropriate retention time window.

11.10 Review all data and update the appropriate tests in the LIMS system. A write-up including a run log, a calibration summary, batch quality control summary, and copies of all chromatograms should be turned into the area supervisor for each batch.

11.10.1 If edits are needed in the calibration after the data has been calculated, the run can be reprocessed using the batch function in the software. Refer to the instrument manuals or on-screen help for addition information.

12.0 INSTRUMENT MAINTENANCE

12.1 Whenever a new suppressor is put in place or when the baseline is unstable or very high, the suppressor should be regenerated. The procedure below is for the Ultra 4 mm suppressor.

12.1.1 Using a disposable plastic syringe, push approximately 3 mL if 0.2(200mN) H_2SO_4 through the ELUENT OUT port and 5 mL of 0.2N H_2SO_4 through the REGIN IN port respectively.

12.1.2 Allow the suppressor to sit for approximately 20 minutes to fully hydrate the suppressor screens and membranes.

12.1.3 Re-connect the suppressor to the system in the recycle mode.

12.2 Periodically, due to the matrix of samples, both guard and analytical columns become degraded and cleaning them becomes necessary. This is evidenced in changing retention times, round-shaped peaks, tailing peaks and overall poor integration. The metals cleanup should be done a minimum of once per month, while the others should be done a minimum of once per quarter.

12.2.1 There are 3 recommended cleanup solutions for the AS18A and AG18 columns.

12.2.2 Metal contamination column clean-up: Use 500 ml of 0.1M oxalic acid solution.

12.2.3 Low valency hydrophilic ionic contamination column clean-up. Use 500 ml of 10X eluent concentrate (300 mM KOH).

12.2.4 High valency hydrophobic ion 200mM HCl in 80% acetonitrile: The acetonitrile solution is stored in a separate eluent bottle because acetonitrile slowly breaks down in acidic aqueous solutions. Prepare 2 bottles (E1 and E2) with the following 500-mL solutions: E1: 100% Acetonitrile and E2: 1M HCl using DI water.

12.3 Column Clean-up Procedure.

12.3.1 Prepare 500 mL solution of the appropriate cleanup solution from 12.2.1

12.3.2 Disconnect the ASRS-ULTRA from the IonPac AS18A Analytical column. **Make**

sure to reverse the order of the guard and analytical column in the eluent flow path. Contaminants that have accumulated on the guard column can be eluted onto the analytical column and irreversibly damage it. If in doubt, clean each column separately. Double check that the eluent flows in the direction designated on each of the column labels.

12.3.3 Set the pump flow rate to 1.0 mL/min for an AS18A 4-mm analytical or guard column.

12.3.4 Rinse the column for 15 minutes with DI water before pumping the chosen cleanup solution over the columns.

12.3.5 Pump the cleanup solution through the column for at least 60 minutes.

12.3.6 Rinse the column for 15 minutes with DI water before pumping eluent over the column.

12.3.7 Equilibrate the columns with eluent before resuming normal operation for at least 30 minutes.

12.3.8 Reconnect the ASRS-ULTRA and place the guard column in line between the injection valve and the analytical column.

13.0 METHOD PERFORMANCE

Method performance (accuracy and precision) is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix duplicates (DUP). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix duplicate samples are compared to method defined control limits. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

14.0 QC REQUIREMENTS

14.1 A method detection limit study must be done semiannually or whenever there is a significant change in the background or instrument response. The MDL study is done following the procedure outlined in the Accutest laboratory SOP QA020, current revision. A minimum of seven replicates spiked at 3 to 5 times the MDL must be taken through the procedure for each anion. If instrument conditions (columns, etc.) are modified, then a new MDL must be done.

14.2 Although national standards define batch as a maximum of 20 samples in one day, IC batch size is reduced to 10 samples in order to satisfy method QC frequency and various program requirement (state-specific as well as private clients). A method blank and a spike blank are required to be run with every batch. Additionally a matrix spike and a matrix duplicate are required for every 10 samples. In some cases a matrix spike duplicate may be required in place of a duplicate.

14.2.1 The method blank must contain <½ RL of each anion that is reported and this sample must be run with each set of samples in a batch. If the blank contains more than the reporting level, then all samples must be reanalyzed. If no sample volume

remains to be reanalyzed, then the data must be flagged. (The exception is if the sample results are less than the reporting limit.)

14.2.1.1 Although the method states that values greater than the MDL should be suspect, this is not appropriate for the concentration levels being applied for this analysis. MDL's are generally up to 10 times lower than reporting limits for all analytes and values over the MDL do not impact data usability.

14.2.2 The recovery of the spike blank must be within the limits of 90 to 110% recovery for each anion that is reported and this sample must be run with each set of samples in a batch. If the recoveries are outside of this range, then all associated samples must be reanalyzed. If no sample volume remains to be reanalyzed, then the data must be flagged.

14.2.3 The matrix spike is spiked with all anions of interest. Method limits of 90 -110 % recovery must be applied. Control limits must be generated from laboratory data to support method limits. If the recoveries are outside of this range, and all other method quality control is within limits, then matrix interference should be suspected.

14.2.4 For matrix duplicates control limits of 10% RPD must be applied for all sample values within the calibration range (up to 10 times the reporting limit). If the RPD values are outside of this range, and all other method quality control is within limits, then sample non-homogeneity should be suspected.

14.3 An external source standard (ICV) must be analyzed after every new calibration and its recovery must be within 10% of the true value. Continuing calibration checks and blanks are run every 10 samples (recoveries must be in the 90 to 110% range) and the blanks must not have anion concentrations higher than one half the reporting limit. If the CCV is not within ± 10%, a second CCV should be analyzed. If the CCV is still outside of the limits, sample analysis must be discontinued and the cause determined, and the instrument recalibrated. All samples after the last acceptable CCV must be reanalyzed.

14.4 It is recommended that a new calibration be run a minimum of once per month. (It is required that a calibration be run once per quarter.) Calibrations standards may be varied from the one stated in this SOP depending on the levels of each anion that are to be reported. A minimum of 5 standards and a blank are required and a low standard must be at or below the reporting limit for each anion. A correlation coefficient of 0.995 is required.

14.4.1 A new calibration is required when standard retention times shift by more than 10% from the original calibration.

14.5 CCVa must be analyzed in the beginning of the analytical run. Concentration of Chloride and Sulfate are 200mg/l.

14.6 A low check at the reporting limit (CCV2) for each anion must be run after each calibration.

14.7 Continuing Calibration Verification (CCV) Checks at or near the mid-level of the curve must be run at the beginning and the end of the run and after every 10 samples throughout the run. Every CCV must be followed by a continuing calibration blank (CCB). The CCV must have results within 90-110 % of the true value. If the results are outside of that range for a CCV, then all bracketed samples must be reanalyzed. The results for the CCB must be less than the reporting limit for an analyte. If they are not, then all bracketed samples for that analyte must be reanalyzed.

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14.8 Retention time windows must be established whenever a new column/guard column is installed in an instrument or whenever a major change has been made to an instrument.

Retention time windows are established by injecting standard mix three times over the course of 24 hours and calculating the standard deviation of the retention times of each analyte. Plus or minus three times the standard deviation of the retention times is defined as the retention time window of that compound.

Peak identification is based on the retention time of an analyte in the standard (initial or continuing) being used as the mid-point of the retention time window. The retention time windows should be used as a guide for identifying compounds; however, the experience of the analyst should weigh heavily in the interpretation of the chromatograms. The analyst should monitor the retention times of known standard peaks throughout an instrument run as an indication of instrument performance.

Because calculated retention time windows are generally very tight (less than ± 0.10 minutes), the retention time windows for the data processing method are generally set wider than the calculated window. This is done to ensure that the software does not miss any potential "hits". The analyst will then review these "hits" and determine if the retention times are close enough to the retention time of the target analyte to positively identify the peak or to require confirmation.

14.9 The Linear Calibration Range (LCR) is the concentration range the instrument response is linear and must be initially determined and verified every 6 months or whenever a significant change in the instrument is observed or expected. Initially, enough standards must be used to insure the curve is linear. The linearity verification must use at a minimum, a blank and 3 standards. The verification data must be within ± 10% of the initial values. If the data falls outside of this range, then the linearity of the instrument must be reestablished. If any portion of the curve is nonlinear, then sufficient standards must be used to clearly delineate the nonlinear portion of the curve.

15.0 DOCUMENTATION REQUIREMENTS

15.1 All reagents must be recorded in a reagent logbook with manufacturers, lot numbers, and expiration dates. All reagent information must be cross referenced on the sample worksheet.

15.2 All instrument data must be exported to the LIMS system and a copy of the run log must be included in the logbook by the instrument.

15.3 A data package consisting of a manual run log, a LIMS run log, a calibration summary, batch quality control summary, and copies of all chromatograms must be turned into the area supervisor for each batch. The analyst should also complete the preliminary review in the LIMS system.

15.4 Refer to SOP QA029, current revision, for procedures and documentation that must be followed when peaks are manually integrated.

16.0 POLLUTION PREVENTION & WASTE MANAGEMENT

16.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All

safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 16.2.

16.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, SAM108, current revision. This document describes the proper disposal of all waste materials generated during the testing of samples.

17.0 ADDITIONAL REFERENCES

17.1 Dionex Instrument and column manuals

17.2 QA029 Manual Integration SOP, current revision.

17.3 NELAC standards, current revision.

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ANALYSIS OF VOLATILE ORGANICS BY GC/MS

Prepared by:	Rick Watkins	Date:	07/21/09
Reviewed by:	Norm Farmer	Date:	07/21/09

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TEST NAME: ANALYSIS OF VOLATILE ORGANICS BY GC/MS

METHOD REFERENCE: SW846 8260B

DEPT: MS

Revised Sections: 6.1, 6.2, 6.3, 6.4, 6.7, 9.4.2.4, 10.0, and 12.0 Added 1.2.7 and 7.5.4

1.0 SCOPE AND APPLICATION, SUMMARY

1.1 Scope and Application

1.1.1 This method is used to determine the concentrations of various volatile organic compounds in water and solid matrices utilizing a gas chromatograph equipped with a mass spectrometer detector. Routine compounds can be found in Table 1.

1.1.2 Reporting limits (RL) are based on the sample amount and the lowest calibration standard. Reporting limits may vary depending on matrix complications and sample volumes. Reporting limits for this method are in the range of 1.0 ug/l for aqueous samples and 5 ug/kg for solid samples. Solid matrices are reported on a dry weight basis.

1.1.3 The Method Detection Limit (MDL) for each analyte is evaluated on an annual basis for each matrix and instrument. MDLs are pooled for each matrix, and the final pooled MDLs are verified. The verified MDLs are stored in the LIMS and should be at least 2 to 3 times lower than the RL. Exceptions may be made on a case by case basis; however, at no point shall the MDL be higher than the reported RL.

1.1.4 Compounds detected at concentrations between the RL and MDL are quantitated and qualified as estimated values and reported with either a “J” or “I” qualifier. Some program or project specifications may require that no values below the RL be reported.

1.2 Summary

1.2.1 This method is adapted from SW846 method 8260B.

1.2.2 Samples are received, stored and analyzed within the appropriate holding times.

1.2.3 Sample preparation is performed in accordance with Accutest SOP OP020 and OP021.

1.2.4 The samples are analyzed on a gas chromatograph equipped with mass spectrometer detector.

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1.2.5 The peaks detected are identified by comparison to characteristic ions and retention times specific to the known target list of compounds.

1.2.6 Additional unknown peaks with a response > 10% of the closest internal standard may be processed through a library search with comparison to a database of approximately 98,000 spectra. An estimated concentration is quantitated by assuming a response factor of 1.

1.2.7 Manual integrations are performed in accordance with SOP QA029.

2.0 PRESERVATION AND HOLDING TIME

2.1 Preservation

Aqueous Samples:

2.1.1 Samples shall be collected in standard 40ml vials with Teflon lined silicone septa. HCl is used to adjust the pH of the sample to <2.

2.1.2 The samples must be stored in capped vials, with minimum headspace, at 4°C in an area free of solvent fumes. The size of any bubble caused by degassing upon cooling should not exceed 5-6mm.

Solid Samples:

2.1.3 Special 40ml vials for purge-and-trap of solid samples, as well as the collection and preservation options are described in OP020.

2.1.4 Low level soil samples are preserved by storing them in sealed VOA vials at temperatures between –10 °C to –20 °C. High level soil samples are preserved by storing them in methanol at a ratio of 1 gram of soil to 1ml of methanol.

2.2 Holding Time

2.2.1 Aqueous samples are to be analyzed within 14 days of collection, unless otherwise specified by the contract. Samples that are not preserved should be analyzed within 7 days of collection; however, the preservation deficiency must be noted in the report.

2.2.2 Solid and waste samples must be analyzed within 14 days of collection.

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3.0 INTERFERENCES

3.1 Data from all blanks, samples, and spikes must be evaluated for interferences.

3.2 Impurities in the purge gas, organic compounds out-gassing from the plumbing ahead of the trap, and solvent vapors in the laboratory account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running laboratory blanks. The use of non-TFE tubing, non-TFE thread sealants, or flow controllers with rubber components in the purging device should be avoided.

3.3 Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) through the septum seal into the sample during shipment and storage. A trip blank can serve as a check on such contamination.

3.4 Contamination by carry-over can occur whenever high level and low-level samples are sequentially analyzed. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of reagent water to check for carry-over.

4.0 DEFINITIONS

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or samples loaded on an instrument within the same 12-hour shift, which ever comes first.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. For all MS methods, a CCV must be analyzed at the beginning of each analytical run.

4.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.5 Internal Standards: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Internal standards for Mass Spec methods are often deuterated forms of target analytes. Internal standards are used to compensate for retention time and response shifts during an analytical run.

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4.6 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

4.7 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

4.8 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.9 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.10 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.11 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.12 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

4.13 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the purge efficiency.

4.14 Trip Blank: A sample of analyte-free matrix taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples.

5.0 REAGENTS

5.1 Methanol – purge-and-trap grade or equivalent

5.2 Volatile stock standards – Various mixes, traceable to Certificate of Analysis

5.3 4-Bromofluorobenzene (BFB) – instrument tuning mix

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5.4 Surrogate standards –

Dibromofluoromethane
1,2-Dichloroethane-d4
Toluene-d8
4-Bromofluorobenzene

5.5 Internal standards –

Fluorobenzene
Chlorobenzene-d5
1,4-Dichlorobenzene-d4
tert-Butyl alcohol-d10

6.0 APPARATUS

6.1 Gas Chromatograph – HP 5890 or Agilent Technologies 6890 or 7890

6.1.1 Gas Chromatograph

The analytical system that is complete with a temperature programmable gas chromatograph and all required accessories, analytical columns, and gases.

6.1.2 The injection port is designed for split-splitless injection with capillary columns. The injection port must have an appropriate interface for sample introduction.

6.2 Mass Spectrometer– HP 5970 or Agilent Technologies 5973 or 5975

The mass spectrometer must be capable of scanning from 35-300 amu every second or less utilizing 70-volt (nominal) electron energy in the electron impact ionization mode. It must also be capable of producing a mass spectrum that meets all the criteria in section 7.5.1.1 when injecting 50 ng of Bromofluorobenzene (BFB).

6.3 Purge and Trap – OI Analytical 4560 or 4660 with OI Analytical 4552 or 4551

6.3.1 The following autosampler models are used for purging, trapping and desorbing the sample onto GC column.

- O.I. Model 4560 sample concentrator with 4552 Water/Soil multisampler
- O.I. Model 4660 sample concentrator with 4552 Water/Soil multisampler
- O.I. Model 4660 sample concentrator with 4551 Water multisampler

6.3.2 The sample purge vial must be designed to accept 5 ml samples with a water column at least 3 cm deep.

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6.3.3 The multisampler is equipped with a heater capable of maintaining the purge chamber at 40 ◦C to improve purging efficiency. The heater is to be used for soil and sediment analysis.

6.3.4 The desorber should be capable of rapidly heating the trap to the manufacturer recommended desorb temperature.

6.4 Data System – Agilent Technologies MS Chemstation rev. AA03.02, DA00.01 or EA02.00

6.4.1 A computer system interfaced to the mass spectrometer that allows for the continuous acquisition and storage of all mass spectral data obtained throughout the duration of the chromatographic program.

6.4.2 The computer utilizes software that allows searching any GC/MS data file for ions of a specific mass and that can plot such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP).

6.4.3 The software should allow for integrating the abundances in any EICP between specific time or scan number limits.

6.4.4 The most recent version of the EPA/NIST mass spectral library should be available.

6.4.5 Data is archived to magnetic tape for long term storage.

6.5 Trap – OI #10 or equivalent: Tenax, Silica Gel, and Carbon Molecular Sieve. The trap should be conditioned according to the manufacturer's recommendations.

6.6 Columns – RTX-624 or equivalent: 60m X 0.25mm 1.4um.
- RTX-VMS or equivalent: 60m X 0.25mm 1.4um
- RTX-VMS or equivalent: 40m X 0.18mm 1.0um

6.7 Gas-tight syringes and class "A" volumetric glassware for dilutions of standards and samples.

7.0 PROCEDURE

7.1 Standards Preparation

Standards are prepared from commercially available certified reference standards. All standards must be logged in the Volatile Standards Logbook. All standards shall be traceable to their original source. The standards should be stored at temperatures between –10 °C and –20 °C, or as recommended by the manufacturer.

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7.1.1 Stock Standard Solutions

Stock standards are available from several commercial vendors. All vendors must supply a "Certificate of Analysis" with the standard. The certificate will be retained by the lab. Hold time for unopened stock standards is until the vendor's expiration date. Once opened, the hold time is reduced to six months (one month for gases) or the vendor's expiration date (whichever is shorter).

7.1.2 Intermediate Standard Solutions

Intermediate standards are prepared by quantitative dilution of the stock standard with methanol. The hold time for intermediate standards is one month (one week for gases) or the vendor's expiration date (whichever is shorter). Intermediate standards may need to be remade if comparison to other standards indicate analyte degradation or concentration changes.

7.1.3 Calibration Standards

Calibration standards for the volatile organics are prepared at a minimum of five concentration levels through quantitative dilutions of the intermediate standard. The low standard is at a concentration at or below the RL and the remaining standards define the working range of the detector.

Calibration standard concentrations are verified by the analysis of an initial calibration verification (ICV) standard.

7.2 Instrument Conditions

<u>Gas Chromatograph/ Mass Spectrometer</u>

Carrier gas flow	1.0 ml/min
Transfer line temperature	220 - 280 °C
Analyzer temperature	150 °C

Oven program – 45 °C for 2.5 minutes
10 °C/min to 80 °C for 0 minutes
15 °C/min to 185 °C for 0 minutes
30 °C/min to 240 °C for 2.5 minutes

OR

Oven program – 45 °C for 4.0 minutes
10 °C/min to 100 °C for 0 minutes
14 °C/min to 220 °C for 0 minutes
30 °C/min to 240 °C for 4.0 minutes

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GC conditions are optimized for each instrument. Actual conditions may vary slightly from those listed above.

7.3 Purge and Trap Device conditions

Purge Gas:	Helium at 30 ml/min
Sample Temp:	Aqueous (Ambient)
	Soils (40°C)
Trap Temp:	<25°C
Purge Time:	11 min
Desorb:	2 min. at 190°C
Bake:	5 min. at 210°C

7.4 Sample Preparation

7.4.1 Water Samples

A 5ml aliquot of sample is loaded onto the purge-and-trap device and purged for 11 minutes. Detailed procedures are described in SOP OP021.

7.4.2 Solid Samples

A 5-gram aliquot of sample is loaded onto the purge-and-trap device. 5mls of reagent water is added along with internal standards and surrogates. The sample is then purged for 11 minutes while heated to 40°C and mechanically agitated. Detailed procedures are described in SOP OP020.

7.5 Gas Chromatographic Analysis

Instrument calibration consists of two major sections:

Initial Calibration Procedures
Continuing Calibration Verification

7.5.1 Initial Calibration Procedures

Before samples can be run, the GC/MS system must be tuned, the injection port inertness must be verified, and the instrument must be calibrated.

7.5.1.1 Tune Verification (BFB)

The instrument should be hardware tuned per manufacturer's instructions. Verify the instrument tune by injecting 2ul (50ng) of BFB solution onto the instrument. The resulting BFB spectra should meet the criteria in the following table.

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BFB KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
50	15-40% of mass 95
75	30-60% of mass 95
95	Base peak, 100% relative abundance
96	5-9% of mass 95
173	<2% of mass 174
174	>50% of mass 95
175	5-9 % of mass 174
176	>95% and <101% of mass 174
177	5-9% of mass 176

Evaluate the tune spectrum using three mass scans from the chromatographic peak and a subtraction of instrument background. This procedure is performed automatically by the MS Chemstation software by running “autofind” on the BFB peak.

Select the scans at the peak apex and one to each side of the apex. Calculate an average of the mass abundances from the three scans.

Background subtraction is required. Select a single scan in the chromatogram that is absent of any interfering compound peak and no more than 20 scans prior to the elution of BFB. The background subtraction should be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the tuning compound peak.

Alternatively, the average spectra over the entire peak may be used. **All subsequent tune evaluations must use the same procedure that was used for the Initial Calibration.**

If the criteria are not achieved, the analyst must retune the mass spectrometer and repeat the test until all criteria are met.

Analysis must not begin until the tuning criteria are met. The injection time of the acceptable tune analysis is considered the start of the 12-hour clock. The same mass spec settings must be used for the calibration standards and samples that were used for the tune evaluation standard.

7.5.1.2 Internal Standard Calibration

A minimum 5-point calibration curve is created for the volatile organic compounds and surrogates using an internal standard technique. Accutest Laboratories routinely performs a 6-point calibration to maximize the calibration range.

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The low point may be omitted from the calibration table for any compound with an RL set at the level two standard. Additionally the high point may be omitted for any compound that exhibits poor linearity at the upper end of the calibration range.

Response factors (RF) for each analyte are determined as follows:

$$RF = (A_{anayte} \mathbf{X} C_{istd})/(A_{istd} \mathbf{X} C_{analyte})$$

A_{anayte} = area of the analyte
A_{istd} = area of the internal standard
$C_{analyte}$ = concentration of the analyte
C_{istd} = concentration of the internal standard.

The mean RF and standard deviation of the RF are determined for each analyte. The percent relative standard deviation (%RSD) of the response factors is calculated for each analyte as follows:

%RSD = (Standard Deviation of RF X 100) / Mean RF

If the %RSD $\leq$ 15%, linearity through the origin can be assumed and the mean RF can be used to quantitate target analytes in the samples. Alternatively if the %RSD > 15% a calibration curve of response vs. amount can be plotted. If the correlation coefficient (r) is $\geq$0.995 ($r^2 \geq$0.990) then the curve can be used to quantitate target analytes in the samples.

The method also employs a series of Calibration Check Compounds (CCC) and System Performance Check Compounds (SPCC). The %RSD for any CCC must be $\leq$ 30 % and the average relative response factor for any SPCC must be at least 0.10 or 0.30 (See tables below). If the %RSD for any CCC is $\leq$ 30% but > 15% the compound should be evaluated by curve fit.

Calibration Check Compounds (CCC)

Vinyl chloride	1,1-Dichloroethene
Chloroform	1,2-Dichloropropane
Toluene	Ethylbenzene

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System Performance Check Compounds (SPCC)

Compound	**Minimum RF**
Chloromethane	0.1
1,1-Dichloroethane	0.1
Bromoform	0.1
1,1,2,2-Tetrachloroethane	0.3
Chlorobenzene	0.3

7.5.1.3 Initial Calibration Verification (ICV)

The validity of the initial calibration curve must be verified through the analysis of an initial calibration verification (ICV) standard. The ICV should be prepared from a second source at a mid-range concentration.

The %D for all normal analytes of interest should be ≤ 25%, the %D for all poor performing (PP) analytes of interest should be ≤ 40%. (These analytes are identified in Table 1) If the %D > 25% (>40% for PP), the analysis of samples may still proceed if the analyte failed high and the analyte is not expected to be present in the samples. However, if a reportable analyte is detected in a sample and the %D for that analyte was greater than 25% (>40% for PP) in the ICV, the sample will need to be reanalyzed on a system with a passing ICV for that analyte.

If the ICV does not meet this criteria, a second standard should be prepared. If the ICV still does not meet criteria, analyze an ICV prepared from a third source. If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.

7.5.2 Continuing Calibration Verification (CCV)

7.5.2.1 Inject 2ul of the tune evaluation mix at the beginning of each 12-hour shift. Evaluate the resultant peaks against the criteria in section 7.5.1.1. The injection time of this standard starts the 12-hour window.

7.5.2.2 Analyze a continuing calibration check standard. Since the method only requires one CCV per analytical batch, the level of the CCV should be varied throughout the week. At least one CCV must be below the mid-point of the calibration curve.

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7.5.2.3 The RF of check standard for SPCC compounds must meet the minimum RF requirement as listed in the table.

7.5.2.4 The %D for the CCC compounds must be ≤ 20%. If the CCCs are not part of the target list, then all target analytes must meet the 20 %D criteria.

7.5.2.5 The %D for all other analytes of interest should be ≤ 20%; however, the large number of analytes in this method presents a substantial probability that a few of the analytes will fall outside of this range. If the %D > 20%, the analysis of samples may still proceed if the analyte failed high and the analyte is not expected to be present in the samples. However, if a reportable analyte is detected in a sample and the %D for that analyte was greater than 20% in the CCV, the sample will need to be reanalyzed on a system with a passing CCV for that analyte, or the data must be qualified.

7.5.2.6 The criteria in 7.5.2.3 and 7.5.2.4 must be met for the continuing calibration to be considered valid. Additionally, only analytes that are being reported for a given sample must meet the criteria in 7.5.2.5. If the first continuing calibration verification does not meet criteria, a second standard may be injected. If the second standard does not meet criteria, the system must be recalibrated.

7.5.2.7 If any of the internal standard area change by a factor of two (-50% to +100%) or retention time changes by more than 30 seconds from the midpoint standard of the last initial calibration, the mass spectrometer must be inspected for malfunctions and corrections made, as appropriate. Corrective action may include re-calibration (initial Calibration) of the instrument.

7.5.3 Sample Analysis

7.5.3.1 Samples are analyzed in a set referred to as an analysis sequence or batch. A batch consists of the following:

Tune Evaluation Mix
Initial Calibration Standards (or CCV)
QC Samples
Samples

7.5.3.2 One microliter of internal standard/surrogate solution is added to every 5ml of sample in the sparge vessel. Generally, 5ml of sample are transferred to the sparge vessel.

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7.5.3.3 After purging, the system will automatically reverse flow and rapidly heat the trap to desorb the sample analytes onto the GC column.

7.5.3.4 Qualitative identification

The target compounds shall be identified by analysts with competent knowledge in the interpretation of mass spectra by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound. The criteria required for a positive identification is:

The sample component must elute at the same relative retention time (RRT) as the daily standard. The RRT of sample component must be within ± 0.06 RRT units of the standard.

All ions present in the standard mass spectra at a relative intensity greater than 10% (major abundant ion in the spectrum equals 100%) should be present in the sample spectrum.

The relative intensities of these ions must agree within ± 30% between the daily standard and sample spectra. (Example: For an ion with an abundance of 50% in the standard spectra, the corresponding sample abundance must be between 20 and 80%.)

Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25% of sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

If peak identification is prevented by the presence of interferences, the sample must be diluted so that the interference does not mask any analytes.

7.5.3.5 Quantitative analysis

When a target compound has been identified, concentration will be based on the integrated area of the quantitation ion, which is normally the base peak.

The sample matrix may produce an interference with the primary ion. This may be characterized by an excessive background signal of the same ion, which distorts the peak shape beyond a definitive integration. The interference could also, severely inhibit the response of the internal standard ion. If an

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interference is apparent the secondary ion can be used to generate a new calibration factor.

If the analyte response exceeds the linear range of the system, the extract must be diluted and reanalyzed. It is recommended that samples be diluted so that the response falls into the middle of the calibration curve.

7.5.3.6 Library search for tentatively identified compounds

If a library search is requested, the analyst should perform a forward library search of the NIST mass spectral library to tentatively identify 10 to 20 non-target compounds.

Guidelines for making tentative identification are:

These compounds should have a response greater than 10% of the nearest internal standard. The response is obtained from the Total Ion Chromatogram.

The search is to include a spectral printout of the best library match for a particular substance. The results are to be interpreted by the analyst.

Relative intensities of major ions in the reference spectrum (ions >10% of the most abundant ion) should be present in the sample spectrum.

The relative intensities the major ions should agree within ±20%.

Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

Ions present in the reference spectrum but not in the sample spectrum should be verified by performing further manual background subtraction to eliminate the interference created by coeluting peaks and/or matrix interference.

Quantitation of the tentatively identified compounds is obtained from the total ion chromatogram based on a response factor of 1 from the nearest internal standard and is to be tabulated on the library search summary data sheet.

7.5.4 Instrument maintenance

Routine maintenance of the instruments will help keep them in optimum working condition. Because of the variability in work load and sample matrix, it is not feasible to set up an exact

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maintenance schedule for each instrument. See SOP QA032 for maintenance recommendations.

8.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix spike duplicate samples are compared to statistically generated control limits. These control limits are reviewed and updated annually. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

9.0 QUALITY ASSURANCE / QUALITY CONTROL

Accuracy and matrix bias are monitored by the use of surrogates and by the analysis of a QC set that is prepared with each batch (maximum of 20 samples) of samples. The QC set consists of a method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD).

9.1 Internal Standards

Fluorobenzene, Chlorobenzene-d5, 1,4-Dichlorobenzene-d4, and Tert Butyl Alcohol-d10 are used as internal standards for this method. The response of the internal standard in all subsequent runs should be within a factor of two (-50% to +100%) of the internal standard response in the opening CCV for each sequence. On days that an initial calibration is performed, the internal standard responses should be compared to the internal standard responses for the mid-point standard. The response for Tert Butyl Alcohol-d10 need only be monitored if target analytes are being reported that reference that particular internal standard.

9.1.1 If the internal standard responses are not within limits, the following are required.

9.1.1.1 Check to be sure that there are no errors in calculations, integrations, or internal standards solutions. If errors are found, recalculate the data accordingly.

9.1.1.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

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9.1.1.3 If no problem is found, reanalyze the sample. **NOTE:** If the recoveries are high and the sample is non-detect, then reanalysis may not be necessary. If there is insufficient sample for reanalysis, footnote this on the report.

9.1.1.4 If upon reanalysis, the recovery is still not within control limits, the problem is considered matrix interference. Surrogates from both sets of analysis should be reported on the final report.

9.2 Surrogates

9.2.1 Dibromofluoromethane, 1,2-Dichloroethane-d4, Toluene-d8, and 4-Bromofluorobenzene are used as the surrogate standards to monitor the efficiency of the purge-and-trap system.

A known amount of surrogate standard is added to each sample including the QC set prior to sparging. The percent recovery for each surrogate is calculated as follows:

% Recovery = (Sample Amount / Amount Spiked) X 100

The percent recovery must fall within the established control limits for all surrogates for the results to be acceptable.

9.2.2 If any surrogate recovery is not within the established control limits, the following are required.

9.2.2.1 Check to be sure that there are no errors in calculations, integrations, surrogate solutions or internal standards. If errors are found, recalculate the data accordingly.

9.2.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.2.2.3 If no problem is found, reanalyze the sample. **NOTE:** If the recoveries are high and the sample is non-detect, then reanalysis may not be necessary. If there is insufficient sample for reanalysis, footnote this on the report

9.2.2.4 If upon reanalysis, the recovery is still not within control limits, the problem is considered matrix interference. Surrogates from both sets of analysis should be reported on the final report.

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9.3 Method Blank

9.3.1 The method blank is de-ionized water to which the surrogate standard has been added. The method blank is then purged along with the other samples to determine any contamination from the system or ambient sources. The method blank must be free of any analytes of interest or interferences at ½ the required reporting level to be acceptable. Common laboratory contaminants such as methylene chloride must be below the RL if present. If the method blank is not acceptable, corrective action must be taken to determine the source of the contamination. Samples associated with a contaminated method blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples or qualifying the results with a “B” or “V” qualifier.

9.3.2 If the MB is contaminated but the samples are non-detect, then the source of contamination should be investigated and documented. The sample results can be reported without qualification.

9.3.3 If the MB is contaminated but the samples results are > 10 times the contamination level, the source of the contamination should be investigated and documented. The samples results may be reported with the appropriate “B” or “V” qualifier. This must be approved by the department supervisor.

9.3.4 If the MB is contaminated but the samples results are < 10 times the contamination level, the source of the contamination should be investigated and documented. The samples should be reanalyzed for confirmation. If there is insufficient sample to reanalyze, or if the sample is reanalyzed beyond hold time, the appropriate footnote and qualifiers should be added to the results. This must be approved by the department supervisor.

9.4 Blank Spike

9.4.1 The blank spike is de-ionized water to which the surrogate standard and spike standard have been added. The blank spike is then processed along with the other samples to monitor the efficiency of the purge-and-trap procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = (Blank Spike Amount / Amount Spiked) X 100

The percent recovery for each analyte of interest should fall within the established control limits for the results to be acceptable. The large number of analytes in this method presents a substantial probability that a few of the analytes will fall outside of the established control limits. This may not indicate that the system is out of control; therefore, corrective action may not be necessary.

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Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. A marginal exceedance in the Blank Spike is defined as a recovery being outside of 3 standard deviations but within 4 standard deviations of the mean.

The number of allowable marginal exceedances is based on the number of analytes in the Blank Spike. Marginal Exceedances must be random. If the same analyte exceeds the BS control limits repeatedly, it is an indication of a systematic problem and corrective action must be taken.

The number of allowable marginal exceedances is as follows:

1) > 90 analytes in BS, 5 analytes allowed in ME range;

2) 71-90 analytes in BS, 4 analytes allowed in ME range;

3) 51-70 analytes in BS, 3 analytes allowed in ME range;

4) 31-50 analytes in BS, 2 analytes allowed in ME range;

5) 11-30 analytes in BS, 1 analyte allowed in ME range;

6) < 11 analytes in BS, no analytes allowed in ME range

9.4.2 If the blank spike recoveries are not within the established control limits, the following are required.

9.4.2.1 Check to be sure that there are no errors in calculations, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly.

9.4.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.

9.4.2.3 Check to see if the recoveries that are outside of control limits are analytes of concern. If the analytes are not being reported, additional corrective action is not necessary and the sample results can be reported without qualification.

9.4.2.4 If the recovery of an analyte in the BS is high and the associated sample is non-detect, the data may be reportable.

9.4.2.5 If no problem is found, the department supervisor shall review the data and determine what further corrective action is best for each particular sample. That may include reanalyzing the samples or qualifying the results as estimated.

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9.4.2.6 If there is insufficient sample to reanalyze, or if the sample is reanalyzed beyond hold time, the appropriate footnote and qualifiers should be added to the results. This must be approved by the department supervisor.

9.4.2.7 Because of their problematic nature, 2-Chloroethyl-vinyl-ether and acrolein are generally not evaluated in the blank spike unless they are of specific concern for a given project.

9.5 Matrix Spike and Matrix Spike Duplicate

9.5.1 Matrix spike and spike duplicates are replicate sample aliquots to which the surrogate standard and spike standard have been added. The matrix spike and spike duplicate are then processed along with the other samples to monitor the precision and accuracy of the purge-and-trap procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = [(Spike Amount – Sample Amount) / Amount Spiked] X 100

The percent recovery for each analyte of interest must fall within the established control limits for the results to be acceptable.

9.5.2 If the matrix spike recoveries are not within the established control limits, the following are required.

9.5.2.1 Check to be sure that there are no errors in calculations, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly.

9.5.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.5.2.3 If no problem is found, compare the recoveries to those of the blank spike. If the blank spike recoveries indicate that the problem is sample related, document this on the run narrative. Matrix spike recovery failures are not grounds for reanalysis, but are an indication of the sample matrix effects.

9.5.3 Precision

Matrix spike and spike duplicate recoveries for each analyte are used to calculate the relative percent difference (RPD) for each compound.

RPD = [| MS Result – MSD Result | / Average Result] X 100

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The RPD for each analyte should fall within the established control limits. If more than 33% of the RPDs fall outside of the established control limits, the department supervisor shall review the data and determine if any corrective action is necessary. RPD failures are generally not grounds for batch reanalysis.

10.0 CALCULATIONS

The concentration of each target compound in the original sample is calculated as follows:

Water (ug/l) = ($CONC_{inst}$) X DF

Soil (ug/kg) = [($CONC_{inst}$) X (5 / W_I)] / %solids (*low level soils)*

Soil (ug/kg) = [($CONC_{inst}$) X (V_F / V_A) X (5 / W_I) X DF] / %solids (*high level soils)*

$CONC_{inst}$	=	Instrument concentration calculated from the initial calibration using mean RF, linear curve, or quadratic curve
DF	=	Dilution Factor
V_F	=	Volume of methanol extract (ul)
V_A	=	Volume of methanol aliquot (ul)
W_I	=	Weight of sample (g)
%solids	=	Dry weight determination in decimal form

For high level soils, V_F is calculated as follows:

V_F = {ml of solvent + [(%moisture X W_I) / 100]} X 1000 ul/ml

11.0 SAFETY AND POLLUTION PREVENTION

11.1 Safety

The analyst should follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which includes the use of safety glasses and lab coats.

The toxicity of each reagent and target analyte has not been precisely defined; however, each reagent and sample should be treated as a potential health hazard. Material Safety Data Sheets (MSDS) are available for all reagents and many of the target analytes. Exposure must be reduced to the lowest possible level. Personal protective equipment should be used by all analysts.

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11.2 Pollution Prevention

Waste solvents from the sample analysis, methanol extraction, and standards preparation are collected in waste storage bottles and are eventually transferred to the non-chlorinated waste drum.

Old stock standards are disposed of in the waste vial drum.

Samples are archived and stored for 30 days after analysis. Spent aqueous samples and those deemed non-hazardous are rinsed down the drain with large amounts of water.

Aqueous samples that are deemed hazardous are disposed of in the aqueous waste drum.

Soil samples are disposed of in the soil waste drum.

12.0 REFERENCES

SW846 Method 8000C Revision 3, March 2003

SW846 Method 8260B Revision 2, December 1996

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TABLE 1

Routine Target Analytes

Dichlorodifluoromethane	**2-Butanone**	n-Propylbenzene
Chloromethane	1,1-Dichloropropene	Bromobenzene
Vinyl Chloride	Propionitrile	1,1,2,2-Tetrachloroethane
Bromomethane	Methacrylonitrile	1,3,5-Trimethylbenzene
Chloroethane	Benzene	2-Chlorotoluene
Trichlorofluoromethane	TAME	**trans-1,4-Dichloro-2-Butene**
Ethyl Ether	1,2-Dichloroethane	1,2,3-Trichloropropane
1,2-Dichlorotrifluoroethane	Trichloroethene	**Cyclohexanone**
1,1-Dichloroethene	Methylcyclohexane	4-Chlorotoluene
Freon 113	Dibromomethane	tert-Butylbenzene
Carbon Disulfide	1,2-Dichloropropane	1,2,4-Trimethylbenzene
Iodomethane	Bromodichloromethane	**Pentachloroethane**
Acrolein	Methyl methacrylate	sec-Butylbenzene
Allyl chloride	**2-Chloroethyl vinyl ether**	4-Isopropyltoluene
Methylene Chloride	cis-1,3-Dichloropropene	1,3-Dichlorobenzene
Acetone	Toluene	1,4-Dichlorobenzene
Methyl acetate	2-Nitropropane	n-Butylbenzene
trans-1,2-Dichloroethene	4-Methyl-2-pentanone	**Benzyl Chloride**
Hexane	trans-1,3-Dichloropropene	1,2-Dichlorobenzene
Methyl Tert Butyl Ether	Tetrachloroethene	**1,2-Dibromo-3-Chloropropane**
Acetonitrile	Ethyl methacrylate	Hexachlorobutadiene
Di-isopropyl ether	1,1,2-Trichloroethane	1,2,4-Trichlorobenzene
Chloroprene	Dibromochloromethane	Naphthalene
1,1-Dichloroethane	1,3-Dichloropropane	1,2,3-Trichlorobenzene
Acrylonitrile	1,2-Dibromoethane	**Ethanol**
ETBE	**2-hexanone**	Tert Butyl Alcohol
Vinyl acetate	1-Chlorohexane	Isobutyl alcohol
cis-1,2-Dichloroethene	Ethylbenzene	Tert Amyl Alcohol
2,2-Dichloropropane	Chlorobenzene	**1,4-Dioxane**
Bromochloromethane	1,1,1,2-Tetrachloroethane	ETBA
Cyclohexane	m,p-Xylene	Tert Amy Alcohol
Chloroform	o-Xylene	Tert Butyl Formate
Ethyl acetate	Styrene	
Tetrahydrofuran	Bromoform	
Carbon Tetrachloride	Isopropylbenzene	
1,1,1-Trichloroethane	cis-1,4-Dichloro-2-butene	

Bolded analytes are considered “Poor Performing”

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ANALYSIS OF SEMIVOLATILE ORGANICS BY GC/MS

Prepared by:	Norm Farmer	Date:	07/20/09
Reviewed by:	Mark Erstling	Date:	07/20/09

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TEST NAME: ANALYSIS OF SEMIVOLATILE ORGANICS BY GC/MS

METHOD REFERENCE: SW846 8270C

DEPT: MS

Revised Sections: 6.5, 9.4.2.4 and 12.0 Added 1.2.7 and 7.4.4

1.0 SCOPE AND APPLICATION, SUMMARY

1.1 Scope and Application

1.1.1 This method is used to determine the concentrations of various semivolatile organic compounds in water and solid matrices utilizing a gas chromatograph equipped with a mass spectrometer detector. Routine compounds can be found in Table 1.

1.1.2 Reporting limits (RL) are based on the extraction procedure and the lowest calibration standard. Reporting limits may vary depending on matrix complications and sample volumes. Reporting limits for this method are in the range of 5.0 ug/l for aqueous samples and 170 ug/kg for solid samples. Solid matrices are reported on a dry weight basis.

1.1.3 The Method Detection Limit (MDL) for each analyte is evaluated on an annual basis for each matrix and instrument. MDLs are pooled for each matrix, and the final pooled MDLs are verified. The verified MDLs are stored in the LIMS and should be at least 2 to 3 times lower than the RL. Exceptions may be made on a case by case basis; however, at no point shall the MDL be higher than the reported RL.

1.1.4 Compounds detected at concentrations between the RL and MDL are quantitated and qualified as estimated values and reported with either a “J” or “I” qualifier. Some program or project specifications may require that no values below the RL be reported.

1.2 Summary

1.2.1 This method is adapted from SW846 method 8270C.

1.2.2 Samples are received, stored and extracted within the appropriate holding times.

1.2.3 Sample preparation is performed in accordance with Accutest SOP OP006 and OP007.

1.2.4 The extracts are analyzed on a gas chromatograph equipped with mass spectrometer detector.

1.2.5 The peaks detected are identified by comparison to characteristic ions and retention times specific to the known target list of compounds.

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1.2.6 Additional unknown peaks with a response > 12.5% of the closest internal standard may be processed through a library search with comparison to a database of approximately 98,000 spectra. An estimated concentration is quantitated by assuming a response factor of 1.

1.2.7 Manual integrations are performed in accordance with SOP QA029.

2.0 PRESERVATION AND HOLDING TIME

2.1 Preservation

2.1.1 Samples shall be collected in amber glass bottles with Teflon lined caps. One-liter bottles are recommended for aqueous samples and 300ml jars are recommended for solid samples.

2.1.2 The samples must be protected from light and refrigerated at 4°C from the time of collection until extraction. The extracts must be refrigerated at –10°C to –20°C until analysis.

2.2 Holding Time

2.2.1 Aqueous samples must be extracted within 7 days of collection.

2.2.2 Solid and waste samples must be extracted within 14 days of collection.

2.2.3 Extracts must be analyzed within 40 days of extraction.

3.0 INTERFERENCES

3.1 Data from all blanks, samples, and spikes must be evaluated for interferences.

3.2 Method interferences may be caused by contaminants in solvents, reagents, or glassware. Interferences from phthalate esters can be eliminated by using plastic-free solvent containers and solvent rinsed glassware.

3.3 Other organic compounds, including chlorinated hydrocarbons, petroleum hydrocarbons, and phthalate esters may be coextracted by this method.

3.4 Aldol condensation byproducts may form when samples are extracted using solvent mixes containing acetone. Concrete samples in particular are prone to forming aldol condensation byproducts at levels that can interfere with the analysis. Therefore, concrete samples should be extracted with 100% methylene chloride.

3.5 Benzidine and benzaldehyde are extremely reactive in the calibration mix and will quickly break down. Analytes may need to be calibrated separately.

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4.0 DEFINITIONS

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. For all MS methods, a CCV must be analyzed at the beginning of each analytical run.

4.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.5 Internal Standards: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Internal standards for Mass Spec methods are often deuterated forms of target analytes. Internal standards are used to compensate for retention time and response shifts during an analytical run.

4.6 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

4.7 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

4.8 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.9 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.10 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

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4.11 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.12 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

4.13 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the extraction efficiency.

5.0 REAGENTS

5.1 Methylene Chloride – pesticide grade or equivalent

5.2 Semivolatile stock standards – Various mixes, traceable to Certificate of Analysis

5.3 Decafluorotriphenylphosphine mix (DFTPP) – Also contains pentachlorophenol, benzidine and DDT.

5.4 Base/neutral surrogate standards – Acid surrogate standards –

Base/neutral surrogate standards	Acid surrogate standards
Nitrobenzene-d5	Phenol-d6
2-Fluorobiphenyl	2-Fluorophenol
P-Terphenyl-d14	2,4,6-Tribromophenol

5.5 Internal standards –

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

6.0 APPARATUS

6.1 Gas Chromatograph – Agilent Technologies 6890 with 7683 Autosampler

6.1.1 Gas Chromatograph

The analytical system that is complete with a temperature programmable gas chromatograph and all required accessories, analytical columns, and gases.

6.1.2 The injection port is designed for split-splitless injection with capillary columns.

6.1.3 Autosampler allows for unattended sample and standard injection throughout the analytical run.

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6.2 Mass Spectrometer – Agilent Technologies 5973 and 5975

The mass spectrometer must be capable of scanning from 35-500 amu every second or less utilizing a 70-volt (nominal) electron energy in the electron impact ionization mode. It must also be capable of producing a mass spectrum that meets all the criteria in section 7.4.1.1 when injecting 50 ng of Decafluorotriphenylphosphine (DFTPP).

6.3 Data System – Agilent Technologies MS Chemstation rev. BA 02.00 and DA 02.00

6.3.1 A computer system interfaced to the mass spectrometer that allows for the continuous acquisition and storage of all mass spectral data obtained throughout the duration of the chromatographic program.

6.3.2 The computer utilizes software that allows searching any GC/MS data file for ions of a specific mass and that can plot such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP).

6.3.3 The software should allow for integrating the abundances in any EICP between specific time or scan number limits.

6.3.4 The most recent version of the EPA/NIST mass spectral library should be available.

6.3.5 Data is archived to magnetic tape for long term storage.

6.4 DB-5MS Column or equivalent: 30m X 0.25mm X 0.25um

6.5 Gas-tight syringes and class “A” volumetric glassware for dilutions of standards and extracts.

7.0 PROCEDURE

7.1 Standards Preparation

Standards are prepared from commercially available certified reference standards. All standards must be logged in the Semivolatile Standards Logbook. All standards shall be traceable to their original source. The standards should be stored at temperatures between –10 °C and –20 °C, or as recommended by the manufacturer.

7.1.1 Stock Standard Solutions

Stock standards are available from several commercial vendors. All vendors must supply a “Certificate of Analysis” with the standard. The certificate will be retained by the lab. Hold time for unopened stock standards is until the vendor’s expiration date. Once opened, the hold

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time is reduced to one year or the vendor's expiration date (whichever is shorter).

7.1.2 Intermediate Standard Solutions

Intermediate standards are prepared by quantitative dilution of the stock standard with methylene chloride. The hold time for intermediate standards is six months or the vendor's expiration date (whichever is shorter). Intermediate standards may need to be remade if comparison to other standards indicate analyte degradation or concentration changes.

7.1.3 Calibration Standards

Calibration standards for the semivolatile organics are prepared at a minimum of five concentration levels through quantitative dilutions of the intermediate standard. The low standard is at a concentration at or below the RL and the remaining standards define the working range of the detector.

Benzidine and benzaldehyde are extremely reactive in the calibration mix and will quickly break down. Fresh standards may need to be made if these analytes are requested.

Calibration standard concentrations are verified by the analysis of an initial calibration verification (ICV) standard.

7.2 Gas Chromatograph Conditions

1ul or 2ul autosampler injection Pulsed splitless or 4:1 split injection

Carrier gas – UHP Helium (1.0 to 1.7 ml/min ramped flow)

Injection port temperature – 280 °C

Transfer line temperature – 280 °C

Source temperature – 230 °C

Quad temperature – 150 °C

Oven program – 40 °C for 2.0 minutes
35 °C/min to 130 °C for 0 minutes
12 °C/min to 320 °C for 1.4 minutes

GC conditions are optimized for each instrument. Actual conditions may vary slightly from those listed above.

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7.3 Sample Preparation

7.3.1 Water Samples

A 1000ml aliquot of sample is pH adjusted and extracted with methylene chloride utilizing separatory funnel extraction. The extract is concentrated to 1.0ml.

7.3.2 Solid Samples

A 30-gram aliquot of sample is extracted with methylene chloride and acetone utilizing pulse sonication. The extract is concentrated to 1.0ml.

7.4 Gas Chromatographic Analysis

Instrument calibration consists of two major sections:

Initial Calibration Procedures
Continuing Calibration Verification

7.4.1 Initial Calibration Procedures

Before samples can be run, the GC/MS system must be tuned, the injection port inertness must be verified, and the instrument must be calibrated.

7.4.1.1 Tune Verification (DFTPP)

The instrument should be hardware tuned per manufacturer's instructions. Verify the instrument tune by injecting 50ng of DFTPP solution onto the instrument. The resulting DFTPP spectra should meet the criteria in the following table.

DFTPP KEY IONS AND ION ABUNDANCE CRITERIA

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

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Evaluate the tune spectrum using three mass scans from the chromatographic peak and a subtraction of instrument background. This procedure is performed automatically by the MS Chemstation software by running "autofind" on the DFTPP peak.

Select the scans at the peak apex and one to each side of the apex. Calculate an average of the mass abundances from the three scans.

Background subtraction is required. Select a single scan in the chromatogram that is absent of any interfering compound peak and no more than 20 scans prior to the elution of DFTPP. The background subtraction should be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the tuning compound peak.

If the criteria are not achieved, the analyst must retune the mass spectrometer and repeat the test until all criteria are met.

Analysis must not begin until the tuning criteria are met. The injection time of the acceptable tune analysis is considered the start of the 12-hour clock. The same mass spec settings must be used for the calibration standards and samples that were used for the tune evaluation standard.

7.4.1.2 Injection Port Inertness Verification

DDT, pentachlorophenol, and benzidine must also be evaluated in the tune standard. These compounds are used to assess injection port inertness and column performance.

Pentachlorophenol and benzidine should be present at their normal responses and, no peak tailing should be visible. The tailing factor for Benzidine must be less than 3 and the tailing factor for pentachlorophenol must be less than 5.

DDT breakdown should not exceed 20%. Breakdown is calculated as follows:

$$\%DDT_{BREAKDOWN} = \frac{(\text{DDE Area} + \text{DDD Area}) \times 100}{(\text{DDE Area} + \text{DDD Area} + \text{DDT Area})}$$

If degradation is excessive or peak tailing is noticed, injection port maintenance is required.

This performance test must be passed before any samples or standards are analyzed.

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7.4.1.3 Internal Standard Calibration

A minimum 5-point calibration curve is created for the semivolatile organic compounds and surrogates using an internal standard technique. Accutest Laboratories routinely performs a 6-point calibration to maximize the calibration range.

The low point may be omitted from the calibration table for any compound with an RL set at the level two standard. Additionally the high point may be omitted for any compound that exhibits poor linearity at the upper end of the calibration range.

Response factors (RF) for each analyte are determined as follows:

$$RF = (A_{anayte} \mathbf{X} C_{istd})/(A_{istd} \mathbf{X} C_{analyte})$$

A_{anayte} = area of the analyte
A_{istd} = area of the internal standard
$C_{analyte}$ = concentration of the analyte
C_{istd} = concentration of the internal standard.

The mean RF and standard deviation of the RF are determined for each analyte. The percent relative standard deviation (%RSD) of the response factors is calculated for each analyte as follows:

%RSD = (Standard Deviation of RF X 100) / Mean RF

If the %RSD $\leq$ 15%, linearity through the origin can be assumed and the mean RF can be used to quantitate target analytes in the samples. Alternatively if the %RSD > 15% a calibration curve of response vs. amount can be plotted. If the correlation coefficient (r) is $\geq$0.995 ($r^2 \geq$0.990) then the curve can be used to quantitate target analytes in the samples.

The method also employs a series of Calibration Check Compounds (CCC) and System Performance Check Compounds (SPCC). The %RSD for any CCC must be $\leq$ 30% and the average relative response factor for any SPCC must be at least 0.05. If the %RSD for any CCC is $\leq$ 30% but > 15% the compound should be evaluated by curve fit.

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Calibration Check Compounds (CCC)

Base Neutral	**Acid**
1,4-Dichlorobenzene	Phenol
Hexachlorobutadiene	2,4-Dichlorophenol
Acenaphthene	2-Nitrophenol
Fluoranthene	p-Chloro-m-cresol
N-Nitrosodiphenylamine	2,4,6-Trichlorophenol
Di-n-octyl phthalate	Pentachlorophenol
Benzo (a) pyrene	

System Performance Check Compounds (SPCC)

Base Neutral	**Acid**
N-Nitroso-di-n-propylamine	2,4-Dinitrophenol
Hexachlorocyclopentadiene	4-Nitrophenol

7.4.1.4 Initial Calibration Verification (ICV)

The validity of the initial calibration curve must be verified through the analysis of an initial calibration verification (ICV) standard. The ICV should be prepared from a second source at a mid-range concentration. Because of compound interactions, the ICV for this method is prepared as two separate standards that cover the entire list of compounds.

The %D for all analytes of interest should be ≤ 25%. If the %D > 25%, the analysis of samples may still proceed if the analyte failed high and the analyte is not expected to be present in the samples. However, if a reportable analyte is detected in a sample and the %D for that analyte was greater than 25% in the ICV, the sample will need to be reanalyzed on a system with a passing ICV for that analyte.

If the ICV does not meet this criteria, a second standard should be prepared. If the ICV still does not meet criteria, analyze an ICV prepared from a third source. If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.

7.4.2 Continuing Calibration Verification (CCV)

7.4.2.1 Inject 1ul of the tune evaluation mix at the beginning of each 12-hour shift. Evaluate the resultant peaks against the criteria in sections 7.4.1.1 and 7.4.1.2. The injection time of this standard starts the 12-hour window.

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7.4.2.2. Analyze a continuing calibration check standard. Since the method only requires one CCV per analytical batch, the level of the CCV should be varied throughout the week. At least one CCV must be below the mid-point of the calibration curve.

7.4.2.3. The minimum RF of check standard for SPCC compounds must be 0.05.

7.4.2.4. The %D for the CCC compounds must be ≤ 20%. If the CCCs are not part of the target list, then all target analytes must meet the 20 %D criteria.

7.4.2.5. The %D for all other analytes of interest should be ≤ 20%. If the %D > 20%, the analysis of samples may still proceed if the analyte failed high and the analyte is not expected to be present in the samples. However, if a reportable analyte is detected in a sample and the %D for that analyte was greater than 20% in the CCV, the sample will need to be reanalyzed on a system with a passing CCV for that analyte, or the data must be qualified.

7.4.2.6. The criteria in 7.4.2.3 and 7.4.2.4 must be met for the continuing calibration to be considered valid. Additionally, only analytes that are being reported for a given sample must meet the criteria in 7.4.2.5. If the first continuing calibration verification does not meet criteria, a second standard may be injected. If the second standard does not meet criteria, the system must be recalibrated.

7.4.2.7. If any of the internal standard area change by a factor of two (-50% to +100%) or retention time changes by more than 30 seconds from the midpoint standard of the last initial calibration, the mass spectrometer must be inspected for malfunctions and corrections made, as appropriate. Corrective action may include re-calibration (initial Calibration) of the instrument.

7.4.3 Sample Extract Analysis

7.4.3.1 Samples are analyzed in a set referred to as an analysis sequence or batch. A batch consists of the following:

Tune Evaluation Mix
Initial Calibration Standards (or CCV)
QC Extracts
Sample Extracts

7.4.3.2 Four microliters of internal standard solution is added to every 100ul of extract in the autosampler vial. Generally, 400ul of extract are transferred to the autosampler vial with a gas tight syringe.

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7.4.3.3 One or two microliters (same amount as standards) of extract is injected into the GC by the autosampler. The data system then records the resultant peak responses and retention times.

7.4.3.4 Qualitative identification

The target compounds shall be identified by analysts with competent knowledge in the interpretation of mass spectra by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound. The criteria required for a positive identification is:

The sample component must elute at the same relative retention time (RRT) as the daily standard. The RRT of sample component must be within ± 0.06 RRT units of the standard.

All ions present in the standard mass spectra at a relative intensity greater than 10% (major abundant ion in the spectrum equals 100%) should be present in the sample spectrum.

The relative intensities of these ions must agree within ± 30% between the daily standard and sample spectra. (Example: For an ion with an abundance of 50% in the standard spectra, the corresponding sample abundance must be between 20 and 80%.)

Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25% of sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

If peak identification is prevented by the presence of interferences, further cleanup may be required or the extract must be diluted so that the interference does not mask any analytes.

7.4.3.5 Quantitative analysis

When a target compound has been identified, concentration will be based on the integrated area of the quantitation ion, which is normally the base peak.

The sample matrix may produce an interference with the primary ion. This may be characterized by an excessive background signal of the same ion, which distorts the peak shape beyond a definitive integration. The interference could also, severely inhibit the response of the internal standard ion. If an

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interference is apparent the secondary ion can be used to generate a new calibration factor.

If the analyte response exceeds the linear range of the system, the extract must be diluted and reanalyzed. It is recommended that extracts be diluted so that the response falls into the middle of the calibration curve.

7.4.3.6 Library search for tentatively identified compounds

If a library search is requested, the analyst should perform a forward library search of the NIST mass spectral library to tentatively identify 10 to 20 non-target compounds.

Guidelines for making tentative identification are:

These compounds should have a response greater than 12.5% of the nearest internal standard. The response is obtained from the Total Ion Chromatogram.

The search is to include a spectral printout of the best library match for a particular substance. The results are to be interpreted by the analyst.

Relative intensities of major ions in the reference spectrum (ions >10% of the most abundant ion) should be present in the sample spectrum.

The relative intensities the major ions should agree within ±20%.

Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

Ions present in the reference spectrum but not in the sample spectrum should be verified by performing further manual background subtraction to eliminate the interference created by coeluting peaks and/or matrix interference.

Quantitation of the tentatively identified compounds is obtained from the total ion chromatogram based on a response factor of 1 from the nearest internal standard and is to be tabulated on the library search summary data sheet.

7.4.4 Instrument Maintenance

Routine maintenance of the instruments will help keep them in optimum working condition. Because of the variability in work load and sample matrix, it is not feasible to set up an exact maintenance schedule for each instrument. See SOP QA032 for maintenance recommendations.

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8.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix spike duplicate samples are compared to statistically generated control limits. These control limits are reviewed and updated annually. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

9.0 QUALITY ASSURANCE / QUALITY CONTROL

Accuracy and matrix bias are monitored by the use of surrogates and by the analysis of a QC set that is prepared with each batch (maximum of 20 samples) of samples. The QC set consists of a method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD).

9.1 Internal Standards

1,4-Dichlorobenzene-d4, Naphthalene-d8, Acenaphthene-d10, Phenanthrene-d10, Chrysene-d12 and Perylene-d12 are used as internal standards for this method. The response of the internal standard in all subsequent runs should be within a factor of two (-50% to +100%) of the internal standard response in the opening CCV for each sequence. On days that an initial calibration is performed, the internal standard responses should be compared to the internal standard responses for the mid-point standard.

9.1.1 If the internal standard responses are not within limits, the following are required.

9.1.1.1 Check to be sure that there are no errors in calculations, integrations, or internal standards solutions. If errors are found, recalculate the data accordingly.

9.1.1.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.1.1.3 If no problem is found, prepare a second aliquot of extract and reanalyze the sample.

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9.1.1.4 If upon reanalysis, the responses are still not within limits, the problem is considered matrix interference. The extract may need to be diluted or the results qualified.

9.2 Surrogates

9.2.1 Nitrobenzene-d5, 2-Fluorobiphenyl, and p-Terphenyl are used as the base neutral surrogate standards and Phenol-d5, 2-Fluorophenol, and 2,4,6-Tribromophenol are used as the acid surrogate standards to monitor the efficiency of the extraction.

A known amount of surrogate standard is added to each sample including the QC set prior to extraction. The percent recovery for each surrogate is calculated as follows:

% Recovery = (Sample Amount / Amount Spiked) X 100

The percent recovery must fall within the established control limits for all surrogates for the results to be acceptable.

9.2.2 If any surrogate recovery is not within the established control limits, the following are required. Note: If the samples are being analyzed for only base neutral compounds or only acid compounds, then only the relative surrogates need to be monitored.

9.2.2.1 Check to be sure that there are no errors in calculations, integrations, surrogate solutions or internal standards. If errors are found, recalculate the data accordingly.

9.2.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.2.2.3 If no problem is found, re-extract and reanalyze the sample. **NOTE:** If the recoveries are high and the sample is non-detect, then re-extraction may not be necessary. If there is insufficient sample for re-extraction, reanalyze the sample and footnote this on the report

9.2.2.4 If upon reanalysis, the recovery is still not within control limits, the problem is considered matrix interference. Surrogates from both sets of analysis should be reported on the final report.

9.3 Method Blank

9.3.1 The method blank is either de-ionized water or sodium sulfate (depending upon sample matrix) to which the surrogate standard has been added. The method blank is then extracted and taken through all cleanup

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procedures along with the other samples to determine any contamination from reagents, glassware, or high level samples. The method blank must be free of any analytes of interest or interferences at ½ the required reporting level to be acceptable. If the method blank is not acceptable, corrective action must be taken to determine the source of the contamination. Samples associated with a contaminated method blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples, re-extracting and reanalyzing the samples or qualifying the results with a "B" or "V" qualifier.

9.3.2 If the MB is contaminated but the samples are non-detect, then the source of contamination should be investigated and documented. The sample results can be reported without qualification.

9.3.3 If the MB is contaminated but the samples results are > 10 times the contamination level, the source of the contamination should be investigated and documented. The samples results may be reported with the appropriate "B" or "V" qualifier. This must be approved by the department supervisor.

9.3.4 If the MB is contaminated but the samples results are < 10 times the contamination level, the source of the contamination should be investigated and documented. The samples should be re-extracted and reanalyzed for confirmation. If there is insufficient sample to re-extract, or if the sample is re-extracted beyond hold time, the appropriate footnote and qualifiers should be added to the results. This must be approved by the department supervisor.

9.4 Blank Spike

9.4.1 The blank spike is either de-ionized water or sodium sulfate (depending upon sample matrix) to which the surrogate standard and spike standard have been added. The blank spike is then extracted and taken through all cleanup procedures along with the other samples to monitor the efficiency of the extraction procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = (Blank Spike Amount / Amount Spiked) X 100

The percent recovery for each analyte of interest should fall within the established control limits for the results to be acceptable. The large number of analytes in this method presents a substantial probability that a few of the analytes will fall outside of the established control limits. This may not indicate that the system is out of control; therefore, corrective action may not be necessary.

Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. A marginal exceedance in the Blank Spike is defined as a recovery being outside of 3 standard deviations but within 4 standard deviations of the mean.

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The number of allowable marginal exceedances is based on the number of analytes in the Blank Spike. Marginal Exceedances must be random. If the same analyte exceeds the BS control limits repeatedly, it is an indication of a systematic problem and corrective action must be taken.

The number of allowable marginal exceedances is as follows:

1) > 90 analytes in BS, 5 analytes allowed in ME range;

2) 71-90 analytes in BS, 4 analytes allowed in ME range;

3) 51-70 analytes in BS, 3 analytes allowed in ME range;

4) 31-50 analytes in BS, 2 analytes allowed in ME range;

5) 11-30 analytes in BS, 1 analyte allowed in ME range;

6) < 11 analytes in BS, no analytes allowed in ME range

9.4.2 If the blank spike recoveries are not within the established control limits, the following are required.

9.4.2.1 Check to be sure that there are no errors in calculations, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly.

9.4.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.

9.4.2.3 Check to see if the recoveries that are outside of control limits are analytes of concern. If the analytes are not being reported, additional corrective action is not necessary and the sample results can be reported without qualification.

9.4.2.4 If the recovery of an analyte in the BS is high and the associated sample is non-detect, the data may be reportable.

9.4.2.5 If no problem is found, the department supervisor shall review the data and determine what further corrective action is best for each particular sample. That may include reanalyzing the samples, re-extracting and reanalyzing the samples, or qualifying the results as estimated.

9.4.2.6 If there is insufficient sample to re-extract, or if the sample is re-extracted beyond hold time, the appropriate footnote and qualifiers should be added to the results. This must be approved by the department supervisor.

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9.4.2.7 Because of their problematic nature, benzidine, benzaldehyde, and benzoic acid are generally not evaluated in the blank spike unless they are of specific concern for a given project.

9.5 Matrix Spike and Matrix Spike Duplicate

9.5.1 Matrix spike and spike duplicates are replicate sample aliquots to which the surrogate standard and spike standard have been added. The matrix spike and spike duplicate are then extracted and taken through all cleanup procedures along with the other samples to monitor the precision and accuracy of the extraction procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = [(Spike Amount – Sample Amount) / Amount Spiked] X 100

The percent recovery for each analyte of interest must fall within the established control limits for the results to be acceptable.

9.5.2 If the matrix spike recoveries are not within the established control limits, the following are required.

9.5.2.1 Check to be sure that there are no errors in calculations, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly.

9.5.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.5.2.3 If no problem is found, compare the recoveries to those of the blank spike. If the blank spike recoveries indicate that the problem is sample related, document this on the run narrative. Matrix spike recovery failures are not grounds for re-extraction but are an indication of the sample matrix effects.

9.5.3 Precision

Matrix spike and spike duplicate recoveries for each analyte are used to calculate the relative percent difference (RPD) for each compound.

RPD = [| MS Result – MSD Result | / Average Result] X 100

The RPD for each analyte should fall within the established control limits. If more than 33% of the RPDs fall outside of the established control limits, the MS and MSD should be reanalyzed to ensure that there was no injection problem. If upon reanalysis the RPDs are still outside of the control limits, the department supervisor shall review the data and

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determine if any further action is necessary. RPD failures are generally not grounds for re-extraction.

10.0 CALCULATIONS

The concentration of each analyte in the original sample is calculated as follows:

Water (ug/l) = $(CONC_{inst}) \times (V_F / V_I) \times DF$

Soil (ug/kg) = $[(CONC_{inst}) \times (V_F / W_I) \times DF] / \%solids$

$CONC_{inst}$	=	Instrument concentration calculated from the initial calibration using mean RF, linear curve, or quadratic curve
DF	=	Dilution Factor
V_F	=	Volume of final extract (ul)
V_I	=	Volume of sample extracted (ml)
W_I	=	Weight of sample extracted (g)
%solids	=	Dry weight determination in decimal form

All soils are reported on a dry weight basis.

11.0 SAFETY AND POLLUTION PREVENTION

11.1 Safety

The analyst should follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which includes the use of safety glasses and lab coats.

The toxicity of each reagent and target analyte has not been precisely defined; however, each reagent and sample should be treated as a potential health hazard. Material Safety Data Sheets (MSDS) are available for all reagents and many of the target analytes. Exposure must be reduced to the lowest possible level. Personal protective equipment should be used by all analysts.

11.2 Pollution Prevention

Waste solvents from the sample analysis and standards preparation are collected in waste storage bottles and are eventually transferred to the chlorinated waste drum.

Sample Extracts are archived and stored for 60 days after analysis. Old extracts and standards are disposed of in the waste vial drum.

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12.0 REFERENCES

SW846 Method 8000C Revision 3, March 2003

SW846 Method 8270C Revision 3, December 1996

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TABLE 1: Routine Target Analytes

Benzenethiol
Benzoic Acid
2-Chlorophenol
4-Chloro-3-methyl phenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,6-Dichlorophenol
4,6-Dinitro-o-cresol
2-Methylphenol
3&4-Methylphenol
2-Nitrophenol
4-Nitrophenol
Pentachlorophenol
Phenol
2,3,4,6-Tetrachlorophenol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2-Acetylaminofluorene
4-Aminobiphenyl
Acenaphthene
Acenaphthylene
Acetophenone
Anilazine
Aniline
Anthracene
Aramite
A,A-Dimethylphenethylamine
Atrazine
Benzaldehyde
Benzidine
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
4-Bromophenyl phenyl ether
Butyl benzyl phthalate
Benzyl Alcohol
1,1'-Biphenyl
2-Chloronaphthalene
1-Chloronaphthalene
4-Chloroaniline
Caprolactam
Carbazole
Chlorobenzilate
Chrysene
bis(2-Chloroethoxy)methane
bis(2-Chloroethyl)ether
bis(2-Chloroisopropyl)ether
4-Chlorophenyl phenyl ether
1,2-Dichlorobenzene
1,2-Diphenylhydrazine
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
3,3'-Dichlorobenzidine
3,3'-Dimethylbenzidine
7,12-Dimethylbenz(a)anthracene
Diallate
Dibenz(a,h)acridine
Dibenz(a,j)acridine
Dibenzo(a,h)anthracene
Dibenzofuran
Dimethoate
Diphenylamine
Diphenyl ether
Disulfoton
m-Dinitrobenzene
p-(Dimethylamine)azobenzene
Di-n-butyl phthalate
Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate
1,4-Dioxane
bis(2-Ethylhexyl)phthalate
Ethyl methanesulfonate
Famphur
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexachlorophene
Hexachloropropene
Indene
Indeno(1,2,3-cd)pyrene
Isodrin
Isophorone
Isosafrole
Kepone
1-Methylnaphthalene

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TABLE 1: Routine Target Analytes (continued)

2-Methylnaphthalene
3-Methylcholanthrene
4,4'-Methylenebis(2-chloroaniline)
Methapyrilene
Methyl methanesulfonate
Methyl parathion
Methyl Chrysene
1,4-Naphthoquinone
1-Naphthylamine
2-Naphthylamine
Nicotine
2-Nitroaniline
3-Nitroaniline
4-Nitroaniline
5-Nitro-o-toluidine
Naphthalene
Nitrobenzene
N-Nitrosodimethylamine
4-Nitroquinoline 1-Oxide
N-Nitroso-di-n-propylamine
N-Nitrosodi-n-butylamine
N-Nitrosodiethylamine
N-Nitrosodiphenylamine
N-Nitrosomethylethylamine
N-Nitrosomorpholine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
O,O,O-Triethyl phosphorothioate
2-Picoline
Parathion
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene
Phenacetin
Phenanthrene
Phorate
Pronamide
Propazine
Pyrene
Pyridine
p-Phenylenediamine
Quinoline
Safrole
Simazine
1,2,4,5-Tetrachlorobenzene
1,2,4-Trichlorobenzene
Thionazin
o-Toluidine
Toluene-2,4-diamine
sym-Trinitrobenzene
Tetraethyl dithiopyrophosphate

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STANDARD OPERATING PROCEDURE FOR THE EXTRACTION OF BASE-NEUTRAL AND ACID (BNAs) EXTRACTABLES FROM WATER SAMPLES

Prepared by:	Norm Farmer	Date:	06-23-09
Reviewed by:	Mark Erstling	Date:	06-30-09

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TEST NAME: **STANDARD OPERATING PROCEDURE FOR THE EXTRACTION OF BASE-NEUTRAL AND ACID (BNAs) EXTRACTABLES FROM WATER SAMPLES**

Method: EPA 625 and SW846 3510C/8270C

Dept: OP

Revised Sections: Edited 5.8, 5.9, 7.2, 7.4 and 7.6

1.0 Summary, Scope and Application

1.1 Summary

Aqueous samples are serially extracted with methylene chloride, concentrated by Kuderna-Danish apparatus, and stored in glass vials with Teflon lined screw caps.

1.2 Scope and Application

This procedure is applicable to aqueous samples submitted for semivolatile analysis by GC/MS methods, including EPA 625 and SW-846 8270C.

2.0 Discussion and Comments

This procedure is adapted from SW-846 methods 3500B and 3510C. The method utilizes “Separatory Funnel Liquid-Liquid Extraction”; it is not applicable to samples requiring “Continuous Liquid-Liquid Extraction”.

Although the mass spectrometer identifies compounds by specific ions, it will respond to most organic compounds. It is important to minimize extraneous contaminants by scrupulously cleaning all glassware and by using only high purity reagents. Additionally, all extraction items that come in contact with the sample must be made from glass or Teflon. Plastic items must be avoided because they can lead to phthalate contamination.

3.0 Preservation and Holding Times

3.1 Preservation

3.1.1 Samples shall be collected in amber glass bottles with Teflon lined caps. One-liter bottles are recommended for aqueous samples.

3.1.2 The samples must be protected from light and refrigerated at 4°C from the time of collection until extraction. The extracts must be refrigerated at –10°C to –20°C until analysis.

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3.2 Holding Time

3.2.1 Aqueous samples must be extracted within 7 days of collection. A sample is considered extracted after the methylene chloride aliquots have been combined in the Erlenmeyer flask.

3.2.2 Extracts must be analyzed within 40 days of extraction.

4.0 Definitions

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or 12 hours which ever comes first.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.4 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.5 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.6 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.7 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.8 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

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4.9 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the extraction efficiency.

5.0 Reagents

5.1 Acetone – pesticide grade or equivalent

5.2 Methylene chloride – pesticide grade or equivalent

5.3 Anhydrous sodium sulfate – precleaned to remove phthalates

5.4 Reagent water – distilled or deionized - free of interferences

5.5 10 Normal NaOH

5.6 1:1 H_2SO_4

5.7 BNA Surrogate Solution – prepared in acetone or methanol at a concentration specified by the GC/MS analyst. All surrogate solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.

5.8 BNA Spike Solution #1– prepared in acetone or methanol at a concentration specified by the GC/MS analyst. All spike solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use. This solution contains the majority of the spiked analytes.

5.9 BNA Spike Solution #2– prepared in acetone or methanol at a concentration specified by the GC/MS analyst. All spike solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use. This solution contains analytes that are not stable when mixed with those in Solution #1.

6.0 Glassware and Apparatus

6.1 1000ml graduated cylinder

6.2 2 liter separatory funnel (glass or Teflon)

6.3 250ml separatory funnel

6.4 250ml or 500ml Erlenmeyer flasks

6.5 0.5ml or 1.0ml syringes

6.6 1.0ml volumetric flask

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6.7 500ml Kuderna-Danish (K-D) flask

6.8 10ml graduated concentrator tube

6.9 3-ball macro Snyder column

6.10 Disposable transfer pipettes

6.11 pH paper

6.12 Teflon boiling chips

6.13 glass wool – precleaned

6.14 Glass filter funnel

6.15 Fisher P8 filters, or equivalent

6.16 2.0ml glass screw cap vials – caps must have Teflon lined septa

6.17 Water bath – adjustable temperature control

6.18 Nitrogen evaporator

7.0 Procedure

7.1 The extraction of all samples must be documented on a "prep sheet". The prep sheet will include such items as: sample ID, bottle number, initial volume, final volume, pHs, solvent lot numbers, spike and surrogate lot numbers, batch numbers, and dates. The extraction technician is responsible for filling out all the required information on the prep sheet. A copy of the prep sheet will be submitted to the GC/MS analyst with the extracts.

7.2 Mark the level of the sample (upper edge) on the bottle with a Sharpie. Transfer the entire sample directly into the appropriately labeled separatory funnel. Rinse the sample bottle with a 50-60ml aliquot of methylene chloride and transfer it to the appropriate separatory funnel. Fill the bottle to the sample mark with tap water. Transfer the water to a 1000ml graduated cylinder and record the sample volume. Discard the tap water.

Alternative procedure for samples with high silt or sediment content.

The entire contents of the sample bottle should be analyzed for aqueous samples, including any solids that may have been collected. However, high levels of solids in the sample can create heavy emulsions that can not be broken down by the various mechanical means.

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The solids will normally settle out during storage. If the sample bottle contains more than an inch of solids, it may be necessary to decant the water phase rather than extracting the entire sample. The decision to decant a water sample should be based on the experience and judgement of the extraction technician or the department supervisor. If the sample is decanted, it must be noted on the prep sheet.

Using a 1000ml-graduated cylinder, transfer the sample to the appropriately labeled separatory funnel taking care to minimize the amount of solids that are transferred. Record the actual sample volume that is transferred. Rinse the graduated cylinder with a 50-60ml aliquot of methylene chloride and transfer it to the appropriate separatory funnel.

The graduated cylinder must be rinsed with hot tap water, reagent water, and methylene chloride between samples in order to prevent cross contamination.

7.3 Using a 1000ml-graduated cylinder, transfer 1000ml of each of the QC samples to the appropriately labeled separatory funnels. This includes the method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD). Use 1000ml of reagent water for the MB and BS. Use additional 1000ml aliquots of a sample for the MS and MSD. If there is insufficient sample volume, a lesser volume may be used. Record both the sample ID and volume on the prep sheet.

7.4 Check the pH of each sample by dipping a disposable transfer pipette into the sample and touching it to the pH paper. Record the pH on the prep sheet.

7.5 Using the dedicated surrogate syringe add 0.5ml of surrogate solution to each of the samples including the QC samples. Record the surrogate lot number on the prep sheet.

7.6 Using the dedicated spike syringe add 0.5ml of spike solution #1 and #2 to the BS, MS, and MSD. Record the spike lot number on the prep sheet.

NOTE: If samples are being analyzed for Base-Neutral extractable compounds only, sections 7.7 to 7.10 may be omitted.

7.7 Adjust the pH of each sample to <2 by adding 1ml aliquots of 1:1 H_2SO_4. Swirl the sample and recheck the pH after each aliquot is added.

7.8 Cap and shake each separatory funnel for two minutes. **CAUTION:** The separatory funnels must be vented frequently to avoid an excessive buildup in pressure.

7.9 After shaking, allow the layers to separate for at least 10 minutes. Collect the solvent layer (bottom) in a labeled 250ml (if BN and Acids fractions are kept separate) or 500ml (if fractions are to be combined) Erlenmeyer flask.

NOTE: Some samples may form emulsions. If emulsions are present, the technician must take steps to breakdown the emulsion. This may include filtering

the emulsion through a smaller separatory funnel, centrifuging, or filtering through sodium sulfate.

7.10 Repeat steps 7.8 and 7.9 two additional times using 50 to 60ml of methylene chloride. Combine the extract in the Erlenmeyer flask.

NOTE: If samples are being analyzed for Acid extractable compounds only, sections 7.11 to 7.14 may be omitted.

7.11 Adjust the pH of each sample to >11 by adding 2ml aliquots of 10 N NaOH. Swirl the sample and recheck the pH after each aliquot is added.

7.12 Cap and shake each separatory funnel for two minutes. **CAUTION:** The separatory funnels must be vented frequently to avoid an excessive buildup in pressure.

7.13 After shaking, allow the layers to separate for at least 10 minutes. Collect the solvent layer (bottom) in a labeled 250ml (if BN and Acids fractions are kept separate) or 500ml (if fractions are to be combined) Erlenmeyer flask.

NOTE: Some samples may form emulsions. If emulsions are present, the technician must take steps to breakdown the emulsion. This may include filtering the emulsion through a smaller separatory funnel, centrifuging, or filtering through sodium sulfate.

7.14 Repeat steps 7.12 and 7.13 two additional times using 50 to 60ml of methylene chloride. Combine the extract in the Erlenmeyer flask.

7.15 Assemble and label the K-D flasks and concentrator tubes. Using forceps, place a Teflon boiling chip in each concentrator tube.

7.16 This step is **mandatory** for this extraction because any acid residue remaining in the extract will cause some of the unstable analytes to decompose. Place a glass filter funnel containing sodium sulfate supported on a Fisher P8 filter on the K-D flask. Pour the extracts through the sodium sulfate into the K-D flasks and rinse with methylene chloride. Remove the funnels and attach the Snyder columns.

7.17 Pre-wet the Snyder column with a few drops of methylene chloride and place the K-D assembly in a hot (65 to 75 ^{o}C) water bath. **NOTE:** If the bath is too hot, the more volatile compounds may be lost during this step. Concentrate the extract to approximately 5ml.

7.18 Remove the K-D assembly from the bath and allow it to cool. Remove the Snyder columns and rinse them with methylene chloride and then with acetone before placing them back in their storage rack.

7.19 Wipe the water from the joint area between the K-D flask and the concentrator tube. Transfer the sample ID to the concentrator tube. Remove the concentrator

tube from the K-D flask, **rinse the joint with solvent**, and place the concentrator tube in the rack for the nitrogen evaporator.

7.20 Use a steady stream of nitrogen to concentrate the extract to 0.5ml.

7.21 If the extract is cloudy or contains water droplets, run the extract through a micro column of glass wool and sodium sulfate.

7.22 Transfer the extract to a 1.0ml volumetric flask. Rinse the concentrator tube with a few drops of methylene chloride and transfer it to the volumetric flask. Adjust the final volume to 1.0ml. **NOTE:** If the extract will not concentrate to 1.0ml, choose the next appropriate final volume. Be sure to record the final volume on the prep sheet.

7.23 Transfer the extract to an appropriately labeled 2.0ml screw cap vial. Store the extracts in the "extract freezer" until they are needed for analysis.

8.0 Quality Assurance and Quality Control

8.1 An extraction batch is defined as samples of a similar matrix that are prepared for a particular parameter. The batch size is limited to 20 samples. A batch may be held open for up to 12 hours; however, samples should not be added after the QC set has been completed. **NOTE:** Some project plans may require different batch definitions.

8.2 A method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD) must be extracted with each new batch of samples.

9.0 Safety and Waste Disposal

9.1 Safety

9.1.1 Safety glasses, gloves and lab coats should be worn when handling samples, standards or solvents.

9.1.2 Material Safety Data Sheets (MSDS) are available for all reagents and solvents used in the lab. Technicians should review the MSDS prior to using any new reagents or solvents.

9.1.3 Methylene chloride is an inhalation hazard and a suspected carcinogen. Fume hoods must be used to minimize exposure to vapors.

9.2 Waste Disposal

9.2.1 Waste methylene chloride is placed in the "chlorinated waste" container.

9.2.2 Waste acetone is placed in the "non-chlorinated waste" container.

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9.2.3 Waste sodium sulfate is placed in a waste container after the solvent has drained or evaporated.

9.2.4 Extracted water samples are rinsed down the drain with large amounts of water.

10.0 References

10.1 SW-846 Method 3500B, Rev. 2, 12/96

10.2 SW-846 Method 3510C, Rev. 3, 12/96

10.3 SW-846 Method 8270C, Rev. 3, 12/96

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STANDARD OPERATING PROCEDURE FOR THE EXTRACTION OF TOTAL PETROLEUM HYDROCARBONS FROM WATER SAMPLES (FL-PRO)

Prepared by:	Norm Farmer	Date:	06-23-09
Reviewed by:	Mark Erstling	Date:	06-30-09

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TEST NAME: **STANDARD OPERATING PROCEDURE FOR THE EXTRACTION OF TOTAL PETROLEUM HYDROCARBONS FROM WATER SAMPLES (FL-PRO)**

Method: FL-PRO

Dept: OP

Revised Sections: Edited 7.2, 7.4 and 7.6

1.0 Summary, Scope and Application

1.1 Summary

Aqueous samples are serially extracted with methylene chloride, concentrated by TurboVap, and stored in glass vials with Teflon lined screw caps.

1.2 Scope and Application

This procedure is applicable to aqueous samples submitted for Total Petroleum Hydrocarbon analysis by GC/FID method FL-PRO.

2.0 Discussion and Comments

This procedure is adapted from Florida DEP method FL-PRO. The method utilizes "Separatory Funnel Liquid-Liquid Extraction"; it is not applicable to samples requiring "Continuous Liquid-Liquid Extraction".

The FID is a non-selective detector and will respond to most organic compounds. It is important to minimize extraneous contaminants by scrupulously cleaning all glassware and by using only high purity reagents. Additionally, all extraction items that come in contact with the sample must be made from glass or Teflon.

Animal oils, vegetable oils, and biogenic terpenes can be removed by treating the extract with silica gel.

3.0 Preservation and Holding Times

3.1 Preservation

3.1.1 Samples shall be collected in amber glass bottles with Teflon lined caps. One-liter bottles are recommended for aqueous samples.

3.1.2 The samples must be protected from light and refrigerated at 4°C from the time of collection until extraction. The extracts must be refrigerated at 4°C until analysis.

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3.2 Holding Time

3.2.1 Aqueous samples must be extracted within 7 days of collection. A sample is considered extracted after the methylene chloride aliquots have been combined in the Erlenmeyer flask.

3.2.2 Extracts must be analyzed within 40 days of extraction.

4.0 Definitions

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or 12 hours which ever comes first.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.4 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.5 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.6 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.7 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.8 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

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4.9 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the extraction efficiency.

5.0 Reagents

5.1 Acetone – pesticide grade or equivalent

5.2 Methylene chloride – pesticide grade or equivalent

5.3 Anhydrous sodium sulfate – precleaned to remove phthalates

5.4 Reagent water – distilled or deionized - free of interferences

5.5 Silica gel – Davidson grade 950 or equivalent – 60 to 200 mesh

5.6 1:1 H_2SO_4

5.7 FLPRO Surrogate Solution – prepared in acetone or methanol at a concentration specified by the GC analyst. All surrogate solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.

5.8 FLPRO Spike Solution – prepared in acetone or methanol at a concentration specified by the GC analyst. All spike solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.

6.0 Glassware and Apparatus

6.1 1000ml graduated cylinder

6.2 2 liter separatory funnel (glass or Teflon)

6.3 250ml separatory funnel

6.4 250ml or 500ml Erlenmeyer flasks

6.5 0.5 and 1.0ml syringes

6.6 1.0ml volumetric flask

6.7 200ml graduated TurboVap tube

6.8 Disposable transfer pipettes

6.9 pH paper

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6.10 glass wool – precleaned

6.11 Glass filter funnel

6.12 Fisher P8 filters, or equivalent

6.13 2.0ml glass screw cap vials – caps must have Teflon lined septa

6.14 Zymark TurboVap II or equivalent

7.0 Procedure

7.1 The extraction of all samples must be documented on a "prep sheet". The prep sheet will include such items as: sample ID, bottle number, initial volume, final volume, pHs, solvent lot numbers, spike and surrogate lot numbers, batch numbers, and dates. The extraction technician is responsible for filling out all the required information on the prep sheet. A copy of the prep sheet will be submitted to the GC analyst with the extracts.

7.2 Mark the level of the sample (upper edge) on the bottle with a Sharpie. Transfer the entire sample directly into the appropriately labeled separatory funnel. Rinse the sample bottle with a 50-60ml aliquot of methylene chloride and transfer it to the appropriate separatory funnel. Fill the bottle to the sample mark with tap water. Transfer the water to a 1000ml graduated cylinder and record the sample volume. Discard the tap water.

Alternative procedure for samples with high silt or sediment content.

The entire contents of the sample bottle should be analyzed for aqueous samples, including any solids that may have been collected. However, high levels of solids in the sample can create heavy emulsions that can not be broken down by the various mechanical means.

The solids will normally settle out during storage. If the sample bottle contains more than an inch of solids, it may be necessary to decant the water phase rather than extracting the entire sample. The decision to decant a water sample should be based on the experience and judgement of the extraction technician or the department supervisor. If the sample is decanted, it must be noted on the prep sheet.

Using a 1000ml-graduated cylinder, transfer the sample to the appropriately labeled separatory funnel taking care to minimize the amount of solids that are transferred. Record the actual sample volume that is transferred. Rinse the graduated cylinder with a 50-60ml aliquot of methylene chloride and transfer it to the appropriate separatory funnel.

The graduated cylinder must be rinsed with hot tap water, reagent water, and methylene chloride between samples in order to prevent cross contamination.

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7.3 Using the 1000ml-graduated cylinder, transfer 1000ml of each of the QC samples to the appropriately labeled separatory funnels. This includes the method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD). Use 1000ml of reagent water for the MB and BS. Use additional 1000ml aliquots of a sample for the MS and MSD. If there is insufficient sample volume, a lesser volume may be used. Record the sample ID, bottle number, and volume on the prep sheet.

7.4 Check the pH of each sample by dipping a disposable transfer pipette into the sample and touching it to the pH paper. Record the pH on the prep sheet. Samples for TPH analysis should have been preserved to a pH <2. If a sample was inadequately preserved, adjust the pH to <2 by adding 2ml aliquots of 1:1 H_2SO_4. Swirl the sample and recheck the pH after each aliquot is added.

7.5 Using the dedicated surrogate syringe add 0.5ml of surrogate solution to each of the samples including the QC samples. Record the surrogate lot number on the prep sheet.

7.6 The spike mix must be allowed to come to room temperature before use. Using the dedicated spike syringe add 0.5ml of spike solution to the BS, MS, and MSD. Record the spike lot number on the prep sheet.

7.7 Cap and shake each separatory funnel for two minutes. **CAUTION:** The separatory funnels must be vented frequently to avoid an excessive buildup in pressure.

7.8 After shaking, allow the layers to separate for at least 10 minutes. Collect the solvent layer (bottom) in a labeled 250ml Erlenmeyer flask.

NOTE: Some samples may form emulsions. If emulsions are present, the technician must take steps to breakdown the emulsion. This may include filtering the emulsion through a smaller separatory funnel, centrifuging, or filtering through sodium sulfate.

7.9 Repeat steps 7.7 and 7.8 two additional times using 50 to 60ml of methylene chloride. Combine the extract in the Erlenmeyer flask.

7.10 Label the TurboVap tubes and place them in the metal support rack.

7.11 This step is **optional**, but it must be performed if the extracts appear cloudy or contain water droplets. Place a glass filter funnel containing sodium sulfate supported on a Fisher P8 filter on the TurboVap tube. Pour the extracts through the sodium sulfate into the TurboVap tube and rinse with methylene chloride. Care must be taken not to overfill the TurboVap tube.

7.12 If the extract appears to be dry, simply transfer it to an appropriately labeled TurboVap tube. Rinse the Erlenmeyer flask with methylene chloride and transfer

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to the appropriate TurboVap tube. Care must be taken not to overfill the TurboVap tube.

7.13 Set the water bath temperature for the TurboVap to 40 ^{o}C. Place the tube in the TurboVap. Concentrate the extract to 0.7ml.

7.14 Remove the TurboVap tube and place it in the metal support rack to allow it to cool.

7.15 If the extract is cloudy or contains water droplets, run the extract through a micro column of glass wool and sodium sulfate.

7.16 Transfer the extract to a 1.0ml volumetric flask. Rinse the TurboVap tube with a few drops of methylene chloride and transfer it to the volumetric flask. Adjust the final volume to 1.0ml. **NOTE:** If the extract will not concentrate to 1.0ml, choose the next appropriate final volume. Be sure to record the final volume on the prep sheet.

7.17 Add 0.2 to 0.3 grams of silica gel to each extract. Use a transfer pipette to mix each extract.

7.18 Allow the silica gel to settle.

7.19 Transfer the extract to an appropriately labeled 2.0ml screw cap vial. Store the extracts in the “extract refrigerator” until they are needed for analysis.

8.0 Quality Assurance and Quality Control

8.1 An extraction batch is defined as samples of a similar matrix that are prepared for a particular parameter. The batch size is limited to 20 samples. A batch may be held open for up to 12 hours; however, samples should not be added after the QC set has been completed. **NOTE:** Some project plans may require different batch definitions.

8.2 A method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD) must be extracted with each new batch of samples.

9.0 Safety and Waste Disposal

9.1 Safety

9.1.1 Safety glasses, gloves and lab coats should be worn when handling samples, standards or solvents.

9.1.2 Material Safety Data Sheets (MSDS) are available for all reagents and solvents used in the lab. Technicians should review the MSDS prior to using any new reagents or solvents.

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9.1.3 Methylene chloride is an inhalation hazard and a suspected carcinogen. Fume hoods must be used to minimize exposure to vapors.

9.2 Waste Disposal

9.2.1 Waste methylene chloride is placed in the “chlorinated waste” container.

9.2.2 Waste acetone is placed in the “non-chlorinated waste” container.

9.2.3 Waste sodium sulfate is placed in a waste container after the solvent has drained or evaporated.

9.2.4 Extracted water samples are rinsed down the drain with large amounts of water.

10.0 References

10.1 SW-846 Method 3500B, Rev. 2, 12/96

10.2 SW-846 Method 3510C, Rev. 3, 12/96

10.3 Florida DEP Method FL-PRO, REV. 1, 11/95

10.4 SW-846 Method 8015B, Rev. 2, 12/96

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STANDARD OPERATING PROCEDURE FOR THE EXTRACTION OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) FROM WATER SAMPLES FOR HPLC ANALYSIS

Prepared by:	Norm Farmer	Date:	06-23-09
Reviewed by:	Mike Eger	Date:	07-07-09

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TEST NAME: **STANDARD OPERATING PROCEDURE FOR THE EXTRACTION OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) FROM WATER SAMPLES FOR HPLC ANALYSIS**

Method: EPA 610 and SW846 3510C/8310

Dept: OP

Revised Sections: Edited 5.7, 5.8, 7.2, 7.4, 7.5 and 7.6

1.0 Summary, Scope and Application

1.1 Summary

Aqueous samples are serially extracted with methylene chloride, concentrated by Turbovap, solvent exchanged, and stored in glass vials with Teflon lined screw caps.

1.2 Scope and Application

This procedure is applicable to aqueous samples submitted for PAH analysis by HPLC methods, including EPA 610 (HPLC option) and SW-846 8310.

2.0 Discussion and Comments

This procedure is adapted from SW-846 methods 3500B and 3510C. The method utilizes “Separatory Funnel Liquid-Liquid Extraction”; it is not applicable to samples requiring “Continuous Liquid-Liquid Extraction”.

The HPLC detector is extremely sensitive and will respond to many organic compounds. It is important to minimize extraneous contaminants and carryover by scrupulously cleaning all glassware and by using only high purity reagents. Additionally, all extraction items that come in contact with the sample must be made from glass or Teflon.

3.0 Preservation and Holding Times

3.1 Preservation

3.1.1 Samples shall be collected in amber glass bottles with Teflon lined caps. One-liter bottles are recommended for aqueous samples.

3.1.2 The samples must be protected from light and refrigerated at 4°C from the time of collection until extraction. The extracts must be refrigerated at 4°C until analysis.

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3.2 Holding Time

3.2.1 Aqueous samples must be extracted within 7 days of collection. A sample is considered extracted after the methylene chloride aliquots have been combined in the Erlenmeyer flask.

3.2.2 Extracts must be analyzed within 40 days of extraction.

4.0 Definitions

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or 12 hours which ever comes first.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.4 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.5 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.6 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.7 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.8 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

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4.9 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the extraction efficiency.

5.0 Reagents

5.1 Acetone – pesticide grade or equivalent

5.2 Methylene chloride – pesticide grade or equivalent

5.3 Acetonitrile – HPLC grade or equivalent

5.4 Anhydrous sodium sulfate – precleaned to remove phthalates

5.5 Reagent water – HPLC grade or equivalent

5.6 Methanol – HPLC grade or equivalent

5.7 PAH Water Surrogate Solution – prepared in acetonitrile or methanol at a concentration specified by the HPLC analyst. All surrogate solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.

5.8 PAH Water Spike Solution – prepared in acetonitrile or methanol at a concentration specified by the HPLC analyst. All spike solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.

6.0 Glassware and Apparatus

6.1 1000ml graduated cylinder

6.2 2 liter separatory funnel (glass or Teflon)

6.3 250ml separatory funnel

6.4 250ml or 500ml Erlenmeyer flasks

6.5 0.5ml or 1.0ml syringes

6.6 1.0ml volumetric flask

6.7 200ml graduated TurboVap tube

6.8 Disposable transfer pipettes

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6.9 pH paper

6.10 glass wool – precleaned

6.11 Glass filter funnel

6.12 Fisher P8 filters, or equivalent

6.13 2.0ml glass screw cap vials – caps must have Teflon lined septa

6.14 Zymark TurboVap II or equivalent

7.0 Procedure

7.1 The extraction of all samples must be documented on a "prep sheet". The prep sheet will include such items as: sample ID, bottle number, initial volume, final volume, pHs, solvent lot numbers, spike and surrogate lot numbers, batch numbers, and dates. The extraction technician is responsible for filling out all the required information on the prep sheet. A copy of the prep sheet will be submitted to the GC analyst with the extracts.

7.2 Mark the level of the sample (upper edge) on the bottle with a Sharpie. Transfer the entire sample directly into the appropriately labeled separatory funnel. Rinse the sample bottle with a 50-60ml aliquot of methylene chloride and transfer it to the appropriate separatory funnel. Fill the bottle to the sample mark with tap water. Transfer the water to a 1000ml graduated cylinder and record the sample volume. Discard the tap water.

Alternative procedure for samples with high silt or sediment content.

The entire contents of the sample bottle should be analyzed for aqueous samples, including any solids that may have been collected. However, high levels of solids in the sample can create heavy emulsions that can not be broken down by the various mechanical means.

The solids will normally settle out during storage. If the sample bottle contains more than an inch of solids, it may be necessary to decant the water phase rather than extracting the entire sample. The decision to decant a water sample should be based on the experience and judgement of the extraction technician or the department supervisor. If the sample is decanted, it must be noted on the prep sheet.

Using a 1000ml-graduated cylinder, transfer the sample to the appropriately labeled separatory funnel taking care to minimize the amount of solids that are transferred. Record the actual sample volume that is transferred. Rinse the graduated cylinder with a 50-60ml aliquot of methylene chloride and transfer it to the appropriate separatory funnel.

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The graduated cylinder must be rinsed with hot tap water, reagent water, and methylene chloride between samples in order to prevent cross contamination.

7.3 Using a 1000ml-graduated cylinder, transfer 1000ml of each of the QC samples to the appropriately labeled separatory funnels. This includes the method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD). Use 1000ml of reagent water for the MB and BS. Use additional 1000ml aliquots of a sample for the MS and MSD. If there is insufficient sample volume, a lesser volume may be used. Record the sample ID, bottle number, and volume on the prep sheet.

7.4 Check the pH of each sample by dipping a disposable transfer pipette into the sample and touching it to the pH paper. Record the pH on the prep sheet. Samples for PAH analysis should be extracted at the pH at which they were received.

7.5 Using the dedicated surrogate syringe add 0.5ml of PAH Water Surrogate Solution to each of the samples including the QC samples. Record the surrogate lot number on the prep sheet.

7.6 Using the dedicated spike syringe add 0.5ml of PAH Water Spike Solution to the BS, MS, and MSD. Record the spike lot number on the prep sheet.

7.7 Cap and shake each separatory funnel for two minutes. **CAUTION:** The separatory funnels must be vented frequently to avoid an excessive buildup in pressure.

7.8 After shaking, allow the layers to separate for at least 10 minutes. Collect the solvent layer (bottom) in a labeled 250ml Erlenmeyer flask.

NOTE: Some samples may form emulsions. If emulsions are present, the technician must take steps to breakdown the emulsion. This may include filtering the emulsion through a smaller separatory funnel, centrifuging, or filtering through sodium sulfate.

7.9 Repeat steps 7.7 and 7.8 two additional times using 50 to 60ml of methylene chloride. Combine the extract in the Erlenmeyer flask.

7.10 Label the TurboVap tubes and place them in the metal support rack.

7.11 Transfer the extract to an appropriately labeled TurboVap tube. Rinse the Erlenmeyer flask with methylene chloride and transfer to the appropriate TurboVap tube. Care must be taken not to overfill the TurboVap tube.

7.12 Set the water bath temperature for the TurboVap to 40 ^{o}C. Place the tube in the TurboVap. **NOTE:** If the bath is too hot, the more volatile compounds may be lost during this step. Concentrate the extract to between 1 and 5ml.

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7.13 Add approximately 30ml of acetonitrile to the each of the TurboVap tubes. Increase the TurboVap water bath temperature to 55 ^{o}C and concentrate the extract to 0.7ml.

7.14 Remove the TurboVap tube and place it in the metal support rack to allow it to cool.

7.15 Transfer the extract to a 1.0ml volumetric flask. Rinse the TurboVap tube with a few drops of acetonitrile and transfer it to the volumetric flask. Adjust the final volume to 1.0ml. **NOTE:** If the extract will not concentrate to 1.0ml, choose the next appropriate final volume. Be sure to record the final volume on the prep sheet.

7.16 Transfer the extract to an appropriately labeled 2.0ml screw cap vial. Store the extracts in the "extract refrigerator" until they are needed for analysis.

8.0 Quality Assurance and Quality Control

8.1 An extraction batch is defined as samples of a similar matrix that are prepared for a particular parameter. The batch size is limited to 20 samples. A batch may be held open for up to 12 hours; however, samples should not be added after the QC set has been completed. **NOTE:** Some project plans may require different batch definitions.

8.2 A method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD) must be extracted with each new batch of samples.

9.0 Safety and Waste Disposal

9.1 Safety

9.1.1 Safety glasses, gloves and lab coats should be worn when handling samples, standards or solvents.

9.1.2 Material Safety Data Sheets (MSDS) are available for all reagents and solvents used in the lab. Technicians should review the MSDS prior to using any new reagents or solvents.

9.1.3 Methylene chloride and acetonitrile are inhalation hazards and suspected carcinogens. Fume hoods must be used to minimize exposure to vapors.

9.2 Waste Disposal

9.2.1 Waste methylene chloride is placed in the "chlorinated waste" container.

9.2.2 Waste acetone and acetonitrile are placed in the "non-chlorinated waste" container.

9.2.3 Waste sodium sulfate is placed in a waste container after the solvent has drained or evaporated.

9.2.4 Extracted water samples are rinsed down the drain with large amounts of water.

10.0 References

10.1 SW-846 Method 3500B, Rev. 2, 12/96

10.2 SW-846 Method 3510C, Rev. 3, 12/96

10.3 SW-846 Method 8310, Rev. 0, 09/86

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STANDARD OPERATING PROCEDURE FOR THE INTRODUCTION OF VOLATILE ORGANICS ANALYTES USING PURGE-AND-TRAP

Prepared by:	Rick Watkins	Date:	07/11/09
Reviewed by:	Norm Farmer	Date:	07/15/09

Annual Review

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TEST NAME: STANDARD OPERATING PROCEDURE FOR THE INTRODUCTION OF VOLATILE ORGANICS ANALYTES USING PURGE-AND-TRAP

Method: SW846 5030B

Dept: OP

Revised Sections: 6.7, 7.5, and 7.5.2

1.0 Summary, Scope and Application

1.1 Summary

Aqueous samples: Helium is bubbled through a portion of the aqueous sample at ambient or elevated temperature; the volatile components are transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the volatile components are adsorbed. After purging is completed, the sorbent column is rapidly heated and backflushed with helium to desorb the components onto a gas chromatographic column.

High-level extracts from Method 5035A: An aliquot of the extract is combined with organic free reagent water in the purging chamber. It is then analyzed following the procedure for aqueous samples.

1.2 Scope and Application

This method describes a purge-and-trap procedure for the analysis of volatile organic compounds (VOCs) in aqueous samples, water miscible liquids, and high-level extracts (prepared in Method 5035A).

2.0 Discussion and Comments

This procedure is adapted from SW-846 method 5030B. Cross contamination can occur whenever high concentration samples are analyzed. Any sample that contains analytes an order of magnitude higher than the highest level standard can be described as a possible source for cross contamination.

Two types of system contamination are possible in this method. A high-level sample followed by a low-level sample may show “carryover” of compounds with higher boiling points or water solubility. This type of contamination usually only persists for the analysis immediately following the high-level sample.

Extremely high-level samples may cause more persistent system contamination. These samples will cause “carryover” in one or more subsequent analysis. They may also result in “positional carryover”. The high-level compounds may linger in the autosampler position where the high-level sample was purged.

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The analyst must use any available historical data or client supplied information to avoid contaminating the system. Volatile analysis systems employing the “Archon” are much less susceptible to carryover but are not immune altogether. Any doubt or suspicion is cause for reanalysis.

3.0 Preservation and Holding Times

3.1 Preservation

3.1.1 Samples should be preserved to a pH < 2. The pH should be checked and recorded immediately after the sample analysis.

3.1.2 If the sample is not preserved to a pH < 2, it must be noted on the report.

3.1.3 Samples should be checked for the presence of residual chlorine. If residual chlorine present, it must be noted on the report.

3.2 Holding Times

3.2.1 All samples must be analyzed within fourteen days of collection.

3.2.2 Some agencies and project plans may require unpreserved samples to be analyzed within seven days of collection.

4.0 Definitions

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or samples loaded on an instrument within the same 12-hour shift, which ever comes first.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.4 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.5 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

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4.6 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.7 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.8 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

4.9 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the purge efficiency.

4.10 Trip Blank: A sample of analyte-free matrix taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples.

5.0 Reagents

5.1 Reagent water – distilled or deionized water free of interferences

5.2 Methanol – purge-and-trap grade or equivalent

5.3 Surrogate Solution – prepared in methanol at a concentration specified by the analyst.

5.4 Standard Solution – prepared in methanol or water at a concentration specified by the analyst.

5.5 Internal Standard Solution – prepared in methanol at a concentration specified by the analyst.

5.6 Spike Solution – prepared in methanol at a concentration specified by the analyst.

6.0 Glassware and Apparatus

6.1 Microsyringes – 10ul, 25ul, 50ul, 100ul, 250ul, 500ul, and 1000ul. These syringes are gastight with Teflon plunger tips used for spike and surrogate solutions. These may also be employed for sample dilutions.

6.2 Syringes – 5ml, and 10ml syringes with Luer-Lok tip.

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6.3 Volumetric flasks – 5ml, 10ml, 50ml, and 100ml class A flasks are used for standard and spike preparation and sample dilution.

6.4 Vials – 40ml vials with Teflon lined septa.

6.5 OI Analytical MPM 16 position samplers employing needle type spargers.

6.6 OI Analytical 4560 and 4660 sample concentrators.

6.7 OI Analytical 4552 (Archon) and 4551 autosamplers.

6.8 OI Analytical #10 trap or equivalent for 8021 or 8260 analysis, #7 trap for 8015 and 8021 Aromatics. Other traps may be used for 602 or 8015 analysis provided method criteria is met.

6.9 pH paper – narrow range (0.0-3.0) and wide range (1-12)

6.10 Potassium iodide – starch paper (residual chlorine check)

7.0 Procedure for Aqueous Samples

7.1 Prior to sample analysis, the GC system must be calibrated. The procedures for the determinative methods give details on preparation of standards for initial and daily calibrations. The GC-MS methods also require instrument tuning prior to proceeding with calibration.

7.2 Adjust the purge gas flow rate to 30-40ml/min on the purge-and-trap device. Once the flow is optimized, it is not necessary to set the flow daily, although periodic checking is recommended.

7.3 Traps shall be conditioned according to manufacturer's instructions upon installation. Prior to use, condition the trap daily by stepping the sample concentrator to the "bake" mode. Since bake temperature will vary according to method and trap type, ensure the proper concentrator method is loaded when performing the daily conditioning.

7.4 All samples and standard solutions must be allowed to warm to ambient temperature before analysis.

7.5 OI Analytical 4552 (Archon) or 4551 Procedure

7.5.1 Prepare aqueous standards by injecting aliquots of standard solutions into a 50ml volumetric flask and inverting several times to mix. . The standard is then transferred to a 40ml vial with Teflon-lined septa cap.

7.5.2 Load standards, samples, and blanks into the auto-sampler tray. Program the auto-sampler methods to perform 5ml or 25ml purges and dilutions when appropriate. Link auto-sampler methods together to build

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the run sequence. Without disturbing the vial seal, the autosampler will transfer a 5ml or 25ml volume from the vial and transfer it to the purge-and-trap device, along with a 1ul aliquot of internal standard/surrogate mix.

Caution: Care must be taken when programming the Archon. If the sample size exceeds the capacity of the purge vessel, catastrophic damage to the GC system may result! Consult the user manual if unfamiliar with use of the Archon.

7.6 Sixteen Position Auto-sampler (MPM-16) Procedure

7.6.1 For 16 position autosampler units, flush about 5ml of warmed reagent water through each sample valve that was used on the previous run. Then remove the glassware from those positions. Step the concentrator through each of those positions while holding a purge vessel under the sparger to remove any sample that may remain in the purge line. Replace the glassware with clean purge vessels that have been dried at 105C.

7.6.2 Remove the plunger from the 5ml luer-lok syringe to be used. Allow the sample to come to ambient temperature. Observe the sample for any headspace or signs of leakage and note it in the bench book if needed. Carefully pour the sample into the syringe barrel, replace the plunger, and adjust the sample volume.

7.6.3 Standards are prepared by injecting aliquots of standard solutions into a 5ml luer-lok syringe filled with DI water.

7.6.4 Sample dilutions, if needed, may be made up to 1000x directly in the luer-lok syringe by filling the syringe with reagent water and adding an aliquot of sample using a microsyringe. Dilutions greater than 1000x should be made in a volumetric flask and then transferred to the luer-lok syringe.

7.6.5 Add surrogate spiking solutions as needed through the Luer end of the syringe. Add matrix-spiking solutions as needed. Immediately, attach the syringe to the sample valve on the purging device. Open the valve and inject the sample into the purging chamber. Close the valve and remove the syringe.

7.7 Purge the sample for the time specified in the determinative method SOP.

7.8 Place the purge-and-trap system in the desorb mode and preheat the trap to the temperature specified in the method SOP. Start the flow of carrier gas, begin the GC temperature program, and start GC data acquisition. Continue the carrier flow for the time specified in the method SOP.

7.9 Recondition the trap by returning the purge-and-trap device to the purge mode. Maintain the trap temperature and bake time as specified in the method SOP.

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7.10 Note: Modern purge-and-trap units are computerized and user programmable. The steps discussed in 7.7 to 7.9 are normally automatically controlled throughout an analysis sequence and are not necessarily manually performed by the analyst. Systems using an Archon headspace sampler also incorporate additional steps (such as hot water rinses of the purge chamber) between analysis that may reduce contamination.

7.11 Calculate response factors (RF) or calibration factors (CF) for each analyte of interest using the procedure described in Method 8000. Update the calibration levels in the MS Chemstation method and evaluate the response factors. Specific calibration requirements are described in the determinative methods and in Method 8000. The method must be saved to the hard drive after all levels are updated.

7.12 Any compound of interest that exceeds the initial calibration range should be diluted and reanalyzed so that the highest peak of interest falls in the upper half of the linear range of the curve.

7.13 After analyzing the sample, remove the sample cap. Using narrow range pH test paper (0.0 – 3.0) check the sample pH. If the pH is found to be > 3.0, use wide range pH test paper (1 – 12) to check the sample pH. Check for presence of residual chlorine with potassium iodide / starch test paper. Quickly recap the vial. Record sample pH and presence / absence of residual chlorine.

8.0 Analysis of water-miscible liquids

Water-miscible liquids are analyzed as water samples after first diluting them at least 50-fold with reagent water.

9.0 Soil extracts from Method 5035

9.1 The methanol soils extracts prepared according to Method 5035 are diluted into reagent water at least 50-fold by addition of an aliquot of the methanol extract into a 5ml syringe filled with reagent water. The volume of methanol extract added to 5ml should not exceed 100ul. The volume of methanol added to 5ml of water being purged should be kept constant. Therefore, add to the 5ml syringe whatever volume of clean methanol is necessary to maintain a volume of 100ul per 5ml of water. Higher dilutions are made by introducing smaller aliquots of methanol extract (not less than 1ul into 5ml), or by using a volumetric flask.

9.2 The water/methanol sample is introduced as a water sample as previously described.

9.3 The purge temperature is either ambient or heated depending on the system and method used. All standards and spikes must be treated in the same manner as the samples.

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10.0 Quality Assurance and Quality Control

10.1 A sample batch is defined as samples of a similar matrix that are prepared for a particular parameter. The batch size is limited to 20 samples. A batch may be held open for up to 12 hours. **NOTE:** Some project plans may require different batch definitions.

10.2 A method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD) must be analyzed with each new batch of samples.

11.0 Safety and Waste Disposal

11.1 Safety

11.1.1 The analyst should follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which includes the use of safety glasses and lab coats.

11.1.2 The toxicity of each reagent and target analyte has not been precisely defined; however, each reagent and sample should be treated as a potential health hazard. Material Safety Data Sheets (MSDS) are available for all reagents and many of the target analytes. Exposure must be reduced to the lowest possible level. Personal protective equipment should be used by all analysts.

11.2 Waste Disposal

11.2.1 Expired and purged water samples are rinsed down the drain with large amounts of water.

11.2.2 Expired standards are disposed of in the waste vial drum.

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12.0 References

12.1 SW-846 Method 5030B, Rev. 2, 12/96

12.2 SW-846 Method 5030C, Rev. 3, 05/03

12.3 SW-846 Method 5035A, Rev. 1, 07/02

12.4 SW-846 Method 5000, Rev. 0, 12/96

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DATA ENTRY for SAMPLE LOGIN

Prepared by: Ellen Pampel Date: 01/20/2010

Reviewed by: Svetlana Izosimova Date: 01/29/2010

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TITLE: **DATA ENTRY for SAMPLE LOGIN**

REFERENCES: Seed Pack1, Laboratory Manual

Revised Sections: new

1.0 Scope and Application

1.1 This SOP describes the processes used for entering sample and order related information provided by the client during initial project set-up and through sample collection, delivery, and custody transfer. This SOP applies to all commercial samples analyzed by Accutest Laboratories

2.0 Summary

2.1 Project specifications are defined by the clients and combined with critical information obtained during sample collection. This information is documented and translated into coded information that is translatable by laboratory staff into operating instructions that describe client specifications. The coded information is entered into the laboratory information management system (LIMS) by the login staff for permanent storage and retrieved by departmental and technical staff for scheduling purposes. Analysts are responsible for reviewing and applying the technical specifications that have been entered into the LIMS before proceeding with analysis. Report generation staff accesses report configuration specifications from the LIMS to determine the type of report required by the client.

3.0 Definitions

ACCURACY: The closeness of agreement between an observed value and an accepted reference value. When applied to a set of observed values, accuracy will be a combination of a random component and of a common systematic error (or bias) component.

ANALYST: The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CHAIN OF CUSTODY: An unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples.

CONTROL SAMPLE: A QC sample introduced into a process to monitor the performance of the system.
CORRECTIVE ACTION: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

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DUPLICATE ANALYSES: The analyses or measurements of the variable of interest performed identically on two sub-samples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurements precision but not the precision of samplings, preservation or storage internal to the laboratory.

EQUIPMENT RINSATE: A sample of analyte-free media which has been used to rinse the sampling equipment. It is collected after completion of decontamination and prior to sampling. This blank is useful in documenting adequate decontamination of sampling equipment.

FIELD DUPLICATES: Independent samples which are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. These duplicates are useful in documenting the precision of the sampling process.

HOLDING TIMES (MAXIMUM ALLOWABLE HOLDING TIMES): The maximum times that samples may be held prior to analysis and still be considered valid or not compromised .

LOG IN REVIEW REPORT: A form generated in LIMs which summarizes all of the specifications pertaining to the log in of a singe job. This form is used to check the accuracy of log in and document the review process.

MANAGER: The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual.

MATRIX: The component or substrate (e.g., surface water, drinking water) which contains the analyte of interest.

PRESERVATION: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

PROFICIENCY TESTING: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

PROFICIENCY TESTING PROGRAM: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results, and the collective demographics and results summary of all participation laboratories.

PROFICIENCY TESTING SAMPLE: A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

PROJECT: Single or multiple data collection activities that are related through the same planning sequence.

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PROTOCOL: A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed.

QUALITY ASSURANCE: An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROJECT PLAN (QAPjP): An orderly assemblage of detailed procedures designed to produce data of sufficient quality to meet the data quality objectives for a specific data collection activity.

QUALITY CONTOL: The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

QUALITY CONTOL SAMPLE: An uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to asses the performance of all or a portion of the measurement system.

RAW DATA: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report o of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted.

SPLIT SAMPLES: Aliquots of sample taken from the same container and analyzed independently. In cases where aliquots of samples are impossible to obtain, field duplicate samples should be taken for the matrix duplicate analysis. These are usually taken after mixing or compositing and are used to document intra- or inter-laboratory precision.

SUPERVISOR: The individual designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses.

SURROGATE: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples.

TECHNICAL DIRECTOR: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory.

TEST: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate.

TEST METHOD: An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP.

TRIP BLANK: A sample of analyte-free media taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organics samples.

4.0 Health & Safety

4.1 This administrative procedure does not require specific health and safety precautions. For general requirements refer to the Accutest Chemical Hygiene & Safety Plan.

5.0 Interferences: N/A

6.0 Equipment & Supplies: NA

7.0 Standards & Reagents: NA

8.0 Sample Collection, Preservation & Holding Time: NA

9.0 Procedure

9.1 Custody Receipt

9.1.1 The job folder containing the chain of custody and sample receipt confirmation form is delivered to the login staff after samples are delivered to Accutest, unpacked, and documented by Sample management.

9.1.2 New project information data sheets, which include client specifications not included on the chain of custody, are kept by the Client Services associates. This information must be entered into the laboratory information management system (LIMS)

9.2 Data Entry

9.2.1 All client and custody information pertaining to samples delivered to Accutest must be entered into the LIMS as quickly as possible.

9.2.2 New Accounts Information. LIMS data screens must be completed with the following information

9.2.2.1 Query the system to make sure that the account does not exist. To query LIMS in all Accutest locations, go to Maint, Client info, then F12 for Account or F11 for project search. A query of account information for any or all Accutest facilities can be initiated to determine if an account or project exists. If it does, use the same root name for the account code, or the same code if it matches an existing account name, state and city.

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9.2.2.2 All accounts must have a contact address, telephone number and fax number (optional)

9.2.2.3 Accounts are created under the Maintenance, Client Info headings in the LIMS. Create an account name as follows:

9.2.2.3.1 The maximum number of characters allowed by the system for accounts is 8.

9.2.2.3.2 If a submitter name is a multiple word name, use first initials of primary words only for the account name. Do not include initials for words such as Inc., Corp., Co., or LTD. Some examples are listed below.

Company	Account Name
All American Water Company	AAW
Franklin Twp. Health Dept.	FTHD
Handex of Western Pennsylvania	HOWP

9.2.2.3.3 If a company already uses some form of initials as their name or logo, then use their trademark or initials for the account name. Some examples are shown below.

Company	Account Name
Groundwater Technology, Inc.	GTI
MDL Consulting Group	MDL

9.2.2.3.4 If the submitter name is only one word (excluding Corp., Inc., etc.), then use the first three letters of the word as the account name. Never use the "&" in an account name. Some examples are shown below.

Company	Account Name
Handex	HAN
Aqualon	AQU
Claremont Co.	CLA
Hydronics Corp.	HYD

9.2.2.4 For companies with two word names, applying the above rules would often result in non-descriptive account names and potential duplication of two letter root names. To avoid this problem, the naming conventions must be flexible to allow for choosing account names that are unique and can be intuitively correlated with the company name. The name should be created by using three to four letters from the first and second words in the company name to create a more descriptive root name.

9.2.2.5 Clients with multiple offices will be designated by using up to 4 letters for the first part of the account name followed first by a 2 letter abbreviation for the state and then by a 1-2 letter abbreviation for the town. The town abbreviation may be obtained by either using the first letter of the town or, for a multiple word town, using the first letter of each word (example - Toms River would be TR).

9.2.2.6 Using the above rules, a new account set up for Absolute Environmental located in Tampa, Florida would be ABENFLT rather than AEFLT.

9.2.3 After the new account name has been created, enter the other account information. This should include, at a minimum, the contact name, address, telephone number and fax number.

9.2.4 After creating a new account, review all of the account information and check that it is correct.

9.3 New Projects

9.3.1 Before creating any new project for an account you must verify the project does not already exist. This can be done by using a query in the system. The query must be done in a number of different combinations to verify that the project does not exist.

9.3.2 Primary Client Information. Fill out the project information screen making sure that all of the relevant information is complete. Information that must be included on this form is outlined below.

9.3.2.1 Description - Name of Project, Address (including street, city, and state) if provided.

9.3.2.2 Project type

9.3.2.3 TA Time. This is the client's normal turn around time.

9.3.2.4 Project Manger

9.3.2.5 Client project number. This field is primarily populated by accounting and may contain Purchase Order or other billing information.

9.3.2.6 Terms. NET30 is the standard payment term.

9.3.2.7 Deliverable Type. This is the deliverable type required for the project.

9.3.2.8 State. This is the two letter abbreviation for state the project site is located in.

9.3.2.9 Soil ppm (Y/N). The default for this category is no. This means that organics soil results will be reported in ug/kg. If the client needs results reported in mg/kg (ppm) for organics, then an Y should be entered. However, this must remain the same for the life of the project.

9.3.2.10 CS Code. The client services code should be used to designate Accutest's internal project manager/client services associate.

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9.3.2.11 Sales Code. The sales code should be used to designate who's sales region this falls under

9.3.2.12 Reporting Addresses

9.3.2.13 Billing Address (entered by Accounting dept).

9.3.2.14 Number of report copies required.

9.3.3 Clients may send in the same project and write the project location differently, even though it is the same project. Examples of this include using a project number instead of a name, changing the way the location of the project is written or using abbreviations for the project location. Also, if the project location is at an intersection, the client may use the various street names. If a street is known by several different names, clients may use either or both of these names. For example, Route 522 is also referred to as Dayton-Jamesburg Road. **NOTE:** Do Not Create New Projects for These.

9.4 A new project may be set up by copying an existing project or by committing to create a new project. In either case, all the information outlined in 9.1 must be included in the project screen.

9.4.1 The information in 9.3.1 through 9.3.11 can be entered in one screen.

9.4.2 After the above information is entered, then page down and fill in the Address Type. All projects must have a reporting address type. The reporting address can be sent to a different person than the project manager. If the client requires multiple report copies or faxed data, it should also be entered here

9.5 Custody and Technical Information

9.5.1 After the project screens are completed, complete the individual sample custody information, analytical requirements, and hard copy deliverables requirements.

9.5.2 Primary Point of Collection. Enter the location and identifiers for each sample collected using the information on the chain of custody.

9.5.3 Analysis Requirements. Select the product codes for each sample. The product codes automatically link the sample into a specific department for scheduling

9.5.3.1 Product codes with definitions are found in the system under Maintenance in the Product definition area.

9.6 Specifications Review. After completing data entry, review the entered data for accuracy.

9.6.1 Print the login review report. This form details all information that was entered into the LIMS for the project. Use the original project information and chain of custody data for comparison

9.6.1.1 If errors are detected, correct them immediately and reprint the login review report. Email the laboratory manager/supervisor to inform them of the changes.

9.7 Change Orders. Change orders originate with the client services representative and are delivered to the login group via email.

9.7.1 The login supervisor prints a copy of the Email for scanning.

9.7.2 The login record is modified to reflect the change. The login review report is reprinted and is sent to the PM/CSA for verification.

9.7.3 Affected departments are notified of the change.

10.0 Creating New Product Codes

10.1 Product codes are standardized between Accutest offices.

10.1.1 The team leader at corporate (NJ) establishes new product codes. The new product codes are approved by the lab manager of that department.

10.1.2 The New Jersey Login supervisor creates or oversees the creation of all new product codes.

10.2 Procedure

10.2.1 Email the log in team leader at corporate (NJ) to have a new test code created.

10.2.2 Product codes should be limited to 10 characters (12 is the maximum allowed by the system) and must consist of the method, product definition, and exact department codes.

10.2.3 New organic product codes will consist of three distinct parts: the fraction, the method, and the list. Example test codes are shown below.

Fraction	Method	List
V	624	PPL
V	8240	TCL+
AB	625	PPL

10.2.4 Organic fractions will be designated using the letter codes shown below.

Code		Fraction	Example
V	=	Volatile	V624PPL
B	=	Base Neutral	B625PPL
A	=	Acid Extractable	A8270PPL
AB	=	Acid/Base Neutrals	AB8270TCL
D	=	Direct Injection	D8015METH
P	=	Pest and/or PCB	P608PPL
H	=	Herbicides	H8150HERB

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X	=	Package/Parent	XPP40
F	=	Field Analysis	SCONF

10.2.5 When creating an add-on test (i.e. Acetone, MTBE, and DIPE) use the format of fraction, department, plus symbol, and add-on compound. Examples are shown below.

Fraction	Dept.	Plus	Compound	Instructions/Comments
V	MS	+	MTBE	Added to V624PPL, V8240TC or V524STD, V8240TCL
V	GC	+	MTBE	Added to V6012PPL, V602STD or V502STD

10.2.6 Once the product code is approved, it can be created in the ACS system.

10.2.7 Go into the system into Maintenance and Product Definition. Before creating the new test code, query to make sure that the product code does not exist. If it does not, proceed with creating a new product.

10.2.8 Query up a product that is similar to the one you are creating or use the “Copy Products” command. Then use Options and Copy to copy the product. Modify the product name, pricing, product description, and method. Also verify that department paths are correct

10.2.9 After the product is created, review the entry for errors. Then notify the appropriate staff (normally area managers or supervisors) so that the product can be added to the appropriate group(s) and entry links can be created.

11.0Quality Assurance

11.1Following the review of the printed login review report, the login technician signs and dates the form.

11.2The job folder is sent to the client services representative/project manager for secondary review and signature on the login review report.

11.3The job folder then undergoes login peer review and the login review report is signed

11.4The job folder is then sent to the scanning department, where login review report is reviewed for sample ID, date and time. Then the chain of custody and the sample receipt confirmation form are scanned.

11.5Errors noted during the review are hand corrected and returned to the login technician for correction. After correction, the review process is re-initiated.

12.0Documentation

12.1Login review reports, field sheets, miscellaneous documentation and chains of custody are scanned into the Document (COC) database. Original COCs are kept on file for 1 year before being disposed of.

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13.0Pollution Prevention and Waste Management: NA

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Sample Receipt and Storage

Prepared by: Svetlana Izosimova Date: 10/07/09

Reviewed by: Randy Shields Date: 10/15/09

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Sample Receipt and Storage

Summary of changes: After hours sample delivery – sec. 3.2.6; IR Gun recording – sec. 3.2.1; Sec. 3.2.2 – editorial; record format in 24hr time and mm/dd/yy – sec. 5

1.0 Objective: To maintain documentation of custody of all bottle sets, samples, digestates, distillates, and extracts that fall under the responsibility of Accutest.

2.0 Responsibility: Sample Custodian

3.0 External Chain-of-Custody Procedure:

3.1 Samples are received via commercial carrier, client delivery, or are picked up by Accutest employees. Upon receipt, sample management inspects the outside of the container for signs of tampering, such as a torn or missing custody seal. The staff will review the custody document for the following information:

3.1.1 Client Information- Name / Address

3.1.2 Facility Information- Project name, Location, Project Number.

3.1.3 Field ID / Point of Collection- Date- Time-(HOLD TIMES) Samplers Initials- # of containers Shipped, Preservative types.

3.1.4 Matrix of samples: WW-waste water, GW-ground water, SW-surface water, DW-drinking water, SO-Soil, OTS-other solid, OTL-other liquid, AIR-air, FB-field blank, TB-trip blank.

3.1.5 Analytical Information- In particular we look for samples with Short Hold times such as 72 hrs or less remaining on analyses upon receipt. These samples are treated first and processed immediately. Labels are created and the samples are given directly to the appropriate lab. A Short Hold Notification Form is filled out and relinquished by the sample receiving technician, laboratory personnel accept the samples and a copy of the SHNF is placed in project folder.(See Attachment)

3.1.6 TURN AROUND TIME- Samples with a 6 day or less TAT are processed as soon as possible, depending on samples with short hold status.

3.1.7 Signature of whom the sample was relinquished by, and to whom it was relinquished. Should be in the following sequence. Client-Carrier-Laboratory. Per FL DEP SOPs signature shall consist of full signature – no initial – and affiliation.

3.1.8 Special Requirements and or comments- Compositing, filtering or preservation of samples, Extended sample storage etc.

3.2 The sample custodian accepts sample custody upon receipt of samples and verification that the custody document is correct. Sample conditions, sample temperature, and other observations, including custody seal condition, are documented in detail on the Sample Receipt Confirmation form.

3.2.1 Sample temperature is measured directly using an Infrared Thermometer. This thermometer is calibrated measuring the temperature off of white sample label against NIST-traceable liquid-in-glass thermometer – see SOP QA002. When recording the cooler temperature with the use of an IR gun the following needs to be documented on Sample Receipt Confirmation Form:

3.2.1.1 IR gun used.

3.2.1.2 Correction factor

3.2.1.3 Observed cooler temperature.

3.2.1.4 Corrected Cooler Temperature

3.2.2 Apply temperature correction factor for a face value – positive number to be added to direct reading temperature, negative correction factor to be subtracted.

3.2.3 **Samples must remain in coolers full of ice until it is time to process the job for login. Coolers received out of temperature range, have initial temp recorded and then have ice added until receive response from client.** 40 CFR part 136 and NELAC standards 2003 revision designate acceptable temperature as “above freezing and below 6°C”.

3.2.4 Any discrepancies or non-compliant situations are documented on the Sample Receipt Confirmation Form and then communicated to the Accutest Laboratories Southeast project manager assigned to the particular client., who then contacts the client for resolution. A system of red and yellow flags on the folders quickly identifies the chains of custody that have discrepancies. Red flags require the client be contacted before the samples can be logged in, such as missing COC’s, samples being out of hold, insufficient sample volume, bottles received not on COC or out of temperature range. If resolution of the problem is taking time, the samples are labeled as is and placed into refrigerated storage until the problems are resolved. Samples are then removed and adjusted accordingly. Yellow flags identify discrepancies that do not interfere with log-in and/or analysis of the samples, such

as 1 of 2 PAH bottles received broken or supplied. The resolution is documented and communicated to sample management for execution via a changeorder. (See attached forms)

3.2.5 Once the sample custodian is satisfied with the information on the chain of custody document, the job number is assigned with the next available Accutest Southeast job ID. Job numbers are prefixed with an 'F' followed by the sample number. Every different point of collection must have a different sample ID. The assigned sample ID must be written on the chain of custody, to the left of the line representing the sample unless there is insufficient space. Sample ID's are then placed to the right of the sample ID. The custodian then assigns a unique sample identifier to each sample container.

3.2.6 **After Hours Delivery Procedure**. Upon return to the lab Accutest-employed couriers will check and record temperature of coolers with the use of IR gun (sec. 3.2.1). Couriers will have to start the Sample Receipt Confirmation Form – without assigning F#### job number – and initial the recorded temperatures. This form is attached to the existing CoC. Coolers will be placed into Refrigerated storage until Sample Receiving Technicians can process the coolers. Sample Receiving technicians will arrive first thing in the morning to verify Short Holds, Rushes etc as per sec. 3.1.5 and 3.1.6.

3.3 When assigning a job number, job information on the chain of custody is entered in the sample receipt logbook (see attached). The following information shall be documented in the sample receipt logbook:

3.3.1 Accutest Labs Southeast Assigned Job #
3.3.2 Client Name
3.3.3 Project Name
3.3.4 Date Samples Received.
3.3.5 # of coolers Received.
3.3.6 Courier Information
3.3.7 Skif # (Sample Kit Information Sheet)
3.3.8 Technician Initials

3.4 The sample custodian then checks the samples' preservation, with the exception of the volatile samples, which are checked by the analyst after the sample is analyzed. Should a sample be received preserved incorrectly the following actions are taken.

3.4.1 pH and residual chlorine: The pH is ascertained by using narrow-range pH paper and applying the sample with a disposable pipette. (HNO3, H2SO4, NAOH and NAOH ZNAC Samples)(Per Sample) Residual chlorine presence/absence is measured using potassium iodide/starch paper in samples or EPA 600 series and samples originated in North Carolina (one bottle per well).

3.4.2 Pesticides/PCB's/Semivolatile Organic aqueous samples with residual chlorine present: Add 1 ml of 8% sodium thiosulfate solution per 1liter (0.008%) to all containers except VOA. Record event on Sample Receipt Confirmation Form and in sample preservation logbook

3.4.3 Cyanide is preserved to pH ≥ 12 using 10N NaOH, prepared by WetChem personnel.

3.4.4 Sulfide is preserved to pH ≥ 9 using 10N NaOH and Zn acetate, prepared by WetChem personnel.

3.4.5 Aqueous samples for metals are preserved to pH ≤ 2 with nitric acid, prepared by WetChem Personnel. These samples are marked with colored label "**Metals Sample Received Unpreserved. Preserved Date_____Time_____ Analyze after 24 hours".** For correctly preserved aqueous metals sampling date and time from COC is recorded as date and time of preservation.

3.4.6 Aqueous samples for TRPH and some WetChem parameters are preserved to a pH of ≤2 with H2SO4, prepared by WetChem Personnel.

3.5 If Sample volume is incorrect for the requested tests, insufficient sample volume will be recorded on sample receipt confirmation, the folder will be flagged with a red sticker and the project manager will contact the client immediately for further instruction. Any comments should be noted in detail, such as obvious headspace in VOA vials or TOX bottles, leaking bottles, or broken bottles, on the Sample Receipt Confirmation form and given to the project manager to resolve with the client on how to proceed with the samples. The form is filed in the job folder with the chain of custody and any other paperwork relevant to the job.

3.6 Incorrectly preserved samples have the proper amount of Preservative added, upon confirmation from PM or Client, volume added is recorded on the Sample Receipt Confirmation form and in preservative adjustment log. The same volume and type of preservative is then added to the Equipment Blank and/or Field Blank, regardless of pH reading. Volume added is recorded on the Sample Receipt Confirmation form and in the preservative adjustment log. Also see Sec. 3.4.5.

Job Number, Sample ID, Bottle Number, Parameter, Preservative Type, Preservative Lot, and Amount of Pres. Added. Date/Time Added and the technician's initials.

3.7 All bottles must be labeled. Each bottle will be labeled both on the cap and on the bottle. VOA vials have the label wrapped around the top of the vial, just below the cap. The labels are generated by the electronic sample receipt log. The following information is entered into the electronic log:

3.7.1 Job #:
3.7.2 Client Name and Project
3.7.3 Date and time samples were received.
3.7.4 The number of coolers received
3.7.5 The temperature of each cooler
3.7.6 Initials of custodian logging in the job
3.7.7 Number of samples
3.7.8 Number of bottles
3.7.9 Bottle type

3.7.10 Preservative by code. Preservatives codes are:

"1" = preservative is checked by analyst
"2" = not applicable
"3" = correctly preserved for the analysis requested

3.7.11 Bottle storage location

3.7.12 Department to do the analysis

3.7.13 The information is saved and labels can be printed.

3.8 The following information must be on the bottle:

3.8.1 The sample number and bottle number
3.8.2 Storage location
3.8.3 The preservative used during sampling as indicated on the chain
3.8.4 Any hazard the Sample Custodian may be aware of

3.9 The samples must be placed in their assigned locations and kept at above freezing and below 6°C until preparation and/or analysis. Water samples preserved with HNO_3 for metals analyses are stored at room temperature. Access to the area is limited.

3.10 The original chain of custody, the Sample Receipt Confirmation form, Subcontract COC and any additional documented information relative to the job, is put in the folder indicated with the job number and forwarded to computer log in.

4.0 Sample Storage Temperature:

4.1 While in the laboratory, samples shall be stored in limited-access, temperature – controlled areas. Refrigerators shall be monitored for temperature daily. Acceptance criteria for the temperature of refrigerator is above freezing and below 6°C* (NELAC 2003 5.5.8.4) and is listed in the refrigerator log.

Thermometers that have been calibrated with a NIST traceable thermometer monitor all cold storage areas. As indicated by the finding of the calibration, a correction factor is applied to each thermometer for a face value. Records that include acceptance criteria shall be maintained.

*According to NELAC 2003 5.5.8.3.1 temperature "in transit" can be between 0 – 6.0°C, when specified storage temperature is 4°C.

4.2 Samples for volatile organics determination shall be stored separately from other samples, standards, and sample extracts. Acceptance criteria for the temperature of a volatile refrigerator is 0.5 to 6.0 °C and is listed in the refrigerator's log. VOC Soil freezers are maintained at –15.0 +/- 5.0°C. Sample storage area for volatile organics shall be monitored for cross contamination through the use of refrigerator blanks. Refrigerator blanks shall be analyzed every other week.

4.2.1 If a contaminant is detected in the refrigerator blank, it must be reanalyzed to confirm the contaminant.

4.2.2 If confirmed, the samples must be removed from the refrigerator and placed in coolers with ice, or in alternate refrigerated storage.

4.2.3 All samples received after the date of the last clean refrigerator blank must be checked for the same contaminants. If present, they must be reported and flagged with a qualifier indicating possible lab contamination.

4.2.4 The source of the contamination must be located and removed.

4.2.5 A new refrigerator blank is then placed in the refrigerator and analyzed after 24 hours.

4.2.6 Samples may be returned to the refrigerator when all contaminants are removed as indicated by the analysis of a refrigerator blank without contamination.

5.0 Documentation

All samples received by Accutest must come with a chain-of-custody (COC). Special attention shall be paid to client-specific COCs.

Accutest personnel MUST record dates and time in **mm/dd/yy 24:00** format, and both observed and corrected temperatures.

6.0 References

6.1 NELAC Standards, current revision
6.2 State of Florida DEP SOPs

6.3 40 CFR, Part 136.
6.4 DoD QSM Final Version 4.1, 2009

Sample and Laboratory Waste Disposition

Prepared by: Svetlana Izosimova Date: 04/18/2007

Reviewed by: Aaron S. Ben David Date: 04/18/2007

Annual Review

Reviewed by: Svetlana Izosimova Date: 07/16/2008

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TITLE: **Sample and Laboratory Waste Disposition**

Summary of changes: Added PCB HazWaste handling procedure – sec. 4.1.5 and 4.2.4.

REFERENCES: Florida DEP Hazardous Waste; 40 CFR, Part 261

1.0 Scope and Application

The disposal of samples and lab waste adhering to Florida State and Federal Regulations.

2.0 Summary

This SOP describes the procedures used by Accutest Laboratories to properly and safely dispose of samples and laboratory wastes; hazardous and non-hazardous; domestic and foreign.

3.0 Definitions

3.1 Foreign sample: Samples from sites that are outside the continental United States.

3.2 Hazardous Sample or Waste: A material is considered hazardous if it is listed in the Code of Federal Regulations, 40 CFR, Part 261 or it demonstrates any of the hazardous characteristics including, ignitability, corrosivity, reactivity, or has demonstrated toxicity.

4.0 Procedure

Sample Disposal: Samples are kept in appropriate storage for a minimum of 30 days after the report is sent to the client unless otherwise specified by client. The samples are divided into three categories: Aqueous, Soil, and Non-aqueous liquid.

4.1 Aqueous Samples

4.1.1 A disposal list is generated by computer, based on either reporting dates or sample number range. The disposal list consists of Job #, Sample #, Matrix, Storage Location, Received date, Released date, Account, Project and Hazard Status. (See attached)

4.1.2 Samples are then removed from the refrigerators and/or cabinets, and are separated as non-hazardous (non-detected or normal) and hazardous (positive result) samples.

4.1.3 Non-hazardous samples are neutralized in the sink in Sample Receiving department and flushed down the drain with tap water. Final volume and pH of the sample disposed is recorded in logbook.

4.1.4 ALSE contract disposal company segregates hazardous aqueous samples into the appropriate waste drums for disposal.

4.1.5 Samples containing PCB in excess of 50 ppm are automatically flagged by LIMS on disposal list. These samples are labeled with distinct PCB label and segregated from the rest of waste samples to be disposed of in LabPak.

4.1.6 Some samples, on a case by case basis, are returned to the client for disposal.

4.2 Soil Samples

4.2.1 Domestic Soil Samples (DSS) are placed in drums after the storage period, either in a hazardous or non-hazardous drum per the samples' status on the disposal sheets.

4.2.2 When the drums are full, they are then sampled and analyzed to determine their hazardous constituents (Full TCLP, RCI, and PCBs).

4.2.3 Based on the results of analysis, the drums are then either disposed of as hazardous or non-hazardous by our contract disposal company.

4.2.4 Samples containing PCB in excess of 50 ppm are automatically flagged by LIMS on disposal list. These samples are labeled with distinct PCB label and segregated from the rest of waste samples to be disposed of in LabPak.

4.2.5 Some samples, on a case by case basis, will be returned to the client for disposal.

4.2.6 Foreign soil samples (FSS) come in vials (volatile organic analysis) or jars. After minimum 60-day hold period, but not to exceed 6 months, these FSS are disposed of in the following manner.

4.2.6.1 FSS vials: Vial samples are preserved either with methanol or DI water. Vials with water are decontaminated by removing the caps, placing the vials in racks and heating the vials to 154.5 to 192.5°C (310 to 379°F) for 30 minutes in an oven. Timing starts when the entire mass reaches the desired temperature. The cooled soil is placed into a drum per the hazard status on the disposal sheets. Vials with methanol must be filtered. The filtrate(methanol) is disposed of in the non-chlorinated solvent waste drum. The soil is then drummed per the hazard status on the disposal sheets.

4.2.6.2 FSS Solids: FSS in jars are emptied into aluminum trays. They are heat-treated, along with the jars and caps in pans, in

the oven for 30 minutes at 154.5 to 192.5°C (310 to 379°F). Afterwards the soil is placed in the appropriate drum.

4.3 Non-aqueous liquid samples

4.3.1 Non-aqueous samples are placed in drums after the hold period.

4.3.2 When the drums are full, they are then sampled and analyzed to determine their hazardous constituents (PCBs). Drums have a 6 month expiration time. If the drum is not full by then it is analyzed and picked up by our contract disposal company.

4.3.3 Based on the results of analysis, the drums are then either disposed of as hazardous or non-hazardous by our contract disposal company.

4.3.4 Samples, on a case by case basis, will be returned to the client for disposal.

4.4 Sample Containers

4.4.1 Containers from samples deemed Non-Hazardous are immediately disposed of into a waste container provided by waste management services specifically for Accutest Laboratories Southeast direct use. A lock and key has been installed to keep the containers use limited to Accutest only.

4.4.2 Containers from samples deemed hazardous are disposed of into the Hazardous waste solids drum.

4.4.3 Waste Management services picks the container up on a weekly basis and brings to the local sort facility where contents are destroyed - recycled.

4.5 Laboratory Waste Disposal:

4.5.1 All materials determined to be hazardous are containerized in appropriate vessels (i.e.: drums). A waste is considered hazardous if it is listed in the Code of Federal Regulations, 40 CFR, Part 261 or it demonstrates any of the hazardous characteristics including, ignitability, corrosivity, reactivity, or has demonstrated toxicity. Our contract disposal company disposes of the drums.

4.5.2 WASTE DRUMS are separated by type:

4.5.3 Chlorinated Waste (Closed Top Steel)- Methylene Chloride

4.5.4 Non-Chlorinated Waste (Closed Top Steel)- Hexane, Methanol, and mixed solvents

4.5.5 Sodium Sulfate/Used Charcoal (Open Top Steel)- Charcoal and paper filters used in the filtering of samples.

4.5.6 Non Hazardous Aqueous Vials (Open Top Poly)- Pimarily Acid Vials

4.5.7 Hazardous Flammable Vials (Open Top Poly)- Methylene Chloride, Hexane.

4.5.8 Hazardous Aqueous waste (Closed Top Poly)- High Odor Samples, Lachate Waste.

4.5.9 Non Hazardous Soil (Open Top Steel)- Soils

4.5.10 Hazardous Solid Waste- (Open Top Steel)

4.5.11 Non-Aqueous/Oil Samples- (Closed Top Steel)

4.5.12 Disposal is done as conscientiously as possible following guidelines set forth by both the State of Florida and our contract disposal company. Management and proper handling is necessary to void any violation. The guidelines change depending on how much waste is generated on a monthly basis:

4.5.12.1 Less than 220 pounds (100 kilograms or about half a drum) is a “Conditionally Exempt Small Quantity Generator”.

4.5.12.2 A “Small Quantity Generator” generates 220-2,200 pounds (100-1,000 kilograms or about half a drum to 5 drums)

4.5.12.3 More than 2,200 pounds (100-1,000 kilograms or more than about 5 drums) is a “Large quantity Generator”.

4.5.12.4 Accutest Laboratories SE is considered a “Small Quantity Generator”.

4.6 Waste Containers and Storage

4.6.1 Containers must be maintained in good condition at all times. Care must be taken to prevent leaks, ruptures, and the accumulation of rainwater on tops of the drums.

4.6.2 Waste containers must be kept closed at all times, except when waste is being transferred to drum.

4.6.3 The containers must be compatible with the waste being stored (i.e. acids should not be stored in metal drums). Never store incompatible wastes in

the same container (i.e. acids and bases). Containers must be stored in such a way to accommodate inspection for leaks and damage from all sides

4.6.4 Each waste container must be labeled with the following information.

4.6.4.1 Type and nature of waste (soil, oil, hazardous, non-hazardous)

4.6.4.2 Waste generator's name and address

4.6.4.3 Manifest document number

4.6.4.4 Proper DOT shipping name and identification number

4.6.4.5 Accumulation start date (change to storage date when container is full)

4.6.4.6 In addition, a hazardous waste must have the words "HAZARDOUS WASTE. FEDERAL LAW PROHIBITS IMPROPER DISPOSAL. IF FOUND, PLEASE CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY" prominently displayed on the container.

4.6.5 Inspection and Records

4.6.5.1 Containers must be inspected weekly. All records must be kept on file for three years. The records, which must be kept on file, include:

4.6.5.1.1 A written log of the inspections
4.6.5.1.2 Manifests and shipping receipts
4.6.5.1.3 Results of laboratory analyses of the wastes
4.6.5.1.4 Land Disposal Restriction form

5.0 Health and Safety

5.1 All employees who handle waste materials should wear full protective clothing including safety glasses &/or face shield, gloves, boots, lab coat or a Tyvek suit, and air-purifying respirator. Direct skin contact with waste materials should be avoided.

5.2 If an employee has accidentally been exposed to a hazardous waste, the individual should rinse the affected areas thoroughly under a safety shower for at least 15 minutes. If the individual begins to exhibit any adverse effects from the exposure, he should be immediately transported to the nearest hospital

emergency room. Employees are referred to the Material Safety Data Sheets for specific instructions on exposure to hazardous substances.

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Compound List Report
Product: V8260TCL Volatile Organics, TCL

Compound	CAS No.	LOQ	LOD	DL	Units
1,1,1,2-Tetrachloroethane	630-20-6	1	0.2	0.2	ug/l
1,1,1-Trichloroethane	71-55-6	1	0.22	0.22	ug/l
1,1,1-Trichloroethane	71-55-6	1	0.22	0.22	ug/l
1,1,2,2-Tetrachloroethane	79-34-5	1	0.29	0.29	ug/l
1,1,2,2-Tetrachloroethane	79-34-5	1	0.29	0.29	ug/l
1,1,2-Trichloroethane	79-00-5	1	0.29	0.29	ug/l
1,1,2-Trichloroethane	79-00-5	1	0.29	0.29	ug/l
1,1-Dichloroethane	75-34-3	1	0.22	0.22	ug/l
1,1-Dichloroethylene	75-35-4	1	0.29	0.29	ug/l
1,1-Dichloropropene	563-58-6	1	0.25	0.25	ug/l
1,2,3-Trichlorobenzene	87-61-6	1	0.5	0.5	ug/l
1,2,3-Trichloropropane	96-18-4	2	0.37	0.37	ug/l
1,2,4-Trichlorobenzene	120-82-1	1	0.5	0.5	ug/l
1,2,4-Trimethylbenzene	95-63-6	2	0.22	0.22	ug/l
1,2-Dibromo-3-chloropropane	96-12-8	2	0.59	0.59	ug/l
1,2-Dibromoethane	106-93-4	1	0.23	0.23	ug/l
1,2-Dichloroethane	107-06-2	1	0.33	0.33	ug/l
1,2-Dichloropropane	78-87-5	1	0.27	0.27	ug/l
1,2-Dichloropropane	78-87-5	1	0.27	0.27	ug/l
1,3,5-Trimethylbenzene	108-67-8	2	0.21	0.21	ug/l
1,3-Dichloropropane	142-28-9	1	0.28	0.28	ug/l
2,2-Dichloropropane	594-20-7	1	0.37	0.37	ug/l
2-Chloroethyl vinyl ether	110-75-8	5	1.1	1.1	ug/l
2-Hexanone	591-78-6	10	5	5	ug/l
4-Methyl-2-pentanone	108-10-1	5	2	2	ug/l
Acetone	67-64-1	25	10	10	ug/l
Acrolein	107-02-8	20	10	10	ug/l
Acrylonitrile	107-13-1	10	3	3	ug/l
Benzene	71-43-2	1	0.21	0.21	ug/l
Bromochloromethane	74-97-5	1	0.23	0.23	ug/l
Bromodichloromethane	75-27-4	1	0.28	0.28	ug/l
Bromoform	75-25-2	1	0.24	0.24	ug/l
Carbon disulfide	75-15-0	2	0.4	0.4	ug/l
Carbon tetrachloride	56-23-5	1	0.34	0.34	ug/l
Chlorobenzene	108-90-7	1	0.2	0.2	ug/l
Chloroethane	75-00-3	2	0.51	0.51	ug/l
Chloroform	67-66-3	1	0.25	0.25	ug/l
cis-1,2-Dichloroethylene	156-59-2	1	0.32	0.32	ug/l
cis-1,3-Dichloropropene	10061-01-5	1	0.2	0.2	ug/l
Dibromochloromethane	124-48-1	1	0.33	0.33	ug/l
Dichlorodifluoromethane	75-71-8	2	0.67	0.67	ug/l
Ethylbenzene	100-41-4	1	0.2	0.2	ug/l

Hexachlorobutadiene	87-68-3	2	0.4	0.4	ug/l
Isopropylbenzene	98-82-8	1	0.2	0.2	ug/l
m-Dichlorobenzene	541-73-1	1	0.29	0.29	ug/l
Methyl bromide	74-83-9	2	0.78	0.78	ug/l
Methyl chloride	74-87-3	2	0.5	0.5	ug/l
Methyl ethyl ketone	78-93-3	5	2	2	ug/l
Methyl Tert Butyl Ether	1634-04-4	1	0.25	0.25	ug/l
Methylene bromide	74-95-3	2	0.27	0.27	ug/l
Methylene chloride	75-09-2	5	2	2	ug/l
Naphthalene	91-20-3	5	1	1	ug/l
n-Butylbenzene	104-51-8	1	0.24	0.24	ug/l
n-Propylbenzene	103-65-1	1	0.2	0.2	ug/l
o-Chlorotoluene	95-49-8	1	0.25	0.25	ug/l
o-Dichlorobenzene	95-50-1	1	0.26	0.26	ug/l
p-Chlorotoluene	106-43-4	1	0.23	0.23	ug/l
p-Dichlorobenzene	106-46-7	1	0.22	0.22	ug/l
p-Isopropyltoluene	99-87-6	1	0.21	0.21	ug/l
sec-Butylbenzene	135-98-8	1	0.23	0.23	ug/l
Styrene	100-42-5	1	0.2	0.2	ug/l
tert-Butylbenzene	98-06-6	1	0.24	0.24	ug/l
Tetrachloroethylene	127-18-4	1	0.44	0.44	ug/l
Toluene	108-88-3	1	0.2	0.2	ug/l
trans-1,2-Dichloroethylene	156-60-5	1	0.34	0.34	ug/l
trans-1,3-Dichloropropene	10061-02-6	1	0.22	0.22	ug/l
Trichloroethylene	79-01-6	1	0.24	0.24	ug/l
Vinyl Acetate	108-05-4	10	2.4	2.4	ug/l
Vinyl chloride	75-01-4	1	0.28	0.28	ug/l
Xylene (total)	1330-20-7	3	0.54	0.54	ug/l

Dibromofluoromethane	1868-53-7
1,2-Dichloroethane-D4	17060-07-0
Toluene-D8	2037-26-5
4-Bromofluorobenzene	460-00-4

35 compounds and 4 surrogates reported in list VTCL

(a) Addon product code: VMS+NAP

MS/MSD	RPD	BS	DUP
81-119	10	81-119	10
79-133	11	79-133	11
79-133	11	79-133	11
71-120	11	71-120	11
71-120	11	71-120	11
80-114	11	80-114	11
80-114	11	80-114	11
82-127	10	82-127	10
75-133	13	75-133	13
87-127	10	87-127	10
64-126	16	64-126	16
77-115	12	77-115	12
68-123	11	68-123	11
82-120	10	82-120	10
61-118	15	61-118	15
80-115	10	80-115	10
76-122	11	76-122	11
81-120	11	81-120	11
81-120	11	81-120	11
83-123	10	83-123	10
81-113	11	81-113	11
77-138	12	77-138	12
63-125	24	63-125	24
58-125	14	58-125	14
62-125	13	62-125	13
59-134	14	59-134	14
33-157	21	33-157	21
62-124	13	62-124	13
83-124	11	83-124	11
78-112	10	78-112	10
76-116	10	76-116	10
68-128	11	68-128	11
67-147	12	67-147	12
74-139	13	74-139	13
87-115	9	87-115	9
54-166	20	54-166	20
85-123	10	85-123	10
81-114	10	81-114	10
83-119	10	83-119	10
74-116	11	74-116	11
34-158	22	34-158	22
87-118	10	87-118	10

71-133	12	71-133	12	
87-131	10	87-131	10	
86-115	9	86-115	9	
55-151	21	55-151	21	
55-173	22	55-173	22	
61-127	13	61-127	13	
75-116	10	75-116	10	
81-116	10	81-116	10	
69-125	11	69-125	11	
59-125	15	59-125	15	(a)
84-124	10	84-124	10	
86-125	10	86-125	10	
84-121	10	84-121	10	
85-115	9	85-115	9	
84-120	10	84-120	10	
87-113	10	87-113	10	
83-125	9	83-125	9	
86-127	10	86-127	10	
78-118	11	78-118	11	
83-126	10	83-126	10	
80-131	12	80-131	12	
86-116	10	86-116	10	
82-126	10	82-126	10	
87-123	10	87-123	10	
85-124	10	85-124	10	
38-159	11	38-159	11	
57-153	22	57-153	22	
86-120	10	86-120	10	

Surrogate Limits:	87-116
Surrogate Limits:	76-127
Surrogate Limits:	86-112
Surrogate Limits:	84-120

Compound List Report
Product: AB8270TCL Semivolatiles, TCL

Compound	CAS No.	LOQ	LOD	DL	Units
Benzoic Acid	65-85-0	25	10	2.16	ug/l
2-Chlorophenol	95-57-8	5	1	0.64	ug/l
4-Chloro-3-methyl phenol	59-50-7	5	1	0.52	ug/l
2,4-Dichlorophenol	120-83-2	5	1	0.52	ug/l
2,4-Dimethylphenol	105-67-9	5	1	0.39	ug/l
2,4-Dinitrophenol	51-28-5	25	10	6.03	ug/l
4,6-Dinitro-o-cresol	534-52-1	10	1	0.95	ug/l
2-Methylphenol	95-48-7	5	1	0.63	ug/l
3&4-Methylphenol		5	1.6	1.53	ug/l
2-Nitrophenol	88-75-5	5	1	0.61	ug/l
4-Nitrophenol	100-02-7	25	10	1.8	ug/l
Pentachlorophenol	87-86-5	25	10	0.93	ug/l
Phenol	108-95-2	5	1	0.67	ug/l
2,4,5-Trichlorophenol	95-95-4	5	1	0.52	ug/l
2,4,6-Trichlorophenol	88-06-2	5	1	0.52	ug/l
Acenaphthene	83-32-9	5	1	0.79	ug/l
Acenaphthylene	208-96-8	5	1	0.7	ug/l
Anthracene	120-12-7	5	1	0.55	ug/l
Benzo(a)anthracene	56-55-3	5	1	0.37	ug/l
Benzo(a)pyrene	50-32-8	5	1	0.48	ug/l
Benzo(b)fluoranthene	205-99-2	5	1	0.46	ug/l
Benzo(g,h,i)perylene	191-24-2	5	1	0.39	ug/l
Benzo(k)fluoranthene	207-08-9	5	1	0.45	ug/l
4-Bromophenyl phenyl ether	101-55-3	5	1	0.84	ug/l
Butyl benzyl phthalate	85-68-7	5	1	0.33	ug/l
Benzyl Alcohol	100-51-6	5	1	0.66	ug/l
2-Chloronaphthalene	91-58-7	5	1	0.83	ug/l
4-Chloroaniline	106-47-8	5	1	0.55	ug/l
Carbazole	86-74-8	5	1	0.36	ug/l
Chrysene	218-01-9	5	1	0.41	ug/l
bis(2-Chloroethoxy)methane	111-91-1	5	1	0.49	ug/l
bis(2-Chloroethyl)ether	111-44-4	5	1	0.56	ug/l
bis(2-Chloroisopropyl)ether	108-60-1	5	1	0.64	ug/l
4-Chlorophenyl phenyl ether	7005-72-3	5	1	0.91	ug/l
1,2-Dichlorobenzene	95-50-1	5	1	0.75	ug/l
1,3-Dichlorobenzene	541-73-1	5	1	0.69	ug/l
1,4-Dichlorobenzene	106-46-7	5	1	0.73	ug/l
2,4-Dinitrotoluene	121-14-2	5	1	0.52	ug/l
2,6-Dinitrotoluene	606-20-2	5	1	0.51	ug/l
3,3'-Dichlorobenzidine	91-94-1	10	2	0.31	ug/l
Dibenzo(a,h)anthracene	53-70-3	5	1	0.54	ug/l

Dibenzofuran	132-64-9	5	1	0.62	ug/l
Di-n-butyl phthalate	84-74-2	5	1	0.36	ug/l
Di-n-octyl phthalate	117-84-0	5	1	0.35	ug/l
Diethyl phthalate	84-66-2	5	2	0.45	ug/l
Dimethyl phthalate	131-11-3	5	1.1	1.1	ug/l
bis(2-Ethylhexyl)phthalate	117-81-7	5	2	0.45	ug/l
Fluoranthene	206-44-0	5	1	0.3	ug/l
Fluorene	86-73-7	5	1	0.71	ug/l
Hexachlorobenzene	118-74-1	5	1	0.75	ug/l
Hexachlorobutadiene	87-68-3	5	2.6	2.56	ug/l
Hexachlorocyclopentadiene	77-47-4	10	4.9	4.81	ug/l
Hexachloroethane	67-72-1	5	2.2	2.19	ug/l
Indeno(1,2,3-cd)pyrene	193-39-5	5	1	0.43	ug/l
Isophorone	78-59-1	5	1	0.46	ug/l
1-Methylnaphthalene	90-12-0	5	1	0.78	ug/l
2-Methylnaphthalene	91-57-6	5	1	0.66	ug/l
2-Nitroaniline	88-74-4	5	1	0.7	ug/l
3-Nitroaniline	99-09-2	5	1	0.61	ug/l
4-Nitroaniline	100-01-6	5	1	0.33	ug/l
Naphthalene	91-20-3	5	1	0.72	ug/l
Nitrobenzene	98-95-3	5	1	0.53	ug/l
N-Nitroso-di-n-propylamine	621-64-7	5	1	0.54	ug/l
N-Nitrosodiphenylamine	86-30-6	5	1	0.36	ug/l
Phenanthrene	85-01-8	5	1	0.65	ug/l
Pyrene	129-00-0	5	1	0.44	ug/l
1,2,4-Trichlorobenzene	120-82-1	5	1	0.86	ug/l

2-Fluorophenol	367-12-4
Phenol-d5	4165-62-2
2,4,6-Tribromophenol	118-79-6
Nitrobenzene-d5	4165-60-0
2-Fluorobiphenyl	321-60-8
Terphenyl-d14	1718-51-0

Control Limits (%) Rev: 01/16/07

MS/MSD		RPD	BS	DUP
	Oct-50	40	Oct-50	40
44-103		29	44-103	29
53-105		24	53-105	24
53-108		26	53-108	26
37-91		28	37-91	28
37-111		30	37-111	30
62-115		26	62-115	26
35-91		30	35-91	30
32-85		29	32-85	29
49-111		30	49-111	30
13-55		31	13-55	31
57-118		26	57-118	26
13-54		34	13-54	34
59-106		23	59-106	23
58-107		24	58-107	24
58-106		21	58-106	21
58-105		21	58-105	21
65-108		19	65-108	19
63-111		19	63-111	19
62-106		20	62-106	20
63-109		20	63-109	20
61-111		21	61-111	21
64-111		20	64-111	20
64-107		20	64-107	20
59-114		20	59-114	20
34-98		27	34-98	27
54-105		24	54-105	24
53-103		22	53-103	22
66-109		20	66-109	20
64-111		19	64-111	19
48-101		28	48-101	28
51-108		27	51-108	27
43-106		27	43-106	27
61-107		20	61-107	20
41-102		28	41-102	28
38-100		28	38-100	28
40-100		28	40-100	28
60-109		20	60-109	20
58-104		21	58-104	21
57-105		25	57-105	25
62-112		20	62-112	20

61-108	20	61-108	20
62-109	20	62-109	20
60-120	24	60-120	24
62-109	19	62-109	19
63-106	19	63-106	19
59-116	21	59-116	21
65-114	21	65-114	21
61-106	19	61-106	19
62-107	20	62-107	20
38-107	30	38-107	30
19-84	35	19-84	35
35-101	29	35-101	29
61-113	20	61-113	20
56-111	26	56-111	26
52-102	25	52-102	25
56-112	26	56-112	26
60-109	20	60-109	20
52-107	21	52-107	21
59-111	21	59-111	21
50-104	28	50-104	28
52-105	28	52-105	28
51-104	28	51-104	28
57-110	19	57-110	19
65-108	20	65-108	20
60-113	20	60-113	20
45-104	28	45-104	28

Surrogate Limits:	14-62
Surrogate Limits:	Oct-40
Surrogate Limits:	33-118
Surrogate Limits:	42-108
Surrogate Limits:	40-106
Surrogate Limits:	39-121

Method Ref: SW846 8310
Polynuclear Aromatic Hydrocarbons

Compound	CAS No.	LOQ	LOD	DL	Units
Acenaphthene	83-32-9	2	1	0.059	ug/l
Acenaphthylene	208-96-8	2	1	0.066	ug/l
Anthracene	120-12-7	2	1	0.018	ug/l
Benzo(a)anthracene	56-55-3	0.2	0.05	0.018	ug/l
Benzo(a)pyrene	50-32-8	0.2	0.05	0.019	ug/l
Benzo(b)fluoranthene	205-99-2	0.2	0.05	0.022	ug/l
Benzo(g,h,i)perylene	191-24-2	0.2	0.1	0.032	ug/l
Benzo(k)fluoranthene	207-08-9	0.2	0.05	0.018	ug/l
Chrysene	218-01-9	2	0.5	0.014	ug/l
Dibenzo(a,h)anthracene	53-70-3	0.2	0.05	0.016	ug/l
Fluoranthene	206-44-0	2	0.5	0.027	ug/l
Fluorene	86-73-7	2	1	0.036	ug/l
Indeno(1,2,3-cd)pyrene	193-39-5	0.2	0.05	0.039	ug/l
Naphthalene	91-20-3	2	1	0.038	ug/l
1-Methylnaphthalene	90-12-0	2	0.5	0.058	ug/l
2-Methylnaphthalene	91-57-6	2	0.5	0.044	ug/l
Phenanthrene	85-01-8	2	1	0.035	ug/l
Pyrene	129-00-0	2	0.5	0.032	ug/l
o-Terphenyl	84-15-1				
p-Terphenyl	92-94-4				

18 compounds and 2 surrogates reported in list B8310

Control Limits (%)

MS/MSD	RPD	BS	DUP
60-102	33	60-102	33
66-108	32	66-108	32
64-107	28	64-107	28
70-108	19	70-108	19
72-115	20	72-115	20
73-111	20	73-111	20
69-113	22	69-113	22
70-111	21	70-111	21
71-111	20	71-111	20
71-114	23	71-114	23
68-110	17	68-110	17
63-102	25	63-102	25
69-110	22	69-110	22
55-94	28	55-94	28
55-97	29	55-97	29
51-97	25	51-97	25
67-108	22	67-108	22
71-107	17	71-107	17

Surrogate Limits: 43-121

Surrogate Limits: 30-122

Compound List Report
Product: FLPRO Total Petroleum Hydrocarbons by FLPRO

Compound	CAS No.	LOQ	LOD	DL	Units
TPH (C8-C40)		0.25	0.17	0.046	mg/l
o-Terphenyl	84-15-1				

1 compounds and 1 surrogates reported in list

Control Limits (%) Rev: 01/16/07

MS/MSD	RPD	BS	DUP
54-110	28	54-110	28

Surrogate Limits: 38-122

Parameter	Method	Units	LOQ	LOD	DL	BS/MS/MSD	%RSD
Sulfide	SM4500S=F	mg/l	1	0.6	0.54	76-112	34
TOC*	SM5310B/9060	mg/l	1	0.5	0.076	90-110	20
Sulfate	EPA 300/9056	mg/l	2	1	0.467	90-110	20

*Inorganic carbon is calculated from Total Carbon and TOC. The limits are the same.

APPENDIX D

LABORATORY DoD ELAP CERTIFICATION

LABORATORY ACCREDITATION BUREAU

Certificate # L2229

Scope of Accreditation For Accutest Laboratories Southeast, Inc

4405 Vineland Rd, Ste C-15
Orlando, FL 32811
Svetlana Izosimova, Ph.D., QA Officer
1-407-425-6700

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to Accutest Laboratories Southeast, Inc. to perform the following tests:

Accreditation granted through: December 15, 2012

Testing - Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	8011	1,2-Dibromoethane (EDB)
GC	8011	1,2-Dibromo-3-Chloropropane (DBCP)
GC	8015C	Diesel range organics (DRO)
GC	8015C	Oil Range Organics (ORO)
GC	8015C	Gasoline range organics (GRO)
GC	8015C	Ethanol
GC	8015C	2-Ethoxyethanol
GC	8015C	Isobutyl alcohol (2-Methyl-1-propanol)
GC	8015C	Isopropyl alcohol (2-Propanol)
GC	8015C	Methanol
GC	8015C	n-Butyl alcohol
GC	8015C	n-Propanol
GC	8015B	Diesel range organics (DRO)
GC	8015B	Oil Range Organics (ORO)
GC	8015B	Gasoline range organics (GRO)
GC	8015B	Ethanol
GC	8015B	2-Ethoxyethanol
GC	8015B	Isobutyl alcohol (2-Methyl-1-propanol)
GC	8015B	Isopropyl alcohol (2-Propanol)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	8015B	Methanol
GC	8015B	n-Butyl alcohol
GC	8015B	n-Propanol
GC	8021B	Benzene
GC	8021B	Ethylbenzene
GC	8021B	Chlorobenzene
GC	8021B	Toluene
GC	8021B	1,2-Dichlorobenzene
GC	8021B	1,3-Dichlorobenzene
GC	8021B	1,4-Dichlorobenzene
GC	8021B	m-Xylene
GC	8021B	p-Xylene
GC	8021B	o-Xylene
GC	8021B	Methyl-tert-Butyl Ether
GC	8081A	4 4`-DDD
GC	8081A	4 4`-DDE
GC	8081A	4 4`-DDT
GC	8081A	Aldrin
GC	8081A	Chlordane (tech.)
GC	8081A	Dieldrin
GC	8081A	Endosulfan I
GC	8081A	Endosulfan II
GC	8081A	Endosulfan sulfate
GC	8081A	Endrin
GC	8081A	Endrin aldehyde
GC	8081A	Endrin ketone
GC	8081A	Heptachlor
GC	8081A	Heptachlor epoxide
GC	8081A	Methoxychlor
GC	8081A	Toxaphene (Chlorinated camphene)
GC	8081A	alpha-BHC (alpha-Hexachlorocyclohexane)
GC	8081A	alpha-Chlordane
GC	8081A	beta-BHC (beta-Hexachlorocyclohexane)
GC	8081A	delta-BHC
GC	8081A	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC	8081A	gamma-Chlordane
GC	8081B	4 4`-DDD
GC	8081B	4 4`-DDE
GC	8081B	4 4`-DDT
GC	8081B	Aldrin

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	8081B	Chlordane (tech.)
GC	8081B	Dieldrin
GC	8081B	Endosulfan I
GC	8081B	Endosulfan II
GC	8081B	Endosulfan sulfate
GC	8081B	Endrin
GC	8081B	Endrin aldehyde
GC	8081B	Endrin ketone
GC	8081B	Heptachlor
GC	8081B	Heptachlor epoxide
GC	8081B	Methoxychlor
GC	8081B	Toxaphene (Chlorinated camphene)
GC	8081B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC	8081B	alpha-Chlordane
GC	8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC	8081B	delta-BHC
GC	8081B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC	8081B	gamma-Chlordane
GC	8082	Aroclor-1016 (PCB-1016)
GC	8082	Aroclor-1221 (PCB-1221)
GC	8082	Aroclor-1232 (PCB-1232)
GC	8082	Aroclor-1242 (PCB-1242)
GC	8082	Aroclor-1248 (PCB-1248)
GC	8082	Aroclor-1254 (PCB-1254)
GC	8082	Aroclor-1260 (PCB-1260)
GC	8082	Aroclor-1262 (PCB-1262)
GC	8082	Aroclor-1268 (PCB-1268)
GC	8082	2,4'-diCB bz8
GC	8082	2,2',5-trCB bz18
GC	8082	2,4,4'-trCB bz28
GC	8082	2,2',3,5'-teCB bz44
GC	8082	2,2',4,5'-teCB bz49
GC	8082	2,2',5,5'-teCB bz52
GC	8082	2,3'4,4'-teCB bz66
GC	8082	3,3',4,4'-teCB bz77
GC	8082	3,4,4',5-teCB bz81
GC	8082	2,2',3,4,5'-peCB bz87
GC	8082	2,2',3,4',5-peCB bz90
GC	8082	2,2',4,5,5'-peCB bz101
GC	8082	2,3,3',4,4'-peCB bz105

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	8082	2,3',4,4',5-peCB bz118
GC	8082	2',3,4,4',5-peCB bz123
GC	8082	3,3',4,4',5-peCB bz126
GC	8082	2,2',3,3',4,4'-hxCB bz128
GC	8082	2,2',3,4,4',5'-hxCB bz138
GC	8082	2,2',3,5,5',6-hxCB bz151
GC	8082	2,2',4,4',5,5'-hxCB bz153
GC	8082	2,3,3',4,4',5-hxCB bz156
GC	8082	2,3,3',4,4',5'-hxCB bz157
GC	8082	2,3',4,4',5,5'-hxCB bz167
GC	8082	3,3',4,4',5,5'-hxCB bz169
GC	8082	2,2',3,3',4,4',5-hpCB bz170
GC	8082	2,2',3,4,4',5,5'-hpCB bz180
GC	8082	2,2',3,4,4',5',6-hpCB bz183
GC	8082	2,2',3,4,4',6,6'-hpCB bz184
GC	8082	2,2',3,4',5,5',6-hpCB bz187
GC	8082	2,3,3',4,4',5,5'-hpCB bz189
GC	8082	2,2',3,3',4,4',5,6-ocCB bz195
GC	8082	2,2',3,3',4,4',5,5',6-noCB bz206
GC	8082	Decachlorobiphenyl bz209
GC	8082A	Aroclor-1016 (PCB-1016)
GC	8082A	Aroclor-1221 (PCB-1221)
GC	8082A	Aroclor-1232 (PCB-1232)
GC	8082A	Aroclor-1242 (PCB-1242)
GC	8082A	Aroclor-1248 (PCB-1248)
GC	8082A	Aroclor-1254 (PCB-1254)
GC	8082A	Aroclor-1260 (PCB-1260)
GC	8082A	Aroclor-1262 (PCB-1262)
GC	8082A	Aroclor-1268 (PCB-1268)
GC	8082A	2,4'-diCB bz8
GC	8082A	2,2',5-trCB bz18
GC	8082A	2,4,4'-trCB bz28
GC	8082A	2,2',3,5'-teCB bz44
GC	8082A	2,2',4,5'-teCB bz49
GC	8082A	2,2',5,5'-teCB bz52
GC	8082A	2,3'4,4'-teCB bz66
GC	8082A	3,3',4,4'-teCB bz77
GC	8082A	3,4,4',5-teCB bz81
GC	8082A	2,2',3,4,5'-peCB bz87
GC	8082A	2,2',3,4',5-peCB bz90

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	8082A	2,2',4,5,5'-peCB bz101
GC	8082A	2,3,3',4,4'-peCB bz105
GC	8082A	2,3',4,4',5-peCB bz118
GC	8082A	2',3,4,4',5-peCB bz123
GC	8082A	3,3',4,4',5-peCB bz126
GC	8082A	2,2',3,3',4,4'-hxCB bz128
GC	8082A	2,2',3,4,4',5'-hxCB bz138
GC	8082A	2,2',3,5,5',6-hxCB bz151
GC	8082A	2,2',4,4',5,5'-hxCB bz153
GC	8082A	2,3,3',4,4',5-hxCB bz156
GC	8082A	2,3,3',4,4',5'-hxCB bz157
GC	8082A	2,3',4,4',5,5'-hxCB bz167
GC	8082A	3,3',4,4',5,5'-hxCB bz169
GC	8082A	2,2',3,3',4,4',5-hpCB bz170
GC	8082A	2,2',3,4,4',5,5'-hpCB bz180
GC	8082A	2,2',3,4,4',5',6-hpCB bz183
GC	8082A	2,2',3,4,4',6,6'-hpCB bz184
GC	8082A	2,2',3,4',5,5',6-hpCB bz187
GC	8082A	2,3,3',4,4',5,5'-hpCB bz189
GC	8082A	2,2',3,3',4,4',5,6-ocCB bz195
GC	8082A	2,2',3,3',4,4',5,5',6-noCB bz206
GC	8082A	Decachlorobiphenyl bz209
GC	8091	2 4-Dinitrotoluene (2 4-DNT)
GC	8091	2 6-Dinitrotoluene (2 6-DNT)
GC	8141B	Azinphos-methyl (Guthion)
GC	8141B	Bolstar (Sulprofos)
GC	8141B	Carbophenothion
GC	8141B	Chlorpyrifos
GC	8141B	Coumaphos
GC	8141B	Demeton-o
GC	8141B	Demeton-s
GC	8141B	Diazinon
GC	8141B	Dichlorovos (DDVP Dichlorvos)
GC	8141B	Dimethoate
GC	8141B	Disulfoton
GC	8141B	EPN
GC	8141B	Ethion
GC	8141B	Ethoprop
GC	8141B	Famphur
GC	8141B	Fensulfothion

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	8141B	Fenthion
GC	8141B	Malathion
GC	8141B	Merphos
GC	8141B	Methyl parathion (Parathion methyl)
GC	8141B	Mevinphos
GC	8141B	Monocrotophos
GC	8141B	Naled
GC	8141B	Parathion ethyl
GC	8141B	Phorate
GC	8141B	Ronnel
GC	8141B	Stirofos
GC	8141B	Sulfotepp
GC	8141B	Tetraethyl pyrophosphate (TEPP)
GC	8141B	Thionazin (Zinophos)
GC	8141B	Tokuthion (Prothiophos)
GC	8141B	Trichloronate
GC	8141B	o o o-Triethyl phosphorothioate
GC	8151A	2 4 5-T
GC	8151A	2 4-D
GC	8151A	2 4-DB
GC	8151A	Dalapon
GC	8151A	Dicamba
GC	8151A	Dichloroprop (Dichlorprop)
GC	8151A	Dinoseb (2-sec-butyl-4 6-dinitrophenol DNBP)
GC	8151A	MCPA
GC	8151A	MCPP
GC	8151A	Pentachlorophenol
GC	8151A	Silvex (2 4 5-TP)
GC	RSK-175	Acetylene
GC	RSK-175	Methane
GC	RSK-175	Ethane
GC	RSK-175	Ethene
GC	RSK-175	Propane
GC	FL-PRO	Total Petroleum Hydrocarbons (TPH)
GC	MA-EPH	Diesel range organics (DRO)
GC	MA-VPH	Gasoline range organics (GRO)
GC	OA-1	Gasoline range organics (GRO)
GC	OA-2	Diesel range organics (DRO)
GC	TN-EPH	Diesel range organics (DRO)
GC	TN-GRO	Gasoline range organics (GRO)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	WI-DRO	Diesel range organics (DRO)
GC/MS	8260B	1 1 1 2-Tetrachloroethane
GC/MS	8260B	1 1 1-Trichloroethane
GC/MS	8260B	1 1 2 2-Tetrachloroethane
GC/MS	8260B	1 1 2-Trichloroethane
GC/MS	8260B	1 1-Dichloroethane
GC/MS	8260B	1 1-Dichloroethylene
GC/MS	8260B	1 1-Dichloropropene
GC/MS	8260B	1 2 3-Trichlorobenzene
GC/MS	8260B	1 2 3-Trichloropropane
GC/MS	8260B	1 2 4-Trichlorobenzene
GC/MS	8260B	1 2 4-Trimethylbenzene
GC/MS	8260B	1 2-Dibromo-3-chloropropane (DBCP)
GC/MS	8260B	1 2-Dibromoethane (EDB Ethylene dibromide)
GC/MS	8260B	1 2-Dichlorobenzene
GC/MS	8260B	1 2-Dichloroethane
GC/MS	8260B	1 2-Dichloropropane
GC/MS	8260B	1,2-Dichlorotrifluoroethane (Freon 123)
GC/MS	8260B	1 3 5-Trimethylbenzene
GC/MS	8260B	1 3-Dichlorobenzene
GC/MS	8260B	1 3-Dichloropropane
GC/MS	8260B	1 4-Dichlorobenzene
GC/MS	8260B	1-Chlorohexane
GC/MS	8260B	2 2-Dichloropropane
GC/MS	8260B	2-Butanone (Methyl ethyl ketone MEK)
GC/MS	8260B	2-Chloroethyl vinyl ether
GC/MS	8260B	2-Chlorotoluene
GC/MS	8260B	2-Hexanone
GC/MS	8260B	2-Nitropropane
GC/MS	8260B	4-Chlorotoluene
GC/MS	8260B	4-Methyl-2-pentanone (MIBK)
GC/MS	8260B	Acetone
GC/MS	8260B	Acetonitrile
GC/MS	8260B	Acrolein (Propenal)
GC/MS	8260B	Acrylonitrile
GC/MS	8260B	Allyl chloride (3-Chloropropene)
GC/MS	8260B	Benzene
GC/MS	8260B	Benzyl Chloride
GC/MS	8260B	Bromobenzene
GC/MS	8260B	Bromochloromethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260B	Bromodichloromethane
GC/MS	8260B	Bromoform
GC/MS	8260B	Carbon disulfide
GC/MS	8260B	Carbon tetrachloride
GC/MS	8260B	Chlorobenzene
GC/MS	8260B	Chloroethane
GC/MS	8260B	Chloroform
GC/MS	8260B	Chloroprene
GC/MS	8260B	Cyclohexane
GC/MS	8260B	Cyclohexanone
GC/MS	8260B	Di-isopropylether (DIPE)
GC/MS	8260B	Dibromochloromethane
GC/MS	8260B	Dibromomethane
GC/MS	8260B	Dichlorodifluoromethane
GC/MS	8260B	Diethyl ether
GC/MS	8260B	Ethanol
GC/MS	8260B	Ethyl acetate
GC/MS	8260B	Ethyl methacrylate
GC/MS	8260B	Ethyl-t-butylether (ETBE)
GC/MS	8260B	Ethylbenzene
GC/MS	8260B	Ethylene Oxide
GC/MS	8260B	Hexachlorobutadiene
GC/MS	8260B	Hexane
GC/MS	8260B	Iodomethane (Methyl iodide)
GC/MS	8260B	Isobutyl alcohol (2-Methyl-1-propanol)
GC/MS	8260B	Isopropylbenzene
GC/MS	8260B	Methacrylonitrile
GC/MS	8260B	Methyl Acetate
GC/MS	8260B	Methyl bromide (Bromomethane)
GC/MS	8260B	Methyl chloride (Chloromethane)
GC/MS	8260B	Methylcyclohexane
GC/MS	8260B	Methyl methacrylate
GC/MS	8260B	Methyl tert-butyl ether (MTBE)
GC/MS	8260B	Methylene chloride
GC/MS	8260B	Naphthalene
GC/MS	8260B	Pentachloroethane
GC/MS	8260B	Propionitrile (Ethyl cyanide)
GC/MS	8260B	Styrene
GC/MS	8260B	T-amylmethylether (TAME)
GC/MS	8260B	Tetrachloroethylene (Perchloroethylene)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260B	Tetrahydrofuran
GC/MS	8260B	Toluene
GC/MS	8260B	Trichloroethene (Trichloroethylene)
GC/MS	8260B	Trichlorofluoromethane
GC/MS	8260B	Vinyl acetate
GC/MS	8260B	Vinyl chloride
GC/MS	8260B	Xylene (total)
GC/MS	8260B	m,p-Xylene
GC/MS	8260B	o-Xylene
GC/MS	8260B	cis-1 2-Dichloroethylene
GC/MS	8260B	cis-1 3-Dichloropropene
GC/MS	8260B	cis-1 4-Dichloro-2-butene
GC/MS	8260B	n-Butylbenzene
GC/MS	8260B	n-Propylbenzene
GC/MS	8260B	p-Dioxane
GC/MS	8260B	p-Isopropyltoluene
GC/MS	8260B	sec-Butylbenzene
GC/MS	8260B	tert-Butyl alcohol
GC/MS	8260B	tert-Butylbenzene
GC/MS	8260B	trans-1 2-Dichloroethylene
GC/MS	8260B	trans-1 3-Dichloropropylene
GC/MS	8260B	trans-1 4-Dichloro-2-butene
GC/MS	8260B	Ethyl tert-butyl alcohol
GC/MS	8260B	Isopropyl ether
GC/MS	8260B	tert-Amyl alcohol
GC/MS	8260B	tert-Butyl formate
GC/MS	8260B	1 1 2-Trichloro-1 2 2-trifluoroethane
GC/MS	8260C	1 1 1 2-Tetrachloroethane
GC/MS	8260C	1 1 1-Trichloroethane
GC/MS	8260C	1 1 2 2-Tetrachloroethane
GC/MS	8260C	1 1 2-Trichloroethane
GC/MS	8260C	1 1-Dichloroethane
GC/MS	8260C	1 1-Dichloroethylene
GC/MS	8260C	1 1-Dichloropropene
GC/MS	8260C	1 2 3-Trichlorobenzene
GC/MS	8260C	1 2 3-Trichloropropane
GC/MS	8260C	1 2 4-Trichlorobenzene
GC/MS	8260C	1 2 4-Trimethylbenzene
GC/MS	8260C	1 2-Dibromo-3-chloropropane (DBCP)
GC/MS	8260C	1 2-Dibromoethane (EDB Ethylene dibromide)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260C	1 2-Dichlorobenzene
GC/MS	8260C	1 2-Dichloroethane
GC/MS	8260C	1 2-Dichloropropane
GC/MS	8260C	1,2-Dichlorotrifluoroethane (Freon 123)
GC/MS	8260C	1 3 5-Trimethylbenzene
GC/MS	8260C	1 3-Dichlorobenzene
GC/MS	8260C	1 3-Dichloropropane
GC/MS	8260C	1 4-Dichlorobenzene
GC/MS	8260C	1-Chlorohexane
GC/MS	8260C	2 2-Dichloropropane
GC/MS	8260C	2-Butanone (Methyl ethyl ketone MEK)
GC/MS	8260C	2-Chloroethyl vinyl ether
GC/MS	8260C	2-Chlorotoluene
GC/MS	8260C	2-Hexanone
GC/MS	8260C	2-Nitropropane
GC/MS	8260C	4-Chlorotoluene
GC/MS	8260C	4-Methyl-2-pentanone (MIBK)
GC/MS	8260C	Acetone
GC/MS	8260C	Acetonitrile
GC/MS	8260C	Acrolein (Propenal)
GC/MS	8260C	Acrylonitrile
GC/MS	8260C	Allyl chloride (3-Chloropropene)
GC/MS	8260C	Benzene
GC/MS	8260C	Benzyl Chloride
GC/MS	8260C	Bromobenzene
GC/MS	8260C	Bromochloromethane
GC/MS	8260C	Bromodichloromethane
GC/MS	8260C	Bromoform
GC/MS	8260C	Carbon disulfide
GC/MS	8260C	Carbon tetrachloride
GC/MS	8260C	Chlorobenzene
GC/MS	8260C	Chloroethane
GC/MS	8260C	Chloroform
GC/MS	8260C	Chloroprene
GC/MS	8260C	Cyclohexane
GC/MS	8260C	Cyclohexanone
GC/MS	8260C	Di-isopropylether (DIPE)
GC/MS	8260C	Dibromochloromethane
GC/MS	8260C	Dibromomethane
GC/MS	8260C	Dichlorodifluoromethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260C	Diethyl ether
GC/MS	8260C	Ethanol
GC/MS	8260C	Ethyl acetate
GC/MS	8260C	Ethyl methacrylate
GC/MS	8260C	Ethyl-t-butylether (ETBE)
GC/MS	8260C	Ethylbenzene
GC/MS	8260C	Ethyl Acetate
GC/MS	8260C	Hexachlorobutadiene
GC/MS	8260C	Hexane
GC/MS	8260C	Iodomethane (Methyl iodide)
GC/MS	8260C	Isobutyl alcohol (2-Methyl-1-propanol)
GC/MS	8260C	Isopropylbenzene
GC/MS	8260C	Methacrylonitrile
GC/MS	8260C	Methyl Acetate
GC/MS	8260C	Methyl bromide (Bromomethane)
GC/MS	8260C	Methyl chloride (Chloromethane)
GC/MS	8260C	Methylcyclohexane
GC/MS	8260C	Methyl methacrylate
GC/MS	8260C	Methyl tert-butyl ether (MTBE)
GC/MS	8260C	Methylene chloride
GC/MS	8260C	Naphthalene
GC/MS	8260C	Pentachloroethane
GC/MS	8260C	Propionitrile (Ethyl cyanide)
GC/MS	8260C	Styrene
GC/MS	8260C	T-amylmethylether (TAME)
GC/MS	8260C	Tetrachloroethylene (Perchloroethylene)
GC/MS	8260C	Tetrahydrofuran
GC/MS	8260C	Toluene
GC/MS	8260C	Trichloroethene (Trichloroethylene)
GC/MS	8260C	Trichlorofluoromethane
GC/MS	8260C	Vinyl acetate
GC/MS	8260C	Vinyl chloride
GC/MS	8260C	Xylene (total)
GC/MS	8260C	m,p-Xylene
GC/MS	8260C	o-Xylene
GC/MS	8260C	cis-1 2-Dichloroethylene
GC/MS	8260C	cis-1 3-Dichloropropene
GC/MS	8260C	cis-1 4-Dichloro-2-butene
GC/MS	8260C	n-Butylbenzene
GC/MS	8260C	n-Propylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260C	p-Dioxane
GC/MS	8260C	p-Isopropyltoluene
GC/MS	8260C	sec-Butylbenzene
GC/MS	8260C	tert-Butyl alcohol
GC/MS	8260C	tert-Butylbenzene
GC/MS	8260C	trans-1 2-Dichloroethylene
GC/MS	8260C	trans-1 3-Dichloropropylene
GC/MS	8260C	trans-1 4-Dichloro-2-butene
GC/MS	8260C	Ethyl tert-butyl alcohol
GC/MS	8260C	Isopropyl ether
GC/MS	8260C	tert-Amyl alcohol
GC/MS	8260C	tert-Butyl formate
GC/MS	8260C	1 1 2-Trichloro-1 2 2-trifluoroethane
GC/MS	8270C	1 2 4 5-Tetrachlorobenzene
GC/MS	8270C	1 2 4-Trichlorobenzene
GC/MS	8270C	1 2-Dichlorobenzene
GC/MS	8270C	1 2-Diphenylhydrazine
GC/MS	8270C	1 3 5-Trinitrobenzene (1 3 5-TNB)
GC/MS	8270C	1 3-Dichlorobenzene
GC/MS	8270C	1 3-Dinitrobenzene (1 3-DNB)
GC/MS	8270C	1 4-Dichlorobenzene
GC/MS	8270C	1 4-Dithiane
GC/MS	8270C	1 4-Oxathiane
GC/MS	8270C	1 4-Naphthoquinone
GC/MS	8270C	1 4-Phenylenediamine
GC/MS	8270C	1-Chloronaphthalene
GC/MS	8270C	1-Methylnaphthalene (added to method at FDEP request)
GC/MS	8270C	1-Naphthylamine
GC/MS	8270C	2 3 4 6-Tetrachlorophenol
GC/MS	8270C	2 4 5-Trichlorophenol
GC/MS	8270C	2 4 6-Trichlorophenol
GC/MS	8270C	2 4-Dichlorophenol
GC/MS	8270C	2 4-Dimethylphenol
GC/MS	8270C	2 4-Dinitrophenol
GC/MS	8270C	2 4-Dinitrotoluene (2 4-DNT)
GC/MS	8270C	2 6-Dichlorophenol
GC/MS	8270C	2 6-Dinitrotoluene (2 6-DNT)
GC/MS	8270C	2-Acetylaminofluorene
GC/MS	8270C	2-Chloronaphthalene
GC/MS	8270C	2-Chlorophenol

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270C	2-Methyl-4 6-dinitrophenol
GC/MS	8270C	2-Methylnaphthalene
GC/MS	8270C	2-Methylphenol (o-Cresol)
GC/MS	8270C	2-Naphthylamine
GC/MS	8270C	2-Nitroaniline
GC/MS	8270C	2-Nitrophenol
GC/MS	8270C	2-Picoline (2-Methylpyridine)
GC/MS	8270C	3 3`-Dichlorobenzidine
GC/MS	8270C	3 3`-Dimethylbenzidine
GC/MS	8270C	3-Methylcholanthrene
GC/MS	8270C	3-Methylphenol (m-Cresol)
GC/MS	8270C	3-Nitroaniline
GC/MS	8270C	4-Aminobiphenyl
GC/MS	8270C	4-Bromophenyl phenyl ether
GC/MS	8270C	4-Chloro-3-methylphenol
GC/MS	8270C	4-Chloroaniline
GC/MS	8270C	4-Chlorophenyl phenylether
GC/MS	8270C	4-Dimethyl aminoazobenzene
GC/MS	8270C	4-Methylphenol (p-Cresol)
GC/MS	8270C	4-Nitroaniline
GC/MS	8270C	4-Nitrophenol
GC/MS	8270C	4 4’-methylene-bis(2-chloroaniline)
GC/MS	8270C	5-Nitro-o-toluidine
GC/MS	8270C	7 12-Dimethylbenz(a) anthracene
GC/MS	8270C	Acenaphthene
GC/MS	8270C	Acenaphthylene
GC/MS	8270C	Acetophenone
GC/MS	8270C	Aniline
GC/MS	8270C	Anthracene
GC/MS	8270C	Aramite
GC/MS	8270C	Benzidine
GC/MS	8270C	Benzo(a)anthracene
GC/MS	8270C	Benzo(a)pyrene
GC/MS	8270C	Benzo(b)fluoranthene
GC/MS	8270C	Benzo(g h i)perylene
GC/MS	8270C	Benzo(k)fluoranthene
GC/MS	8270C	Benzoic acid
GC/MS	8270C	Benzyl alcohol
GC/MS	8270C	Butyl benzyl phthalate
GC/MS	8270C	Carbazole

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270C	Chrysene
GC/MS	8270C	Di-n-butyl phthalate
GC/MS	8270C	Di-n-octyl phthalate
GC/MS	8270C	Dibenz(a h)anthracene
GC/MS	8270C	Dibenz(a j)acridine
GC/MS	8270C	Dibenzofuran
GC/MS	8270C	Diethyl phthalate
GC/MS	8270C	Dimethyl phthalate
GC/MS	8270C	Diphenyl Ether
GC/MS	8270C	Ethyl methanesulfonate
GC/MS	8270C	Fluoranthene
GC/MS	8270C	Fluorene
GC/MS	8270C	Hexachlorobenzene
GC/MS	8270C	Hexachlorobutadiene
GC/MS	8270C	Hexachlorocyclopentadiene
GC/MS	8270C	Hexachloroethane
GC/MS	8270C	Hexachlorophene
GC/MS	8270C	Hexachloropropene
GC/MS	8270C	Indeno(1 2 3-cd)pyrene
GC/MS	8270C	Isophorone
GC/MS	8270C	Isosafrole
GC/MS	8270C	Methapyrilene
GC/MS	8270C	Methyl methanesulfonate
GC/MS	8270C	Naphthalene
GC/MS	8270C	Nicotine
GC/MS	8270C	Nitrobenzene
GC/MS	8270C	Nitroquinoline-1-oxide
GC/MS	8270C	Pentachlorobenzene
GC/MS	8270C	Pentachloronitrobenzene
GC/MS	8270C	Pentachlorophenol
GC/MS	8270C	Phenacetin
GC/MS	8270C	Phenanthrene
GC/MS	8270C	Phenol
GC/MS	8270C	Pronamide (Kerb)
GC/MS	8270C	Pyrene
GC/MS	8270C	Pyridine
GC/MS	8270C	Resorcinol
GC/MS	8270C	Safrole
GC/MS	8270C	a-a-Dimethylphenethylamine
GC/MS	8270C	bis(2-Chloroethoxy)methane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270C	bis(2-Chloroethyl) ether
GC/MS	8270C	bis(2-Chloroisopropyl) ether (2 2`-Oxybis(1-chloropropane))
GC/MS	8270C	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	8270C	n-Nitroso-di-n-butylamine
GC/MS	8270C	n-Nitrosodi-n-propylamine
GC/MS	8270C	n-Nitrosodiethylamine
GC/MS	8270C	n-Nitrosodimethylamine
GC/MS	8270C	n-Nitrosodiphenylamine
GC/MS	8270C	n-Nitrosodiphenylamine/Diphenylamine (analyte pair)
GC/MS	8270C	n-Nitrosomethylethylamine
GC/MS	8270C	n-Nitrosomorpholine
GC/MS	8270C	n-Nitrosopiperidine
GC/MS	8270C	n-Nitrosopyrrolidine
GC/MS	8270C	o-Toluidine
GC/MS	8270C	Anilazine
GC/MS	8270C	Chlorobenzilate
GC/MS	8270C	Diallate
GC/MS	8270C	Dimethoate
GC/MS	8270C	Disulfoton
GC/MS	8270C	Famphur
GC/MS	8270C	Isodrin
GC/MS	8270C	Kepone
GC/MS	8270C	Methyl parathion (Parathion methyl)
GC/MS	8270C	Parathion ethyl
GC/MS	8270C	Phorate
GC/MS	8270C	Sulfotepp
GC/MS	8270C	Thionazin (Zinophos)
GC/MS	8270C	o o o-Triethyl phosphorothioate
GC/MS	8270C	1 4-Dioxane (1 4-Diethyleneoxide)
GC/MS	8270C	Propazine
GC/MS	8270C	Benzaldehyde
GC/MS	8270C	Biphenyl
GC/MS	8270C	Caprolactam
GC/MS	8270C	Pentachloroethane
GC/MS	8270C	Atrazine
GC/MS	8270C	Simazine
GC/MS	8270D	1 2 4 5-Tetrachlorobenzene
GC/MS	8270D	1 2 4-Trichlorobenzene
GC/MS	8270D	1 2-Dichlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270D	1 2-Diphenylhydrazine
GC/MS	8270D	1 3 5-Trinitrobenzene (1 3 5-TNB)
GC/MS	8270D	1 3-Dichlorobenzene
GC/MS	8270D	1 3-Dinitrobenzene (1 3-DNB)
GC/MS	8270D	1 4-Dichlorobenzene
GC/MS	8270D	1 4-Dithiane
GC/MS	8270D	1 4-Oxathiane
GC/MS	8270D	1 4-Naphthoquinone
GC/MS	8270D	1 4-Phenylenediamine
GC/MS	8270D	1-Chloronaphthalene
GC/MS	8270D	1-Methylnaphthalene (added to method at FDEP request)
GC/MS	8270D	1-Naphthylamine
GC/MS	8270D	2 3 4 6-Tetrachlorophenol
GC/MS	8270D	2 4 5-Trichlorophenol
GC/MS	8270D	2 4 6-Trichlorophenol
GC/MS	8270D	2 4-Dichlorophenol
GC/MS	8270D	2 4-Dimethylphenol
GC/MS	8270D	2 4-Dinitrophenol
GC/MS	8270D	2 4-Dinitrotoluene (2 4-DNT)
GC/MS	8270D	2 6-Dichlorophenol
GC/MS	8270D	2 6-Dinitrotoluene (2 6-DNT)
GC/MS	8270D	2-Acetylaminofluorene
GC/MS	8270D	2-Chloronaphthalene
GC/MS	8270D	2-Chlorophenol
GC/MS	8270D	2-Methyl-4 6-dinitrophenol
GC/MS	8270D	2-Methylnaphthalene
GC/MS	8270D	2-Methylphenol (o-Cresol)
GC/MS	8270D	2-Naphthylamine
GC/MS	8270D	2-Nitroaniline
GC/MS	8270D	2-Nitrophenol
GC/MS	8270D	2-Picoline (2-Methylpyridine)
GC/MS	8270D	3 3`-Dichlorobenzidine
GC/MS	8270D	3 3`-Dimethylbenzidine
GC/MS	8270D	3-Methylcholanthrene
GC/MS	8270D	3-Methylphenol (m-Cresol)
GC/MS	8270D	3-Nitroaniline
GC/MS	8270D	4-Aminobiphenyl
GC/MS	8270D	4-Bromophenyl phenyl ether
GC/MS	8270D	4-Chloro-3-methylphenol
GC/MS	8270D	4-Chloroaniline

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270D	4-Chlorophenyl phenylether
GC/MS	8270D	4-Dimethyl aminoazobenzene
GC/MS	8270D	4-Methylphenol (p-Cresol)
GC/MS	8270D	4-Nitroaniline
GC/MS	8270D	4-Nitrophenol
GC/MS	8270D	4 4'-methylene-bis(2-chloroaniline)
GC/MS	8270D	5-Nitro-o-toluidine
GC/MS	8270D	7 12-Dimethylbenz(a) anthracene
GC/MS	8270D	Acenaphthene
GC/MS	8270D	Acenaphthylene
GC/MS	8270D	Acetophenone
GC/MS	8270D	Aniline
GC/MS	8270D	Anthracene
GC/MS	8270D	Aramite
GC/MS	8270D	Benzidine
GC/MS	8270D	Benzo(a)anthracene
GC/MS	8270D	Benzo(a)pyrene
GC/MS	8270D	Benzo(b)fluoranthene
GC/MS	8270D	Benzo(g h i)perylene
GC/MS	8270D	Benzo(k)fluoranthene
GC/MS	8270D	Benzoic acid
GC/MS	8270D	Benzyl alcohol
GC/MS	8270D	Butyl benzyl phthalate
GC/MS	8270D	Carbazole
GC/MS	8270D	Chrysene
GC/MS	8270D	Di-n-butyl phthalate
GC/MS	8270D	Di-n-octyl phthalate
GC/MS	8270D	Dibenz(a h)anthracene
GC/MS	8270D	Dibenz(a j)acridine
GC/MS	8270D	Dibenzofuran
GC/MS	8270D	Diethyl phthalate
GC/MS	8270D	Dimethyl phthalate
GC/MS	8270D	Diphenyl Ether
GC/MS	8270D	Ethyl methanesulfonate
GC/MS	8270D	Fluoranthene
GC/MS	8270D	Fluorene
GC/MS	8270D	Hexachlorobenzene
GC/MS	8270D	Hexachlorobutadiene
GC/MS	8270D	Hexachlorocyclopentadiene
GC/MS	8270D	Hexachloroethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270D	Hexachlorophene
GC/MS	8270D	Hexachloropropene
GC/MS	8270D	Indeno(1 2 3-cd)pyrene
GC/MS	8270D	Isophorone
GC/MS	8270D	Isosafrole
GC/MS	8270D	Methapyrilene
GC/MS	8270D	Methyl methanesulfonate
GC/MS	8270D	Naphthalene
GC/MS	8270D	Nicotine
GC/MS	8270D	Nitrobenzene
GC/MS	8270D	Nitroquinoline-1-oxide
GC/MS	8270D	Pentachlorobenzene
GC/MS	8270D	Pentachloronitrobenzene
GC/MS	8270D	Pentachlorophenol
GC/MS	8270D	Phenacetin
GC/MS	8270D	Phenanthrene
GC/MS	8270D	Phenol
GC/MS	8270D	Pronamide (Kerb)
GC/MS	8270D	Pyrene
GC/MS	8270D	Pyridine
GC/MS	8270D	Resorcinol
GC/MS	8270D	Safrole
GC/MS	8270D	a-a-Dimethylphenethylamine
GC/MS	8270D	bis(2-Chloroethoxy)methane
GC/MS	8270D	bis(2-Chloroethyl) ether
GC/MS	8270D	bis(2-Chloroisopropyl) ether (2 2`-Oxybis(1-chloropropane))
GC/MS	8270D	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	8270D	n-Nitroso-di-n-butylamine
GC/MS	8270D	n-Nitrosodi-n-propylamine
GC/MS	8270D	n-Nitrosodiethylamine
GC/MS	8270D	n-Nitrosodimethylamine
GC/MS	8270D	n-Nitrosodiphenylamine
GC/MS	8270D	n-Nitrosodiphenylamine/Diphenylamine (analyte pair)
GC/MS	8270D	n-Nitrosomethylethylamine
GC/MS	8270D	n-Nitrosomorpholine
GC/MS	8270D	n-Nitrosopiperidine
GC/MS	8270D	n-Nitrosopyrrolidine
GC/MS	8270D	o-Toluidine
GC/MS	8270D	Anilazine

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270D	Chlorobenzilate
GC/MS	8270D	Diallate
GC/MS	8270D	Dimethoate
GC/MS	8270D	Disulfoton
GC/MS	8270D	Famphur
GC/MS	8270D	Isodrin
GC/MS	8270D	Kepone
GC/MS	8270D	Methyl parathion (Parathion methyl)
GC/MS	8270D	Parathion ethyl
GC/MS	8270D	Phorate
GC/MS	8270D	Sulfotepp
GC/MS	8270D	Thionazin (Zinophos)
GC/MS	8270D	o o o-Triethyl phosphorothioate
GC/MS	8270D	1 4-Dioxane (1 4-Diethyleneoxide)
GC/MS	8270D	Propazine
GC/MS	8270D	Benzaldehyde
GC/MS	8270D	Biphenyl
GC/MS	8270D	Caprolactam
GC/MS	8270D	Pentachloroethane
GC/MS	8270D	Atrazine
GC/MS	8270D	Simazine
HPLC	8310	1-Methylnaphthalene
HPLC	8310	2-Methylnaphthalene
HPLC	8310	Acenaphthene
HPLC	8310	Acenaphthylene
HPLC	8310	Anthracene
HPLC	8310	Benzo(a)anthracene
HPLC	8310	Benzo(a)pyrene
HPLC	8310	Benzo(b)fluoranthene
HPLC	8310	Benzo(g h i)perylene
HPLC	8310	Benzo(k)fluoranthene
HPLC	8310	Chrysene
HPLC	8310	Dibenz(a h)anthracene
HPLC	8310	Fluoranthene
HPLC	8310	Fluorene
HPLC	8310	Indeno(1 2 3-cd)pyrene
HPLC	8310	Naphthalene
HPLC	8310	Phenanthrene
HPLC	8310	Pyrene
HPLC	610	1-Methylnaphthalene

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC	610	2-Methylnaphthalene
HPLC	610	Acenaphthene
HPLC	610	Acenaphthylene
HPLC	610	Anthracene
HPLC	610	Benzo(a)anthracene
HPLC	610	Benzo(a)pyrene
HPLC	610	Benzo(b)fluoranthene
HPLC	610	Benzo(g h i)perylene
HPLC	610	Benzo(k)fluoranthene
HPLC	610	Chrysene
HPLC	610	Dibenz(a h)anthracene
HPLC	610	Fluoranthene
HPLC	610	Fluorene
HPLC	610	Indeno(1 2 3-cd)pyrene
HPLC	610	Naphthalene
HPLC	610	Phenanthrene
HPLC	610	Pyrene
HPLC	8330A	1 3 5-Trinitrobenzene (1 3 5-TNB)
HPLC	8330A	1 3-Dinitrobenzene (1 3-DNB)
HPLC	8330A	2 2’, 6 6’-Tetranitro-4 4’-azoxytoluene
HPLC	8330A	2 4 6-Trinitrotoluene (2 4 6-TNT)
HPLC	8330A	2 4-Dinitrotoluene (2 4-DNT)
HPLC	8330A	2 6-Dinitrotoluene (2 6-DNT)
HPLC	8330A	2-Amino-4 6-dinitrotoluene (2-am-dnt)
HPLC	8330A	2-Nitrotoluene
HPLC	8330A	3 5-Dinitroaniline
HPLC	8330A	3-Nitrotoluene
HPLC	8330A	4-Amino-2 6-dinitrotoluene (4-am-dnt)
HPLC	8330A	4-Nitrotoluene
HPLC	8330A	Nitrobenzene
HPLC	8330A	Nitroglycerin
HPLC	8330A	Octahydro-1 3 5 7-tetranitro-1 3 5 7-tetrazocine (HMX)
HPLC	8330A	Pentaerythritoltetranitrate (PETN)
HPLC	8330A	RDX (hexahydro-1 3 5-trinitro-1 3 5-triazine)
HPLC	8330A	Tetryl (methyl-2 4 6-trinitrophenylnitramine)
HPLC	8330A	2-amino-6-Nitrotoluene
HPLC	8330A	4-amino-2-Nitrotoluene
HPLC	8330A	2-amino-4-Nitrotoluene
HPLC	8330A	2,4-diamino-6-Nitrotoluene

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC	8330A	2,6-diamino-4-Nitrotoluene
HPLC	8330A	DNX
HPLC	8330A	MNX
HPLC	8330A	TNX
HPLC	8330B	1 3 5-Trinitrobenzene (1 3 5-TNB)
HPLC	8330B	1 3-Dinitrobenzene (1 3-DNB)
HPLC	8330B	2 4 6-Trinitrotoluene (2 4 6-TNT)
HPLC	8330B	2 4-Dinitrotoluene (2 4-DNT)
HPLC	8330B	2 6-Dinitrotoluene (2 6-DNT)
HPLC	8330B	2-Amino-4 6-dinitrotoluene (2-am-dnt)
HPLC	8330B	2-Nitrotoluene
HPLC	8330B	3 5-Dinitroaniline
HPLC	8330B	3-Nitrotoluene
HPLC	8330B	4-Amino-2 6-dinitrotoluene (4-am-dnt)
HPLC	8330B	4-Nitrotoluene
HPLC	8330B	Nitrobenzene
HPLC	8330B	Nitroglycerin
HPLC	8330B	Octahydro-1 3 5 7-tetranitro-1 3 5 7-tetrazocine (HMX)
HPLC	8330B	Pentaerythritoltetranitrate (PETN)
HPLC	8330B	RDX (hexahydro-1 3 5-trinitro-1 3 5-triazine)
HPLC	8330B	Tetryl (methyl-2 4 6-trinitrophenylnitramine)
HPLC	8330B	2-amino-6-Nitrotoluene
HPLC	8330B	4-amino-2-Nitrotoluene
HPLC	8330B	2-amino-4-Nitrotoluene
HPLC	8330B	2,4-diamino-6-Nitrotoluene
HPLC	8330B	2,6-diamino-4-Nitrotoluene
HPLC	8330B	DNX
HPLC	8330B	MNX
HPLC	8330B	TNX
HPLC	8332	PETN
HPLC	8332	Nitroglycerin
ICP	6010B,C	Aluminum
ICP	6010B,C	Antimony
ICP	6010B,C	Arsenic
ICP	6010B,C	Barium
ICP	6010B,C	Beryllium
ICP	6010B,C	Cadmium
ICP	6010B,C	Calcium
ICP	6010B,C	Chromium
ICP	6010B,C	Cobalt

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP	6010B,C	Copper
ICP	6010B,C	Iron
ICP	6010B,C	Lead
ICP	6010B,C	Magnesium
ICP	6010B,C	Manganese
ICP	6010B,C	Molybdenum
ICP	6010B,C	Nickel
ICP	6010B,C	Potassium
ICP	6010B,C	Selenium
ICP	6010B,C	Silver
ICP	6010B,C	Sodium
ICP	6010B,C	Thallium
ICP	6010B,C	Tin
ICP	6010B,C	Vanadium
ICP	6010B,C	Zinc
CVAA	7470A	Mercury
UV/VIS	7196A	Hexavalent Chromium
UV/VIS	9012B	Cyanide, automated colorimetry with off-line distillation
IC	EPA 300	Bromide
IC	EPA 300	Chloride
IC	EPA 300	Fluoride
IC	EPA 300	Nitrate
IC	EPA 300	Nitrite
IC	EPA 300	Sulfate
IC	EPA 300	Total nitrate-nitrite
IC	9056A	Bromide
IC	9056A	Chloride
IC	9056A	Fluoride
IC	9056A	Nitrate
IC	9056A	Nitrite
IC	9056A	Sulfate
IC	9056A	Total nitrate-nitrite
Gravimetric Methods	EPA 1664A	Oil and Grease
Gravimetric Methods	9070A	Oil and Grease
Gravimetric Methods	SM2540B	Total Residue (Total Solids)
Gravimetric Methods	SM2540C	Filterable Residue (Total Dissolved Solids)
Gravimetric Methods	SM2540D	Non-Filterable Residue (Total Suspended Solids)
Electrometric Methods	SM4500H+B	Hydrogen Ion (pH)
Electrometric Methods	9040C	Hydrogen Ion (pH)
Combustion	9060A	Total Organic Carbon

Non-Potable Water

Preparation	Method	Type
8011	8011	Microextraction
5030B	8015B,C	GRO, OA-1, TN-VPH, MA-VPH, Purge and Trap, aqueous
MA-EPH	MA-EPH	Diesel Range Organic, Liquid-liquid extraction and fractionation
3510C	8015B,C	DRO/ORO, FL-PRO, OA-2, TN-EPH, WI-DRO Liquid-Liquid Extraction
3510C	8015B,C	Non-Halogenated Organics (Alcohols), direct inject
5030B	8021B	Aromatic VOC, Purge and Trap, aqueous
3510C	8081A,B	Chlorinated Pesticides, Liquid-Liquid Extraction
3510C	8082/8082A	PCBs and Congeners, Liquid-Liquid Extraction
3510C	8091	Nitroaromatics, Liquid-Liquid Extraction
3510C	8141B	Organophosphorus Pesticides, Liquid-Liquid Extraction
8151A	8151A	Chlorinated Herbicides, Liquid-Liquid Extraction
5030B	8260B,C	VOC by GC/MS, Purge and Trap, aqueous
3510C	8270C,D	BNA Extractables by GC/MS, Liquid-Liquid Extraction
3510C	8310	PAH, Liquid-Liquid Extraction
610	610	PAH, Liquid-Liquid Extraction
3535A	8330A,B/8332	Explosives, Solid Phase Extraction
Lachat MicroDistillation	9012	Cyanide, Lachat MicroDistillation proprietary method, aqueous
3010A	6010B,C	Metals by ICP, Acid Digestion, aqueous
7470A	7470A	Hg by CVAA, digestion, aqueous

Solid and Chemical Materials

Technology	Method	Analyte
GC	8011	1,2-Dibromoethane (EDB)
GC	8011	1,2-Dibromo-3-Chloropropane (DBCP)
GC	8015C	Diesel range organics (DRO)
GC	8015C	Oil Range Organics (ORO)
GC	8015C	Gasoline range organics (GRO)
GC	8015C	Ethanol
GC	8015C	2-Ethoxyethanol
GC	8015C	Isobutyl alcohol (2-Methyl-1-propanol)
GC	8015C	Isopropyl alcohol (2-Propanol)
GC	8015C	Methanol
GC	8015C	n-Butyl alcohol
GC	8015C	n-Propanol
GC	8015B	Diesel range organics (DRO)
GC	8015B	Oil Range Organics (ORO)
GC	8015B	Gasoline range organics (GRO)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	8015B	Ethanol
GC	8015B	2-Ethoxyethanol
GC	8015B	Isobutyl alcohol (2-Methyl-1-propanol)
GC	8015B	Isopropyl alcohol (2-Propanol)
GC	8015B	Methanol
GC	8015B	n-Butyl alcohol
GC	8015B	n-Propanol
GC	8081A	4 4`-DDD
GC	8081A	4 4`-DDE
GC	8081A	4 4`-DDT
GC	8081A	Aldrin
GC	8081A	Chlordane (tech.)
GC	8081A	Dieldrin
GC	8081A	Endosulfan I
GC	8081A	Endosulfan II
GC	8081A	Endosulfan sulfate
GC	8081A	Endrin
GC	8081A	Endrin aldehyde
GC	8081A	Endrin ketone
GC	8081A	Heptachlor
GC	8081A	Heptachlor epoxide
GC	8081A	Methoxychlor
GC	8081A	Toxaphene (Chlorinated camphene)
GC	8081A	alpha-BHC (alpha-Hexachlorocyclohexane)
GC	8081A	alpha-Chlordane
GC	8081A	beta-BHC (beta-Hexachlorocyclohexane)
GC	8081A	delta-BHC
GC	8081A	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC	8081A	gamma-Chlordane
GC	8081B	4 4`-DDD
GC	8081B	4 4`-DDE
GC	8081B	4 4`-DDT
GC	8081B	Aldrin
GC	8081B	Chlordane (tech.)
GC	8081B	Dieldrin
GC	8081B	Endosulfan I
GC	8081B	Endosulfan II
GC	8081B	Endosulfan sulfate
GC	8081B	Endrin
GC	8081B	Endrin aldehyde

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	8081B	Endrin ketone
GC	8081B	Heptachlor
GC	8081B	Heptachlor epoxide
GC	8081B	Methoxychlor
GC	8081B	Toxaphene (Chlorinated camphene)
GC	8081B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC	8081B	alpha-Chlordane
GC	8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC	8081B	delta-BHC
GC	8081B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC	8081B	gamma-Chlordane
GC	8082	Aroclor-1016 (PCB-1016)
GC	8082	Aroclor-1221 (PCB-1221)
GC	8082	Aroclor-1232 (PCB-1232)
GC	8082	Aroclor-1242 (PCB-1242)
GC	8082	Aroclor-1248 (PCB-1248)
GC	8082	Aroclor-1254 (PCB-1254)
GC	8082	Aroclor-1260 (PCB-1260)
GC	8082	Aroclor-1262 (PCB-1262)
GC	8082	Aroclor-1268 (PCB-1268)
GC	8082	2,4'-diCB bz8
GC	8082	2,2',5-trCB bz18
GC	8082	2,4,4'-trCB bz28
GC	8082	2,2',3,5'-teCB bz44
GC	8082	2,2',4,5'-teCB bz49
GC	8082	2,2',5,5'-teCB bz52
GC	8082	2,3'4,4'-teCB bz66
GC	8082	3,3',4,4'-teCB bz77
GC	8082	3,4,4',5-teCB bz81
GC	8082	2,2',3,4,5'-peCB bz87
GC	8082	2,2',3,4',5-peCB bz90
GC	8082	2,2',4,5,5'-peCB bz101
GC	8082	2,3,3',4,4'-peCB bz105
GC	8082	2,3',4,4',5-peCB bz118
GC	8082	2',3,4,4',5-peCB bz123
GC	8082	3,3',4,4',5-peCB bz126
GC	8082	2,2',3,3',4,4'-hxCB bz128
GC	8082	2,2',3,4,4',5'-hxCB bz138
GC	8082	2,2',3,5,5',6-hxCB bz151
GC	8082	2,2',4,4',5,5'-hxCB bz153

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	8082	2,3,3',4,4',5-hxCB bz156
GC	8082	2,3,3',4,4',5'-hxCB bz157
GC	8082	2,3',4,4',5,5'-hxCB bz167
GC	8082	3,3',4,4',5,5'-hxCB bz169
GC	8082	2,2',3,3',4,4',5-hpCB bz170
GC	8082	2,2',3,4,4',5,5'-hpCB bz180
GC	8082	2,2',3,4,4',5',6-hpCB bz183
GC	8082	2,2',3,4,4',6,6'-hpCB bz184
GC	8082	2,2',3,4',5,5',6-hpCB bz187
GC	8082	2,3,3',4,4',5,5'-hpCB bz189
GC	8082	2,2',3,3',4,4',5,6-ocCB bz195
GC	8082	2,2',3,3',4,4',5,5',6-noCB bz206
GC	8082	Decachlorobiphenyl bz209
GC	8082A	Aroclor-1016 (PCB-1016)
GC	8082A	Aroclor-1221 (PCB-1221)
GC	8082A	Aroclor-1232 (PCB-1232)
GC	8082A	Aroclor-1242 (PCB-1242)
GC	8082A	Aroclor-1248 (PCB-1248)
GC	8082A	Aroclor-1254 (PCB-1254)
GC	8082A	Aroclor-1260 (PCB-1260)
GC	8082A	Aroclor-1262 (PCB-1262)
GC	8082A	Aroclor-1268 (PCB-1268)
GC	8082A	2,4'-diCB bz8
GC	8082A	2,2',5-trCB bz18
GC	8082A	2,4,4'-trCB bz28
GC	8082A	2,2',3,5'-teCB bz44
GC	8082A	2,2',4,5'-teCB bz49
GC	8082A	2,2',5,5'-teCB bz52
GC	8082A	2,3'4,4'-teCB bz66
GC	8082A	3,3',4,4'-teCB bz77
GC	8082A	3,4,4',5-teCB bz81
GC	8082A	2,2',3,4,5'-peCB bz87
GC	8082A	2,2',3,4',5-peCB bz90
GC	8082A	2,2',4,5,5'-peCB bz101
GC	8082A	2,3,3',4,4'-peCB bz105
GC	8082A	2,3',4,4',5-peCB bz118
GC	8082A	2',3,4,4',5-peCB bz123
GC	8082A	3,3',4,4',5-peCB bz126
GC	8082A	2,2',3,3',4,4'-hxCB bz128
GC	8082A	2,2',3,4,4',5'-hxCB bz138

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	8082A	2,2',3,5,5',6-hxCB bz151
GC	8082A	2,2',4,4',5,5'-hxCB bz153
GC	8082A	2,3,3',4,4',5-hxCB bz156
GC	8082A	2,3,3',4,4',5'-hxCB bz157
GC	8082A	2,3',4,4',5,5'-hxCB bz167
GC	8082A	3,3',4,4',5,5'-hxCB bz169
GC	8082A	2,2',3,3',4,4',5-hpCB bz170
GC	8082A	2,2',3,4,4',5,5'-hpCB bz180
GC	8082A	2,2',3,4,4',5',6-hpCB bz183
GC	8082A	2,2',3,4,4',6,6'-hpCB bz184
GC	8082A	2,2',3,4',5,5',6-hpCB bz187
GC	8082A	2,3,3',4,4',5,5'-hpCB bz189
GC	8082A	2,2',3,3',4,4',5,6-ocCB bz195
GC	8082A	2,2',3,3',4,4',5,5',6-noCB bz206
GC	8082A	Decachlorobiphenyl bz209
GC	8141B	Azinphos-methyl (Guthion)
GC	8141B	Bolstar (Sulprofos)
GC	8141B	Carbophenothion
GC	8141B	Chlorpyrifos
GC	8141B	Coumaphos
GC	8141B	Demeton-o
GC	8141B	Demeton-s
GC	8141B	Diazinon
GC	8141B	Dichlorovos (DDVP Dichlorvos)
GC	8141B	Dimethoate
GC	8141B	Disulfoton
GC	8141B	EPN
GC	8141B	Ethion
GC	8141B	Ethoprop
GC	8141B	Famphur
GC	8141B	Fensulfothion
GC	8141B	Fenthion
GC	8141B	Malathion
GC	8141B	Merphos
GC	8141B	Methyl parathion (Parathion methyl)
GC	8141B	Mevinphos
GC	8141B	Monocrotophos
GC	8141B	Naled
GC	8141B	Parathion ethyl
GC	8141B	Phorate

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	8141B	Ronnel
GC	8141B	Stirofos
GC	8141B	Sulfotepp
GC	8141B	Tetraethyl pyrophosphate (TEPP)
GC	8141B	Thionazin (Zinophos)
GC	8141B	Tokuthion (Prothiophos)
GC	8141B	Trichloronate
GC	8141B	o o o-Triethyl phosphorothioate
GC	8151A	2 4 5-T
GC	8151A	2 4-D
GC	8151A	2 4-DB
GC	8151A	Dalapon
GC	8151A	Dicamba
GC	8151A	Dichloroprop (Dichlorprop)
GC	8151A	Dinoseb (2-sec-butyl-4 6-dinitrophenol DNBP)
GC	8151A	MCPA
GC	8151A	MCPP
GC	8151A	Pentachlorophenol
GC	8151A	Silvex (2 4 5-TP)
GC	FL-PRO	Total Petroleum Hydrocarbons (TPH)
GC	MA-EPH	Diesel range organics (DRO)
GC	MA-VPH	Gasoline range organics (GRO)
GC	OA-1	Gasoline range organics (GRO)
GC	OA-2	Diesel range organics (DRO)
GC	TN-EPH	Diesel range organics (DRO)
GC	TN-GRO	Gasoline range organics (GRO)
GC/MS	8260B	1 1 1 2-Tetrachloroethane
GC/MS	8260B	1 1 1-Trichloroethane
GC/MS	8260B	1 1 2 2-Tetrachloroethane
GC/MS	8260B	1 1 2-Trichloroethane
GC/MS	8260B	1 1-Dichloroethane
GC/MS	8260B	1 1-Dichloroethylene
GC/MS	8260B	1 1-Dichloropropene
GC/MS	8260B	1 2 3-Trichlorobenzene
GC/MS	8260B	1 2 3-Trichloropropane
GC/MS	8260B	1 2 4-Trichlorobenzene
GC/MS	8260B	1 2 4-Trimethylbenzene
GC/MS	8260B	1 2-Dibromo-3-chloropropane (DBCP)
GC/MS	8260B	1 2-Dibromoethane (EDB Ethylene dibromide)
GC/MS	8260B	1 2-Dichlorobenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260B	1 2-Dichloroethane
GC/MS	8260B	1 2-Dichloropropane
GC/MS	8260B	1 2-Dichlorotrifluoroethane (Freon 123)
GC/MS	8260B	1 3 5-Trimethylbenzene
GC/MS	8260B	1 3-Dichlorobenzene
GC/MS	8260B	1 3-Dichloropropane
GC/MS	8260B	1 4-Dichlorobenzene
GC/MS	8260B	1-Chlorohexane
GC/MS	8260B	2 2-Dichloropropane
GC/MS	8260B	2-Butanone (Methyl ethyl ketone MEK)
GC/MS	8260B	2-Chloroethyl vinyl ether
GC/MS	8260B	2-Chlorotoluene
GC/MS	8260B	2-Hexanone
GC/MS	8260B	2-Nitropropane
GC/MS	8260B	4-Chlorotoluene
GC/MS	8260B	4-Methyl-2-pentanone (MIBK)
GC/MS	8260B	Acetone
GC/MS	8260B	Acetonitrile
GC/MS	8260B	Acrolein (Propenal)
GC/MS	8260B	Acrylonitrile
GC/MS	8260B	Allyl chloride (3-Chloropropene)
GC/MS	8260B	Benzene
GC/MS	8260B	Benzyl chloride
GC/MS	8260B	Bromobenzene
GC/MS	8260B	Bromochloromethane
GC/MS	8260B	Bromodichloromethane
GC/MS	8260B	Bromoform
GC/MS	8260B	Carbon disulfide
GC/MS	8260B	Carbon tetrachloride
GC/MS	8260B	Chlorobenzene
GC/MS	8260B	Chloroethane
GC/MS	8260B	Chloroform
GC/MS	8260B	Chloroprene
GC/MS	8260B	Cyclohexane
GC/MS	8260B	Cyclohexanone
GC/MS	8260B	Di-isopropylether (DIPE)
GC/MS	8260B	Dibromochloromethane
GC/MS	8260B	Dibromomethane
GC/MS	8260B	Dichlorodifluoromethane
GC/MS	8260B	Diethyl ether

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260B	Ethanol
GC/MS	8260B	Ethyl acetate
GC/MS	8260B	Ethylene oxide
GC/MS	8260B	Ethyl methacrylate
GC/MS	8260B	Ethyl-t-butylether (ETBE)
GC/MS	8260B	Ethylbenzene
GC/MS	8260B	Hexachlorobutadiene
GC/MS	8260B	Hexane
GC/MS	8260B	Iodomethane (Methyl iodide)
GC/MS	8260B	Isobutyl alcohol (2-Methyl-1-propanol)
GC/MS	8260B	Isopropylbenzene
GC/MS	8260B	Methacrylonitrile
GC/MS	8260B	Methyl Acetate
GC/MS	8260B	Methyl bromide (Bromomethane)
GC/MS	8260B	Methyl chloride (Chloromethane)
GC/MS	8260B	Methylcyclohexane
GC/MS	8260B	Methyl methacrylate
GC/MS	8260B	Methyl tert-butyl ether (MTBE)
GC/MS	8260B	Methylene chloride
GC/MS	8260B	Naphthalene
GC/MS	8260B	Pentachloroethane
GC/MS	8260B	Propionitrile (Ethyl cyanide)
GC/MS	8260B	Styrene
GC/MS	8260B	T-amylmethylether (TAME)
GC/MS	8260B	Tetrachloroethylene (Perchloroethylene)
GC/MS	8260B	Tetrahydrofuran
GC/MS	8260B	Toluene
GC/MS	8260B	Trichloroethene (Trichloroethylene)
GC/MS	8260B	Trichlorofluoromethane
GC/MS	8260B	Vinyl acetate
GC/MS	8260B	Vinyl chloride
GC/MS	8260B	Xylene (total)
GC/MS	8260B	m,p-Xylene
GC/MS	8260B	o-Xylene
GC/MS	8260B	cis-1 2-Dichloroethylene
GC/MS	8260B	cis-1 3-Dichloropropene
GC/MS	8260B	cis-1 4-Dichloro-2-butene
GC/MS	8260B	n-Butylbenzene
GC/MS	8260B	n-Propylbenzene
GC/MS	8260B	p-Dioxane

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260B	p-Isopropyltoluene
GC/MS	8260B	sec-Butylbenzene
GC/MS	8260B	tert-Butyl alcohol
GC/MS	8260B	tert-Butylbenzene
GC/MS	8260B	trans-1 2-Dichloroethylene
GC/MS	8260B	trans-1 3-Dichloropropylene
GC/MS	8260B	trans-1 4-Dichloro-2-butene
GC/MS	8260B	Ethyl tert-butyl alcohol
GC/MS	8260B	Isopropyl ether
GC/MS	8260B	tert-Amyl alcohol
GC/MS	8260B	tert-Butyl formate
GC/MS	8260B	1 1 2-Trichloro-1 2 2-trifluoroethane
GC/MS	8260C	1 1 1 2-Tetrachloroethane
GC/MS	8260C	1 1 1-Trichloroethane
GC/MS	8260C	1 1 2 2-Tetrachloroethane
GC/MS	8260C	1 1 2-Trichloroethane
GC/MS	8260C	1 1-Dichloroethane
GC/MS	8260C	1 1-Dichloroethylene
GC/MS	8260C	1 1-Dichloropropene
GC/MS	8260C	1 2 3-Trichlorobenzene
GC/MS	8260C	1 2 3-Trichloropropane
GC/MS	8260C	1 2 4-Trichlorobenzene
GC/MS	8260C	1 2 4-Trimethylbenzene
GC/MS	8260C	1 2-Dibromo-3-chloropropane (DBCP)
GC/MS	8260C	1 2-Dibromoethane (EDB Ethylene dibromide)
GC/MS	8260C	1 2-Dichlorobenzene
GC/MS	8260C	1 2-Dichloroethane
GC/MS	8260C	1 2-Dichloropropane
GC/MS	8260C	1 2-Dichlorotrifluoroethane (Freon 123)
GC/MS	8260C	1 3 5-Trimethylbenzene
GC/MS	8260C	1 3-Dichlorobenzene
GC/MS	8260C	1 3-Dichloropropane
GC/MS	8260C	1 4-Dichlorobenzene
GC/MS	8260C	1-Chlorohexane
GC/MS	8260C	2 2-Dichloropropane
GC/MS	8260C	2-Butanone (Methyl ethyl ketone MEK)
GC/MS	8260C	2-Chloroethyl vinyl ether
GC/MS	8260C	2-Chlorotoluene
GC/MS	8260C	2-Hexanone
GC/MS	8260C	2-Nitropropane

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260C	4-Chlorotoluene
GC/MS	8260C	4-Methyl-2-pentanone (MIBK)
GC/MS	8260C	Acetone
GC/MS	8260C	Acetonitrile
GC/MS	8260C	Acrolein (Propenal)
GC/MS	8260C	Acrylonitrile
GC/MS	8260C	Allyl chloride (3-Chloropropene)
GC/MS	8260C	Benzene
GC/MS	8260C	Benzyl chloride
GC/MS	8260C	Bromobenzene
GC/MS	8260C	Bromochloromethane
GC/MS	8260C	Bromodichloromethane
GC/MS	8260C	Bromoform
GC/MS	8260C	Carbon disulfide
GC/MS	8260C	Carbon tetrachloride
GC/MS	8260C	Chlorobenzene
GC/MS	8260C	Chloroethane
GC/MS	8260C	Chloroform
GC/MS	8260C	Chloroprene
GC/MS	8260C	Cyclohexane
GC/MS	8260C	Cyclohexanone
GC/MS	8260C	Di-isopropylether (DIPE)
GC/MS	8260C	Dibromochloromethane
GC/MS	8260C	Dibromomethane
GC/MS	8260C	Dichlorodifluoromethane
GC/MS	8260C	Diethyl ether
GC/MS	8260C	Ethanol
GC/MS	8260C	Ethyl acetate
GC/MS	8260C	Ethylene oxide
GC/MS	8260C	Ethyl methacrylate
GC/MS	8260C	Ethyl-t-butylether (ETBE)
GC/MS	8260C	Ethylbenzene
GC/MS	8260C	Hexachlorobutadiene
GC/MS	8260C	Hexane
GC/MS	8260C	Iodomethane (Methyl iodide)
GC/MS	8260C	Isobutyl alcohol (2-Methyl-1-propanol)
GC/MS	8260C	Isopropylbenzene
GC/MS	8260C	Methacrylonitrile
GC/MS	8260C	Methyl Acetate
GC/MS	8260C	Methyl bromide (Bromomethane)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260C	Methyl chloride (Chloromethane)
GC/MS	8260C	Methylcyclohexane
GC/MS	8260C	Methyl methacrylate
GC/MS	8260C	Methyl tert-butyl ether (MTBE)
GC/MS	8260C	Methylene chloride
GC/MS	8260C	Naphthalene
GC/MS	8260C	Pentachloroethane
GC/MS	8260C	Propionitrile (Ethyl cyanide)
GC/MS	8260C	Styrene
GC/MS	8260C	T-amylmethylether (TAME)
GC/MS	8260C	Tetrachloroethylene (Perchloroethylene)
GC/MS	8260C	Tetrahydrofuran
GC/MS	8260C	Toluene
GC/MS	8260C	Trichloroethene (Trichloroethylene)
GC/MS	8260C	Trichlorofluoromethane
GC/MS	8260C	Vinyl acetate
GC/MS	8260C	Vinyl chloride
GC/MS	8260C	Xylene (total)
GC/MS	8260C	m,p-Xylene
GC/MS	8260C	o-Xylene
GC/MS	8260C	cis-1 2-Dichloroethylene
GC/MS	8260C	cis-1 3-Dichloropropene
GC/MS	8260C	cis-1 4-Dichloro-2-butene
GC/MS	8260C	n-Butylbenzene
GC/MS	8260C	n-Propylbenzene
GC/MS	8260C	p-Dioxane
GC/MS	8260C	p-Isopropyltoluene
GC/MS	8260C	sec-Butylbenzene
GC/MS	8260C	tert-Butyl alcohol
GC/MS	8260C	tert-Butylbenzene
GC/MS	8260C	trans-1 2-Dichloroethylene
GC/MS	8260C	trans-1 3-Dichloropropylene
GC/MS	8260C	trans-1 4-Dichloro-2-butene
GC/MS	8260C	Ethyl tert-butyl alcohol
GC/MS	8260C	Isopropyl ether
GC/MS	8260C	tert-Amyl alcohol
GC/MS	8260C	tert-Butyl formate
GC/MS	8260C	1 1 2-Trichloro-1 2 2-trifluoroethane
GC/MS	8270C	1 2 4 5-Tetrachlorobenzene
GC/MS	8270C	1 2 4-Trichlorobenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270C	1 2-Dichlorobenzene
GC/MS	8270C	1 2-Diphenylhydrazine
GC/MS	8270C	1 3 5-Trinitrobenzene (1 3 5-TNB)
GC/MS	8270C	1 3-Dichlorobenzene
GC/MS	8270C	1 3-Dinitrobenzene (1 3-DNB)
GC/MS	8270C	1 4-Dichlorobenzene
GC/MS	8270C	1 4-Dithiane
GC/MS	8270C	1 4-Oxathiane
GC/MS	8270C	1 4-Naphthoquinone
GC/MS	8270C	1 4-Phenylenediamine
GC/MS	8270C	1-Chloronaphthalene
GC/MS	8270C	1-Methylnaphthalene (added to method at FDEP request)
GC/MS	8270C	1-Naphthylamine
GC/MS	8270C	2 3 4 6-Tetrachlorophenol
GC/MS	8270C	2 4 5-Trichlorophenol
GC/MS	8270C	2 4 6-Trichlorophenol
GC/MS	8270C	2 4-Dichlorophenol
GC/MS	8270C	2 4-Dimethylphenol
GC/MS	8270C	2 4-Dinitrophenol
GC/MS	8270C	2 4-Dinitrotoluene (2 4-DNT)
GC/MS	8270C	2 6-Dichlorophenol
GC/MS	8270C	2 6-Dinitrotoluene (2 6-DNT)
GC/MS	8270C	2-Acetylaminofluorene
GC/MS	8270C	2-Chloronaphthalene
GC/MS	8270C	2-Chlorophenol
GC/MS	8270C	2-Methyl-4 6-dinitrophenol
GC/MS	8270C	2-Methylnaphthalene
GC/MS	8270C	2-Methylphenol (o-Cresol)
GC/MS	8270C	2-Naphthylamine
GC/MS	8270C	2-Nitroaniline
GC/MS	8270C	2-Nitrophenol
GC/MS	8270C	2-Picoline (2-Methylpyridine)
GC/MS	8270C	3 3`-Dichlorobenzidine
GC/MS	8270C	3 3`-Dimethylbenzidine
GC/MS	8270C	3-Methylcholanthrene
GC/MS	8270C	3-Methylphenol (m-Cresol)
GC/MS	8270C	3-Nitroaniline
GC/MS	8270C	4-Aminobiphenyl
GC/MS	8270C	4-Bromophenyl phenyl ether
GC/MS	8270C	4-Chloro-3-methylphenol

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270C	4-Chloroaniline
GC/MS	8270C	4-Chlorophenyl phenylether
GC/MS	8270C	4-Dimethyl aminoazobenzene
GC/MS	8270C	4-Methylphenol (p-Cresol)
GC/MS	8270C	4-Nitroaniline
GC/MS	8270C	4-Nitrophenol
GC/MS	8270C	4 4'-methylene-bis(2-chloroaniline)
GC/MS	8270C	5-Nitro-o-toluidine
GC/MS	8270C	7 12-Dimethylbenz(a) anthracene
GC/MS	8270C	Acenaphthene
GC/MS	8270C	Acenaphthylene
GC/MS	8270C	Acetophenone
GC/MS	8270C	Aniline
GC/MS	8270C	Anthracene
GC/MS	8270C	Aramite
GC/MS	8270C	Benzidine
GC/MS	8270C	Benzo(a)anthracene
GC/MS	8270C	Benzo(a)pyrene
GC/MS	8270C	Benzo(b)fluoranthene
GC/MS	8270C	Benzo(g h i)perylene
GC/MS	8270C	Benzo(k)fluoranthene
GC/MS	8270C	Benzoic acid
GC/MS	8270C	Benzyl alcohol
GC/MS	8270C	Butyl benzyl phthalate
GC/MS	8270C	Carbazole
GC/MS	8270C	Chrysene
GC/MS	8270C	Di-n-butyl phthalate
GC/MS	8270C	Di-n-octyl phthalate
GC/MS	8270C	Dibenz(a h)anthracene
GC/MS	8270C	Dibenz(a j)acridine
GC/MS	8270C	Dibenzofuran
GC/MS	8270C	Diethyl phthalate
GC/MS	8270C	Dimethyl phthalate
GC/MS	8270C	Diphenyl Ether
GC/MS	8270C	Ethyl methanesulfonate
GC/MS	8270C	Fluoranthene
GC/MS	8270C	Fluorene
GC/MS	8270C	Hexachlorobenzene
GC/MS	8270C	Hexachlorobutadiene
GC/MS	8270C	Hexachlorocyclopentadiene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270C	Hexachloroethane
GC/MS	8270C	Hexachlorophene
GC/MS	8270C	Hexachloropropene
GC/MS	8270C	Indeno(1 2 3-cd)pyrene
GC/MS	8270C	Isophorone
GC/MS	8270C	Isosafrole
GC/MS	8270C	Methapyrilene
GC/MS	8270C	Methyl methanesulfonate
GC/MS	8270C	Naphthalene
GC/MS	8270C	Nicotine
GC/MS	8270C	Nitrobenzene
GC/MS	8270C	Nitroquinoline-1-oxide
GC/MS	8270C	Pentachlorobenzene
GC/MS	8270C	Pentachloronitrobenzene
GC/MS	8270C	Pentachlorophenol
GC/MS	8270C	Phenacetin
GC/MS	8270C	Phenanthrene
GC/MS	8270C	Phenol
GC/MS	8270C	Pronamide (Kerb)
GC/MS	8270C	Pyrene
GC/MS	8270C	Pyridine
GC/MS	8270C	Resorcinol
GC/MS	8270C	Safrole
GC/MS	8270C	a-a-Dimethylphenethylamine
GC/MS	8270C	bis(2-Chloroethoxy)methane
GC/MS	8270C	bis(2-Chloroethyl) ether
GC/MS	8270C	bis(2-Chloroisopropyl) ether (2 2`-Oxybis(1-chloropropane))
GC/MS	8270C	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	8270C	n-Nitroso-di-n-butylamine
GC/MS	8270C	n-Nitrosodi-n-propylamine
GC/MS	8270C	n-Nitrosodiethylamine
GC/MS	8270C	n-Nitrosodimethylamine
GC/MS	8270C	n-Nitrosodiphenylamine
GC/MS	8270C	n-Nitrosodiphenylamine/Diphenylamine (analyte pair)
GC/MS	8270C	n-Nitrosomethylethylamine
GC/MS	8270C	n-Nitrosomorpholine
GC/MS	8270C	n-Nitrosopiperidine
GC/MS	8270C	n-Nitrosopyrrolidine
GC/MS	8270C	o-Toluidine

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270C	Anilazine
GC/MS	8270C	Chlorobenzilate
GC/MS	8270C	Diallate
GC/MS	8270C	Dimethoate
GC/MS	8270C	Disulfoton
GC/MS	8270C	Famphur
GC/MS	8270C	Isodrin
GC/MS	8270C	Kepone
GC/MS	8270C	Methyl parathion (Parathion methyl)
GC/MS	8270C	Parathion ethyl
GC/MS	8270C	Phorate
GC/MS	8270C	Sulfotepp
GC/MS	8270C	Thionazin (Zinophos)
GC/MS	8270C	o o o-Triethyl phosphorothioate
GC/MS	8270C	1 4-Dioxane (1 4-Diethyleneoxide)
GC/MS	8270C	Propazine
GC/MS	8270C	Benzaldehyde
GC/MS	8270C	Biphenyl
GC/MS	8270C	Caprolactam
GC/MS	8270C	Pentachloroethane
GC/MS	8270C	Atrazine
GC/MS	8270C	Simazine
GC/MS	8270D	1 2 4 5-Tetrachlorobenzene
GC/MS	8270D	1 2 4-Trichlorobenzene
GC/MS	8270D	1 2-Dichlorobenzene
GC/MS	8270D	1 2-Diphenylhydrazine
GC/MS	8270D	1 3 5-Trinitrobenzene (1 3 5-TNB)
GC/MS	8270D	1 3-Dichlorobenzene
GC/MS	8270D	1 3-Dinitrobenzene (1 3-DNB)
GC/MS	8270D	1 4-Dichlorobenzene
GC/MS	8270D	1 4-Dithiane
GC/MS	8270D	1 4-Oxathiane
GC/MS	8270D	1 4-Naphthoquinone
GC/MS	8270D	1 4-Phenylenediamine
GC/MS	8270D	1-Chloronaphthalene
GC/MS	8270D	1-Methylnaphthalene (added to method at FDEP request)
GC/MS	8270D	1-Naphthylamine
GC/MS	8270D	2 3 4 6-Tetrachlorophenol
GC/MS	8270D	2 4 5-Trichlorophenol
GC/MS	8270D	2 4 6-Trichlorophenol

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270D	2 4-Dichlorophenol
GC/MS	8270D	2 4-Dimethylphenol
GC/MS	8270D	2 4-Dinitrophenol
GC/MS	8270D	2 4-Dinitrotoluene (2 4-DNT)
GC/MS	8270D	2 6-Dichlorophenol
GC/MS	8270D	2 6-Dinitrotoluene (2 6-DNT)
GC/MS	8270D	2-Acetylaminofluorene
GC/MS	8270D	2-Chloronaphthalene
GC/MS	8270D	2-Chlorophenol
GC/MS	8270D	2-Methyl-4 6-dinitrophenol
GC/MS	8270D	2-Methylnaphthalene
GC/MS	8270D	2-Methylphenol (o-Cresol)
GC/MS	8270D	2-Naphthylamine
GC/MS	8270D	2-Nitroaniline
GC/MS	8270D	2-Nitrophenol
GC/MS	8270D	2-Picoline (2-Methylpyridine)
GC/MS	8270D	3 3`-Dichlorobenzidine
GC/MS	8270D	3 3`-Dimethylbenzidine
GC/MS	8270D	3-Methylcholanthrene
GC/MS	8270D	3-Methylphenol (m-Cresol)
GC/MS	8270D	3-Nitroaniline
GC/MS	8270D	4-Aminobiphenyl
GC/MS	8270D	4-Bromophenyl phenyl ether
GC/MS	8270D	4-Chloro-3-methylphenol
GC/MS	8270D	4-Chloroaniline
GC/MS	8270D	4-Chlorophenyl phenylether
GC/MS	8270D	4-Dimethyl aminoazobenzene
GC/MS	8270D	4-Methylphenol (p-Cresol)
GC/MS	8270D	4-Nitroaniline
GC/MS	8270D	4-Nitrophenol
GC/MS	8270D	4 4’-methylene-bis(2-chloroaniline)
GC/MS	8270D	5-Nitro-o-toluidine
GC/MS	8270D	7 12-Dimethylbenz(a) anthracene
GC/MS	8270D	Acenaphthene
GC/MS	8270D	Acenaphthylene
GC/MS	8270D	Acetophenone
GC/MS	8270D	Aniline
GC/MS	8270D	Anthracene
GC/MS	8270D	Aramite
GC/MS	8270D	Benzidine

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270D	Benzo(a)anthracene
GC/MS	8270D	Benzo(a)pyrene
GC/MS	8270D	Benzo(b)fluoranthene
GC/MS	8270D	Benzo(g h i)perylene
GC/MS	8270D	Benzo(k)fluoranthene
GC/MS	8270D	Benzoic acid
GC/MS	8270D	Benzyl alcohol
GC/MS	8270D	Butyl benzyl phthalate
GC/MS	8270D	Carbazole
GC/MS	8270D	Chrysene
GC/MS	8270D	Di-n-butyl phthalate
GC/MS	8270D	Di-n-octyl phthalate
GC/MS	8270D	Dibenz(a h)anthracene
GC/MS	8270D	Dibenz(a j)acridine
GC/MS	8270D	Dibenzofuran
GC/MS	8270D	Diethyl phthalate
GC/MS	8270D	Dimethyl phthalate
GC/MS	8270D	Diphenyl Ether
GC/MS	8270D	Ethyl methanesulfonate
GC/MS	8270D	Fluoranthene
GC/MS	8270D	Fluorene
GC/MS	8270D	Hexachlorobenzene
GC/MS	8270D	Hexachlorobutadiene
GC/MS	8270D	Hexachlorocyclopentadiene
GC/MS	8270D	Hexachloroethane
GC/MS	8270D	Hexachlorophene
GC/MS	8270D	Hexachloropropene
GC/MS	8270D	Indeno(1 2 3-cd)pyrene
GC/MS	8270D	Isophorone
GC/MS	8270D	Isosafrole
GC/MS	8270D	Methapyrilene
GC/MS	8270D	Methyl methanesulfonate
GC/MS	8270D	Naphthalene
GC/MS	8270D	Nicotine
GC/MS	8270D	Nitrobenzene
GC/MS	8270D	Nitroquinoline-1-oxide
GC/MS	8270D	Pentachlorobenzene
GC/MS	8270D	Pentachloronitrobenzene
GC/MS	8270D	Pentachlorophenol
GC/MS	8270D	Phenacetin

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270D	Phenanthrene
GC/MS	8270D	Phenol
GC/MS	8270D	Pronamide (Kerb)
GC/MS	8270D	Pyrene
GC/MS	8270D	Pyridine
GC/MS	8270D	Resorcinol
GC/MS	8270D	Safrole
GC/MS	8270D	a-a-Dimethylphenethylamine
GC/MS	8270D	bis(2-Chloroethoxy)methane
GC/MS	8270D	bis(2-Chloroethyl) ether
GC/MS	8270D	bis(2-Chloroisopropyl) ether (2 2`-Oxybis(1-chloropropane))
GC/MS	8270D	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	8270D	n-Nitroso-di-n-butylamine
GC/MS	8270D	n-Nitrosodi-n-propylamine
GC/MS	8270D	n-Nitrosodiethylamine
GC/MS	8270D	n-Nitrosodimethylamine
GC/MS	8270D	n-Nitrosodiphenylamine
GC/MS	8270D	n-Nitrosodiphenylamine/Diphenylamine (analyte pair)
GC/MS	8270D	n-Nitrosomethylethylamine
GC/MS	8270D	n-Nitrosomorpholine
GC/MS	8270D	n-Nitrosopiperidine
GC/MS	8270D	n-Nitrosopyrrolidine
GC/MS	8270D	o-Toluidine
GC/MS	8270D	Anilazine
GC/MS	8270D	Chlorobenzilate
GC/MS	8270D	Diallate
GC/MS	8270D	Dimethoate
GC/MS	8270D	Disulfoton
GC/MS	8270D	Famphur
GC/MS	8270D	Isodrin
GC/MS	8270D	Kepone
GC/MS	8270D	Methyl parathion (Parathion methyl)
GC/MS	8270D	Parathion ethyl
GC/MS	8270D	Phorate
GC/MS	8270D	Sulfotepp
GC/MS	8270D	Thionazin (Zinophos)
GC/MS	8270D	o o o-Triethyl phosphorothioate
GC/MS	8270D	1 4-Dioxane (1 4-Diethyleneoxide)
GC/MS	8270D	Propazine

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270D	Benzaldehyde
GC/MS	8270D	Biphenyl
GC/MS	8270D	Caprolactam
GC/MS	8270D	Pentachloroethane
GC/MS	8270D	Atrazine
GC/MS	8270D	Simazine
HPLC	8310	1-Methylnaphthalene
HPLC	8310	2-Methylnaphthalene
HPLC	8310	Acenaphthene
HPLC	8310	Acenaphthylene
HPLC	8310	Anthracene
HPLC	8310	Benzo(a)anthracene
HPLC	8310	Benzo(a)pyrene
HPLC	8310	Benzo(b)fluoranthene
HPLC	8310	Benzo(g h i)perylene
HPLC	8310	Benzo(k)fluoranthene
HPLC	8310	Chrysene
HPLC	8310	Dibenz(a h)anthracene
HPLC	8310	Fluoranthene
HPLC	8310	Fluorene
HPLC	8310	Indeno(1 2 3-cd)pyrene
HPLC	8310	Naphthalene
HPLC	8310	Phenanthrene
HPLC	8310	Pyrene
HPLC	8330A	1 3 5-Trinitrobenzene (1 3 5-TNB)
HPLC	8330A	1 3-Dinitrobenzene (1 3-DNB)
HPLC	8330A	2 2’, 6 6’-Tetranitro-4 4’-azoxytoluene
HPLC	8330A	2 4 6-Trinitrotoluene (2 4 6-TNT)
HPLC	8330A	2 4-Dinitrotoluene (2 4-DNT)
HPLC	8330A	2 6-Dinitrotoluene (2 6-DNT)
HPLC	8330A	2-Amino-4 6-dinitrotoluene (2-am-dnt)
HPLC	8330A	2-Nitrotoluene
HPLC	8330A	3 5-Dinitroaniline
HPLC	8330A	3-Nitrotoluene
HPLC	8330A	4-Amino-2 6-dinitrotoluene (4-am-dnt)
HPLC	8330A	4-Nitrotoluene
HPLC	8330A	Nitrobenzene
HPLC	8330A	Nitroglycerin
HPLC	8330A	Octahydro-1 3 5 7-tetranitro-1 3 5 7-tetrazocine (HMX)
HPLC	8330A	Pentaerythritoltetranitrate (PETN)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
HPLC	8330A	RDX (hexahydro-1 3 5-trinitro-1 3 5-triazine)
HPLC	8330A	Tetryl (methyl-2 4 6-trinitrophenylnitramine)
HPLC	8330A	Nitroglycerin
HPLC	8330A	2-amino-6-Nitrotoluene
HPLC	8330A	4-amino-2-Nitrotoluene
HPLC	8330A	2-amino-4-Nitrotoluene
HPLC	8330A	2,4-diamino-6-Nitrotoluene
HPLC	8330A	2,6-diamino-4-Nitrotoluene
HPLC	8330A	DNX
HPLC	8330A	MNX
HPLC	8330A	TNX
HPLC	8330B	1 3 5-Trinitrobenzene (1 3 5-TNB)
HPLC	8330B	1 3-Dinitrobenzene (1 3-DNB)
HPLC	8330B	2 4 6-Trinitrotoluene (2 4 6-TNT)
HPLC	8330B	2 4-Dinitrotoluene (2 4-DNT)
HPLC	8330B	2 6-Dinitrotoluene (2 6-DNT)
HPLC	8330B	2-Amino-4 6-dinitrotoluene (2-am-dnt)
HPLC	8330B	2-Nitrotoluene
HPLC	8330B	3 5-Dinitroaniline
HPLC	8330B	3-Nitrotoluene
HPLC	8330B	4-Amino-2 6-dinitrotoluene (4-am-dnt)
HPLC	8330B	4-Nitrotoluene
HPLC	8330B	Nitrobenzene
HPLC	8330B	Nitroglycerin
HPLC	8330B	Octahydro-1 3 5 7-tetranitro-1 3 5 7-tetrazocine (HMX)
HPLC	8330B	Pentaerythritoltetranitrate (PETN)
HPLC	8330B	RDX (hexahydro-1 3 5-trinitro-1 3 5-triazine)
HPLC	8330B	Tetryl (methyl-2 4 6-trinitrophenylnitramine)
HPLC	8330B	Nitroglycerin
HPLC	8330B	2-amino-6-Nitrotoluene
HPLC	8330B	4-amino-2-Nitrotoluene
HPLC	8330B	2-amino-4-Nitrotoluene
HPLC	8330B	2,4-diamino-6-Nitrotoluene
HPLC	8330B	2,6-diamino-4-Nitrotoluene
HPLC	8330B	DNX
HPLC	8330B	MNX
HPLC	8330B	TNX
HPLC	8332	PETN
HPLC	8332	Nitroglycerin
ICP	6010B,C	Aluminum

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP	6010B,C	Antimony
ICP	6010B,C	Arsenic
ICP	6010B,C	Barium
ICP	6010B,C	Beryllium
ICP	6010B,C	Cadmium
ICP	6010B,C	Calcium
ICP	6010B,C	Chromium
ICP	6010B,C	Cobalt
ICP	6010B,C	Copper
ICP	6010B,C	Iron
ICP	6010B,C	Lead
ICP	6010B,C	Magnesium
ICP	6010B,C	Manganese
ICP	6010B,C	Molybdenum
ICP	6010B,C	Nickel
ICP	6010B,C	Potassium
ICP	6010B,C	Selenium
ICP	6010B,C	Silver
ICP	6010B,C	Sodium
ICP	6010B,C	Thallium
ICP	6010B,C	Tin
ICP	6010B,C	Vanadium
ICP	6010B,C	Zinc
CVAA	7471A	Mercury
CVAA	7471B	Mercury
UV/VIS	7196A	Hexavalent Chromium
UV/VIS	9012B	Cyanide, automated colorimetry with off-line distillation
IC	9056A	Bromide
IC	9056A	Chloride
IC	9056A	Fluoride
IC	9056A	Nitrate
IC	9056A	Nitrite
IC	9056A	Sulfate
IC	9056A	Total nitrate-nitrite
Gravimetric Methods	SM2540B	% solids
Gravimetric Methods	9071B	Oil and Grease
Electrometric Methods	9045D	Hydrogen Ion (pH)
Combustion	9060A	Total Organic Carbon
TCLP Extraction	1311	TCLP
SPLP Extraction	1312	SPLP

LABORATORY ACCREDITATION BUREAU

Certificate # L2229

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Waste Characterization	1010A	Ignitability, Closed Cup
Waste Characterization	1110A	Corrosivity Towards Steel
Waste Characterization	Ch.7	Reactive Cyanide and Reactive Sulfide
Preparation	**Method**	**Type**
8011	8011	Microextraction
5035	8015B,C	GRO, OA-1, TN-GRO, MA-VPH, Purge and Trap, solid
MA-EPH	MA-EPH	Diesel Range Organic, Ultrasonic extraction and fractionation
3550B,C	8015B,C	DRO/ORO, FL-PRO, OA-2, TN-EPH, WI-DRO Ultrasonic Extraction
3550B,C	8015B,C	Non-Halogenated Organics (Alcohols), direct inject , DI water leach
3550B,C	8081A,B	Chlorinated Pesticides, Ultrasonic Extraction
3550B,C	8082/8082A	PCBs and Congeners, Ultrasonic Extraction
3550B,C	8141B	Organophosphorus Pesticides, Ultrasonic Extraction
8151A	8151A	Chlorinated Herbicides, Ultrasonic Extraction
5035	8260B,C	VOC by GC/MS, Purge and Trap, solid
5030B	8260B,C	VOC by GC/MS, Purge and Trap, TCLP Extracts
3550B,C	8270C,D	BNA Extractables by GC/MS, Ultrasonic Extraction
3550B,C	8310	PAH, Ultrasonic Extraction
8330A/8332	8330A/8332	Explosives, Ultrasonic Extraction
8330B	8330B	Explosives, Shaker Table Extraction
3010A	6010B,C	Metals by ICP, Acid Digestion, TCLP extracts
3050B	6010B,C	Metals by ICP, Acid Digestion, solid
7470A	7470A	Hg by CVAA, TCLP extracts
7471,A	7471/7471A	Hg by CVAA, solid
3060A	7196A	Cr6+, Alkaline Digestion
Lachat MicroDistillation	9012	Cyanide, Lachat MicroDistillation proprietary method, solids
3580A	8081A,B/8141B/ 8082/8082A/8270C,D /8015B,C	Waste Dilution, Extractables
3585	8260B,D/8015B,C	Waste Dilution for Volatile Organics
3510C	8081A,B/ 8270C,D/ 8151A	TCLP parameters

Notes:

1) This laboratory offers commercial testing service.

Approved By: _____ Date: December 15, 2009

R. Douglas Leonard
Chief Technical Officer

Issued: 12/15/09

State of Florida
Department of Health, Bureau of Laboratories
This is to certify that

E83510

ACCUTEST LABORATORIES SOUTHEAST, INC.
4405 VINELAND ROAD, SUITE C-15
ORLANDO, FL 32811

has complied with Florida Administrative Code 64E-1,
for the examination of Environmental samples in the following categories

DRINKING WATER - PRIMARY INORGANIC CONTAMINANTS, DRINKING WATER - SECONDARY INORGANIC CONTAMINANTS, DRINKING WATER - SYNTHETIC ORGANIC CONTAMINANTS, NON-POTABLE WATER - EXTRACTABLE ORGANICS, NON-POTABLE WATER - GENERAL CHEMISTRY, NON-POTABLE WATER - METALS, NON-POTABLE WATER - PESTICIDES-HERBICIDES-PCB'S, NON-POTABLE WATER - VOLATILE ORGANICS, SOLID AND CHEMICAL MATERIALS - EXTRACTABLE ORGANICS, SOLID AND CHEMICAL MATERIALS - GENERAL CHEMISTRY, SOLID AND CHEMICAL MATERIALS - METALS, SOLID AND CHEMICAL MATERIALS - PESTICIDES-HERBICIDES-PCB'S, SOLID AND CHEMICAL MATERIALS - VOLATILE ORGANICS, AIR AND EMISSIONS - VOLATILE ORGANICS

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

EFFECTIVE July 01, 2009 THROUGH June 30, 2010

Max Salfinger, M.D.
Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1697, 7/04
NON-TRANSFERABLE E83510-16-07/01/2009
Supersedes all previously issued certificates